



Design of Extension to Punto Verde Environmental Theme Park



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Abstract

This report recommends a design plan for an extension to the Punto Verde environmental theme park. We analyzed the extension site, designed educational attractions, produced a site layout, and generated an itemized construction budget. The extension we designed encourages children to become better citizens by promoting environmental and social education through interaction, discovery, challenge, adventure, creativity, and sociability. Our recommendations promote appreciation of nature, social responsibility, and environmental awareness in visitors, inspiring them to be positive stewards of the environment.

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Table of Contents

Abstract	ii
Acknowledgements	iii
Authorship Page	iv
Table of Contents	v
List of Tables	vii
List of Figures	viii
Executive Summary	ix
Chapter 1: Introduction	1
Chapter 2: Literature Review	3
2.1 Puerto Rico Overview	3
2.2 Punto Verde and its Mission	3
2.3 Environmental Concerns in Puerto Rico	5
2.3.1 Water Pollution in Puerto Rico	6
2.3.2 Climate Change in Puerto Rico	7
2.4 Pro-Active Environmental Strategies	8
2.4.1 Wind Energy	9
2.4.2 Solar Energy	10
2.5 Environmental Park Case Studies	11
2.6 Educational Techniques	12
2.6.1 “Nature-Deficit Disorder” in Children	12
2.6.2 Childhood Educational Strategies	13
2.6.3 Strategies for Environmental Education	14
Chapter 3: Methodology	16

3.1 Review of Site Analysis	16
3.2 Design of Extension	17
3.3 Budget.....	19
Chapter 4: Results and Analysis	20
4.1 Site Analysis	20
4.2 Design of Extension	21
4.2.1 Punto Air.....	22
4.2.2 Punto Bug	25
4.2.3 Punto Energy.....	27
4.2.4 Punto Pollution.....	31
4.2.5 Punto Recycling	34
4.2.6 Punto Relaxation	36
4.2.7 Punto Water	38
4.2.8 Site Layout.....	39
4.3 Budget.....	41
Chapter 5: Conclusion.....	46
5.1 Appreciation of Nature	46
5.2 Social Responsibility	47
5.3 Environmental Awareness	48
Afterword	50
References	51
Appendix A: Punto Verde Mission Statement	55
Appendix B: Puerto Rican History	56

List of Tables

Table 4-1: Itemized budget.....42

Table 5-2: Appreciation of nature overview.....47

Table 5-3: Social responsibility overview48

Table 5-4: Environmental awareness overview49

List of Figures

Figure 0-1: Conceptual sketches	xii
Figure 2-1: Punto Chiquitines (Little Children’s Point).....	5
Figure 2-2: Open-Air Theatre	5
Figure 2-3: Direct normal solar radiation.....	10
Figure 2-4: Geology display at INBioparque	12
Figure 3-1: Aerial view of Punto Verde.....	16
Figure 4-1: Punto Verde site map	20
Figure 4-2: Cross section of extension with piles.....	21
Figure 4-3: Punto Air	22
Figure 4-4: Punto Bug	24
Figure 4-5: Verde City	28
Figure 4-6: Solar Ferris Wheel	30
Figure 4-7: Punto Pollution	31
Figure 4-8: Punto Recycling	33
Figure 4-9: Punto Relaxation.....	36
Figure 4-10: Punto Water	37
Figure 4-11: Site layout.....	40

Executive Summary

The declining state of the environment has been brought about by people and organizations worldwide lacking an appreciation of nature, sense of social responsibility, and awareness of the environment. For many years, the combination of these three factors has been responsible for much of the apathy toward protecting the environment. Without effective environmental education, this trend is likely to continue. If the policies of individuals and corporations do not change, all life on Earth will suffer the consequences. This potential future has inspired an environmental education movement around the world.

Specifically targeting children, the Punto Verde environmental theme park in San Juan, Puerto Rico was founded on the holistic mission of providing environmental education in a natural setting through interaction, discovery, challenge, adventure, creativity, and sociability. Already planning for the future, Punto Verde intends to expand into an adjacent plot of undeveloped land, but in order to secure the land for development it is necessary to formulate a plan of action.

To address this need and synergize with Punto Verde's educational mission, our team designed a layout of attractions geared toward increasing visitors' appreciation of nature, sense of social responsibility, and environmental awareness. We completed attraction sketches and descriptions, a site layout, and budget report, which we delivered to the park's coordinator and design team to be presented to the governing body in charge of the land. This report details what we recommended and how we made the required decisions for our design.

