Designing a Community Space in Buxton, Guyana

A Major Qualifying Project to be submitted to the faculty of

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Abstract

Guyana is a developing country in South America that has the opportunity to grow economically because of its rapid oil production. Yet, with Guyana being a carbon-neutral country vulnerable to climate change, this oil production can pose environmental and social problems. This project focused on creating a community space in the neighborhood of Buxton that promotes connectivity among locals and celebrates Guyanese culture. The inclusion of this space also comes with an emphasis on highlighting the social and environmental issues that the community and country as a whole faces as a way to empower individuals to create positive change. The final product of this project consists of a full site plan created in Civil3D.

Capstone Design Statement

ABET (The Accreditation Board for Engineering and Technology) defines constraints for a design project to ensure the project's success as feasibility, functionality, and alignment with specified goals. These constraints can encompass a wide range of factors including economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations. Throughout the following Major Qualifying Project (MQP), the following constraints were addressed:

Social: This project's design prioritizes the community's engagement in design by ensuring that all residents feel welcome and able to use all facilities easily. Park facilities were included based on standards set by parks in general. The design also aims to highlight the culture of the area and unite social divisions through the inclusion of art.

Political: The revision and construction of this space depends on the approval of the local government of the area, the Neighborhood Democratic Council. This project must align with the local policies and plans of the area.

Environment and Sustainability: Since Guyana has achieved carbon neutrality, it was important that the project aimed to create minimal to no impact on the environment. This was done through the management of rainwater through swales and using path materials that allowed for proper drainage. The expected environmental changes due to climate change were also considered in this project's design.

Manufacturability: This project considers that it can be executed successfully based on construction expertise and the area's cultural context.

Professional Licensure Statement

The practice of civil engineering requires a high level of expertise, commitment, and ethical responsibility. Achieving professional licensure is a critical milestone that signifies an engineer's competency and dedication to upholding public health, safety, and welfare. The process of becoming a licensed professional engineer (PE) is structured to ensure that qualified individuals are entrusted with engineering responsibilities, starting with the Fundamentals of Engineering (FE) exam, typically taken upon graduation from an ABET-accredited engineering program. The exam assesses the candidate's understanding of fundamental engineering principles. Passing this exam confers the status of Engineer-in-Training (EIT), marking the initial step towards professional licensure. Following this, candidates may acquire a specified period of relevant work experience, under the supervision of a licensed PE. This experience is crucial for developing practical skills and applying theoretical knowledge to real-world engineering challenges. Upon fulfilling the work experience requirement, candidates are eligible to take the Professional Engineering (PE) exam, a rigorous assessment of their specialized knowledge and ability to apply advanced engineering principles in practice. Professional licensure is essential as it provides legal authority to sign and seal engineering documents, enhances professional credibility, and opens doors to advanced career opportunities. Most importantly, it ensures that licensed engineers are equipped to deliver safe and reliable engineering solutions, thus safeguarding the public and maintaining the highest standards of the profession.

Executive Summary

Guyana is a diverse and culturally rich country in South America that recently discovered oil on its coast in 2017. Economically, this poses a great financial opportunity for the country to elevate its status in the world through oil. Yet many worry that the interference of oil companies in Guyana will disproportionately affect the population and the country's status as a carbon-neutral country. With ExxonMobil's promotions and campaigns to appeal to Guyanese people, there presents an opportunity to create better spaces for community members across Georgetown.

The goal of this project was to design a community space in the neighborhood of Buxton, Guyana, located in Georgetown. The goal was to create a space that promoted connectivity among locals and embraced and accentuated Guyanese culture through the inclusion of art and design choices. Since the lot in question was already used by members of the community, the goal was to accentuate its current uses through design choices.

I executed the project goal through a humanistic and holistic lens. This was done through research regarding the social benefits of community spaces in developing countries, the inclusion of art in public spaces, and through outreach to local artists and affiliated members of the community. I spoke to a previous member of the community to understand the needs and desires that could be met with this space. I used this input to influence a design for the space that ultimately allowed for varied use based on user preference. A site analysis was also conducted to get a better geographical understanding of the space.

Stormwater calculations allowed for the facilitation of the design by keeping in mind the need for easy drainage of water in the land. The design of this space includes many different variables that allow for moveability and gathering. Walking paths were placed throughout the

space along with benches. I added shade areas that would house picnic tables and other seating arrangements, as well as gazebos. A multipurpose space was also included in the design, mainly intended to be a space that is adaptable to many different uses such as a gathering space for people or a popup local market. A space was also allocated for the inclusion of a statue or art display that would highlight Guyanese culture and create a sense of unity among the people.

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Introduction

With a population of just over 750 thousand people, Guyana is one of the smallest countries in South America. As a previous Dutch and British colony, the country has a diverse cultural population, with African, Indian, Amerindian (indigenous), and European influences. Its recent history has been marked by a transition to democracy and the discovery of vast offshore oil reserves, which have the potential to transform the nation's economy and global standing (Worldbank, 2023). The 1992 general elections marked a turning point when the People's Progressive Party (PPP) assumed power, and Guyana began its journey towards becoming a more inclusive and representative democracy (Congressional Research Service, 2023).

