

PREPA Via Verde Pipeline
Essential Fish Habitat Evaluation

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Via Verde Pipeline Essential Fish Habitat Evaluation

Executive Summary

The Via Verde Pipeline project is currently being reviewed by the NOAA Marine Fisheries Service (NMFS) Protected Resources Division (PRD) and the Habitat Conservation Division (HCD) for potential impacts to Endangered and Threatened Species and Critical Habitats. A total of twelve (12) Endangered and Threatened Species and three (3) Critical Habitats fall under the jurisdiction of the NOAA Marine Fisheries Service for the commonwealth of Puerto Rico.

Five community types, identified by the Caribbean Fishery Management Council (CFMC) as Essential Fish Habitat (EFH) were initially identified as potentially occurring within the project limits. These included mangroves, seagrass, sandy bottom, karstic hard bottom, and algal communities. Pursuant to a NMFS request, surveys of the organisms in the marine and estuarine areas within the limits of the horizontal directional drill areas were conducted. The areas to be surveyed and the nature of the survey protocols used were reviewed and approved by NOAA NMFS biologists prior to undertaking the field surveys. Three principle areas along the pipeline right-of-way; Eco Electrica - Peñuelas (Mile Points 0.0 – 3.5), Cambalache (MP 41.5), and San Juan (MP 79.5 – 92.0) were surveyed.

The essential fish habitat areas evaluated corresponded with all of the marine and estuarine horizontal directional drills (HDD) currently proposed for the Via Verde Pipeline project. A total eighteen stations were evaluated; fifteen of the eighteen HDD crossings were found to contain natural systems that included a mixture of physical, chemical, and biological properties that are included with the Caribbean Fishery Management Council's (CFMC) definition of Essential Fish Habitat. Mangroves, sandy bottom, and algal bottom communities were the most abundant communities found. Areas of karstic hard bottom were limited and seagrasses were not found. Mangrove forested systems were the dominant EFH community type being found at ten of the eighteen EFH Stations sampled.

The Caribbean Fishery Management Council identifies these habitats as EFH for several species, including juvenile and adult gray snapper (*Lutjanus griseus*); juvenile mutton snapper (*Lutjanus analis*); juvenile nassau (*Epinephelus striatus*) and goliath grouper (*Epinephelus itajara*); and juvenile spiny lobster (*Panulirus argus*). One listed species, a juvenile gray snapper, was observed during the survey and it is acknowledged that suitable habitat for all of these species exists in estuarine and marine portions of the project right-of-way. The fish variability and abundance observed during the survey were not high, likely owing to the absence of seagrass cover in the vicinity of the mangroves systems at the crossing sites. The 92 mile Via Verde Pipeline project as currently designed has limited the impacts to habitats identified as EFH by the Caribbean Fishery Management Council to 0.008 acres or 351 square feet.

Essential Fish Habitat Evaluation

Project Overview - NOAA's National Marine Fisheries Service (NMFS) reviewed the public notice dated November 19, 2010, for SAJ-2010-02881 (IP-EWG). The applicant, Autoridad de Energia Electrica, requests authorization from the Department of the Army to construct and install a 24-inch diameter, steel natural gas (NG) pipeline approximately 92 miles long with a construction right-of way (ROW) of 150 feet that traverses the island of Puerto Rico from the EcoEléctrica Liquid Natural Gas Terminal in the municipality of Peñuelas to the Cambalache Thermoelectric Power Plant in the municipality of Arecibo, and then eastward to the Palo Seco power plant facility in the municipalities of Toa Baja and San Juan. The total project area is about 1,115 acres based upon an average construction right-of-way width of 100 feet and the pipeline will traverse 235 rivers and wetlands, including 369 acres of jurisdictional Waters of the United States. The public notice indicates that the work would impact approximately 28.5 acres of Estuarine Forested Wetland and Canals which are identified as essential fish habitat (EFH) by the Caribbean Fishery Management Council (CMFC).

NOAA / NMFS Essential Fish Habitat (EFH) Concerns – The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth a new mandate for NOAA's National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. The essential fish habitat (EFH) provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals - maintaining sustainable fisheries. Critical to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. The Caribbean FMC, with assistance from NMFS, has delineated EFH for federally managed species within the U.S. Caribbean. The generic FMP amendment delineating EFH for species managed by the Caribbean FMC was completed in early 1999 and subsequently updated and revised in late 2005. In addition, EFH for highly migratory pelagic species managed by the NMFS has been identified and includes various coastal and offshore waters of Puerto Rico and the U.S. Virgin Islands.

Essential fish habitat (EFH) is defined as those waters and substrate that are necessary to fish for spawning, breeding, feeding, or growing to maturity, as defined by the Caribbean Fishery Management Council (CMFC). Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fishes and may include areas historically used by fishes. Substrate includes sediment, hardbottom, structures underlying the waters, and any associated biological communities. Necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers all habitat types used by a species throughout its life cycle. Only species managed under a federal fishery management plan (FMP) are covered (50 C.F.R. 600). Representative categories of Essential Fish Habitat identified in Fishery Management Plan Amendment of the Caribbean Fishery Management Council within the project right of way may include estuarine areas (water column, salt marshes, mangrove wetlands, intertidal flats/salt ponds, sand and shell substrate, live and hard bottoms, mud flats, sandy beaches, and rocky shores) and marine areas (water column, sand and shell substrate, algal plains and live and hard bottoms).

NOAA / NMFS Project Consultation Status - The applicant's scientific and consulting team met with NMFS Habitat Conservation Division (HCD) staff on January 6, 2011 in St. Petersburg, Florida. A NMFS HCD letter (Dec 19 2010) provided three (3) EFH Conservation Recommendations and four (4) requests for additional information before EFH consultation could be completed. The purpose of the meeting was to coordinate what additional information was required and to review and explain the information provided to the NMFS to date. Upon completion and receipt of the results of a field EFH evaluation of the proposed Via Verde estuarine/marine pipeline crossing the NMFS Habitat Conservation Division will complete the Essential Fish Habitat consultation for the project.

The extent of estuarine forested habitat and canals to be impacted was not accurately reflected in the original public notice dated November 19, 2010. The approximate acreage to be impacted was correctly identified and represented in the JPA document originally submitted to the United States Army Corps of Engineers (USACE). The following is a breakdown of proposed temporary impacts to wetlands and other surface waters based upon the information included with the USACE JPA submittal:

- Canals = 0.67 acre
- Canals with Mangrove shorelines = 0.00 acre
- Estuarine Forested – Mangroves = 0.00 acre
- Estuarine - Saltflat w/ mangroves = 0.56 acre
- Rivers/Creeks/Tributaries = 1.39 acre
- Unnamed Creeks (in Karst Region) = 0.90 acre
- Ditches (within herbaceous wetlands) = 0.08 acre

Based upon the sum of the acreages identified above, the calculated total temporary impact to waters of the United States which may constitute EFH is approximately 3.6 acres. These numbers were discussed with the NMFS during the January 6, 2010 meeting and this information has subsequently been provided to the USACE. It was additionally explained to the NMFS that no direct impacts to mangrove forested estuarine habitat will occur because Horizontal Directional Drilling (HDD) will be utilized in those systems and the temporary impacts associated with the additional work space areas will be further minimized. The construction right-of-way has been limited to a maximum width of 50 feet at all marine and estuarine crossings.

The NMFS has indicated that the site of the proposed project includes mangroves, sandy bottom, algal communities, and possibly seagrass. The Caribbean Fishery Management Council identifies these habitats as EFH for several species, including juvenile and adult gray snapper (*Lutjanus griseus*); juvenile mutton snapper (*Lutjanus analis*); juvenile nassau (*Epinephelus striatus*) and goliath grouper (*Epinephelus itajara*); and juvenile spiny lobster (*Panulirus argus*). Seagrass and mangrove directly benefit the fishery resources of the Atlantic Ocean and the Caribbean Sea by providing nursery habitat. Seagrass and mangrove habitats are part of a habitat complex that includes hard bottoms and coral reefs, and this habitat complex supports a diverse community of fish and invertebrates within the Atlantic Ocean and the Caribbean Sea. Seagrass and mangrove also provide important water quality maintenance functions (such as pollution uptake), stabilize sediments, attenuate wave action, and produce and export detritus (decaying organic material), which is an important component of marine

and estuarine food chains. The cumulative loss or potential impacts to these habitats continues to reduce fisheries production within the waters of Puerto Rico.

To ascertain the extent of any marine and/or estuarine impacts which may adversely affect EFH, the NMFS has requested an actual survey of the organisms in the estuarine areas that the project right-of-way will traverse. This report represents the results of the EFH survey conducted. The Summary, Conclusions, and Recommendations included herein detail what impacts, if any, are expected to EFH.

The Via Verde Pipeline project is currently being reviewed by the NOAA Marine Fisheries Service Protected Resources Division (PRD) and the Habitat Conservation Division (HCD) for potential impacts to Endangered and Threatened Species and Critical Habitats. A total of twelve (12) Endangered and Threatened Species and three (3) Critical Habitats fall under the jurisdiction of the NOAA Marine Fisheries Service for the commonwealth of Puerto Rico. These include 5 species of marine mammals, 5 species of marine turtles, and 2 species of invertebrates (marine corals). In addition, three areas designated as Critical Habitat for the green sea turtle, hawksbill turtle, and elkhorn and staghorn corals have been established. An additional 8 species of finfish and one coral are currently listed as Species of Concern. Table 1 below presents the current listings as obtained from the NOAA Fisheries Service, Southeast Regional Office, Protected Resources Division website (<http://sero.nmfs.noaa.gov/pr/pr.htm>) as of February 22, 2011.

EFH Survey Sampling Protocols and Methodology

Five community types, identified by the Caribbean Fishery Management Council (CFMC) as Essential Fish Habitat (EFH) were identified as potentially occurring within the project limits. These included mangroves, seagrass, sandy bottom, karstic hard bottom, and algal communities. The NMFS requested that an actual survey of the organisms in the estuarine areas within the limits of the HD drill areas be conducted. The areas to be surveyed included marine and estuarine habitats in three principle areas along the pipeline right-of-way; Eco Electrica - Peñuelas (Mile Points 0.0 – 3.5), Cambalache (MP 41.5), and San Juan (MP 79.5 – 92.0). Both the biotic and physical habitat characteristics were surveyed using standardized methods within each community ecosystem identified. Specific National Marine Fisheries Service (NMFS) survey protocols (i.e. seagrass) were used where available. The intent of this survey was to document the presence and/or absence data for finfish species, the occurrence of any endangered and/or threatened species, and the types of habitats subject to jurisdiction and regulation by the NOAA Marine Fisheries Service. Sample sites were visited only one time during the period from February 14 to February 18, 2011. Sample sites were accessed by wading, snorkeling, or kayak. The locations of the Essential Fish Habitat stations sampled have been included on the Plan design sheets in Appendix A of this document.

The site sampling and data reporting protocols were reviewed and approved by NOAA NMFS biologists Jocelyn Karazsia and Jose Rivera prior to undertaking the field surveys. NOAA NMFS biologists José

Rivera accompanied the consulting scientists during the field evaluation of four EFH sites (EFH 9, 10, 14 and 15) in the Toa Baja region on February 17, 2011.

The scope of services conducted included a desktop screening assessment (Level 0 survey), field surveys of HDD sites (Level 1 Field Surveys), and the development of a summary report. A brief description of the survey levels, the EFH community types assessed, and specific sampling protocols used are summarized below:

SURVEY LEVELS

Level 0 Survey – This evaluation included a desktop screening assessment that consisted of compiling documented information for the five CFMC ecosystems of concern through a literature search and a census of local experts. No field observations were made during this initial assessment level. The desktop analysis preceded any of the field studies. The information compiled during the desktop evaluation included area and geomorphometric classification; habitat type; watershed land use; evaluation of existing water quality databases (i.e., salinity, temperature, DO, pH, turbidity); known biological assemblage data; and waterbody column and coastal geologic data.

Level 1 Field Surveys - The surveys conducted were limited to a one-time visit to sites to collect biological and habitat data using standardized methods. The primary focus of the Level 1 surveys was to determine the presence or absence of those community types identified by the Caribbean Fishery Management Council as EFH. The focus of these initial surveys was to develop baseline information. A brief description of the individual EFH habitat surveys conducted has included below.

ESSENTIAL FISH COMMUNITY TYPES

Mangroves - Indicators evaluated included overall vegetative species distribution and abundance, percent canopy cover, faunal biodiversity, hydrology, and soil. Species dominance was also noted. Photographic documentation of each site visited was taken.

Seagrass – This EFH habitat type was not present within the estuarine and marine portions of the project right of way. The initial presence and/or absence surveys conducted at the HDD crossing sites did not find any seagrasses presence within or adjacent to the construction right-of-way corridor.

Algal Communities - Biological sampling and photographic documentation of all algal communities was conducted. Specimens observed were photographed in situ with only a limited number of specimens removed for verification. Sedimentary environments with interspersed bedrock (exposed wave-cut platform bedrock) were evaluated for the presence of stands of various groups of large and robust algal forms which provided three-dimensional structural heterogeneity. Large stands of filamentous and thin sheet forms of algae indicative of stressed or physically disturbed environments were also noted.

TABLE 1			
Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the NOAA Fisheries Service, Commonwealth of Puerto Rico			
Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	<i>Balaenoptera musculus</i>	Endangered	12/2/70
finback whale	<i>Balaenoptera physalus</i>	Endangered	12/2/70
humpback whale	<i>Megaptera novaeangliae</i>	Endangered	12/2/70
sei whale	<i>Balaenoptera borealis</i>	Endangered	12/2/70
sperm whale	<i>Physeter macrocephalus</i>	Endangered	12/2/70
Turtles			
green sea turtle	<i>Chelonia mydas</i>	Threatened ¹	7/28/78
hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	6/2/70
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered	12/2/70
leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	6/2/70
loggerhead sea turtle	<i>Caretta caretta</i>	Threatened	7/28/78
Invertebrates			
elkhorn coral	<i>Acrophora palmata</i>	Threatened	5/9/06
staghorn coral	<i>Acrophora cervicornis</i>	Threatened	5/9/06
Species of Concern ³	Scientific Name		
Fish			
dusky shark	<i>Carcharhinus obscurus</i>		
mangrove rivulus	<i>Rivulus marmoratus</i>		
night shark	<i>Carcharhinus signatus</i>		
sand tiger shark	<i>Carcharias taurus</i>		
speckled hind	<i>Epinephelus drummondhayi</i>		
striped croaker	<i>Bairdiella sanctaeluciae</i>		
Warsaw grouper	<i>Epinephelus nigritus</i>		
Invertebrates			
ivory tree coral	<i>Oculina varicosa</i>		
<p>¹ Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered</p> <p>³ Species of Concern are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.</p> <p>Reference: http://sero.nmfs.noaa.gov/pr/pr.htm February 22, 2011</p>			

Sandy Bottom Communities – The survey protocol for the sand bottom communities was similar to that utilized for the hard bottoms. Estimates of percent cover by algae and attached biota, percent sediment cover, sediment thickness/accumulation, and counts of dominant attached epifauna were made. No benthic invertebrate studies were undertaken, however prominent bivalves were photo documented and noted. Macro biota were identified to the lowest practical taxonomic level.

Hard Bottom Communities - The initial presence and/or absence surveys conducted at the HDD sites did not reveal any hardbottom communities. The only highly convoluted surfaces observed resulted from manmade alterations (physical excavation) rather than subaerial weathering, stream erosion, and karst formation during sea-level low stands.

Specific areas to be surveyed for each of the aforementioned community types present included: community habitat characterization, endemic species survey (visual observations, seines, traps), water column characteristics/water quality parameters (turbidity, salinity), photographic documentation of areas (includes underwater photographs where applicable), and collection of voucher specimens.

FIELD PROTOCOLS

The following field protocols were used:

Visual Observations - Biologist used high quality binoculars (Pentax, Model: 8x42 DCF WP) and range finders (Leupold, Model: RX-IV) to record data on species composition, habitat use patterns, and movements of endemic fauna in the project area. Field identification references included Abbott (1968), Gilbert and Williams (2002), Humann and DeLoach (1995), Liogier and Martorell (2000), Littler (1989), and Raffaele (1989). Positional data was collected using WAAS enabled handheld GPS receivers manufactured by Garmin (GPSmap 60CSx and Oregon 400c).

Habitat Characterization - Wetland habitat types were classified using the National Wetlands Inventory classification system as found in this USFWS publication: *Classification of Wetlands and Deepwater Habitats of the United States, 1979*, by Cowardin, Lewis M. et al. Descriptions of community structure were further developed using site specific plant species composition, size, and relative percent cover.

Seine Net Collection was accomplished using a 4-foot high by 30-foot long, ¼-inch nylon mesh net with a weighted leadline. Seine collection was performed using either of two basic techniques, seine hauling and driving. Pulling the seine through the water (seine hauling) was used where sufficient clear space existed while in confined spaces (smaller streams, mangrove lined channels) driving was accomplished by scientists kicking the substrate, snorkeling, or bumping bars along the substrate and vegetation. Where channel widths were less than 30 feet wide, the seine was extended from bank to bank (typically edge of vegetation to edge of vegetation and pursed in a circular manner. Where channel widths exceeded 30 feet, the seines were pulled perpendicular to the shoreline then pursed in a circular manner and sorted on the shoreline. Visual identification and photographic documentation were used to identify captured specimens in the field. The aforementioned field identification guide

references and photographic documentation were the principle techniques tools used by field scientists. Qualitative sampling only was performed and estimates of abundance when recorded represent the mean number of each species captured per seine haul. Only one seine haul was performed per station. Total fish counts, lengths and weights were not performed. All game/sport fishes were returned to the water as quickly as possible to avoid harm. No voucher specimens were retained. Photographs were taken where applicable.

