



Infrastructure Master Plan Phase I for
Former Naval Station Roosevelt Roads, Ceiba, Puerto Rico

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1 Introduction

The re-development of the former “Naval Station Roosevelt Roads” (NSRR or Roosevelt Roads) in Ceiba and Naguabo, requires the planning for a proper infrastructure support. Because of its age and prior uses, the existing facilities at FNSRR won’t –at mid and long term- optimally satisfy the predicted demands as defined by the “” (the Reuse Plan).

After the United States Navy ceased military operations in Roosevelt Roads in 2004, the Government of Puerto Rico created the “Local Redevelopment Authority – Roosevelt Roads” (LRA) as the government agency authorized to promote the re-development at the former base. The LRA’s primary objectives for the 8,600-acre site include:

- to work with the private sector –in collaboration with the government- to provide incentives and tools needed to maximize the assets of this facility, its lush natural environment and to promote its conservation in a manner that will drive a robust economic development in the region;
- to enhance Puerto Rico as a premier eco-tourism, entertainment, commercial and recreational destination in the Caribbean; and
- to create jobs and spur economic development in the Eastern region and Puerto Rico as a whole.

The 2014 Development Zones Master Plan was prepared as a Reuse Plan to supplement and redirect the focus of the development to better leverage site opportunities, current market potentials and strategic economic development opportunities in order to temperate new economic and social conditions. It proposes a well-balanced mix of uses and intensities, leveraging on FNSRR’s privileged location, lush vegetation and unique physical assets (deep port, airport, marinas, etc.). It focuses on creating a world-class tourism destination for furthering regional economic development and job creation. After full build-up (in about 25 years), it is expected to create 21,000 jobs and bring \$280 million from the construction and \$600 million from the operation during the first 20-25 years. It will then support a mixed development of residential units, hotel rooms, combined lodging, retail, office and light industrial space.

The “2012 Roosevelt Roads Infrastructure Master Plan” was developed as a fundamental complement to the Reuse Plan and the Land Use Plan prepared by the PR Planning Board. It provided the guidelines and cost projections for the entire shared infrastructure and major utility components. It also included an assessment of the existing conditions based on data supplied by the former occupants as well as from technical reports prepared by numerous professionals since 2004.

Based on current redevelopment conditions, the LRA has the intention to provide initial infrastructure improvements for a portion of the development zones (Zones as established in the 2014 Development Zones Master Plan: A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, D1), in a 5 years period beginning in 2016 and completed at the end of year 2020.

This report incorporates current data as well as the data contained in the 2012 Infrastructure Master Plan and compares the assessed infrastructure components (transportation, water distribution, sanitary sewer, storm sewer, electric power utilities and telecommunications) against the proposed projects (as per the 2014 Development Zones Master Plan) and determines the capacity and adequacy of each system. It provides a list of recommendations for improvements or changes within all primary, shared utility corridors. It also incorporates development phases into its recommendations.

Being of a strategic nature, this Initial Infrastructure Improvements Plan impacts the principal infrastructure services, i.e. primary electrical lines, main roadways, water treatment facilities, primary water distribution and sewer lines. This assessment doesn't analyze or include the secondary infrastructure requirements within future public or private developments inside the zones parcels. Nonetheless, capacities and demands assume the development goals proposed within the 2014 Development Zones Master Plan for the whole redevelopment period.

In essence, the assessment concluded that:

- Given the age, most of the existing utility systems are obsolete and inefficient which will require major reinvestment to update/modernize.
- The overall roadway system is generally sufficient, providing good access to nearly all areas of the site; however current roadway conditions will require rebuilding due to age/lack of maintenance, widening for increased capacity and aesthetic improvements (streetscape, landscape, signage, etc) to meet the objectives of the Development Zones Master Plan.
- A biking trail network are not operational and virtually non-existent, requiring an entirely new plan to make accessible the various area of the site.
- Water production can be maintained by upgrading the existing water treatment plant and distribution system.
- Wastewater treatment shall be established inside the existing facilities.
- A reclaimed water system shall be implemented
- The telecommunication system is minimal and antiquated, requiring an entirely new system and delivery infrastructure to provide the site and area with modern phone, data communication service
- Much of the storm water management relies on a fairly unsophisticated system of swales, channels and culverts which will require both a comprehensive, site-wide strategy and development-specific approach when accommodating the demands of the full redevelopment.

Given this assessment, there is a unique opportunity to create new modern utility corridors in conjunction with roadway improvements that will serve the long-term demands and future expansion of the Roosevelt Roads redevelopment.

Roosevelt Roads can serve as a model "city" of sorts, utilizing the latest design, technologies and practices (sustainability, integrated design, etc.) to rebuild its infrastructure for the future.

A synopsis of the planned improvements within the development follows.

2 Development Zones

In 2014, the Local Redevelopment Authority (LRA) completed the Development Zones Master Plan, to serve as an update of the area's redevelopment efforts that better reflect current market changes and on-going economic development initiatives.

The Development Zones Master Plan should be read and understood as part of a group of prior studies and efforts that include prior reuse plans (2004 and 2010), environmental assessments, the 2012 Infrastructure Master Plan, among others. This document describes the distribution of uses among Roosevelt Roads' more than 3,400 acres of developable land.

The initial infrastructure improvements will be established along the following development zones: A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, D1.

From that Plan, a brief description of each development zone to be considered under the initial infrastructure improvements, is presented here:

2.1 Zone A: Forrestal Drive Corridor

2.1.1 A1 Waterfront District

The gross development area for this subzone is about 2,980,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 1 (Hospital, Ferry Terminal, International Cruise Terminal), 2 (Casino, Casino Hotel), 3 (Marina) and 8 (Golf Course - Par 3).

Promoted uses within Subzone A1 include:

- (i) Commercial Mixed Use. The Signature Mixed use Development is projected to be Roosevelt Roads' single largest development, absorbing the areas designated for the Casino and Casino Hotel in the 2010 Addendum. This anchor development –located on the waterfront areas between Pier 1 and Pier 3- might focus in either tourism or commercial purposes. Uses include hotel, retail, office, residential, entertainment, food service, research and development, institutional, among others.
- (ii) Healthcare. Hospital-related developments will complement the existing hospital facility (by others). This activity will be located on the hills adjacent to the existing hospital.
- (iii) Transportation. The proposed Ferry Terminal consists of a passenger terminal on Pier 2 with facilities for serving the passenger boat/ferry service to Vieques, Culebra and the US Virgin Islands.
- (iv) Marina. A full service, deep draft marina will be located between Piers 2 and 3. This activity will occupy waterfront and inland areas and may accommodate a small cruise ship terminal within its premises.
- (v) Park. An oceanfront golf / public park amenity will take up the former landfill and its waterfront surroundings. This activity may be “free-standing” or be part of the Signature Mixed-use Development. Also, a linear waterfront park will be required for the former cargo wharfs between Piers 1 and 3.

For this initial 5 years re-development period, it is contemplated that approximately a total of 633,750 square feet of all the indicated uses will be developed.

2.1.2 A2 Forrestal Bayview Hills

The gross development area for this subzone is about 1,270,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 1 (Hotel), 2 (Retail / Restaurant / Entertainment) and 3 (Retail / Restaurant / Entertainment, Residential).

Promoted uses within Subzone A2 include:

- (i) Hospitality. A hotel component consisting of small, ocean view inns will be integrated within the other activities in this subzone. These lodges might cater to the health-tourism, maritime and leisure industries.
- (ii) Commercial. The retail / restaurant / entertainment components from the 2010 Addendum will be relaxed to allow any (zoning-complying) commercial mix that aligns and complements the Signature Mixed Use Development adjacent to this subzone.
- (iii) Residential. Subzone A2 is appropriate for low rise, ocean-view, multifamily residential developments that cater to the health tourism, retirement communities and/or live-work settings.

For this initial 5 years re-development period, it is contemplated that approximately a total of 350,000 square feet of all the indicated uses will be developed.

2.1.3 A3 Municipal Marina

The gross development area for this subzone is about 305,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 1 (Marina, Retail / Restaurant / Entertainment) and 8 (Hotel).

Promoted uses within Subzone A3 include:

- (i) Marina. The existing small vessel marina will have area for boat storage growth (via dry stacks) as well as related support spaces. Additional mooring buoys can be installed near the marina's piers.
- (ii) Hospitality. The master plan envisions a small hotel component directly related to the marina.
- (iii) Commercial. A retail/office component will complement the marina by providing space for uses such as marine shops, engine repairs, boat ramp, fishing village, among others.

For this initial 5 years re-development period, it is contemplated that a commercial marina of 70 boat slips will be developed.

2.1.4 A4 Hospital Parcel

The gross development area for this subzone is about 150,000 sf. This subzone includes the former Hospital and its surrounding facilities (storage and utility buildings and parking lots).

Promoted uses within Subzone A4 include:

- (i) Hospital. Existing 36 bed hospital building to be refurbished for hospital or health care related uses.

For this initial 5 years re-development period, it is contemplated that the hospital will be refurbished and in operation.

2.2 Zone B: Industrial Clusters

2.2.1 B1 Waterfront Industrial

The gross development area for this subzone is about 230,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 1 (Industrial Back of House) and 3 (Office).

Promoted uses within Subzone B1 include:

- (i) Industrial. This waterfront area is being promoted as a boat repair/drydock area plus the industrial “Back of House” for Roosevelt Roads. Uses allowed must not produce heavy industrial emissions so as not to degrade the quality of the tourism, residential and commercial components nearby. This area has access to a deep port and is close to the Ceiba Ariport.
- (ii) Office. Administrative offices and small commercial spaces within this area will support the larger industrial operations located nearby.

For this initial 5 years re-development period, it is contemplated that a commercial vessel repair facility on the existing drydock, (Astivenca) will be developed.

2.2.2 B2 Fuel Terminal

The gross development area for this subzone is about 50,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zone 8 (Industrial).

Promoted uses within Subzone B2 include:

- (i) Industrial. The fuel terminal includes storage tanks, oil pipes, fuel mixing mechanisms, laboratories, administrative / employee office spaces and mechanical / electrical support spaces. There is additional land within this zone to allow for the expansion of fuel storage operations.

For this initial 5 years re-development period, it is contemplated that the laboratory facility and pump station will be developed.

2.2.3 B3 Light Industrial Support

The gross development area for this subzone is about 250,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 7 (Industrial Back of House) and 8 (Office).

Promoted uses within Subzone B3 include:

- (i) Office. Administrative offices and small commercial spaces within this area will support the larger industrial operations located nearby.
- (ii) Industrial. This zone is designated as a space for light industrial operations, particularly to support other areas within Roosevelt Roads (marine, healthcare, fuel storage, airfield, R&D, etc.)

For this initial 5 years re-development period, it is contemplated that that approximately a total of 6,000 square feet of all the indicated uses will be developed (facility and pump station).

2.2.4 B4 Water Treatment Plant

The gross development area for this subzone is about 10,000 sf.

Promoted uses within Subzone B4 include:

- (i) Infrastructure Support. This area contains the potable water treatment plant and main crude water reservoir. It will remain zoned for this same use.

For this initial 5 years re-development period, it is contemplated that that the water treatment plant will be improved and in operation.

2.3 Zone C: Green Belt

2.3.1 C1 Marsh Vista

The gross development area for this subzone is about 315,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 4 (Golf Course and Clubhouse, Residential) and 8 (Retail / Restaurant / Entertainment).

Promoted uses within Subzone C1 include:

- (i) Golf. An 18-hole sustainably maintained golf course could be inserted in this area with careful consideration of protecting the marsh from pesticides and other related chemicals.
- (ii) Residential. Single family, detached housing with a focus on sustainability will be promoted within these hills overlooking the mangroves and Piñeros Island. Ocean, marsh and golf views are main attractions of this zone.
- (iii) Commercial. Small retail, food service and entertainment activities will complement and support the golf and residential components.

For this initial 5 years re-development period, it is contemplated that approximately a total of 78,750 square feet of all the indicated uses will be developed.

2.3.2 C2 Punta Puerca

The gross development area for this subzone is about 830,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 3 (Hotels, Visitor's Center, Museum, Water Taxi) and 8 (Residential Villas).

Promoted uses within Subzone C2 include:

- (i) Hospitality. Eco-lodging is the main activity within Punta Puerca. One or more ecological hospitality projects (upscale and/or entry level) can occur within this peninsula that overlooks the waterfront, Vieques and Piñeros Islands.
- (ii) Institutional. Supplementing the ecological hotels, a research component focused on the Yunque rainforest and the marine habitats nearby are recommended for this subzone.
- (iii) Transportation. A small water taxi terminal will be promoted for this region, interconnecting Punta Puerca with the waterfront and with other destinations such as Piñeros Island and the Ceiba Ensanche.
- (iv) Residential. The residential component within Punta Puerca will be promoted as an ecological vacation housing case study. This subzone can also host a small retirement community focused on respecting its natural setting.

For this initial 5 years re-development period, it is contemplated that approximately a total of 83,000 square feet of all the indicated uses will be developed in addition to a 50 room eco-lodge.

2.4 Zones D: Langley Drive Corridor

2.4.1 D1 Langley Urban Strip

The gross development area for this subzone is about 1,895,000 sf. This subzone groups and reprograms activities from the 2010 Addendum within zones 6 (Retail) and 7 (Retail / Restaurant / Entertainment, part of the Residential component, Hotel).