One of the most significant developments in Guyana's recent history is the discovery of vast offshore oil reserves. In 2015, major oil companies such as ExxonMobil began exploring Guyana's waters leading to the discovery of substantial oil deposits. This discovery has the potential to transform Guyana's economy, however, it also comes with significant challenges, such as ensuring equitable distribution of wealth, protecting the environment, and managing the potential social and economic impacts of this newfound resource (Coto, 2023). Guyana achieved carbon neutrality to reduce the harmful effects of climate change within the country, yet oil production threatens that status (Sovacool et al., 2023). As Guyana navigates the complexities of its oil industry, the country finds itself at a critical juncture in its history, poised for both great opportunities and considerable responsibilities on the international stage.

With more financial development reaching Guyana, there is also a need to socially develop through the expansion and refining of its public spaces. In the neighborhood of Buxton in Georgetown, an undeveloped lot is used regularly by locals. This space is near the sea wall and a water pump station and is frequented by community members despite the lack of development.

The goal of this project is to create a multi-use community space in this lot that accentuates the culture of the area and provides locals with a space that meets the needs and desires of the community. Ideally, this space will be used to help members interact and communicate about imminent changes in the country and how they can work to adapt to climate change, oil production, and many more challenges.

Background

Guyana’s Colonial History

Guyana is the only English-speaking country in South America, a legacy of its colonial history under British rule. Guyana was established as a Dutch colony in 1580, where the land was primarily used for trading. During the 17th and 18th centuries, Guyana was a prime spot for sugarcane and rice production, where African slave labor was used to sustain farms near the coastal regions, where the soil was fertile (BBC News, 2019). Mining was another primary economic avenue for European settlers, with bauxite for aluminum production, and gold as the primary resources of interest. With British control of the country, Indian indentured servants contractually immigrated to Guyana to work replacing the recently abolished slavery in the country in 1834 (BBC News, 2019). The African slave trade and Indian immigration to Guyana are what define the ethnic composition of the modern-day country. About 40% of the population is indo-Guyanese, about 30% of the population is Afro-Guyanese, 20% of the population is mixed and the indigenous populations make up 10% of the country.

Because Guyana’s coastal region is primarily below sea level, Dutch and British powers spent money and resources ensuring the protection of agricultural lands primarily through the construction of sea walls, dams, and extensive irrigation channels (Khemraj, 2015). These preventative measures were expensive to maintain and often proved futile in protecting agricultural land. Polder agriculture created more fertile lands by draining swamps into nearby rivers and using the mineral-rich soil for farming. This was used in Guyana to allow for higher rates of production and more farmable land (Khemraj, 2015). Yet, by the second half of the 18th century, the use of polder agriculture created more economic troubles because of the high cost needed to maintain irrigation and drainage systems. Overall, colonizing powers used short-term solutions to the agricultural problems that they were facing, leading to stunted growth in the country economically (Khemraj, 2015).

Political and Social Systems

Guyana's government was formed as an after-effect of its colonial history. With almost all its inhabitants in a history of displacement, the rising political parties aimed to give the people a sense of national identity. A socialist political party was born in 1950 that threatened the existing colonial forces in the country. The People's Progressive Party (PPP) was started by an Indo-Guyanese man whose aim was to unite the two ethnic parties of Guyana (Bahadoor, 2023). Yet this threatened the goals the British had for its colony, and therefore British forces rejected the constitution made by the PPP and implemented martial law to ensure no backlash. The People's National Congress (PNC) was born after the country was split into two factions by the manipulation of the British, with the PNC representing moderate socialist practices, while the PPP represented stricter Marxism (Bahadoor, 2023). Within ten years, the two parties were racialized, with the PPP widely representing the Indo-Guyanese population and the PNC representing the Afro-Guyanese population (Bahadoor, 2023).

American and British imperialist forces created tension between the two parties/ethnic classes to prevent the country from developing further into socialism, which directly contradicted the goals of the United States and Britain. Guyana's colonial past was still very relevant by the time it became an independent country in 1970. During this time, the belief of "non-white inferiority" was predominant in the ruling class, and therefore to claim superiority in the country, the two parties pitted against each other to improve their social position (Bartels, 1980). This proved futile in improving the lives of the Guyanese but instead drove a barrier between the people that stunted Guyana's potential growth. This tension still exists among people, socially and also physically. In Georgetown, Guyana's capital, the Indo-Guyanese live primarily west of the Demerara River while the Afro-Guyanese live east of the Demerara River.

Currently, Irfaan Ali serves as president of the country representing the People's Progressive Party since August 2020. The two parties' beliefs remain the same, as well as their racial affiliations. Primarily, the PPP remains the country's primary political party and has acted to elevate the global status of Guyana, potentially through oil.

Economy and Oil Industry

In 2015, crude oil was found on the coast of Guyana, sparking an interest from oil companies worldwide to extract the resources that lay beneath Guyana (Kennedy, 2023). While many other companies have been extracting in Guyana, ExxonMobil, having a contract with Guyana since 1999, leads the charge in extraction. (Westervelt, 2023). The market for oil in Guyana has been extremely competitive, with various oil companies vying for a profit (Kennedy, 2023). The discovery of oil has the potential to greatly benefit the Guyanese population with the influx of jobs and opportunities in the oil industry.