Fish traps consisted of standard galvanized minnow style traps with meshes of $\frac{1}{4}$ and $\frac{1}{2}$ inches. Two fish traps were also utilized. The smaller trap used was a nine inch diameter by thirty-one inch long (9 inches X 31 inches) galvanized Minnow Trap with double entrance openings of 1inch and was constructed of $\frac{1}{4}$ -inch mesh galvanized steel wire. The larger fish trap measured fifteen inches in diameter by thirty-one inches long (15 inches X 31 inches) and was constructed of $\frac{1}{2}$ -inch mesh galvanized steel wire with double entrance openings of 2 $\frac{1}{2}$ inches each. Fish traps were set prior to station data collection and recovered upon completion of site evaluation. Time of trap deployment will average one hour.

Water column characteristics/water quality parameters - At each station, water samples were taken after each sampling event from the middle of the channel, 0.25m below the surface and 0.25m above the estuary floor. Samples were field analyzed using a portable VEE GEE, Model: A366ATC Refractometer which provided for a salinity measurement range of 0 to 100 parts per thousand (ppt) with an accuracy of +/- 1 ppt. Estimates of secchi depth were performed using a weighted lead line. Depth profiles were recorded for each channel section using a weighted tape measure with measurements being taken at the edge of vegetation, quarter points, and centerline of the channel. Secchi depths were noted at each measurement point.

Photographic Documentation – All photographs were digital media taken with a Canon Model G10, 14.7 mega pixel camera. Underwater shots were taken using the same camera housed in a Canon waterproof acrylic housing (Canon Model: WP-DC28). Individual specimens or community type photographs were labeled using the EFH Station number and digital camera frame number. Date and time were automatically added to metadata on memory card. Individual specimens or groups were photographed on a plain plastic background with a measuring tape. Camera orientation was perpendicular to the specimen in landscape mode whenever possible to obtain a full side view and fill the view finder with the specimen. The camera number, frame numbers, trip number, set number, specimen number, species of animal, and any notes or questions were additionally recorded on an appropriate data form; typically in the waterproof field logbook.

EFH Survey Sampling Stations

A total of 17 survey stations were originally chosen for field evaluation using a combination of GIS mapping, local knowledge of the EFH flora and fauna, and Puerto Rico database reviews to identify potential EFH sampling sites. The initial stations were selected by superimposing the pipeline right-of-way with the locations of the horizontal directional drill points depicted on a GIS (geographic information system) based 2010 color aerial photograph. Two of the original stations established, the Palo Seco lateral line (EFH 16) and the San Juan Meter Station crossing (EFH 17), were visited and

removed from further consideration. Station 16 was eliminated due to the fact that it is a palustrine wetland which lacks a hydrologic connection to the adjoining estuarine areas and EFH Station 17 was a concrete lined stormwater conveyance that does not receive tidal flows. Two additional stations (EFH 4 and EFH 5) were added in Peñuelas, in the vicinity of the Eco Electrica facility, to better evaluate the role and importance of upland cut, mangrove lined ditches to fish habitat in this area.

All stations chosen correspond to the locations of those directional drill points where the pipeline will pass underneath estuarine/marine waterbodies and associated watersheds. No direct impacts to forested estuarine habitat are proposed due to the fact that Horizontal Directional Drilling (HDD) will be utilized in all estuarine and marine systems. The average pipeline depth below ground surface ranges from 40 to 80 feet. The pipeline will be embedded in a naturally occurring lens of marine clay which will further reduce the likelihood of any releases of the non-toxic drilling muds (bentonite) into the estuarine/marine environment during pipe installation.

Plan design sheets which include the locations of each EFH Station, pipeline design profiles, and other applicable data, have been included in Appendix A of this document. Table 2 presents a summary of information for each EFH Station surveyed.

Horizontal Directional Drill (HDD) Considerations for Protection of Essential Fish Habitat

All construction associated with the project site will occur above the mean high water line. Directional drills will be used to traverse all estuarine/marine Waters of the United States. All directional drills have been located to originate and exit in the uplands whenever possible. Embedment depths for the 24 inch pipe line to be installed will range from 40 to 80 feet below the existing ground (bottom) for the entire waterbody at each crossing point. The pipeline will typically be embedded in a naturally occurring lens of marine clay which will further reduce the likelihood of any releases of the non-toxic drilling muds (bentonite) into the estuarine/marine environment during pipe installation. A list of the waterbodies and site specific crossings with data are included in Table 3 which follows.

PREPA recognizes that difficult subsoil conditions can adversely affect HDD crossings in any area. To ensure that the project can be completed in a timely and environmentally sensitive manner, the pipeline design engineers (Gulf Interstate Engineering) have completed a series of boreholes (up to 35m deep). The results of these borings have provided detailed information regarding alluvial beds; sand and silt deposits; and the marine sub-stratum; composed of mainly clay and marley clay for the subsurface strata at each of the HDD points. The results of these borings indicate that safe HDD crossings can be undertaken and the data obtained has allowed for the development of site specific HDD profiles and drilling techniques to be employed during pipe installation to match the prevailing conditions. Each HDD design has been developed to: minimize the length of the downward and upward sections using high entry and exit angles; remain as long as possible in the sandy-silty level; and to deepen the profile in the soil in close proximity to the river bed, to guarantee a sufficiently thick soil cover to avoid any risk of frac-out.

Via Verde Pipeline Essential Fish Habitat Evaluation
Table 2. Essential Fish Habitat Survey Station Information

EFH Station ID No.	Region	Design Sheet Reference	Reference Boring	CL Station	Crossing Designation	Crossing Type	Mile Marker	Dominant Community Type	Location		Comments
									Latitude	Longitude	
Eco Electrica (MM 0.0 - MM 2.5)											
EFH1	Penuelas_1	48.0-Z-322.50 SHT. 1 of 1 REV. 1		-22+46		Pipe Rack		E2SS3N7	17°59'21.64"N	66°45'09.43"W	Saltflat
EFH2	Penuelas_2	48.0-Z-322.50 SHT. 1 of 1 REV. 1	B1,B2	-01+42		Metering Station		Disturbed Uplands	17°59'35.08"N	66°44'51.59"W	Eco Electrica Meter Station
EFH3	Penuelas_3	48.0-Z-325.00 SHT. 1 of 1 REV. 1	B1	0+00		HDD	0.28	E2US2/3Ph	17°59'45.00"N	66°44'52.76"W	HDD fill pad, diked wetland
EFH4	Penuelas_4	48.0-Z-325.00 SHT. 1 of 1 REV. 1	B1	1+50		HDD		E2FO3N	17°59'45.56"N	66°44'51.59"W	mangrove canal
EFH4A	Penuelas_4A	48.0-Z-325.00 SHT. 1 of 1 REV. 1	B2-MP.0.28	4+75	Rio de Matilde	HDD		E1UBLx	17°59'46.86"N	66°44'48.60"W	NW side of canal
EFH5	Penuelas_5	48.0-Z-321.01 SHT. 1 of 1 REV. 1	B2-MP.0.76	(3)		HDD	1.48	E2EFO3N	17°59'54.59"N	66°44'23.04"W	tidal ditch
EFH6	Penuelas_6	48.0-Z-325.01 SHT. 1 of 1 REV. 1	B1-MP.1.49	4+35	Rio de Tallaboa	HDD		R2UB1/2H	18° 00'03.01"N	66°43'54.00"W	CL River
Combalache (MM 40.5 - MM 42.5)											
EFH7	Arecibo_1	48.0-Z-321.44 SHT. 44 of 96 REV. 0	B14-2	2152+07	Rio de Grande Aricebo	HDD	40.75	E1UBL	18° 27'45.90"N	66°42'21.13"W	CL River
EFH8	Arecibo_2	48.0-Z-321.44 SHT. 44 of 96 REV. 0	B2		Mangrove Canal	Metering Station		E2FO3N2	18° 28'08.92"N	66°41'57.72"W	Combalache Metering Station
North Shoreline (MM 80.69 - MM 85.13)											
EFH9	Toa Baja_1	48.0-Z-321.88 SHT. 1 of 1 REV. 2	B33-2	4253+78	Rio Cocal Tributary	HDD		E2FO3M	18°27'51.54"N	66°12'25.91"W	CL River Tributary
EFH10	Toa Baja_2	48.0-Z-321.88 SHT. 1 of 1 REV. 2	B33-1	4281+19	Rio Cocal River	HDD		E1UB2L	18°27'55.07"N	66°11'57.75"W	CL River
EFH11	Toa Baja_3	48.0-Z-325.20 SHT. 1 of 2 REV. B	B1-165, west		Levittown Beach Shoreline W	HDD		M1UBL	18°27'30.04"N	66°10'59.11"W	Beach shoreline point
EFH12	Toa Baja_4	48.0-Z-325.21 SHT. 1 of 2 REV. B	B4-165		Levittown Beach Shoreline Middle	HDD		M2US2P	18°27'09.40"N	66°10'30.39"W	HDDrill exit point w/pad
EFH13	Toa Baja_5	48.0-Z-325.21 SHT. 2 of 2 REV. B	B34-1		Levittown Beach Shoreline E	HDD		M2US2P	18°27'03.08"N	66°09'57.12"W	HDDrill entry point w/pad
EFH14	Toa Baja_6	48.0-Z-322.41 SHT. 1 of 1 REV. 2	B35-1		Rio de Hondo	HDD		E1UBLx	18°26'47.53"N	66°09'42.63"W	CL River
EFH15	Toa Baja_7	48.0-Z-322.41 SHT. 1 of 1 REV. 2	B35-3		Rio de Bayamon	HDD		E1UBLx	18°26'46.01"N	66°09'34.63"W	CL River
Palo Seco PS (MM 85.8 - MM)											
EFH16	Toa Baja_8	48.0-Z-322.41 SHT. 1 of 1 REV. 2	B35-3					PEM1C	18°26'58.98"N	66°09'11.21"W	Coll Pt. No. 28
San Juan (MM 87.0 - San Juan Meter Station)											
EFH17	Guaynabo_1	48.0-Z-322.50 SHT. 1 of 1 REV. 1	B1, B39-1		PR-24 San Juan	Directional Bore	90.5	PRB1r0	18°25'32.80"N	66° 06'44.23"W	Concrete drainage ditch, no EFH

A magnetic tracking system will be used for drill guidance, allowing for the use of the comprehensive and precise geotechnical investigations which were crucial in creating optimized drilling profiles. The project will also use an accurate guidance system; and the correct mud composition for crossing types to preclude excessive pressures which are associated with frac-outs.

The drilling plan developed includes, but is not necessarily limited to the following:

- description of superficial and bedrock geological conditions and the proposed bore profile at each HDD location;
- assessment of the likelihood of a “frac-out” involving the release of drilling fluids from the bore hole into the overlying fresh, estuarine, and/or marine waters;
- procedures to monitor drilling fluid returns, regulate drilling pressure, and add loss circulation materials as necessary to plug fractures along the bore path and minimize the possibility of a frac-out;
- to minimize the release of drilling mud when the drill punches through the ground surface, operators will have the ability to switch from drilling mud to water only to lubricate the bore during the last stage of the operation before the drill reaches its exit point;
- procedures for monitoring the bore path between the bore entry and the planned exit point to detect a release of drilling mud; a Contingency Plan for the containment and cleanup of a discharge of the non-toxic drilling mud onto the shore or seabed; and reporting procedures to document the implementation of the plan and its effectiveness.

Table 3 details the HDD crossing information (crossing location, length of each crossing and depth the pipe would be placed at beneath the waterway bottom) which pertains to the EFH Stations surveyed.

TABLE 3. Via Verde Pipeline - HDD Crossing Information

EFH Station Station	Crossing Number	Waterway/ Tributary	Length of HDD (ft.)	Depth of Pipe
EFH 1	None	See Note 1 below	None	NA
EFH 2	None	See Note 2 below	None	NA
EFH 3,4,4A	C1	Matilde River	1,560	-50 ft
EFH 5	C3	Unnamed Canal	1,417	-58 ft
EFH 6	C5	Rio Tallaboa	1,298	-58 ft
EFH 7	C43	Rio Grande de Arecibo	1,838	-55 ft
EFH 8	C43A	Cambalachee Canal	950	-50 ft
EFH 9,10	C93	Rio Cocal Mangroves/River	4,531	-55 ft
EFH 11,12	19	Shoreline at Levittown	4,495	-55 ft
EFH 13	20	Shoreline at Levittown	3,782	-55 ft
EFH 14,15	C95	Rio Hondo/Rio Bayamon	1,831	-80 ft
EFH 17	None	Upland Cut Ditch at PR-24	285	-50 ft

Note 1: Pipeline to be elevated on new pipe rack located west of dirt maintenance road parallel to the existing pipe racks in this area (Station -25+46 to -02+00)

Note 2: Proposed Eco Electrica Metering Station to be constructed on existing upland fill pad, not EFH, not a wetland area (Station 00+00)

The pipe depth at each HDD crossing will be a minimum of 40 feet to ensure no frac-outs or channel bed erosion will affect the pipe. Placing the pipe at these depths will enable a "dry crossing" well below the river bed. These sections of the project will be built so the directional drilling begins at a safe distance from a waterway channel, utilizes pipe racks and rollers to minimize surface impacts in pipe lay-down areas, and extends below the bed at an appropriate depth, which was determined by subsurface exploration with geotechnical borings. In addition to the eighteen waterway crossings, three locations (EFH 11, 12, and 13) have been designed to minimize the potential for liquefaction and coastal erosion. At these locations the pipe will be installed by HDD at depths of 50 feet or more, which will protect the pipe from the action of the waves and preclude and disturbance to essential fish habitat and its associated biological communities. For this reason, minimal impact will occur to the dunes and the coastline at Levittown.

SURVEY RESULTS

A total of 18 stations were evaluated over a period of 5 days from February 14 to 18, 2011. The locations of the Essential Fish Habitat stations sampled have been included on the Plan design sheets in Appendix A of this document. Locations were initially established using GIS based aerial photography and then located in the field using two models of WAAS enabled, handheld GPS receivers manufactured by Garmin (GPSmap 60CSx and Oregon 400c). Tables 4 through 8 present the EFH species data collected. Photographs documenting the habitat observed at each EFH survey point are included in Appendix B. A brief summary of the data collected and a description of the each station sampled is included below:

EFH Habitat Types

Representative categories of Essential Fish Habitat (EFH), as identified in Fishery Management Plan Amendment of the Caribbean Fishery Management Council, were found within the project right of way. These included both estuarine areas (water column, mangrove wetlands, intertidal flats/salt ponds, sand and shell substrate, and mud flats) and marine areas (water column, sand and shell substrate, algal plains and hard bottoms). A total of eighteen stations were evaluated; fifteen of the eighteen HDD crossings were found to contain natural systems that included a mixture of physical, chemical, and biological properties that are included with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat.

With the exception of EFH Station 7 (Rio Cocal west), all of the EFH stations surveyed displayed anthropogenic impacts. These included upstream water diversions, streambed channelization, stormwater inputs, and garbage/waste debris deposition. No seagrass communities were observed within the limits of or adjacent to any of the proposed HDD crossing sites. The fish variability and

abundance observed during the survey were not high, likely owing to the absence of seagrass cover in the vicinity of the mangroves systems at the crossing sites (Pitman, S.J. et.al., 2006).

Mangroves, sandy bottom, and algal bottom communities were the most abundant communities found. Areas of karstic hard bottom were limited and seagrasses were not found. Mangrove forested systems were the dominant EFH community type; being found at ten of the eighteen EFH Stations sampled. No direct impacts to mangrove forested systems are proposed with the project as designed. The Rio Hondo and Rio Bayamon survey stations (EFH Stations 14 and 15) contained both estuarine mangrove and sandy bottom communities but were classified as Estuarine Sandy Bottoms based upon the percent cover of the dominant community type.

The Levittown shoreline area (Station 4336+06 to Station 4435+10) included the only marine areas. Within this EFH category, two marine community types were represented: sand and shell substrate and attached and drift macroalgae. The attached and drift macroalgae were associated with the intertidal and subtidal wave cut platform rock to the north. This area corresponds to Essential Fish Habitat Stations 9, 10, and 11. The water was turbid in this beach area and the shoreline is composed primarily of erosional sediments deposited from riverine sources.

Fish Community

Nearly all the fish collected during the survey were juveniles of marine species. As one would expect, there were also several species of fresh water fish taken in the brackish water environments. Most adult marine fish, the jacks (Family Carangidae) for example, do not live as adults in fresh water. As they grow older, some physiological change causes them to move to saltier waters. This may be a volume/surface area factor with regard to osmoregulation. Some mangroves, which shelter juvenile fish, may also be hypersaline. Here again few if any adults are found, suggesting an osmoregulatory facility in small fish which is lost as growth increases. Adults may also be deterred by the shallowness of the waters and the restricted space along the roots.