Promoted uses within Subzone D1 include:

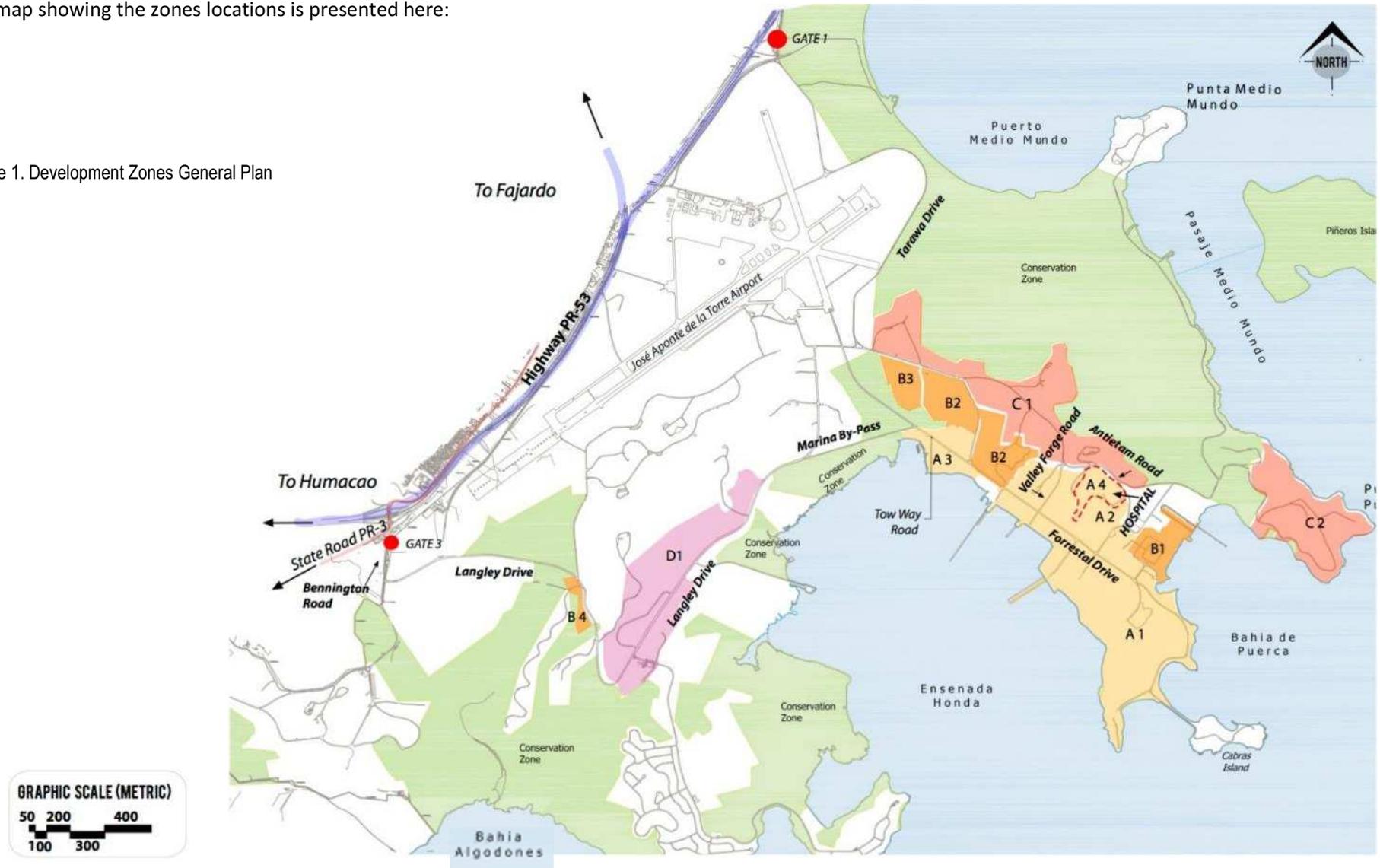
- (i) Commercial. The existing buildings that housed the Navy Exchange and commissary will anchor the subzone's retail component. Infill retail and food service buildings will be strategically planned for this strip of road. Other commercial uses include entertainment (bowling, game rooms) and foodservice (restaurants, supermarket, fast food).
- (ii) Residential. This area has zones where low-rise multifamily housing is desirable. The market for these communities can be directed towards the area's working families, retired couples and short-term rentals.
- (iii) Hospitality. The former Navy Lodge will be the anchor of the hospitality component within Langley Drive. This area can serve business travelers, budget-oriented travelers and general tourism.

For this initial 5 years re-development period, it is contemplated that approximately a total of 473,750 square feet of all the indicated uses will be developed in addition to a 100 room hotel-lodge.

2.5 Development Zones Map

The map showing the zones locations is presented here:

Figure 1. Development Zones General Plan



3 Road Network Infrastructure

Roosevelt Roads is composed of a network of approximately 110 miles (177 kilometers) of main and secondary roads, avenues and local streets. There is road access to practically all the components on the premises. A vast majority of the roads were established on the 1940's during the initial Base development.

Almost all of the existing roads on the Base are asphalt paved, two-lane (one on each direction), roads without curbs and gutters, and with minimal lighting.

The Base was originally accessible through four gates, with direct access to State Road PR-53. During the last years of operation as a Naval Base, only two main gates were operational, Gate 1 at the north portion and Gate 3 at the southwest portion. There is another access, Gate 4 that can be rehabilitated as needed.

The majority of the proposed new developments described on the 2014 Development Zones Master Plan are being contemplated along existing road corridors. Hence the stance of the Infrastructure Master Plan is to minimize new road developments and maximize the re-use potential of the existing corridors that comprise the road network in the premises and utilize the existing road corridors for the location of the new or upgraded utilities to allow for a rapid development in the short term.

Five types of road sections (I , II, III, IV and V) have been defined and will be implemented along the existing road corridors accordingly.

3.1 Gate 1 Access

The existing Gate 1 access will be improved in order to improve incoming and outgoing traffic from State Road PR-3.

Currently there is a minimum easement of 15.00 meters through this road. The existing road has a width of 7.30 meters that includes two 3.65 m lanes. At the current location of the access guardhouse there is a variable width of up to 22.00 meters. It is proposed to maintain this easement.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified and re-asphalted
- Demolition of existing guardhouse
- Construction of new access control guardhouse at the same location
- New entrance landscaping

3.2 Gate 3 Access and Bennington Road

The existing Gate 3 access will be re-opened and improved in order to accommodate incoming and outgoing traffic from State Roads PR-53 and PR-3.

Currently there is a minimum easement of 15.00 meters through this road. The existing road has a width of 7.30 meters that includes two 3.65 m lanes. At the current location of the access guardhouse there is a variable width of up to 22.00 meters.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified and re-asphalted
- Minor lanes widening
- New traffic marking and signage
- New road lighting
- Demolition of existing guardhouse
- Construction of new access control guardhouse at the same location
- New entrance landscaping

It is proposed to maintain this easement, but there will be a need to create a pedestrian path and a bike lane/path.

During this stage of the total re-development the existing two lanes can handle traffic flows. The proposed section shall be a Road Section Type “I”, this will maintain a two lane (3.65 m each) undivided road width with auxiliary shoulders (3.00 m each), and a sidewalk on one side. One of the shoulders will be a used as a combined as a bike lane.

3.3 Langley Drive from Bennington Road to Zone D1

The existing road width of 13.00 meters includes two 3.50 m lanes and two 3.00 m. shoulders.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

This access road will need improvements. A new proposed road section Type “I” will be implemented. This road portion will maintain a two lane undivided road.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified, and re-asphalted
- Minor lane widening on both sides
- New traffic marking and signage
- New road lighting
- New landscaping

3.4 Langley Drive along Zone D1 and up to Marina By-Pass Road

Currently there is a minimum easement of 30.00 meters through this road. The existing road width of 20.00 meters includes four 3.50 m lanes and two 3.00 m. shoulders.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

This access road will need improvements. A new proposed road section Type "II" with a total width of 30.00 meters will be implemented. This road portion will maintain a full section of four lanes of 3.50 m each (two on each direction) plus two additional parking lanes of 2.50 m each (one on each direction) On a future phase, sidewalks, plantings and a new bike lane will be implemented.

This road section provides the facilities for pedestrian traffic in an urban setting as well as landscaping on wide planting sections. In addition taking in account a service drop-off or parking lane on each side to provide support for commercial activities.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

New at grade intersection with traffic lights shall be implemented along the route, especially at proposed development intersections.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified, and re-asphalted
- Lanes widening
- New traffic marking and signage
- New road lighting
- New landscaping

3.5 Marina By-Pass Road

Currently there is a minimum easement of 15.00 meters through this road. The existing road width of 7.30 meters includes two 3.65 m lanes.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. This road portion has traffic weight limitations due to poor subsurface conditions.

This access road will need improvements. A new proposed road section Type "III" with a total width of 15.00 meters will be implemented. This road portion will be upgraded to a full section of four lanes of 3.50 m each (two on each direction) plus one 1.00 m shoulder on one side. On a future phase, sidewalks, plantings and a new bike lane will be implemented.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified, and re-asphalted
- Lanes widening
- New traffic marking and signage
- New road lighting
- New landscaping

3.6 Tow Way Road from Marina By-Pass up to Forrestal Drive

Currently there is a minimum easement of 18.00 meters through this road. The existing road width of 11.00 meters includes two 5.50 m lanes.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

This road portion will need major improvements in order to satisfy the expected traffic flows in an urban setting and context.

A new proposed road section Type “IV” will be implemented. This road portion will be widened to a full section of four lanes (two on each direction), with a total width of 18.00 meters. This road portion will maintain a full section of four lanes of 3.50 m each (two on each direction), and a planting median. On a future phase, sidewalks will be implemented.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

New “Tee” type at grade intersection with traffic lights shall be implemented along the route, especially at the intersection with Forrestal Drive.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified, and re-asphalted
- Lanes widening
- New traffic marking and signage
- New road lighting
- New landscaping

3.7 Forrestal Drive from Tow Way Road up to Forrestal WWTP Access

Currently there is a variable easement between 15.00 and 18.00 meters through this road. The existing road width is also variable from 7.00 m (one lane on each direction) to 10.00 m (two lanes in one direction and one lane in the other direction).

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

This road portion will need major improvements in order to satisfy the expected traffic flows in an urban setting and context.

A new proposed road section Type "IV" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction), with a total width of 18.00 meters. This road portion will maintain a full section of four lanes of 3.50 m each (two on each direction), and a planting median. On a future phase, sidewalks will be implemented.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

New "Tee" type at grade intersection with traffic lights shall be implemented along the route, especially at the intersection with Forrestal Drive.

The major improvements to be considered for this initial 5 years re-development period are:

- The pavement surface shall be scarified, and re-asphalted
- Lanes widening
- New traffic marking and signage
- New road lighting
- New landscaping

3.8 Bike Lanes & Pedestrian Paths

There are minimum facilities for pedestrian or bicycle traffic on the Base premises. The only pedestrian facilities are sidewalks portions mostly on the Capehart residential areas and around school zones. There are few pedestrian crossings, and the available are located on some intersections and school zones.

There are no bicycle paths on any of the road portions, nor there are curbs or shoulder dividers for cyclist protection.

Additional future road improvements will consider the development of pedestrian paths and bike lanes. On non-urban sections, a separate bike path is proposed along conservation zones, thus creating scenic paths on natural settings. On urban areas, bike lanes are incorporated along pedestrian paths and combined shoulders. **The mentioned improvements are not considered for this initial 5 years re-development.**

3.9 Roads Improvement Sections and Map

The proposed road sections (I, II, III and IV) are presented here:

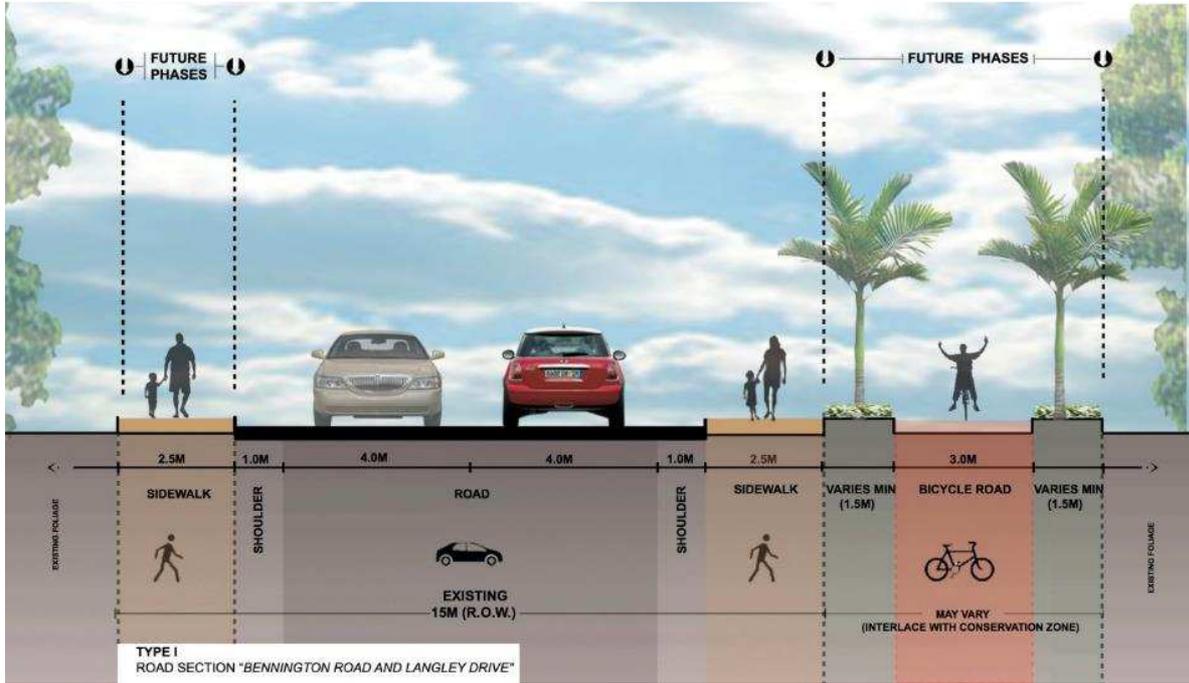


Figure 2. Section Type I

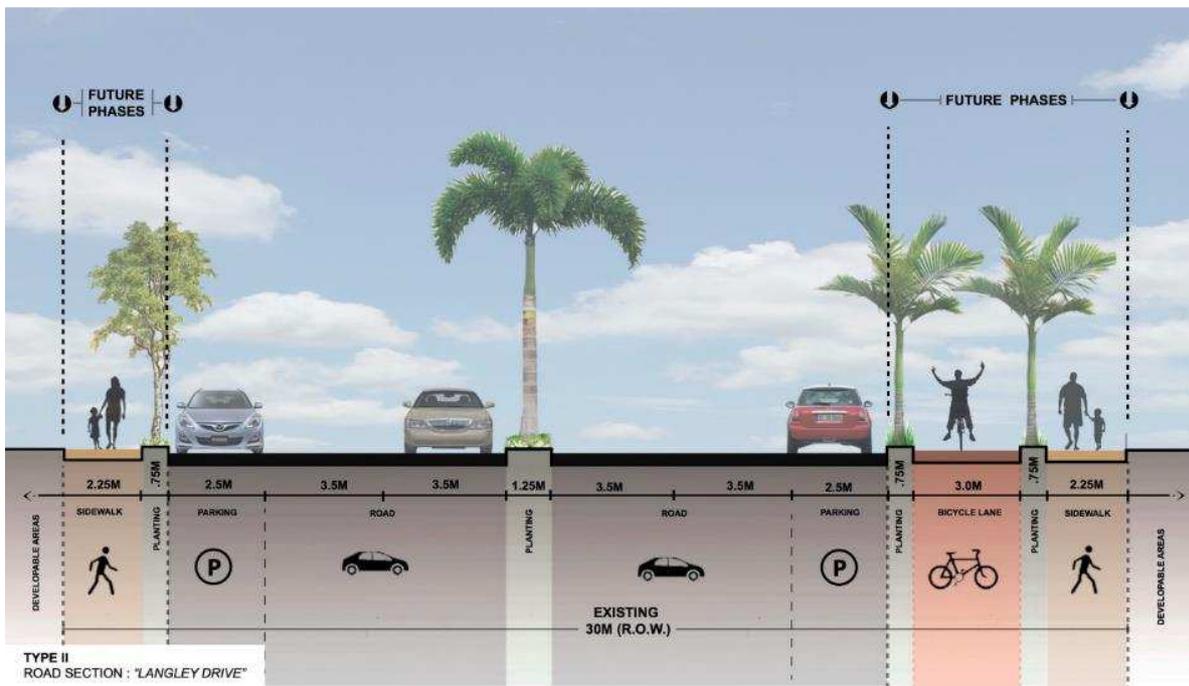


Figure 3. Section Type II

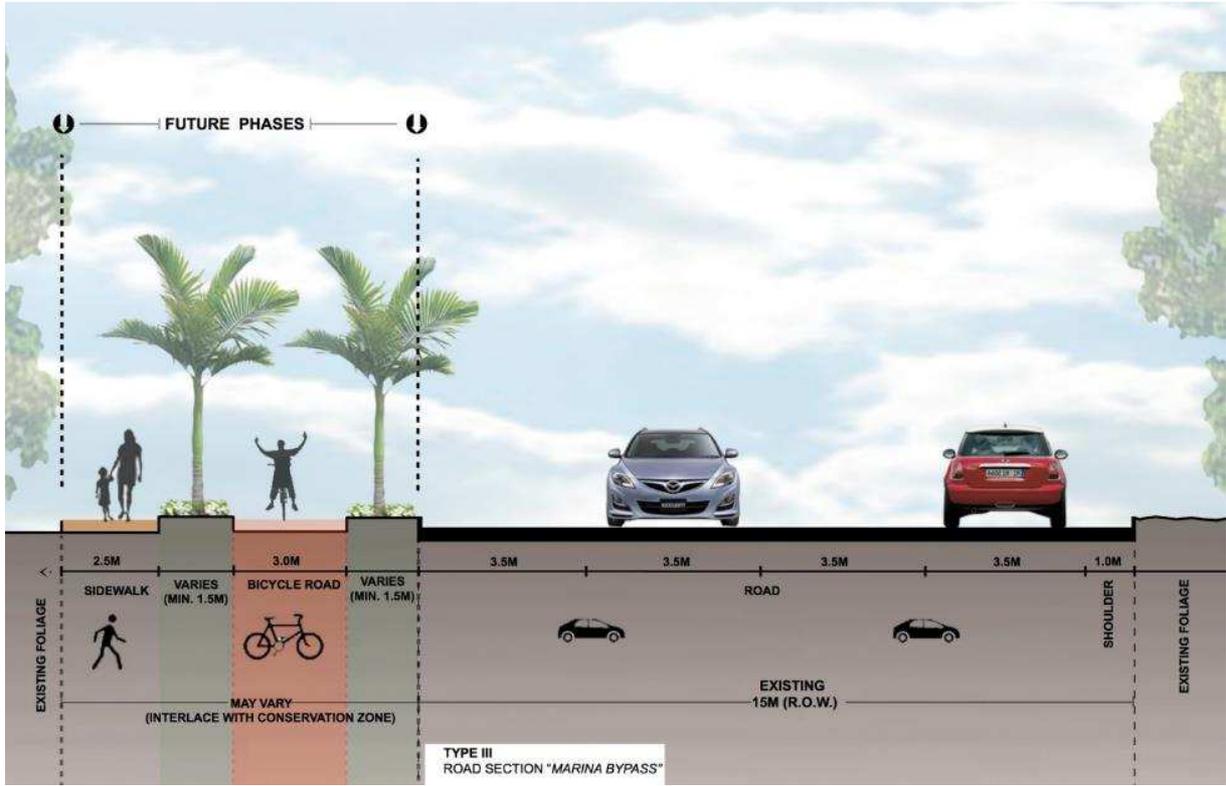


Figure 4. Section Type III

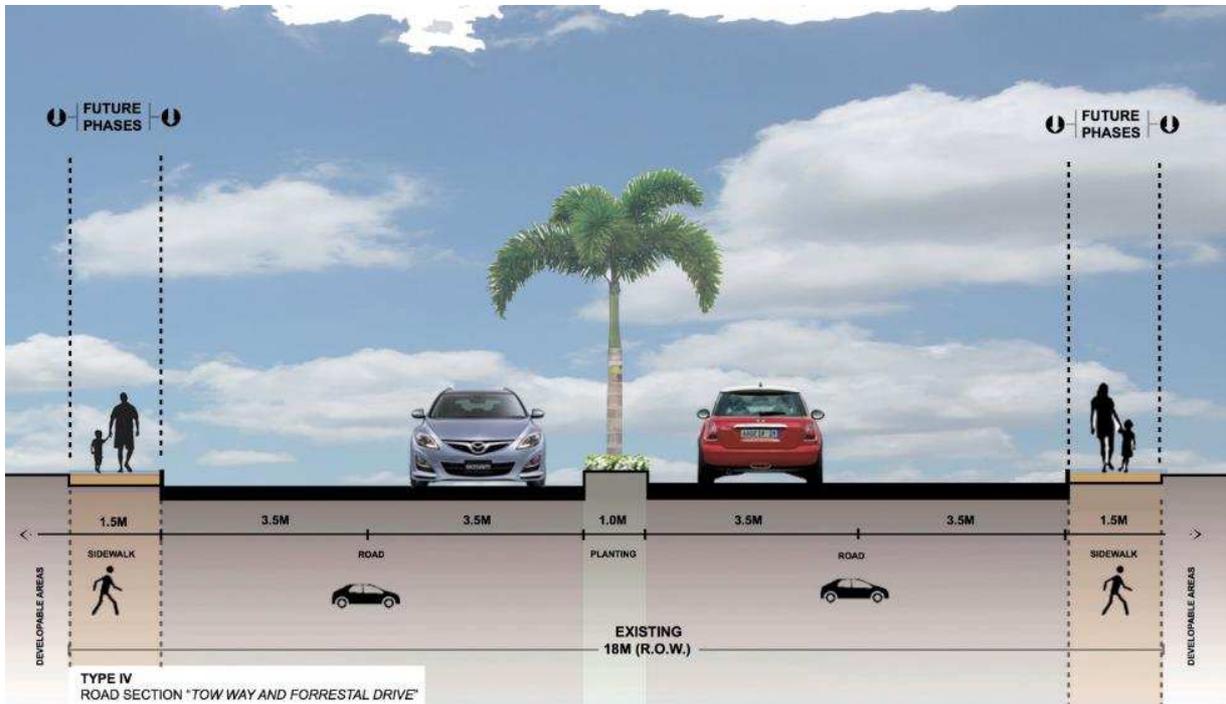
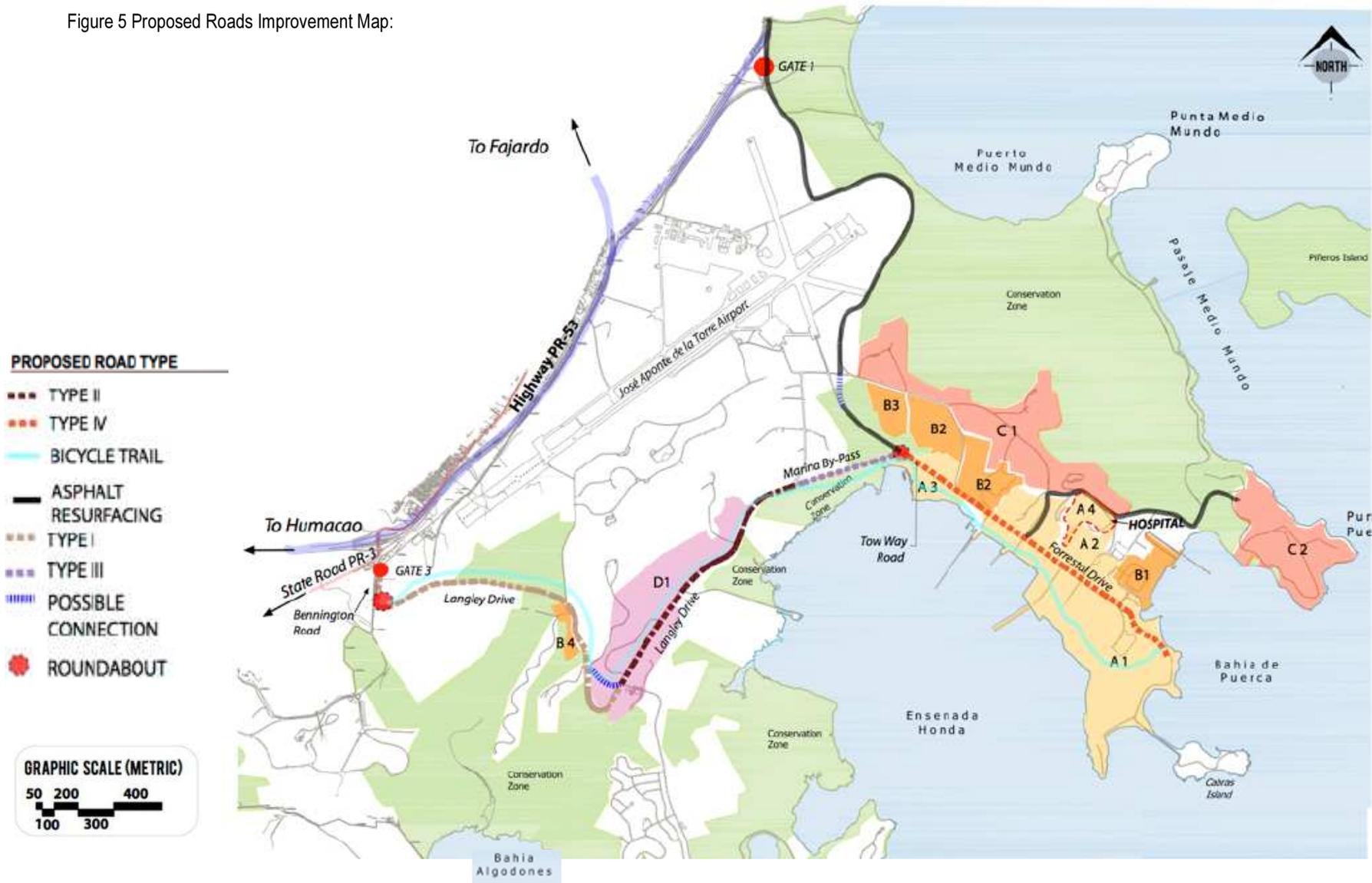


Figure 5. Section Type IV

The general map showing the road improvements locations is presented here:

Figure 5 Proposed Roads Improvement Map:



4 Potable Water Production and Distribution Infrastructure

4.1 General Water System

Currently the only potable water source for the Base is the product of the Water Treatment Plant (WTP), located inside the premises. The raw water supply for this WTP is received from the Rio Blanco River, located at approximately 11 miles southwest at the Municipality of Naguabo. The raw water is conveyed by gravity through a 27 inch diameter reinforced concrete pipe, up to a reservoir and then is conveyed either by gravity or by a booster pump system to the adjacent WTP.

After water is treated at the WTP, it is distributed through a network of pipes, tanks and booster stations all around the Base. This will be accomplished as a private utility provider, independent of the Puerto Rico Aqueduct and Sewer Authority (PRASA) system.

It is proposed to maintain the current water production system but major improvements are needed. The proposed water system improvements are as follows:

4.2 Raw Water Intake and Transport

The condition of raw water intake at the Rio Blanco River and of the 27" \emptyset raw water pipe need to be evaluated.

A survey must be performed in order to determine the exact location and existing easements of the existing raw water pipeline.

It is proposed to perform a CCTV video pipe inspection thru the pipeline length. This evaluation will determine the pipeline conditions, and improvements can be established.

The raw water pipeline will be rehabilitated by lining the walls with a hardened synthetic fiber tube or a similar technology in order to minimize existing or future infiltration/exfiltration problems.

The mentioned improvements are not considered for this initial 5 years re-development.

4.3 Water Treatment

This project proposes the rehabilitation of the Roosevelt Roads Naval Station Water Treatment (Filtration) Plant. The WTP provide treatment by means of rapid mixing and flocculation chamber, settling tanks, dual media filtration and chlorination. The rehabilitation considers retrofitting of existing units and improvements of several components of the WTP in order to have a fully automatically and efficient production.

Based on current conditions the proposed project consider improvements to the following:

1. Raw Water Intake and Bar Screen
2. Raw Water Screen Channel & Reservoir
3. Raw Water Tank (Tacan- 1,500,000 gallons)
4. Filtration Plant Units
5. Process Control Instrumentation
6. Chlorine System
7. Laboratory Equipment
8. Pump System
9. Sludge Lagoon

4.4 Water Distribution System

It is proposed to repair, replace and install new main distribution pipelines along the existing road corridors on Langley Drive, Marina By-Pass, Tow Way Road and Forrestal Drive. The existing main pipelines on those corridors will be abandoned or removed as needed.

The following works are contemplated:

- A combination of repairs and new installation of 14" Ø PVC main line will begin at the Potable Water Treatment Plant and will continue up to the location of the Tacan Storage Tank.
- Another 12" Ø PVC main line will begin also at the junction with the WTP and will continue along Langley Drive up to the intersection on Bennington Road on the west, in order to provide a connection for the future developments on that area.
- Two new 12" Ø PVC lines will be installed from Langley Drive up to the Tacan tank connection, one for tank filling and another for distribution.
- A combination of repairs and new installation of 12" Ø PVC main line will continue from the Tacan tank connection point and along Langley Drive and thru Marina By Pass and Tow Way Road and continues through Forrestal Drive up to Barnes Street on Zone A2.
- A combination of repairs and new installation of 8" Ø PVC main line on Valley Forge Road and continuing thru Antietam Road to serve the proposed Hospital.
- A new 6" and 4" Ø PVC lines on Antietam Road and thru the existing access road to Zone C2.
- A combination of repairs and new installation of 10" Ø PVC main on Langley Road from intersection of Barnes Street up to Forrestal WWTP Access Road.
- A new 6" Ø line up to the future cruise ship/ ferry terminal on Pier 3 and Bulkheads "C" and "D".

