

6.6 Impacts on Agriculture

In Peñuelas there will be a small impact on the Peñuelas, Guayanilla and Yauco Agricultural Reserve. This Reserve has a total area of 2,019,917 square meters and the temporary impact area will be 18,636 square meters, which equals 0.9% of the total Reserve area. In addition, once the project is completed in that area, agricultural activities will be able to continue in the same. The farmer will be indemnified by the AEE for the temporary damages. In addition, there is a farm where improved pasture is cultivated, the same is owned by Lucas Pérez Valdivieso and is divided in two parcels: 387-000-002-44 and 363-056-212-02.

Fifteen farms were identified in Adjuntas in which coffee is mostly cultivated and other crops such as citrus. The information of those farms is included below:

Cadaster Number	Titleholder	Crops
291-000-001-039	Charles H. Morgan	Not in use
291-000-001-038	Jose E. Carrillo Norat	Not in use
290-000-005-048	Unknown	Coffee
267-000-006-27	Jorge Ballester	Coffee
267-000-006-035	Sucn. Ramon Gonzalez Sotomayor	Coffee (the cultivated area is not affected)
267-000-006-59	Francisco López Atienza	Coffee
267-000-006-56	Unknown	Coffee
267-000-006-27	Unknown	Coffee
267-000-006-35	Unknown	Coffee
267-000-006-56	Unknown	Coffee (The cultivated area is not affected)
266-050-147-02	Unknown	Coffee
266-000-005-71	Unknown	Coffee
266-000-005-16	Unknown	Coffee
266-000-005-17	Unknown	Coffee
240-000-009-39	Luis Juan Ramos Santiago (Hacienda Central Pellejas)	Improved pastures

Ten farms were identified in the Municipality of Utuado in which coffee is mostly cultivated and other crops such as citrus. The information on these farms is included below:

Cadaster Number	Titleholder	Crops
214-000-004-14	Luis Juan Ramos Santiago (Hacienda Central Pellejas)	Improved pastures
214-000-009-34	Sucn. Juan Avila Rivera	Plantains
214-000-009-15	Juan Reyes Rivera	Coffee
214-000-009-25	Unknown	Plantains and coffee
214-000-009-16	Sucn. Juan Avila Rivera	Coffee
214-000-009-01	Unknown	Citrus, coffee and plantains
214-000-003-70	Sucn. Juan Avila Rivera	Citrus, coffee and plantains
214-000-003-48	Juan C. Cortes Lugo	Plantains
214-000-003-51	Juan C. Cortes Lugo	Plantains
214-000-003-23	Unknown	Plantains

Among the farms in Utuado, inside Hacienda Central Pellejas, there is a parcel with the FWS designation as a perpetual conservation easement and with approved permits for agro-touristic developments.

In the north of the island the farms identified belong to the Lands Authority (AT). These farms are identified in the following table:

Farm	Town	Use
Las Mercedes	Arecibo	Pastures for cutting
San Francisco	Arecibo	Pastures for cutting, milk cattle, government, natural reserve
Santa Bárbara	Arecibo	Pastures for cutting
Monte Grande	Arecibo	Pastures for cutting, autodrome, milk cattle, improved pastures
Tiburones Liza	Arecibo	Natural reserve, pastures for cutting
Garrochales	Arecibo	Landfill, pastures, natural reserve
Mendoza	Barceloneta	Sludge injection, pastures for cutting
Higuerito	Barceloneta	Pastures for cutting, cattle ranching, sludge injection
La Luisa	Manatí	Hay pastures, milk cattle
Sucn Vázquez Escobar	Vega Baja and Manatí	Pineapple farms

Carmen	Vega Alta	Transmission towers, forests
La Julia	Dorado	Agro-touristic park
Constancia	Toa Baja	Lawn planting, ornamental plants

Part of these farms are used for agriculture. Mostly they are planted with pasture for cutting and animal feed. The farms are also leased for activities such as: installation of transmission towers, autodrome, sludge injection and cattle ranching.

No pineapple groves were observed in the area of Barceloneta. These crops were found between miles 61.4 and 63.4, between the Municipalities of Manatí and Vega Baja. The same will be impacted with the 100-foot construction right-of-way. There will be coordination to construct in a season in which the impact is minimized. In case the impact is unavoidable, the AEE will indemnify farmers for their losses.

The Toa Valley in Toa Baja is catalogued as specially protected rustic soils with conservation of resources. Via Verde is compatible with this category because it will only present a temporary impact and after the construction the indicated uses can continue in effect.

The potential impacts on agricultural lands will include: Loss of crops, interference with agricultural drainage, loss of topsoil, soil compaction and impact to irrigation systems. Most of the impacts will be temporary, others will be permanent. The AEE will acquire a 150-foot wide right-of-way. Once construction ends, the lands can be used for planting again. The planting of trees whose roots could interfere with the pipeline will not be permitted.

The AEE will consult with the AT to determine the crops planting and harvesting seasons and establish the date when there would be less impact on agriculture. According to data from the AT, most of the crops are pastures and they are planted and harvested year-round. In all lands in active cultivation, the farmer affected will be indemnified for his damages. The AEE will pay for the damages caused by crop losses. The owner will be explained of the procedure he must follow to file his claim. Once the project's construction is completed, the farmers will be able to use the operations right-of-way to continue their crops, as long as they are short-rooted, such as vegetables, legumes and grasses.

As a measure to minimize the impact to sections of agricultural lands, the surface portion of the soil, or topsoil (the first 12 inches in depth) from the rest of the soil, and it will be stored to reuse it during the restoration stage. While this soil is stored, for a period no longer than a week under normal conditions, it will be covered with tarpaulin or natural covers to protect its quality and composition. Erosion control measures will also be implemented to avoid loss of nutrients in the soil and the surface terrain will be

decompacted to facilitate planting and water absorption. (See Section 6.4.2). Before starting the works in agricultural fields, the AEE will consult with the Department of Agriculture to obtain their recommendations with respect to the additional mitigation measures that should be implemented in each type of activity.

Control measures to protect alluvial aquifers that will be discussed in Sections 6.4 and 6.5 will be implemented. In addition there will be coordination with expert personnel from the Federal Department of Agriculture to obtain their recommendations for the protection of these aquifers.

The AEE will coordinate with the owners or lessees of the agricultural lands so they will identify the location of the irrigation systems, if any, and to provide copies of the available drawings, if available. In addition, there will be coordination with the owners of farms dedicated to agribusiness, to know the details of the cattle's movement patterns. Temporary bridges will be created over the trenches to permit the passage of animals, if the owner so requires. Otherwise, the work area will be cordoned off to prevent access to it by the animals. The owners or lessees will be notified, and coordination will be had with them to provide entry to the farm for the construction works.

Regarding the cumulative impact on agriculture, many of the agricultural areas have been impacted by earth movement activities for many years. The movement of earth can accelerate the erosion of the soil and the loss of topsoil and nutrients. This can result in low production and the excessive use of fertilizers to compensate for the lost resources. Notwithstanding, the impact of Vía Verde, although unavoidable in these areas, is temporary. The quality of the topsoil should not be affected because it will be relocated from where it was removed, after being protected while the construction is carried out, so Vía Verde will not contribute significantly as regards cumulative impact.

6.7 Impacts on Superficial Bodies of Water

The possible impacts on bodies of water are: sedimentation, pollution due to spills, increase in turbidity, mortality of species, reduction of dissolved oxygen. Control measures to minimize these impacts that will be identified later will be implemented. In the event of a break in the pipeline in which the gas has to cross through a body of water before escaping to the atmosphere, the amount of gas that will dissolve in the water will be minute because the solubility of methane in water is 0.0022%. However, if the body of water is in movement, the gas will go quickly into the atmosphere due to the aeration process.

Two-hundred four (204) bodies of water through which the project will cross have been identified. This includes rivers, ravines, canals and a wetland. Some of these bodies of water will be crossed by open trench. When crossing by open trench, the trench is excavated while the body of water continues to flow through the 'dam and pump' method. This is the quickest method to cross small bodies of water.

Higher-volume bodies of water, such as rivers, will be crossed with the horizontal direct drilling method (HDD). HDD is considered a 'dry' crossing method because it does not interfere with the flow of water. This information is presented in the following table:

Bodies of Water and Type of Crossing

T1-Horizontal Direct Drilling T2-Flume pipe, Dam and Pump T3- Open Trench

ID	Body of Water	Type of Crossing	Town
ID	Cuerpo de Agua	Tipo de cruce	Pueblo
C1	Canal	T1	Peñuelas
C2	Canal	T1	Peñuelas
C4	Canal	T3	Peñuelas
C5	Río Tallaboa	T1	Peñuelas
C6	Quebrada sin nombre	T3	Peñuelas
C7	Quebrada sin nombre	T3	Peñuelas
C8	Quebrada sin nombre	T3	Peñuelas
C9	Quebrada sin nombre	T3	Peñuelas
C10	Quebrada sin nombre	T3	Peñuelas
C11	Quebrada sin nombre	T3	Peñuelas
C12	Quebrada sin nombre	T3	Adjuntas
C13	Quebrada sin nombre	T3	Adjuntas
C14	Quebrada sin nombre	T3	Adjuntas
C15	Quebrada sin nombre	T3	Adjuntas
C16	Quebrada sin nombre	T3	Adjuntas
C17	Quebrada sin nombre	T3	Adjuntas
C18	Quebrada sin nombre	T3	Adjuntas
C19	Quebrada sin nombre	T3	Adjuntas
C20	Río Pellejas	T2	Utua
C21	Quebrada sin nombre	T3	Utua
C22	Quebrada sin nombre	T3	Utua
C23	Quebrada Arenas	T3	Utua
C24	Quebrada Arenas	T3	Utua
C25	Quebrada Arenas	T3	Utua
C26	Río Grande de Arecibo	T1	Utua
C27	Quebrada sin nombre	T3	Utua
C28	Quebrada sin nombre	T3	Utua
C29	Quebrada sin nombre	T3	Utua
C30	Quebrada sin nombre	T3	Utua
C31	Río Grande de Arecibo	T1	Utua
C32	Quebrada sin nombre	T3	Utua
C33	Quebrada sin nombre	T3	Utua
C34	Río Grande de Arecibo	T1	Utua
C35	Quebrada Jobos	T3	Utua
C38	Quebrada sin nombre	T3	Arecibo
C39	Río Tanama	T1	Arecibo

C40	Ditch	T3	Arecibo
C41	Canal Perdomo	T3	Arecibo
C42	Ditch	T3	Arecibo
C43	Río Grande de Arecibo	T1	Arecibo
C44	Ditch	T3	Arecibo
C45	Ditch	T3	Arecibo
C46	Ditch	T3	Arecibo
C47	Ditch	T3	Arecibo
C48	Ditch	T3	Arecibo
C49	Ditch	T3	Arecibo
C50	Ditch	T3	Arecibo
C51	Ditch	T3	Arecibo
C52	Ditch	T3	Arecibo
C53	Ditch	T3	Arecibo
C54	Ditch	T3	Arecibo
C55	Ditch	T3	Barceloneta
C56	Ditch	T3	Barceloneta
C57	Ditch	T3	Barceloneta
C58	Ditch	T3	Barceloneta
C59	Ditch	T3	Barceloneta
C60	Ditch	T3	Barceloneta
C61	Ditch	T3	Barceloneta
C62	Ditch	T3	Barceloneta
C63	Ditch	T3	Barceloneta
C64	Ditch	T3	Barceloneta
C65	Ditch	T3	Barceloneta
C66	Río Grande de Manatí	T1	Manatí
C67	Creek	T3	Manatí
C68	Creek	T3	Manatí
C69	Caño de los Nachos	T3	Manatí
C70	Ditch	T3	Manatí
C71	Ditch	T3	Manatí
C72	Río Grande de Manatí	T1	Manatí
C73	Río Grande de Manatí	T1	Manatí
C74	Río Indio	T1	Vega Baja
C75	Río Indio	T1	Vega Baja
C76	Río Indio	T1	Vega Baja
C78	Quebrada sin nombre	T3	Vega Baja
C80	Río Cibuco	T2	Vega Alta
C81	Quebrada sin nombre	T3	Vega Alta
C82	Ditch	T3	Dorado
C83	Río de la Plata	T1	Toa Baja
C84	Ditch	T3	Toa Baja
C85	Ditch	T3	Toa Baja
C86	Ditch	T3	Toa Baja
C87	Ditch	T3	Toa Baja
C88	Ditch	T3	Dorado
C89	Río Cocal	T3	Dorado

C90	Rio Cocal	T1	Toa Baja
C91	Quebrada sin nombre	T3	Toa Baja
C95	Río Hondo / Río Bayamón	T1	Cataño
C97	Ditch	T3	Toa Baja
C98	Quebrada Diego	T3	Bayamón
C99	Quebrada Las Lajas	T3	Guaynabo
C100	Quebrada Santa Catalina	T3	Guaynabo
W1	Estuarine-Salt Flat- Mangle	No impacto	Peñuelas
W2	Estuarine-Salt Flat- Mangle	No impacto	Peñuelas
W3	Estuarine-Salt Flat- Mangle	No impacto	Peñuelas
W4	Estuarine-Salt Flat- Mangle	No impacto	Peñuelas
W5	Canal, Mangle	No impacto	Peñuelas
W8	Canal	T3	Peñuelas
W9	Canal	T3	Peñuelas
W10	Palustrine-Man Altered, Herbaceous	Humedal	Peñuelas
W11	Canals	T2	Utado
W17	Palustrine-Herbaceous	Wetland	Arecibo
W19	Palustrine- man altered herbaceous	Wetland	Arecibo
W20	Canal	T3	Arecibo
W21	Palustrine, man altered herbaceous	Wetland	Arecibo
W22	Palustrine, man altered herbaceous	Wetland	Arecibo
W24	Palustrine- man altered herbaceous	Wetland	Arecibo
W25	Canals	Wetland	Arecibo
W26	Palustrine- man altered herbaceous	Wetland	Arecibo
W27	Canals	Wetland	Arecibo
W28	Canals	T3	Arecibo
W29	Canals	Wetland	Arecibo
W30	Palustrine herbaceous	Wetland	Arecibo
W32	Palustrine herbaceous	Wetland	Arecibo
W33	Palustrine herbaceous	Wetland	Arecibo
W34	Palustrine, man altered herbaceous	Wetland	Arecibo
W35	Palustrine- man altered herbaceous	Wetland	Arecibo
W36	Canals	Wetland	Arecibo
W37	Palustrine-man altered herbaceous	Wetland	Arecibo
W38	Palustrine-man altered herbaceous	Wetland	Arecibo
W39	Palustrine herbaceous	Wetland	Arecibo
W40	Palustrine herbaceous	Wetland	Arecibo
W41	Palustrine herbaceous	Wetland	Arecibo
W42	Palustrine herbaceous	Wetland	Arecibo
W43	Palustrine herbaceous	Wetland	Arecibo
W44	Palustrine-man altered	Wetland	Arecibo

	herbaceous		
W45	Palustrine-man altered herbaceous	Wetland	Arecibo
W46	Palustrine-man altered herbaceous	Wetland	Arecibo
W47	Palustrine-man altered herbaceous	Wetland	Arecibo
W48	Palustrine-man altered herbaceous	Wetland	Arecibo
W49	Palustrine herbaceous	Wetland	Arecibo
W50	Palustrine herbaceous	Wetland	Arecibo
W51	Palustrine herbaceous	Wetland	Arecibo
W52	Palustrine herbaceous	Wetland	Barceloneta
W53	Palustrine herbaceous	Wetland	Barceloneta
W54	Palustrine herbaceous	Wetland	Barceloneta
W55	Palustrine-man altered herbaceous	Wetland	Barceloneta
W56	Palustrine herbaceous	Wetland	Barceloneta
W57	Palustrine herbaceous	Wetland	Barceloneta
W58	Palustrine herbaceous	Wetland	Barceloneta
W59	Canals	T3	Barceloneta
W60	Palustrine herbaceous	Wetland	Manatí
W61	Palustrine, man altered herbaceous	Wetland	Manatí
W62	Palustrine herbaceous	Wetland	Manatí
W64	Palustrine-herbaceous	Wetland	Manatí
W65	Palustrine, man altered herbaceous	Wetland	Manatí
W66	Palustrine-man altered herbaceous	Wetland	Manatí
W67	Palustrine-man altered herbaceous	Wetland	Manatí
W68	Canals	Type 3	Manatí
W69	Palustrine,man altered herbaceous	Wetland	Manatí
W70	Palustrine-man altered herbaceous	Wetland	Manatí
W71	Palustrine-man altered herbaceous	Wetland	Manatí
W72	Palustrine herbaceous	Wetland	Manatí
W74	Palustrine herbaceous	Wetland	Manatí
W76	Palustrine herbaceous	Wetland	Manatí
W77	Palustrine-man altered herbaceous	Wetland	Manatí
W78	Canal	T2	Vega Baja
W79	Canal	T2	Vega Baja
W80	Canal	T2	Vega Baja
W81	Canal	Wetland	Vega Baja
W82	Palustrine-herbaceous	Wetland	Vega Baja
W83	Palustrine-herbaceous	Wetland	Vega Baja
W84	Canal	T2	Vega Alta
W85	Palustrine-herbaceous	Wetland	Vega Baja

W86	Canal	T2	Vega Alta
W87	Palustrine herbaceous	Wetland	Vega Alta
W88	Palustrine herbaceous	Wetland	Vega Alta
W89	Palustrine-man altered herbaceous	Wetland	Vega Alta
W90	Palustrine-man altered herbaceous	Wetland	Vega Alta
W91	Palustrine herbaceous	Wetland	Vega Alta
W92	Palustrine-man altered herbaceous	Wetland	Dorado
W93	Palustrine-man altered herbaceous	Wetland	Dorado
W94	Palustrine-man altered herbaceous	Wetland	Dorado
W95	Palustrine-man altered herbaceous	Wetland	Dorado
W96	Canal	T3	Toa Baja
W97	Palustrine-man altered herbaceous	Wetland	Toa Baja
W98	Palustrine-man altered herbaceous	Wetland	Toa Baja
W99	Palustrine-man altered herbaceous	Wetland	Toa Baja
W100	Palustrine-man altered herbaceous	Wetland	Toa Baja
W101	Canal	Wetland	Dorado
W103	Estuarine Forested	T1	Toa Baja
W105	Palustrine herbaceous	Wetland	Toa Baja
W112	Canal	Wetland	Toa Baja
W113	Palustrine herbaceous	Wetland	Toa Baja
W116	Palustrine herbaceous	Wetland	Toa Baja
W117	Palustrine herbaceous	Wetland	Cataño
W118	Palustrine herbaceous	Wetland	Bayamón/Cataño
W119	Palustrine herbaceous	Wetland	Bayamón
W120	Palustrine herbaceous	Wetland	Guaynabo
W121	Canal	T3	Guaynabo
W122	Canal	Wetland	Guaynabo
W123	Palustrine herbaceous	Wetland	Guaynabo
W124	Estuarine forested	Wetland	Guaynabo
W125	Estuarine forested	Wetland	Guaynabo
W126	Estuarine forested	Wetland	Guaynabo
W127	Estuarine forested	Wetland	Guaynabo
W128	Canal	Wetland	Guaynabo
W129	Estuarine forested	Wetland	Guaynabo
W130	Palustrine herbaceous	Wetland	Guaynabo
W131	Palustrine herbaceous	Wetland	Guaynabo
W132	Palustrine herbaceous	Wetland	Guaynabo
W133	Palustrine herbaceous	Wetland	Guaynabo
W134	Canal	No impact	Guaynabo
W135	Canal	No impact	Guaynabo
W137	Canal	No impact	Guaynabo

Throughout almost its entire course of 92 miles, the pipeline will be installed at least 3 feet under the terrestrial surface and at least 6 feet under the river beds and ravines. No permanent effect on the bodies of water is anticipated. However, a temporary effect during the construction process in the crossing of river ravines is anticipated, which will be appropriately controlled.

Two types of crossings are anticipated: open trench and Horizontal Direct Drilling (HDD). The first type, open trench, will be used in the stormwater runoff courses and the ravines; and the second will be used to cross the rivers.

In regard to the open trenches, the excavation through water beds entails impact, particularly by the suspension of solids and by disturbances in the materials of the bed. For the crossing work, the watercourse will be diverted to a temporary course that allows the excavation of the water bed and carry out the installation. Once the installation is complete, the water bed will be stabilized with materials compatible with the original bed. Then the water will be redirected in its natural course, and the site of the temporary course will be restored to its original form. The mitigation of the impacts will be carried out through erosion and sedimentation control measures. CES plans will be designed in harmony with the Stormwater Pollution Prevention Plans (SWPPP) required by the Environmental Protection Agency (EPA).

As to the HDD, the rivers will not suffer any impact on their river beds, because this technology permits making a "dry crossing" by passing well below the river bed. The drilling equipment will drill the ground below the river bed and install the pipeline without affecting the river bed. The incorporation of the 24-inch pipeline in the areas classified as aquifers may be done in two ways: first, that the pipeline is installed over the water table, and second, that the pipeline is installed below the aquifer's water table. A third way in which it could be done is when the pipeline is partially submerged in the water table as a result of the fluctuations in the aquifer's level due to the variation in the annual rainfall cycle.

When it is installed over the water table, the pipeline will not cause any alteration in the aquifer's recharge. Aquifer recharge areas begin on the flanks of the central mountain range, upstream of the aquifers *per se*. However, in those cases where the aquifer also recharges on site, there will be an insignificant effect on the direct recharge which will correspond to the diameter and length of the pipeline, since the water that has to infiltrate to the subsoil at the site of the trench will be delayed in its course because it will have to flow around the pipeline.

In those places where the pipeline must be installed below the water table, the impact will also be negligible due to the extremely low migration velocities that are normal in aquifers. However, for a more detailed evaluation it is necessary to determine the direction of the flow lines and the thickness of the aquifer. In case the flow lines are parallel or they have a minimal deviation angle with respect to the axis of the pipeline, the impact of the pipeline on the movement of subterranean water will be negligible (the

one that corresponds to the area of the 24-inch diameter pipeline, that is 3.14 square feet).

In case the flow lines are perpendicular to the axis of the pipeline or they have an incidence angle of more than 45 degrees, the flow lines will encounter an obstruction in their course and the aquifer's transmissibility will be diminished. Nevertheless, this reduction in transmissibility will be imperceptible, again due to the extremely low migration velocities. However, in those areas that during the design phase are identified as compromised to a reduction of transmissibility, transmissibility compensation measures will be employed, as for example, the installation of pockets of granular material (river sand) as backfill of the trenches in short and localized stretches sufficient to compensate the transmissibility.

Additionally, the determination of the aquifer's thickness is important, especially when the flow lines are perpendicular to the axis of the pipeline. If the thickness of the saturated aquifer is only a few feet, the impact of the two-foot diameter pipeline will be significant in terms of flow per unit of area. In this case, the compensation of transmissibility will be essential. For these reasons, in those aquifers whose thickness is of a few feet, the preferred measure will be avoiding the same. However, if it were unavoidable, studies will be made to determine the aquifer's transmissibility and the form of compensation of transmissibility will be designed with the results of said studies.

The pipeline that is installed below the water table will stand in the course of the flow of subterranean waters. However, since the velocity of the water is close to zero, the impact will be imperceptible. The hydrology of the wetland will not be affected in practice. However, in the particular case in which the pipeline runs perpendicular to the flow of subterranean water and that the wetland's aquifer is thin, structures will be installed that compensate the reduction of transmissibility, or the installation of the pipeline will run deeper. The compensation structures, when necessary, will consist of high-transmissibility granular material installed around the pipeline in localized areas. The granular material will be covered with a synthetic filter fabric.

6.7.1. Crossing by open trench

The crossings that will be made by open trench are crossings of small, perennial and intermittent ravines, ditches and drainage and irrigation canals. Some of these bodies of water are dry or of a minimal flow.

The impacts in open trench include an increase in turbidity, sedimentation downstream of the crossing, reduction of dissolved oxygen, mortality of aquatic fauna and flora. In addition to this, there could be impact to the water quality caused by leaks of oil and other fluids in the machinery.

The impact will be mitigated by reducing the time of construction. In the United States, the Federal Energy Regulatory Agency requires that crossings of bodies of water less

than 10 feet wide are crossed in 24 hours or less and bodies of water from 10 to 100 feet wide in 48 hours. These are the standards that will apply to this project.

No vehicles leaking oil or other liquids that could pollute the waters will be allowed. If the vehicle develops leaks during the work, spill kits will be used to collect any leakage and the vehicle will be removed from the site.

6.7.2. Horizontal direct drilling (HDD)

A successful crossing with this method avoids impacts on the bodies of water because it does not interfere with the flow, the water quality or with the aquatic fauna and flora. The AEE is experienced in the use of this technique in projects like underground electric lines and the submarine cable of Isleta Marina.

During the drilling, a mixture of bentonite and water is used to lubricate the drill, maintain perforation and remove residues from the drill. Bentonite is the commercial name of non-toxic clays formed from volcanic ash. The United States is the world's leading producer of Bentonite. The best quality bentonite is found in Ft. Benton, Wyoming. It is acquired commercially in 50 - 100 pound bags, similar to cement. To prepare it, the bentonite is mixed with water (Eg: 50 lbs. For each 300 gallons of water, maintain a pH of 8-9) to form a slurry that acts as a cooling fluid for the drill and the probe, and as a lubricant for the drill head. The mixture is prepared in a tank and then transferred to a mud pit at the entrance and exit of the drill. Other mud pits will be needed to store the mud and to dry the used mud for later reuse. These mud pits will be covered with impermeable liners. In addition, hay bales and a silt fence will be installed around them.

Bentonite does not require special storage procedures. It can be stored in open air covered with plastic tarpaulin, or in a covered building to protect it from the rain.

The principal impact of the drilling procedure could be the inadvertent release of bentonite. Bentonite could escape through unidentified fractures in the material underlying the river bed, in the area of the mud pits, or along the course of the perforation due to unfavorable ground conditions. The HDD crossings could fail for various reasons, including the inability to close the pilot hole, inability to maintain a stable open hole or inability to pull the pipeline through the perforation. To avoid these faults, an adequate design will be developed, specific to the area, the correct equipment and specialized personnel to operate it will be used. If any of the parts of the drilling has problems and it cannot be finished, the design engineers will study the geotechnical data to identify the cause. If necessary, other geotechnical studies will be made, or the location of the crossing will be changed.