Yet the intentions of oil companies do not seem to be aligned with the country or its people and they are looking to gain a positive reputation in Guyana. Primarily, oil companies intend to make money as efficiently as possible (Westervelt, 2023) even at great environmental and safety costs. While Guyana is not a rich country, it has reached a status of carbon neutrality (Sovacool, 2023) that created social and environmental plans for protecting the country from future changes to its climate. Therefore, ExxonMobil took an interest in winning the approval of the public eye, like through sponsoring the Caribbean Premier League's Amazon Warriors, Guyana's Cricket team, and pushing positive advertising that exalted Exxon (Westervelt, 2023). Despite this, certain individuals still fear that the benefits that oil can bring to Guyana will not be distributed to its citizens (Westervelt, 2023). Economically, this is known as the "resource curse," where a developing country in the Global South that has an abundance of precious resources faces the possibility of receiving negative side effects from its production (Addisu Lashitew & Werker, 2020). Yet Guyana continues to push oil production in excessive and dangerous ways that could harm Caribbean countries because of the financial incentives government officials gain (Westervelt, 2023). Venezuela is a notable example of this phenomenon. In this instance, the government put an extreme emphasis on oil extraction and production, resulting in little economic diversity in the country (Wald, 2017).

Despite the potential downsides of oil in Guyana, the global perspective establishes that oil will allow Guyana to improve its economic standpoint, but also establish Guyana as a bigger political power. Guyana, currently one of the countries with the highest poverty rates with half of the country living on 5 U.S dollars per day (News Source Guyana, 2022), stands to greatly benefit from a new abundant source of revenue. Another perspective also claims that while oil production sets the globe back in terms of contributions to the greenhouse gas effect, the money earned from oil production can be used for climate adaptation practices in the country (Westervelt, 2023). Guyana's current Vice President Bharrat Jagdeo is vocal about the lack of climate adaptation funding that developing countries have and is an advocate of using oil money to facilitate adaptation (OilNOW, 2022). Exxon has also donated money to a forest conservation program that allowed for its expansion (Westervelt, 2023). This benefits the people, specifically the indigenous populations in Guyana who look to establish better practices for a healthier environment.

This has not been the trend for oil-rich countries in the past. When oil is discovered in a developing country, the social downsides often take a higher toll compared to the financial benefits that the country gains. With what the NAACP calls, "Fossil Fuel Foolery," the perceived benefits of fossil fuel production are often overplayed, and the downsides are overlooked. For example, companies such as Exxon can underplay the impact that oil extraction has on a space, especially in marginalized communities (NAACP). Therefore, it is important to educate citizens of oil-rich countries on how oil can affect their lives and empower them to take action to seek social benefits from new oil money.

Facing a Changing Climate

Starting in 2009, Guyana committed itself to a carbon reduction plan that resulted in the country reaching carbon neutrality (LCDS, 2022) and further commits to reducing emissions by 70% by 2030. This is a milestone that few countries have been able to attain. This process began with the leveraging of Guyana's forests to act as a carbon sink which was highly possible because of the vast forest cover that the country has (Sovacool, 2023). Forest resources have been a great source of income for Guyana in the past, therefore investing further in forestry had economic and environmental benefits. The country then committed to the inclusion of renewable energy projects where possible and the foundation of international partnerships that provided financial support for further conservation (Sovacool, 2023). Guyana also ensured in its carbon reduction plan that the benefits of decarbonization would reach the marginalized communities in Guyana such as its indigenous populations. The country also added the right to a healthy environment in its constitution, guaranteeing that citizens have the right to clean and safe environments. Guyana stands as an example for many developing nations on how carbon neutrality can be achieved.

Despite the work that Guyana has done to reach carbon neutrality, it still stands to face the harshest effects of climate change. By 2030, it's predicted that the entire Guyanese coast will be completely flooded and unlivable (Bahadur, 2024). Most of the population of the country lives on the coast and would be displaced by this extensive flooding. Because of a weak insurance policy with ExxonMobil, Guyana could be liable for such spills if they occur in the future (Bahadur, 2024). Exxon's drilling in Guyana is also the riskiest type, being deepwater drilling. Spills of this magnitude will negatively affect Guyana but also bordering and Caribbean countries (Westervelt, 2023). Additionally, with the country's constitution guaranteeing a healthy environment for all, a catastrophic spill would be a breach of these rights, making the activities of Exxon unlawful (Bahadur, 2024). Many in the country have been wooed by the potential benefits that Exxon brings to Guyana, yet a simple accident could greatly harm the residents and the country.

Guyana's actions with reaching and maintaining carbon neutrality and simultaneously making deals with ExxonMobil and other oil companies are contradicting and misleading to its citizens and the rest of the world. While Guyana's carbon emissions are relatively low compared to higher consumerist countries such as the United States, the extraction of oil within its borders is contradictory to the message of environmental protection. With all the occurrences that are probable in Guyana's future, it is vital for residents of the country to be educated on these issues through various means and feel the pride and empowerment to create meaningful change within various scales.