The fish community survey resulted in 34 species of fish (Table 4) representing 23 families being captured. Another 9 species were known to occur in the sampling area but were not captured or observed. The majority of species were represented by only a few individuals due to the limited sampling effort. Creel and cast net census from local fishermen present (February 18th and 19th) at the sampling points were used to supplement the species list when available. Only four species were represented at greater than 50% of the stations sampled. The most common species, the white mullet (*Mugil curema*), was captured or observed at 13 of the 15 estuarine/marine stations sampled. The two most common families, Mugilidae and Carangidae, were well distributed over the 15 estuarine/marine stations sampled. Approximately 37% of the species observed or collected have been documented as resident species (i.e. known to be present in at least 7 out of 12 months during the year). Transient species, those typically found in the estuary in only one or two non-consecutive months, comprised 35% of the species observed or collected. The remaining species (28%) have been classified as cyclical or regular visitors (i.e. those typically using the estuary from 3 to 6 months out of the year or for two consecutive months). The majority of species were found in only a few of the sampling stations (reference Table 4).

Macroalgae and Seagrass

Sufficient visibility existed at most stations to allow for visual assessment and confirmation of the presence or absence of seagrass and/or macroalgae beds. No rooted macrophytes or seagrasses were observed within, or in the immediate vicinity of, the project right-of-way at any of the 18 stations visited. Attached and drift macroalgae were observed along the Levittown shoreline (Essential Fish Habitat Stations 9, 10, and 11), the mouths of the Rio Cocal and Rio Hondo, and amongst the mangrove prop root communities in Peñuelas (EFH 4A).

Five common species of algae were observed at multiple EFH stations. The algae found were considered common based on visual observations of presence/absence during initial surveys over a wide variety of areas. Two congeneric species of brown algae (Division Chromophyta), *Dictyota dichotoma* and *Dictyota cervicornis* were collected and prevalent along the Levittown shoreline from the Rio Cocal to the Rio Bayamon. Two species red algae (Division Rhodophyta) species, *Acanthophora spicifera* and *Hypnea musciformis* were observed growing epiphytically on the roots of mangroves and associated with mangrove prop root communities. *H. musciformis*, a finely branched epiphytized species, was frequently observed attached to rubble or rock substrates. The fifth species, *Ulva fasciata* is a green alga (Division Chlorophyta) and was found anchored to hard substrates in areas that were likely subject to nutrient enrichment. *Ulva* and *Enteromorpha* are tolerant of fresh water, favor nutrient enriched water, and flourish near riverine/marine interphases.

Via Verde Pipeline Essential Fish Habitat (EFH) Evaluation
 Table 4. Fish species captured and observed at EFH survey stations, February 14 - 19, 2011.

Scientific Name	Common Name	Family	EFH Survey Station Numbers																
			Penuelas						Arecibo		Toa Baja							Guaynabo	
			1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16
<i>Anchoa hepsetus</i>	Striped anchovy	Engraulidae					N												
<i>Anchovia clupeioides</i>	Anchovy	Engraulidae					N						N	N	N	N	N		
<i>Anguilla rostrata</i>	American eel	Anguillidae							X										
<i>Archosargus rhomboidalis</i>	Sea bream	Sparidae					X					X							
<i>Bairdiella ronchus</i>	Ground croaker	Scianenidae					X						X	X	X	X	X	F	
<i>Bathygobius curacao</i>	Notchtongue goby	Gobiidae							N									W	
<i>Bathygobius soporator</i>	Frillfin goby	Gobiidae	X	U		X		X											
<i>Caranx hippos</i>	Crevalle jack	Carangidae		P								X	X	X	X	X	X	W	
<i>Caranx latus</i>	Horse-eye jack	Carangidae		L								X	X	X	X	X	X	E	
<i>Carcharhinus leucas</i>	Bull shark	Carcharhinidae		A			N					N	N	N	N	N	N	T	
<i>Centropomus ensiferus</i>	Fat snook	Centropomidae		N						N	N	N						L	
<i>Centropomus pectinatus</i>	Tarpon snook	Centropomidae		D						X								A	
<i>Centropomus undecimalis</i>	Common snook	Centropomidae					X				X	X	X	X	X	X	X	N	
<i>Cetengraulis edentulus</i>	Anchovy or Bocua	Engraulidae					X						X	X	X	X	X	D	
<i>Cyprinodon variegatus</i>	sheepshead minnow	Cyprinodontidae									X	X							
<i>Diapterus auratus</i>	Irish pompano	Gerrediae														X	X		
<i>Diapterus rhomberus</i>	Caitipa mojarra	Gerrediae										X							
<i>Dormitator maculatus</i>	Fat sleeper	Eleotridae							X										
<i>Eleotris pisonis</i>	Spinycheek sleeper	Eleotridae							X										
<i>Elops saurus</i>	Ladyfish	Elopidae										X	X	X	X	X			
<i>Epinephelus itajara</i>	Goliath grouper	Serranidae					N	N				N	N	N	N	N	N		
<i>Epinephelus striatus</i>	Nassau grouper	Serranidae																	
<i>Eucinostomus argenteus</i>	Spotfin mojarra	Gerrediae																	
<i>Eugerres plumieri</i>	striped mojarra	Gerrediae					X				X	X	X	X	X				
<i>Gambusia affinis</i>	Mosquitofish	Poeciliidae				X				X									X
<i>Gerres cinereus</i>	Yellowfin mojarra	Gerrediae																	
<i>Gobiomorus dormitor</i>	Bib-mouthed sleeper	Eleotridae							X									F	
<i>Lutjanus analis</i>	Mutton snapper	Lutjanidae					N	N			N	N	N			N	N	W	
<i>Lutjanus griseus</i>	Gray snapper	Lutjanidae				N	N	N	X		N	N	N	N	N	N	N		
<i>Lutjanus jocu</i>	Dog snapper	Lutjanidae		U										X	X	X		W	
<i>Megalops atlanticus</i>	Tarpon	Megalopidae		P			X	X	X	X		X	X	X	X	X	X	E	
<i>Microphis bracyurus</i>	Possam pipefish	Syngnathidae		L			X	N			X	X	X	X	X	N	N	T	
<i>Mugil curema</i>	White mullet	Mugilidae		A	X	X	X	X	X	X	X	X	X	X	X	X	X	L	
<i>Opisthonema oglinum</i>	Atlantic thread herring	Clupeidae		N			X	X				X	X	X	X	X	X	A	
<i>Oreochromis mossambicus</i>	Mozambique talapia	Chicliidae		D					X	X								N	X
<i>Panulirus argus</i>	Spiny lobster	Palinuridae					N	N			N	N							
<i>Poecilia reticulata</i>	Molly	Poeciliidae								X								D	
<i>Polydactylus virginicus</i>	Barbu	Polynemidae														X	X		
<i>Selene vomer</i>	Lookdown	Carangidae											N	N	N				
<i>Sphyraena barracuda</i>	Great barracuda	Sphraenidae					X												
<i>Strongylura notata</i>	Redfin needlefish	Belonidae								X									
<i>Strongylura timucu</i>	Timucu	Belonidae								X									
<i>Trachinotus falcatus</i>	Permit	Carangidae														X	X		

Notes: X - Denotes species captured or observed
 N - Presence documented or suitable habitat exists

Via Verde Pipeline Essential Fish Habitat (EFH) Evaluation
 Table 5. Benthic macroalgae found at EFH survey stations.

Genus / Species	Family	Peñuelas					Arecibo		Toa Baja							Guaynabo		
		EFH Station Number																
		1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16
<i>Acanthophora spicifera</i>	Rhodophyta											X	X	X				
<i>Bostrychia montagnei</i>	Rhodophyta					X												
<i>Caulerpa sertularoides</i>	Chlorophyta																	
<i>Caulerpa spp.</i>	Chlorophyta																	
<i>Chaetomorpha linum</i>	Chlorophyta		U			X												F
<i>Dictyota ciliota</i>	Phaeophyta		P									X	X	X				W
<i>Dictyota dichotoma</i>	Phaeophyta		L							X	X	X	X					
<i>Dunaniella salina</i>	Green Algae	X	A	X														W
<i>Enteromorpha flexuosa</i>	Green algae		N			X												E
<i>Gracilaria spp.</i>	Rhodophyta		D															T
<i>Hypnea musciformis</i>	Rhodophyta					X						X	X	X				L
<i>Laurencia obtusa</i>	Rhodophyta											X	X	X				A
<i>Laurencia papillosa</i>	Rhodophyta											X	X	X				N
<i>Polysiphonia sp.</i>	Rhodophyta																	D
<i>Ulva fasciata</i>	Chlorophyta											X	X	X	X			
<i>Ulva spp.</i>	Chlorophyta																	
Unid. Filamentous Green	Chlorophyta						X											

Notes:

Via Verde Pipeline Essential Fish Habitat (EFH) Evaluation
 Table 6. Plants - Macrophytes found at EFH survey stations, February 14 - 19, 2011.

Scientific Name	Common Name	Peñuelas					Aricebo		Toa Baja							Guaynabo		
		EFH Survey Station Number																
		1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16
<i>Acrostichum aureum</i>	Mangrove fern								X									
<i>Acrostichum danaeifolium</i>	Giant leather fern									X	X							
<i>Albizia procera</i>	Albicia					X		X						X	X			
<i>Avicennia germinans</i>	Black mangrove	X		X	X	X	X			X	X							
<i>Bambusa vulgaris</i>	Bamboo							X										
<i>Brachiaria mutica</i>	Para grass																	X
<i>Coccoloba uvifera</i>	Seagrape											X	X					
<i>Cocos nucifera</i>	Coconut palm											X	X	X				
<i>Cyperus alternifolius</i>	Umbrella sedge							X										
<i>Cyperus iria</i>	Flat sedge																	X
<i>Cyperus ligularis</i>	Swamp flatsedge			X														
<i>Cyperus odoratus</i>	Flat sedge				X													
<i>Dalbergia ecastaphyllum</i>	Dalbergia											X	X					
<i>Eclipta prostrata</i>	False daisy																	X
<i>Eleocharis interstinca</i>	Jointed spikerush																	X
<i>Gynerium sagittatum</i>	Caña brava							X										
<i>Halodule beaudettei</i>	Shoalgrass																	
<i>Halophila baillonis</i>	Paddlegrass																	
<i>Halophila decipiens</i>	Paddlegrass																	
<i>Halophila englemanni</i>	Star grass																	
<i>Heliotropum curassavicum</i>	seaside heliotrope	X		X														
<i>Ipomea pes-caprae</i>	Railroad vine	X		X								X	X	X				
<i>Ipomea setifera</i>	Wild morning glory																	X
<i>Juncus roemerianus</i>	Black needlerush																	
<i>Laguncularia racemosa</i>	White mangrove	X		X					X		X							
<i>Leucana leucocephala</i>	Leucana	X	X	X														X
<i>Limonium carolinianum</i>	Sea lavender																	
<i>Megathyrsus maximus</i>	Guinea grass		X											X	X	X		
<i>Mimosa pellita</i>	Mimosa							X										
<i>Paspalum vaginatum</i>	Seashore knotgrass													X				
<i>Paullinia pinnata</i>	Soapberry														X	X		
<i>Peltophorum pterocarpum</i>	Yellow poinciana														X	X		
<i>Rhizophora mangle</i>	Red mangrove					X	X		X	X				X	X			
<i>Ruppia maritima</i>	Widgeon grass																	
<i>Sesuvium portulacastrum</i>	Sea purslane	X		X														
<i>Spartina patens</i>	Marsh-hay cord grass												X					
<i>Sporobolis virginicus</i>	Seashore dropseed grass											X	X	X				
<i>Syringodium filiforme</i>	Manatee grass																	
<i>Terminalia catappa</i>	Tropical almond tree							X						X	X			
<i>Thalassia testudinum</i>	Turtlegrass																	
<i>Wedelia trilobata</i>	Creeping oxeye												X					

Notes: Of the 7 species of seagrass known to occur in Puerto Rico - including *Thalassia testudinum* (turtle grass), *Halophila baillonis*, *H. decipiens*, and *H. engelmannii* (paddle grasses), *Halodule beaudettei* (shoal grass), *Syringodium filiforme* (manatee grass), and *Ruppia maritima* (widgeon grass); none were found to be present within or adjacent to the EFH survey stations.

Via Verde Pipeline Essential Fish Habitat (EFH) Evaluation
Table 7. Invertebrates found at EFH survey stations.

Scientific Name	Common Name	EFH Survey Station Number																
		Penuelas				Aricebo				Toa Baja								
		1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16
<i>Aratus pisoni</i>	Mangrove crab				X													
<i>Arca zebra</i>	Turkey wing													X				
<i>Ascidia nigra</i>	Black tunicate				X													
<i>Barbatia candida</i>	White bearded ark												X					
<i>Callinectes sapidus</i>	Blue crab				X										X			
<i>Cardisoma guanhumi</i>	Giant land crab				X				X									
<i>Cassiopeia xamachana</i>	Upside-down jellyfish				X													
<i>Cerithiidae scalariformis</i>	Ladderhorn snail										X	X	X					
<i>Diodora viridula</i>	Green keyhole limpet										X	X	X					
<i>Donax variabilis</i>	Variable coquina											X						
<i>Ectenascidea turbiniata</i>	Mangrove tunicate				X													
<i>Goniopsis cruentata</i>	Spotted mangrove crab				N					N					N		N	
<i>Isognomon alatus</i>	Flat tree oyster				X													
<i>Littorina angulifera</i>	Mangrove periwinkle				X													
<i>Melampus coffeus</i>	Coffee bean snail																	
<i>Mytilopsis leucophaeta</i>	Dark false mussel													X				
<i>Noetia ponderosa</i>	Ponderous ark													X				
<i>Ocypode spp.</i>	Ghost crab(s)																	
<i>Panulirus argus</i>	Spiny lobster				N							X	X	X				
<i>Petricola pholadriiformis</i>	False angel wing										N	N	N					
<i>Phallusia nigra</i>	Black tunicate				X									X				
<i>Sesarma cinereum</i>	Gray marsh crab				N						N	N						
<i>Sesarma curacaoense</i>	Curacao marsh crab				N						N	N						
<i>Styela plicata</i>	Pleated sea squirt				X													
<i>Tedania ignis</i>	Fire sponge				X													
<i>Tellina tampaensis</i>	Tampa tellin											X	X	X				
<i>Triphora nigrocineta</i>	Black-lined triphora																	
<i>Uca pugilator</i>	Sand fiddler crab				EFH	X												
<i>Uca rapax</i>	Caribbean fiddler crab				X	X											X	
<i>Xiphocaris elongata</i>	Yellow nose shrimp					X												

Notes: X - Denotes species captured or observed
N - Presence documented or suitable habitat exists

Scientific Name		Common Name		Via Verde Pipeline Essential Fish Habitat (EFH) Evaluation																	
				Peñuelas								Aricebo								Toa Baja	Guaynabo
				1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16	17
<i>Anas discors</i>			X																		
<i>Ardea herodias</i>																					
<i>Bubulcus ibis</i>					X																
<i>Butorides striatus</i>						X															
<i>Calidris minutilla</i>												X									
<i>Calidris pusilla</i>			X									X	X								
<i>Ceryle alcyon</i>						X															
<i>Chadrius semipalmatus</i>			X																		
<i>Coccyzus americanus</i>										X											
<i>Columba leucocephala</i>																					
<i>Coereba flaveola</i>											X								F		
<i>Crotophaga ani</i>																					
<i>Dendroica discolor</i>											X										
<i>Egretta caerulea</i>		X	L			X															
<i>Elaenia martinica</i>																					
<i>Gallinula chloropus</i>							X														
<i>Himantopus mexicanus</i>																					
<i>Nycticorax nycticorax</i>																					
<i>Nycticorax viroleus</i>																					
<i>Pandion haliaetus</i>																					
<i>Pelicanus occidentalis</i>																					
<i>Phalacrocorax auritus</i>																					
<i>Quiscalus niger</i>																					
<i>Seiurus noveboracensis</i>																					
<i>Zenaida asiatica</i>																					
<i>Zenaida aurita</i>																					

Notes:

Individual EFH Station Summaries

EFH 1 – Peñuelas 1 (E2SS3N7), Pipeline Segment from Eco Electrica Terminal to Meter Station

Vegetative/Physical Characteristics - The wetland is best described as a hypersaline mangrove saltflat. The wetland area in the vicinity of EFH Station 1 was approximately 70 feet wide by 550 feet long and extended from Station -23+88 to Station -19+11. Drawing No. 48.0-Z-322.21 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts this wetland area. The aerial extent of the wetland was estimated to be 0.20 acres (8,800 square feet) assuming that 40 feet of the proposed pipeline right-of-way falls within the wetland. The pipeline will be constructed above ground, elevated on concrete piling supported pipe racks, over this wetland area. Permanent impacts to this area will be limited to the placement of the concrete pilings and the spread foot concrete pads. Each square piling/pad placement will pre-empt approximately 9 square feet. At the time of the survey, the area was inundated with 3 inches of water. The salinity in the area was 52 parts per thousand (ppt) and the water was clear; surface to bottom. Percent cover by natural vegetation in the project right-of-way area was approximately 60% and the vegetation in the basin area was dominated by dwarf black mangroves (*Avicennia germinans*), sea purslane (*Sesuvium portulacastrum*), and seaside heliotrope (*Heliotropium curassavicum*). The upland/wetland transitional fringe included Leucana (*Leucana leucocephala*), white mangrove (*Laguncularia racemosa*), swamp flatsedge (*Cyperus ligularis*) and seaside morning glory (*Ipomea pes-caprae*). Photographs EFH1-2528, EFH1-2528, and EFH11-2530 in Appendix B depict this hypersaline mangrove wetland.