Although bentonite is composed of naturally-occurring, non-toxic materials, its deposit in bodies of water affect the turbidity, diminishes the quantity of dissolved oxygen and affects the respiration of aquatic organisms. A bentonite escape is usually detected

when there is a loss of circulation of drilling liquid, a loss of pressure and/or bentonite is detected on the surface of the body of water. One of the functions of bentonite is to seal the perforation to maintain the downhole pressure. If there is an escape there is a change of pressure and a reduction in the amount of bentonite recirculated. A bentonite escape does not require the evacuation of nearby residences. The remaining bentonite after the drilling is done is left to dry in the mud pits and later will be disposed of in accordance with the applicable regulations.

During the drilling, a dye will be added (uranine), that will help detect any escapes to the surface. If an escape is detected, the fluid's pump will be turned off, which will immediately stop the flow of bentonite. An inspector will be assigned, whose function will be to observe the body of water during the drilling. This inspector will keep in contact with the team in charge of the drilling and will instruct them to stop the process if bentonite is observed (mixed with uranine) on the surface. In addition, he will document all his observations from the beginning of the drilling to the end. Drilling could last 2-3 days, but it all depends on the depth, the distance to the other shore and the design in general. Each crossing by HDD is designed individually, based on geotechnical studies of the site. The team of workers in charge of the HDD crossings are specialists in this type of crossing. This is the only work they will perform for the project.

We enclose the Material Safety Data Sheet (MSDS) for Bentonite. It indicates that bentonite is an irritant to the eyes and the respiratory tract if inhaled (dust). It can also irritate the skin. In case of contact with the eyes, the eyes must be irrigated with water for 15 minutes. In contact with the skin, it must be washed off with soap and water. In case of inhalation, the person must be removed outdoors (in case of exposure to bentonite in an enclosed area).

In addition, we enclose the MSDS for uranine. Like uranine in its solid (powder) form it causes irritation to the eyes and if inhaled. According to the MSDS, the chemicals contained in uranine are not listed in the TSCA lists, Significant New Rule, Chemical Test Rules, Health and Safety Reporting List, CERCLA Hazardous Substances, SARA Section 302, Extremely Hazardous Substances. Uranine does not contain air pollutants, it does not affect the ozone layer. Neither does it contain pollutants listed as water pollutants.

Also enclosed is a Responses to Bentonite Escapes Plan where the HDD process and the control measures to be implemented in case of an escape are described in more detail.

Even though they are technically viable, HDD crossings can fail for various reasons, including inability to complete the pilot hole, inability to maintain a stable open hole, or inability to pull the pipeline through the perforation.

To prevent the technique from failing, geotechnical studies will be conducted and

construction plans specific to the site will be developed during the crossing's design stage.

The principal impact that could occur is the inadvertent release of bentonite. Bentonite could escape through unidentified fractures in the material underlying the river bed, in the area of the mud pits, or along the course of the perforation due to unfavorable ground conditions. Although bentonite is composed of naturally-occurring non-toxic materials, its deposit in bodies of water affects the turbidity, diminishes the quantity of dissolved oxygen and affects the respiration of aquatic organisms.

Another impact associated to the HDD is the size of the construction area. In normal construction, this right-of-way will be 100 feet. For the HDD a construction area of 100-300 feet on both sides of the body of water will be used.

Erosion and sedimentation control measures will be implemented in the construction area during the crossing, in order to minimize the sedimentation of the body of water during rain events.

To minimize the impact in case of bentonite escapes, a dye will be added to the bentonite, because small escapes are difficult to detect due to the water turbidity and to bentonite's specific gravity. If an escape is detected, the fluid pump will be turned off, which will immediately stop the flow of bentonite and the pertinent Agencies will be notified. An inspector will be assigned to corroborate compliance.

Vehicles with leaks of oil or other liquids that could pollute the waters will not be permitted. If the vehicle develops leaks during the works, a spill kit will be used to pick up any leakage and the vehicle will be removed from the site.

Once the crossing is finished, all the soil that was removed in the right-of-way will be reused to restore the same. If necessary, additional backfill will be used.

6.8 Impacts to Subterranean Waters and Aquifers

Thirty-one (31) aquifers were identified in an area of within 400 meters from the project along the course of the alignment.

Trenches 4-6 feet deep will be excavated for the project and this does not represent an impact to resources of subterranean waters or aquifers. The gas pipelines can pollute subterranean waters if the natural gas used during the operation of the project contains pollutants that condense (natural gas liquids) and there is a break in the inferior part of the pipeline through which they can escape. In addition, there can be pollution where there are compressor stations to propel the gas. It is important to mention that the gas to be used in Via Verde will not have the kind of pollutant that condenses (by specification), nor will it have compressor stations.

Escapes of natural gas rise to the atmosphere because it is lighter than air. In case of an escape in the pipeline, the effects will be visible in the vegetation of the right-of-way, because it will wither and dry.

Although it is considered that the possibility of pollution of subterranean waters is remote, spills of oil and fuel that are not addressed quickly could pollute the waters. To prevent that possibility, a Spills Control Plan will be implemented. The project's Environmental Coordinator will be in charge of compliance with the parameters established in the Plan. This Plan will be prepared following the guidelines of the Code of Federal Regulations, Title 40, Protection of the Environment, Part 112, Oil Pollution Prevention. The same will be filed with the EPA for evaluation. This Plan will have a section where the Operation Centers and the factors specific to each one of them will be discussed. Each Operations Center will have a copy of the Plan. The Environmental Coordinator will offer informative talks at each Center. During construction, the resident engineer will be responsible for ensuring the implementation of the control measures, in coordination with the Environmental Coordinator.

6.9 Impacts on Flood-prone Zones

The possibility of impact on the flood levels by some actions emerging from the installation of the pipeline is anticipated, but at the same time structural measures destined to mitigate this possible impact are established so that the flood levels are not increased by the pipeline construction actions.

The project opens the possibility that surplus of the excavation to install the 24-inch diameter pipeline will be deposited temporarily in zones regulated as flood-prone. In relation to this, Regulation No. 13 of Flood-prone Zones of the Puerto Rico Planning Board has specific requirements for each Zone.

Zone A is an area that has not been studied. FEMA does not have a detailed study and the maps do not have base flood levels. The flood levels in this area should not be increased; unless there is a Hydrologic and Hydraulic (H/H) study that justifies the landfill action. Zone AE is an area that has a detailed study. There are two sub-zones in this Zone: the floodplain and the floodway. In the floodplain, which is the area outside the floodway, landfill can be deposited without the need of an H/H study. However, landfill in the floodway is not permitted; unless an H/H study demonstrates that the flood levels are not increased by the landfill action. Zone VE is similar to Zone AE. The difference is that in this zone the floods originate from cyclonic waves. Depositing landfill in the floodplain of this zone is permitted, not so in the floodway; unless there is an H/H study that demonstrates that the land fill action does not produce an increase of flood levels. Zone X is a zone with a 0.2% probability of occurrence (500 year rainfall), there is no restriction on the deposit of landfill. Following from the above is that in the floodplain of Zones AE and VE and in Zone X landfill can be deposited without an Hydrologic and Hydraulic study. But it is not permitted to deposit landfill in the floodways of Zones AE and VE unless an H/H study demonstrates that the flood

levels will not be increased.

The construction of the pipeline through flood-prone zones will only have the possibility of temporary impacts. The surplus materials from the excavation can have temporary effects on the flood levels if they are deposited in the floodway. This situation would have to be accidental in character, of a fortuitous flood event, which would not permit the removal of said surplus materials before its occurrence. Even despite this possibility, the temporary effects will be minimal because the volume of surplus material will be only that corresponding to the material not yet transported to its place of final disposal during the work day. Permanent effects in the flood levels are not foreseen because all the surplus from the excavation will be transported to deposit sites outside the floodway.

The surplus material from the excavation will be deposited along the installation of the pipeline in the floodplains of Zone AE, Zone VE and Zone X. The material will be dispersed within the pipeline's right-of-way. The surplus of the excavation in the floodway of Zones AE and VE, in general, will be transported and deposited in authorized places outside the floodway.

6.10 Impacts on the Infrastructure

The infrastructure services for the Municipalities through which the pipeline crosses will not be affected or significantly compromised by the project. Nonetheless, regarding other underground infrastructure in the project area, there will be compliance with Regulation 7245 of the Public Service Commission, Regulation for the Creation and Operation of the Excavations and Demolitions Coordination Center, before commencing the construction of the project. Through the coordination required to be made with the owners of other infrastructures in this Regulation, plans will be developed to avoid damage to said infrastructures and plans will be agreed in response to any emergency that could arise in case of unexpected damage to the same. Each owner of infrastructures in the area of the project will have an Inspector present at the moment of the excavation, as required in the Regulation.

6.10.1. Impact on AAA Infrastructure

The project will cross through several aqueduct lines and several sewer systems. (See Section 3.8.1.) Before carrying out the excavations in the vicinity of those underground aqueduct and sewer systems mentioned below, the constructors of Vía Verde will coordinate said excavations with the owners of these underground structures, through the Public Service Commission or the new Permit Management Office, as applicable. In case of finding unidentified infrastructure, the construction will be detained until the owner of such infrastructure has been identified or a permit to proceed is obtained from the Public Service Commission.

6.10.1.1. Water Consumption

The consumption of water during the construction is estimated at 10,344,000 gallons. This consumption will be during or due to: the hydrostatic testing of the pipeline, drinking water supply for consumption by the employees, sprinkling the project's area to prevent the emission of fugitive dust and for sanitary use by the employees.

To verify the pipeline's integrity prior to its operation, it is required to conduct hydrostatic tests. This is done to ensure that the system is capable to withstand the operating pressure for which it was designed.

This test entails the greatest water consumption of the whole project. The contractor will conduct the test by stretches to reduce the amount of water needed. The decision of the length of the stretches is made by the contractor, based on his professional experience and in the topography of the route. To the effect of calculating the water consumption, a stretch length of 12 miles will be used. The total consumption will be 5,700,000 gallons. The water will be transferred from stretch to stretch until it arrives at the San Juan Thermoelectric Power Plant, where it will be discharged in the NPDES 001 discharge.

This test entails the greatest consumption of water of the whole project. The contractor will decide how to carry out the test, according to the water supply. The pipeline can be tested all at once or divided in sections. It is estimated that 7 million gallons of water will be needed to perform the test in a single day (8 hours).

The following alternatives to obtain the necessary supply were considered:

- The alternative of obtaining the water from the rivers adjacent to the project was evaluated, but it was discarded to avoid impacts on the water quality and to the fauna and flora.
- The construction of wells for this event was evaluated, but it was discarded because it represented an inefficient use of the resource.
- Because the AAA's drinking water system will be used for other phases of the project, its use was discarded so as to not overload it.
- The use of existing wells for which the AEE has a use franchise was evaluated. There is a system of wells under franchise RO-13-08-01-FI-70311. Said franchise permits a total extraction of 5.122 MGD. The decision was for this option to eliminate the impact on the public distribution system and the bodies of water.
- After this test is concluded, the water will be discharged in the NPDES 001 discharge of the San Juan Thermoelectric Power Plant. The Power Plant's NPDES discharge permit has a Certificate of Water Quality from the Environmental Quality Board. It is important to mention that the water for the

test is clean water extracted from wells. There will be coordination with the Federal Environmental Protection Agency (EPA) to obtain a temporary discharge permit. There will be compliance with all the sampling and analysis conditions established by the EPA.

During construction, it is necessary to provide drinking water to the worker brigades of the different phases of the project. It is estimated that the maximum water consumption will be 1,200 gallons daily. The project's duration is estimated at 9 months and work will proceed 7 days a week. The drinking water consumption will be approximately 324,000 gallons.

No water from the AAA will be used for this purpose. Bottled water will be provided which will be purchased from local providers. The contractor will identify the local suppliers and arrangements will be made prior to the commencement of construction that will allow them to absorb the increased demand. The temporary increase in demand will have a positive impact on local business. The project's operation does not require the use of drinking water.

Water will be used to sprinkle the project's construction areas and minimize the emissions of fugitive dust to the atmosphere. Tanker trucks with a capacity of 2,000 gallons, equipped for this purpose, will be used to sprinkle. A maximum daily consumption of 16,000 gallons is estimated for this area. This means a maximum 4,320,000 gallons during the whole project.

A local supplier will be contracted to sprinkle the soil. He will be responsible for providing the truck and the water.

6.10.1.2. Wells

One hundred fifty-six (156) wells were identified within a radius of 460 meters from the alignment proposed for the project. Only six of these are within the project's operation right-of-way. (See Section 3.5.9.)

Water Wells				
ID	Well's Name	Municipality	Ward	Distance/ meters
018	Valdivieso #01	Peñuelas	Tallaboa Poniente	10
019	USGS	Peñuelas	Tallaboa Poniente	10
020	Valdivieso #02	Peñuelas	Tallaboa Poniente	8
087	Concora Factor	Arecibo	Factor	15
131	Maguayo #02	Dorado	Higuillar	10

132	Maguayo #03	Dorado	Maguayo	10
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Of these wells, those identified as 018, 020, 087, 131, and 132 are drinking water wells; well 019 is for sampling.

The following measures will be taken to avoid or minimize impacts on the station and the wells:

- They will be identified in the project's final drawings for the knowledge of the construction personnel.
- If the wells are encountered during the clearing of the right-of-way, their location will be marked to avoid impacting them.
- There will be coordination with the owners of these wells to interrupt their operation and protect them during construction.
- Any break that could occur due to the construction will be repaired.

6.11 Impacts on Transportation and Traffic

6.11.1. Maritime transportation

The pipeline segments that will form the project and their components will be purchased out of Puerto Rico, because their manufacture is specialized. The machinery required for the project's construction process is also specialized and specifically designed for the activities of excavation, laying of the pipeline and drilling, among others. Barges will be used for the maritime transport of the materials and machinery to the Port of the Americas in Ponce and the San Juan port zone. The materials received will be carried by land transportation to the operation centers in Ponce and Toa Baja where the same will be stored. The following measures will be taken to minimize the impact the receipt, debarkation, dispatch and transportation of the machinery, pipe segments and other equipment to the operation centers could have:

- There will be compliance with all the requirements established by the different receipt ports, the Ports Authority and Federal Customs prior to the receipt of the shipment.
- The contractor will develop a logistics plan for the proposed activity, which will be presented to the pertinent authorities for comments and endorsement. The plan will include the following aspects: details of the shipping port, maritime travel itinerary, number of barges, frequency of trips, inventory of equipment, classified and identified containers, time for unloading the equipment, identification of areas for the temporary storage

in the port, maximum allowable residence time for materials in the port, travel itinerary and mobilization of materials out of the port, among others. Among the benefits derived from implementing the plan are:

- Expediting the inventory inspection and review process by the Ports Authority and Federal Customs.
- Avoid penalties for delays or residence time of the barge in the port.
- Avoid delays in the port's activities
- More efficient and speedy movement of equipment.

6.11.2. Ground transportation and traffic

The Via Verde project comprises a length of 92 miles, approximately. The roadways will be used as access to transport personnel, equipment, vehicles (light and heavy) and materials to the different areas of the project. The main highways will be: PR-337, PR-127, PR-2, PR-385, PR-132, PR-520, PR-391, PR-123, PR-10, PR-143, PR-521, PR-524, PR-111, PR-621, PR-22, PR-681, PR-684, PR-616, PR-149, PR-672, PR-137, PR-155, PR-674, PR-160, PR-676, PR-690, PR-694, PR-693, PR-165, PR-5 and PR-28. Most of these highways are catalogued as having several lanes in both directions, wide and passable.

During the construction stage there will be an increase in light and heavy traffic, especially in areas near the operation centers. This increase may cause traffic congestion and inconveniences to the population.

Small and local roads will be crossed with the open trench method and this will cause short periods of traffic delays.

The following measures will be taken to minimize the project's impact on the integrity of the public roads and on the interruption or increase in traffic:

- A Traffic Management Plan will be prepared and submitted to the Highways and Transportation Authority for their approval. The most important elements of this Plan are: Identifying traffic flow patterns, identifying alternate routes and emergency accesses, traffic control at intersections, pedestrian control, accesses for impaired persons, coordination with law and order agencies to implement the Plan. All the traffic control signs and signals will be in compliance with the requirements of applicable regulations.

Different traffic control methods are presented in Addendum 6.1, Typical MOT Diagrams.

- Unpaved roads will be crossed with the open trench method. This method

will require the temporary closure of traffic and detours will be established. This will be coordinated with the ACT and the local police and it will be referred to in the Traffic Management Plan. The contractor will be in charge of establishing measures such as the installation of warning signs to ensure safety and minimize the obstruction of traffic. If necessary, steel plates will be used to cover the trenches if the crossing works take more than a day.

6.12 Impacts on Archaeological Sites and Cultural and Historic Places

Part of the information below was obtained from the ArcGIS 9 ArcMap 9.2 (ArcView Geographical Information System) software programs, with the Planning Board's database for the years 2004 to 2009. In addition, the AEE contracted Environmental and Educational Consultants (in Spanish Asesores Ambientales y Educativos (AAE)) to conduct the project's environmental studies, who in turn contracted archaeologists Marisol Rodríguez Miranda and Carlos Ayes Suárez to carry out the Phase 1A study. Said study identified the known archaeological resources and established the base to discover additional resources in the area of the project. A copy of Phase IA Study is in Appendix 5. According to the results of the Phase IA Study, Phase 1B studies will be conducted where necessary. After evaluating the results of the Phase IB study, the areas where Phase II and Phase III studies will be conducted will be identified. An inventory of properties with architectural value will be made and a Structures Protection Plan will be prepared, if necessary. In case an archaeologically sensitive area is found, that had not previously been identified at the moment of movement earth, the recommendations of the archaeologist that will be contracted to those ends will be followed.

As a result of the surface survey, three rock shelters with petroglyphs were found located in the impact zone of the proposed project. The presence of possible agricultural terraces associated with pre-Columbian cultures was also detected.

In addition, the remains of two railroad bridges and two haciendas were found. Archaeologist María López Cruz prepared the evaluation sheets for these remains. To facilitate the evaluation to be made of these data by the Institute of Puerto Rican Culture (ICP), the official sheets of said Agency were used. They correspond to the Cambalache Bridge, Hacienda Teresa, Hacienda Las Lisas in Arecibo and remains associated to Hacienda Plazuela in Barceloneta.

Isolated finds of colonial material were detected all along the alignment in the North area from Cambalache Sugar Cane Mill to the Plantaje Shrine. These finds constitute an indicator of areas with greater possibilities of finding activity related to the agricultural history of the whole north zone. It is possible that these materials are associated to the habitation areas created due to the activities of the haciendas and to the subsequent population movements they generate.

The most important finds in the area to be occupied by the alignment right-of-way are indicated next: Tallaboa Site, for which a Phase IB study is recommended; Puentes, for which protection is recommended through the placement of cement and orange mesh barriers; Hacienda La Teresa, for which a Phase IB study is recommended; Hacienda Las Lisas, for which a Phase IB study is recommended; Paso del Indio, which although widely studied, there are no studies of the area where the pipeline will be located, for which reason a Phase IB study is recommended; Dorado 15, which has not been delimited, for which a Phase II is recommended; Hacienda La Candelaria, for which there is a recommendation to enter into a mitigation process that includes architectonic documentation and archaeological excavation; Warehouse 5, for which the liberation of the area is recommended, because the same has been widely studied, and to enter into a mitigation process for the site.

In case resources are impacted and the route cannot be changed, the Authority will carry out Phase III studies. In addition, it will file the request for services and file a project before the Historic Buildings Heritage Program for its evaluation and recommendations. Visits to sensitive areas will be coordinated, as required by the agency to conduct their own evaluation. In addition, a protocol will be developed to protect resources of this kind that lie near the construction of the project.

6.13 Noise Impacts

The location, magnitude and frequency of the environmental noise can vary considerably over the course of the day. The basic units used by the JCA to measure acceptable noise levels are the decibels dB(A). The acceptable noise limit is different for daytime and nighttime hours. The JCA's Noise Pollution Control Regulation establishes the maximum permissible levels for the different receptor zones in the day and at night. In addition, it establishes the maximum permissible for motor vehicles measured at a distance of 50 feet, stationary or in motion. This information is shown in the following tables:

Noise Emission Levels in dB(A)

Noise level exceeded by 10% of the measurement period (L10)

Fuente Emisora	Zonas Receptoras							
	Zona I (Res)		Zona II (Com)		Zona III (Indus.)		Zona IV (Tranq.)	
	Diurno	Nocturno	Diurno	Nocturno	Diurno	Nocturno	Diurno	Nocturno
Zona I (Res)	60	50	65	55	70	60	50	45
Zona II (Com)	65	50	70	60	75	65	50	45
Zona III (Indus.)	65	50	70	65	75	75	50	45

Maximum permissible levels for motor vehicles in public roads measured at a distance of 50 feet

Tipo de Vehículo	35 MIH o Menos	Sobre 35 M/H	Estacionado (Motor Encendido)
Vehículos de Motor de 10,000 lbs. o más (peso bruto)	86 db (A)	90 db (A)	88 db (A)
Motocicletas (cualesquiera)	80 db (A)	84 db (A)	88 db (A)
Otros (cualesquiera otro o combinación)	76 db (A)	80 db (A)	88 db (A)

The magnitude of a noise impact depends, generally, of the type of construction activity, the noise levels generated by the equipment and machinery, the duration of each phase of construction, and the distance between the noise source and the receptor. Vía Verde is a lineal project and the construction will move day to day. This means that the noise will not be concentrated in one specific area.

The noise levels for the heavy machinery to be used in the construction are itemized in the following table:

Equipo	Nivel de Ruido (dbA) a 50 pies
Bulldozer	85
Backhoe para excavar	80
Backhoe para rellenar	85
Sideboom	85
Niveladores	85
Camión	88
Wheel ditcher	80

The noise levels of the machinery to be used for the construction are comparable to those established by the Regulation. In the majority of cases the equipments will be operated in isolated areas outside the 50 feet of impact to the receptor. Although the Regulation establishes an exception for the prohibition of the sound emission limits during the installation of essential public services, the following measures will be taken to minimize the effects of noise on populated areas:

- The construction works will be circumscribed to the day schedule established by the Regulation.
- No vehicles or machinery without noise control equipment or with

defective equipment will be allowed.

- Inasmuch as possible, the newest equipment to be found will be used. Although there is a factory-established noise limit for construction equipment, older equipments emit more noise due to wear and tear. The friction between the parts increases the noise level.
- The machinery will be turned off when not in use.
- The construction of this project will be divided in four segments and the accesses to each work area will be located in a manner that they are not within 50 feet of residences or quiet zones.

6.14 Impacts caused by Spills

The possibility of spills always exists when working with chemical products, and equipment and machinery that use oils or other fluids to operate adequately. The key is prevention through an information program to employees and an aggressive maintenance program of the equipment used.

Generally, spills occur by human error. Among the principal causes are poor handling of the products, lack of maintenance of the equipments, and lack of adequate knowledge about the functioning and operation of the machinery.

The spills in this project, if they occur, will not be of a significant magnitude, since in the majority of cases small amounts of the products will be used (paints, oils, epoxy, etc.). The following equipments and materials are possible sources of spills: heavy machinery, light vehicles, emergency electricity generators, paints, coatings and clays (bentonite). Spills of these products or of the liquids in the equipment can impact water quality and the soil.

The following measures will be implemented to avoid spills or minimize the impact of the same, if they occur:

- The contractor's Environmental Coordinator will prepare a Spills Control Plan. This Plan will be prepared following the guidelines of the Code of Federal Regulations, Title 40, Protection of the Environment, Part 112, Oil Pollution Prevention. The same will be filed with the EPA for evaluation. This Plan will have a section where the Operation Centers will be discussed, together with the factors specific to each one. Each Operation Center will have a copy of the Plan. A section on the handling of chemical products will be included.
- Prior to the commencement of the project, the Coordinator will meet with the employees (including subcontractors) to discuss the handling of oils and chemicals, and the situations that could cause spills and how to avoid

or minimize the impact of the same. In addition, they will be told how to respond to a spill and who to inform, according to their place of work. The resident engineer in the different operation centers will be responsible for ensuring the implementation of the control measures, in coordination with the Environmental Coordinator.

- The oils and other chemical products needed for the project, which are purchased by the principal contractor, will be stored in the designated warehouse area of the operation centers. Small containers will be stored in metal shelves, bentonite will be stored on wood pallets. Other products in 20 to 55 gallon containers will be stored on wood pallets.
- We will make sure that the assigned employees know the correct functioning and operation of the machinery.

6.14.1. Spills on the Soil

- The contractor's Environmental Coordinator will prepare a Spills Control Plan. This Plan will be prepared following the guidelines of the Code of Federal Regulations, Title 40, Protection of the Environment, Part 112, Oil Pollution Prevention. The same will be filed with the EPA for evaluation. This Plan will have a section where the Operations Centers and the factors specific to each one will be discussed. Each Operation Center will have a copy of the Plan. A section on handling chemical products will be included.
- All the project's vehicles will have a Spill Kit.
- Small spills of oil or other liquids will be cleaned with absorbent material and the contaminated soil will be removed.
- The soil will be placed in containers and identified appropriately. Full RCRA tests will be conducted before disposal in an authorized site.
- No vehicles with leaks will be permitted in the work area, nor will it be permitted to store chemical products out of the operation centers.

6.14.2 Spills in Water

- The contractor's Environmental Coordinator will prepare a Spill Control Plan. This Plan will be prepared following the guidelines of the Code of Federal Regulations, Title 40, Protection of the Environment, Part 112, Oil Pollution Prevention. The same will be filed with the EPA for evaluation. This Plan will have a section where the Operations Centers and the factors specific to each one will be discussed. Each Operations Center will have a copy of the Plan. A section on handling chemical products will

be included.

- A Plan on spills specific to the HDD process using bentonite will be prepared. (See Addendum 6.2, Spill Prevention and Contingency Plan for Drilling Mud Use).
- Oil leaks in water, if they occur, will come from the use of heavy machinery in crossings by open trench through ravines or wetlands. These will be cleaned with absorbent pads and the waste will be collected in containers for disposal.
- No vehicles with fuel or lubricant leaks will be permitted in the work area.

In case of a spill, the Environmental Coordinator will prepare a report that includes the following information:

- Physical and mailing address.
- The installation's telephone numbers.
- Day and time the spill occurred.
- Type of material spilled.
- Estimated amount of spilled material.
- Source of the spill.
- Description of the affected site.
- Cause of the spill.
- Damages caused by the spill.
- Actions taken to mitigate the effects of the spill.
- Indicate whether it was necessary to evacuate personnel or residents.
- Name of persons and/or organizations notified of the spill.

The Coordinator will have the emergency telephone numbers of the concerned agencies and will be responsible for communicating the incident to such agencies. In addition, he will attend to the inspections of these agencies and will see to it that the additional measures recommended by such agencies are implemented.