Community and Social Development

With more financial opportunities presenting itself in Guyana, there are more opportunities to support the social development of the country through different means. This can be as simple as improving roads and infrastructure and creating a more educated population. In the scope of this project, that means development that enhances community and allows for more interaction between people. The goal of this project is also to enhance the culture of the area through artistic and creative means to bridge societal boundaries and conflicts and highlight the effects that climate change will have on the area.

Third Places

Third places are defined as spaces in which individuals can stay when they are not at work, school, or home. Typically, these are spaces like religious centers, coffee shops, parks, and other public venues. These spaces allow for interactions between members of a community, and they foster a stronger sense of identity tied to location (Goosen, 2020). They are beneficial in making individuals feel closer to the place in which they reside, and to the people around them.

In the Global South, third spaces become vital for social development. Third places garner a sense of pride in location and culture when done correctly that can stimulate a desire to improve what is not working in the current society. In addition, interaction with other members of the community can start public discourse and mobilize action that improves the quality of life for many individuals (Oldenburg, 1989). While this is mostly for a local sense of government, allowing citizens to feel that they have a say in the actions of a community can empower bigger-scale action beyond the scope of the community. Currently, in Guyana, there are few planned spaces in which individuals can gather to exchange ideas. The creation of a space where this type of behavior is facilitated and encouraged would allow community members to improve where needed.

Art as a Tool for Development

Art can also be used to foster a sense of community in individuals. The inclusion of art in public spaces allows for individuals to be heard in different ways. It allows for freedom of expression and improves the community's appearance. This creates a sense of pride and engages young people to create changes in their community (Young, 2023) This can be a mural that displays the culture of an area and highlights the key parts of what sets the space apart from others, or a display that recognizes the history of an area and gives recognition to known public figures. Similarly, public art can highlight where there are concerns in the community. For Guyana, it can function to highlight how climate change poses to devastate the country in the future as a form of reflection and activism for viewers.

Methodology

Approach

The first step in designing this space was to understand the space's potential and how the development of a park in this area can increase the well-being of the nearby residents. Research was done on community centers in developing countries and how community involvement in projects such as these can create a stronger and more unified bond among people. Various designs and ideas for parks and community centers were analyzed to see how they could be incorporated into this space. There was also an investigation into how art can be added to the space to create a sense of cultural pride in the area. After this research, the design process began with sketches, site evaluations, and eventually moving the design to 2D modeling software.

Community Involvement

The objective of interviews is to understand the social needs, dynamics of the community, and the important cultural aspects of Buxton to then use this information to inform and guide the development of the community space. The aim is to get information on where people spend their free time, activities that are carried out by individuals, and how different spaces are used when members of the community are not at home or in workspaces. Questions were written about the possibility of a community space and what members of the community would like to see in the space for them to utilize it to its fullest potential. Because of the proximity to a primary school, questions directed towards children, or their teachers were included to get an understanding of how kids after school could utilize the space. The developed research questions are listed in Appendix A.

The questions asked to the community would have been delivered in concise and clear ways to receive thorough answers. The questions were crafted to receive a specific response but still gave the freedom for individuals to express their thoughts. Questions such as “Which local places or venues do you frequent and enjoy?” allowed for a specific response and still an open-ended answer.

In addition to seeking input from locals, collaborations with artists were sought in the space's design. Primarily, contacts with local artists were made for the possibility of a mural, sculpture or other form of art to be added to the space and their thoughts on what the space can be used for. Though no interviews with artists were conducted, the overall aim was to understand how Guyanese culture can become a spotlight in this space. This outreach was done through Facebook, Instagram, and more formally through email. The inclusion of art was also researched to find examples that would best highlight the problems that the community can face.

Site Design

Site design refers to the entire process of the development of a parcel of land. The design phase of civil engineering projects includes considerations such as stormwater management, elevation planning, land cover studies, and much more. Therefore, a systematic and comprehensive approach is crucial.

Topography

Determining topography considerations is a crucial step in civil engineering design as it influences various aspects of the project such as drainage and overall site layout. The process typically begins with obtaining topographic data through surveys, LiDAR (Light Detection and Ranging), or other techniques. This data provides information about the shape, elevation, and features of the land. The next step is analyzing the data to identify the slope of the land, the location of natural drainage patterns, and the presence of any geological features such as rock outcrops or faults. This analysis helps engineers understand how the topography will impact the design and construction of the project. Based on the analysis, engineers can then develop a topographic plan that outlines how the site will be graded, where roads and structures will be located, and how drainage will be managed. This plan is essential for ensuring that the project is designed in a way that minimizes earthwork, maximizes site efficiency, and meets all regulatory requirements.

Stormwater Management

Since this project is in a high-rainfall area, stormwater is vital to the design process. The process typically begins with a thorough site assessment to understand the natural topography, soil composition, and existing vegetation. This information is essential for making informed decisions about the project's design and layout. The rational method is a widely used technique for estimating peak runoff rates from a specific site based on its characteristics and design parameters. The process involves several key steps to determine the peak flow rate that will inform the design of stormwater infrastructure.