Sediments and Benthos — The sediments in this area were classified as grey silts and fine sands with shell fragments. The organic content was high and there were large quantities of shells. The sediments were anoxic except for a few inches at the surface. Living organisms were rare. Mats of green and brown filamentous macroalgae were found on top of the sediment throughout the open water areas. The dominant algae tentatively identified as *Dunaniella salina*, a halophilic green alga known to dominate in hypersaline environments (Schleper et al. 1995).

Habitat Utilization - Habitat utilization by fauna was limited to fiddler crabs (*Uca* spp.), a little blue heron (*Egretta caerulea*), and one species of goby, the frillfin goby (*Bathygobius soporator*), which was observed in limited numbers. No seine sample or fish traps were set at this location.

EFH Determination/Comments - The area included the necessary vegetation and sediments to qualify as essential fish habitat however the wetland is not directly connected to the adjacent tidal wetland systems during normal tidal inundation. Extreme tides do reach and inundate this area. Since most juveniles of the “selected species of concern” require euryhaline conditions and an associated diverse biological communities to facilitate growth to maturity, this area would not constitute high value intertidal habitat.

EFH 2 – Peñuelas 2 (Uplands – Not EFH), Eco Electrica Meter Station

Vegetative/Physical Characteristics - The meter station pad is not located within a wetland area. The 0.82 acre area is part of a larger disturbed upland approximately 22 acres in size which extends from Sta.

-06+40 to Sta. 8+55. Drawing No. 48.0-Z-322.21 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts this upland area along with the limits of the proposed meter station. Initial vegetation signatures from the aerial photographs suggested that this area may have included supra-tidal flats and/or salterns. At the time of the survey, no water was present in the area. Percent cover by natural vegetation within the limits of the proposed meter station pad was approximately 85% and the vegetation in this area was dominated ruderal upland species which included Leucana (*Leucana leucocephala*) and the large non-native, tufted perennial grass, known as Guinea grass (*Megathyrsus maximus*, syn. *Panicum maximum*). Photographs EFH2-2595 and EFH2-2596 in Appendix B depict this upland fill pad.

EFH Determination/Comments - This area was not a wetland and did not include any waters (aquatic areas) and their associated physical, chemical, and biological properties that are used by fish; therefore the area was removed from consideration for EFH concerns.

EFH 3 – Peñuelas 3 (E2SS3/UBL) South Wetland / (E2US2/3P) North Wetland, HDD Extra Workspace

Vegetative/Physical Characteristics - The proposed workspace is located within two wetlands which are separated by an elevated berm that is used as an access road. The south wetland is directly connected to a tidal system while the north wetland is completely impounded. The south wetland area within the designated right-of-way was approximately 40 feet wide by 220 feet long (0.20 acre) and extends from Station 5+88 to Station 8+80. Drawing No. 48.0-Z-322.21 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts this wetland area. The pipeline will be constructed above ground, elevated on concrete piling supported pipe racks, over this wetland area. Permanent impacts to this area will be limited to the placement of the concrete pilings and the spread foot concrete pads. Each square piling/pad placement will pre-empt approximately 9 square feet.

Both wetlands associated with EFH Station 3 experience tidal fluctuations. These wetlands are man-altered and appear to be some type of former holding ponds. Both exhibit large expanses of unconsolidated muddy bottom and are lined by dwarfed black mangroves. The extra work space to be located in this area is approximately 145 wide by 200 long and will be used as an HDD entry point. The area is located at Sta. 9+29. Drawing No. 48.0-Z-325.00 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts the limits of the proposed extra work space. The aerial extent of the wetlands within the limits of the workspace, were estimated to be 0.55 acres. High salinities appeared to limit the number of species colonizing the wetland areas. At the time of the survey, both wetland areas (north and south of the berm) included expanses of open water. The salinity in both areas was 56 parts per thousand (ppt) and the water was clear; surface to bottom. Percent cover by natural vegetation within the limits of the proposed construction workspace was approximately 60% and the vegetation in the basin area was dominated by dwarf black mangroves (*Avicennia germinans*), sea purslane (*Sesuvium portulacastrum*), and seaside heliotrope (*Heliotropium curassavicum*). The upland/wetland transitional fringe included Leucana (*Leucana leucocephala*), white mangrove (*Laguncularia racemosa*), swamp flatsedge (*Cyperus ligularis*) and railroad vine (*Ipomea pes-caprae*). Photographs EFH3S-2569, EFH3S-2586, EFH3N-2571, and EFH3N-2576 in Appendix B depict this upland fill pad.

Sediments and Benthos — The sediments in this area were characterized by a 3 inch veneer of gray silts and fine sands over gray clay. The sediments were anoxic except for a few inches at the surface. Smaller mats of green and brown filamentous macroalgae were irregularly found on top of the sediment in the open water areas. The dominant algae was the same as that observed in EFH Station 1, tentatively identified as *Dunaniella salina*.

Habitat Utilization - Fauna observed within the proposed workspace area included fiddler crabs *Uca* spp. and three avian species, the semi-palmated sandpiper (*Calidris pusilla*), the yellow-crowned night heron (*Nycticorax violaceus*), and the black-necked stilt (*Himantopus mexicanus*). The stilt is a ground nesting species building its nest near water on a platform of grass and twigs where it lays 3 to 7 eggs. The breeding/nesting season for this species occurs from April to August. No seine sample or fish traps were set at this location. Schools of white mullet (*Mugil curema*) were observed to the south and west within the tidally connected wetland.

EFH Determination/Comments - One of the two wetland areas included with this station were found to exhibit physical, chemical, and biological properties that are consistent with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. The area would not constitute high value intertidal habitat as both wetland areas have been man altered and do not exhibit the diverse biological communities found in similar natural estuarine systems located to the southwest. The north wetland is not directly connected to the adjacent tidal wetland systems during normal tidal inundation and therefore was not determined to be Essential Fish Habitat. Tidal fluctuations did however exist within this wetland area. Temporary impacts have been limited to the north, non-EFH wetland. Minor impacts will be required to the south EFH wetland but will be limited to the placement of the concrete pilings and the spread foot concrete pads. Each square piling/pad placement will preempt approximately 9 square feet. Compensation for impacts to this wetland, if required, could be mitigated for on-site within the limits of the existing shoreline. A scrape down of existing spoil berms or previously disturbed upland areas; possibly prior to the commencement of construction, would assure that no temporal loss of wetland functions would occur and that the created wetlands would be successful.

EFH 4 – Peñuelas 4 (E2FO3N), Un-named Mangrove Lined Drainage Canal

Vegetative/Physical Characteristics - The wetland is best described as an upland cut mangrove lined drainage canal. The width of the wetland area in the vicinity of EFH Station 4 was approximately 45 feet from top of bank to top of bank and the total wetland area encompassed by the project right-of-way was 0.05 acres (2,250 square feet). The area is located at Sta. 1+50 and will be included in the 1,417 linear foot directional drill (HDD) which runs under the Matilde River to the east. Drawing Sheets No. 48.0-Z-325.00 (Sheet 1 of 1, Rev. 1) and 48.0-Z-321.01 (Sheet 01 of 96, Rev. 1) found in Appendix A depicts the limits of the canal and EFH sampling point. The crossing site was adjacent to an existing piling supported pipe bridge. It was apparent that this canal is subject to large and extended fluctuations in water levels; possibly upland cut and man-regulated for water cooling purposes. The pneumatophores of the black mangroves which lined canal banks were up to 12 inches (30.5 cm) in length and some exhibited adventitious rooting. At the time of the survey, the area was inundated and

the water depth at the centerline of the channel was 1.92 feet (58.4 cm). The salinity in the area was measured and was found to be 7 parts per thousand (ppt) and the water was turbid with evidence of an iridescent surface sheen. Water quality within the ditch appeared to be poor and a distinct petrochemical odor was present. Percent cover by natural vegetation within the project right-of-way area was approximately 70% and the vegetation along the canal banks was dominated by black mangroves (*Avicennia germinans*). The upland/wetland transitional fringe included the flatsedge (*Cyperus odoratus*). Photographs EFH3S-2569, EFH3S-2586, EFH3N-2571, and EFH3N-2576 in Appendix B depict this mangrove wetland.

Sediments and Benthos — The sediments in this area were classified as grey silts and fine sands with shell fragments. The silt and organic content was high and the depth to “solid bottom” was not determined. The sediments were anoxic except for a few inches at the surface. Living organisms were rare. No macroalgae, algal mats or seagrasses were observed within the limited open water areas.

Habitat Utilization - Fauna observed within and adjacent to the ditch included the common moorhen (*Gallinula chloropus*), greater Antillean grackle (*Quiscalus niger*), prairie warbler (*Dendroica discolor*), fiddler crabs (*Uca* spp.), the giant land crab (*Cardisoma guanhumii*), and small finfish; thought to be white mullet (*Mugil curema*) and the frillfin goby (*Bathygobius soporator*) which was observed in limited numbers. No seine sample or fish traps were set at this location.

EFH Determination/Comments - The area included the necessary vegetation and sediments to qualify as essential fish habitat however the wetland is not directly connected to the adjacent tidal wetland systems during normal tidal inundation. Extreme tides do however reach and inundate this area. Since most juveniles of the “selected species of concern” require euryhaline conditions and associated diverse biological communities to facilitate growth to maturity, this area would not constitute high value intertidal habitat.

EFH 4A – Peñuelas 4A (E1UBLx), Matilde River

Vegetative/Physical Characteristics - The wetland is best described as a man altered canal that has been deepened and widened for vessel access. The HDD crossing point lies approximately 2,230 feet upstream from the Matilde River mouth. All uplands within the surrounding watershed have been developed as, and/or are presently being used for, commercial/industrial uses. The width of the wetland area in the vicinity of EFH Station 4A was approximately 195 feet from top of bank to top of bank and the total wetland area encompassed by the project right-of-way was 0.48 acres (1,950 square feet). The area is located at construction line Sta. 4+75 and will be included in the 1,417 linear foot directional drill (HDD) which runs under the Matilde River and exits in the upland industrial area approximately 935 feet to the east. Drawing Sheets No. 48.0-Z-325.00 (Sheet 1 of 1, Rev. 1) and 48.0-Z-321.01 (Sheet 01 of 96, Rev. 1) found in Appendix A depicts the limits of the Matilde River crossing and EFH sampling point. The banks of the channel at this point are lined with red mangroves (*R. mangle*) which are approximately 25 feet (8 meters) in height. Water depth at the edge of the mangroves was two feet and the canal side slopes are steep, rapidly dropping off to six feet. The width of the open water body was 95 feet.

At the time of the survey, the tide was low and the water depth at the centerline of the channel was estimated to be seven feet (2.13 meters). The salinity in the area was measured and was found to be 37 parts per thousand (ppt) and the water was moderately clear. Secchi depth was measured at six feet. Percent cover by natural vegetation within the project right-of-way area was approximately 40% and was dominated by red mangroves (*Rhizophora mangle*) concentrated along the canal banks. The upland/wetland transitional fringe included Albicia (*Albizia procera*) and panic grasses (*Panicum* sp.). No seine sample or fish traps were set at this location. Photographs EFH4A-2556, EFH4A-2558, and EFH4A-2560 in Appendix B depict this channel, the mangrove shoreline and the landward extent of the mangrove fringe.

Sediments and Benthos — The sediments in this area were classified as grey silts and fine sands with shell fragments. The silt and organic content was high and the depth to “solid bottom” was not determined. The sediments present were silts and very fine sands covered with mangrove litter and organics within the mangrove fringe and gray fine sands waterward towards the centerline of the canal. Macro algae and algal mats were observed in the sub tidal zone associated with the mangrove prop roots. No seagrasses were observed within the limited open water areas.

Habitat Utilization - Fauna observed at the Matilde River EFH site included a sub littoral/littoral community associated with the prop root zone of red mangroves. Within the prop roots four species of included macro algae were observed (*Ulva* sp., *Bostrychia montagnei*, *Chaetomorpha linum*, and *Enteromorpha flexuosa*). In addition, common sessile filter feeding organisms such as bryozoans, black tunicate (*Ascidia nigra*), fire sponge (*Tedania ignis*), and flat tree oyster (*Isognomon alatus*) were observed fixed to the prop roots. The upside down jellyfish (*Cassiopeia xamachana*) was also present in limited numbers. In the arboreal canopy, several mobile invertebrates were present including the common mangrove crabs (*Aratus pisoni* and *Sesarma* sp.) and lagoonal snails (*Littorina anguilifera* and *Cerithidea scalariformis*). Six species of finfish were observed in the open water areas and within the mangrove prop roots. These included the white mullet (*Mugil curema*), moharra (*Eugerres plumieri*), snook (*Centropomus* sp.), Atlantic thread herring (*Opisthonema oglinum*), ground croaker (*Bairdiella ronchus*), and the tarpon (*Megalops atlanticus*). Fiddler crab burrows (*Uca* sp.) and burrows of the giant land crab (*Cardisoma guanhumi*) were abundant landward of the mangroves.

EFH Determination/Comments - EFH Area 4A includes the necessary vegetation, associated biological community, and sediments to qualify as essential fish habitat pursuant to the Caribbean Fishery Management Council’s (CMFC) definition of Essential Fish Habitat. The area would constitute high value intertidal habitat except for the man induced alterations to the associated uplands and watershed. This was the only mangrove wetland in the Peñuelas EFH sampling area to exhibit an extensive prop root community and associated guilded structure; however, more diverse biological communities were found in similar unaltered, natural estuarine systems located to the southwest.

EFH 5 – Peñuelas 5 (E2EFO3N), Un-Named Canal

Vegetative/Physical Characteristics - The wetland is best described as a mangrove lined drainage canal. The width of the wetland area in the vicinity of EFH Station 5 was approximately 68 feet from top of

bank to top of bank and the total wetland area encompassed by the project right-of-way was 0.08 acres (3,400 square feet). The area is located at Sta. 40+05 and will be included in a 1,205 linear foot directional drill (HDD) which will be solely dedicated to this crossing. Entry and ending points for the HDD are in the uplands and are located greater than 550 feet from the wetland canal. Immediately to the south of the crossing point is an existing concrete bridge. Drawing Sheet No. 48.0-Z-321.01 (Sheet 01 of 96, Rev. 1) found in Appendix A depicts the limits of the directional drill crossing and the EFH sampling point. At the time of the survey, the area was tidally inundated and the water depth at the centerline of the channel was 6.1 feet (1.86 meters). The salinity in the area was measured and was found to be 23 parts per thousand (ppt) and the water was turbid with a noticeable brown organic color. Secchi depth was less than 0.5 foot (15.24 cm). Percent cover by natural vegetation within the project right-of-way area was approximately 75% with only a small open water area located along the centerline of the canal. The canal banks are dominated by large black mangroves (*Avicennia germinans*) and red mangroves (*Rhizophora mangle*) which ranged up to 20 feet in height (6.09 m). The mangrove canopy covers the channel along this section of the canal. Photographs EFH5-2534, EFH5-2540, and EFH5-2541 in Appendix B depict this channel, the mangrove shoreline and some representative fish collected in the seine sample.

Sediments and Benthos — The sediments in this area were classified as very fine brown sands with organics and detrital matter. The silt and organic content was high and the depth to “solid bottom” was difficult to determine. No macroalgae, algal mats or seagrasses were observed within the limited open water areas.

Habitat Utilization - Observations of fauna utilizing the habitat included the yellow-crowned night-heron (*Nycticorax violaceus*), common moorhen (*Gallinula chloropus*), greater Antillean grackle (*Quiscalus niger*), white-winged dove (*Zenaida asiatica*), Zenaida dove (*Zenaida aurita*), bananaquit (*Coereba flaveola*), green iguana (*Iguana iguana*), the giant land crab (*Cardisoma guanhumii*), fiddler crabs (*Uca* spp.), and several smaller finfish species. No fish traps were set at this location. One seine sample, which affectively spanned the open water area, was collected. Fish captured in the seine included tarpon (*Megalops atlanticus*) and the frillfin goby (*Bathygobius soporator*). Other schooling fishes, thought to be white mullet and Atlantic threadfin were also observed.

EFH Determination/Comments - The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. however the wetland is not directly connected to the adjacent tidal wetland systems during normal tidal inundation. Extreme tides do however reach and inundate this area. Since most juveniles of the “selected species of concern” require euryhaline conditions and associated diverse biological communities to facilitate growth to maturity, this area would not constitute high value intertidal habitat.