6.15 Impacts Caused by Hazardous and Non-hazardous Solid Wastes

During the construction works, **non-hazardous** solid wastes, common to this type of project will be generated. These consist mostly of debris of wood, sand, rock, paper, soil, plastic, asphalt, metal, cement and vegetable cover.

The total wastes estimated for this project is greater than 100 cubic yards weekly, approximately. The contractor will pick up and transport these wastes to a nearby landfill approved by the JCA. In addition, there will be waste generated by portable toilets, paints, used oil, etc.

The impact of these wastes will be concentrated mostly in the landfills because there will be an increase in the amount of wastes they will receive during the construction of the project. This impact will be minimized by reusing part of the soil to backfill the trenches and restore the right-of-way and recycling all recyclable material, such as used oil.

Poor handling of hazardous or non-hazardous wastes can contribute to water and soil pollution.

The following measures will be taken to minimize the impacts from waste generation:

6.15.1. Non-hazardous solid wastes

- The material removed during the right-of-way clearing and leveling phase, such as **leftover** soil, rocks and debris, will be placed in hauling trucks and disposed of in places that require fill and are authorized to receive it or in an approved landfill. The trucks will use covers to minimize the emission of fugitive dust.
- The vegetable cover removed during the right-of-way clearing and leveling phase, will be mechanically shredded and reused as wood chips for the control of erosion in slopes, as allowed by Law 70 of September 18, 1992, Puerto Rico Solid Waste Reduction and Recycling Act, as amended and Regulation No. 6825, better known as the Recycling Regulation. The shredding will be carried out with a Morbark top grinder near the site where it is generated, where the resulting material will also be used.
- The material removed during the excavation of the trenches will be stored to be reused during the restoration stage. This includes subsoil and topsoil. It will be stored within the construction right-of-way and all the erosion and sedimentation measures discussed in this Document and those included in the CES Plan to be presented together with the application for the General Consolidated Permit will be taken.
- The erosion and sedimentation control measures discussed in this document and those which are included in the CES Plan that will be filed together with the application for the General Consolidated Permit will be implemented in the soil storage areas.
- The reuse of the soil to backfill the trenches and restore the rights-of-way reduces the project's impact on landfills and fill soil quarries and it maintains the integrity of the soil characteristics in the area.
- In case any surplus soil is left over, the same will be donated to a landfill site or authorized sanitary landfill.
- Wastes generated by the employees will be collected in plastic bags and placed

in containers to be later disposed of in approved landfills.

- A company will be contracted to provide portable toilet services. The same will be responsible for the transportation and disposal of the wastes. In addition it will be responsible for addressing any kind of spill of this kind of waste.

6.15.2. Hazardous Wastes

- The only hazardous chemical products to be used during the construction will be epoxy-based products, oils and lubricants. Inasmuch as possible, this type of waste will be minimized. Used oils and lubricants will be recycled and the epoxy-based products will be used to the maximum and any surplus will be stored for future use.
- Handling of chemical products such as epoxy, paints and other materials will be delegated on experienced personnel. This type of waste will be separated from the other construction wastes.
- Chemical product wastes will be disposed of in conformity with the contents of the Material Safety Data Sheet (MSDS) and applicable regulations. The project's Environmental Coordinator will carry out all the hazardous or toxic waste disposal activities.
- Prior to the disposal of solid wastes presumed to be hazardous but not yet identified, the residues will be analyzed (full RCRA) to identify whether they are hazardous or toxic.

6.15.3. Used waters

The generation of used waters will originate, for the most part, from the hydrostatic tests to verify the pipeline's integrity. In addition, there will be a fraction of sanitary residues generated by the employees.

Although the hydrostatic test water is clean water, an adequate place is required for its disposal. It is estimated that 10 million gallons of water will be needed for the test. Poor management of that amount of water and uncontrolled disposal techniques could result in soil erosion.

Poor handling and disposal of sanitary wastes could impact water quality and pollute the soil.

The following measures will be implemented to minimize the impact of used waters:

6.15.3.1. Hydrostatic tests

After the test is performed, the water will be discharged in discharge point NPDES 001 of the San Juan Thermoelectric Power Plant. There will be coordination with the Federal Environmental Protection Agency (EPA) to obtain the temporary discharge permit. All the sampling and analysis conditions established by the EPA will be complied with.

6.15.3.2. Sanitary residues

Portable toilets will be provided for use by personnel hired during the construction. In this way the inadequate disposal of biological pollutants in the areas near the project will be avoided. The contractor that provides the portable toilets will be responsible for the disposal of the wastes and for providing maintenance of such toilets at least once weekly, in accordance with the applicable regulations of the Department of Labor and Human Resources. In addition, he will be responsible for addressing any spill of this waste. This will be done in coordination with the project's Environmental Coordinator.

6.16. Socioeconomic Impacts

The socioeconomic aspect of the Municipalities where the project will be constructed will be impacted temporarily. The impact is positive for the economy, because the local labor force and the services of local businesses will be used.

In addition, there will be temporary impacts that will cause inconveniences to the citizens. Those impacts are discussed next.

6.16.1. Economy

The project represents a temporary benefit to the local economy. Among the benefits directly related to the project are: increase in taxes paid to the Municipalities due to the construction, increase in employment opportunities and an increase in sales, among others. This increase in local sales will be beneficial to the municipalities because they will receive the recently established tax on purchases.

Puerto Rico has hotels and hostels that will house workers coming from the United States who will be staying for nine months. Together with the inns, the restaurants, gas stations, fast food businesses and convenience stores will benefit from the daily consumption by these and the local workers.

During the construction stage, between 1,000 and 1,200 direct temporary jobs will be created, approximately. Hiring local workers will have a temporary positive impact on the municipal economy. In addition, there will be contracting of local businesses and industries, such as: hauling trucks, sprinkling trucks, heavy equipment, leased cars, trailers, portable toilets, purchases of lumber, gravel and bottled water, among others. In addition, it is estimated that the project will generate some 4,000 to 4,500 indirect jobs.

6.16.2. Community

In Chapter 7, Socioeconomic Study, it was determined that the project's construction will not have a disproportionate environmental impact on any group.

The increase in traffic, noise and fugitive dust are factors that will impact the communities adjacent to the construction. There will also be an impact to other residents who use the public roads and to visitors, but to a lesser degree. It is important to underscore that, by the nature of the project, the impact is short-lived. The project's construction is not stationary. The same will move from one place to another in lineal form, day to day. Residents adjacent to the construction will be notified in advance of the dates construction will be carried out in their area.

The impacts caused by an increase in traffic, fugitive dust and noise cannot be avoided, but the following measures will be implemented to minimize them: free access to communities and residences will be ensured; the work area will be delimited; specialized work areas, such as the operations centers, will be located outside of the quiet zones. In addition, there will be compliance with the measures indicated in sections 6.4.1, 6.11.2 and 6.13 (Fugitive dust, Traffic and Transportation, and Noise, respectively).

The AEE will implement a public information program to educate the community. It will begin prior to the construction and will continue during the same. This will include the use of radio and the local and regional newspapers to disseminate information.

6.16.3. Impacts to public services and facilities

The construction of Vía Verde will cause temporary and minor impacts on the public services of police, firefighters and medical services. This impact will not be significant because, prior to the construction works, there will be coordination with the corresponding Agencies to ensure effective response in case of an emergency.

There will be coordination with state and municipal police to maintain order and control traffic in some areas. Their services will not be necessary in agricultural or barren areas, which represent the majority of the land that will be used.

The Health Centers of each municipality will be identified to transport to them any employee that could suffer an accident. The companies that will be evaluated for the construction of the project must have an impeccable safety record and no major accidents are expected. The existing system has adequate capacity to address any minor accident.

There will be coordination with emergency management agencies, such as the Fire Department, to handle emergencies.

6.16.4. Land Acquisition

One of the most important impacts will be the acquisition of land to establish the project's right-of-way. Although there are no federal or state regulations that establish a clearance distance with respect to buildings, the AEE will establish a 150-foot right-of-way along the length of the alignment for conservation and maintenance purposes. This right-of-way will be known as the maintenance right-of-way and it may be increased or reduced in those areas where there are space limitations or particular situations. It was calculated that within this maintenance right-of-way there were approximately 102 structures or residences.

The AEE will acquire the land by expropriation in the operation right-of-way and, if necessary, will extend the acquisition of land within all the maintenance right-of-way. The latter will be in the minority of cases. In public interest projects, the AEE is empowered by law to expropriate the land needed for a right-of-way. No more land than necessary will be expropriated. The AEE will appraise the properties and the owners will be compensated (fair market value) for the assessed value.

The project's construction will not alter the general use of the land. However, there will be specific limitations in the operation right-of-way. In agricultural areas, the owner will be able to use the area of the operation right-of-way for light agriculture, planting lawn or any other activity that does not interfere with the operation of the pipeline. The construction of buildings or structures and planting of trees or vegetation with deep roots will not be permitted.

6.17 Impacts on flora and fauna

The construction of the Project will necessitate clearing some 100-foot wide sections in forest areas. The greater impact will be during the construction process. In the operational phase there will be no impact in most of the areas, because there is no noise, no impermeabilization of the soil and no discharges of substances such as oil and fuel. At the end of construction, a 50-foot wide operation right-of-way will be maintained. This means that after construction, vegetation will be permitted to exist adjacent to the 50-foot wide operation right-of-way. To reduce the edge effect, the mitigation plan will contemplate the restoration of the remaining 50 feet that were cleared for the construction phase with the species that were present in that section of the forest before the construction and which exist in the contiguous forest.

The indirect impacts on the habitats are mostly related to the clearance of the existing vegetation during the construction. When deforestation occurs an edge effect is created and invading species can colonize the deforested area. Among these there are exotic and native species. These species can eliminate native species by depredation, genetic modification and transmission of diseases. To minimize this impact, part of the right-of-way will be reforested, except for the part corresponding to the 50-foot wide

operation right-of-way, which will remain free of deep-rooted vegetation.

This 50-foot wide strip will be restored naturally with herbaceous and arbustive vegetation between the two forest sub-units. Although this does not comply with the environmental requirements and conditions of all the species that could be affected, because it is not possible to reforest using trees, a natural strip is provided that serves as a connection to several species. On the forest margins or edges, the trees that will be planted as part of the mitigation plan will be the same native species with broad crowns that are found in that type of habitat. This will create a bridge between both sub-units and will provide a connection to those species that inhabit the highest forest stratum.

Vía Verde will require patrolling the 50-foot operation right-of-way, for that reason the AEE proposes that every six months a biologist patrols the right-of-way in forest areas of ecological value that are prone to the edge effect. This biologist will identify the invading species or the conditions affecting those areas and will propose control methods. In addition, these areas could serve as study platforms for universities. In this way the proliferation of undesired species will be controlled and the impact caused by the edge effect and the fragmentation in these areas will be minimized. The loss of habitat will be compensated through a mitigation plan that considers the characteristics and processes intrinsic to the habitat affected by the Project.

By mitigating compensating for the lost habitat area, the AEE proposes to mitigate in areas contiguous to the affected area, whenever possible. In this manner the proportion of perimeter to area of such zone can be maintained stable.

Recognized among the habitats that will be affected are the loss of habitat of the Guabairo (*Caprimulgus noctitherus*), Vahl's boxwood (*Buxus Vahlia*) and of other species. To determine the presence of the habitat of the listed species, studies specific to these species and their habitat were conducted. These studies will be complemented with additional field studies, as was coordinated with the FWS. In addition, the Project contemplates the preparation of a mitigation plan designed to compensate for the loss of habitat of the listed species found (if any) during said study.

As part of the work plan agreed with the FWS, a study will be made to determine the presence of the Coquí Llanero (*Eleutherodactylus juanariveroi*) in the Project's route, near the area of Punta Salinas in Toa Baja. This will provide important information to avoid its impact in case the presence of this species is determined in the area of the Project.

The fauna and flora study conducted for the Project produced a broad inventory of the species present along its route. The results found, with regards to the species observed allow us to specify the type of natural community, what type of habitat and the general conditions existing in the sampling site. The results also included data on the tree cover by type of forest, which allows us to establish an estimate of the maturity of

the forested areas sampled. In addition, the dominant species were included, of flora as well as of fauna, by area sampled. Data such as the abundance or density index of species were not part of the study's design.

With regard to errors in common and scientific names, we must indicate that we used recent published scientific references. Common names vary from region to region and even from town to town.

Other species that could be impacted are bats. There are 13 species of bats in Puerto Rico, divided into 5 families. Of these only 12 have been observed in bat roosts in the municipalities crossed by the Project's route. Although 12 species are found in the municipalities, only four species of bat could be affected by the construction of the project. These species are: *Artibeus jamaicensis* (Common Fruit Bat), *Erophylla sezekorni* (Buffy Flower Bat), *Monophyllus redmani* (Leach's Single Leaf Bat, Puerto Rican Long-tongued Bat) of the Phyllostomidae family and *Eptesicus fuscus* (Big Brown Bat) of the Vespertilionidae family. These four species use the Vega State Forest in the Municipalities of Vega Alta and Vega Baja to roost. In addition, the Common Fruit Bat can be found in Matos cave located on PR-10, in Utuado. These species that could be affected by the project nest in caves, whether warm or cold. Since the project does not contemplate the installation of pipeline in cave areas, these species are at lower risk of losing their roosting areas. The mitigation and compensation plan for the impacts caused by the Project will include the necessary measures for the protection of these species, considering the vegetation that produces fruits for frugivorous species. This plan will be developed in coordination with the DRNA.

The Project does not impact the habitat of the White-crowned Pigeon (*Columba leucocephala*) in the Municipality of Toa Baja, since no type of forest, mogotes or mangroves will be impacted in this municipality. Areas in other municipalities that could be habitat for this species will be impacted. However, such species was not seen during the field studies.

Regarding the impact on trees, an inventory will be conducted in compliance with the Planting, Pruning and Forestation Regulation (Regulation #25) of the Planning Board (JP) and the Department of Natural and Environmental Resources (DRNA), which includes the corresponding mitigation. In the study, 31 species of critical flora were identified, as designated by the DRNA (see Chapter 3). The mitigation and compensation plan for the impacts caused by the Project will include the necessary measures for the protection of these species.

The biological diversity along the project route is documented in the flora and fauna study conducted for it. Biodiversity could be affected more by indirect impacts than by the direct impact. The instantaneous (direct) effect of the Project's construction phase is the removal of species from the space they occupy at present. However, individuals of the same species remain in the adjacent, not-cleared areas. There could be indirect impacts on biodiversity by the secondary effects of fragmentation in the short and

middle terms. That is why it is important to establish the mitigation and management measures (like the previously mentioned ones) to avoid or reduce the edge effect that could promote the colonization of undesired species that have an effect on the native biodiversity.

6.17.1. Protected, threatened or endangered species

According to the consultation with the United States Fish and Wildlife Service (USF&WS), the Project could affect adequate habitat for the species listed in Section 3.2.2.15. During the field work for this study, none of the species was detected, with the exception of the guabairo. The methodology used, which consisted of walks through stretches of different longitudes and the transects to determine the occurrence of species, the forests' basal areas and the tree density by hectare, did not detect the presence of these species listed at the federal level.

The project's alignment crosses through different areas with characteristics and elements similar to the environments where these species inhabit, according to the life zone in which they are. With regard to plants, although the same were not detected, if any of those existed in the project's alignment its impact could be avoided as describe below for plants designated as critical at the state level.

With regard to the Puerto Rican Sharp-shinned Hawk (*Accipiter striatus venator*), the Guaraguaito (*Buteo platypterus brunnesens*), the Puerto Rican Parrot (*Amazona vittata*) and the Guabairo (*Caprimulgus noctitherus*), construction impacts to areas similar to their respective habitats will be avoided, especially during their mating and nesting seasons.

It bears mentioning that the species listed for PR-10 and the Río Abajo area of the Subtropical Wet Forest should not be impacted, because the Project's alignment in that zone crosses through the right-of-way of highway PR-10.

The guabairo will be protected with the implementation of a protocol for its protection and conservation during the construction phase. Also, the impact on the guabairo will be minimized by constructing the project outside of this species' nesting season. On the other hand, the guabairo has limited distribution. Nevertheless, recent studies of this species (Vilella, 2009) have demonstrated that it has a broader distribution than previously reported. That is why the protection of adjacent areas, or areas near where the guabairo exists, constitutes one of the most important measures to increase its distribution and population.

Although the only endangered species (federal designation) found in the study area was the guabairo, several species designated as critical at the state level were found. These are listed in Section 3.2.2.14.

The species of flora designated as critical can be identified with some conspicuous method (printed ribbon marker or "DO NOT CUT" flagging tape) and thus avoid

impacting them. If there is a possibility of impacting these individuals, the same will be transplanted to an adequate place, by personnel qualified for that practice. These species are designated as critical for different reasons: for folkloric importance or for being indicator species of habitats of greater importance.

The species of flora in the wetlands of the north are mostly herbaceous. Cobana Negra (*Sthalia monosperma*) is sometimes found associated with mangroves. The mangroves in the project's alignment are present in the areas of Cucharillas (Guaynabo/Cataño), Río Cocal (Toa Baja/Dorado) and in Peñuelas. However, it wasn't found there. Although this species could be in herbaceous areas adjacent to mangroves, these areas will not be impacted due to the construction method the project will use in these areas.

The white or siliceous sands through which the Project's alignment will cross are already impacted. These were found in the area of Arecibo, west of the sanitary landfill. These areas have been used for the extraction of this material, for cattle grazing and for yard maintenance in some residences. The presence of *Chamaecrista glandulosa* was not detected, although the area was walked through more than once.

With regard to the fauna species, the guabairo (*Caprimulgus noctiterus*) is designated as endangered, and the Puerto Rican Boa (*Epicrates inornatus*) and the White-cheeked Pintail (*Anas bahamensis*), as vulnerable. The white-cheeked pintail was seen flying over the project's alignment in Peñuelas. These prefer lagoons or ponds, which are not under the impact footprint of the Project.

The Puerto Rican boa will be protected by the implementation of a protocol for its protection and conservation during the construction phase. In the case of the Puerto Rican boa, its distribution is very broad and it includes most of the island.

All permanent loss of habitat of the guabairo will be mitigated in a 10:1 ratio, in coordination with the Department of Natural Resources and United States Fish & Wildlife Service. The mitigation will be made in accordance with a plan to those effects that will have the approval of both agencies before its implementation.

Cumulative Impact on the Habitat of the Guabairo

According to NOAA's Environmental Sensitivity Index Map, the guabairo is present in the mountainous zone of Peñuelas, north of PR-2. The study of flora and fauna conducted for the Vía Verde project confirmed the presence of the species in Peñuelas' Tallaboa Saliente ward. The study that was conducted for the construction of Gasoducto del Sur (Southern Gas Pipeline), confirmed the presence in the Encarnación ward. There is also presence of the guabairo in the mountainous area of Ponce, in the Canas ward, which borders Peñuelas' Encarnación ward. In Peñuelas, the guabairo's habitat was impacted in the past by the construction of an industrial landfill, the clearing of part of the construction right-of-way of Gasoducto del Sur and the clearing of areas

for the construction of houses and businesses. In addition, it is under pressure from future developments.

In Ponce the habitat was impacted in the past by the construction of PR-2, the Ponce Correctional Center (Las Cucharas), and the clearing of the right-of-way for the construction of Gasoducto del Sur. In addition, it is also under pressure from future developments. There are two future housing developments, one of them with construction permit from the Municipality of Ponce. In this estate the land is completely segmented by roads.

All these projects have contributed to diminish and fragment the habitat of the species. The survival of the guabairo depends on the presence of forested areas because it nests on the ground and avoids areas with no vegetation. Although according to Vilella and Zwank, 1987, the guabairo also can exist in lands that have suffered some type of impact.

Vía Verde is a future project that will add on to the past, present and future impact of the species, since it will add to the fragmentation and reduction of the same caused by the mentioned projects. However, since there will be no human habitation in the area of the right-of-way, there will be some degree of natural restoration of the same that could foster the presence in its surroundings.

It is important to mention, that far as is known, only the construction of PR-2 by the Highways Authority, and the clearing of part of the right-of-way for Gasoducto del Sur by the AEE, were the only ones that considered the impact on the guabairo's habitat and prepared mitigation plans. The AC (Highways Authority) bought lands with guabairo habitat in another area of Peñuelas, and the AEE promised to transfer \$5 million dollars to the DRNA for the purchase of land with guabairo habitat. The AEE transferred \$1.5 million dollars and the DRNA is in the process of purchasing. The AEE will continue transferring funds as the DRNA supplies yearly reports with the status of the acquisition.

For the Vía Verde project, the AEE will continue to contribute to the purchase of land of high value that are guabairo habitat. These lands will be transferred to the DRNA for perpetual conservation. These lands will be acquired contiguous to the existing habitat of this species, so as to mitigate the fragmentation to said habitat by maintaining the ratio of perimeter to area of the zone. The mitigation will be in situ or in contiguous areas, in a 10:1 ratio, by acquiring land in the north portion of the hills that constitute guabairo habitat.

6.18 Impact on Air Quality

Air quality can be impacted by the modification of the units, whether in regard to the criteria pollutants, dangerous and others included in the Prevention of Significant Deterioration (PSD) program, the fugitive dust and the emission sources that will be

used during the construction phase.

6.18.1. Description of Criteria Pollutants and their Effect on Health and the Environment

The so-called criteria pollutants are those for which limits have been established to protect human health and well-being. There are two categories of health effects as a function of exposure time to the pollutants: acute and chronic. Acute effects affect specific organs immediately, such as those related to breathing and the eyes. Chronic effects are those that will present themselves after a long exposure (years) to the pollutants. Damages to human health vary with the intensity and duration of exposure to the pollutants and with the populations' health level. Specific population groups are more sensitive to pollution than others, such as children, senior citizens and persons with cardiopulmonary and respiratory diseases.

Next, the impacts produced by each pollutant on health and the ecology are summarized:

- **Sulphur dioxide (SO₂)**

Sulphur dioxide belongs to the sulphur oxides family (SO_x). These are colorless gases created by burning sulphur and they tend to dissolve easily in water. The primary source of SO_x is burning fossil fuels, containing sulphur in their composition.

Exposure to SO₂ produces acute or chronic irritation and inflammation of conjunctival and respiratory mucous membranes. SO₂ can be transformed into other products, such as fine sulphate (SO₄) particles and sulphuric acid fog (H₂SO₄). It has been found that under a combination of particles and SO₄, health risk tends to increase with an increase in morbidity and mortality of chronic heart and respiratory patients. In asthmatic individuals it could produce bronchial constriction.

- **Nitrogen dioxide (NO₂)**

Nitrogen dioxide (NO₂), together with suspended particles are responsible for the reddish-brown layer frequently seen over many urban areas. This gas belongs to the nitrogen oxides (NO_x). These are a group of highly reactive gases that contain different amounts of oxygen and nitrogen, like nitric oxide (NO) and nitrogen dioxide.

Nitrogen oxides are formed when a fuel is burned at high temperatures and/or when it contains nitrogen compounds. The principal sources of NO_x are motor vehicles, electric generation plants and other industrial, commercial and residential sources that burn fuel. NO_x can also be formed naturally, by bacterial decomposition of organic nitrates, forest and grassland fires and, to a lesser degree in electric storms.

The progressive increase in exposure to NO₂ can produce olfactory perception

problems, respiratory distress, acute respiratory pain and pulmonary edema.

- **Particulate Matter (PM)**

It forms a complex mixture of solid and liquid materials suspended in the air that can vary significantly in size, shape and composition, depending fundamentally on its origin. The size of the particulate matter varies from 0.005 to 100 microns (10⁻⁶) in aerodynamic diameter, that is, from a few atoms to the thickness of a human hair.

The particles are formed by natural processes like plant pollination and forest fires and by sources like burning fossil fuels to fertilizing agricultural fields. The particles can be directly emitted from the source, as primary particles and they can form secondary particles when some atmospheric gases react, such as: nitrogen oxides, sulphur oxides, ammonia, organic compounds, etc.

Some fifteen years ago their study and environmental regulation were centered on the total suspended particles (TSP), which are smaller than 100 μm in aerodynamic diameter. Subsequently, the attention centered on particles smaller than 10 μm , and until a few years ago, on fine and ultra-fine particles, that is, smaller than 2.5 and 1 μm , respectively. Thus, the so-called PM 10 can be divided, by their size, in coarse, fine and ultra-fine, with the coarse fraction comprised of particles whose aerodynamic diameter is between 2.5 and 10 μm (PM 2.5-10); the fine fraction includes particles with an aerodynamic diameter smaller than 2.5 μm (PM_{2.5}), and, finally, the ultra-fine fraction includes particles smaller than 1 μm .

The smaller the particles, they can penetrate directly inside the lungs with possible toxic effects due to their inherent physical-chemical characteristics. In several studies, conducted in the United States and Europe, it has been found that prolonged exposure to fine particles originating in combustion is an important environmental risk factor in cases of mortality from cardiopulmonary disease and lung cancer.

- **Lead (Pb)**

Lead is a metal that was frequently used to manufacture water pipes, food containers, paints and gasoline. The primary source of air pollution from lead has been the use of leaded fuels in automobiles.

Because lead is not consumed in the combustion process it is emitted as particulate matter. Lead is a toxic pollutant for humans, its difficult removal from the body makes it accumulate in several organs and it may damage the central nervous system. Acute intoxication causes symptoms such as diarrhoea, vomit, colic, convulsions and head aches. Its elimination from the body is possible with medical treatment, although the damage caused principally to the nervous system is not reversible. Children with high levels of lead in their blood exhibit disorders in their social behavior and a limited mental development with irreversible neuro-behavioral effects.

- **Ozone (O₃)**

Ozone is a colorless gas compound, it has the capacity to oxidate materials. Ozone is a secondary pollutant formed through the chemical reaction of nitrogen dioxide (NO₂) and volatile organic compounds (VOC) in sunlight.

Ozone can cause pulmonary inflammation, depression of the immunologic system against pulmonary infections, acute changes in the pulmonary function, structure and metabolism and systemic effects in soft organs like the liver.

6.18.2 Preliminary Estimate of Criteria Pollutant Emissions

The proposed action provides for the change to natural gas in the Cambalache, Palo Seco and San Juan power plants. This change represents a substantial reduction in the emissions of criteria pollutants into the air (those regulated by federal and local regulations). A **preliminary** estimate of emissions was prepared to determine the applicability of a PSD permit and Rule 201 of the Regulation for the Control of Air Pollution (RCCA) of the JCA. For this computation, the estimate of emissions resulting from burning natural gas was based on emission factors AP-42 of the EPA and operation at 100% was presumed. The mission values will be reviewed once the contracts for the design and conversion of the generating units are granted. During this process the manufacturer's emission factors will be obtained, which are more precise.