To begin our design, we completed an informal site analysis of the extension land, making note of topographical features, infrastructure, and nearby wetlands. In order to do this, we scanned an existing site map containing grading information and the location of most features, then traced and scaled it in AutoCAD. Any required information which was not included in the previous survey was then collected by making our own measurements in the field and inputting the data into our site map.

Next, the group focused on the process of designing attractions which fit our educational goals, as well as having popular appeal, minimized environmental impact and maximized consumer safety. Surveys conducted of Puerto Rican teachers, independent research and brainstorming, and meetings with park coordinators and designers were used in the synthesis of

our attraction concepts. We acquired the input of local teachers on techniques for group learning, environmental education, and aspects of their teaching strategies. Ideas were inspired by various sources, from children's museums and arts and crafts websites to other theme parks. The insight provided by this research was a starting point for further creative development by the team, which materialized through group brainstorming. All potential ideas were then screened and streamlined through our evaluation process, which we used to judge each attraction concept based on the aforementioned criteria of educational relevance, popular appeal, environmental impact, and consumer safety. We proposed our attraction ideas at weekly meetings with our sponsors and advisors, describing the concepts and communicating the theoretical basis on which they were justified. In this manner, we obtained feedback which allowed us to finalize our designs as appropriate to fit the needs of the park.

The existing park is divided into subsections called "puntos" (Spanish for "points") which contain various attractions and activities which fall under a unifying theme. For our extension, we continued this layout format of puntos, conceptualizing both overall themes and individual attractions. We completed a proposed site layout for the extension using our previously developed site map to choose locations appropriate for each punto. Puntos Air, Bug, Energy, Pollution, Recycling, Relaxation, and Water were designed, each with their own set of unique attractions. This array of proposed puntos and their attractions addressed our three main educational themes.

The first theme, combatting "nature-deficit disorder" (Louv, 2008), aims to introduce children to the environment around them and encourage a love of nature. This connection must exist in order for children to care about environmental causes and work toward a solution. Some of our attraction recommendations demonstrate the renewing cycle of nature and promote empathy with various natural environments. Others allow children to play directly in nature and encourage them to see it as a peaceful, healthy, and fun place to be.

Ideally, citizens of the world should feel compelled by a sense of social responsibility for their actions both towards society and the environment. We integrated elements into our attractions which support the development of this kind of responsibility in visitors. Understanding the consequences of one's individual actions, or "cause and effect", is crucial to make decisions that are beneficial to the whole. Specific attractions we designed teach about

teamwork and cooperation through interactive challenges that require children to work together in order to achieve a common goal. Our attractions also teach about the role of an individual in the overall scheme of environmental issues, as well as various techniques and behaviors one can apply on a daily basis to positively impact the environment. Instilling a sense of social responsibility in visitors will contextualize their individual effect on the environment and stimulate their interest in gaining awareness of the environmental problems we face today.

Being educated on environmental issues at an early age will encourage children to continue being pro-active participants in society. Our attractions promote the environmental awareness of visitors throughout the extension in an engaging and interactive way. Teaching participants about alternative energy gives them environmentally friendly options to continue using in their daily lives. There are also opportunities for visitors to directly learn about the threats facing the Puerto Rican environment through visualizations of the current land conditions.

After finalizing our ideas, the team's artist, Ross Doran, created a visual representation of each area and its included attractions by producing a set of conceptual sketches.