EFH 6 – Peñuelas 6 (R2UB1/2H), Rio Tallaboa

Vegetative/Physical Characteristics - The wetland has been classified as a lower perennial riverine system with a mixed bottom consisting of cobble-gravel and sand. The wetland was not mapped by the NWI Inventory at the point of the proposed HDD. The area is located at Sta. 40+05 and will be included

in a 1,298 linear foot directional drill (HDD) which will be solely dedicated to this crossing. Drawing Sheet No. 48.0-Z-325.01 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts the limits of the directional drill crossing and the EFH sampling point. Entry and ending points for the HDD are in the uplands and both are located greater than 500 feet from the river system. The boring depth will be at minus 58 feet below the river bottom at the point crossing point. The river channel is approximately 33.5 feet wide at the crossing point and the river connects with the open ocean 0.78 miles to the south-southwest of the EFH sampling station. No evidence of tidal influence was observed at the sampling point and the salinity was measured to be 2.0 parts per thousand (ppt). Downstream flow was evident and however no suspended sediment and fine particulates were evident in the water column at the transect location. Water clarity was good and Secchi depth was at stream bottom. The eastern river bank was heavily escarped with near vertical side slopes at the crossing location. The west bank was vegetated. Photographs EFH6-2547, EFH5-2550, EFH5-2551, and EFH5-2554 in Appendix B depict this river channel and the associated shoreline. The channel depth profile was relatively flat with depths ranging from 0.6 to 1.3 feet.

Percent cover by natural vegetation within the project right-of-way area was limited to twenty-five percent (25%) of the crossing area and is concentrated on the west bank and a small stand of at the toe of slope of the east bank. The vegetation along the western river bank was dominated by the troublesome weed *Mimosa pellita* tall stands of bamboo (*Bambusa vulgaris*) with Albicia (*Albizia procera*) and tropical almond trees (*Terminalia catappa*) interspersed. Forest canopy height ranged from 9 – 12 meters. The dominant understory species in this area was the umbrella sedge (*Cyperus alternifolius*). The western river bank was comprised of dense stands of caña brava (*Gynerium sagittatum*) which stood in excess of 5 meters in height. Vegetative cover in this area approached 85 percent.

Sediments and Benthos — The sediments in this area were classified as dark gray fine sand with limited silt. The bottom sediments were “well washed” right up to the river bank. Depositional sediments from flood waters No rooted macro algae or rooted macrophytes and/or seagrasses were observed within the limits of the transect. Some filamentous green fouling algae was observed collected on snags (fallen woody debris) within the river bed.

Habitat Utilization - Observations of fauna utilizing the habitat included the smooth-billed ani (*Crotophaga ani*), the belted kingfisher (*Ceryle alcyon*), a green-backed heron (*Butorides striatus*), and several finfish species. No fish traps were set at this location and one seine sample was collected. Due to the mixed bottom composition at the crossing site, the seining met with limited success. Several specimens of the yellow-nose shrimp (*Xiphocaris elongata*) were captured along with one fat sleeper (*Dormitor maculatus*). Most of the finfish observed were smaller species of the sleeper family (Eleotridae) and appeared to include the fat sleeper (*Dormitor maculatus*), the bigmouth sleeper (*Gobiomorus dormitor*), and the spinycheek sleeper (*Eleotris pisonis*).

EFH Determination/Comments - This area was not found to exhibit physical, chemical, and biological properties that are consistent with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. The area at the point of the proposed crossing lacked any tidal influence the

necessary vegetation to qualify as essential fish habitat however the river is directly connected to the nearby marine system and several marine/estuarine species, including the pipefish (*Microphis brachyurus*) and gray snapper (*Lutjanus griseus*), were observed within the river, approximately 0.25 miles to the south of the crossing site. The area will not be subjected to any direct impacts due to the embedment depth (-58 feet) and the distance of the directional drill points from the riverine waterbody (greater than 500 feet minimum). Since most juveniles of the “selected species of concern” require euryhaline conditions and access to associated diverse biological communities to facilitate growth to maturity, this subtidal riverine area should be considered Essential Fish Habitat.

EFH 7 – Arecibo 1 (E1UBL-Subtidal River), Rio Grande de Arecibo

Vegetative/Physical Characteristics - The wetland has been mapped as estuarine subtidal unconsolidated bottom by the NWI Inventory at the point of the proposed HDD. The 1,823 foot long HDD will pass under the river at a depth of minus 55 feet below the river bottom at the crossing point. The river channel is approximately 135 feet wide at the crossing point. Drawing Sheet No. 48.0-Z-321.44 (Sheet 44 of 96, Rev. 1) found in Appendix A depicts the limits of the directional drill crossing and the EFH sampling point. The river connects with the open ocean 0.8 miles to the northwest in the vicinity of the PR-680 bridge (Avenue de Victor Rojas). Currents were rapid and suspended sediment and fine particulates were present in the water column at the transect location. Secchi depth was less than 3 feet. The river banks were escarped with steep side slopes (1-foot vertical to 1.5-feet horizontal, 1H:1.5V) at the crossing location. The distance from top of bank to water surface was approximately 3 feet and the total water depth at the toe of slope of the bank was -4.66 feet. Depth continued to drop off rapidly; being -8.75 feet within 15 feet of the river bank. No benthic algae, rooted macro algae or rooted macrophytes (seagrasses) were observed within the limits of the transect. Salinity measured 1.5 ppt at the time of the site visit.

Percent cover by natural vegetation within the project right-of-way area was approximately averaged 65% and the vegetation along the eastern river bank was dominated by tall stands of bamboo (*Bambusa vulgaris*) with Albicia (*Albizia procera*) and tropical almond trees (*Terminalia catappa*) interspersed. Forest canopy height ranged from 9 – 12 meters. The dominant understory species in this area was the umbrella sedge (*Cyperus alternifolius*). The western river bank was comprised of dense stands of caña brava (*Gynerium sagittatum*) which stood in excess of 5 meters in height. Vegetative cover in this area approached 85 percent. Photographs EFH7-2599, EFH7-2600, EFH7-2603, and EFH7-2604 in Appendix B depict this river channel and the associated shoreline vegetation.

Sediments and Benthos — The sediments in this area were classified as tan to light brown fine sands. Bottom scour was evident at this point in the river bend and the presence of silt, very fine sands, and organic matter was high within the water column. The bottom sediments were “well washed” right up to the river bank. No macroalgae, algal mats or seagrasses were observed within the open water areas.

Habitat Utilization - Observations of fauna utilizing the habitat included a pair of green-backed herons (*Butorides striatus*), several green iguanas (*Iguana iguana*), the giant land crab (*Cardisoma guanhumi*), and several finfish species including the white mullet (*Mugil curema*), Mozambique tilapia

(*Oreochromis mossambicus*), tarpon (*Megalops atlanticus*), and the timucu (*Strongylura timucu*). No seine sample or fish traps were set at this location due to the escarped banks, deep water depths, and swift current at this crossing point.

EFH Determination/Comments - The area at the point of the proposed crossing lacked the necessary vegetation to qualify as essential fish habitat but the river was tidally influenced and directly connected to the adjacent marine waters making the area a valuable corridor for juvenile and migratory finfish. Since most juveniles of the “selected species of concern” require euryhaline conditions and access to associated diverse biological communities to facilitate growth to maturity, this subtidal riverine area should be considered Essential Fish Habitat.

EFH 8 – Arecibo 2 (E2FO3N2 – Mangrove lined Canal), Tributary to Caño Tiburones

Vegetative/Physical Characteristics - The wetland area was not mapped as estuarine habitat by the NWI Inventory at the point of the proposed pipeline crossing. The canal is spanned by an existing open grate steel bridge. The channel may have previously used a cooling canal associated with the Cambalachee power plant located immediately to the north. The canal was determined to be a Water of the United States (WoUS) due to its tidal connection to the adjacent Caño Tiburones however the channel is non-navigable by vessel traffic at the sampling point. The proposed crossing for this canal would require a 180 foot long shallow directional drill, or HDD, to pass under the narrow canal bottom at the crossing point. Drawing Sheet No. 48.0-Z-321.44 (Sheet 44 of 96, Rev. 1) found in Appendix A depicts the EFH sampling point, the proposed Cambalache Meter Station, and the associated service laterals. The mangrove lined channel is approximately 60 feet wide from top of bank to top of bank at the crossing point with a canopied open water area approximately 30 feet wide. The banks include areas of exposed limerock. The channel continues northwest, then north for a distance of 0.53 miles, running parallel to PR-681, where it connects with the larger Caño Tiburones before entering the open ocean. The water depths in the canal ranged from 2 feet deep at the shoreline to 4.5 feet deep in the centerline of the channel. The canal is lined along both sides with large white mangroves (*Laguncularia racemosa*) which are 9 to 10 meters (27 to 30 feet) in height resulting in 100% canopy closure. Smaller red mangroves (*Rhizophora mangle*) line the open water area of the canal. The understory, where present, is limited to leather fern (*Acrostichum aureum*). Photographs EFH8-2608, EFH8-2610, and EFH8-2614 in Appendix B depict this mangrove lined canal and a snook captured at this location.

Sediments and Benthos - The sediments were deep, unconsolidated muck and silts with limited amounts of very fine gray sands. Extensive amounts of mangrove detrital matter were present. No macroalgae, algal mats or seagrasses were observed within the open water areas. A slight out-going tidal current was present and suspended sediment and fine particulates were observed being transported in the water column at the transect location. Secchi depth was less than 3 feet. Salinity measured 5.0 ppt at the time of the site visit and no stratification was noted.

Habitat Utilization - Observations of fauna utilizing the habitat included the yellow-crowned night-heron (*Nycticorax violaceus*), northern water thrush (*Seiurus noveboracensis*), the giant land crab (*Cardisoma guanhumii*), fiddler crabs (*Uca* spp.), and several smaller finfish species. No fish traps were set at this

location. A seine sample, which represented approximately one-third of the open water area, was collected. Fish captured included the common snook (*Centropomus undecimalis*).

EFH Determination/Comments - The canal wetland exhibited physical, chemical, and biological properties that are consistent with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. The area is a high value intertidal habitat due to its mature and expansive forested mangrove canopy and its importance as a source of mangrove organic matter (detritus) to the associated community food web. No impacts to this habitat will be required to this mangrove lined canal do to the use of an HDD which originates and terminates in the uplands. No secondary or cumulative impacts are anticipated.

EFH 9 – Toa Baja 1 (E2FO3M – Riverine Mangrove Forest), Rio Cocal Tributary

Vegetative/Physical Characteristics - The wetland is best described as a riverine mangrove forest. The width of the mangrove forested area in the vicinity of EFH Station 9 was approximately 600 feet and the open waterbody was limited to 15 feet in width. The total wetland area encompassed by the project right-of-way for this project segment, Station 4245+63 to Station 4288+15, was 4.88 acres (212,600 square feet). The area is will be included in a single 4,531 linear foot directional drill (HDD) embedded at a depth of minus 55 feet below the river bottom. The HDD right-of-way area has been limited to 50 feet wide in this riverine mangrove forest. Entry and ending points for the HDD are in the uplands and are located greater than 750 feet from the mangrove forested wetland. The area lies 0.6 miles west-southwest of the PR-165 Rio Cocal highway bridge. Drawing Sheet No. 48.0-Z-321.88 (Sheet 88 of 96, Rev. 1) found in Appendix A depicts the EFH sampling point, the limits of the construction right-of-way, and the HDD boring points. The water depth at EFH Station 9 was 5.1 feet (1.55 meters) at the time of the survey. The salinity in the area was low at 8 parts per thousand (ppt) and the water was turbid with a noticeable brown organic color. Secchi depth was less than 0.5 feet (15.24 cm). Percent cover by natural vegetation within the project right-of-way area was approximately 95% with only a small open water area located along the centerline of the canal. The mangrove forested area was dominated by large red (*Rhizophora mangle*) and black mangroves (*Avicennia germinans*) which ranged up to 45 feet in height (13.7 m). A limited number of white mangroves (*Laguncularia racemosa*) and swamp fern (*Acrostichum danaeifolium*) were also interspersed throughout the forest understory. The mangrove canopy covers the channel along much of this section of the canal. Photographs EFH9-2620 and EFH9-2624 in Appendix B depict the narrow open water channel within the larger mangrove forested system. The EFH survey station was located along the centerline of the 50 foot wide pipeline right-of-way which corresponds with the centerline of the open water channel. Photographs EFH9-2620 and EFH9-2624 in Appendix B depict the location of the EFH sampling station.

Sediments and Benthos — The sediments in this area were classified as very fine gray sands with organic and detrital matter. Deep pockets of silts and organic matter were found and the depth to “solid bottom” was often difficult to determine. Open water areas were typically associated with a consolidated karstic bottom. No macroalgae, algal mats or seagrasses were observed within the limited open water areas.

Habitat Utilization - Observations of Fauna observed utilizing the habitat included the yellow-crowned night-heron (*Nycticorax violaceus*), belted kingfisher (*Ceryle alcyon*), black-crowned night-heron (*Nycticorax nycticorax*), Caribbean elaenia (*Elaenia martinica*), common moorhen (*Gallinula chloropus*), yellow-billed cuckoo (*Coccyzus americanus*), green iguana (*Iguana iguana*), common mangrove crabs (*Aratus pisoni* and *Sesarma* sp.), and several finfish species. Two fish traps were set at this location. One seine sample was attempted in a limited open water area. Seining proved to be ineffective as submerged root masses precluded the net lead line from maintain contact with the bottom. Fish observed included the tarpon (*Megalops atlanticus*), snook (*Centropomus* spp.), white mullet (*Mugil curema*), moharra (*Eugerres plumieri*), and Atlantic thread herring (*Opisthonema oglinum*). Colored water prevented visual observations amongst the mangrove roots.

EFH Determination/Comments - The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. This riverine mangrove forested exhibits the euryhaline conditions required and utilized by most juveniles of the “selected species of concern” to facilitate growth to maturity, this area would constitute high value habitat.

EFH 10 – (E1UB2L – Subtidal Open Water Estuarine River Mouth), Rio Cocal Main Channel

Vegetative/Physical Characteristics - This wetland area constitutes the open water estuarine area at the mouth of the Rio Cocal River. The width of the open water area in the vicinity of EFH Station 10 was approximately 600 feet (92 m). feet in width. The total wetland area encompassed by the project right-of-way for this project segment, Station 4245+63 to Station 4288+15, is included in the area computed for EFH 9 (4.88 acres). The area is will be included in the single 4,531 linear foot directional drill (HDD) and the embedment depth is minus 55 feet below the river bottom. The HDD right-of-way area remains limited to 50 feet wide in this subtidal estuarine area. The HDD entry point is located to the east in the uplands and is greater than 550 feet from the estuarine wetland. The crossing area lies approximately 550 feet southwest of the PR-165 Rio Cocal highway bridge. Drawing Sheet No. 48.0-Z-321.88 (Sheet 88 of 96, Rev. 1) found in Appendix A depicts the EFH sampling point, the limits of the construction right-of-way, and the HDD boring points. The water depth at EFH Station 10 ranged from 4 to 6 feet along the center section of the open water channel, shallowing to three feet along the eastern shoreline. The salinity in the area was 23 parts per thousand (ppt) and the water was mildly turbid with a noticeable light brown organic color. Secchi depth however was surprisingly deep at 4.5 feet, enabling the sand bottom to be visible for the entire length of the transect area. No macroalgae, algal mats or seagrasses were observed within the open water area at the crossing point. Natural vegetated cover was limited to the mangrove forested areas at the ends of the study transect. Canopy closure within the mangrove fringe community was 65 to 70% and the average tree height within the system was 35 feet (10.6 m)cover by natural vegetation within the project right-of-way area was approximately 95% with only a small open water area located along the centerline of the canal. These areas were dominated by large red (*Rhizophora mangle*) mangroves which ranged up to 35 feet in height (10.6 m). A limited number of black and white mangroves and swamp fern (*Acrostichum danaeifolium*) were also interspersed throughout the forest understory.

Sediments and Benthos — The sediments in this area were classified as gray fine sand with some silts. Noticeably absent were the pockets of silts, organic matter, and detritus found upstream at EFH Station 9. No macroalgae, algal mats or seagrasses were observed within the open water areas associated with the pipeline crossing.

Habitat Utilization - Fauna observed utilizing the habitat included the black-crowned night-heron (*Nycticorax nycticorax*), green iguana (*Iguana iguana*), common mangrove crabs (*Aratus pisoni* and *Sesarma* sp.), swimming crabs (*Callinectes sapidus*) and finfish species. Two fish traps were set at this location. One seine sample was collected in an open water area adjacent to the bridge shoreline. Fish observed and or captured included the tarpon (*Megalops atlanticus*), snook (*Centropomus* spp.), white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*) and juvenile Carrangidae (*Caranx hippos* and *C. latus*).

EFH Determination/Comments - The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. This subtidal estuarine exhibits the necessary vegetation, sediments (sandy bottoms), and associated benthic community euryhaline conditions and sandy bottoms required and utilized by most juveniles of the “selected species of concern” to facilitate growth to maturity, this area would constitute high value habitat.