- A new 6" Ø line up to the future industrial area on the existing Drydock.
- A combination of repairs and new installation of 8" Ø line up to the Armed Forces Reserve Facilities.
- A new 4" Ø line up to Forrestal WWTP.

All the existing secondary or service branches that serve the existing or proposed facilities shall remain connected but to the new water mains.

The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

All existing fire hydrants and pressure regulators along the proposed road corridors shall be removed and new ones installed due to the proposed widening of the road sections.

The existing treated water storage tank (TACAN), will be also rehabilitated as follows:

- New interior and exterior coatings
- Replacement on valves and fittings
- Installation on remote control system.

It will be the responsibility of individual developers to provide the adequate distribution systems on their respective developments, and to provide a connection to the new main lines to be installed.

4.5 Water Demands Table

All the proposed improvements are based on the current and future water demands for each zone under development as shown on the following table.

Table 1. Water Demands Table

POTABLE WATER DEMAND FOR CURRENT & PROPOSED TENANTS AT ROOSEVELT ROADS - YEARS 2015-2020
for Zones A1, A2, A3, A4, B1, B2, B3, B4, C2 and D1

Parcel Zone	Name	Condition	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Use Rate per Day	Water Demand (GPD)		
YEARS 2015-2016															
B4	Water Treatment Plant	Existing Facilities	Potable Water Treatment Plant	3,800								300 gallons/1,000 sq. ft.	1,140		
D1		Existing Facilities	CROEC Educational Facilities (Former Elementary School) - Includes classrooms, library, school administration, cafeteria, gym, showers and basketball court, bedroom areas.	67,368					250			100 gallons/student	25,000		
A3	Commercial Marina	Proposed Facilities	Marina	5,000						70		30 gallons/boat slip	2,100		
B1	Waterfront Industrial		Astivenca (shipyard)	180,000								Given flow info	10,000		
A1	Waterfront District		Ferry Terminal New Building (or alternative to use Building 2351)	5900							400		5 gallons/visitor	2,000	
A4	Hospital		All Hands Public Beach (Restrooms and Concession) 4 plumbing fixtures	500									350 gallons/plumbing fixture	1,400	
B2	Fuel Terminal		Hospital (1790)	130,000		100							350 gallons/bed	35,000	
A2	Forrestal Bayview Hills		Tank Farm Building 192 Laboratory	4,923									300 gallons/1,000 sq. ft.	1,477	
			Tank Farm Building 1982 Pump Station	1,000									300 gallons/1,000 sq. ft.	300	
			Community Use (Building 1715)	1,600										300 gallons/1,000 sq. ft.	480
			Community Use (Building 2036)	1,525										300 gallons/1,000 sq. ft.	458
			Community Use (Building 2036A)	1,680										300 gallons/1,000 sq. ft.	504
		Community Use (Building 371)	5,100										300 gallons/1,000 sq. ft.	1,530	
		Community Use (Building 3109)	4,000										300 gallons/1,000 sq. ft.	1,200	
		Community Use (Building 3091)	4,000										300 gallons/1,000 sq. ft.	1,200	
A1		Existing Facilities	National Guard Boat Ramp (2301)	9,500								300 gallons/1,000 sq. ft.	2,850		
			Homeland Security Boat Ramp + Proposed. Customs-Border Patrol Building (2217)	2,500									300 gallons/1,000 sq. ft.	750	
B1			Armed Forces Reserve Center (29, B2468, B2469, B2-B5, B4)	72,000								Given flow info	1,500		
A3	Commercial Marina		DRNA Office (2334)	2,000								300 gallons/1,000 sq. ft.	600		
A2	Forrestal Bayview Hills		LRA Office (1205)	2,500								300 gallons/1,000 sq. ft.	750		
			Zone Total	520,136								Zone Total =	94,810		
ADDITIONAL THROUGH YEARS 2016-2020															
A1	Waterfront District		Proposed Facilities	Mixed-use Development	633,750								300 gallons/1,000 sq. ft.	190,125	
A2	Forrestal Bayview Hills		Proposed Facilities	Mixed-use Development	350,000								300 gallons/1,000 sq. ft.	105,000	
B3	Light Industrial		Proposed Facilities	Light Industrial	60,000								300 gallons/1,000 sq. ft.	18,000	
C1	Marsh Vista	Proposed Facilities	Eco-Housing- retail	78,750								300 gallons/1,000 sq. ft.	23,625		
C2	Punta Puerca	Proposed Facilities	Visitors Center, research	83,000								300 gallons/1,000 sq. ft.	24,900		
			Eco-Lodging				50					400 gallons/room	20,000		
D1	Langley Urban Strip	Proposed Facilities	Mixed-use Development	473,750								300 gallons/1,000 sq. ft.	142,125		
			Hotel-Lodge				100					700 gallons/room	70,000		
			Zone Total	1,679,250								Zone Total =	593,775		
												TOTAL WATER DEMAND (GPD)	688,585		

4.6 Water Improvements Map

The general map showing the water system improvements locations is presented here:

Figure 6. Proposed Water System Improvements Map



5 Wastewater Collection and Treatment Infrastructure

The wastewater collection system at Roosevelt Roads is composed of a series of gravity lines, lift stations, force lines and three wastewater treatment plants. About 90% of the occupied and developed portions of the Base were serviced by means of the wastewater collection system. All the systems are independent the Puerto Rico Aqueduct and Sewer Authority (PRASA) services. Currently all lift stations and wastewater treatment plants are non-operational.

By a combination of improvements to the existing system and the provision of new pipelines, lift stations, connections, and the establishing of a new wastewater treatment plant at the current location of the Forrestal WWTP, the future demands can be satisfied. This will be accomplished as a private utility provider, independent of the Puerto Rico Aqueduct and Sewer Authority (PRASA) system.

The proposed sanitary sewer system improvements are as follows:

5.1 Gravity Collection System

From the initial analysis the main findings are:

- Most of the existing gravity sewer lines are non-compliant with PRASA regulations regarding minimum slopes and maximum distance between manholes.
- Existing manholes do not comply with safety regulations regarding location and cover protection.
- Some segments do not have the adequate capacity to handle the proposed development future flows.

Based on those findings it is recommended that all the main gravity sewer lines located on the principal road corridors be substituted with a new sewer collection system.

The new systems will be located along the main roads corridors or their respective right of ways, and shall be designed in according with current PRASA regulations.

The following works are contemplated:

- A new 10" Ø PVC main line on Langley Drive along Zone D1 and up to Lift station 1971.
- A new 10" Ø PVC main line on Langley Drive along Zone D1 and up to Lift station 2382.
- A new 15" Ø PVC main line along Forrestal Drive from the boat Marina to Lift Station 39.
- A new 18" Ø PVC main line along Forrestal Drive from the Lift Station 39 up to Forrestal WWTP.
- A new 10" Ø PVC main line from the future cruise ship/ ferry terminal on Pier 3 and Bulkheads "C" and "D".
- A new 10" Ø line from the future industrial area on the existing Drydock.
- A new 10" Ø line up to the Armed Forces Reserve Facilities.

It will be the responsibility of individual developers to provide the adequate collection systems on their respective developments, and to provide a connection either by gravity or by force lines, to the new main lines to be installed.

5.2 Lift Station and Forceline Systems

From the initial analysis the main findings for the Lift Stations 1971, 2382 and 39 Lift Stations systems are:

- Leaking or broken pumps
- Electrical panels with interior debris and corrosion
- Telemetry and alarm systems out of service
- Outdated automatic control systems
- Emergency Generators without battery systems
- Dry pit sump pump systems missing
- Vault doors corroded and non-working
- Buffer zone non compliance
- No trolley hoists for pumps servicing or removal
- Non Compliance with parcel dimensions and safety equipment required by PRASA Regulations

Based on those findings it is recommended that all the forceline sewer lines located on the principal road corridors be substituted with a new system.

The new systems will be located along the main roads corridors or their respective right of ways, and shall be designed in according with current PRASA regulations.

The following works are contemplated:

- A new 4" Ø PVC forceline on Langley Drive along Zone D1 and from Lift station 1971 up to the new proposed gravity sewer system on the same drive.
- A new 6" Ø PVC forceline from Lift Station 2382 along Langley Drive, Marina By-Pass, Tow Way Road and Forrestal Drive up to Lift station 39.
- A new 12" Ø PVC forceline from Lift Station 39 and up to the new proposed 18" Ø gravity sewer system on Forrestal Drive.
- Rehabilitation and expansion of Lift Stations 39, 1971 and 2382.

5.3 Forrestal Wastewater Treatment Plant

It is proposed to operate a wastewater treatment system at the current location of the Forrestal WWTP. The refurbishing and operation of the existing facilities would require a very high investment and will not provide the latest technology for an efficient treatment.

Based on the current wastewater production of approximately 100,000 gpd and a full development production of approximately 2 MGD on the zone to be developed for this project, it is proposed to establish a two-phase strategy.

Based on the above exposed, it is recommended to be design and construct a new advanced treatment wastewater treatment plant to constructed in two phases. The first one will have a capacity of 1 MGD and the second one a 100% expansion, which will provide a total of 2 MGD of treatment capacity during average flows and a hydraulic peak flow of 3 MGD.

The Forrestal WWTP development phases are considered as follows:

5.3.1 Phase A

Description

Phase A considers the construction of a new WWTP and demolition of the existing Forrestal WWTP. The proposed capacity for the new plant will be of 1 million gallons per day (MGD), considering a future expansion of an additional 1 million gallons per day (MGD). The new WWTP provides wastewater treatment by means of several pretreatment unit, biological treatment, and disinfection after which a portion of the treated wastewater will be reused for irrigation, cooling, between other uses.

5.3.2 Phase B

Description

Phase B improvements are not considered for this initial 5 years re-development.

Phase B consists the expansion of the new WWTP to 2.0 MGD. Proposed expansion considers the addition of the following units:

1. Biological Reactors (2)
2. Secondary Clarifier (2)
3. Choline Contact Chamber (2)

Treated wastewater might be used for irrigation, cooling, between other uses and solids will produce power and at the end will be composted with yard and food wastes.

Solids generated as the result of the treatment of wastewater might be digested and mixed with yard and food wastes to produce energy and reduce the costs associated with tip-in fees in landfills. Once energy is recovered through anaerobic digestion a second process of composting will complete the reuse cycle. Produced compost will be used for green areas conditioning, reducing the need of chemical fertilizers. An additional aspect to evaluate is the installation of a methane collection system to the former Roosevelt Roads Landfill. A detailed study shall be performed to determine feasibility.

5.4 Wastewater Production Table

All the proposed improvements are based on the current and future wastewater production for each zone under development as shown on the following table.

Table 2. Wastewater Production Table

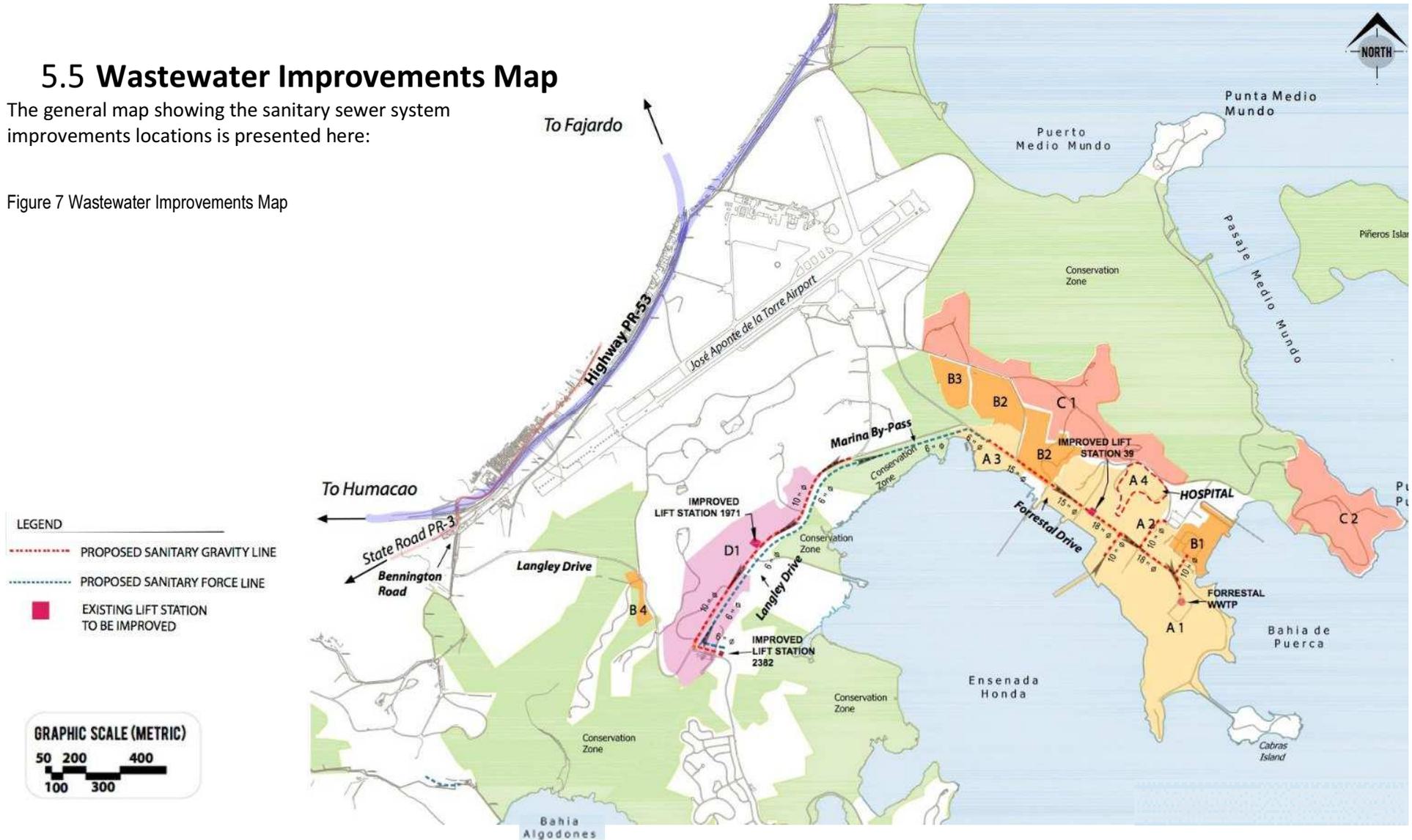
WASTEWATER PRODUCTION FOR CURRENT & PROPOSED TENANTS AT ROOSEVELT ROADS - YEARS 2015-2020
for Zones A1, A2, A3, A4, B1, B2, B3, B4, C2 and D1