Acid and fluoride aerosol pollutants are included in these estimates. In addition, an estimate of CO₂e emissions was included. The estimate of the CO₂e emissions is based on the maximum emission potential for each power plant. Below are some tables that contain the preliminary applicability analysis of PSD and Rule 201.

Preliminary PSD Analysis for Palo Seco Units 3 & 4						
Fuel S, % 1.5						
Pollutants	Existing Allowable Emissions (One Unit)* (ton/yr)	Existing Allowable Emissions Units 3 & 4 (ton/yr)	Projected NG Emissions (ton/yr)**	Increment Netting (ton/yr)	PSD Significant Emission Rate (ton/yr)	PSD, Yes or No
PM	979.00	1,958.00	32	-1,925.8	25	No
PM10	118.00	236.00	129	-107.3	15	No
SO ₂	13,554.00	27,108.00	10	-27,097.8	40	No
H ₂ SO ₄	602.80	1,205.60	16	-1,190.0	7	No
Nox	2,417.00	4,834.00	4,740	-94.3	40	No
CO	288.00	576.00	1,422	845.9	100	Yes
VOC	44.00	88.00	93	5.1	40	No
Pb	0.24	0.48	0	-0.5	0.6	No
Fluoride	2.16	4.32	-	-	3	-

*Existing Allowable Emissions as Stated in TV Permit Application

**Emissions Factors from AP-42

Preliminary PSD Analysis for San Juan Units 7, 8, 9, 10 & San Juan Combined Cycle Units 5 & 6									
Pollutants	SJ 7, 8, 9, & 10		SJCC5 & 6		Total Emissions NG Conversion (ton/yr)	PSD Significant Emission Rate (ton/yr)	Existing Allowable Emissions***	Increment Netting	PSD Applicability
	Natural Gas Emission Factors* (lb/10 ⁶ scf)	Emissions NG Conversion (ton/yr)	Natural Gas Emission Factors (lb/10 ⁶ scf)	Emissions NG Conversion (ton/yr)					
PM	1.90	32.87	1.94	28.19	61.07	25	2,946.22	-2,885.15	No
PM ₁₀	7.60	131.49	6.73	97.94	229.43	15	1,430.51	-1,201.08	No
SO ₂ **	0.60	10.38	3.47	50.45	60.84	40	7,619.76	-7,558.92	No
H ₂ SO ₄	0.92	15.90	5.31	77.26	93.15	7	1,592.26	-1,499.11	No
NOx	280.00	4,844.52	326.40	4,748.62	9,593.14	40	6,739.20	2,853.94	Yes
CO	84.00	1,453.36	83.64	1,216.83	2,670.19	100	1,654.73	1,015.46	Yes
VOC	5.50	95.16	2.14	31.16	126.32	40	190.70	-64.38	No
Pb	n/a	n/a	n/a	n/a	n/a	0.6	3.54	-	-
Fluoride	No info	No info	No info	No info	No info	3	-	-	-

*Emission Factors from AP-42

**AP-42 Table 3.1-2a

*** Existing Allowable Emissions Stated in TV Permit

Preliminary PSD Analysis Cambalache 1, 2 & 3						
Pollutants	Emission Factors (lb/10 ⁶ scf)*	Emissions NG Conversion (ton/yr)	PSD Significant Emission Rate (ton/yr)	Baseline Actual Emissions (ton/yr)	Increment Netting	PSD Applicability
Cambalache 1,2 & 3						
PM	1.94	21.15	25	113.90	-92.76	No
PM ₁₀	6.73	73.46	15	290.45	-216.99	No
SO ₂	3.47	37.84	40	780.23	-742.39	No
H ₂ SO ₄	5.31	57.94	7	182.24	-124.30	No
NOx	326.40	3561.47	40	120.28	3,441.18	Yes
CO	83.64	912.63	100	207.75	704.87	Yes
VOC	2.14	23.37	40	71.80	-48.43	No

Pb	n/a	n/a	0.6	0.12		n/a
Fluoride	No info	No info	3	-		No info

*Emission Factors from AP-42

When the increments are greater than the PSD values, the proposed action could have a significant impact on air quality. These are:

Pollutant	Rate of Emission (tpa)
Carbon monoxide	100
Nitrogen oxides	40
Sulphur dioxide	40
Particulate Matter	25
Ozone	40 (of volatile organic compounds)
Lead	0.6
PM10	15

The analysis and measures needed to minimize this possible impact will be determined under the PSD regulation and the Puerto Rico Air Pollution Control Regulation, of the Environmental Quality Board (JCA). These regulations will require the significant impact analysis by mathematic modeling of atmospheric dispersion, applying the regulatory provisions for new emission sources (New Source Performance Standard), emission control measures, visibility analysis and environmental justice. The regulatory provisions determined under these regulations will become federally enforceable conditions under the Title V federal and state permit system.

The **preliminary** emission estimates indicate that there can be applicability for Rule 201 of the RCCA (Location Approval) and PSD due to the pollution emissions of NO_x and CO in the San Juan and Cambalache power stations and of CO in Palo Seco power plant. The formal exercise of applicability or no applicability of this regulation will be performed once the formal permit application process begins. This will be done when the Environmental Compliance Certification is obtained (Article 4B3 of the Environmental Public Policy Act).

The required emission control measures will be implemented according to the determinations of the applicability or no applicability analysis for Rule 201 of the RCCA (Location Approval), as well as for PSD. Each power plant will be evaluated individually

to determine if control equipment is necessary and what will be the control required in accordance with the Best Available Control Technology (BACT).

- **PM₁₀ Maintenance Area in Guaynabo**

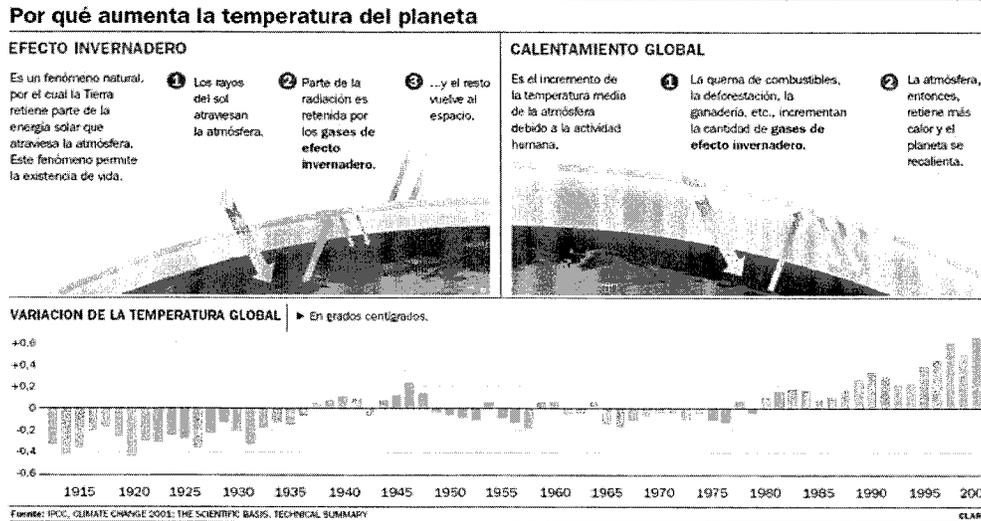
The RCCA was amended recently to re-designate the Guaynabo PM₁₀ No Achievement Area, as a Maintenance Area through a 24-Hour National Environmental Air Quality Maintenance Standard for particulate matter (PM₁₀) for the Municipality of Guaynabo. According to the preliminary calculations, the conversion of the Palo Seco and San Juan generating units will have the effect of reducing the PM₁₀ emissions in the Guaynabo Area by about 85%. This because the almost insignificant sulphur content of natural gas, which is a precursor of the PM₁₀ pollutant.

- **Carbon dioxide**

It is important to highlight that, although the preliminary estimate indicates that Rule 201 and the PSD could apply, there is a significant reduction in the criteria pollutant emissions. In addition, Via Verde will result in a significative reduction (between 29% and 59%) in carbon dioxide (CO₂) emissions.

Carbon Dioxide Equivalent (CO₂e)				
Power Plant	Fuel Oil (Tons/yr)	Natural Gas (Tons/yr)	Diference (Tons/yr)	Reduction %
Palo Seco	2868,150.7	2022,146.4	846,004.3	29%
San Juan	4281,122.4	1738,194.4	2542,928.0	59%
Cambalache	1857,413.0	1303,468.8	553,944.2	30%

This gas is a product of combustion that has the capacity to retaining the heat the sun radiates on the planet. It is postulated that human activity causes an increase in the concentration of carbon dioxide in the atmosphere, which in turn results in an increase in global temperature. This phenomenon is denominated global warming. Global warming can have negative environmental impacts, such as droughts, wildfires, more intense storms, heat waves, glacier melting, considerable increase in sea levels, changes in ecosystems, coral bleaching, costal erosion and air quality deterioration, among others.



Throughout the world efforts are directed at controlling emissions of carbon dioxide. In fact several legislative projects were presented in Puerto Rico for the control of global warming, some of which are now law. However some of these laws became dead letter, due to the impossibility of enforcement.

Vía Verde provides a tool to assert the legislative intent regarding Puerto Rico's contributions to the control of global warming and anticipates federal environmental laws and regulations in the process of publication, by diminishing emissions of this gas.

- **Hazardous Pollutants**

The estimate of hazardous pollutant emissions for each power plant is included in the following table:

**Future Potential HAP's Emissions
100% Natural Gas / 0% Fuel Oil Scenario**

Pollutants	Emissions From Units 3 and 4 Palo Seco Power Plant	Emissions From Units 7, 8, 9 and 10 San Juan Power Plant	Pollutants	Emissions From Units 1, 2, & 3 Cambalache Power Plant	Emissions From Units 5 and 6 San Juan Power Plant
1,1,1-Trichloroethane	-	-	1,3-Butadiene	0.00	0.01
1,4-Dichlorobenzene	0.02	0.02	Acetaldehyde	0.45	0.59
Acenaphthene	0.00	0.00	Acrolein	0.07	0.09
Acenaphthylene	0.00	0.00	Benzene	0.13	0.18
Anthracene	0.00	0.00	Ethylbenzene	0.36	0.47
Benzo(a)anthracene	0.00	0.00	Formaldehyde	7.90	10.54
Benzene	0.04	0.04	Naphthalene	0.01	0.02
Benzob(k)fluoranthene	0.00	0.00	PAH	0.02	0.03
Benzof(e)pyrene	0.00	0.00	Propylene Oxide	0.32	0.43
Benzof(g,h,i)perylene	0.00	0.00	Toluene	1.45	1.93
Dibenzo(a,h)anthracene	0.00	0.00	Xylenes	0.71	0.95
Ethylbenzene	0.00	0.00	Arsenic	0.00	0.00
Fluoranthene	0.00	0.00	Beryllium	0.00	0.00
Fluorene	0.00	0.00	Cadmium	0.00	0.00
Formaldehyde ¹⁰	1.27	1.30	Chromium	0.00	0.00
Indeno(1,2,3-cd)pyrene	0.00	0.00	Lead	0.00	0.00
Naphthalene/PAHs	0.01	0.01	Manganese	0.00	0.00
n-Hexane	30.47	31.14	Mercury	0.00	0.00
Phenanthrene	0.00	0.00	Nickel	0.00	0.00
Pyrene	0.00	0.00	Selenium	0.00	0.00
Toluene	0.06	0.06	-	-	-
Xylene	0.00	0.00	-	-	-
Arsenic	0.00	0.00	-	-	-
Antimony	0.00	0.00	-	-	-
Beryllium	0.00	0.00	-	-	-
Cadmium	0.02	0.02	-	-	-
Chromium	0.02	0.02	-	-	-
Chromium VI	0.00	0.00	-	-	-
Cobalt	0.00	0.00	-	-	-
Lead	0.00	0.00	-	-	-
Manganese	0.01	0.01	-	-	-
Mercury	0.00	0.00	-	-	-
Nickel	0.04	0.04	-	-	-
Phosphorous	0.00	0.00	-	-	-
Selenium	0.00	0.00	-	-	-
Organic Total	31.88	32.57	Organic Total	11.43	15.25
Metallic Total	0.09	0.10	Metallic Total	0.00	0.00
Total HAPs	31.96	32.66	Total HAPs	11.43	15.25

The estimate is based on the maximum emission potential for each power plant. The federal regulation establishes that, an emission source is a major one, in hazardous pollutant emissions, if it has the capacity to emit 10 tons/yr of an individual pollutant or 25 tons/yr in the combination of said pollutants (CAPs). Depending on the emission source, combustion turbines or steam boilers, the corresponding NESHAP (National Emission Standard for Hazardous Air Pollutants) emission standard will be applied, as required by regulation.

For combustion turbines (Cambalache Power Station and Combined Cycle Turbines units 5 and 6 of San Juan Power Station), applies NESHAP for Construction Turbines 40 CFR Part 63, Sub-part YYYY of March 4, 2004, which establishes a limit of emission for the pollutant formaldehyde.

As for the boilers of the San Juan and Palo Seco Power Plants, at present the Environmental Protection Agency is collecting information to establish some emission standards for this type of source by March, 2011 (Air Toxics Standards for Utilities - Utility NESHAP).

Regarding the cumulative affects on air quality due to the operation of the units in the power plants that will use natural gas, the present permits system the Power Plants now have considers each one as a sole Emission Source. Therefore, the cumulative effects are contemplated in the permits in affect, and also in the permits that will be obtained for the changes related to the use of natural gas. The processing of the

corresponding permits will consider the applicability of NSPS, NSR regulations and the Puerto Rico Air Pollution Control Regulation, for the totality of emissions in each one of the power plants individually.

It is important to highlight that the cumulative impact from pollutant emissions will be positive because there will be a reduction of up to 64% in criteria pollutants (over 129,000,000 pounds annually) and up to 30% in carbon dioxide.

- **How the proposed action is in harmony or conflicts with the specific terms and goals of the plans in effect regarding the use of land, applicable public policies and controls of the area to be affected**

The public policy applicable to the activity under study is the following:

- Constitution of Puerto Rico
- Goals and public policy of the Puerto Rico Land Use Plan (JP 1995)
- Law 111 of 1985 (For the Protection of Caves, Caverns and Sinkholes)
- Law 292 of 1999 (For the Protection of the Karst Physiography of Puerto Rico)

We discuss next the concurrence of the proposed action with the applicable public policy:

6.19.1. Constitution of Puerto Rico

The Constitution of Puerto Rico provides in Article VI, Section 19 that: "The public policy of the Commonwealth of Puerto Rico will be the most effective conservation of its natural resources, as well as the greater development and use of the same for the general benefit of the community."

It is clear that this is balancing language between the protection of natural resource and their social and economic use. It's about no part of the relationship becoming exclusive of the other, but rather integrate in the most harmonious way possible; in other words, not to underutilize or overuse the country's natural resources. As discussed in this DIA-P, the proposed action pursues a balance between conservation and environmental protection, as well as the social and economic use of the natural resources. The construction of the proposed action will only impact temporarily a minimal portion of the country's physiography. Such impact will be temporary, because after the project is constructed, the strip of ground will reforest in a natural and assisted form, so there will be no net loss of wildlife habitat. At the end of several years the environmental impact will be nil and negligible when compared with the social and economic benefits such an important infrastructure will bring.

6.19.2. Goals and Public Policy Of Land Use in Puerto Rico

The document Goals and Public Policy of the Land Use Plan establishes among its general goals the following: "To direct the planning process towards the achievement of an integral, sustainable development ensuring the judicious use of the land resource and fostering the conservation of our natural resources for the enjoyment and benefit of present and future generations."

An integral, sustainable development is the balance between economic development and the conservation of natural resources with the goal of achieving a better quality of life. As discussed in this DIA-P, the proposed action is an economic activity that does not compromise the island's natural resources permanently. In this DIA we discuss in quantitative form the temporary impact that will happen in the areas under study. It is clear that such impact will be a temporary one and that the benefits of the action in the short, medium and long term will be essential to favor Puerto Rico's economic situation.

In addition, the project is not incompatible with the municipal land use plans. In fact, said project is contemplated in the Municipality of Arecibo's Land Use Plan.

6.19.3. Law 111 of 1985 (For the Protection of Caves, Caverns and Sinkholes)

Law 111 was adopted with the purpose of protecting the caves, caverns and sinkholes. As discussed in the DIA-P, in the region under study enclosures of caverns and sinkholes were identified, so this law applies. To prevent any effect on these systems, the AEE will carry out a series of studies on the nature of such systems to identify potential effects of the extraction activity and the possible use of explosives. Through the study of potential effects of extraction, we will determine the distances the construction must keep so as to not affect the physical stability of caves and sinkholes. Therefore we conclude that it is possible to carry out the construction without undermining the goal of conservation of the caverns and sinkholes.

6.19.4. Law 292 of 1999 (For the Protection of the Karst Physiography of Puerto Rico)

Law 292 broadened the intent of Law 111 to other physiographic conditions found in the Karst zone. In its main statement it establishes the following: "To protect, conserve and prohibit the destruction of the Karst physiography, its natural formations and natural materials, such as fauna, flora, soils, rocks and minerals; to prevent the transportation and sale of natural materials **without the corresponding permit...**" (emphasis provided).

Notice that the law establishes the condition of a permit in order to carry out activities in the Karst zone. Although the DRNA has not developed a system of special permits for this zone, through the earth crust permits carrying out activities in is authorized. In the case at hand, the proponent will handle the permit to extract earth crust for the installation of the proposed infrastructure. Through this permit the DRNA will authorize

the action in an orderly fashion in this important zone. To achieve this, the proponent will avoid, minimize and compensate the potential impacts, as discussed in this DIA-P.

6.20. Change of land use through zoning

The proposed action does not contemplate prohibiting changes in land use through zoning. The action proposes that there are no changes in the use of land in the area it occupies; that is to say, the action seeks that the agricultural uses as well as the undeveloped areas covered with arborescent vegetation and wetlands remain that way, because in that way human populations are kept away from the alignment. Only one restriction will be established through the constitution of an operation right-of-way in favor of the AEE, in which the planting of deep-rooted trees or the construction of any structures will not be permitted.

6.21. Justification of the proposed use of resources

At present, the land proposed to construct the action are used mostly for agriculture and areas free of anthropogenic developments. A portion of the land sustains vegetation and wildlife. However, a significant portion of the premises have been recently modified in their topography and vegetable cover (for example, the highways rights-of-way). All these zones have varied functional values as wildlife habitats.

No significant economic use will be modified as part of the proposed action. The agricultural uses will return back to normal once the proposed infrastructure is installed. Likewise will happen with the wildlife, once the right-of-way is restored. In the short term, the action on the green zones will mean the temporary loss in both cases. The reforestation of the zones that remain inactive will contribute to reduce the impact on flora and fauna in the premises.

In the short, medium and long terms, the proposed action will have a positive impact on the economy of the regions where it is proposed (investment in construction) and of the island in general.

6.22. Justification of resource commitment

The irreversible commitments of the proposed action will be the temporary modification of floor space and the consumption of non-renewable resources such as fuel for the construction equipment. The impacts regarding water consumption and the occupation of a space of habitat for wildlife are considered temporary and renewable. However, the environmental and natural benefits derived from the action include the improvement of wetlands and wildlife habitats through the mitigation plans, the protection of air quality due to the significant reduction (more than 50%) in emanations in the AEE's power plants and the reduction and stabilization of the cost of electricity in Puerto Rico.

6.23. Environmental monitoring program

As part of the efforts to avoid or minimize the impacts of the construction, the project will have an Environmental Coordinator that will be in charge of the project's environmental impact matters. Among his functions will be:

- Offering talks to employees about the project's environmental impact and how they can help minimize it.
- Supervising and ensuring compliance with all the protection measures required in the permits, certificates, or other authorization documents.
- Coordinate responses to environmental incidents.
- Document incidents and corrective actions and attend to visits from regulatory agencies.

INTRODUCTION

PREPA's Strategic Plan and the Government's Energy Reform are geared to reduce the cost of electricity for end users in Puerto Rico. A number of factors contribute to the high cost of electricity in Puerto Rico. These factors are as follows:

1. The current heavy reliance on oil-derived fuels for the generation of electricity is a major factor in the high cost of electricity.
 - Most of PREPA's electricity requirements are provided using residual fuel in its steam plants.
2. PREPA is an isolated system without interconnections and must maintain greater generating capacity reserve margins to maintain its system reliability than otherwise would be necessary, with the corresponding higher capital, operating and maintenance costs.
3. Most of PREPA's generating capacity is located on the Southern part of the island and many of these units are among PREPA's oldest, least efficient, units with high operating costs and emissions.

PREPA's total generating capacity is 5,840 MW. It self generates approximately 70% of its electrical capacity and purchases the remainder from two co-generators. The Vía Verde project will be an energy complex with two primary components: (i) a 92 miles pipeline to transport the natural gas from Peñuelas to the PREPA's generating plants at Arecibo (Cambalache), Toa Baja (Palo Seco), and San Juan (San Juan) located in the north coast of the island and (ii) the conversion of the existing boilers to a co-firing combustion system at these locations. The project will provide generation capacity to the grid Puerto Rico Electric Power Authority by 2012, and will be an important component of the Puerto Rico's gas infrastructure. As a separate project, Via Verde could also provide natural gas to facilitate the conversion of the 820-MW South Coast Power Plant, which is currently burning liquid fuel (bunker-C).

Environmental Benefits

The project was designed to comply with the Puerto Rico's environmental controls and regulations, especially on air emissions, ambient air quality, wastewater effluent, ambient water quality, and noise. Given the management measures, monitoring by the best available technology, and commitments for the project, including the environmental regulations set by the Environmental Quality Board, the project's impacts on the environment will be manageable. The project will ensure that it meets the Environmental Protection Agency's standards and regulations. This project is indispensable to reduce the air pollution resulting from the use of fuel oil #6 in Puerto Rico.

In view of the move towards cleaner energy sources and the need to diversify the Puerto Rico's energy supply mix, natural gas was considered for the project. Natural Gas meets environmental regulations through the use of proven state-of-the-art low emissions and environmental control technologies. LNG was a superior alternative since it is the cleanest burning fuel, with least emissions per kilowatt-hour of electricity

generated; it is odorless, nontoxic, and has very low level contaminant levels; it requires no environmental cleanup for spills; and there are no procurement problems.

Vía Verde Description:

The Puerto Rico Power Electric Authority (PREPA) proposes the construction of a carbon steel pipeline with the following Specifications:

- API 5L, grade X70,
- Schedule from 0.375 to 0.500 inches, depending in its classification,
- Twenty Four (24) inches in diameter,
- Fusion Bonded Epoxy of, at least, 14 Mils for corrosion protection,
- Cathodic Protection by impressed current for an additional corrosion protection,
- Meets the standards and regulations set for by entities such as: DOT 40 CFR 192, ASME B31.8, ASTM, ANSI, NACE, NFPA, API, OSHA, and the Puerto Rico Public Service Commission,

The transmission pipeline will be used for transferring natural gas from EcoEléctrica, in Peñuelas where the Liquefied Natural Gas storage tank is located, to PREPA's generating plants at Arecibo (Cambalache), Toa Baja (Palo Seco), and San Juan (San Juan). The pipeline will be underground and it will be approximately 92 miles long. The pipeline will require a Maintenance Right of Way (ROW) of 150 feet wide. Out of these 150 feet, the construction process will only impact 100 feet. After construction is finished, 50 out of the 100 feet will be restored to its original state, and only 50 feet will remain as a permanent operational ROW, which will be kept free of deeply rooted vegetation. Total Impacted Area: 1,107.4 acres, approximately, and an additional 32 acres for special situations such as water body crossings. The pipeline will go across 13 municipalities and 48 wards. The municipalities are: Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón, and Guaynabo. The estimated cost of the project is approximately \$447 millions (design, material acquisition, shipping and delivery, construction, state and local rights and taxes, land acquisition, field studies, environmental documents and permits). An additional \$50 to \$70 million will be required for the conversion of generating units for the use of natural gas. The direct temporary employments are estimated to be between 1,000 y 1,200 and the indirect temporary employments between 4,000 to 4,500.

PREPA has submitted the Preliminary Environmental Impact Statement (P-EIS) to the Environmental Quality Board (EQB) for review and Public Hearings and will adopt any comments or recommendations that are legally binding.

ALTERNATIVES ANALYSIS

Background

Section 404(b)(1) of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States unless the proposed discharge is the least environmentally damaging practicable alternative capable of achieving the project purpose. Alternative routes for the pipeline and to the pipeline were evaluated pursuant to 40 CFR 230.10. The National Environmental Policy Act (NEPA) and implementing regulations at 40 CFR 1502.14, together with the Commonwealth Policy Act, require a range of reasonable alternatives including the no action alternative be evaluated. Under these laws and regulations, the no action alternative and action alternatives that meet the project purpose and need of the preferred alternative are considered to be reasonable alternatives. Under the aforementioned laws, these alternatives do not need to be available to the applicant. Though the Corps will evaluate these alternatives, the alternatives selected should be available to the applicant at the time of the permit decision.

The Government of Puerto Rico's 1993 Energy Policy acknowledged the island's high dependency on oil, which at the time was 99%, and the high environmental cost this caused. The policy directs the Puerto Rico Electric Power Authority (PREPA) diversification of fuel sources for power generation to reduce the volatility of oil prices and overall power generation costs and to introduce environmental criteria for the selection of new power plants. Following is a detailed discussion of alternatives to the proposed Via Verde project that meet the project purpose and need. Each alternative discussed addresses logistics, technology, cost and environmental consequences and is followed by a statement indicating whether or not we consider the alternative to be practicable. Among alternatives considered were: the construction of a natural gas import terminal on the north coast of the island, three tanker and buoys systems (Deepwater Port) for receipt of natural gas at Palo Seco, San Juan and Cambalache plants, and several terrestrial alignments for a natural gas pipeline system. The alternative of no action was also analyzed.

EVALUATION CRITERIA

To evaluate the data on each of the alternatives discussed, a set of criteria was defined and rated. Also, weight was given to each criterion according to its importance. Each alternative will be discussed separately and at the end, a table will be presented where the criteria is applied and the rating is multiplied by the weight to obtain a numerical value for each alternative. The alternative with the highest value is deemed the best alternative for construction.