The first step in using the rational method is to calculate the watershed area that contributes runoff to the site under consideration. This area is typically delineated based on slopes and identifying depressions in an area. This can be found with topographic maps or aerial imagery. Next, the rainfall intensity for the design storm event is determined based on historical data and regional rainfall frequency curves. Rainfall intensity can also be found in existing IDF curves. This intensity is then used to calculate the total volume of rainfall that will fall on the watershed area during the design storm (i.e., a 5-year storm). Once the rainfall volume is known, the next step is to estimate the runoff coefficient, which represents the fraction of rainfall that will become runoff. The runoff coefficient depends on various factors such as land use, soil type, and vegetation cover. With the runoff coefficient and rainfall volume determined, the rational method equation is applied to calculate the peak runoff rate. This rate is crucial for designing stormwater infrastructure such as pipes, culverts, and detention basins to safely convey and manage stormwater runoff. Based on these calculations, design systems such as detention ponds or permeable pavements can be used to mitigate flooding and pollution.

Environmental, Legal, and Financial Constraints

Practical considerations in the design phase focus on feasibility, cost-effectiveness, and sustainability. Design projects must balance the objectives of a project with budget constraints and environmental regulations. For instance, while designing stormwater management systems, engineers must consider the cost of construction, maintenance, and long-term effectiveness. Similarly, in grading and landscaping, practical considerations include the cost of earthwork and the impact of grading on the site's aesthetics and accessibility.

From speaking to a representative of the community, Georgetown holds no zoning ordinances that dictate the type of development that can occur in certain locations. Therefore, new development goes through the Neighborhood Democratic Council. This council acts as a committee to make decisions for the betterment of the community. Approval for new design plans would go through this council. Buxton is mainly residential with agricultural land south of where residents are located. North of the neighborhood is a protected and managed mangrove bordered by the seawall along the coastline. The area is just above sea level.

Design Process

Iterative design processes are often employed to refine the initial designs based on feedback from stakeholders and further analysis. This involves revisiting the site assessment to incorporate new information or adjusting the design to address unforeseen challenges. In bigger projects, collaboration with architects, landscape designers, and environmental scientists is also crucial to ensure that the final design meets the project's objectives and enhances the site's functionality and aesthetics.

Throughout the design phase, engineers must also consider the long-term sustainability of their designs. This includes incorporating green infrastructure, such as green roofs or rain gardens, to reduce the project's environmental footprint and enhance its resilience to climate change. By integrating theoretical knowledge with practical considerations and a focus on sustainability, engineers can create innovative and effective designs that enhance the built environment while minimizing environmental impact. In this project, the goal was to highlight the environmental sensitivities of the area, therefore considerations of sustainability are at the forefront of the focus.

Physical Site Evaluations

The objective of site evaluations was to understand how environmental conditions would pose obstacles to the design of the community space. To understand the obstacles that can interfere with the design, physical site evaluations were conducted. Given the lack of informational data on the environmental conditions in Georgetown and more generally in Guyana, this part of the analysis was conducted using estimates and data from Puerto Rico. Guyana and Puerto Rico are both Caribbean countries that share similar temperatures (about 80 degrees Fahrenheit for both), humidities (about 70-75% for both), and climate patterns.

To understand stormwater in the lot area, data on the soil type, slope, and land cover of the area was found to then select a runoff coefficient for the rational method. Using this and existing IDF curves of Puerto Rico to define times of concentration, the peak runoff rates were calculated for different storm sizes.

Layout Concept

Based on the information collected from research, a design was sketched by hand to ideate how the space can be used to the fullest capacity. First, walking paths were placed around most of the perimeter of the space. The path intersected with the existing paving that already exists along the sea wall. The space was then sectioned off behind the existing water pump station to be open space. Paths were added from the perimeter to a central plaza to allow for connectivity to more areas of the lot from many different locations. A public building was added to the lot that would have bathrooms, recreation spaces, and for people to use the space to its fullest potential. A playground was placed in the bottom right corner of the lot for the school that is nearby. Shade areas and picnic tables were added to many different places in the space to allow people to use these spaces as they see fit and allow them to be comfortable in this center while also promoting connectivity.

Setup in ArcGIS/Civil 3D

Using Google Earth, a lot boundary polygon was created in ArcGIS that would then be transferred into Civil3D. This allowed for the constraining of needed information to the area of interest. A geolocation coordinate system of Guyana was added to the file to get specific numbers and measurements of the space. The lot boundary created in Google Earth was also imported into Civil 3D. The sketched design was translated into the file through polyline tools.

Results

Interviews and Research

Interviews from individuals in the community could not be completed within this project's time frame. Yet there were still discussions with an affiliate of the community. There was information provided on the neighborhood's layout, the occupations of nearby residents, and how the vacant lot is used. From speaking to a sponsor from the community, information was learned about how community members spend their time away from school and work. The lot in question is frequented by many even with a lack of facilities and ease of access. The goal presented was to create a space where community members would use this lot in more convenient and accessible ways. This meant understanding what individuals would like to see in this space to accentuate their current habits without displacing any behaviors.

There was research conducted on how a community space/park would be laid out for the most convenient use. What was found was the inclusion of spaces that could be used for multiple purposes allowed for the freedom to convert the space into whatever people needed or desired it to be. This was a design principle that was kept in the process of creating this space. Other important aspects included cleanliness, accessibility, and greenery, all of which are addressed by this design. What was also kept in mind was the cost of construction for the entire space.