Parcel Zone	Name	Condition	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Use Rate per Day	Wastewater Demand (GPD) 75% of Potable Water Demand	
YEARS 2015-2016														
B4	Water Treatment Plant	Existing Facilities	Potable Water Treatment Plant	3,800								300 gallons/1,000 sq. ft.	855	
D1		Existing Facilities	CROEC Educational Facilities (Former Elementary School) - Includes classrooms, library, school administration, cafeteria, gym, showers and basketball court, bedroom areas.	67,368					250			100 gallons/student	18,750	
A3	Commercial Marina	Proposed Facilities	Marina	5,000						70		30 gallons/boat slip	1,575	
B1	Waterfront Industrial		Astivenca (shipyard)	180,000								Given flow info	7,500	
A1	Waterfront District		Ferry Terminal New Building (or alternative to use Building 2351)	5900							400	5 gallons/visitor	1,500	
A4	Hospital		All Hands Public Beach (Restrooms and Concession) 4 plumbing fixtures	500								350 gallons/plumbing fixture	1,050	
B2	Fuel Terminal		Hospital (1790)	130,000		100						350 gallons/bed	26,250	
A2	Forrestal Bayview Hills		Tank Farm Building 192 Laboratory	4,923									300 gallons/1,000 sq. ft.	1,108
			Tank Farm Building 1982 Pump Station	1,000									300 gallons/1,000 sq. ft.	225
			Community Use (Building 1715)	1,600									300 gallons/1,000 sq. ft.	360
			Community Use (Building 2036)	1,525									300 gallons/1,000 sq. ft.	343
			Community Use (Building 2036A)	1,680									300 gallons/1,000 sq. ft.	378
		Community Use (Building 371)	5,100									300 gallons/1,000 sq. ft.	1,148	
		Community Use (Building 3109)	4,000									300 gallons/1,000 sq. ft.	900	
		Community Use (Building 3091)	4,000									300 gallons/1,000 sq. ft.	900	
A1		Existing Facilities	National Guard Boat Ramp (2301)	9,500								300 gallons/1,000 sq. ft.	2,138	
			Homeland Security Boat Ramp + Proposed. Customs-Border Patrol Building (2217)	2,500									300 gallons/1,000 sq. ft.	563
			Armed Forces Reserve Center (29, B2468, B2469, B2-B5, B4)	72,000									Given flow info	1500*.75
			A3	Commercial Marina	DRNA Office (2334)	2,000								300 gallons/1,000 sq. ft.
A2	Forrestal Bayview Hills	LRA Office (1205)	2,500								300 gallons/1,000 sq. ft.	563		
Zone Total				520,136								Zone Total =	69,983	
ADDITIONAL THROUGH YEARS 2016-2020														
A1	Waterfront District	Proposed Facilities	Mixed-use Development	633,750								300 gallons/1,000 sq. ft.	142,594	
A2	Forrestal Bayview Hills	Proposed Facilities	Mixed-use Development	350,000								300 gallons/1,000 sq. ft.	78,750	
B3	Light Industrial	Proposed Facilities	Light Industrial	60,000								300 gallons/1,000 sq. ft.	13,500	
C1	Marsh Vista	Proposed Facilities	Eco-Housing- retail	78,750								300 gallons/1,000 sq. ft.	17,719	
C2	Punta Puerca	Proposed Facilities	Visitors Center, research	83,000								300 gallons/1,000 sq. ft.	18,675	
			Eco-Lodging				50					400 gallons/room	15,000	
D1	Langley Urban Strip	Proposed Facilities	Mixed-use Development	473,750								300 gallons/1,000 sq. ft.	106,594	
			Hotel-Lodge				100						700 gallons/room	52,500
Zone Total				1,679,250								Zone Total =	445,331	
												TOTAL WASTEWATER DEMAND (GPD)=	515,314	

5.5 Wastewater Improvements Map

The general map showing the sanitary sewer system improvements locations is presented here:

Figure 7 Wastewater Improvements Map



6 Reclaimed Water Infrastructure

Reusing water increases efficiency and reduces waste by getting the most work done per unit of treated source water. Examples of water reuse include the use of condensate for cooling tower makeup, or a closed-loop recycling system where process wastewater is repeatedly recycled back through the process in which the water was generated.

Reclaimed water is a sub-set of water reuse: highly treated wastewater from a municipal wastewater treatment system that is utilized for a suitable and beneficial purpose. Use of reclaimed water in its simplest form involves taking highly treated wastewater and distributing it to offset the demand for potable (drinking) water. "Purple pipes" are used to distribute reclaimed water. Reclaimed water requires extensive treatment and disinfection before distribution in order to ensure public health and environmental quality protection.

The reclaimed water can be used for non-potable purposes including, but not limited to, the following:

- Irrigation of public and private landscapes and turf
- Soil compaction
- Dust control
- Non-potable processes such as concrete production and cooling water
- Industrial and commercial toilet flush and fire prevention systems where there are separate, non-potable plumbing lines
 - Bulk fill stations
 - Decorative ponds and fountains
 - Street sweeping (not street cleaning)
 - Sewer cleaning (not washing)
 - Vehicle washing

A new reclaimed water system is proposed. The system will be composed of:

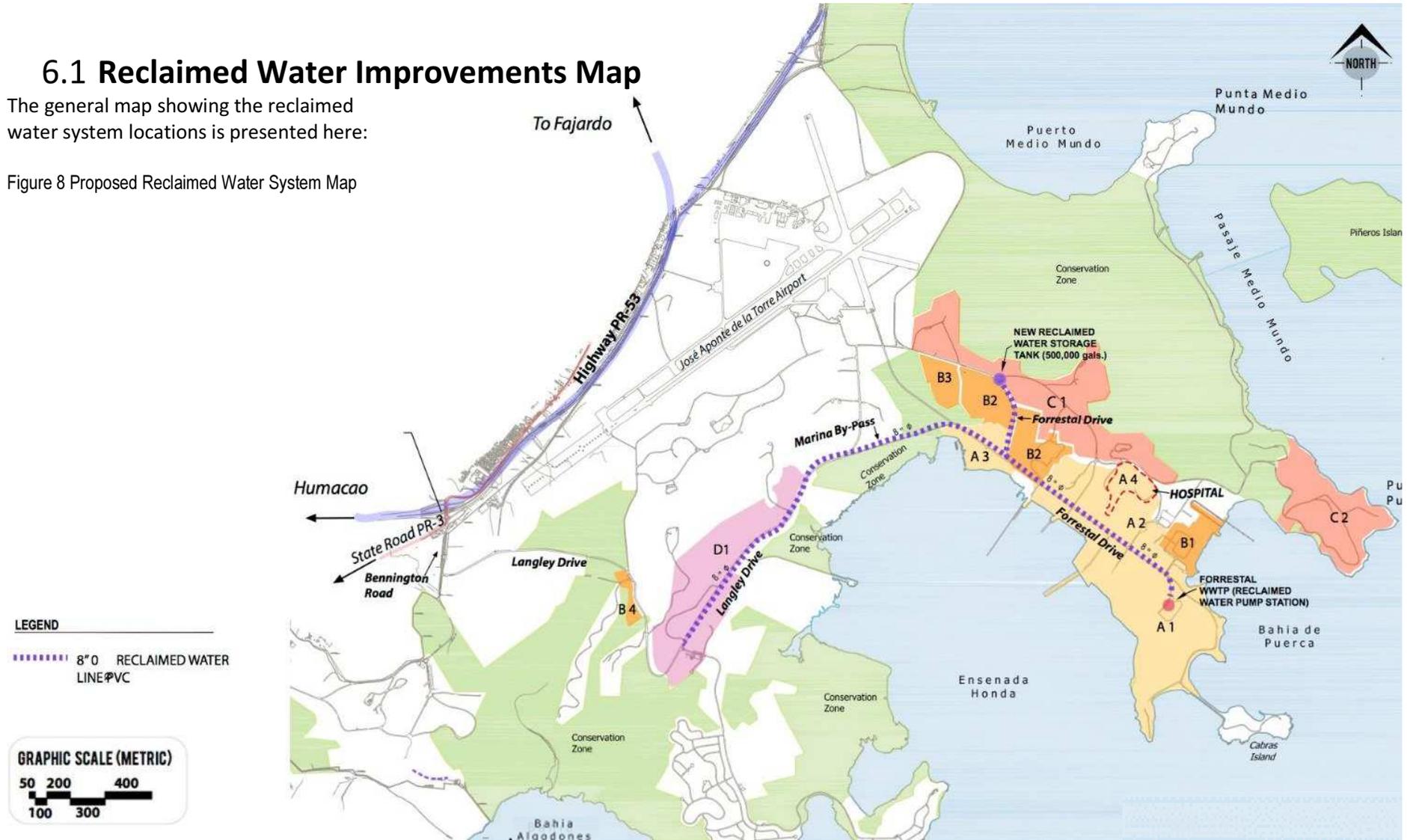
- A new equalization tank and pumping station at the outlet of the Forrestal WWTP.
- A new 8" Ø forceline along Forrestal Drive, Tow Way Road, Marina By Pass and Langley Drive up to Zone D1.
- A new 500,000 gallons reclaimed water storage and distribution tank, and connection pipeline.
- Some segments do not have the adequate capacity to handle the proposed development future flows.

For the reclaimed water system to be a feasible operation, it is necessary to increase the treated wastewater production after the initial 5 years re-development. Only the planning, studies and design tasks are included on the initial 5 years re-development.

6.1 Reclaimed Water Improvements Map

The general map showing the reclaimed water system locations is presented here:

Figure 8 Proposed Reclaimed Water System Map



7 Stormwater Collection System Infrastructure

The existing stormwater collection and disposal system is mainly composed of a series of surface systems that transport runoff through pipe culverts, box culverts, earth ditches and channels. Those systems finally discharge into regulated and non-regulated outfalls at fresh water bodies such as wetlands and creeks and to salt water bodies such as mangroves and the ocean.

From the assessed analysis the main findings are:

- Corrugated metal pipes show corrosion
- Earth channels and ditches need cleaning due to sediment accumulation
- Grass and vegetation obstruction on culverts inlet and outlet headwalls
- Inadequate amount of storm sewer systems (inlets, catch basins)
- No stormwater quantity mitigation systems on developed areas
- No stormwater quality mitigation system on developed areas
- Based on the analysis prepared, most of the systems have the adequate capacity to handle the flows of the 25 yrs -1 hr storm event

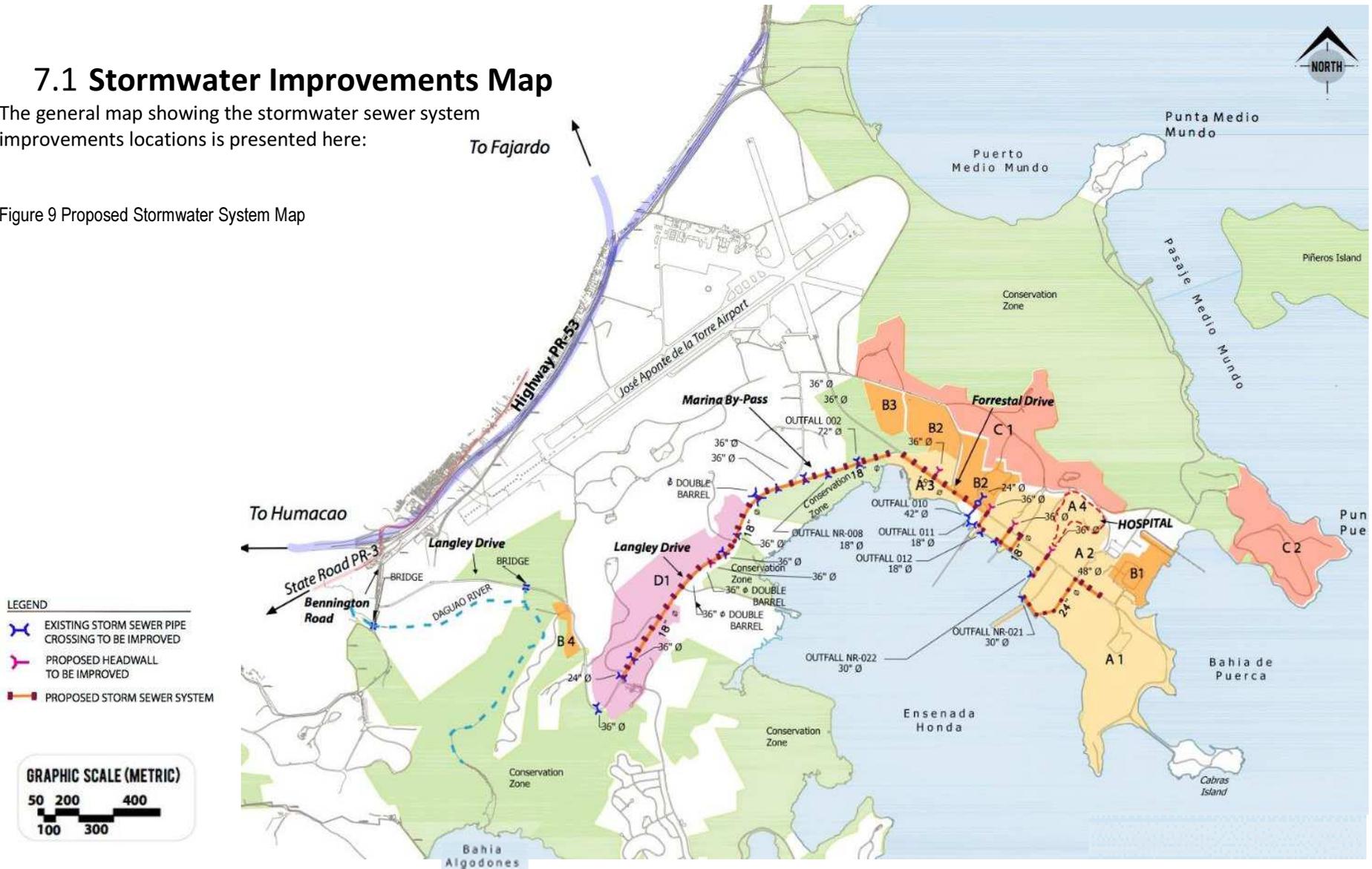
Based on current conditions the proposed project consider improvements to the following:

- Replace or rehabilitate corroded corrugated metal pipes.
- Clean and rehabilitate earth channels and ditches, culverts inlet and outlet headwalls
- Extend culvert lengths according to road corridors widening's.
- Install new storm sewer systems along Langley and Forrestal Drives on the new road sections to be implemented.
- Maintain the location of the existing regulated and non-regulated outfalls at fresh water bodies such as wetlands and creeks and to salt water bodies such as mangroves and the ocean, in order to not disrupt the natural drainage patterns and the delicate ecosystems on those water bodies.
- Parcels or easements shall be created within the project areas, in order to provide adequate areas for developers to incorporate their specific quantity and quality control systems, before discharging into the stormwater infrastructure.
- Replace existing culverts on Marina By-Pass that does not have adequate structural capacity.