Criteria used for site evaluation

Criterion number	Criterion	Consideration
1	Land Use	Avoid land targeted for high density developments. Favorable land uses considered to be public, commercial, agricultural, industrial
2	Bodies of water	Reduce number, complexity and width of crossings
3	Forests and nature reserves	Avoid or minimized to the maximum extent possible impact to known sites
4	Endangered species	Avoid or minimize to the maximum extent possible impact to the species and their habitat
5	Architectural and Archaeological findings	Avoid or minimized to the maximum extent possible impact to known sites
6	Road crossings	Reduce number of road crossings
7	Zoning	Favorable zoning designations: non residential, public, industrial, agricultural, commercial and non-zoned.
8	Topography	Seek route with smallest number of abrupt topographic changes
9	Community	Maximize safety to residents, avoid or minimize number of dwellings directly impacted by the project (expropriation)
10	Pipeline length	Reduce pipeline length to minimize impacts. Place pipeline parallel to or along existing linear disturbances (ROW's)
11	Impacts to jurisdictional areas	Avoid or minimized to the maximum extent possible, impact to jurisdictional areas
12	Pipeline security	Ideally the pipeline is located on private property where public access is limited. The pipeline is ideally suited to rural land uses unlikely to be targeted for high density

Criterion number	Criterion	Consideration
		uses.
13	Impact on transportation or traffic	Avoid or minimize to the maximum extent possible, impact to transportation and terrestrial or maritime traffic
14	Water Quality	Avoid or minimize to the maximum extent possible, impact to water quality, especially permanent effects
15	Aquatic resources	Avoid or minimize to the maximum extent possible, impact to aquatic resources
16	Cost	Develop project that is within the company's financial possibilities
17	Noise impact to communities and species	Minimize noise impact during construction and operation
18	Essential fish habitat	Avoid or minimize impact to this resource
19	Corals	Avoid or minimize impact to this resource
20	Ease of access	The location needs to provide safe access for routine maintenance and integrity monitoring.
21	Exclusion zone	Project location must comply with regulatory requirements on exclusion zones. A special exclusion zone could also be defined by the owner to avoid impact to certain resources.

Rating assigned to each criterion

Criterion number	Criterion	Comment	Condition	Rating
1	Land Use	Per cent of the project in land favorable to construction	0-10	5
			11-100	10
2	Bodies of water	Number of points where the project intercepts a body of water	0-25 crossings	10
			25-100	5
3	Forests and nature reserves	Per cent of the project in forest and nature reserves	0-10	10
			11-20	5

Criterion number	Criterion	Comment	Condition	Rating
4	Endangered species	Per cent of project in areas where these species are found	0-5	10
			5-10	5
5	Architectural and Archaeological findings	Number of sites impacted by the project	0-5	10
			5-10	5
6	Road crossings	Number of crossings	0-40	10
			41-100	5
7	Zoning	Per cent of the project in favorable zoning	0-20	5
			21-100	10
8	Topography	Number of abrupt topographic changes	0-60	10
			60-100	5
9	Community	Number of residences impacted by expropriation	0-15	10
			16-100	5
10	Pipeline length	Covers less miles from point A to point B	Less than 50 miles	10
			More than 50 miles	5
11	Impacts to jurisdictional areas	Percentage of project in jurisdictional areas	0-20	10
			21-50	5
12	Pipeline security	Percentage of auxiliary equipment exposed and accessible to public	0-5	10
			6-10	5
13	Impact on transportation or traffic	Has potential to affect land or marine traffic	Minimum or no impact	10
			Significant	5
14	Water Quality	Turbidity Sedimentation	Permanent	5
			Temporary	10
15	Aquatic resources	General impact to species	Permanent	5
			Temporary	10
16	Cost	Cost efficient	Less than 1 billion	10
			Greater than 1 billion	5
17	Noise impact to communities and species	Produces noise during construction or operation that impacts quality of life or harasses species	Yes	5
			No	10
18	Essential fish habitat	Per cent of the project in	Less or equal to 5	10

Criterion number	Criterion	Comment	Condition	Rating
		designated areas	Greater than 5	5
19	Corals	Per cent of the project in designated areas	Less or equal to 5	10
			Greater than 5	5
20	Ease of access	Safe access for maintenance and inspections	Yes	10
			No	5
21	Exclusion zone	Project location complies with regulatory requirements on exclusion zones	Yes	10
			No	5

Weight assigned to each criterion

1. Important

2. Mid importance

3. More important

Criterion number	Criterion	Weight
1	Land Use	3
2	Bodies of water	2
3	Forests and nature reserves	2
4	Endangered species	3
5	Architectural and Archaeological findings	2
6	Road crossings	2
7	Zoning	3
8	Topography	2
9	Community	3
10	Pipeline length	2
11	Impacts to jurisdictional areas	3
12	Pipeline security	3
13	Impacts on transportation or traffic	3
14	Water quality	3
15	Aquatic resources	3
16	Cost	3
17	Noise impact on communities an species	2
18	Essential fish habitat	2
19	Corals	2
20	Ease of access	2

Criterion number	Criterion	Weight
21	Exclusion zone	3

DESCRIPTION OF ALTERNATIVES CONSIDERED

No Action

The alternative of no action, although considered, was found not feasible given the transcendence, importance; and public welfare pursued by the project.

Preliminary environmental impacts and direct/indirect impacts associated with construction of a natural gas pipeline are considered. If the project is not built the following impacts would be avoided:

- Impacts from moving earth that could result in erosion and sedimentation in bodies of water
- Temporary increases in noise levels
- Impacts to forest reserves
- Temporary impacts to wetlands and other bodies of surface water
- Impacts to farmland
- Temporary impacts to infrastructure such as waterlines, buildings and (possible) phone lines
- Temporary impacts to traffic and roads, i.e. detours
- Potential impacts to archaeological sites
- Acquisition of land by expropriation

However, if the project is built most of these impacts, if not avoided completely, could be minimized and mitigated using engineering design options and support from agencies and municipalities the project would cross through.

No action is not indicative of no impact, since with this alternative PREPA will be forced to continue to produce electricity by burning petroleum products that generate greater amount of pollutants emitted to the air. While some of these emissions can be controlled by using technology that requires, in many cases, an investment of millions of dollars, modern emission reduction highlights that the emissions of these derivatives of petroleum would be greater if related to the burning of natural gas. In addition, maintenance of petroleum burning units has to take place more frequently and with higher costs to guarantee

optimal operation. Continuing to burn petroleum derivatives has other implications, such as an increased frequency of deliveries of these fuels to our ports which increases erosion of the seabed and the likelihood of spills. The continued use of fuels derived from petroleum increases the cost of electricity, which negatively impacts the Puerto Rican economy and results in a lower quality of life for its citizens. Finally, liquid fuels expose PREPA to fluctuations in the market value creating instability in the costs of energy production and invoices. Recognizing that the Puerto Rico economy is directly linked to PREPA's stability, it is important for the company to meet its strategic development plans and maintain a fixed cost structure to avoid sudden peaks of variations in the cost of purchased fuel. Compliance with this plan demonstrates vision, stability and commitment to customers, the ability to assess complex situations of world character and the ability to develop strategies to minimize adverse impacts making it easier to expand options to obtain fuels in the future.

After evaluating local and global dynamics, PREPA developed a strategic plan to guide future development of the company and Puerto Rico. This plan includes the following parameters:

- Diversification of energy sources
- Reduction in costs
- Geographic diversification of generating electricity
- Environmental considerations
- Expansion of electrical generation
- Diversification of revenue

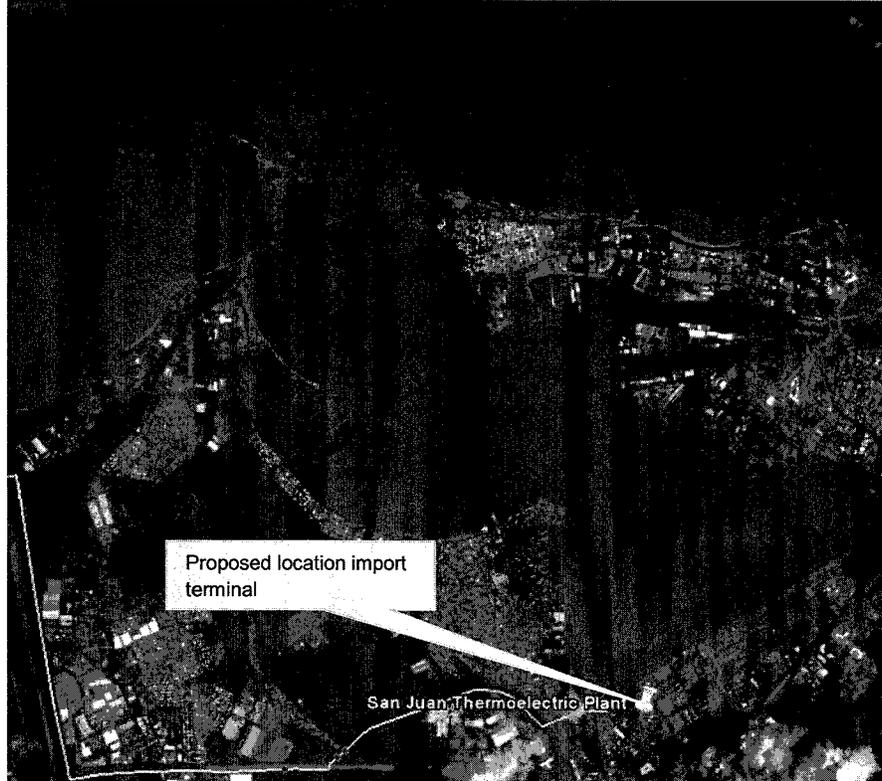
The Via Verde project is part of the plan to diversify fuels which can make PREPA better. In addition, there are important environmental considerations to help AEE to more effectively manage their energy costs. A significant percent of Puerto Rico's generated electrical power depends on oil. At the moment, AEE uses only No. 2 fuel (light distillate) and No. 6 (bunker C) its generator units and it buys electricity, in turn, from the AES co-generators in the municipality of Guayama (coal) and EcoElectrica in the municipality of Penuelas (natural gas). With the introduction of the co-generators AEE began to buy electricity generated from NG or coal but internally AEE still depends exclusively on oil.

PREPA aims to reduce its dependence on the use of oil, which currently is approximately 68%, to approximately 12% by 2014. To do this PREPA must identify alternative fuels that can meet their customers demand for power. Lack of action would only aggravate the current dependence on oil, and at a time of seizure or high global demand, Puerto Rico would have no viable alternatives to generate electricity. In addition, no action exposes PREPA to sudden changes in the cost of oil which reduces the economic capacity of PREPA and, consequently, the Puerto Rican economy. It is important to highlight that PREPA is limited by regulations to the type of fuel it can burn. The greatest limitation is the amount of sulfur contained in fuel. Low sulfur fuel is more expensive than fuel with higher sulfur content. If there are shortages in this type of fuel, or if PREPA cannot set contracts with the suppliers, there are only two options left: reduce the production of electricity, which is not feasible, or burn a cheaper fuel with higher sulfur content in violation of established environmental permits, with subsequent exposure to fines and sanctions from regulatory agencies. The use of natural gas significantly decreases emissions of pollutants to the environment. No action means PREPA must expend significant capital to reduce emissions that result from burning oil and to maintain their units, instead of using that capital to develop a more efficient system that uses cleaner fuel with lower maintenance costs.

The No Action Alternative would not meet the project purpose and will not be considered further.

Construction of a Liquefied Natural Gas Import Terminal

Currently Puerto Rico has the EcoElectrica Cogeneradora in the municipality of Peñuelas, to receive LNG (and meet PREPA's needs). Still, the alternative of building a new terminal closer to PREPA's power facilities was evaluated in consideration of environmental impacts potentially associated with the construction of a delivery pipeline from the EcoElectrica terminal. A location between the three power plants on the northern coast selected to convert to Natural Gas (NG) was identified next to the Central Thermoelectric San Juan (CTSJ) unit. Currently, an existing pier has infrastructure to transport diesel and Bunker C Fuel to two of the three plants, San Juan and Palo Seco.



A new LNG import terminal must be able to receive, download, and store up to 3.0 Bcf/d (3 trillion cubic feet) of liquid natural gas imported by sea. In addition, facilities to gasify and handle the natural gas would also need to be built. The construction of the terminal would result in an environmental impact associated with the different stages of the construction and operation, which include:

- Build, repair, or expand (depending on the case), a pier for receipt of liquid natural gas.
- Increase in the transit of ships.
- Construction of a tank for liquid natural gas storage and gasification - this plant would require an area of approximately 25 acres.
- Constructing navigation channels to support transit tankers, which would mean dredging and disposing dredged material.

Selecting a place to construct a terminal to receive liquid natural gas requires a deep port to minimize the environmental impacts associated with the development and operation of the terminal. In addition, a relatively low population density area with industrial development is necessary.

Three (3) criteria were used to determine whether building close to PREPA's installation import terminal was a viable alternative. These were: 1) specific factors at the workplace, 2) maritime operations and, 3) environmental issues.

1. Factors specific to the workplace

Availability of land

A suitable location must have enough space available to accommodate the proposed installation and all safety components required by the Federal Department of transportation regulations (49 CFR part 193), the U.S. Coast Guard (33 CFR part 127) and the National Fire Protection Association (NFPA). In addition, a site must comply with the regulatory distance required between structures used to gasify LNG and the LNG storage tank. Facilities would need to occupy an area of approximately 25 acres. Structures would include, among other components, a dual containment tank 167 feet in height and diameter with the ability to store 1,000,000 barrels of liquid natural gas at a temperature of minus 260 degrees Fahrenheit and a pressure of 2.0269 psig; vaporization or gasification systems to gasify liquid natural gas, and pipes to transport the natural gas to the power stations. Other factors to be considered would include activities outside and adjacent to the terminal and the distance or separation needed between the terminal to occupied areas of activity and/or populated areas (49 CFR parts 193.2055, 193.2057 and/or populated areas.

Availability of a coastal area

A site must have an available maritime quay with facilities for tankers 950 feet long, with PIP cubic meters capacity, and a minimum 40-foot boat anchor area. The criteria used to assess whether a port or dock has the capacity for this type of project are the depth of greater than 40 feet, navigation channels with extension airway passage (greater than 180 feet) and proximity to equipment to conduct storage and gasification of liquid natural gas. The quay must be approximately 30 feet wide by 1,700 long and have, among others: teams to tie up the tanker to the dock; a boat platform with two levels at the end (a 40-foot wide by 100 long lower level and 20 wide and 100 long upper level); and an emergency spill collection system.

Disposal of dredged material

Any area under consideration must include the requirement to dredge to create a proper shipping channel for the maritime tanker traffic to deliver the liquid natural gas; also a site must be identified for

dredged material generated during construction and future maintenance operations required for the channel.

2. Maritime Operations

Increase in ships

The transit of tanker ships is subject to more restrictions than general maritime traffic. Federal regulations and restrictions could affect other shipping and increase the risk of affecting other users of the navigation channel.

Access to the navigation channel

The quicker a tanker vessel can arrive at the terminal, unload and return to sea, the more economic the operation is. A shorter channel would reduce possible adverse effects on traffic for other ships from marine transit restrictions. Yaw (amplitude and proximity) area: a typical liquid natural gas tanker ship would require a dock with a minimum turning diameter of 1,200 feet and 40 feet of depth.

3. Environmental issues

Environmental consequences

Minimizing environmental impact by using places previously impacted, including the place for dock, and areas zoned for this type of use.

Compatibility with the region

The place must be compatible with future developments on adjacent properties.

According to the rating system described above, the import terminal is favorable based on the following criteria:

1. The land to be used for the project is compatible with the uses defined in the criteria (commercial, industrial, public, agricultural).
2. Bodies of water- the number of water bodies to be crossed are reduced, since the length of pipe between Peñuelas and Arecibo is eliminated with this option.
3. Forests and Reserves- the percentage of forests and reserves is considerably reduced because the length of pipe between Peñuelas and Arecibo is eliminated
4. Architectural and Archaeological findings- no findings anticipated in the marine portion of the project. There are no findings in the land portion from San Juan to Arecibo.
5. Road crossings- the number of road crossings is reduced since the length of pipe from Peñuelas to Arecibo is eliminated.
6. Zoning- the zoning in the project area is compatible with the zoning designated in the criteria: non residential, public, industrial, agricultural, commercial and non-zoned.

7. Topography- the number of abrupt topographic changes is significantly reduced since the length of pipe from Peñuelas to Arecibo is eliminated.
8. Community- the number of residences expropriated is reduced.
9. Pipe length- the length of pipe needed is reduced.
10. Pipeline security – the pipe is still underground.
11. Noise impact – the noise levels will be compatible with the noise levels in the area.

The import terminal proved disadvantageous based on the following criteria:

1. Endangered species- to bring the natural gas tanker to the selected location, the navigation channel must be dredged and a disposal site identified. The Estuary of the Bay of San Juan (EBSJ) is composed of several bodies of water. The EBSJ provides food and shelter to eight species of fauna and 17 species of flora in danger of extinction, such as the Antillean Manatee and several species of turtles, including the hawksbill and leatherback; 160 species of birds, such as the Brown Pelican and the Heron; 19 species of reptiles and amphibians, such as the coquí and Puerto Rican boa; 124 species of fish, Tarpon and bass; and 300 species of wetland plants are found on EBSJ.
2. Impact to jurisdictional areas- the San Juan Bay is considered waters of the United States. In addition to this, a disposal site for the dredged material must be identified. A deep water disposal site would also fall under the jurisdiction of the USACE.
3. Cost – the estimated cost to build an import terminal is approximately \$1.2-\$1.5 billion, above the government's financial capability at the moment.
4. Impact to transportation and traffic- the dredging operation to prepare the navigation channel and the gas natural tankers entering the area would have a significant impact on the maritime traffic of San Juan Bay. Also, there would an increase in maritime traffic due to the LNG ships entering the area. The transit of tanker ships is subject to more restrictions than general maritime traffic. Federal regulations and restrictions could affect other shipping and increase the risk of affecting other users of the navigation channel. One example of an effect would be the increase in maritime traffic restrictions which make it difficult, if not impossible, for others to use the navigation channels simultaneously with LNG tankers
5. Water quality and aquatic resources- Dredging operations would degrade the quality of the receiving waters due to suspended fine sediments. Effects from the turbidity plume

could occur daily during working hours and up to two (2) hours after the discharge of dredged material is completed. This would affect water quality and, consequently, water quality parameters required by environmental permits governing the CTSJ, especially turbidity, sedimentation and suspended solids.

6. Essential fish habitat – There are no identified essential fish habitats in the San Juan Bay.
7. Ease of access – the quicker a tanker vessel can arrive at the terminal, unload and return to sea, the more economic and safe is the operation. In order to reach the unloading pier, the LNG tanker must use three channels, Bar, Anegado and Army Terminal, until it reaches the pier at Puerto Nuevo Bay. A shorter channel would reduce possible adverse effects on traffic for other ships from marine transit restrictions.
8. Corals- the entire north coast of Puerto Rico is designated critical habitat for elkhorn and staghorn coral. Species specific studies would have to be performed to determine the status of the species, if dredging is needed in designated areas.
9. Exclusion zone- the regulations establish an exclusion zone of 1-2 mile radius for the storage tank needed to store the LNG. This exclusion zone limitation could not be met.

Construction of a system of buoys and tankers (Deep water Port) in San Juan, Palo Seco and Arecibo

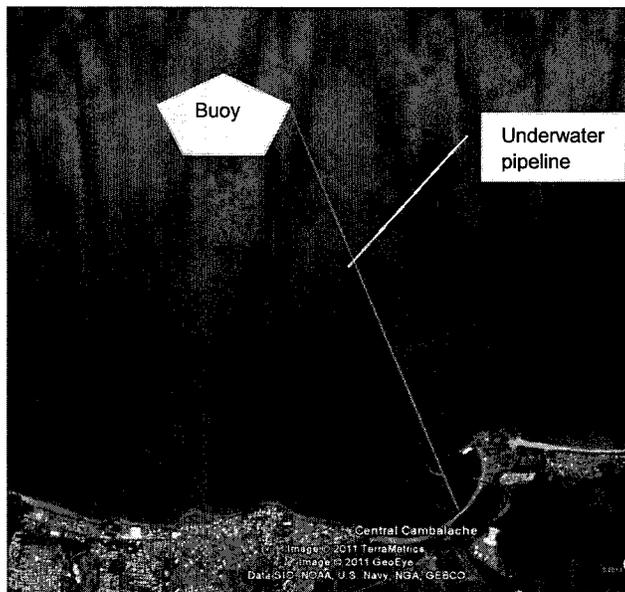
As one of the alternatives to the project, the installation and operation of tankers and a buoy for the receipt, storage and regasification to transport natural gas to each area in the north central system was considered. The buoy would be located 5km from the coast in Palo Seco and Arecibo. In San Juan, the buoy will be located 8 km offshore. The infrastructure needed is:

- one submerged turret loading buoy that connects to the vessel and serves as both a mooring for the vessel and a conduit for the discharge of natural gas
- chains, wire rope, and anchors used to secure the buoy to the seabed
- a flexible riser designed to connect the buoy to a seabed pipeline end manifold (PLEM) – allowing tie-in to a subsea pipeline

- a subsea PLEM that incorporates necessary control instrumentation and related valving;
and,
- an interconnecting subsea pipeline to tie into downstream delivery infrastructure.

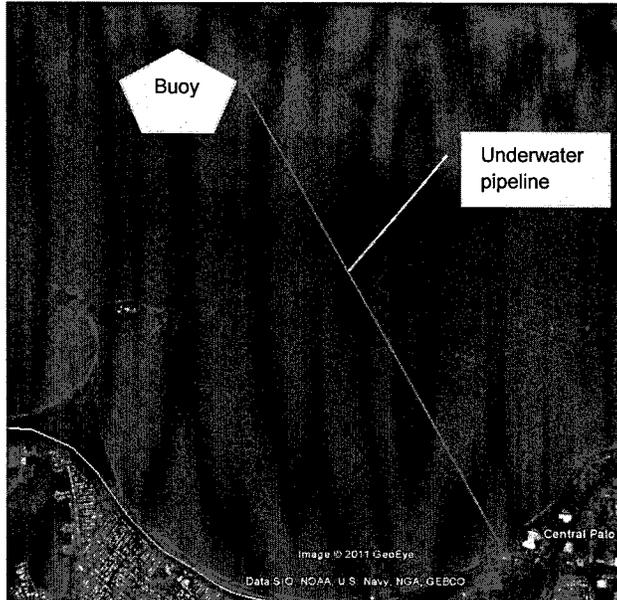


The delivery tanker will have a regasification system. This tanker will dock at the buoy which keeps afloat lines connecting the tanker to a pipeline on the seabed. This pipeline will transport compressed gas to a receiving terminal near the central power unit.

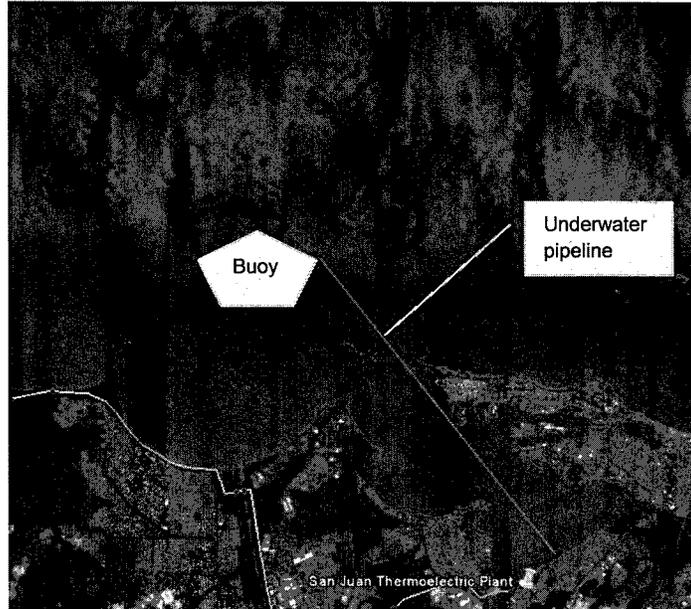


Proposed location LNG receiving buoy

Cambalache, Arcibo



**Proposed location LNG receiving buoy
Palo Seco, Toa Baja**



**Proposed location LNG receiving buoy
San Juan**

According to the ranking system described above, the buoy and barge system is favorable based on the following criteria:

1. Forests and Reserves- no forests and reserves are affected by this alternative
2. Architectural and Archaeological findings- no findings anticipated in the marine portion of the project, but required studies will be performed.
3. Road crossings- no road crossings
4. Topography- it is assumed that the seabed in the area is flat, but a bathymetric study will be performed
5. Community- no residences will be expropriated due to the projects construction.
6. Pipe length- the length of pipe needed is reduced
7. Pipeline security – the pipe is still underground

The import terminal proved disadvantageous based on the following criteria:

1. Bodies of water- although only one body of water is affected by the project, there are no alternatives to avoid its impact. Directional drilling is not an option in this case. The pipe to transport the gas must be buried in a trench of approximately 3 ft deep and 4 ft wide

for a length of ocean between 5-8 miles, per buoy. Also, there will be impact on the sea floor during the installation of the anchors and other equipment related to the buoys.

2. Endangered species- a number of endangered species of sea turtles, whales and others could be affected by the project's construction.
3. Impact to jurisdictional areas- waters affected by the project in San Juan, Palo Seco and Arecibo are jurisdictional.
4. Cost – The AEE would request a private company with expertise in the design, construction, and operating system of a Deepwater Port. This could cost AEE between \$70 and \$80 million per year, subject to signing a contract with that company for a period of not less than 20 years. At the end of the 20 year period the total cost would be approximately \$1.6 billion dollars, per buoy system.
5. Impact to transportation and traffic- As in other cases, the Coast Guard may impose safety zones restrictions extending at least 500 meters in all directions from the buoy to protect vessels and mariners from potential safety hazards associated with the construction of the deepwater port facilities, and to protect the port's infrastructure. All vessels will be prohibited from entering into, remaining or moving within the safety zone.
6. Water quality and aquatic resources- The primary physical impact of construction on water quality would occur as a direct or indirect result of the sediment plume that will be created from setting the buoy anchors, installing the flowlines, and temporarily laying the mooring chain on the seafloor. Although temporary, plumes resulting from disturbance to the seafloor would be exposed to currents with the potential to carry them into the surrounding environment and strip nutrients and/or contaminants from the sediments and release them to the water column. The extent and duration of the turbidity plumes would be based on the strength of the currents at the location of the specific activity. Sediment re-suspension could release sediment bound contaminants, but this is an assumption that need to be validated by chemical analysis of the sediments.

Withdrawal of ballast and cooling water at the port as the regasification vessel unloads cargo (approximately 1 million gallons per day) could potentially entrain zooplankton and ichthyoplankton that serve as prey for other species.