Physical Site Evaluations

When determining the geographical conditions of the area, there were challenges regarding finding accurate and reliable data that would help me understand the existing conditions of the place. Google Maps and images taken of the site were primarily used to get an idea of the vegetation and surrounding areas and how this would affect the design. From the images taken, the land looks to be lightly vegetated and close to the sea wall. There are a few palm trees in the area and residential houses in the surrounding spaces. A water pump station is in the southwest corner of the plot and a soccer field is west of the lot. The seawall creates the northern border of the land.

Figure 1: The image shown is a Google Map screenshot of the lot of interest. To the north is the seawall, and in the southwest corner there is a water pump station that works to transport stormwater throughout Georgetown.

Figure 2: These images show the lot of interest from the Northwest corner. The water pump stations that are adjacent to the lot are pictured. The seawall is also pictured in this image.

Figure 3: These pictures show the lot that is to the West of the lot of interest. The images show a soccer field that is frequented by community members.

Using Google Earth Pro's polygon tool, the boundary for the plot of land was marked and was inputted into Civil3D later. The path tool in Google Earth measures the spot elevation data associated with each latitude/longitude point on the path. Converting this data, a contour map was created of the area and its surroundings using QuikGrid, creating a DXF file. This file was then imported into Civil3D and converted to a DWG file that can be edited more easily. From the contour map, the elevations are observed to remain between two and thirteen feet, with lower elevations to the east and higher elevations to the west and near the water pump station. The slopes calculated by Google Earth Pro were no higher than 2%.

Figure 4: The image to the left shows a screenshot from Google Earth Pro that shows the points taken for latitude/longitude/elevation. Each point is recorded and stored in Google Earth Pro which can then be transferred into an Excel sheet. The image on the right shows the finished contour map after applied through QuikGrid. Elevations were measured in feet and marked for each foot.

Next was understanding the water drainage capacity of the area and how this can also affect the design. To do this, the Rational Method was used to calculate the Peak Runoff Rate of the entire area. The runoff rate was calculated so that a better understanding of how water drains in the area was gained. Considering that Guyana has high rainfall rates, this is an important aspect of the physical site evaluations that could affect and influence the design. The equation for the Rational Method is as follows:

$$Q=CiA$$

Where c is the runoff coefficient, i is the rainfall intensity by inches per hour, and A is the area in acres.

The area in the equation is the area of the plot of land which is 3.57 acres. The runoff coefficient was chosen based on USGS's standard for parks/cemeteries. The range of c-values for parks is 0.10-0.25. Since the site is smaller, a smaller c-value was chosen. Specifically, c=0.13. Since there is limited data on rainfall intensities in Guyana, the Puerto Rico IDF values from NOAA were used due to a similar climate and location to Guyana. A storm recurrence interval of 10 years was chosen, which indicates a 10% chance of a design storm occurring every year, and a time of concentration of 1 hour. Using the above equation, the peak runoff rate of the land before development is 1.202 cfs. In other words, stormwater would drain at a rate of about 1.2 cubic feet per second. This is a lower runoff rate, meaning that there is less water that runs off after the soil absorbs and infiltrates what it can. While the rate is low, it was still important to manage this water in the design of this park. Therefore, accommodations were made in the design.

Considering the acceleration of climate change and its effects on Guyana, it was also important to look at how the runoff rate and stormwater drainage will change in the future. Therefore, the runoff rate with a time of recurrence of 25 years was used, indicating a 25% chance of a storm of the designated size occurring every year. With this change, the peak runoff almost doubles to 1.41 cfs. The runoff rate does not change much with a higher recurrence interval.

Layout Design

As mentioned, an area outline was sketched out in Google Earth Pro and then imported into Civil3D. A coordinate system for Guyana was inserted into the plan that allowed for any design made to line up accurately with the map of Guyana. With the outline properly positioned, the contour map was inserted by making the map a block that was then resized and positioned accurately with the lot outline. Using the map feature on Civil3D, bodies of water were marked with cyan lines, such as the seawall and canals south of the lot.

The design of this space was first sketched out on paper, and then more accurately converted to Civil3D. The design includes walking paths made of gravel, specifically round pea gravel, throughout the space to allow for easier walkability. There are shade areas indicated with rectangles and circles in the design to allow for protection from the sun and the rain. These shade areas would be roofs with stilts to keep them upright and made of sturdy wood that would be able to resist higher rainfalls. They would be placed at a height of 10 feet to allow people to comfortably walk underneath. The picnic tables would be made of sturdy wood such as teak to withstand weather and wear. There are park benches placed along the border of some paths. These would be teak wood benches because of the support and structure that teak wood offers. On the southwest corner of the land, there is a multipurpose space that can be used by the community for whatever needs or desires. This would be designed similarly to the shaded areas with more space to allow for bigger gatherings and multiple uses. For example, it can be used as a gathering space for meetings or an art display show. Throughout the lot, there are indications of trees, which would be native trees of Guyana, and any vegetation added would also be native.

To deal with runoff from rainfall, vegetated swales will be placed in the areas with the steepest slopes. Ideally, the vegetation would be natural grass to ensure that swales blend in with the rest of the area, and don't interfere with any paths that individuals may take. A rain garden was also placed at the lowest point of the park in the southeast corner. Rain gardens can reduce the peak runoff rates during storms and collect extra rainwater. It also adds more natural greenery to the area which enhances the appearance of the space.