EFH 11 – M2US2P Levittown Shoreline West

Vegetative/Physical Characteristics - The Environmental Sensitivity Index (NOAA, ESIMAP 11) describes the section of shoreline from Station 4336+06 to Station 4435+10 as Fine to Medium Grained Sandy Beach and Exposed Wave-Cut Platform Bedrock. This segment includes all of the Levittown beach area and three EFH Stations. This marine habitat is exposed to the waves and currents of the open ocean and the water regime is determined primarily by the ebb and flow of oceanic tides and the relative position of the habitat on the beach slope. EFH Station 11 is located at construction line Station 4348+50 along the uppermost reaches of the Levittown beachfront approximately one-half mile southeast of the intersection of PR-868 and PR-165. Drawing Sheet No. 48.0-Z-321.90 (Sheet 90 of 96, Rev. 1) found in Appendix A depicts the EFH sampling point, the limits of the construction right-of-way, and the HDD boring points. The shoreline at this point is a high energy shoreline and has been stabilized with a series of rip-rap breakwaters and groins. The upland area is subject to erosion and this erosion becomes more pronounced to the east. The beach slope at this point is 1 vertical to 3 horizontal (1V:3H). Photographs EFH11-2528 and EFH11-2530 depict this shoreline section. Portions of the upland along this entire shoreline are to be used as an HDD pull back area. The centerline of the pipeline right-of-way is located approximately 80 feet landward of the mean high water line at this point. All pipeline staging and laydown areas have been designed to be located landward of the mean high water line, typically on the south side of the right-of-way, to avoid any work in Waters of the United States (WoUS) and will be accomplished using pipe racks with rollers to further minimize the disturbance to the ground surface. The pipeline will be embedded at a depth minus 55 feet in this area to protect the pipe from the action of the waves (liquefaction and coastal erosion) and to preclude any disturbance to essential fish habitat and its associated biological communities.

The salinity in this area averages 35 parts per thousand (ppt) and the water was mildly turbid with a light chop at the time of the site inspection. The sand bottom was visible within the transect area at the time of the station survey. Attached macroalgae and drift algae were found 100 feet to the north of the construction right-of-way limit at EFH Station 11, associated with the wave-cut platform bedrock. Photograph EFH11-2529 and EFH13-2512 shows the location of the exposed wave-cut platform bedrock and associated algal communities.

The landward section of this high energy shoreline includes an 85 foot wide band of mixed beach dune, coastal strand, and maritime forest vegetation. The dominant species identified at EFH Station 11 included the coconut palm (*Cocos nucifera*), dalbergia (*Dalbergia ecastaphyllum*), seagrape (*Coccoloba uvifera*), creeping oxeye (*Wedelia trilobata*), and railroad vine (*Ipomea pes-caprae*).

Sediments and Benthos — The sediments in this area were classified as fine to medium grained sand with shell fragments and appear to be depositional sediments originating from the discharges of the Rio Hondo and Rio Bayamon. Colonized bedrock habitat was present to the north of the survey station, beginning approximately 100 feet to the north of the pipeline laydown area and extending waterward beyond the intertidal zone. This habitat is best described as exposed bedrock contiguous with the shoreline that has coverage of macroalgae, gorgonians, and other sessile invertebrates that partially obscures the underlying rock. The attached macroalgae and drift algae present along this section of shoreline included: *Ulva fasciata*, *Dictyota dichotoma* and *D. ciliota*, *Acanthophora spicifera*, *Enteromorpha flexuosa*, *Laurencia papillosa* and *L. obtusa*, and *Hypnea musciformis*. No seagrasses were observed within the nearshore and intertidal areas adjacent to the pipeline right-of-way.

Habitat Utilization - Fauna observed utilizing the area included semi-palmated sandpiper (*Calidris pusilla*), least sandpiper (*Calidris minutilla*), brown pelican (*Pelecanus occidentalis*), green iguana (*Iguana iguana*), ghost crabs (*Ocypode* spp.) and several finfish species. No fish traps or seine samples were collected at this location. Fish known to occur at this location was based upon personal communication with local fisherman, a site specific creel census of fishermen, and/or observations of cast net catches at the time of the survey. Species identified included the tarpon (*Megalops atlanticus*), snook (*Centropomus* spp.), white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*), and the blue crab (*Callinectes sapidus*).

EFH Determination/Comments – The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. The intertidal and subtidal zones exhibited macroalgae and hard substrate, sandy bottoms, and associated benthic communities required and utilized by most juveniles of the “selected species of concern” to facilitate growth to maturity. The intertidal and subtidal areas at this station constitute high value habitat.

EFH 12 – Toa Baja 4 (M2US2P-Marine Open Water Beach), Levittown Mid Shoreline

Vegetative/Physical Characteristics – This station is representative of the fine to medium grained sandy beach and exposed wave-cut platform bedrock area which dominates this entire shoreline. This shoreline segment includes all of the Levittown beach area and three EFH Stations. The beach continues

to be exposed to the wave and currents of the open ocean at this survey point although the station appears to be at a shoreline nodal point or a mid-point between two jetties. This section of beach exhibited a much shallower slope (1V: 4H) and did not show the erosion found at EFH Stations 11 and 13. EFH Station 12 is located at construction line Station 4384+28 and is the most waterward of the three survey stations along the Levittown beachfront. Photographs EFH12-2517, EFH12-2518, and EFH12-2519 depict this shoreline section. This station corresponds to the exit point for one of the horizontal direction drills (HDD). Portions of the upland on either side of this station are to be used as an HDD pull back area. Drawing No. 48.0-Z-321.90 (Sheet 90 of 96) found in Appendix A depicts the construction staging areas. The centerline of the pipeline right-of-way is located approximately 150 feet landward of the mean high water line at this point and this section represents the widest expanse of beach shoreline along this project segment. All pipeline staging and laydown areas have been designed to be located landward of the mean high water line, typically on the south side of the right-of-way, to avoid any work in Waters of the United States (WoUS) and will be accomplished using pipe racks with rollers to further minimize the disturbance to the ground surface. The pipeline will be embedded at a depth minus 55 feet in this area to protect the pipe from the action of the waves (liquefaction and coastal erosion) and to preclude any disturbance to essential fish habitat and its associated biological communities.

The salinity in the area averages 35 parts per thousand (ppt) and the water was mildly turbid with a light chop at the time of the site inspection. The sand bottom was visible within the transect area at the time of the station survey. Attached macroalgae and drift algae, associated with the wave-cut platform bedrock, were found as close as 75 feet to the northern limits of the construction right-of-way limit at EFH Station 12. Photograph EFH12-2516 shows the location of the exposed wave-cut platform bedrock and associated algal communities.

The landward section of this high energy shoreline includes an 85 foot wide band of mixed beach dune, coastal strand, and maritime forest vegetation. A fore-dune, dominated by marsh-hay cord grass (*Spartina patens*), was present at this station. The survey station was located approximately 350 feet west of an existing public picnic area. The dominant vegetation at EFH Station 12 were the same as those identified for Station 11 and included the coconut palm (*Cocos nucifera*), dalbergia (*Dalbergia ecastaphyllum*), seagrape (*Coccoloba uvifera*), creeping oxeye (*Wedelia trilobata*), and railroad vine (*Ipomea pes-caprae*).

Sediments and Benthos — The sediments in this area were classified as fine to medium grained color sand with shell fragments. Colonized bedrock habitat was present, beginning approximately 75 feet to the north of the pipeline laydown area and extending waterward beyond the intertidal zone. The attached macroalgae and drift algae present along this section of shoreline was similar to EFH Station 11 and included: *Ulva fasciata*, *Dictyota dichotoma* and *D. ciliota*, *Acanthophora spicifera*, *Enteromorpha flexuosa*, *Laurencia papillosa* and *L. obtusa*, and *Hypnea musciformis*. No seagrasses were observed within the nearshore, and intertidal areas adjacent to the pipeline right-of-way.

Habitat Utilization - Fauna observed utilizing the habitat included the brown pelican (*Pelicanus occidentalis*), double crested cormorant (*Phalacrocorax auritus*), semipalmated sandpiper (*Calidris*

pusilla) and ghost crabs (*Ocypode* spp.). No fish traps or seine samples were collected at this location due to the availability of cast net sample observations and a fisherman creel census. Fish likely to occur at this location were the same as those identified for EFH Stations 11 and 13. No additional species were observed within the surf zone. The species included the tarpon (*Megalops atlanticus*), snook (*Centropomus* spp.), white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*), and the blue crab (*Callinectes sapidus*).

EFH Determination/Comments – The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. The intertidal and subtidal zones exhibited macroalgae and hard substrate, sandy bottoms, and associated benthic communities required and utilized by most juveniles of the “selected species of concern” to facilitate growth to maturity. The intertidal and subtidal areas at this station constitute high value habitat. The mean higher high water region and upper beach area would not be as highly valued.

EFH 13 – Toa Baja 5 (M2USN – Marine Open Water Beach), Levittown Shoreline East

Vegetative/Physical Characteristics - The Environmental Sensitivity Index (NOAA, ESIMAP 11) describes this section of shoreline as Fine to Medium Grained Sandy Beach and Exposed Wave-Cut Platform Bedrock. This marine habitat is exposed to the waves and currents of the open ocean and the water regime is determined primarily by the ebb and flow of oceanic tides and the relative position of the habitat on the beach slope. EFH Station 13 is located along the Levittown beachfront approximately 925 feet west of the south breakwater of the Rio Hondo Channel and 550 feet south of an HDD entry point to be located at Sta. 4422+10. The shoreline at this point is a high energy shoreline and the land area is subject to erosion as evidenced by escarped uplands. Photograph EFH13-2503 depicts the upland area. Portions of the upland along this shoreline are to be used as an HDD pull back area. Drawing No. 48.0-Z-321.90 (Sheet 90 of 96) found in Appendix A depicts the construction area. All pipeline staging and laydown areas will be located landward of the mean high water line to avoid any work in Waters of the United States (WoUS) and will be accomplished using piperacks with rollers to further minimize the disturbance to ground surface. The pipeline will be embedded at a depth minus 55 feet in this area to protect the pipe from the action of the waves (liquefaction and coastal erosion) and to preclude any disturbance to essential fish habitat and its associated biological communities.

The salinity in the area averages 35 parts per thousand (ppt) and the water was mildly turbid with a light chop at the time of the site inspection. Secchi depth however was surprisingly deep, approximately 4.0 feet, enabling the sand bottom to be visible for the entire length of the transect area. Attached macroalgae and drift algae were found 100 feet north-northwest of EFH Station 13 associated with the wave-cut platform bedrock. Shoreline/upland vegetation was limited to Photographs EFH13-2506, EFH13-2511, EFH13-2510 located in Appendix B depict the wave-cut platform bedrock and these algal communities.

Sediments and Benthos — The sediments in this area were classified as fine to medium grained color sand with shell fragments. Colonized bedrock habitat was present approximately 100 feet to the north

of the pipeline laydown area and extended waterward beyond the intertidal zone. This habitat is best described as exposed bedrock contiguous with the shoreline that has coverage of macroalgae, gorgonians, and other sessile invertebrates that partially obscures the underlying rock. The attached macroalgae and drift algae present along this section of shoreline included: *Ulva fasciata*, *Dictyota dichotoma* and *D. ciliata*, *Acanthophora spicifera*, *Enteromorpha flexuosa*, *Laurencia papillosa* and *L. obtusa*, and *Hypnea musciformis*. No seagrasses were observed within the nearshore, and intertidal areas adjacent to the pipeline right-of-way.

No specific benthic invertebrate surveys were along this section of beach. Surficial grab samples did reveal a large population of coquinas (*Donax variabilis*). Other common gastropods observed included the false angel wing (*Petricola pholadiformis*), common prickly periwinkle (*Nodilittorina tuberculata*), turkey wing (*Arca zebra*) and the dark false mussel (*Mytilopsis leucophaeta*). Other common gastropods shells were also found.

Habitat Utilization - Fauna observed utilizing the habitat included the brown pelican (*Pelicanus occidentalis*), double crested cormorant (*Phalacrocorax auritus*), semipalmated sandpiper (*Calidris pusilla*) and ghost crabs (*Ocypode* spp.). Fish likely to occur at this location were the same as those identified for EFH Stations 11 and 12. No additional species were observed within the surf zone. The species included the tarpon (*Megalops atlanticus*), snook (*Centropomus* spp.), white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*), and the blue crab (*Callinectes sapidus*).

EFH Determination/Comments – The area included the necessary vegetation, sediments, and associated biological community to qualify as essential fish habitat. The intertidal and subtidal zones exhibited macroalgae and hard substrate, sandy bottoms, and associated benthic communities required and utilized by most juveniles of the “selected species of concern” to facilitate growth to maturity. These areas would constitute high value habitat. The upper beach at this station was not considered to be valuable habitat due to the lack of stabilization. Photograph EFH13-2510 illustrates the erosion and escarped conditions present at this station.

EFH 14 – Toa Baja (E1UBLx- Estuarine Unconsolidated Sand Bottom) Rio Hondo Channel

Vegetative/Physical Characteristics - This wetland area constitutes the open water estuarine area at the mouth of the Rio Bayamon River, a channelized waterbody that has also been man-altered for flood control. This wetland is best described as an estuarine (subtidal) river mouth with a sandy, non-vegetated bottom. Side slopes for this channel are steep. The west bank of the river includes a fringe of red mangroves (*R. mangle*) ranging from 25 to 28 feet (7.6 to 8.5 m) in height. The crossing area is included in the single 1,831 linear foot directional drill (HDD) that will span both the Rio Hondo and the adjacent Rio Bayamon channels. The width of the open water area in the vicinity of EFH Station 14 was approximately 226 feet (69 m) in width. The 0.95 acres of total wetland jurisdictional area encompassed by the project right-of-way for this HDD segment (Station 4435+10 to Station 4453+12) includes the areas for both the Rio Hondo and the Rio Bayamon, 0.39 acres of which are associated with Rio Hondo. Photographs EFH14-2642 and EFH14-2636 depict. Drawing No. 48.0-Z-321.91 (Sheet 91 of 96) found in

Appendix A depicts these river crossing areas. Embedment depth at this crossing is minus 80 feet below the river bottom due to the fact that both river systems are part of a flood control project. The HDD right-of-way area remains limited to 50 feet wide in both of these subtidal estuarine areas. The HDD entry point and exit points for this drill are located to the east and west of the channels and both are 500 and 200 feet from the estuarine wetlands. The crossing area lies approximately 1,750 feet southwest of the PR-165 Rio Bayamon/Rio Hondo highway bridge. The water depth at EFH Station 14 ranged from 6.75 to 8.0 feet along the crossing section of the open water channel, shallowing to four feet along the shorelines. The salinity in the area was 3 parts per thousand (ppt) and the water was mildly turbid with a noticeable brown organic color. Flow in this system was higher than that in the Rio Bayamon. Secchi depth was limited to 1.0 feet, precluding clear view of bottom for most of the length of the transect area.

Natural wetland cover was limited to red mangroves (*R. mangle*) at the ends of the study transect. The associate wetland/upland fringe community includes an open canopy composed of tall albizia (*Albizia procera*), Indian almond (*Terminalia catappa*), Yellow poinciana (*Peltophorum pterocarpum*) with soapberry (*Paullinia pinnata*) and Guinea grass (*Megathyrsus maximus*) in the understory.

Sediments and Benthos — The sediments in this area were classified as dark gray fine sand with some silts. No macroalgae, algal mats or seagrasses were observed within the shallow open water areas adjacent to the banks at the crossing point. Attached macroalgae (*Ulva* sp.) was present on the rip-rap along the shoreline adjacent to the PR-165 bridge.

Habitat Utilization - Fauna observed utilizing the habitat included the yellow-crowned night-heron (*Nycticorax violaceus*), brown pelican (*Pelicanus occidentalis*), double crested cormorant (*Phalacrocorax auritus*), green iguana (*Iguana iguana*), swimming crabs (*Callinectes sapidus*) and finfish species. One fish trap was set at this location. One seine sample was collected in an open water area adjacent to a sandbar. Fish observed and or captured were the same as those in the Rio Bayamon and included the white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*) and juvenile Carrangidae (*Caranx hippos* and *C. latus*). Representative species captured in the seine are shown Photograph EFH14-2647.

EFH Determination/Comments - The canal wetland exhibited a mixture of physical, chemical, and biological properties that are included with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. The area included a mangrove lined shoreline, sandy bottom, associated benthic community, and euryhaline conditions utilized by juveniles of the "selected species of concern" to facilitate their life cycles but the area would not be considered high value habitat due to the man induced impacts (channelization and stormwater inputs) and heavy sediment loads being delivered to the system.