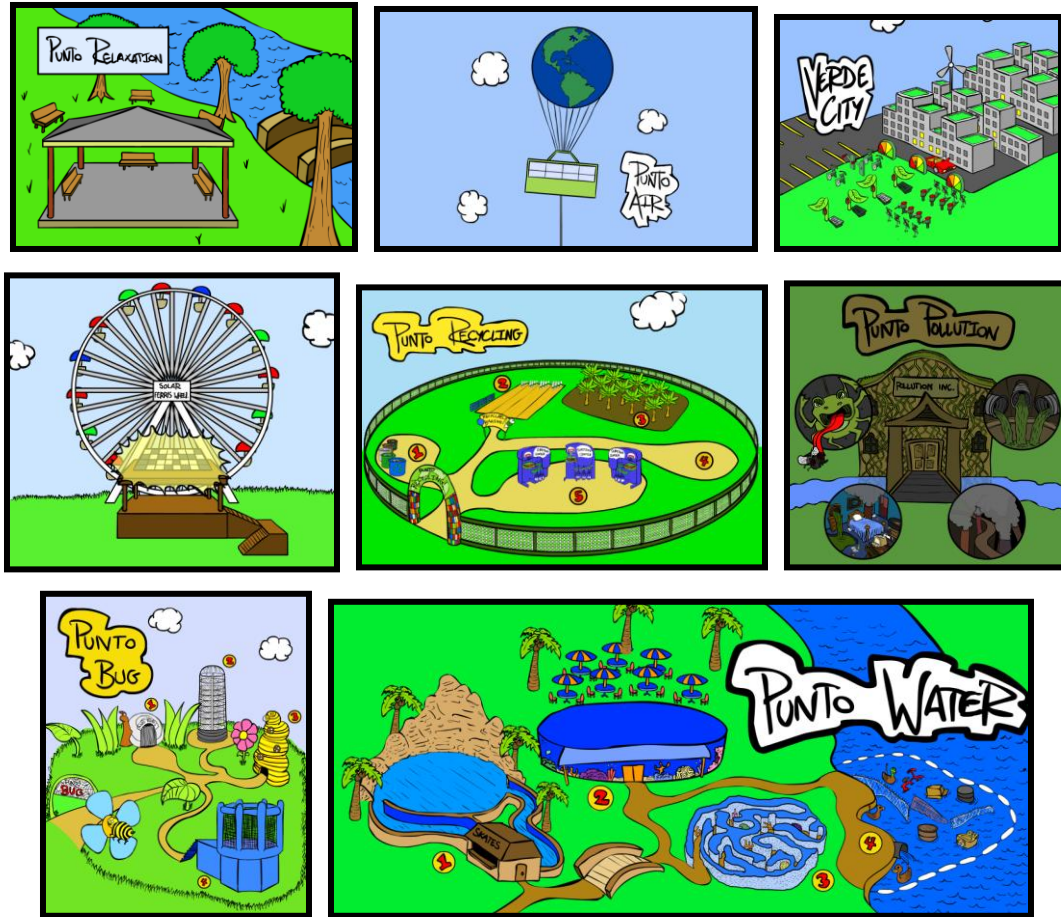


Figure 0-1: Conceptual sketches

With our proposed attraction concepts decided upon, we met with Punto Verde’s landscaping and design professionals to obtain information regarding the placement and number of restrooms, restaurants, and vending areas. With their feedback, a final site layout was established and we proceeded to complete an itemized budget and total cost estimate for our design. Each attraction was considered individually and multiple retailers and contractors were contacted to best determine a cost-effective method for constructing the extension. Other costs such as landscaping, plumbing, electric work, and labor were estimated based on the costs of corresponding tasks in the construction of the existing park. A spreadsheet of individual items, along with a lump sum, was provided to the Punto Verde design team along with our report, site layout and a catalog of attraction conceptual art.

Chapter 1: Introduction

The Earth, humankind's natural environment, is a necessity for life that many in our worldwide culture take for granted. Technological development and industrialization have caused the developing global environmental crisis, making the need to take action and engage in conservation unavoidable if the world's resources are to be preserved for future generations. Given these circumstances, something must be done both worldwide and at a local level to make a positive difference in the actions of citizens and businesses. For people to be motivated to behave differently, they must learn about the issues affecting their home and the world, the consequences of their individual actions, and how they personally can make a difference.

On a small island like Puerto Rico, the social and environmental issues faced on the mainland U.S. are compressed and concentrated due to the small land area and limited indigenous resources. The problem of the Earth's restricted carrying capacity is shown at a micro-scale on Puerto Rico, paralleling the world's problems on a much smaller land mass. It also reminds us that we will all eventually face the same consequences of resource strain and poverty if we do not make serious policy changes regarding our impact and use of the environment. U.S. environmental standards do not necessarily apply on the self-governed island, compounding the problem, and providing little incentive for individuals and corporations to practice environmentally sound policies. The future of Puerto Rico is at stake, and without change the island and its resources will eventually be used up and destroyed. Expanded environmental and social education programs are increasingly important, and offer the island a beacon of hope in this precarious new century.