There is also an indication of an art display or statue in the middle of the lot. Ideally, this would be designed by the community or a local artist representing Guyanese culture. This would be done in collaboration with the community and local artists who desire to represent the people and their culture. This can also be imagined as a reflection of the negative effects of climate change and how it will affect the community within the next ten years. With a wall that indicates the heights of previous floods that have reached in that area and where floods are expected to occur in the future, residents of the community can recognize and reflect on how a changing climate will negatively affect the people and space.

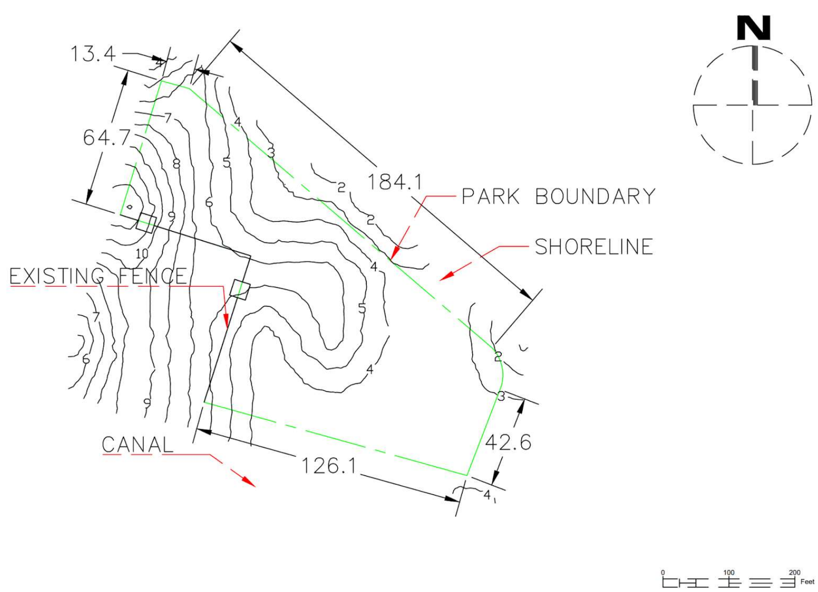

Figure 5: This image shows the preconstruction details of the lot in Civil3D. The plan shows elevation data, the existing sea wall and canals, and where a fence was placed between the lot and the water pump station. Measurements are shown for the lengths of the lot boundaries.

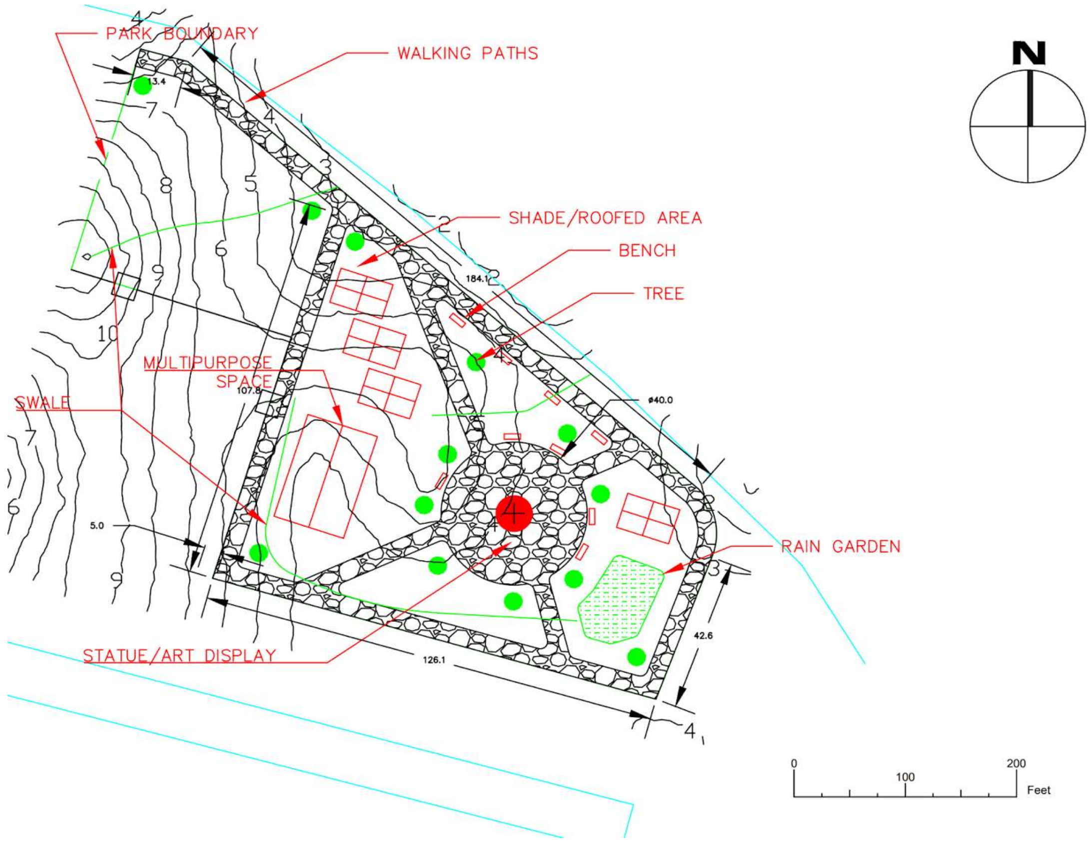

Figure 6: The image shows the plan that includes walking paths throughout the lot indicated with black hatched gravel pattern. Shade areas and the multipurpose space are indicated with red boxes. The placed swales are indicated with green lines, and the rain garden is indicated with a green-hatched grass pattern.

