



Smart-City Concept for Dos Ríos Community in Ciales, PR

Polytechnic University of Puerto Rico – Civil Engineering Senior Project – San Juan, PR

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ABSTRACT

The following analysis proposes a community infrastructure project for “Residencial Dos Ríos”, a community in the municipality of Ciales of the Commonwealth of Puerto Rico. As such, this project will present a plan to develop a green and sustainable community that will positively impact the municipality of Ciales; both socially and economically. The scope of this project will include the reconstruction of domestic households with independent water supply and solar energy systems, commercial expansion to attract new consumers, and an educational center along with recreational areas to attract a more socially enhanced community. It will also include the construction of a channel that will prevent the adjoining river from flooding the community and will double as a source for hydroelectric power. Finally, a smart self-sustaining transportation infrastructure that integrates the community’s geographical topography will create a secure and potential local tourist destination that will be an economic boon to the entire municipality.

INTRODUCTION

On September 20, 2017, Hurricane Maria ravaged Puerto Rico’s infrastructure. Even though much has been mended, not everything nor everyone has been able to fully recover from this tragedy. One such community is “Residencial Dos Ríos”, located in the municipality of Ciales, Puerto Rico. As many of the central areas in Puerto Rico, which are predominantly mountainous, this community suffered greatly when the ever-treacherous Manatí River overflowed producing floods which gave rise to rescue missions to the members of this community even though much of the municipality wasn’t affected by these floods as a result of its higher topography.

Ciales is now an up-and-coming municipality and is highly praised by its natural beauty and surroundings. Approximately 15,800 people are currently living in Ciales and most of its population demographic are of productive working age; between the ages of 18 and 65 (U.S Census Bureau, 2019). It is a prime area for leisure and recreational commercial activities which can exploit its surrounding geography for a business plan. However, “Residencial Dos Ríos”, just outside the town center, remains as a segregated community that is still a risk for all residents.

As such, this Senior Design Project will aim to develop “Residencial Dos Ríos” into a smart, green and sustainable community that will not only provide a sense of security and stability to all residents but will also turn into a destination for investors and visitors. In turn, what was a weak link to this beautiful up and coming municipality, will become a great attraction of prosperity for the future of Ciales.