7. Noise impact - During port operations, sound will be generated by the regasification of the LNG aboard the regasification vessel and the use of thrusters by vessels maneuvering and maintaining position at the port. Another potential sound source would be sound generated from large construction-type dynamic positioning (DP) vessels used for a major repair of the subsea pipeline or unloading facility. Of these potential operations and maintenance/repair sound sources, thruster use for DP is the most significant. The National Marine Fisheries Service recognizes three kinds of sound: continuous, intermittent (or transient), and pulsive. The project will not cause pulsive noise activities. Rather, the sound sources of potential concern will be continuous and intermittent sound sources, including underwater sound generated by regasification/offloading (continuous) and dynamic positioning of vessels (regasification and large repair vessels) using thrusters (intermittent). Both continuous and intermittent sound sources are subject to the National Marine Fisheries Service's 120 dB re 1 μ Pa threshold for determining levels of underwater sound that may result in the disturbance of marine mammals. Potential effects of noise on marine mammals include masking, disturbance (behavioral), hearing impairment (temporary threshold shift [TTS] and permanent threshold shift [PTS]), and non-auditory physiological effects.
8. Essential fish habitat - Withdrawal of ballast and cooling water at the port as the regasification vessel unloads cargo (approximately 1 million gallons per day) could potentially entrain plankton and fish larvae .
9. Ease of access – although the delivery tankers will have easy access to the buoys, on shore personnel will have to travel 5-8 miles in case emergency situations arise.
10. Corals- the entire north coast of Puerto Rico is designated critical habitat for elkhorn and staghorn coral. Species specific studies would have to be performed to determine the status of the species. The species could be affected by trenching done to install the underwater pipeline.

11. The land to be used for the project is not compatible with the uses defined in the criteria (commercial, industrial, public, agricultural).
12. Exclusion zone- the Coast Guard will determine the exclusion zone during construction and operation of the project
13. Zoning- the zoning in the project area is not compatible with the zoning designated in the criteria: non residential, public, industrial, agricultural, commercial and non-zoned

Construction of a Natural Gas Pipeline (Terrestrial routes)

The purpose of this analysis is to select the best terrestrial route for a pipeline to deliver natural gas from the Ecoelectrica facility in Peñuelas to the Cambalache, Palo Seco and San Juan plants. Other works and studies contracted by PREPA were used during the Alternative Routes Selection effort. Part of the study conducted by *Power Technologies Corporation (PTC)* in 2006 was used for this analysis (*Corridor and Alternative Routes Selection Study*). The PTC study was inclusive since it took into consideration the entire island. Corridors were evaluated every 1,000 meters and used the following criteria for such evaluation; topography, land use, existing corridors, and sensitive areas. Options were refined with other factors such as: individual residences, minor topographic variations, sensitive habitats identified during field visits, and methodology of construction in areas of greatest difficulty, such as: steep slopes, bridges and densely populated areas. Finally, the study selected multiple routes to bring natural gas to various points of the island. These included the PREPA facilities at Arecibo, San Juan and Palo Seco, which are the focal points of this Via Verde project.

The study carried out by PTC identified two viable alignments to transport natural gas from EcoElectrica to Central Cambalache and two segments from San Juan to Cambalache.

Ecoelectrica to Cambalache Segments

1. Alignment South to North "A"

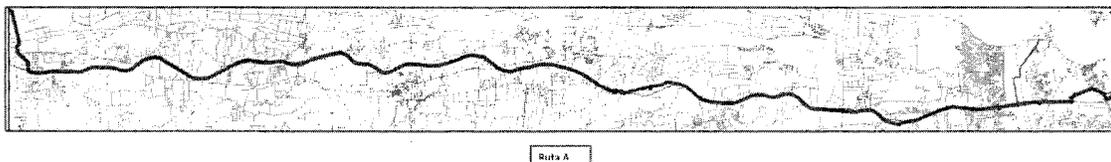
Starting at EcoElectrica, take a Northeast route overland to Ponce and then follow the State Road 10 road easement. The route follows State Road 10 through Adjuntas and Utuado. At Utuado the pipeline moves away from but parallel to the State Road 10 corridor until it reaches Arecibo. At Arecibo the route follows Northern plains until it reaches Central Cambalache. This route runs a total of 45.1 miles and the study labeled this alignment "*Overland*".

2. Alignment South to North "B"

Starting at EcoElectrica, take one of two options to get to State Road 10. The first is to follow the right-of-way of the southern gas pipeline to Ponce and the second option is to take the State Road 10 right-of-way from Guayanilla. Both go to the west of Ponce where the pipeline route follows the State Road 10 right-of-way State Road 10 until it reaches Central Cambalache. This route runs a total of 36.8 miles and the study labeled this alignment "*DOT Route*". The study also identified two viable alignments for the proposed natural gas pipeline, from Central Cambalache to San Juan and Palo Seco.

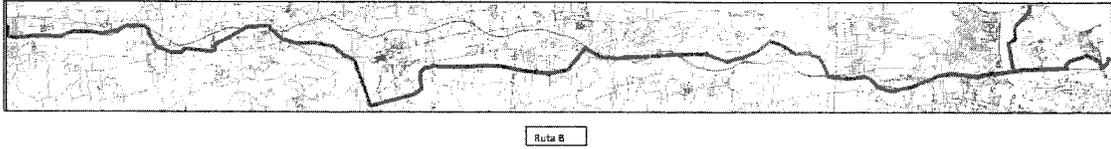
San Juan to Cambalache Segments (East to West)

3. Alignment East to West "A" (Include drawing)



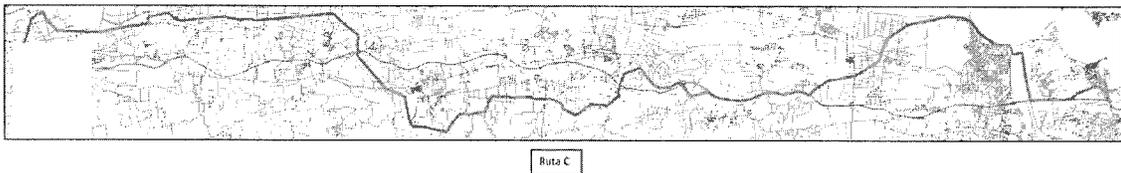
From San Juan, in Levittown, take a path west and cross the Municipalities, of Toa Baja, Dorado, Vega Alta, Vega Baja, Manati and Barceloneta to Arecibo. This route runs a total of 44.6 miles. The study labeled this alignment "*Overland Corridor*".

4. Alignment East to West "B"



From Cataño, follow the PR-22 right-of-way to Arecibo. This route crosses the Municipalities of Toa Baja, Dorado, Vega Alta, Vega Baja, Manati and Barceloneta. This route would necessitate an investigation to determine if the pipeline would interfere with the right-of-way of the Superacueducto (Super Aqueduct). This alignment runs a total of 45.6 miles and the study called this alignment "*DOT Corridor*".

5. Alignment "C" segments



A third alignment, which was not contemplated in any of the previous studies contracted by PREPA, was also considered for the Via Verde project that ran near both of the other two alternative routes but avoided more residential areas. In summary, three (3) routes were considered for the pipeline corridor from EcoElectrica to Arecibo and then from Arecibo to San Juan. These were: alignment South-North A (SNA), alignment South-North B (SNB), alignment South-North C (SNC); alignment West-East A (OEA), West-East B (OEB), West-East C (OEC).

Evaluation criteria for terrestrial route comparison

The following environmental criteria were used to evaluate the six alignment segments and determine which segments met the criteria as explained below:

- **Use of land** - The different uses of land were analyzed in each alignment. A route was defined as favorable for pipeline construction if existing land use was currently used for public, industrial, agricultural and commercial applications. A route was defined as not favorable for construction if land was currently in residential use and/or environmentally-sensitive. The percentage of the alignment with favorable uses and

then the percentage not favorable were compared to obtain a final value. The route which had the largest value received the positive (+) value.

- **Impacted water bodies** - The number of crossings of bodies of water increases the difficulty to construct the pipeline. Crossing a large body of water would need special construction methods to avoid adverse impacts. These construction methods increase the cost of the project. All bodies of water which were intercepted by an alignment were counted. The route with the fewest water body crossings received a positive (+) value.
- **Forests or nature reserves** - Forests and nature reserves were areas considered important public resources due to their high ecological value. For selection of a positive (+) value the criteria considered avoidance or minimization of impacts to these areas. The percentage of forested/nature reserves impacted was measured against the total length of each route alternative. The route with the smallest percentage of forests and nature reserves received the positive (+) value.
- **Endangered Species** - This criterion measured the extent of the alignment alternative that was considered protected habitat and/or had listed species present. The route alternative with the smallest percentage of impact in protected habitat received the positive (+) value.
- **Archaeological sites** - All identified architectural and archaeological sites that would be intercepted by an alignment alternative were marked. The route with the fewest sites received the positive (+) value.
- **Highway crossings** - Road crossings increase the difficulty of pipeline construction since special construction methods are needed to avoid affecting the integrity of the infrastructure and vehicle congestion. All roads intercepted by an alignment alternative were identified. The route with the fewest road crossings received the positive (+) value.
- **Zoning** - The different zonings were identified for each alignment alternative. Favorable zonings were considered to be non residential, public, industrial, agricultural, commercial and non-zoned. Not favorable was considered to be areas zoned residential, or areas identified as forests, historical sites and conservation lands. We measured the extent of alignment with terrain for favorable zoning against not-favorable zoning to obtain a final value. The route which had the largest value (favorable vs. not-favorable) received the positive (+) value.

- **Topography** - Puerto Rico has a variety of topographical areas within its limited geographical scope. The Cordillera Central area is characterized by its rugged topography. We analyzed different levels and steepness of topography and types of soils within each alignment. Abrupt changes in the topographic levels were marked. The route which had the smallest number of abrupt topographic changes received the positive (+) value.
- **Residential areas** - Due to its limited geography and high population density, Puerto Rico has abundant residential areas, especially in the coastal plains. Distance from Residential Areas, as part of the general public safety factors was considered to be a very important factor in identifying the best, practicable alternative. For this reason, greater weight was given in the project planning criterion to minimize the number of homes in the vicinity of an alignment. Any residence which would be within 150 feet from the center of an alignment was identified and counted. The route with the fewest number of residences received the positive (++) value.

To determine the best terrestrial alternative, the three (3) segment alternatives for the South-North section were compared to each other based on the results obtained once the criteria was applied. The three (3) segment alternatives for the East- West section were also compared. The route option with the least impact to each criterion received a positive value (+). Then the total number of positive values for each route alternative was added and tabulated. The route option with the largest number of criteria in its favor was selected. The analysis is summarized in the Table 1.

Table 1: Route Selection Matrix for Terrestrial Route

Criteria	South North A		South North B		South North C		West East A		West East B		West East C	
Use of land	3.09		8.68		14.35	+	1.32		14.38		18.89	+
Bodies of water	23		25		20	+	15		12	+	13	
Forests or nature reserves	1.39	+	2.50		3.04		0.59		0.03	+	2.79	
Endangered Species	6.49		11.69		6.01	+	7.03		1.53	+	10.43	
Architectural and archaeological findings	1		0	+	0	+	0	+	0	+	0	+
Highway crossings	40		28		21	+	64		47		30	+
Zoning	24.21		30.61		33.41	+	4.28		0.44		32.42	+
Topography	86		78		59	+	15		12	+	13	
Residences	17		2	+	2	++	29		22		1	++
Total Positive criteria		1		3		9		1		5		6

Of the three south-north segments, the South-North C (SNC) segment was the most favorable with nine positive points, while South-North B had three positive points and South-North A only one positive point. Minimal direct impact to residential areas also favored segment SNC.

Of the three west-east (east-west) segments, the West East C (OEC) segment was the most favorable with six positive points while, West-East B had five positive points and West-East A only

one positive point. Again, direct impact to residences strongly supported segment OEC since only one residence would be directly impacted while the other two segments potentially directly impact over twenty residences each.

Based on this analysis, together, segment South North C and segment West East C were selected as the best option for a pipeline route.

EVALUATION OF ALTERNATIVES USING RATING AND WEIGHT – Table 2

Criteria	Terrestrial Route			Buoys			Import Terminal		
	Rating	Weight	Total	Rating	Weight	Total	Rating	Weight	Total
Land use	10	3	30	5	3	15	10	3	30
Bodies of water	5	2	10	5	2	10	10	2	20
Forests and nature reserves	5	2	10	10	2	20	10	2	20
Endangered species	5	3	15	5	3	15	5	3	15
Architectural and archaeological findings	10	2	20	10	2	20	10	2	20
Road crossings	5	2	10	10	2	20	10	2	20
Zoning	10	3	30	10	3	30	10	3	30
Topography	5	2	10	10	2	20	10	2	20
Community	10	3	30	10	3	30	10	3	30
Pipe length	5	2	10	5	2	10	10	2	20
Impact to jurisdictional areas	5	3	15	5	3	15	5	3	15
Pipe security	10	3	30	10	3	30	10	3	30
Impact on transportation and traffic	10	2	20	5	2	10	5	2	10
Water quality	10	3	30	5	3	15	5	3	15
Aquatic Resources	10	3	30	5	5	25	5	5	25
Cost	10	3	30	10	3	30	5	3	15
Noise impact	10	2	20	5	2	10	10	2	20
Essential fish habitat	10	2	20	10	2	20	5	2	10
Ease of access	10	2	20	5	2	10	5	2	10
Corals	10	2	20	5	2	10	5	2	10

TOTAL

410

365

385

CONCLUSIONS

1. The alternative of building a terminal at or near the CTSJ is not feasible, nor practicable, when comparing potential environmental impacts associated with the construction of a natural gas pipeline to service AEE's power stations. It must be considered that the process of constructing and operating an LNG import terminal is complex. Permits and endorsements are regulated by the Federal Energy Regulatory Commission (FERC). In comparison, the EcoElectrica studies and permit process to construct an import terminal and start of the operation took between 7 to 10 years. This timeline would not satisfy AEE's need to begin a project to facilitate the transition from oil to a renewable source of energy. The cost of the existing EcoElectrica terminal fluctuated around \$570 million in 1995. Considering inflation, the construction of a similar terminal today would be too onerous as it would be beyond \$1 billion. As a project of the Government of Puerto Rico, it would require funding through bond issues, limiting savings on electrical bills.

Although an area of maritime use, the CTSJ (as well as the other two stations in the northern area) does not comply with depth criteria or the anchor capacity for the necessary tankers. This alternative lacks a dredged material disposal area and necessary dredging activity would adversely impact the benthic community in the area. Maritime traffic would be highly compromised by the existence of only one entrance channel to San Juan Bay. It is believed that locating a receiving terminal here would adversely impact the local economy, as well as the tourism industry.

2. The system of mono buoy and tanker would cost approximately \$70 to \$80 million per year. The plants (Cambalache, Palo Seco and San Juan) have a small footprint and do not have space to locate the terminal facility to receive the CNG. The period of time required to put the system into operation, in compliance with all applicable federal and State legislation is estimated between 5 to 8 years. Although this project is not viable at this time, PREPA will continue to study this possibility since multiple projects using two buoys a natural gas without compression have been constructed in the US Mainland and are operating successfully.

3. Although the terrestrial route is not without impacts, it is the best alternative to deliver natural gas to PREPA's plants in northern Puerto Rico. Impacts to human and other resources can be avoided, minimized or mitigated. There is extensive knowledge about the resources affected by the project and PREPA will work following the regulatory agencies recommendations and strict construction codes.

ELECTRIC POWER AUTHORITY
Puerto Rico's Via Verde Project
Preliminary Environmental Impact Statement (DIA-P)

Summary

This project is one of the tools needed to address the emergency regarding the infrastructure for generating electric power decreed by the Hon. Luis G. Fortuño Burset in Executive Order OE-2010-034, under Law 76 of May 5, 2000. In addition, it is essential to comply with the commitment of his work program aimed to reduce the energy cost and to strengthen Puerto Rico's economy.

What is proposed is the construction of a 24" diameter steel pipeline to transport natural gas from the facilities of EcoEléctrica to the Cambalache, San Juan and Palo Seco Power Plants. The pipeline will be underground, it extends for some 92 miles and it will run through the municipalities of Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón and Guaynabo. The works will include clearing the right of way, excavation of trenches and installation and testing of the pipeline. In addition, they include modifications to units of the Cambalache, Palo Seco and San Juan power plants to enable them to burn natural gas as well as liquid fuels. The estimated cost of the project will be \$447,000,000 dollars which includes the cost of design, purchase, conveyance of and delivery of materials, construction, payment of municipal licenses and taxes, if applicable, purchase of land, studies and permits. The cost for the conversion of the units to natural gas is estimated to be between \$50 to \$70 million dollars. Approximately between 1,000 and 1,200 temporary direct and 4,000 to 5,000 indirect jobs will be generated.

A. Project Rationale

Currently, 99% of the electricity generated by the Electric Power Authority (Autoridad de Energía Eléctrica or AEE, in Spanish) is obtained from petroleum. The excessive and unpredictable increase in the cost of liquid fuels makes us less competitive in a global economy. To control and reduce the high cost of electricity the AEE's Governing Board approved a General Strategic Plan for the Development and Expansion of Generating Capacity. This Plan established, as a quicker, more viable and environmentally safe alternative, that generating capacity would be added using natural gas as the main fuel, as part of the strategy to diversify fuel that would allow us to reduce the operating costs and to maintain sustained environmental compliance.

The main reasons for this determination are the following: in Puerto Rico there already is a Liquefied Natural Gas Terminal; the historical and projected price of natural gas is lower than the distillate fuels and it will be cheaper than residual No. 6 fuel oil; reduces the maintenance cost of the units, which are prepared, or can be modified, for its use; the technology is developed and tested; and there exist confirmed reserves of natural gas in different parts of the world. The use of natural gas for the production of electric

energy increased during the last three years in the United States thanks to the implementation of an intensive domestic policy to promote the extraction of this fuel from non-conventional sources. This action was reflected in the international markets as a reduction in the price of the fuel, which permits Puerto Rico to buy this product at low and favorable prices.

In addition, when analyzing Puerto Rico's economic situation, and its relation with the sudden changes in the cost of liquid fossil fuels, it was concluded that Puerto Rico's economy is not viable, unless its vulnerability to the shocks of crude oil markets is reduced dramatically.¹ This reduction is achieved by diversifying the sources for generating electricity through the use of natural gas, as a transition to the effective use of renewable sources of energy in the future. The direct result will be the strengthening of our economy and, at the same time, the improvement of the environment, as demonstrated by the interpretation made by economists of the Environmental Kuznet's Curve.

Most of the electricity is produced in the south of Puerto Rico, but it is consumed in greater quantities in the north. Hence, the need for a geographical diversification with respect to the generation of electricity. With the construction of the Via Verde project, the AEE will be able to increase generation in the north and to improve the electrical system reliability.. This will give the AEE greater flexibility to choose the parameters to work on the point and with the fuel that will permit the most efficient and economical generation of electricity and with a lesser generation costs and impact on the environment.

On the face of the economic crisis confronting Puerto Rico, the AEE amended its Fuel Diversification Plan to accelerate the transition, through the use of natural gas, to the effective use of renewable energy sources. In the measure in which the use of natural gas cheapens the cost of electric energy and drives the country's economic recovery we will be in position to promote the development and establishment of generation from renewable energy sources. With this in sight the AEE signed several contracts to receive and acquire from private cogenerators a total of 295 MW in renewable energy projects and it is considering proposals to receive and acquire an additional 207 MW. In addition, internally the AEE is studying the viability of renewable solar thermal energy which would generate 50 MW.

B. Description of the Environment

A description of the environment in the zones through which the project will pass is

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Comments in reaction to the conference titled "Transition to an Energy Use and Production Structure that will Permit Efficiency and Growth at a Sustainable Rate" by Gerrit Jan Schaeffer, drafted by Dr. Elías R. Gutierrez, February 19, 2010.

discussed in Chapter 3. The project consists of the construction and installation of a natural gas transportation system through the municipalities of Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón and Guaynabo. The same will have a longitude of 92 miles approximately and will require a maintenance right of way of 150' on each side of the pipeline. The construction will impact, within the right of way and throughout its length, a width of 100' (30.48 m) for the construction within which will be created a 50' (15.24 m) operational right of way and the remaining 50' in width will be restored to its original state once construction activities are completed. The total area impacted by the project will be 1,113.8 acres approximately. An additional area of 32 acres will be required for special and particular situations necessary in this type of construction.

The 48 wards (barrios) through which the pipeline will cross are: in Peñuelas, the wards of Tallaboa Poniente, Encarnación, Tallaboa Saliente, Tallaboa Alta and Rucio; in Adjuntas the wards of Saltillo, Portugués, Vegas Arriba, Vegas Abajo and Pellejas; in Utuado, the wards of Arenas, Salto Arriba, Pueblo, Salto Abajo, Río Abajo, Caguana and Caníaco; In Arecibo, the wards of Río Arriba, Hato Viejo, Carreras, Tanamá, Cambalache, Santana, Factor and Garrochales; in Barceloneta, the wards of Garrochales and Palmas Altas, in Manatí, the wards of Tierras Nuevas Poniente, Bajura Afuera, Río Arriba Poniente, Río Arriba Saliente and Coto Sur; in Vega Baja, the wards of Pugnado Afuera, Río Abajo and Almirante Norte; in Vega Alta, the wards of Bajura, Sabana and Espinosa; in Dorado, the wards of Higuillar, Maguayo and Mameyal; in Toa Baja, the wards of Media Luna, Candelaria, Sabana Seca and Palo Seco; in Cataño, the Palmas ward; in Bayamón the Juan Sánchez ward and in Guaynabo the Juan Sánchez ward.

The environmental document presents a general description of the different environmental aspects characteristic of each one of the municipalities through which the Via Verde pipeline will cross. In addition, the AEE has contracted Asesores Ambientales y Educativos (AAE) to conduct the project's environmental studies. They, in turn, contracted diverse firms to realize the same. The firms contracted were the following: for the flora and fauna study the firm of Coll, Rivera Environmental; for the geology study, the firm of Geo Cim, Inc; for the Jurisdictional Determination, Coll Rivera Environmental; for the archeological study Phase 1A, archeologists Marisol Rodríguez Miranda and Carlos Ayes Suárez. These studies are part of the appendixes that are presented together with the environmental document.

The most relevant aspects regarding the environment are summarized as follows:

- Flora and fauna

For purposes of the flora and fauna, the study area was divided into five sub-areas: subtropical dry forest, subtropical wet forest plains, mogotes of the subtropical wet forest, subtropical wet forest, and lower-montano subtropical wet forest.

For the subtropical dry forest, the total plant species found was 164, divided into 57 families, and the total animal species found was 65 divided into 33 families. Of these, the critical species of flora, regulated and in danger of extinction, according to the Department of Natural and Environmental Resources (DNER) were: palo de vaca (pigeon-berry), jayajabico (soldierwood), guayacán blanco (Hollywood lignumvitae), *Passiflora bilobata* Jussieu, palo de violeta (violet tree) and jusillo (*Henriettea squamulosum*). The species of fauna were: pato quijada colorada (White-cheeked Pintail or Bahama Duck), guabairo (Puerto Rican Whip-Poor-Will, *Caprimulgus vociferous noctitherus*), paloma perdiz áurea (Key West Quail Dove), calandria (Puerto Rican Black-Cowled Oriole) and bien-te-veo (Puerto Rican Vireo).

For the subtropical wet forest plains the plant species was 353, divided into 86 families, and the total animal species was 90, divided into 47 families. Of these, the critical flora species, regulated and in danger of extinction, according to the DNER were: higüerillo (white fiddlewood), cedro hembra (Spanish cedar), ceiba (Silk-cotton tree) and avispillo (Jamaica ocotea). The species of fauna were: culebra corredora (Puerto Rican Racer Snake), paloma cabeciblanca (White-crowned Pigeon), boa de Puerto Rico (Puerto Rican Boa), buruquena (Freshwater Crab), calandria (Puerto Rican Black-Cowled Oriole) and the bien-te-veo (Puerto Rican Vireo).

For the area of subtropical wet forest mogotes the total species of plants was 424, divided into 91 families and the total species of animals was 86, divided into 41 families. Of these, the critical species of flora, regulated and in danger of extinction, according to the DNER were: palo de vaca (pigeon-berry), doncella (*Brysonima coriacea*), ceiba (Silk-cotton tree), almez (*Celtis australis*), ortegón (*Coccoloba swartzii*), palma plateada (Tyre palm), jayajabico (soldierwood), palma de lluvia (Llume palm), corcho blanco (Water Mampoo), *Hyperbaena domingensis*, lebisa (*Licaria triandra*), *Maytenus ponceana*, *Passiflora Murucuja* L., palo de violeta (Violet Tree), *Pristimera caribaea*, almendrón (Florida poison tree), palma de sombrero (Puerto Rico Palmetto), ortiga (*Ureca baccifera*), *Zamia amblyphyllidia*. The species of fauna were: culebra corredora (Puerto Rican Racer snake), boa de Puerto Rico (Puerto Rican Boa), calandria (Puerto Rican Black-Cowled Oriole) and the bien-te-veo (Puerto Rican Vireo).

For the area of the subtropical wet forest the total species of plants was 363, divided into 94 families, and the total species of fauna was 64, divided into 28 families. Of these, the critical species of flora, regulated and in danger of extinction, according to the DNER were: culantrillo, higüerillo (white fiddlewood), doncella (*Brysonima coriacea*), cedro hembra (Spanish-cedar), ceiba (Silk-cotton tree), plateado (*Exostema ellipticum*), *Hibiscus trilobus*, palo de peo (*Lasianthus lanceolatus*), laurel (Jamaica ocotea), almendrón (Florida poison tree), yagrumillo (*Schefflera gleasonii*) and ortiga (*Ureca baccifera*). The species of fauna were: culebra corredora (Puerto Rican Racer Snake), calandria (Puerto Rican Black-Cowled Oriole) and bien-te-veo (Puerto Rican Vireo).

For the area of lower-montano subtropical wet forest the total of plant species was 86, divided into 41 families and the total animal species was 20, divided into 12 families. Of

these, the critical flora species, regulated and in danger of extinction, according to the DRNA was cedro macho (*Hyeronima clusioides*). The fauna species was the bien-te-veo (Puerto Rican Vireo).

Although according to the consultation made with the United States Fish and Wildlife Service (F&WS), the project could affect habitat adequate to several species, none of these species was detected during the field work, with the exception of the guabairo (Puerto Rican Nightjar).

- Geology

According to the study of the geology, the area through which the project will cross is very diverse and it encompasses close to 90 million years of Puerto Rico's geological history. The geological report indicates that the alignment crosses two geological faults that cross in the general direction of east to west in the Juana Diaz outcropping, both of the normal type. These, like the other geological faults that cross the alignment, are considered inactive. The alignment enters the layer of rocks from the Eocene (40 to 55 million years ago) which is comprised in the Great Southern Puerto Rico Fault Zone. The layer, some 4.5 km wide, extends until the margin of the Utuado Pluton, an extensive mass of intrusive rock that is also within the alignment. Also, along a 14 km stretch, the alignment crosses two of the types of topographical zones that characterize the Karst Zone; which are not necessarily part of the protected Karst Zone, according to the DNER.