7.1 Stormwater Improvements Map

The general map showing the stormwater sewer system improvements locations is presented here:

Figure 9 Proposed Stormwater System Map



8 Electrical Distribution System Infrastructure

The Roosevelt Roads electrical facilities are connected to the Puerto Rico Electric Power Authority (PREPA) through a 115 KV Electrical Main Substation located in Daguao Sector, in Ceiba. It is transformed from 115 KV to 38 KV for two main 38 KV circuits that enter the Base. These two 38 KV sub-transmission lines are used for industrial type substations that feed other substations for distribution lines of 13.2 KV and 4.16 KV, that are used mainly for Commercial and Residential loads.

The Puerto Rico Electric Power Authority (PREPA) did an evaluation report of the Roosevelt Roads Facilities in September 10, 2010, and may take over of the electrical systems under the following requirements:

- PREPA has a public policy for electrical distribution loads conversion from 4.16 KV to 13.2 KV in order to eliminate the voltage of 4.16 KV from Puerto Rico's electrical system.
- Any new development must be connected to the 13.2 KV distribution systems. PREPA may accept the 13.2 KV substations Delta, Charlie and India, the 13.2 KV distribution lines and 38 KV sub-transmissions lines, and their corresponding right of ways.
- Existing substations 13.2 KV must have a minimum area of 2,000 square meters, so PREPA can comply with the spacing required for the proper maintenance, repair works, safety clearance and will also permit to increase the capacity of the 13.2 KV substation for serving the new projects that will be develop in the future.
- Sub-transmission lines 38 KV and distribution lines 13.2 KV are limited in capacity (gauges of the lines) and must be increased to 556.5 kcmil ACSR and pole replacement to concrete poles.
- All equipment, electrical installations and land shall have a negative pollutants certification.

The existing electrical system of Roosevelt Roads shall be improved in order to comply with the requirements of the Puerto Rico Electric Power Authority (PREPA), although the final owner and operator of the system can be either PREPA or the LRA through a private contractor. The requirements were summarized on the "Transference Summary Report" prepared by PREPA on September 2010.

In addition, major improvements must be considered due to the increased electrical load demand needed for the complete redevelopment.

The proposed Main Electrical System shall be composed of new 38 KV and 13.2 KV aerial electrical lines located on or adjacent to the main road corridors distributed throughout the Base.

The improvements will include:

- Improvements and upgrade of two of the existing substations: Delta and India for capacity expansion and code compliance.
- Replacement of 13.2 and 38 KV aerial the transmission and distribution lines from the Daguao connection point will be installed cross country up to Delta Substation on Langley Drive.

- Replacement of 13.2 and 38 KV aerial distribution lines from the Delta Substation on Langley Drive up to Marina By-Pass Road.
- Replacement of 13.2 and 38 KV aerial distribution lines from to the intersection of Tow Way Road and along Forrestal Drive, up to the Hospital area and passing thru India Substation and ending at the entrance road to Forrestal WWTP.
- On this project, all other existing main sub-transmission and distribution aerial electrical lines shall be connected to the new systems. A vast majority of the existing electrical systems will be located on the existing aerial electrical systems right of ways.
- New lighting poles and luminaires along the improved road corridors. The use of solar powered LED luminaries is being considered.

8.1 Electrical Loads Demands Table

All the proposed improvements are based on the current and future electrical load demands for each zone under development as shown on the following table.

Table 3. Electrical Demands Table

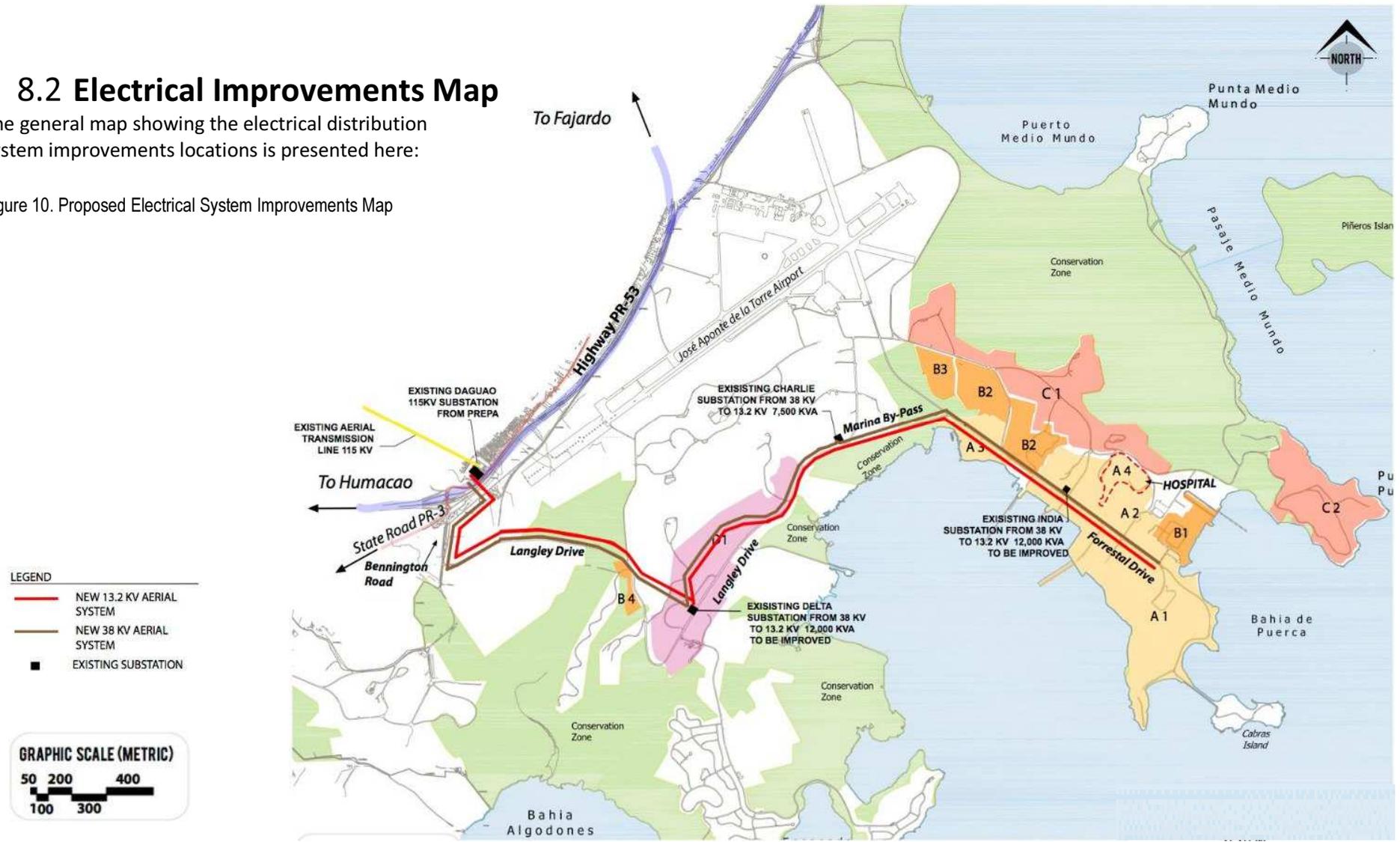
ELECTRIC LOADS DEMAND FOR CURRENT & PROPOSED TENANTS AT ROOSEVELT ROADS - YEARS 2015-2020
for Zones A1, A2, A3, A4, B1, B2, B3, B4, C2 and D1

Parcel Zone	Name	Condition	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Use Rate per Day	Load Demand KVA 13.2KV	Load Demand KVA 38.0KV		
YEARS 2015-2016																
B4	Water Treatment Plant	Existing Facilities	Potable Water Treatment Plant	3,800								0.15k/ sq. ft.	570	0		
D1		Existing Facilities	CROEC Educational Facilities (Former Elementary School) - Includes classrooms, library, school administration, cafeteria, gym, showers and basketball court, bedroom areas.	67,368					250			Existing Transformer Capacity	300	0		
A3	Commercial Marina	Proposed Facilities	Marina	5,000						70		0.5k/boat slip	35	0		
B1	Waterfront Industrial		Astivenca (shipyard)	180,000								Given demand	250	0		
A1	Waterfront District		Ferry Terminal New Building (or alternative to use Building 2351)	5,900								400	0.15k/passenger	60	0	
A4	Hospital		All Hands Public Beach (Restrooms and Concession) 4 plumbing fixtures	500									0.0138k/ sq. ft.	7		
B2	Fuel Terminal		Hospital (1790)	130,000		100							7k/bed	0	700	
A2	Forrestal Bayview Hills		Tank Farm Building 192 Laboratory	4,923									0.0138k/ sq. ft.	68	0	
			Tank Farm Building 1982 Pump Station	1,000									Given demand	350	0	
			Community Use (Building 1715)	1,600										0.0138k/ sq. ft.	22	0
			Community Use (Building 2036)	1,525										0.0138k/ sq. ft.	21	0
			Community Use (Building 2036A)	1,680										0.0138k/ sq. ft.	23	0
		Community Use (Building 371)	5,100										0.0138k/ sq. ft.	70	0	
		Community Use (Building 3109)	4,000										0.0138k/ sq. ft.	55	0	
		Community Use (Building 3091)	4,000										0.0138k/ sq. ft.	55	0	
A1		Existing Facilities	National Guard Boat Ramp (2301)	9,500									0.002k/ sq. ft.	19	0	
			Homeland Security Boat Ramp + Proposed. Customs-Border Patrol Building (2217)	2,500										0.0138k/ sq. ft.	35	0
			Armed Forces Reserve Center (29, B2468, B2469, B2-85, B4)	72,000										0.0138k/ sq. ft.	994	0
			Commercial Marina	DRNA Office (2334)	2,000									0.0138k/ sq. ft.	28	0
A2	Forrestal Bayview Hills	LRA Office (1205)	2,500									0.0138k/ sq. ft.	35	0		
Zone Total				520,136								Zone Total =	3,206	700		
ADDITIONAL THROUGH YEARS 2016-2020																
A1	Waterfront District	Proposed Facilities	Mixed-use Development	633,750								0.0138k/ sq. ft.	8,746	0		
A2	Forrestal Bayview Hills	Proposed Facilities	Cruise Ship Terminal							1500		Given Data	1,425	0		
B3	Light Industrial	Proposed Facilities	Mixed-use Development	350,000								0.0138k/ sq. ft.	4,830	0		
B3	Light Industrial	Proposed Facilities	Light Industrial	60,000												
C1	Marsh Vista	Proposed Facilities	Eco-Housing: retail	78,750								0.0138k/ sq. ft.	1,087	0		
C2	Punta Puerca	Proposed Facilities	Visitors Center, research	83,000								0.0138k/ sq. ft.	1,145	0		
D1	Langley Urban Strip	Proposed Facilities	Eco-Lodging				50									
D1	Langley Urban Strip	Proposed Facilities	Mixed-use Development	473,750								0.0138k/ sq. ft.	6,538	0		
D1	Langley Urban Strip	Proposed Facilities	Hotel-Lodge				100									
Zone Total				1,679,250								Zone Total =	23,771	0		
TOTAL ELECTRICAL DEMAND (KVA) =													26,977	700		

8.2 Electrical Improvements Map

The general map showing the electrical distribution system improvements locations is presented here:

Figure 10. Proposed Electrical System Improvements Map



9 Telecommunications System Infrastructure

The existing telecommunications/data system consists of a combined aerial copper and underground fiber optic network infrastructure. This infrastructure does not comply with current requirements of the “Junta Reglamentadora de Telecomunicaciones de Puerto Rico” (JRTPR).

There are areas with fiber optics cabling, cable tv and old telephone infrastructure. The cellular phone service coverage is very limited. Existing infrastructure is not capable of handling new telecommunication requirements and the existing underground conduits are not usable for future developments.

A new system shall be installed for the Roosevelt Roads redevelopment in order to comply with the requirements of the “Junta Reglamentadora de Telecomunicaciones de Puerto Rico” (JRTPR or PR Telecommunications Regulatory Board). A new system must be considered due to the increased data/communications load demand needed for the complete redevelopment.

Based on future data/communications load demands on the different zones, a new gigabit (1Gbps) network is proposed.

In order for the telecommunication infrastructure to supply this need, a broadband optic fiber backbone network is required. New infrastructure easements and conduits installation are needed in order to install the optic fiber and related equipment to create the network for the future developments.

A redundant underground loop with two connection points (at Gates 1 and Gate 3) for all services providers shall be installed with 10 conduits of 4 inches diameter each and 8 conduits of 2 inches diameter each. This infrastructure will connect at a Main Central Building (1,000 square meter lot size) where it is going to provide a space for each of the qualified service providers of Puerto Rico to serve the communities with high speed internet, cable tv, telephone and other services. This will be possible through the installation of fiber optics cable from the points of connection in the outside of the main gates up to the Main Central Building and then through different zones where new support facilities (approx. 500 square meters parcel size) will be strategically located as per the need of zone’s developments. With this infrastructure a fiber path redundancy is created to help ensure failure free operation in spite of fiber cuts.

The basic infrastructure consist of the preparation of the Main Central Building (approximately 1,000 square feet), underground conduits as per details in phase construction, telecommunication manholes, lot preparation for the support facilities.

It is necessary to provide the infrastructure components and a connection point in order for the service carries to provide their services.

In addition it is necessary to provide a cellular network tower in order to encourage the installation of antennas by the different private service providers.

From analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Maintain Daguao’s connection point (Near Gate 3).
- Replace and Construct new Main Telecommunications Center.
- Construct one new distribution center.