EFH 15 – Toa Baja (E1UBLx - Estuarine Unconsolidated Sand Bottom), Rio Bayamon Channel

Vegetative/Physical Characteristics - This wetland area constitutes the open water estuarine area at the mouth of the Rio Bayamon River, a channelized waterbody that has been man-altered for flood control. This wetland is best described as an estuarine (subtidal) river mouth with a sandy, non-vegetated

bottom. Side slopes for this channel are steep and include a limited number of red mangroves (*R. mangle*) mixed with ruderal upland species. The crossing area will be included in the single 1,831 linear foot directional drill (HDD) that will span both the Rio Hondo and the adjacent Rio Bayamon channels. The width of the open water area in the vicinity of EFH Station 14 was approximately 360 feet (110 m) in width. The 0.95 acre of total wetland jurisdictional area encompassed by the project right-of-way for this HDD segment (Station 4435+10 to Station 4453+12) includes the areas for both the Rio Hondo and the Rio Bayamon, 0.56 acres of which are associated with Rio Bayamon. Photographs EFH15-2636 and EFH15-2639 depict the shorelines at Rio Bayamon crossing area. Drawing No. 48.0-Z-321.91 (Sheet 91 of 96) found in Appendix A provides the crossing construction details. Embedment depth at this crossing is minus 80 feet below the river bottom due to the fact that both river systems are part of a flood control project. The HDD right-of-way area remains limited to 50 feet wide in both of these subtidal estuarine areas. The HDD entry point and exit points for this drill are located to the east and west of the channels and both are 500 and 200 feet from the estuarine wetlands. The crossing area lies approximately 1,750 feet southwest of the PR-165 Rio Bayamon/Rio Hondo highway bridge. The water depth at EFH Station 15 ranged from 3.5 to 4.5 feet along the crossing section of the open water channel, shallowing to two feet along the shorelines. The salinity in the area was 3 parts per thousand (ppt) and the water was mildly turbid with a noticeable light brown organic color. Secchi depth however was surprisingly deep at 4.0 feet, enabling the sand bottom to be visible for most of the length of the transect area. No macroalgae, algal mats or seagrasses were observed within the open water area at the crossing point.

Natural wetland cover was limited to red mangroves (*R. mangle*) at the ends of the study transect. The associate wetland/upland fringe community includes an open canopy composed of tall albizia (*Albizia procera*), Indian almond (*Terminalia catappa*), Yellow poinciana (*Peltophorum pterocarpum*) with soapberry (*Paullinia pinnata*) and Guinea grass (*Megathyrsus maximus*) in the understory.

Sediments and Benthos — The sediments in this area were classified as dark gray fine sand with some silts. No macroalgae, algal mats or seagrasses were observed within the open water areas associated with the pipeline crossing.

Habitat Utilization - Fauna observed utilizing the habitat included the black-crowned night-heron (*Nycticorax nycticorax*), brown pelican (*Pelicanus occidentalis*), double crested cormorant (*Phalacrocorax auritus*), greater Antillean grackle (*Quiscalus niger*), green iguana (*Iguana iguana*), swimming crabs (*Callinectes sapidus*) and finfish species. Two fish traps were set at this location. One seine sample was collected in an open water area adjacent to a sandbar. Fish observed and or captured included the white mullet (*Mugil curema*), striped moharra (*Eugerres plumieri*), ground croaker (*Bairdiella ronchus*), Atlantic thread herring (*Opisthonema oglinum*) and juvenile Carrangidae (*Caranx hippos* and *C. latus*). Photograph EFH15-2637 depicts the representative finfish species captured.

EFH Determination/Comments - The canal wetland exhibited a mixture of physical, chemical, and biological properties that are included with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. The area included limited mangrove vegetation, sandy bottom habitat, estuarine benthic community, and euryhaline conditions utilized by juveniles of the "selected

species of concern” to facilitate growth to maturity. The area functions as essential fish habitat life but the area would not be considered high value habitat due to the man induced impacts (channelization and stormwater inputs) to the system.

EFH 16 – Toa Baja 8 (PEM1E-Freshwater Emergent Wetland- Not EFH), Stormwater Conveyance located within powerline right-of-way

Vegetative/Physical Characteristics - The wetland was originally mapped as an estuarine intertidal emergent wetland by the NWI Inventory however no evidence of any estuarine tidal connection and associated vegetative community was present. The wetland is best described as a palustrine emergent wetland that is located to the south of the PREPA materials storage area adjacent to the Palo Seco power plant. Drawing Sheet No. 48.0-Z-322.45 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts the location of the survey point and the palustrine freshwater wetland. The width of the wetland area in the vicinity exceeds that of the proposed 150-foot wide right of way. The area is located on the route of the pipeline lateral which will service the Palo Seco Meter Station. No standing water was present at the time of the site inspection. Percent cover by natural vegetation within the project right-of-way area was approximately 85% and the vegetation was dominated by false daisy (*Eclipta prostrata*), rice flatsedge (*Cyperus iria*), and jointed spikerush (*Eleocharis interstincta*). The upland/wetland transitional fringe included ruderal upland species which included Leucana (*Leucana leucocephala*) and the large non-native, tufted perennial grass, known as Guinea grass (*Megathyrsus maximus*, syn. *Panicum maximum*).

Sediments and Benthos — The sediments in this area were determined to be hydric and classified as Urban land Durados complex (Ud). No seine sample or fish traps were required at this location due to the absence of water.

EFH Determination/Comments - The wetland area does not include physical, chemical, and biological properties that are consistent with the Caribbean Fishery Management Council’s (CMFC) definition of Essential Fish Habitat and therefore no extensive investigation was conducted for this area.

EFH 17 – Guaynabo 1 (PRB1r0 – Concrete Drainage Ditch - Not EFH), Concrete lined Stormwater Conveyance located within PR-24 Right-of-Way

Vegetative/Physical Characteristics - The wetland was originally thought to be an estuarine intertidal emergent wetland (mangrove lined ditch). The wetland is best described as a concrete lined stormwater conveyance (ditch). The width of the wetland area in the vicinity of the proposed subsurface boring is approximately 30 feet wide from top of bank to top of bank. The wetland system discharges into San Juan Bay which lies approximately 1,200 feet to the northwest, via a box culvert and concrete lined drainage ditches. Drawing Sheet No. 48.0-Z-322.50 (Sheet 1 of 1, Rev. 1) found in Appendix A depicts the location of the survey point and the drainage system. At the point of the proposed crossing the ditch/wetland was entirely freshwater and did not exhibit any tidal fluctuation. The crossing area is located southwest of the proposed San Juan Meter Station. Standing water was present and flowing at the time of the site inspection. Percent cover by natural vegetation within the project right-of-way crossing area was approximately 75% and the vegetation was dominated para grass (*Brachiaria mutica*

syn. purpurecens) along the ditch bottom and lower banks with wild morning glory (*Ipomea setifera*) covering the top of bank. Photographs EFH17-2494 and EFH17-2500 depict the drainage area.

Sediments and Benthos — The sediments accumulated in the bottom of the concrete lined conveyance were approximately 6 inches (15 cm) deep and consisted of gray fine sands, silts, and clay with light rubble.

Habitat Utilization – Fauna observed using this area included the black-crowned night heron (*Nycticorax nycticorax*), Mozambique tilapia (*Oreochromis mossambicus*), mosquitofish (*Poecilia reticulata*), and the Puerto Rican slider turtle (*Trachemys stejnegeri*). No seine sample or fish traps were set at this location.

EFH Determination/Comments - The wetland area does not include physical, chemical, and biological properties that are consistent with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat and appears to be part of a system that is regularly maintained as a stormwater conveyance.

DISCUSSION

Historical observations, even if limited or qualitative, often provide one of the only resources for documenting and assessing important fishery habitat types. The use of historical data in conjunction with limited field surveys is particularly important in developing regions with limited funding for ecological studies and few long-term datasets. This approach, however, can be challenging because historical studies are often characterized by missing or unclear records. In addition, the original data collector may be difficult to locate, potentially leading to methodological uncertainties about the original study.

Fish communities of Caribbean island estuaries have received limited study due to lack of resources and governmental support (Stoner, 1986; Blaber, 2002; Rivera-Monroy et al., 2004). These examples illustrate that even when historical data are limited in scope, they are valuable for identifying species declines, characteristics of vulnerable species, and environmental drivers of change (Patton et al., 1998). Appropriate conservation and management actions are difficult without basic data describing these communities. Such data are crucial: a study of North American marine and estuarine fish species at risk suggests that Caribbean island fish may be particularly vulnerable to environmental change (Musick et al., 2001). Three of the five geographic localities in North America, noted to have a high number of species at risk, were located in southern Florida, a region that shares many species with Puerto Rico. In addition, migratory anadromous and amphidromous species were identified as particularly vulnerable due to habitat degradation (Musick et al., 2001). This finding raises further concern for Caribbean islands such as Puerto Rico, where all native freshwater fish are amphidromous. Fortunately recent studies by researchers (Smith et al., 2004) have documented relative abundance, locations (stations), and seasons (months) of fish captured in estuaries in northern Puerto Rico for the time period 1977 and 2004.

Conservation / Species Listing Status

The NMFS had indicated, and it has been confirmed, that the site of the proposed project includes mangroves, sandy bottom, and algal communities. The Caribbean Fishery Management Council identifies these habitats as EFH for several species, including juvenile and adult gray snapper (*Lutjanus griseus*); juvenile mutton snapper (*Lutjanus analis*); juvenile nassau (*Epinephelus striatus*) and goliath grouper (*Epinephelus itajara*); and juvenile spiny lobster (*Panulirus argus*). To evaluate potential impacts to essential fish habitat, a survey of all of the proposed subsurface horizontal direction drill locations associated with estuarine and marine environments was conducted for the Via Verde Pipeline. The survey was designed to generate presence and/or absence data for finfish species, the occurrence of any endangered and/or threatened species, and the types of habitats subject to jurisdiction and regulation by the NOAA Marine Fisheries Service. A brief description of the habitat requirements for each species of concern identified by the NMFS is included below.

Mutton snapper or Sama (*Lutjanus analis*) - The mutton snapper is listed as "Vulnerable" with the World Conservation Union (IUCN). A species is considered vulnerable when it is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future. The IUCN is a global union of states, governmental agencies, and non-governmental organizations in a partnership that assesses the conservation status of species. Mutton snapper or Sama (*Lutjanus analis*) occurs in offshore areas as well as the clear waters around islands. Large adults are usually found among rocks and corals. Juveniles occur in mangroves, canals and over sandy, vegetated (usually seagrass) environments, where they find protection. This species forms small aggregations during the day. It is a diurnal and nocturnal feeder. Its diet consists mainly of fishes, shrimps, crabs, and other invertebrates. Recent surveys along the northwest coast of Puerto Rico for other estuaries and river systems have not documented this species presence (Smith et. al., 2004). No specimens were collected or observed during this survey but it is acknowledged that this species exists or is likely to be found in estuarine portions of the project Via Verde Pipeline right-of-way. Suitable nursery habitat for this species was found in Peñuelas (EFH Stations 4A and 5), in the mangrove forested areas in the Rio Cocal (EFH Stations 9, 10) and the Rio Hondo and Rio Bayamon (EFH 14 and 15).

Gray snapper or Pargo prieto (*Lutjanus griseus*) - The gray snapper is found in coastal as well as offshore waters around coral reefs, rocky areas, estuaries, mangrove habitats, and sometimes in lower reaches of rivers (especially the young). This diversity of location indicates the tolerance of this species to different salinity ranges. A variety of inshore habitats represent important nursery areas for the young gray snapper. Their post-larvae generally settle in mangroves and seagrass beds, where they find food and protection from predators. The gray snapper is a nocturnal feeder, preying on small fishes, shrimps, crabs and other invertebrates. Suitable nursery habitat for this species was found in Peñuelas (EFH Stations 4, 4A and 5), in the mangrove forested areas in Rio Cocal (EFH Stations 8,9), the wave-cut platform rock areas along the Levittown beach shoreline EFH Stations 11, 12, and 13), and the Rio Hondo and Rio Bayamon (EFH 14 and 15). The species was observed one quarter mile south of EFH Station 6 in Peñuelas. The species is a common marine species and a transient estuarine species. It is acknowledged that this species exists in estuarine and marine portions of the project right-of-way.

The Nassau grouper or Cherna (*Epinephelus striatus*) is currently assessed as "Endangered" by the World Conservation Union (IUCN). The Nassau grouper is also listed as a candidate for the U.S. Endangered Species List because of overfishing. This grouper is common on offshore rocky bottoms and coral reefs throughout the Caribbean region. Juveniles are found closer to shore in seagrass beds that offer a nursery habitat. It is solitary and mainly diurnal but sometimes forms schools. When threatened by predators, this fish can camouflage itself, blending in with its surroundings. The Nassau grouper has a diet that consists mainly of fish, shrimp, crab, lobster, and octopus. It is one of the largest fish found on the reef, where it can grow to a maximum of 1.2 m and weight over 50 pounds, but in the U.S. Caribbean this species is no longer common due to overfishing. The spawning aggregations that appear at the same site each year are easy targets for fishers. During these spawning events, the reproductively mature fish are often caught. This further limits potential population growth through the removal of mature females, leaving behind the young females that release fewer eggs for fertilization. . The Nassau grouper is considered an important food fish throughout the Caribbean and in the West Indies., however harvesting of this species is currently prohibited in the U.S. and U.S. Caribbean. Seagrass beds would be considered the essential habitat for this grouper within the project right-of-way as these areas constitute the primary nursery habitat for this species. No seagrass beds which would constitute nursery habitat were found within the limits of, or adjacent to, the Via Verde Pipeline construction right-of-way.

Goliath grouper (*Epinephelus itajara*) - The goliath grouper is entirely protected from harvest and is recognized as a critically endangered species by the World Conservation Union (IUCN). Considered of fine food quality, goliath grouper were a highly sought after quarry for fishermen of all types. The goliath grouper's inquisitive and generally fearless nature has historically made it a relatively easy prey for spear fishermen. This species also tends to spawn in large aggregations, returning like clockwork to the same locations, making them particularly vulnerable to mass harvesting. The U.S. implemented species protection in 1990, and the Caribbean in 1993. The species' population has been recovering since the ban; with the fish's slow growth rate, however, it will take some time for populations to return to their previous levels. The goliath grouper is found primarily in shallow tropical waters among coral and artificial reefs at depths anywhere from 15 (5 m) to 165 feet (50 m). They may reach extremely large sizes, growing to lengths of 8.2 feet (2.5 m) and can weigh as much as 800 pounds (363 kg). They are usually around 400 pounds when mature. Their range includes the Florida Keys, the Bahamas, most of the Caribbean, and practically all of the Brazilian coast.

Young goliath grouper may permanently live in brackish estuaries, canals, and mangrove swamps, unusual behavior among grouper. Suitable nursery habitat for this species was found in Peñuelas (EFH Stations 4A and 5), in the mangrove forested areas in Rio Cocal (EFH Stations 9, 10), the wave-cut platform rock areas along the Levittown beach shoreline (EFH Stations 11, 12, and 13), and the Rio Hondo and Rio Bayamon (EFH 14 and 15). The species was not observed or captured during the field sampling events but, despite its rarity, it is acknowledged that this species may exist in estuarine and marine portions of the project right-of-way. The species was once a common marine species and transient estuarine species.

Spiny lobster or Langosta común (*Panulirus argus*) - The spiny lobster can be found hiding under coral heads, rocks, and any other place that offers protection from predators. Larval behavior is still poorly understood and the scale of larval dispersal conjectural. However, recruitment processes in some shallow-water species, including effects of the environment on these processes, are becoming clearer. The pueruli larval stage of *P. argus* settle in clumps of *Laurencia* sp. (Herrnkind and Butler 1986) and occasionally in the algal web on submerged mangrove roots (Witham et al. 1964). Juveniles have been observed in seagrass beds and mangrove areas, which serve as nursery habitats. This is a nocturnal species, coming out at night in search of food. They feed on a variety of foods including clams, mussels, crabs, and worms, and occasionally plants. There is also evidence of cannibalism. The spiny lobster is an important source of income for many fisherman of the Caribbean. It is exported from various Caribbean countries, but not from Puerto Rico or the U.S. Virgin Islands, where it is used only for local consumption. The algal web found on the submerged mangrove roots in the Via Verde Pipeline construction right-of-way would constitute suitable nursery habitat for this species. No specimens were collected or observed but it is acknowledged that this species exists in estuarine and marine portions of the project right-of-way. Suitable nursery habitat for this species was found in Peñuelas (EFH Stations 4A and 5) and in the mangrove forested areas in the Rio Cocal (EFH Stations 9, 10).

Sea Turtles - All sandy beaches are assumed to be suitable sea turtle nesting habitat according to the NOAA's Environmental Sensitivity Index for Puerto Rico. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line. Hawksbill turtles (*Eretmochelys imbricata*) have been known to utilize similar areas for nesting. The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, false crawls or habitat utilization of this beach front area, Station 4336+06 to Station 4435+10, has been documented. All pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area. No impacts to potential turtle nesting area will result from the installation of the pipeline in this area.

West Indian manatee (*Trichechus manatus*) - The Environmental Sensitivity Index (NOAA, ESIMAP) describes the submerged zone from Rio Bayamon to Rio Cocal as a Sensitive Biological Resource area for the West Indian manatee (*Trichechus manatus*). This species is currently listed as an Endangered Species pursuant to the Endangered Species Act (ESA). Regulation and protection of this species typically resides with the United States Fish and Wildlife Service. All equipment used for pipeline deployment would move and operate in the uplands during the construction of the Via Verde pipeline and would not pose a threat to this marine mammal. Standard Manatee operation conditions and protocols will be utilized for all construction activities near or adjacent to the mean high water line and within all navigable coastal waterbodies.