The report concludes with a discussion of the limitations that the alignment's geology can present to the Via Verde project. , It indicates that none of them present a major impact to the project, since all of them are addressed with the geologic and geotechnical study that is the basis for the design and construction which minimizes or eliminates their possible impacts.

- Natural systems

The project will cross through a great variety of natural and artificial systems characteristic to the island. The most significant natural and artificial systems within a distance of 400 mt or less of the proposed project alignments were considered in the document.

Next to the project are five bays (the Tallaboa Bay in the Municipality of Peñuelas, the Guayanilla Bay in the Municipality of Guayanilla, the Toa Bay in the Municipality of Toa Baja, the San Juan Bay and the Puerto Nuevo Bay); one cove (Boca Vieja in the Sabana Seca ward of the Municipality of Toa Baja); three estuaries (the estuary of the Tallaboa Bay, the Cocal River estuary, and the San Juan Bay estuary); one beach (Punta Salinas Beach); three forests (Bosque del Pueblo, Rio Abajo Forest and Vega Forest); two quarries (in the municipalities of Peñuelas and Utuado); two salt mines (in the Tallaboa Poniente ward of the Municipality of Peñuelas); four marsh areas

(freshwater marsh in the Santana ward and the Caño Tiburones marsh, both in the Municipality of Arecibo; San Pedro marsh in the Sabana Seca ward of the Municipality of Toa Baja, and Las Cucharillas marsh between the municipalities of Guaynabo, Toa Baja and, for the most part, Cataño); 31 aquifer areas (two each in the municipalities of Peñuelas, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja and Cataño; three in the Municipality of Adjuntas; five in each of the municipalities of Utuado and Arecibo; and one each in the municipalities of Bayamón and Guaynabo); three springs in the Municipality of Arecibo; 18 canals (three in the Municipality of Peñuelas, seven in the Municipality of Arecibo, three in the Municipality of Manatí, one in the Municipality of Vega Baja, one in the Municipality of Dorado, two in the Municipality of Cataño, and one in the Municipality of Guaynabo); six lakes and lagoons (one artificial body of water in the Tallaboa Alta ward of the Municipality of Peñuelas; the Adjuntas lake, in the Juan Gonzalez ward; the Pellejas lake in the Pellejas ward, and the Garzas lake between the Garzas and Saltillo wards; the Matrullas lagoon in the Palo Seco ward of the Municipality of Toa Baja; and Secreta lagoon in the Palmas ward of the Municipality of Cataño); six cave systems (five in the Municipality of Arecibo and one in the Municipality of Vega Baja); a 3.91 lineal-mile crossing in the Carst Belt Region in the Municipality of Manatí; 156 drinking water wells and sampling stations; 117 creeks; 13 rivers (the Tallaboa river in the Municipality of Peñuelas; the Corcho river in the Portugués ward of the Municipality of Adjuntas; the Pellejas river in the Vegas Abajo ward of the Municipality of Adjuntas; the Rio Grande de Arecibo in the Pellejas ward of the Municipality of Adjuntas, and in the Carreras, Hato Viejo and Tanamá wards of the Municipality of Arecibo; the Caguanita river in the Caguana ward of the Municipality of Utuado; the Caguanas river in the Caguanas ward of the Municipality of Utuado; the Tanamá river in the Tanamá ward of the Municipality of Arecibo; the Rio Grande de Manatí in the Palmas Altas, Bajura Afuera and Rio Arriba Poniente wards of the Municipality of Manatí; the Cibuco river in the Municipality of Vega Baja; the La Plata river in the Municipality of Dorado; the Cocal river in the Sabana Seca ward of the Municipality of Toa Baja; the Hondo river in the Palmas ward of the Municipality of Cataño; the Bayamón river in the Palmas ward of the Municipality of Cataño); four natural reserves (Tiburones Canal Natural Reserve, Hacienda La Esperanza Nature Reserve, El Indio Natural Reserve and the Las Cucharillas Marsh Nature Reserve); 128 sinkholes (3 in the Municipality of Utuado, 64 in the Municipality of Arecibo, 47 in the Municipality of Manatí, 9 in the Municipality of Vega Baja, 2 in the Municipality of Guaynabo and one each in the municipalities of Dorado, Toa Baja and Cataño - the alignment will cross over 21 of which 14 had already been impacted by PR-10).

It is stressed that the project will not impact or affect coral reefs, cays, dunes, cisterns, dams, reservoirs, drinking water intakes or irrigation systems because none are in areas near the project.

- Determination of Jurisdiction

The determination of jurisdiction study concluded that of the 2,988,833.3 m² (738.6

acres) of wetlands under the jurisdiction of the United States Corps of Engineers delimited for this project, the project's construction right of way will cover some 369.3 acres.

The delimited wetlands are classified in the following categories: palustrine forested, palustrine herbaceous, palustrine herbaceous in agricultural use in the past or in the present, estuarine forested, estuarine forested canals and estuarine salt marshes. Approximately 2.0 acres of palustrine forested wetlands were delimited; 310.1 acres of palustrine herbaceous wetlands; 397.8 acres of palustrine herbaceous wetlands in agricultural use in the past or in the present; 23.6 acres of estuarine forested wetlands; 1.2 acres of estuarine forested canals; and 3.9 acres of estuarine salt marsh wetlands.

- Soil Classifications

The project is distributed in 419 plots of which 84.8% belong to the private sector and 15.2% to the public sector. The different types of use of the soils through which the alignment will cross were distributed approximately in the following manner: industrial area, 3.1%; public and recreational area, 2.8%; transportation area, 0.3%; commercial area, 0.1%; residential area, 1.0%; agricultural area, 56.2%; forest area, 35.3%; and hydrographic-hydrological area, 1.3%.

Of the 92 miles the project encompasses, 4.3% will be in a zone classified as having a 0.2% annual probability of risk of flooding, 0.43% will be in a zone classified as A (areas with a 1% annual probability of flooding and a 26% probability of flooding within 30 years), 38.9% will be in a zone classified as AE (areas with a 1% annual probability of flooding and a 26% probability of flooding within the next 30 years), 3.8% will be in a zone classified as VE (area with an annual probability of flooding equal to, or greater than 1% and a 26% probability of flooding within 30 years) and 54.5% will be in a zone classified as X (area with an annual probability of flooding of less than 1%).

- Highway crossings

Sixty three (63) state highway crossings are identified as intercepted by the project's alignment. These are indicated in Addendum 1, Highway Crossings.

- Proximity to the communities and quiet zones

The sectors or communities close to the project's alignment, approximately 400 meters or less from them, and each municipality's quiet zones closest to the project were determined. The findings are gathered in Addendum 2, Distance to the Communities and Quiet Zones.

- Archaeological and architectural findings and cultural and historic sites

The Phase 1A study identified the already known archaeological resources and

established the basis for discovering additional resources in the project's area. The following findings are worth highlighting:

In the Municipality of Peñuelas - vestiges of the railroad line and the Loyola Hacienda in the Tallaboa Poniente ward; a small shell heap with pottery and conch shell fragments from the chicoid taino period in the Encarnación ward; the Dolores and Coto Haciendas in the Rucio ward.

In the Municipality of Utuado: an archeological find near the cemetery and the river crossing.

In the Municipality of Arecibo: archaeological residues inside a cave with habitation remains and several in the Rio Arriba ward; archaeological finds in Refugio Salmón and in the Ventana cave, in the Hato Viejo ward; residues, a cave or rockshelter, petroglyphs and pictographs and historical material were found in Matos Cave in the Carreras ward.

In the Municipality of Barceloneta, in the Palmas Altas ward there are vestiges of the railroad line that intercept the alignment at mile 53.25. The Phase 1A Archaeological Study recommends a 1B Phase, with the exclusion of the mountainous areas and the Tiburones Marsh zone, for the whole area the project will traverse in this municipality.

In the Municipality of Manatí: two architectural structures, the Truss Bridge and Central Monserrate sugarcane mill.

In the Municipality of Vega Baja: an architectural structure, Hacienda Monserrate; the study recommends going ahead with Phase 1B in the Paso del Indio area.

In the Municipality of Vega Alta: architectural structure, a bridge; the Abra de los Perros Cave is considered an area of archaeological findings.

In the Municipality of Dorado: Casa Hernandez or the residence of Mrs. Antonia Ramírez; abundant dispersed materials were found of the Taíno/Colonial period of the late 19th Century; material on the surface of the Taíno, subtaino, late saladoid and colonial period in Punta Corozo; a multi-component site with Taíno and late 19th century colonial period in the Mameyal ward.

In the Municipality of Toa Baja: Santa Elena dairy farm; fragments of 19th century historical ceramic dispersed on the surface; ruins of the Our Lady of Candelaria shrine in the ancient Hacienda El Plantaje, in the Sabana Seca ward of Toa Baja; an archaeological site under the gravel topping in the posterior part of land belonging to the Electric Power Authority, in the Palo Seco ward.

In the Municipality of Cataño: Hacienda Palmas in the Palmas ward.

C. Study of Alternatives and selection of the alignment

Chapter 4 analyzes in detail the alternatives considered for the execution of this project. The following were considered among such alternatives: land alignments for a natural gas pipeline; the use of a system of barges and buoys to receive, re-gasify, store and provide natural gas; the construction of a liquified natural gas receiving and re-gasification terminal. In addition the utilization of renewable energie options technically and commercially proven and the No Action alternative were also considered.

- No Action

The No Action alternative was found to be not feasible given the transcendence, importance and public well-being sought by the project. It was considered that, although this alternative would avoid the impact related to the construction, installation and operation of a pipeline to transport natural gas, such impact can be minimized and mitigated. This alternative is not indicative of no impact, since it forces the continued burning of petroleum derived products which generate a greater amount of pollutinon and emissions into the air and at higher costs than the burning of natural gas, which would make the service of electric power more expensive and it would negatively impact Puerto Rico's economy.

The No Action option would not permit maintaining a structure of fixed costs that would avoid the abrupt peak changes in the cost of the fuel acquired. This can only be avoided by reducing the dependence on the use of petroleum and expensive fossil fuels. In addition, the limitations of the federal and state permits on the type of fuel that can be burned would lead us to one of two options: to cease generating electricity, which is not viable, or burn a cheaper fuel with higher sulfur content than that contained in said permits, which would expose us to fines and sanctions.

- Liquified natural gas receiving terminal in the San Juan Power Plant

Even though Puerto Rico has an Liquefied Natural Gas (LNG) Terminal with the capacity to supply our needs, at the EcoElectrica Cogenerator facility, the alternative of constructing a new LNG terminal near the San Juan Thermoelectric Plant was considered because it would be near an existing dock for the receipt of fossil fuel. Three criteria were used determine whether this was a viable alternative: specific site factors, maritime operations, and environmental issues.

The analysis of these criteria leads us to the conclusion that this was not a viable alternative for the following reasons: we would need to dredge the navigational canal and the turning basin; the dredged material would present the problem of securing an adequate disposal location; the dredging and disposal operations would produce a high concentration of sediments, which would impact the benthic area and the water quality even more; maritime traffic would be adversely affected and as a consequence our economy and tourism because the San Juan Bay is the backbone of our tourist

economy; the increase in maritime traffic would affect marine life in the area; there would be an increase in the temperature of the Puerto Nuevo Bay waters, which would have a cumulative effect on the benthic community of the bay, water quality would be affected and, in consequence, the water quality parameters required in the environmental permits which govern the power plant; due to space limitations in the power plant and in areas near it, we would be unable to comply with the regulations that determine the space that must exist between the different elements within the terminal and the establishment of an exclusion zone or distance from populated areas; the environmental impact associated with the construction of the pipelines to transport natural gas in the North of the island would not be eliminated; the process of studies and permits together with the construction and commencement of the operation could take from 7 to 10 years, it would not satisfy our need for an immediate project to propitiate the transition from petroleum to renewable sources of energy; the project would be too onerous because it would surpass \$1,000 million.

- Systems of barges and buoys

The installation of a system of barges and monobuoy for the receipt, storage, re-gasification and transport of the natural gas was considered as one of the alternatives. The AEE evaluated the viability of the construction of these systems in three areas: San Juan, Toa Baja and Arecibo. The criteria considered in such evaluation were: costs, space, time to have it operational, permits, safety, environmental justice, past experiences in Puerto Rico and the United States.

The process for the design, construction and operation of the barges and buoy system would have an approximate cost for each power plant of between 70 and 80 million dollars yearly, subject to the signing of a contract with the company in charge of the process for a term of not less than 20 years. At the end of the 20 years the cost would be some 1.6 billion dollars for each power plant. The time period required to start the operation of the system would be between 5 and 8 years. In addition, an analysis for each power plant demonstrated that it is not a viable alternative in the short term.

The San Juan Power Plant does not have space available to locate the receiving terminal; the pipeline to the power plant would run through an area of intense maritime traffic; there are low-income communities near the project that would be affected; the proximity of CAPECO would influence the community's perception of the project.

The Palo Seco Power Plant does not have space to locate the receiving terminal; the permits process is complicated and costly; there are low-income communities near the project that would be affected, the proximity to CAPECO would influence the community's perception of the project.

The Cambalache Power Plant does not have space available to locate the receiving terminal; the permits process is complicated and costly; there are low-income communities near the project that would be affected.

The foregoing ruled out the construction of a system of barges and monobuoy for the receipt, storage, re-gasification and transport of natural gas within the time frame required for the action under consideration. Consequently, the supply of natural gas to this power plant will have to be through a gas transport pipeline, inevitably.

- Natural gas pipeline

In this analysis, some components of the study owned by the AEE and conducted under contract by *Power Technologies Corporation (PTC)* in 2006, titled: *Corridor and Alternative Routes Selection Study*. The two alignments suggested in the PTC study to carry natural gas from EcoEléctrica to Cambalache Power Plant were analyzed, together with a third alignment not considered in the study. The same was done with the alignments suggested in the study for the transport of natural gas from Cambalache Power Plant to the metropolitan area power plants, Palo Seco and San Juan.

For the selection of the alignment with the greater potential for development, the three alignments for each stretch were compared and the alignment that obtained the greater number of positive criteria in its favor was selected. Eight criteria were used to compare each stretch: land use; bodies of water impacted; miles of forest or natural reserves impacted; endangered species; archaeological findings; highway crossings; zoning or soil calification and nearby residences. For each criterion, a positive (+) value was assigned to the most favored stretch, except for the criterion of nearby residences, which was assigned a value of two (++) positives since one of the primary goals of the project is to be as far away as possible from communities or inhabited areas.

The matrix created would indicate which alignment would have the greater potential for development for each stretch. The alignment selected for the project would be the union of the two favored segments. Necessary variances were incorporated into this selected alignment due to different reasons: minimal impact to the communities, avoiding or minimizing the environmental impacts, economic factors and factors associated to the construction. The total number of variances incorporated were 18, broken as follows: 12 variances to keep far away from communities; three variances to avoid or minimize environmental impacts; one variance for economic factors; and two variances for construction reasons. The incorporation of these variances resulted in the alignment presented in this environmental document.

D. Project Description

Via Verde will provide a natural gas transport system from EcoEléctrica in Peñuelas to the AEE's Cambalache, Palo Seco and San Juan power plants through some 92 miles of 24" diameter, underground steel pipeline.

The pipeline and the other construction materials will be ordered from companies outside of Puerto Rico and will be received by the Port of the Américas and the San

Juan Port Zone. Six operation centers will be established located adjacent to each port, plus in the areas of Utuado, Arecibo, Vega Alta and Toa Baja. Their locations are already impacted by industrial activity and their use will be temporary in nature while the project is under construction. They will serve as bases for the receipt, storage, inventory and dispatch of materials and equipment for the project.

The project will have a cost of \$447,000,000 dollars. This sum includes the items of design, purchase, hauling and delivery of materials, construction, payment of licenses and taxes, land acquisitions, studies and permits. The cost of the conversion to natural gas of the units is estimated at between 50 and 70 million dollars.

Before the excavation begins there will be coordination with the Public Service Commission or with the Permit Office (Oficina de Gerencia de Permisos), as applicable, so that the agencies or companies with underground infrastructure mark the location of said infrastructure. Whenever possible, a minimum distance of 24" from other underground infrastructure will be maintained.

Four gas flow meters with their respective equipment, one bidirectional PIG launcher/receiver and one PIG receiver will be installed, and connections will be provided for a portable PIG launcher/receiver unit. The latter are to carry out inspections, measurements and cleaning inside the pipeline. In addition, isolation or security block valves will be installed to isolate segments in case of inspections, repairs or emergencies, the number and location of which will be determined by the class and location.

The equipment will have the capacity to operate at maximum pressure and temperature of 1,450 psi and 120°F, but the entry pressure will be 650 psi and it will be reduced to 400 psi before it enters the combustion turbines.

- Natural Gas

Natural gas is a fossil fuel formed by organic matter underground at high pressure for geological-scale times. It is a mixture of hydrocarbons whose principal component is methane (CH₄). It is colorless and odorless and it is lighter than air; its specific gravity fluctuates between 0.55 and 0.64; its explosive limit is 3-17%, outside of these limits there is no combustion. Natural gas is non-toxic, but it is a simple asphyxiant if it displaces oxygen, which could produce dizziness, deep breathing or, due to the need for air, nausea and unconsciousness in case of overexposure, which would require immediate medical attention. It is not classified as carcinogen or potentially carcinogen.

To address leakages the emergency response and rescue personnel must use a self-contained respirator (SCBA) and fire-resistant clothing, and they must have the training required by Law (29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*). All personnel must be evacuated from the affected area and if it is in a confined space, the area ventilation is to be increased.

One cubic foot of natural gas produces an average of 1,000 BTU. It represents one fifth of the world's energy consumption. It is one of the cleanest fossil fuels and better for the environment because the sulfur dioxide emissions are minimal and those of nitrous oxide and carbon dioxide are less than those of other fossil fuels. The natural gas industry is comprised of three segments: production, transmission and distribution. In Puerto Rico it is used in its entirety for the generation of electricity although natural gas has other domestic, commercial, industrial and transportation uses.

- Personal safety

The construction project will be contracted out. The contractor will be responsible for submitting a work plan which includes the health and safety aspects established in the Code of Federal Regulations, Title 29, *Labor*, Part 1910, *Occupational Safety and Health Standards* and Part 1926, *Safety and Health Regulations for Construction*.

- Construction stages

The construction will be done by segments and it will follow a specific sequence (production line style). Each construction stage will be described below.

- Identification of owners, Surveying I and Environmental Studies

The *New Star Acquisitions* company was hired for this stage. They identified the land owners; they were asked for an access permit to carry out the land surveying and the pertinent environmental studies and one was signed. In the first stage of the surveying the LIDAR aerial technology was used; with the alignment's coordinates the environmental studies were started.

- Clearance of the right of way

Once the land comprising the right of way has been acquired, heavy machinery will be used to clear and level. Although the construction right of way will be 100' in flat areas, on mountainous areas and in places where the horizontal directional drilling is made, it may range from 100 to 300 feet. It is estimated that 1,113.8 acres will be impacted and 687,760 cubic meters of soil will be removed. The soil removed will be stored to be used later in the restoration stage. The necessary measures will be taken to minimize sedimentation of the water bodies.

- Land surveying

The center points of the line will be checked and marked. Then the pipeline (in 40-foot long spreads) is laid throughout the alignment.

- Trench Construction

Specialized machinery will be used for the construction of the trenches (*wheel ditcher*) or machinery with a mechanical arm, depending on the conditions of the area. The trenches will be 5 to 6 feet deep and 4 to 5 feet wide, so as to allow a 3-foot cap over the pipeline. The removed soil will be sifted and stored alongside the trench to cover the same later. The remainder will be disposed of in an authorized landfill. It is estimated that 494,206 cubic meters of soil will be removed.

The highway crossings will be made by boring and the pipeline will be at a minimum of 4 feet under the same highway. (See addendum 1, Highway Crossings). These segments will be designed to tolerate the weights associated to the highway and the vehicles that pass through it. The crossings of bodies of water and of some highways will be made by horizontal directional drilling (HDD). This is a "dry" crossing method because it does not interfere with the flow of the body of water, and it is made underneath the bed of the body of water. A dye will be added to detect small bentonite leaks. Ten bodies of water were identified that will be crossed by HDD. In addition, 66 crossings of bodies of water were identified to be crossed by open trench. Addendum 3, Crossings of Bodies of Water, contains the bodies of water and the coordinates where the project will cross.

- Welding and bending

Once the pipeline is positioned, the necessary bending is made to couple it to the ground with machinery that exerts hydraulic pressure. Then it is laid on supports, the ends are cleaned, lined up and welded using the manual submerged arc welding method. The welded seams will be checked with non-destructive methods; if any flaw is detected, the weld is repaired or it is cut off and a new weld is made. Lastly, the ends are covered with a protective coating. Next a second inspection of the pipeline protective coating is made.

- Lowering and backfill of the trench

The pipeline is lifted using specialized machinery (sidebooms) and it is lowered into the trench. Fine-particle sifted soil is used first to back-fill the trench to prevent damage to the protective coating. Then the remainder of the soil and small stones are deposited on the excavated trench and finally the top soil is placed within the construction area. In total the minimum cover will be 36 inches and 48 inches in agricultural areas. The recommendations of the Highways Authority with respect to the backfill material to be used will be followed in crossings of highways, roadways and roads where the open trench method was used.

- Hydrostatic testing

In compliance with 49 CFR 192.505, *Strength test requirements for steel pipeline*, hydrostatic testing will be conducted on the totality of the pipeline. The pressure will be higher than the operating pressure for at least eight hours.

- Pipeline right of way restoration

After passing the hydrostatic test, the right of way will be restored. Of the 100 feet width of the construction right of way, 50 will be restored to their original state; the remaining 50 feet will be a permanent or operations right of way, which will be restored only with wild vegetation or lawn without deep roots. In agricultural lands it may be used to plant crops that don't have deep roots. On wetlands, mitigation will be carried out "on site".

- Construction in special areas

- Wetlands and mangrove areas

In non-saturated areas the same equipment and procedure of open trench will be used. In saturated areas, the pipeline is welded outside the wetland area; the excavation and backfill of the trench is made with backhoes; the pipeline is installed by the push and pull method through flotation buoys; the buoys are removed and the pipeline is sunk by its cement coating or using weights.

To prevent the equipment from sinking or to avoid disturbing the soil or excessive turbidity of the water, timber mats or timber rip-raps will be placed. The organic cover extracted will be stored and used as backfill.

- Earthquake prone areas

Via Verde will be designed and constructed with similar specifications to those used in places with a higher incidence of intense earthquakes, like California and Alaska. The following measures will be incorporated to the design to guarantee the integrity and continuous operation of Via Verde: the relative alignment of the pipeline relative to the faults to diminish the impact of a slip in such fault; burying the pipeline in a wide trench, with long lateral slopes filled with compacted sand to allow for the deformation of the pipeline during a seismic event; including enough bends in the design of the pipeline to guarantee its flexibility; the results of the geotechnical studies that will be conducted to evaluate the properties of the soil.

- Karst zone areas

During the construction there will be a resident biologist at all times to evaluate the area carefully. Only light equipment will enter to minimize the possibility of harm. Adequate

erosion and sedimentation controls will be established. There will not be any operation centers or auxiliary spaces of the construction in this zone. The pipeline will be installed through the pulling method to minimize the heavy equipment. The backfill will be adequate to permit the hydraulic capacity of the soil. Once the trench is covered, vegetation will be immediately planted in the area surrounding the permanent right of way. The pipeline patrolling program during the operation will give special attention to the soil to detect any erosion.

- Use of explosives

The use of explosives will not be necessary. Nevertheless, if any area were identified in which the use of explosives is indispensable, it will be made only by specialized personnel and in compliance with the applicable laws and regulations.

- Conversion of Units to natural gas

The units that will use natural gas for the production of energy will be: Units 1, 2 and 3 of the Cambalache Power Station; Units 3 and 4 of the Palo Seco Power Station; Units 7, 8, 9, 10 and Combined Cycle Units 5 and 6 of the San Juan Power Station. The units will be modified so they can burn natural gas, Bunker C or a combination of both. The minimum and maximum flow of natural gas each power station will need, respectively, will be: 5.5 and 61, 1.1 and 84, 1.1 and 180 MMSCFD. The systems that will require modifications, among others, will be: modifications to boilers and their gas supply system and modifications to turbines.

- Risk analysis and safety measures

The safety aspects of the gas pipelines are addressed by the Office of Pipeline Safety (OPS). It is in charge of carrying out inspections, establish regulations, promote research, issue compliance orders, apply civil and criminal penalties and educate the public, among other functions. The Pipeline Safety Improvement Act established an alliance between the Federal Department of Transportation, the Energy Department and the National Institute of Standards and Technology, to conduct research, make demonstrations and standardize procedures that guarantee the integrity of pipelines. Via Verde of Puerto Rico will be governed by the codes of the Federal Department of Transportation.

According to the OPS, the causes of incidents and accidents in the natural gas pipelines are, in order of probability of occurrence: corrosion, excavations, failure of the construction materials, action of the forces of nature, human error and unknown or miscellaneous causes. The OPS established preventive measures to minimize each one of these risks.

- Information program

One of the most important factors of Via Verde is safety, for which reason keeping the public informed is vital to the success of the project. The AEE established a public information plan in two phases.

The first one already commenced and it covers the periods of time before and during the construction. We continue to present the project to the mayors and their legislative assemblies, to agencies with inderence in the project, professional forums and to the general communities. The presentations have the purpose of: conveying clear, concise and correct information; know and respond to the communities' concerns; and establish a point of contact between the community and the AEE. In addition, the different means of communication are used to convey the information.

The second phase will be during the operation of the project. A written Public Information Plan will be developed in accordance with 49 CFR 192.616, Public Awareness, and the American Petroleum Institute, Public Awareness, Recommended Practice 1162.

- Class location

The different specifications for the manufacture of the pipeline are established in 49 CFR 192.5, Class Location, in accordance with its location or the population density. The regulated specifications that will depend on the classification are, among others: thickness of the pipeline, distance between valves, operating pressure, frequency of inspections and tests. The class unit by location extends to 220 yards (200 meters) on both sides of the line center of any continuous mile of pipeline. There are four classes defined in the following way: Class 1- area near the coast or which contains 10 or less buildings designated for human occupation; Class 2 - area which contains more than 10 but less than 46 buildings; Class 3 - area that contains more than 46 buildings or where the pipeline is within 100 yards of a well defined place (building, children's play area, recreational area, open air theater, or where the public congregates) and is occupied by 20 or more persons, at least 5 days in the week for 10 weeks in any 12 month period (the days and weeks don't need to be consecutive); Class 4 - area where there are four storey buildings or taller.