PROPOSED WORK

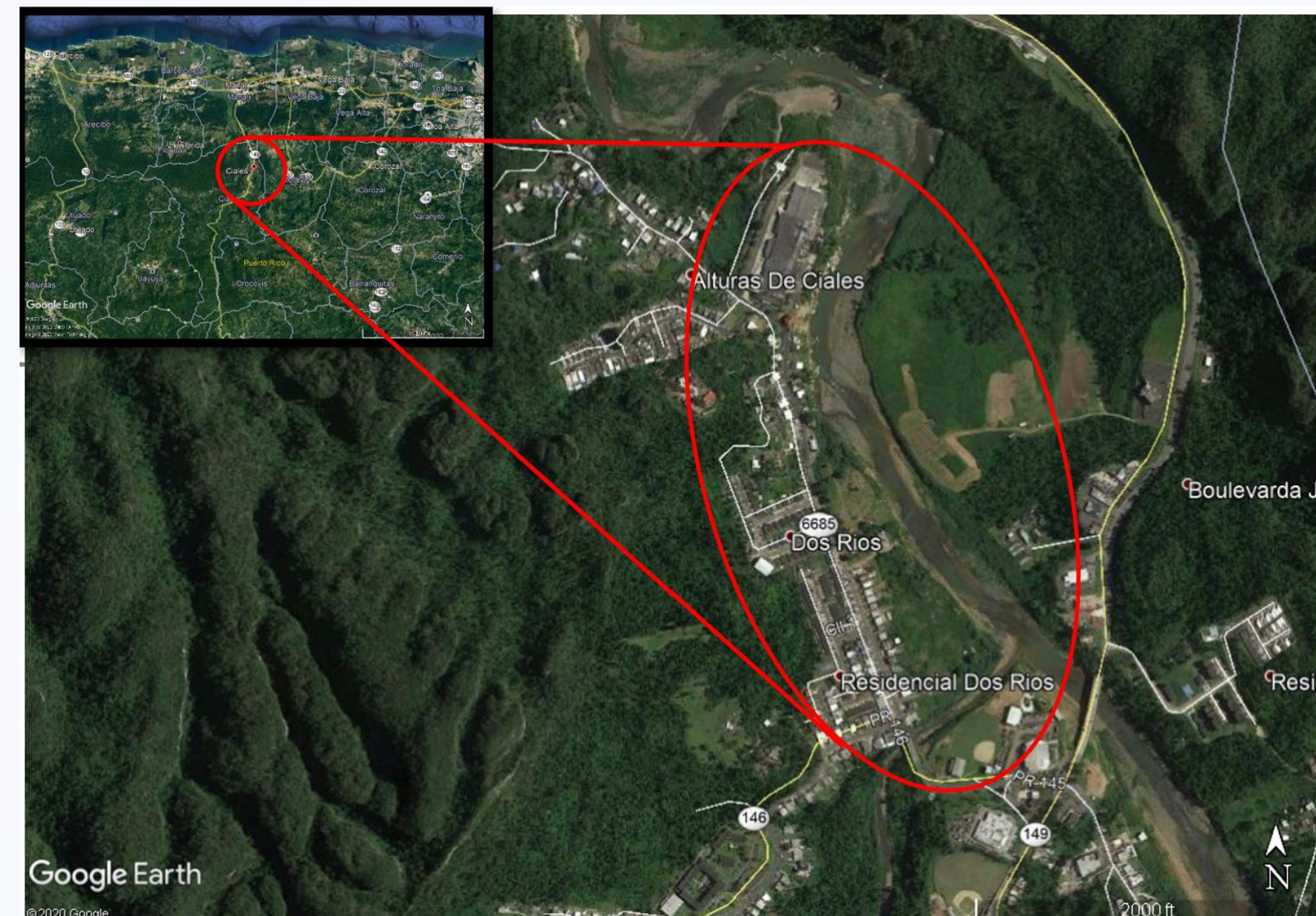
The proposed work for the Senior Design Project is as follows:

- The channelization of the Manatí River to completely mitigate any flooding unto the developing community and the development of a retention pond to mitigate the stormwater flow developed inside the community.
- The modification and design of a new potable and residual water infrastructure which also includes independent water distribution supply systems in case state services should fail.
- The modification and design of a new transportation infrastructure which includes new roads, paving, smart intersection designs and the building of a new access bridge.
- The development of new high-quality public and private housing for local and future residents to the Dos Rios community.
- The development of a smart commercial building which includes commercial and office spaces which will develop economic activity.
- The development of a new local elementary and high school with high-end facilities on par with the smart-city concept.
- The installation of a state-of-the-art sustainable energy system using renewable energy sources such as solar power and a hydroelectric plant.
- The development of recreational areas and sports facilities to maintain a healthy community and youth development.