Coastline Habitats between Rio Bayamon and Rio Cocal (Levittown Shoreline Area) - A review of The Benthic Habitats of Puerto Rico and the U.S. Virgin Islands (NOAA, Tile 22) GIS data base does not include any zone or habitat description for the segment between Rio Bayamon and Punta Salinas. The marine shoreline area north of the project right-of-way (mile marker 80 to 82.5) around the Rio Cocal River mouth, west of Punta Salinas, is classified as being within the Shoreline Intertidal zone, Reef/Colonized Bedrock habitat. This Shoreline Intertidal habitat zone is described as an “area between the high water line (or landward edge of mangroves when present) and lowest spring tide level (excluding emergent segments of barrier reefs)” and the Reef/Colonized Bedrock habitat is described as “exposed bedrock contiguous with the shoreline that has coverage of macroalgae, hard coral, gorgonians, and other sessile invertebrates that partially obscures the underlying rock”.

The characteristics of the shoreline between Rio Bayamon and Punta Salinas meet those descriptions for both zone and habitat. As observed in the field, this coastline has “beach rock” or cemented sand rock along the intertidal zone, which is mostly colonized by macroalgae (dominated by *Ulva* and *Dictyota*). Bivalves such as *Mytilus* sp., were also found along this segment of shoreline.

Mangrove Forested Habitats – The mangrove forested habitats found within the Via Verde Pipeline right-of-way are comprised of four distinct types (Gilmore and Snedaker, 1993) describe 5 distinct types of mangrove based on water level, wave energy, and pore water salinity. These include: mangrove fringe forests, riverine mangrove forests, basin mangrove forests, and dwarf mangrove forests. A brief description of each mangrove community type follows.

Mangrove fringe forests occur along protected coastlines and the exposed open waters of bays and lagoons. These forests typically have a vertical profile, owing to full-sun exposure. Red mangroves dominate fringe forests, but when local topology rises toward the uplands, other species may be included in zones above the water line. Tides are the primary physical factor in fringing forests, with daily cycles of tidal inundation and export transporting buoyant materials such as leaves, twigs and propagules from mangrove areas to adjacent shallow water areas. This export of organic material provides nutrition to a wide variety of organisms and provides for continued growth of the fringing forest.

The mouths of the Rio Cocal, Rio Bayamon, and the Rio Hondo (EFH Stations 8, 14, and 15) include areas of mangroves that are best described as riverine mangrove forests. These occur on seasonal floodplains in areas where natural patterns of freshwater discharge have been altered but remain essentially intact. Salinity drops during the wet season, when rains cause extensive freshwater runoff; however, during the dry season, estuarine waters are able to intrude more deeply into these system via the river channels, and salinity increases as a result. The variable and high seasonal salinity may aid primary production by excluding space competitors from these mangrove areas. Nutrient availability in these systems becomes highest during periods when salinity is lowest, thus promoting optimal mangrove growth. This alternating cycle of high runoff/low salinity followed by low runoff/high salinity led Pool et al. (1977) to suggest that riverine mangrove forests are the most highly productive of the mangrove communities.

Basin mangrove forests are perhaps the most common mangrove community type, and thus are the most commonly altered wetlands. The basin mangrove forests observed within the project right-of-way were associated with inland depressions, ditches, and upland canals which are irregularly flushed by tides. Because of irregular tidal action in these forests, either hypersaline or predominantly fresh conditions can occur periodically. Cintron et al. (1978) observed that the physiological stress induced by extreme hypersalinity may severely limit growth, or induce mortality in mangroves. Black mangroves tend to dominate in the basin communities, but certain exotic trees such as Brazilian pepper (*Schinus terebinthifolius*) and Australian pine (*Casuarina* spp.) were also found to be successful invaders. The basin mangrove forests included large amounts of organic debris when compared to adjacent waters, with the majority being exported as whole leaves, particulates, or dissolved organic substances typical of waters containing high tannin concentrations. Peñuelas EFH Station 5 and Cambalache EFH Station 8 are examples of basin mangrove areas.

Dwarf mangrove forests occurred in areas where nutrients, freshwater, and inundation by tides are all limited. The dominant dwarfed mangrove species observed was the black mangrove (*A. germinans*), with trees generally limited in height to approximately 1 meter or less. Dwarf forests were observed in the vicinity of the Eco Electrica facility in Peñuelas (EFH 1), where physical conditions were suboptimal, in the drier hypersaline transitional areas and salterns. Despite their small size and relatively low area to biomass ratios, the dwarf mangroves typically had higher leaf litter production rates; thus primary production in dwarf forests is likely disproportionately high when compared with normal mangrove forests in this area.

It is well documented that mangroves perform a vital ecological role providing habitat for a wide variety of estuarine and marine species. Odum et al. (1982) reported 220 fish species, 24 reptile species, 18 mammal species, and 181 bird species that all utilize mangroves as habitat during some period of life. Mangrove canopies and aerial roots offer a wealth of habitat opportunities to many species of estuarine invertebrates. Barnacles, sponges, mollusks, segmented worms, shrimp, insects, crabs, and spiny lobsters all utilize mangrove prop roots as habitat for at least part of their life cycles (Gillet, 1996 In: Feller 1996). Additionally, mangrove roots are particularly suitable for juvenile fishes. A study by Thayer et al. (1987) in the Florida Everglades showed that comparatively more fishes were sampled from mangrove areas than from adjacent seagrass beds. In this study, 75% of the number of fishes sampled were taken from mangrove areas, while only 25% were sampled from nearby seagrass beds. Further, when fish densities in each habitat were examined, fish density in mangroves was 35 times higher than in adjacent exposed, openwater seagrass beds. Recent studies however have indicated that the proximity to, presence of, and amount of seagrass surrounding mangrove areas explains more of the variability in fish abundance than fine scale mangrove structure (Pitman et al., 2006)

A number of spatial guilds for mangrove-associated species are normally found with mangrove communities (Gilmore and Snedaker, 1993). The sublittoral/littoral guild utilizes the prop root zone of red mangroves associated with fringe forests and riverine forests. The prop root zone provides sessile filter feeding organisms such as bryozoans, tunicates, barnacles, and mussels with an ideal environment. Mobile organisms such as crabs, shrimp, snails, boring crustaceans, polychaete worms,

many species of juvenile fishes, and other transient species also utilize the prop root zone of mangroves as both a refuge and feeding area.

The arboreal canopy guild consists of species able to migrate from the water's surface to the mangrove canopy. Lagoonal snails such as the coffee bean snail (*Melampus coffeus*), angulate periwinkle (*Littorina anguilifera*), and ladderhorn snail (*Cerithidea scalariformis*) are among the most common of the invertebrate species in this guild. Also common are many species of crustaceans such as the common mangrove crabs *Aratus pisoni*, *Goniopsis cruentata*, *Pachygrapsus* sp., and *Sesarma* spp., the isopod *Ligea exotica*, and many species of insects. Birds also constitute a major component of this spatial guild.

Mangrove system complexity (diversity) was low and spatial guilds were noticeably absent in many of the mangrove forested areas surveyed. This was attributed to artificially altered water levels as many of the ditches and channels surveyed were historically associated with drainage controls in the vicinity of the electric generating facilities.

IMPACT MINIMIZATION

The HDD process would not directly or cumulatively introduce toxic or hazardous substances or chemicals, organic substances, or solid wastes into bodies of water or on land to cause the level of these substances to exceed regulatory standards. The bentonite clay used in the drilling process is a non-toxic clay that is not a hazardous substance. It is possible that drilling mud could escape from the bore into the surrounding geologic formation. Any material migrating to the surface would be rapidly dispersed by current and/or wave action and would not be expected to persist or accumulate in appreciable amounts. During the final stage of drilling, bentonite addition to the drilling fluid can and will be discontinued, and only water used; thus minimizing the release of the clay sediment when the bore exits. Bore exit points have also been located well into the uplands whenever possible to minimize the possibility of a release of drilling mud into estuarine and/or marine systems, and to facilitate the removal of any accumulation of drilling mud on the ground surface.

Under the project design as currently proposed, potential impacts to subsurface geological resources from the proposed Via Verde Pipeline installation would only be associated with the entry and exit points associated with the directional drills. Impacts would include temporary mechanical disturbance of soft sediments, and short-term coverage of relatively small areas of substrate by equipment mats and staging areas. To eliminate all impacts to EFH, all of the staging areas have been located landward of the mean higher high water mark or in the uplands. These areas will be restored to natural grade and allowed to naturally recruit over time. These impacts on these bottom substrates are considered minor and would result in short-term insignificant impacts.

The only hazardous substances that would be used in the proposed project are lubricants and fuel contained in the drilling rig and motorized support equipment. All equipment using such lubricants would be required to adhere to federal, state, and local requirements for the management of hazardous materials and hazardous waste. Although the possibility of groundwater contamination is considered

remote, oil and fuel spills that are not addressed promptly could contaminate the water. To avoid this possibility, PREPA will implement a Spill Control Plan for the project. This Plan has been prepared following the guidelines of the Code of Federal Regulations, Title 40, Protection of the Environment, Part 112, Oil Pollution Prevention. The plan will be submitted to EPA and the Environmental Quality Board (EQB) for evaluation.

CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations (40 CFR 1500 – 1508) implementing the provisions of NEPA, as amended (42 USC 4321, et seq.) provide the definition of cumulative impacts. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. A cumulative impact results from the additive effect of all projects in the same geographical area. Generally, an impact can be considered cumulative if: a) effects of several actions occur in the same locale, b) effects on a particular resource are the same in nature, and c) effects are long-term in nature. The common factor key to cumulative assessment is identifying any potential temporally and/or spatially overlapping or successive effects that may significantly affect individual or populations of marine resources occurring in the analysis areas.

The effects of the proposed project on subsurface geology and water quality are sufficiently small in magnitude and limited in extent that potential additive effects are negligible. Potential water quality impacts are also limited by Clean Water Act (CWA) requirements for permitting, which would be followed for all construction. In accordance with CWA NPDES requirements, the Via Verde Pipeline project would obtain coverage under the Commonwealth of Puerto Rico's general permit for construction stormwater discharges. This would include the preparation and implementation of the SWPPP with BMPs to minimize erosion and sediment transport from upland construction sites and staging areas, and to restore disturbed areas to a stable condition after construction. Therefore, cumulative impacts on geological resources and water quality are anticipated to be insignificant or non-existent.

The project will not result in any direct impacts to marine and estuarine essential fish habitat and the impacts to the adjacent upland watershed areas are essentially contained within an existing small and localized "footprint". Potential impacts associated with the accidental release of drilling fluids (frac-outs) have been carefully considered and addressed through extensive geotechnical investigations and the development of the comprehensive HDD plan which allows for limited and reduced bentonite use and careful regulation and management of drilling pressures. The only potential sources of hazardous materials would be unanticipated accidents or spills that resulted in a discharge of fuel, lubricants, or sensor components (e.g., batteries) from a project vehicle or associated drilling equipment and sensors. Based on existing requirements and procedures for management of such materials and the design of drilling equipment and sensors, such events are extremely unlikely to occur. If such a spill were to occur, it would be a localized occurrence, and standard containment and cleanup protocols have been included with the BMP documents provided for the project. Therefore, significant cumulative impacts are not anticipated to occur.

CONCLUSIONS

Representative categories of Essential Fish Habitat identified in Fishery Management Plan Amendment of the Caribbean Fishery Management Council within the project right of way and subject to the jurisdiction of NOAA's National Marine Fisheries Service (NMFS) include estuarine areas (water column, mangrove wetlands, intertidal flats/salt ponds, sand and shell substrate, sandy beaches, and rocky shores) and marine areas (water column, sand and shell substrate, and algal plains). All HDD construction associated with the project site will occur above the mean high water line. Deep, horizontal directional drills (HDDs) will be used to traverse underneath all marine and estuarine systems (Waters of the United States). Whenever possible, directional drills will originate and exit in the uplands. All directional drill exit and entry points have been located outside of the limits of estuarine and marine wetlands. Embedment depths for the 24 inch pipe line will range from 40 to 80 feet below the existing ground (bottom) for the entire waterbody at each crossing point. The pipeline will typically be embedded in a naturally occurring lens of marine clay which will further reduce the likelihood of any releases of the non-toxic drilling muds (bentonite) into the estuarine/marine environment during pipe installation.

All, or significant portions of all, of the marine and estuarine areas proposed to be directionally drilled were assessed for the presence of Essential Fish Habitat. Fifteen of the eighteen HDD crossings were found to contain natural systems that included a mixture of physical, chemical, and biological properties that are included with the Caribbean Fishery Management Council's (CMFC) definition of Essential Fish Habitat. All of the EFH stations surveyed, with the exception of EFH Station 7 (Rio Cocal west), included anthropogenic impacts (upstream water diversions, channelization, stormwater inputs, garbage/waste debris deposition). Direct impacts to any estuarine or marine habitats identified as essential fish habitats have been limited to the placement of piling/pad structures for pipe racks to be used to elevate portions of the pipeline above the wetlands. The elevated sections of pipeline will occur in the vicinity of Station -23+88 to 8+80 near the Eco Electrica lateral and metering station construction sites. The estimated total impact area for the placement of the concrete pilings and the spread foot pads associated with the pipe rack is approximately 351 square feet or 0.008 acre. This constitutes the only permanent impact to estuarine and marine wetlands associated with Via Verde project as currently designed.

Under the project design as currently proposed, the potential impacts associated Via Verde Pipeline installation would be limited to subsurface geological resources and would only be associated with the entry and exit points associated with the directional drills. These impacts would include temporary mechanical disturbance of soft sediments, and short-term coverage of relatively small areas of substrate by equipment mats and staging areas. In order to eliminate all impacts to EFH, all of the staging areas have been located waterward of the mean high water mark or in the uplands. No significant impacts to estuarine or marine habitats or water quality are anticipated with implementation of the Via Verde Pipeline project as currently designed since the proposed entry and exit locations for the HDDs are located in the uplands; typically on previously developed and/or disturbed sites (agricultural lands). On the associated upland work areas, there is little to no potential for cumulative impacts associated with

future development due to the use and access restrictions associated with the permanent pipeline right-of-way.

Within those areas under the jurisdiction of the National Marine Fisheries Service, the direct effects are insignificant (in size), discountable (extremely unlikely – frac outs), and adequately addressed via established best management practices (turbidity and erosion control plan(s), site specific HDD procedures, and frac-out plan).

EFH CONSERVATION MEASURES

The following EFH conservation recommendations were proposed by NMFS HCD Assistant Regional Director Miles M. Croom in a letter to Colonel Alfred Pantano, District Engineer – Jacksonville District, USACE dated December 19, 2010. In response to the NMFS HCD letter (Dec 19 2010), the following EFH conservation measures have been added, revised, and implemented to insure compliance with the Magnuson-Stevens Fishery Conservation and Management Act.

Direct impacts to estuarine and marine wetlands have been limited to 0.55 acres of non-tidal wetlands and 0.008 acre of tidal wetlands that have been previously disturbed. The principal 0.55 acre wetland impact area is not directly connected to the adjacent estuarine and marine system and is not considered be EFH. The impacts to this wetland area will be temporary, of limited (very short) duration, and the area will be restored to pre-construction conditions. The area to be impacted is effectively isolated from the adjoining estuarine and marine habitats by an earthen berm. The permanent impacts to marine and estuarine habitats associated with the 92 mile pipeline have been limited to 0.008 acres.

NMFS Recommendation 1. *No clearing shall be authorized in areas that support seagrass or mangroves.*

PREPA Conservation Measure 1: The project as designed and re-aligned does not include any clearing in areas that support mangroves or seagrass. No seagrass exists within the areas pipeline crossing areas.

NMFS Recommendation 2. *Best management practices to minimize seagrass and mangrove impacts and water quality degradation shall be incorporated into the project design.*

PREPA Conservation Measure 2: All HDD exit and entry points and pipe laydown areas have been located outside of estuarine, marine, and tidal areas and whenever possible, completely outside of any wetlands. Best management practices have been included which include but are not limited to Stormwater Pollution and Prevention Plan, HDD drilling plan, and Erosion Control Plan.

NMFS Recommendation 3. *Once the final design for the project is set, the applicant shall develop a compensatory mitigation plan that offsets all direct and indirect impacts to EFH. The compensatory mitigation plan, if required, will be based upon a functional assessment of the habitat area and this assessment will be provided to NMFS for review and approval.*

PREPA Conservation Measure 3: No direct or indirect impacts to EFH will result from the HDDs under the estuarine and marine crossings associated with the Via Verde project as presently designed. All temporary impacts associated with the placement of HDD exit and entry points and additional

workspace will be restored to natural grade, properly stabilized, and allowed to naturally recruit. No temporal loss of estuarine or marine habitat designated as EFH will result from the HDD portions of the project as designed. Compensatory mitigation, if required, will be limited to those areas pre-empted by the pipe rack piling support structures. Approximately 770 feet of the pipeline will be elevated over wetland areas. Piling/pad spacing for pipe rack supports will range from 20 to 50 feet with each pad pre-empting approximately 9 square feet. The total impact area associated with all piling/pad structures will be less than 351 square feet or 0.008 acre. Upon completion of the final design, the applicant will conduct a final review and if required, provide a compensatory mitigation plan that offsets all direct and indirect impacts to EFH associated with the construction of the pipe rack support structures. The plan will be based on a functional assessment and provided to NMFS for review and approval. Any mitigation required will be part of the issued permit.