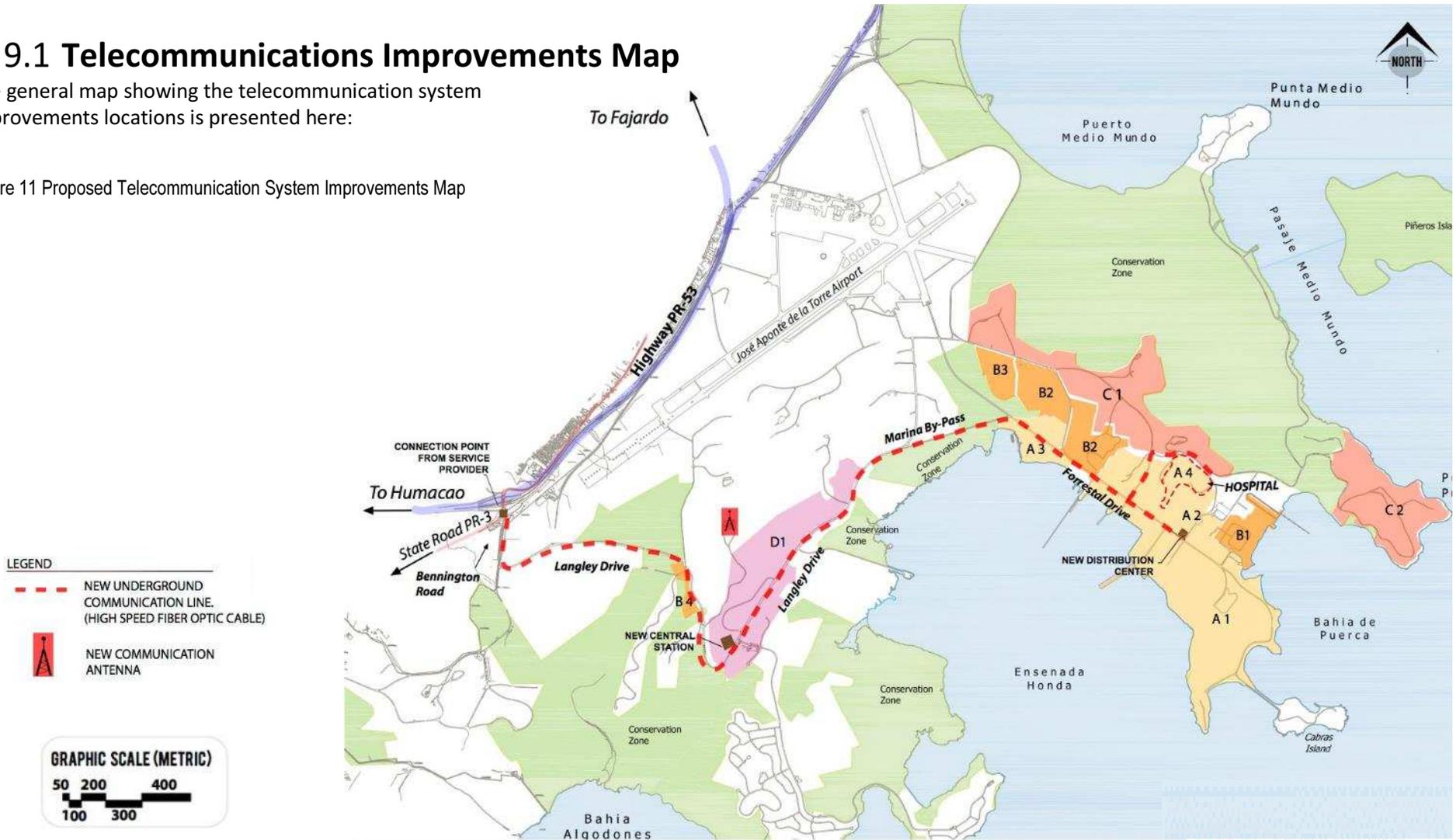
- Replace all existing aerial and underground systems with new underground systems on all zones main corridors to comply with JRTPR Standards.
- Install new underground conduits and junction boxes along main corridors.
- Install new fiber optic lines.
- Install a new cellular network tower.

The installation of a redundant fiber optic loop through Gate 1 is not included on the initial 5 years re-development.

9.1 Telecommunications Improvements Map

The general map showing the telecommunication system improvements locations is presented here:

Figure 11 Proposed Telecommunication System Improvements Map



10 Infrastructure Phasing

This Initial Infrastructure Plan is established by assuming the initial development of zones A1, A2, A3, A4, B1, B2, B3, B4, C1, C2 and D1 as defined in the Roosevelt Roads 2014 Development Zones Master Plan. The infrastructure development for those zones time frame assumes a 5 year built-out beginning on the first half of year 2016 and thru the end of year 2020.

Although the location of Solid Waste Management Units (SWMU's) and Areas of Concern (AoC's) have been considered when preparing this master plan, it is important to consider that the actual cleanup schedule for these areas –under the control of the US Navy- will affect the infrastructure development timing. SWMU's and AoC's affecting the proposed construction area of each infrastructure phase should be conveyed clean to the LRA before impacting such sites with infrastructure construction works.

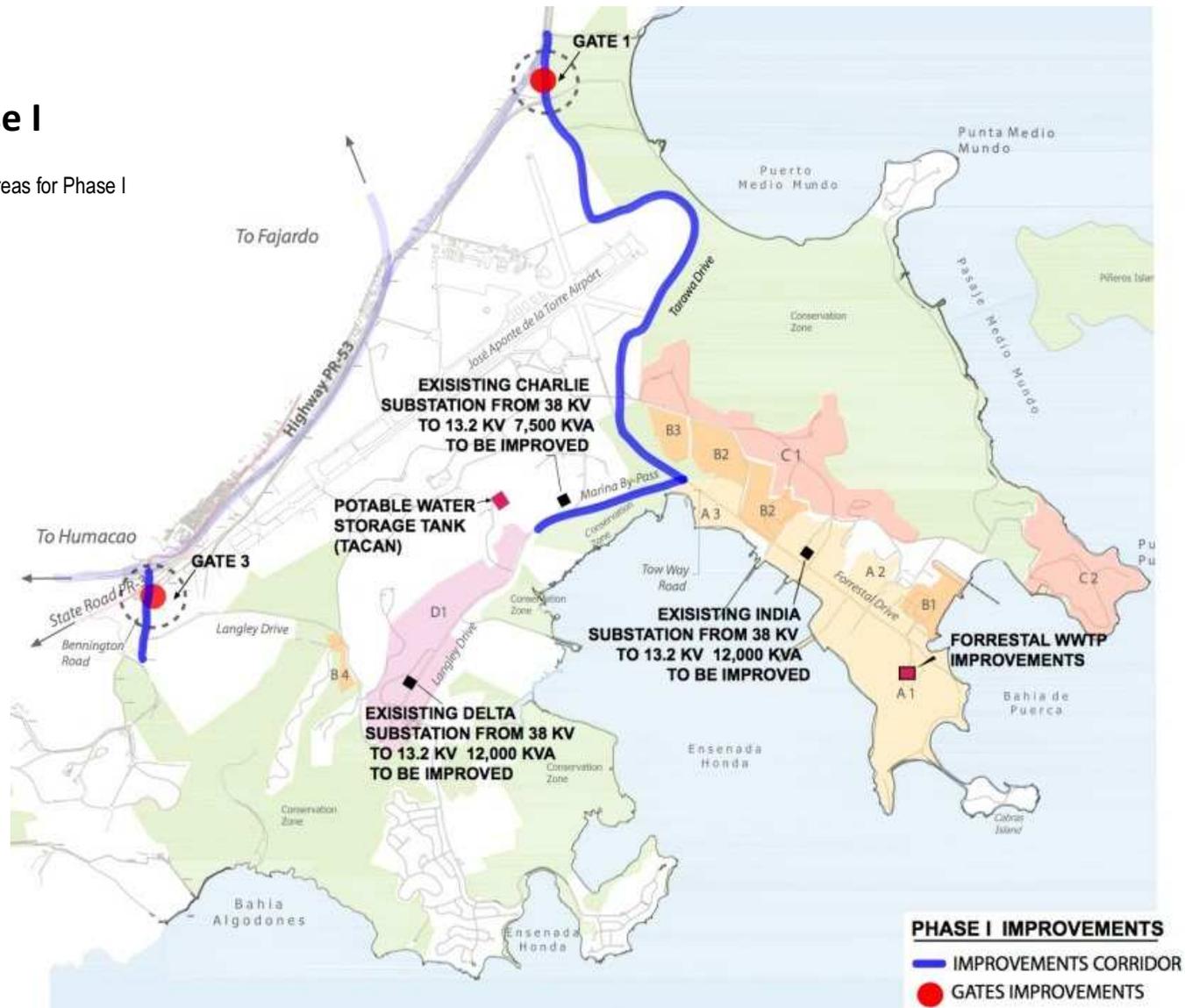
The most basic approach of this master plan to improve and expand utilities services within the Roosevelt Roads redevelopment is to provide adequate infrastructure with the capacity to supply the demands required by all projects to be developed in a specific zone in a pre-defined span of time. Based on this basic premise, the infrastructure construction schedule has been distributed within a five year phasing.

Other general assumptions within this document relating the development of an infrastructure phasing strategy include:

- Special attention has been given to maintain continuity of services for basic utilities during the span of redevelopment phases.
- Only primary roads and utility distribution have been considered for this study. Infrastructure works dependent on specific development projects are not part of this Plan.

10.1 Phase I

Figure 12. Redevelopment Areas for Phase I



This initial phase involves the infrastructure improvements to allow for continued service to existing tenants inside Roosevelt Roads. This phase will begin on January 2016 and ends on December 2016. A brief summary of the improvements described previously on this report for this phase are indicated here:

Roads Network

It includes the following improvements:

- Studies and Designs
- Access Gates No.1 and No.3 re-building
- Bennington Road resurfacing and minor improvements
- Tarawa Drive and Tow Way Road initial resurfacing and minor improvements

Water System

It includes the following improvements:

- Studies and Designs
- Initial Improvements to Water Treatment Plant

Sanitary Sewer System

It includes the following improvements:

- Studies and Designs
- New Forrestal WWTP Initial Phase

Reclaimed Water System

It includes the following improvements:

- Studies and Designs

Stormwater System

It includes the following improvements:

- Studies and Designs
- Pipe Culvert Cleaning and Repairs on Tarawa Road and Tow Way Road

Electrical Distribution System

It includes the following improvements:

- Studies and Designs
- Improvements to Substations Charlie, Delta and India
- New road lighting on Tarawa Drive

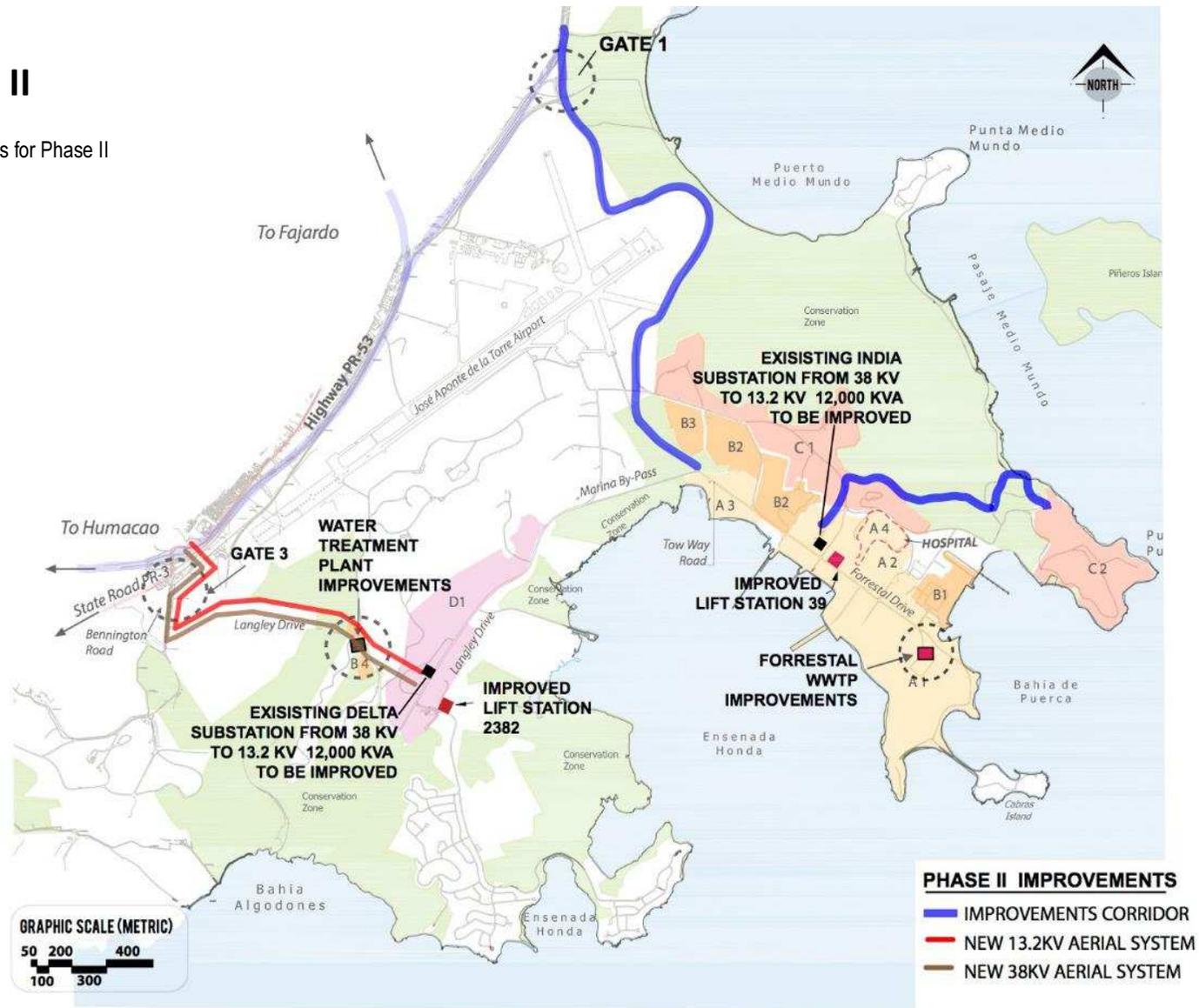
Telecommunications System

It includes the following improvements:

- Studies and Designs

10.2 Phase II

Figure 13. Redevelopment Areas for Phase II



This second phase involves the infrastructure improvements for the future developments. This phase will begin on January 2017 and ends on December 2017. A brief summary of the improvements described previously on this report for this phase are indicated here:

Roads Network

It includes the following improvements:

- Tarawa Drive and Tow Way Road final resurfacing and minor improvements completion
- Improvements to Antietam Road to Hospital and to Punte Puerca (Zone C2)

Water System

It includes the following improvements:

- Continuing Improvements to Water Treatment Plant
- New water mains to Hospital and Punta Puerca

Sanitary Sewer System

It includes the following improvements:

- Continuing new Forrestal WWTP Initial Phase (A)

Reclaimed Water System

It includes the following improvements:

- Studies and Designs

Stormwater System

It includes the following improvements:

- Pipe Culvert Cleaning and Repairs on Tarawa Road and Tow Way Road

Electrical Distribution System

It includes the following improvements:

- New 13.2 and 38 KV Aerial Lines from Daguao Connection Point
- Continuing Improvements to Substations Charlie, Delta and India
- New road lighting on Tow Way Road