METHODOLOGY

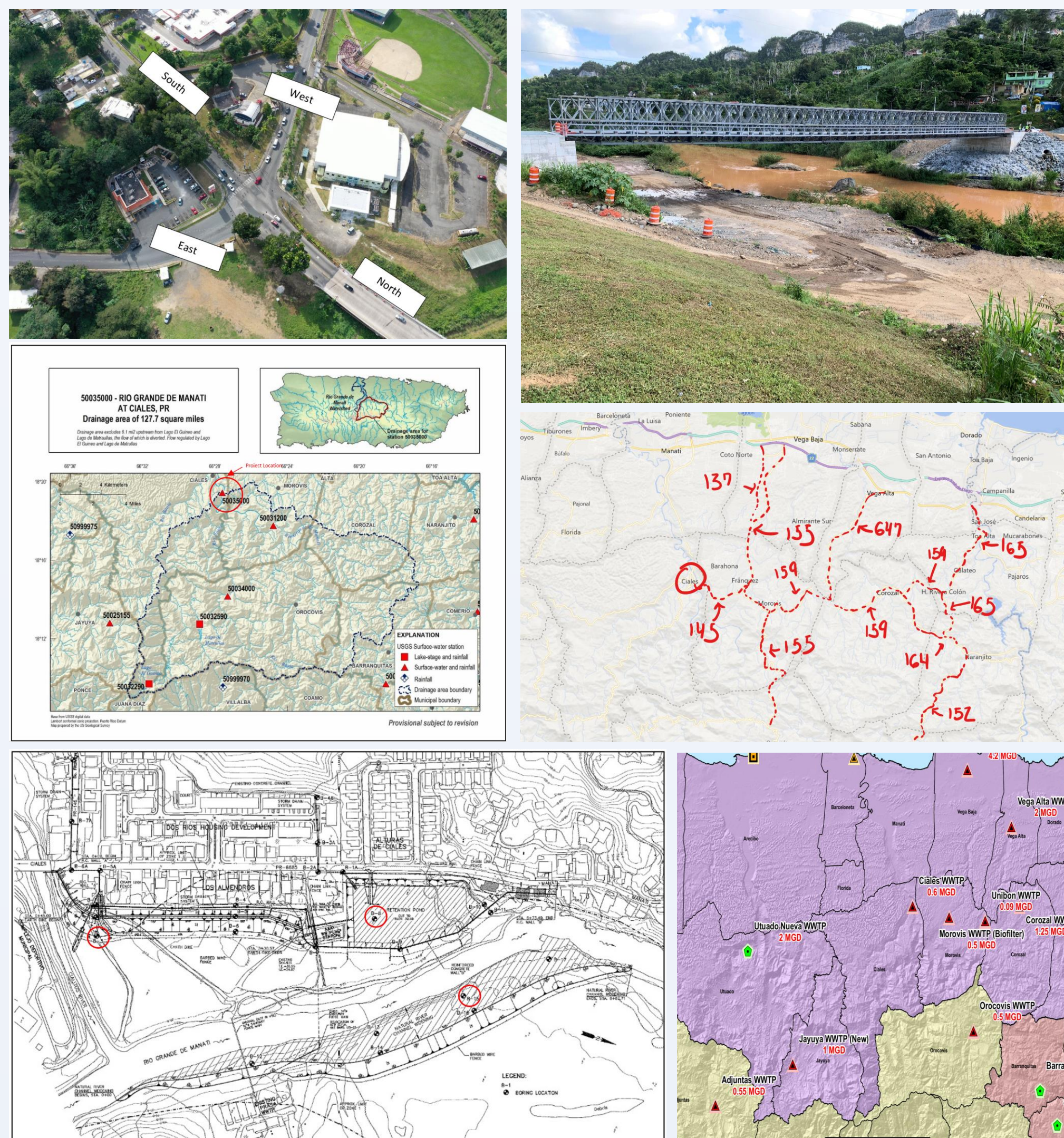
1. Locate and study the project site.

- Project Location



2. Study and establish the current existing infrastructure.

- This study includes: highways, intersections, bridges, local roads, water supply and wastewater management, drainage system, potable water system, energy system, network communications, and houses and other facilities such as schools, hospitals, recreational areas, commercial and businesses, and industries



The following images present some findings such as the community’s main intersection, a new bridge near the community, the drainage area of Rio Grande de Manatí river, local roads network, borings taken by the US Army Corps of Engineers, and an image of the location of the community’s wastewater treatment plant. Some advantages that this project offers is that the community will be of low maintenance and operation cost, energy efficient, it will have water and material efficiency, as well as an enhanced economic boost.

LOG OF TEST BORING				
PROJECT: Dos Rios Sector, PIAO Dos Rios Sector				
BORING LOCATION: Ciales, P.R.				
DATE: 12/15/04				
PROJECT NO: 1000				
BORING NO: 1				
DEPTH TO CENTER OF BORING: 20.0' AFTERBATH: 20.0'				
DATE: 12/15/04				
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