The classification of the class unit by location may vary by the increase in the population density after the pipeline is installed and in use. The federal regulation establishes that a study must be made to determine, among other things, the hoop stress and the yield strength. This study will determine whether there will be a need to vary the operational pressure so as to adapt to the new class by location. The applicable regulation is 49 CFR 192, sections 609, Change in Class Location: Required Study, 611, 553, General Requirements, and 555, Up rating to Pressures that Will Produce a Hoop Stress of 30% or more of SMYS (Specified Maximum Yield Strength) in Steel Pipelines.

- Pipeline specifications

The life span of the Via Verde pipeline is fifty years. The same will be designed in accordance with federal regulation 49 CFR 192, sections 105, Design Formula for Steel Pipe and 111, 107, 113 and 115, Design Factor for Steel Pipe, Yield Strength for Steel Pipe, Longitudinal Joint Factor for Steel Pipe and Temperature De-rating Factor for Steel Pipe, and standard 5L of the American Petroleum Institute (API 5L). Among the tests to be conducted on the pipeline are: chemical analysis, impact, hardness, hydrostatic and weld tests.

- Corrosion control

A Fusion Bonded Epoxy (FBE) external coating will be applied to the pipeline. A second coating, Tough Coat, will be applied over the FBE to the part of the pipeline that passes through bodies of water and under highways for protection when the pipeline is pulled from one side to the other. In addition, the pipeline will have cathodic protection to prevent corrosion. The pipeline will be evaluated annually to insure the functioning of the cathodic protection and the voltage will be monitored by monitoring stations that will check the functioning of the rectifiers. All the parameters of the federal regulations will be followed: 49 CFR 192, sections 463, External Corrosion Control: Cathodic Protection, 469, External Corrosion Control, Test Stations. During the operation, a PIG (pipeline inspection gauge) will also be used, a tool that runs the length of the pipeline and uses non-destructive methods to identify and document defects and anomalies in the same.

- Welding

Welders will be qualified before the project starts; and all of them must pass the tests required for this type of welds. The destructive method will be used for the qualification of the pipeline welds. It consists in evaluating the weld measuring the force needed to break it. Approved welders will be assigned an identification number that must be placed on every welding job s/he performs. If any irregularities are detected in the weld during the X-ray test or the hydrostatic test, the welder will be removed from the job immediately and the weld will either be repaired, or it will be cut off and a new weld will be made. The weld inspections will be visual, by an inspector with specific expertise in the type of weld, and through X-rays. The welds will be covered with a protective coating. The applicable regulation is 49 CFR 192, section 243, Non-destructive Testing.

- Hydrostatic test

Once the pipeline has been lowered into the trench and covered, it is filled with water and a test pressure greater than the maximum allowable operating pressure (MAOP) is applied. The test pressure is 1.1 times the MAOP in open spaces, 1.25 times in Class 2 locations and 1.5 times in Class 3 locations. The pressure applied is stabilized for 8 hours. The test helps locate areas in the pipeline (including the welds) that cannot

tolerate elevated pressures and which therefore fail.

- Pressure control equipment, isolation valves

To prevent accidents caused by excessive pressure, monitoring and protection equipment to guard from harm caused by elevated pressures will be installed. In addition, valves will be installed that will isolate sections of the pipeline in case of emergency or to perform inspections and repairs. These will be placed by intervals as required by regulation, as a function of the Class by Location.

- Precautions for excavations

The greatest risks to the integrity of the pipeline are excavation activities whereby any contact with the pipeline must be informed to the operator for the corresponding actions. Before excavating, every person must communicate with the Public Service Commission, or the Permits Office (OGP), as applicable. They will communicate with the operator who will mark the pipeline's alignment. Work will be done in conjunction with the municipalities to establish an excavation control mechanism. An inspector will be assigned to be present during the excavation.

- Operator qualification

The OPS requires that the operator and personnel hired by him takes part in a formal personnel qualification program (Operator Qualification Rule, August 27, 1999), which must be in writing. This plan must start before the pipeline begins to operate. The personnel qualification program is governed by 49 CFR 192.805, Qualification Program, and it must be documented in accordance with 49 CFR 192.807, Recordkeeping, to demonstrate compliance with the written plan. The OPS established an inspection protocol for use by federal and state inspectors. In addition, the operation personnel must comply with the Regulations of the Testing Program to Detect Controlled Substances in Officers and Employees of the AEE.

- Clearance distance from the pipeline

The regulation, for the purpose of protecting the underground pipeline, requires that it keep a distance of 12 inches from other underground equipment and infrastructure (49 CFR 192.325). Nevertheless, whenever possible a distance of 24 inches will be kept. The regulation does not provide distance requirements between the pipeline and buildings or dwellings.

- Inspection and maintenance

A Pipeline Integrity Management Program will be developed and established pursuant to 49 CFR 192.911, which will discuss the specific risks for each high consequence area (HCA, or AAC for *Area de Alta Consecuencia* in Spanish) identified in accordance with 49 CFR 192.905. In addition, an Inspection and Maintenance Program will be prepared that will cover the pipeline, flow meters, valves and other equipment. Copies

of these will be kept in our Power Plants and in EcoEléctrica. In addition, pursuant to 49 CFR 192.709, Recordkeeping, a file will be kept for everything related to the repairs, patrolling, inspections and tests.

- Patrolling

The AEE will establish a patrolling program to observe evidences of leakage and conditions in the right of way that may affect the integrity of the pipeline. The patrolling methods will be: walk through, drive through or helicopter flights. The frequency of patrolling is established in 49 CFR 192.705, Transmission Lines: Patrolling, and it depends on the class by location.

- Markers

Once the line is constructed, markers will be placed throughout its length. The places, reasons and information the markers must have are regulated in 49 CFR 192.707, Line Markers for Mains and Transmission Lines.

E. Impacts

Every possible effort was made to avoid areas or habitats of ecological value and to avoid significant impacts. In places where it is unavoidable, measures will be taken to minimize the negative effects and mitigate the impact caused.

- Deforestation and soil movement

It is estimated that 1,113.8 acres of land will be impacted. All the trees and vegetation will be removed from that area. The movement of soil for the project's construction is 1,181,966 cubic meters, approximately. The impact caused by these activities will be soil erosion, sedimentation of bodies of water, emission of fugitive dust, possible reduction in the soil's absorption capacity due to compaction, increase in the potential for the introduction of invasive species and reduction of available habitat for fauna.

- Emissions of fugitive dust

The following measures will be taken to minimize these impacts: a construction permit will be requested for fugitive dust emission sources; a Notice of Intent will be filed and a Storm Water Pollution Prevention Plan will be prepared; sprinkler trucks will be used to sprinkle the areas; dump trucks will use tarps.

- Erosion and sedimentation

To minimize the impact the following measures will be taken: the work area will be demarcated to avoid removal from outside the area; an Erosion and Sedimentation Control Plan will be prepared; a Notice of Intent will be filed and a Storm Water

Pollution Prevention Plan will be prepared; the soil will be stored adjacent to the trenches or be reused as backfill (the remainder will be disposed of in an authorized landfill); the soil will be compacted; and the removed vegetable cover and trees will be mechanically shredded and reused as wood chips; in areas of marked slopes, terraces will be built and covered with wood chips.

- Karst Zone

The protected karst zone in Puerto Rico covers some 151 square miles. Vía Verde will cross over some 3.91 linear miles, or 0.08 square miles of these, which is equivalent to **0.05%** of the protected karst zone. During the construction there will be a resident biologist available at all times to evaluate the area carefully. Only light equipment will enter the zone to minimize the probability of damage, for that reason the installation of the pipeline within said area will be using the push and pull method. Adequate erosion and sedimentation controls will be established. There will be no operation centers or auxiliary spaces to the construction in this zone. The backfill will be adequate to allow the soil's hydraulic capacity. Once the trench is covered, vegetation will be planted immediately in the area surrounding the permanent right of way. The pipeline patrolling program during the operation will pay special attention to the soil to detect any erosion.

- Agriculture

The potential impacts on agricultural land will include: crop losses, interference with agricultural drainage, loss of top soil, soil compacting and impact to irrigation systems. Once the construction is finished, the use of the soil will continue as before, including planting as long as it doesn't include trees whose roots may interfere with the pipeline.

The following measures were evaluated to minimize or mitigate the impacts and the viable ones will be implemented: the time of less impact to agriculture will be established; when the soils are used continually for cultivation damages will be indemnified; topsoil will be separated and stored for reuse; erosion control measures will be implemented; the surface soil will be de-compacted to facilitate planting and water absorption; the construction works will be coordinated with landowners and lessees to avoid as much as possible damages to irrigation systems and cattle movement; there will be indemnification for crop losses.

- Deforestation

Loss of vegetation will be inevitable. Therefore the following measures will be taken: the right of way will be delimited to avoid damage in other areas; the soil will be restored to its original state and only the permanent right of way will be kept free of deep-rooted vegetation; a mitigation plan will be devised for cases in which the loss of species with ecological value cannot be avoided; reforestation will be in a 3:1 ratio.

- Forests

The original alignment crossed through three forests: Bosque del Pueblo, Rio Abajo Forest and De La Vega Forest, which together comprise 10,515.85 square miles of forest. To prevent impacting those, the alignment was varied so as to avoid Bosque del Pueblo totally, the Rio Abajo Forest will not be impacted because the existing, already impacted RoW of PR-10 will be used. The only forest to be impacted will be De La Vega Forest. Its total area is 1.85 square miles and only 0.0086 square miles of it will be impacted temporarily, that is 0.47%. Once the construction is finished, 0.0043 square miles will be restored, whereby the permanent impact will be 0.235%. The impact to the total area of the three forests will be 0.0086 square miles or 0.000082%.

- Wetlands

Thirty-three percent (33%) of the alignment will cross through wetlands. The impact will be reflected on soil disturbances, which will increase the turbidity of the water, there will be temporal and permanent loss of vegetation and impact to resident and migratory species. To minimize the impact on wetlands the following measures will be taken: to avoid the accumulation and putrefaction of the removed vegetable cover, it will be removed outside of the area and disposed of as non-hazardous solid waste; the right of way will be delimited to avoid impact outside of this area; erosion and sedimentation control measures will be established; vehicles with leaks will not be allowed; special wetland construction techniques will be used; loss of vegetation will be mitigated on site; a Mitigation Plan will be prepared in coordination with the concerned agencies.

- Mangroves

This resource will not be impacted since measures have already been taken to avoid the same: the alignment was varied in the four mangrove areas so as to avoid crossing over the same or construction techniques will be used that will not impact them (HDD).

- Surface water bodies

Seventy-eight (78) bodies of water through which the project will cross were identified. The small ones will be crossed by open trench. The impacts include turbidity, sedimentation, diminution of dissolved oxygen, mortality of aquatic fauna and flora. The impact will be mitigated by reducing the construction time: bodies of water fewer than 10 feet wide will be crossed in 24 hours or less; from 10 to 100 feet wide, in 48 hours.

The more voluminous bodies of water will be crossed with HDD. Geotechnical studies will be made and construction plans specific for the site will be developed. The release of bentonite may affect the turbidity, diminish dissolved oxygen and affect the respiration of aquatic organisms. To avoid it a dye will be added to detect leaks and, should one occur, the flow of bentonite will be immediately stopped and the pertinent

Agencies will be notified. Another impact is the size of the construction right of way which will be 150 to 300 feet on both sides of the body of water. Erosion and sedimentation control measures will be established.

- Groundwater and aquifers

Thirty-one (31) aquifers were identified; the possibility of polluting groundwater is remote. To avoid oil and fuel spills a Spill Control Plan will be established.

- Water consumption

The hydrostatic test entails the greater water consumption (7 million gallons) whereby, to eliminate the impact on the public distribution system and the bodies of water, the water will be obtained from the wells for which the AEE has a water franchise. Bottled water from local suppliers will be used for consumption by employees. A local supplier will be hired to sprinkle the ground. He will be responsible for supplying the truck and the water.

- Water wells

Of 156 wells within a radius of 460 meters from the alignment, only five are inside the project's operation right of way. These will be identified in the project's drawings, their location will be marked on the ground to avoid impacting them and any breaks that may occur due to the construction will be repaired.

- Transportation and traffic

Barges will be used for the maritime transport of materials and machinery to the Port of the Americas and the San Juan port zone. To minimize the impact to maritime transport the following measures will be taken: all the requirements established by the receiving ports, the Ports Authority and Federal Customs will be complied with; a logistics plan will be submitted for endorsement by the pertinent authorities.

The roadways will be used as access to transport personnel, equipment, vehicles (light and heavy) and materials to the different project areas. Roads will be crossed using the open trench method or drilling. These roads are indicated in Addendum 1, Highway crossings. To minimize the impact to the integrity of the roadways and the interruption of, or increase in traffic the following measures will be taken: car pooling by employees will be encouraged; a Traffic Management Plan will be submitted to the Transportation and Highways Authority (in Spanish Autoridad de Carreteras y Transportación or ACT); if necessary and in coordination with the ACT and the local Police, detours will be established; the trenches will not be left uncovered.

- Archaeological finds and cultural and historic places

Three rock shelters with the presence of petroglyphs, possible farming terraces, remainders of two railroad bridges and the remainders of two haciendas were located. An archaeological study was conducted, Phase 1A which indicated the most important findings: Tallaboa Site, Salto Arriba Site, Bridges, Hacienda La Teresa, Hacienda Las Lisas, rock shelters, farming terraces, Paso del Indio, Punta Corozo, Dorado 15, Toa Baja 18, Hacienda La Candelaria, Warehouse 5. The recommendations the Institute of Puerto Rican Culture and other concerned agencies see fit to provide will be followed.

- Noise

Via Verde is a lineal project and the construction will move along day by day, therefore the noise will not be concentrated in any specific area. The noise levels of the machinery and the vehicles to be used are comparable to those established by the Environmental Quality Board's (in Spanish Junta de Calidad Ambiental or JCA) Noise Pollution Control Regulation. The following measures will be taken to minimize the effects of noise in populated areas: the work will be circumscribed to the time schedule established by the Regulation; the vehicles and machinery will have noise control equipment; inasmuch as possible, the newest equipment found will be used; the machinery will be turned off when not in use.

- Spills

In general, spills occur by human error: poor handling of the products, lack of maintenance of the equipment, and lack of adequate knowledge of the functioning and operation of the machinery. If spill occur, they will not be of a significant magnitude, because small quantities of the products will be used. The most significant event would be the total spill of a fuel truck, 2,500 gallons of diesel fuel.

The following measures will be established to avoid spills or minimize the impact of the same: a Spill Control Plan and a Spill Prevention, Control and Mitigation Plan for the use of bentonite will be prepared; Personnel will be trained (in: handling of chemicals; situations that might cause spills; how to avoid or minimize the impact; how to respond to a spill and who to inform; the correct functioning and operation of machinery); vehicles will have a Spill Kit; spills in water will be cleaned using absorbent pads and in case of spills on the ground, the contaminated soil will be removed; the collected material will be deposited in containers, identified, full RCRA tests will be conducted and it will be disposed of in an authorized place; vehicles with leaks will not be allowed in the work area; no chemicals will be stored outside the operation centers.

- Wastes

It is estimated that non-toxic solid wastes will be generated in amounts greater than 100 cubic yards weekly, approximately. This could increase the amount of waste received at the landfills because this waste will be collected and transported to the nearby landfills approved by the JCA. The impact will be minimized by reusing part of the soil

to backfill the trenches and restore the right of way, only the surplus soil will be disposed of in an authorized landfill. The vegetable cover and trees removed will be mechanically shredded and used as wood chips for erosion control in slopes. Measures will be established for the control of erosion and sedimentation. Handling of chemical products will be delegated on experienced personnel and it will be separated from the other waste to be disposed of in accordance with the pertinent regulations after being characterized with a Full RCRA analysis.

The following measures will be implemented to minimize the impact caused by used water: the water used in the hydrostatic test will be discharged in our power plants with a permit from NPDES and in coordination with the EPA; the contractor who provides the portable toilets will be in charge of providing maintenance and for disposing of the waste and for handling any spills, all in accordance with the regulations of the Department of labor and Human Resources.

- Socioeconomic impact

The project represents a temporary benefit for the local economy. Among the benefits are: the taxes paid to the municipalities if applicable; employment opportunities (between 1,000 and 1,200 temporary direct jobs and some 4,000 to 4,500 indirect jobs); and an increase in sales and the use of services (hotels, motels, restaurants, gas stations, fast food and articles of prime necessity businesses, hauling trucks, sprinkler trucks, heavy equipment, rental of cars, trailers, portable toilets, purchase of lumber, gravel and bottled water, among others).

The project's construction will not have a disproportionate environmental impact on any socioeconomic group and whatever impact there is will be of short duration because the construction is not stationary. Free access to communities and residences will be ensured; the work area will be delimited; special work areas will be located outside the quiet zone; the necessary measures to control fugitive dust, noise and increased traffic will be complied with. A public information program to educate the community prior to the construction will be established and will continue during the same.

One of the most important impacts will be the establishment of the maintenance right of way which encompasses 150 feet of the pipeline. Within this were located approximately 102 structures or residences. The properties will be appraised and the owners will be compensated (fair market value) for the appraised value. The general use of the soil will not be altered, however, the construction of buildings or structures or the planting of trees or vegetation with deep roots will not be permitted in the operation right of way (a width of 50 feet throughout the length of the pipeline).

- Protected, threatened or endangered species

The presence of the listed species was not detected during the field work, with the exception of the guabairo (Puerto Rican Nightjar, *Caprimulgus vociferus noctitherus*).

This species will be protected by the implementation of a protocol for its protection and conservation and by constructing the project outside of its nesting season. All permanent loss of habitat for the guabairo will be mitigated in accordance with a plan approved by the DNER and the United States Fish and Wildlife Service.

Regarding the species of fauna designated as vulnerable, the Puerto Rican boa and the white-cheeked pintail or Bahama duck were sighted. The Puerto Rican boa will be protected by the implementation of a protocol for its protection and conservation during the construction phase. The white-cheeked pintail prefers lagoons or ponds, which are not under the project's impact footprint. Other species such as the falcón de sierra (Puerto Rican Sharp-Shinned Hawk, *Accipiter striatus venator*), the guaraguaíto (Puerto Rican Broad-Winged Hawk, *Buteo platypterus brunnescens*) and the Puerto Rican Parrot (Puerto Rican Amazon, *Amazona vittata vittata*), should not be impacted as long as areas with characteristics similar to their habitat are not disturbed, especially during their mating and nesting seasons.

The species of flora designated as critical can be identified with some conspicuous method (printed marking ribbon, or "DO NOT CUT flagging tape") and thus avoid impacting them. If there is the possibility of impacting them, they will be transplanted to an adequate place, by personnel qualified for this practice.

- Air quality impact

The change to natural gas represents a substantial reduction in criteria pollutants air emissions. The percentage of reduction of criteria pollutants in pounds per year for each power plant, calculated according to the formulas of the Air Pollutants Emission Factors (AP 42), will be the following: 75.79% for the Palo Seco Power Plant, 69.30% for the San Juan Power Plant, and 66.75% for the Cambalache Power Plant. The only individual criteria pollutant that would see a slight increase in the percentage of emissions (6.04%) would be the Volatile Organic Compounds (VOC) in the Palo Seco Power Plant. In compliance with federal regulations, a Prevention of Significant Deterioration (PSD) permit will be obtained for this power plant.

The change to natural gas will also result in a significant reduction (between 25% and 30%) in carbon dioxide emissions. An increase in the concentration of carbon dioxide in the atmosphere results in an increase in global temperatures or global warming.

- Environmental monitoring program

As part of the efforts to avoid or minimize the impacts of the construction, the project will have an Environmental Coordinator who will be in charge of the project's environmental impact issues.

- Cumulative impact

The cumulative impact is the total effect on the environment resulting from a series of past, present or future actions of independent or common origin. No cumulative impact on mangroves and wetlands is expected.

There may be constructions going on in certain project areas which coincide with Vía Verde and contribute to increase the fugitive dust in the air. The cumulative effects on the air quality due to the operation of the units are contemplated in the current permits and those that will be obtained for the changes due to the use of natural gas. The cumulative impact of pollutant emissions will be a positive one, since there will be a reduction in the emissions of criteria pollutants and carbon dioxide.

The project's impact on traffic will be added to the impact due to private and public vehicles from other projects developed in the area. The cumulative impact will be temporary in each municipality.

During the project's construction there will be an increase in the demand for bottled water and water used for sprinkling which will be added to the demand from other construction projects and the demand from the general population. This will be temporary for the duration of the construction.

The impact to agricultural areas in certain areas is unavoidable and in those the project's impact will be added to the impact of past and future agricultural activities.

There will be a temporary noise increase during the construction that will be added to the noise impact of public and private vehicles and other construction equipment located in the area. Although the noise generated by the project will not be concentrated in one specific zone because the construction area will change daily, it will be temporary.

F. Socioeconomic study

Chapter 7 includes a socioeconomic study to determine whether the impact the proposed action will have is one of fair treatment for all groups of persons. To prepare this analysis data from the 2000 Census were used, which were obtained from the information supplied by the Puerto Rico Planning Board, Census Office.

The policy for the implementation of Environmental Justice in Region 2 of the Federal Environmental Protection Agency (EPA), established that a homogeneous population such as Puerto Rico's is identified in its totality as a minority, wherefore an analysis by ethnic groups is not applicable and must be substituted by an analysis of socioeconomic groups and other factors (United States EPA Region 2 Draft Interim Policy on Identifying EJ Areas, June, 1999).

As the population of Puerto Rico is homogeneous, identified in its totality as a minority, we proceeded to measure the impact the project would have on other factors beyond

ethnicity. Among the factors considered were: geographical distribution, racial groups and socioeconomic groups. The socioeconomic factors considered were: gender, age, income, education, employment and housing. The condition for Puerto Rico was established for each one of the factors and it was compared with that of the 13 Municipalities where the construction will be made. From there, it was compared with the 48 specific wards through which it will cross, for the purpose of detecting if any of these areas would be disproportionately affected in any of the factors under consideration.

The following findings were made:

- Geographic distribution - The construction will be made in wards of diverse population density; fluctuating between 5.1 and 2,334.9 inhabitants per square kilometer. Even so, it does not represent a disproportionate burden because it will not require complete sectors or areas of a community to be moved or evicted. The mobilization or eviction of tenants or property owners of existing properties will be isolated. Ninety-one (91) structures or residences were observed within the maintenance right of way, which could be the equivalent of the relocation or compensation of some 263 persons. Addendum 5, Persons within the Maintenance Right of Way, gives an idea of the quantity of persons, by ward and municipality, which could be affected.
- Race - Homogeneity in the distribution of races was observed throughout the project's alignment, and a proportional relation is kept when the wards, the municipality and the island are compared. Only the Palo Seco community in the Palo Seco Ward of the Municipality of Toa Baja represents the black race, in percentage, in a greater proportion than that found in the other wards and municipalities. For this community, the analysis revealed that it is at a considerable distance from the project's area whereby it will not be adversely impacted. There will not be any expropriation of residences or land belonging to this group.
- Gender - The general pattern for Puerto Rico was maintained. The difference in the population by gender in the wards directly associated to the project, compared to that of the municipalities or with the totality of the island of Puerto Rico, is not significant wherefore the project will not have a disproportionate impact on any group in terms of gender.
- Age - The project will not have a disproportionate environmental impact on any group on account of age, or on the services or housing they require. The 18-65 years group will benefit temporarily, because close to 1,200 direct jobs will be created during the construction of the project and services will be used which will benefit these groups and create hundreds of indirect jobs.

- Income - Neither the median and per capita and family income, nor the poverty index will vary as a consequence of the project's construction and operation. The only impact will be on the working class, because close to 1,200 direct jobs will be created in the region, in addition to the indirect jobs, which will represent an increase in income. This increase, although positive, will be temporary, because the construction works will last approximately eleven months.
- Education - The population in areas where the project will be developed is in an average level similar to the rest of Puerto Rico. The schooling or education level attained by the population through which the pipeline will cross will not vary as a consequence of the project's construction and operation and there will not be any disproportionate impact on any group based on the classification of education.
- Employment - The project will not affect the employment and unemployment rates in Puerto Rico directly or indirectly. Nor will it affect the distribution of occupations of employed persons or of the classes of workers. The project's impact on the area will be a temporary increase in the labor force due to the direct and indirect jobs contemplated during the construction.
- Housing - The project will not affect the present housing availability in these municipalities during its construction or operation, because the majority of the land through which the pipeline will cross will not be residential but mostly in agricultural and industrial use, and part of the alignment will pass through government-owned land. In addition, there are housing developments in progress in the thirteen municipalities, which will increase the quantity of housing units in these areas, wherefore the project will not compromise the need for expansion in the housing area. As previously indicated, only 91 structures or residences were found within the maintenance right of way, which represented 0.08, 0.03 and 0.01% of the residences when compared with the total number of residences in the 48 wards through which the construction will be made, the 13 municipalities and the totality of the island, respectively.

We note that no group, based on the different classifications, will receive a disproportionate negative environmental impact on account of the project. Even so, the AEE will take the necessary measures to maintain the communities adjacent to the project and the population of the municipalities, informed of the project's scope, its impacts and benefits. This will be through a public education program developed by the AEE, which will comply with all the applicable state and federal regulations.

As part of this education program, the AEE will be in charge of preparing and

distributing all the necessary informative materials and will schedule meetings with the communities and other interested groups. In addition, the AEE is in communication with, and has presented the project to the mayors of the municipalities where the construction will be made and to the agencies called upon to ensure that projects of this magnitude do not create disproportionate burdens on particular groups.

G. Agencies consulted

Chapter 8 lists the municipalities and agencies consulted, state and federal, and to whom the Preliminary Environmental Impact Statement (in Spanish, Declaración de Impacto Ambiental Preliminar, or DIA-P) will be circulated. Addendum 4, Meetings with Agencies, summarizes the meetings held with them. The agencies to whom the document will be circulated are the following: Puerto Rico Aqueducts and Sewers Authority, Department of Transportation and Highways Authority, Public Lands Authority, Land Management Administration, Public Service Commission, Department of Natural and Environmental Resources, Institute of Puerto Rican Culture, Environmental Quality Board, Planning Board, Fire Department, Ports Authority, State's Historical Preservation Office, United States Corps of Engineers, US Fish and Wildlife Service, Environmental Protection Agency, National Marine Fisheries Service, Federal Highway Authority, and the Municipalities of Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón and Guaynabo.