CONSTRUCTION DETAILS

WALKING PATHS TO BE MADE WITH STONE SLABS ALLOWING FOR WATER TO ESCAPE THROUGH THE PATH

THE INDICATED TREES WILL BE NATIVE AND COMMON TREES OF THE AREA. RECOMMENDED SPECIES ARE LISTED

SHADE AREAS WLL BE GAZEBO LIKE SPACES WITH SQUARE SLANTED ROOFS SUPPORTED BY WOODEN BEAMS. THEY WILL HAVE A HEIGHT OF TEN FEET.

PICNIC TABLES WILL BE AVAILABLE UNDER SHADE AREAS MAKE OF TEAK WOOD.

BENCHES ARE TO BE STEEL SUPPORTED AND MADE WITH TEAK WOOD.

THE MULTIPURPOSE SPACE WILL BE SIMILAR TO THE SHADE AREAS.

THE MIDDLE OF THE INTERSECTING PATHS INDICATES AN ART DISPLAY COORDINATED BY MEMBERS OF THE COMMUNITY.

RAIN GARDENS FUNCTION TO COLLECT RUNOFF RAINWATER AND ADDING GREENERY TO THE AREA. THE GARDEN WOULD BE POPULATED WITH NATIVE FLORA.

SWALES LEAD RUNOFF WATER TO DESIRED LOCATIONS SUCH AS THE SEA WALL OR THE RAIN GARDEN.

PLANT LIST

SCIENTIFIC NAME	COMMON NAME
ANACARDIUM OCCIDENTALE	CASHEW TREE
TERMINALIA CATAPPA	INDIAN ALMOND TREE
MANGIFERA INDICA	INDIAN MANGO TREE
EHRETIA ANACUA	SANDPAPER TREE
MAURITIA FLEXUOSA	MORICHE PALM

Figure 7: This image shows the construction details that include specifics about the site and its elements for construction.

Conclusion

The detail provided in the site plan allows for a framework that could be carried out more technically such as in construction documents and architectural plans if and when the idea is approved. The next steps for this project include official interviews with community members to propose the idea and gauge interest. Following this, consultation and presentation to the Neighborhood Democratic Council would follow, where members of the council would vote to approve or deny this community space. If approval follows, a more comprehensive and detailed plan regarding water systems, structural problems and more will be addressed and fully drafted.

The goal of this project was to construct a community space that residents that would elevate the uses it already possesses and inspire community members to take action in community decisions. With this project comes a stepping stone that allows for the future development of similar spaces not only in Guyana but in other places around the world. The inclusion of third spaces such as these can foster a greater sense of community that can inspire real change where it is necessary.

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Appendices

Appendix A - Interview Questions

- What specific features or aspects of your community do you appreciate the most?
- How would you describe the sense of community in Buxton?
- In your opinion, what makes Buxton a special or distinctive place to live?
- What are the main challenges or issues you see in the community? How do you think they could be addressed?
- Do you feel there is a lack of gathering spaces in the area? If so, how do you think this could be improved?
- Can you share any unique traditions or events that are important to the community?
- What are some common activities or events that bring people together in the neighborhood?
- Are there any significant historical or cultural landmarks in the area?
- Are there any local businesses or services that play a vital role in the community?
- Which local places or venues do you frequent and enjoy?
- In the development of community spaces in Guyana, what are some elements or activities you would like to see included to make it appealing to you and others?
- How do you see a community space contributing to the overall well-being and cohesion of the neighborhood?
- What are your primary needs or requirements as a member of the community, and how do you think a community space could meet those needs effectively?
- Are there any environmental or sustainability concerns that you think should be addressed in the development of the community space?

- Do you know of any existing networks or support systems within the community that help residents in need?

Appendix B - Stormwater Calculations

Stormwater calculations were performed using the rational method:

Q=CiA

Where Q = peak runoff rate (cfs), C = runoff coefficient, i = rainfall intensity (in/hr), and A = area (acres).

The area of the space is 3.57 acres in total. The c-value was selected based on Landscapes Planning: Environmental Applications textbook, where the c-value for parks and cemeteries is to be between 0.10-0.25. A specific c-value of 0.13 was chosen since the lot in interest is relatively smaller. The rainfall intensity was chosen from the IDF curves of Puerto Rico. A time of concentration of one hour and a recurrence interval of 10 years. These factors indicated a rainfall intensity of 2.59 in/hr.

$$Q = 0.13 * 2.59 * 3.57 = 1.202 \text{ cfs}$$

To account for climate changes that would affect the lot, a recurrence interval of 25 years was chosen. The rainfall intensity is then All other factors remain the same

$$Q = 0.13 * 3.04 * 3.57 = 1.41 \text{ cfs}$$