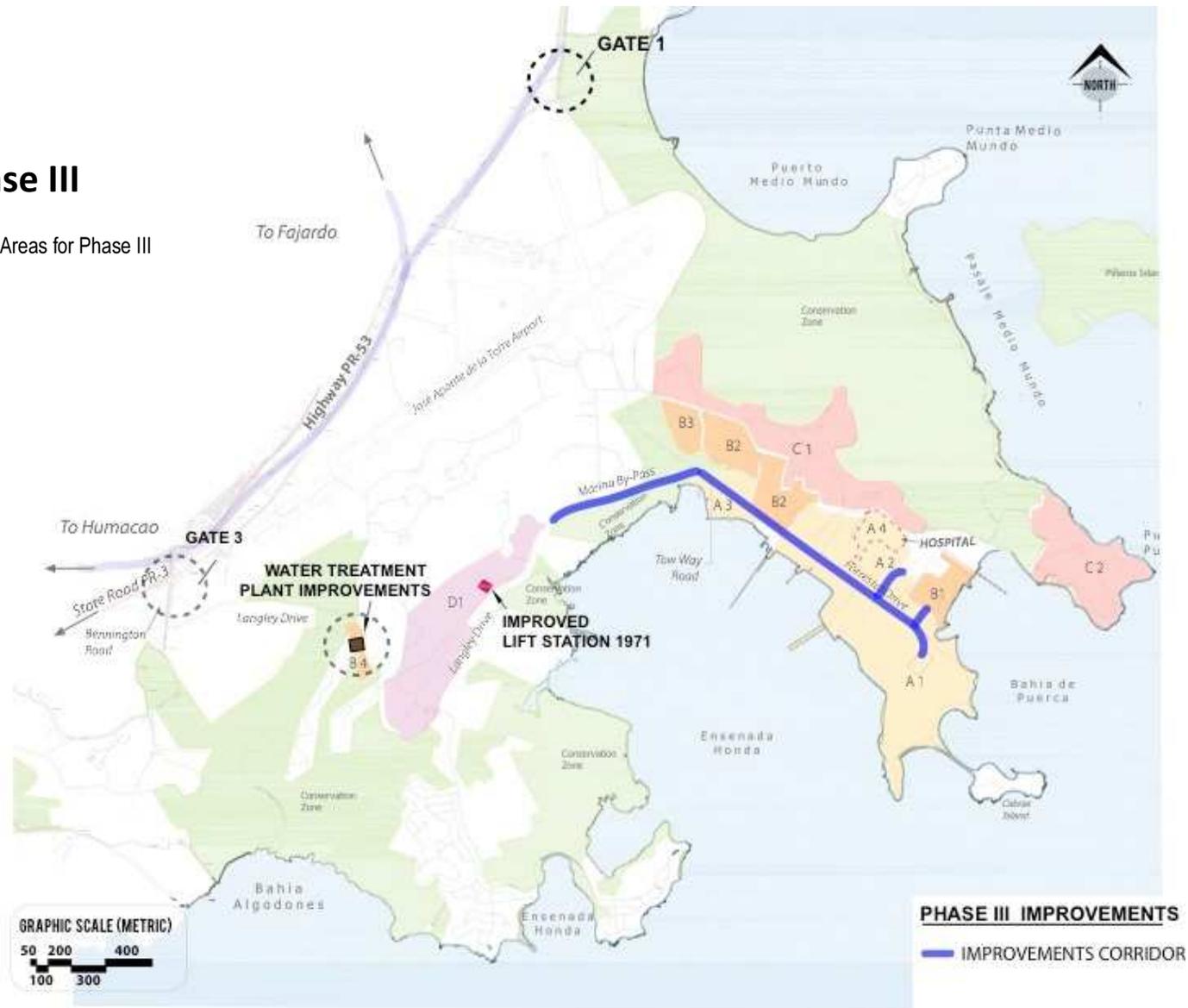
Telecommunications System

It includes the following improvements:

- New Main Central Station
- New Mini Central Station
- New Cellular Communication Tower

10.3 Phase III

Figure 14. Redevelopment Areas for Phase III



This third phase involves the infrastructure improvements for the future developments. This phase will begin on January 2018 and ends on December 2018.

A brief summary of the improvements described previously on this report for this phase are indicated here:

Roads Network

It includes the following improvements:

- Marina By-Pass Road Improvements
- Forrestal Drive Road Widening and Improvements

Water System

It includes the following improvements:

- Continuing Improvements to Water Treatment Plant
- New water mains on Forrestal Drive

Sanitary Sewer System

It includes the following improvements:

- Improvements to Lift Stations 39 and 2382
- New gravity lines and forcelines along Marina By-Pass and Forrestal Drive

Reclaimed Water System

It includes the following improvements:

- Completion of Studies and Designs

Stormwater System

It includes the following improvements:

- New storm sewer systems along Forrestal Drive
- Culverts replacement along Marina By-Pass

Electrical Distribution System

It includes the following improvements:

- New 13.2 and 38 KV Aerial Lines along Marina By-Pass
- New 13.2 and 38 KV Aerial Lines along Forrestal Drive
- New road lighting on Marina By-Pass and Forrestal Drive

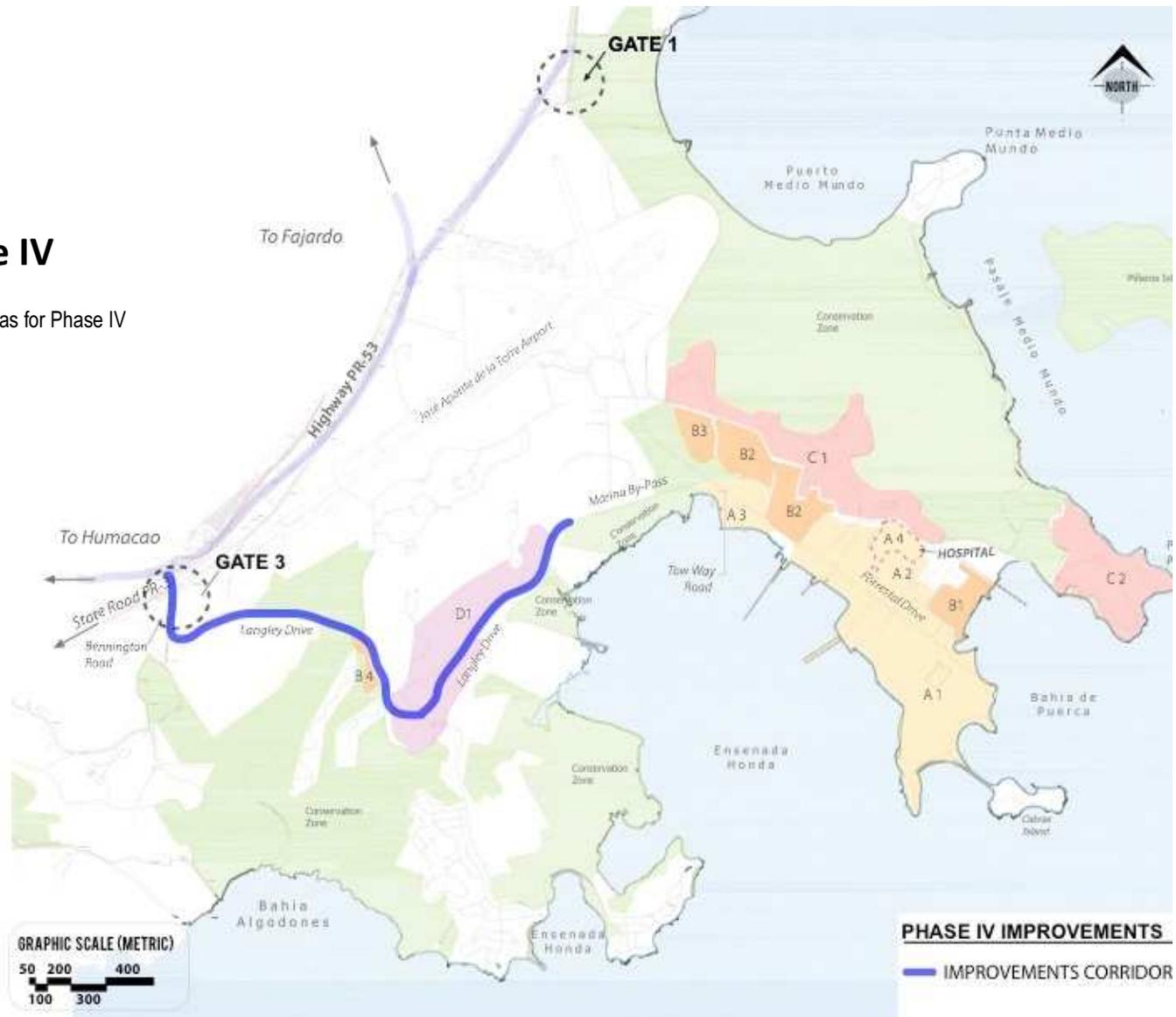
Telecommunications System

It includes the following improvements:

- New Underground Fiber Optic Network along Marina By-Pass and Forrestal Drive

10.4 Phase IV

Figure 15. Redevelopment Areas for Phase IV



This fourth phase involves the infrastructure improvements for the future developments. This phase will begin on January 2019 and ends on December 2019.

A brief summary of the improvements described previously on this report for this phase are indicated here:

Roads Network

It includes the following improvements:

- Langley Drive Road Widening and Improvements

Water System

It includes the following improvements:

- New water mains on Langley Drive

Sanitary Sewer System

It includes the following improvements:

- Improvements to Lift Station 1971
- New gravity lines and forcelines along Langley Drive

Reclaimed Water System

It includes the following improvements:

- No works are contemplated

Stormwater System

It includes the following improvements:

- New storm sewer systems along Langley Drive

Electrical Distribution System

It includes the following improvements:

- New 13.2 and 38 KV Aerial Lines along Langley Drive
- New road lighting on Langley Drive

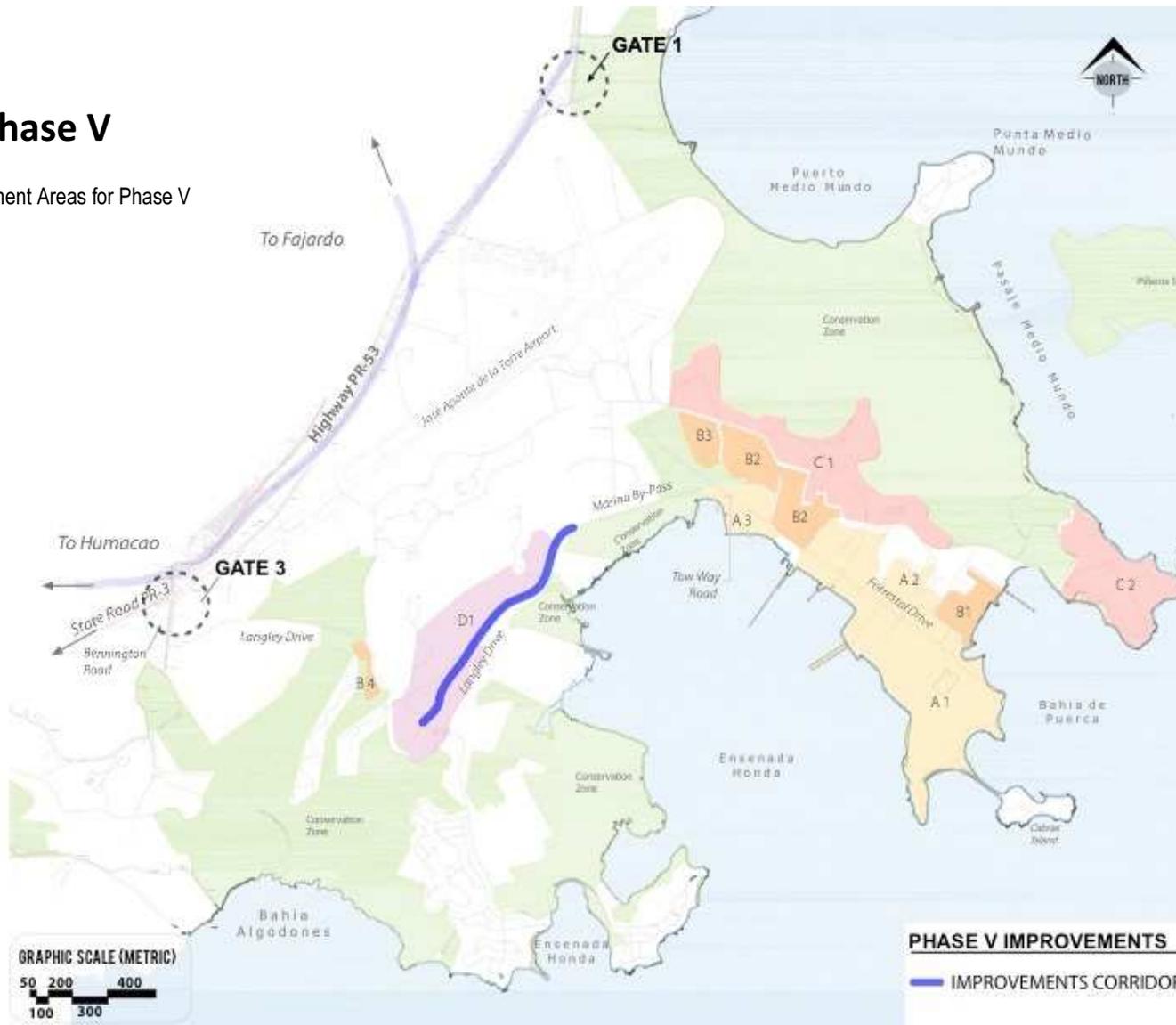
Telecommunications System

It includes the following improvements:

- New Underground Fiber Optic Network along Langley Drive

10.5 Phase V

Figure 16. Redevelopment Areas for Phase V



This final phase involves minor infrastructure improvements and adjustments to provide full service to the developed zones. This phase will begin on January 2020 and ends on December 2020

A brief summary of the improvements described previously on this report for this phase are indicated here:

Roads Network

It includes the following improvements:

- Langley Drive Road Final Widening and Improvements

Water System

It includes the following improvements:

- Improvements to Raw Water Line

Sanitary Sewer System

It includes the following improvements:

- Final construction improvements on lift stations

Reclaimed Water System

It includes the following improvements:

- No works are contemplated

Stormwater System

It includes the following improvements:

- Final construction improvements on Forrestal Drive

Electrical Distribution System

It includes the following improvements:

- New road lighting on Langley Drive

Telecommunications System

It includes the following improvements:

- No works are contemplated