Punto Verde, a nature themed children's park in San Juan, is meant to address these social and environmental problems in Puerto Rico by creating an educational environment where children and parents alike can learn through a fun, hands-on setting. The park's attractions are geared towards natural immersion, environmental education, teamwork, and exploring "cause and effect" relationships. The vision of the Punto Verde development group, a collection of construction and design professionals, integrates the ideals of appreciation of nature, social responsibility, and environmental awareness. With the problems of Puerto Rico insurmountable on a large scale without serious government and private sector intervention, Punto Verde provides a positive local arena where these problems can be addressed on an interpersonal level.

The exhibitions, activities, kiosks, and play areas combine recreational and educational elements to establish a location where the community can be entertained and educated (Rieckehoff, October 7, 2008).

There was a plot of land abutting the existing Punto Verde park, which could effectively be used for a park expansion, but the land was going to be acquired by another party unless Punto Verde produced a viable design proposal. The additional ten acres of land would increase the potential for environmental and social education, as well as aid in growth of the business. Our team made decisions regarding the specific use of the land so as to maximize the popular appeal, educational value, and consumer safety, while minimizing negative environmental impacts and efficiently utilizing the allotted budget. Our goal of completing a design proposal for the extension was fulfilled by reviewing the existing site analysis, designing new attractions, and proposing a site layout and itemized budget of construction costs.

Chapter 2: Literature Review

In order to make informed design decisions for the extension, we considered the socioeconomic and environmental problems in Puerto Rico, the Punto Verde business and mission, general educational techniques, and the strategies of existing environmental theme parks.

2.1 Puerto Rico Overview

From pre-European times until the Industrial Revolution, Puerto Ricans have primarily relied on small-scale agriculture and rural self-sufficiency for sustenance. It is only in the last century that Puerto Rico has moved toward a predominantly industrial economic system (Holt, Desmarais, Aull, 2002). The island has been transformed from virtually 100% agricultural sustenance to 0.7% agricultural output in 2007, accompanied by a manufacturing output of 62.5% (U.S. Census Bureau, 2007). This boom in manufacturing alongside a similar one in construction has resulted in much larger industrialized cities, such as San Juan.

Business growth and the expansion of capitalism have enabled a select few individuals to become extremely wealthy, while 45.5% of Puerto Rican residents live below poverty level, more than triple the overall U.S. poverty rate (U.S. Census Bureau, 2007). Along with contributing to the social disparity today, the economic trend of industrial expansion and population growth has facilitated large scale negative effects on the local environment, with problems such as coral reef destruction and pollution by unregulated industries (Wilensky, Mira, 2007). This is a serious issue, which cannot be solved by any one fixed means, and is deeply set in the history of Puerto Rico (See Appendix B for more information).

2.2 Punto Verde and its Mission

The Punto Verde environmental theme park, located in the center of the city of San Juan, is a versatile business geared towards giving children an educational experience through naturally themed attractions. This puts the park in a unique position to positively impact social and environmental problems in Puerto Rico by preparing children to become responsible citizens. Morally motivated leadership and strong financial backing have enabled the park's development thus far.

Angelita Rieckehoff is the visionary leader and originator of the Punto Verde ecological park concept. Her business sense and drive to succeed are evident in her past role as executive director of the economic development program, Vivero Caimito, a “community based profitable agricultural operation” which saw a fivefold increase in revenue under her leadership (Holt, Desmarais, Aull, 2002). Ms. Rieckehoff went on to start the worker-owned corporation Punto Verde PT (Propiedad Trabajadores) in 2000.

The advantages that worker-owned corporations have over private corporations allowed Ms. Rieckehoff to acquire seven million dollars for the park (Blasor, 2007). In addition, twelve contributors donated more than \$4000 each in order to become “Extraordinary Members” of the Punto Verde PT, enabling the members to receive tax credits and interest (Papini, 2008). Finally, additional funding for the park was gained through a Collateralized Debt Obligation (CDO) financing deal between Oriental Financing and Lehman Brothers. The Punto Verde development team plans to use the 16 million dollars acquired from these sources to finance the future park extension (Hernandez, 2009).

Punto Verde PT intends to create an “empowerment business incubator and a micro-enterprise center for persons of limited resources” and is devoted to “improving the growth of San Juan by helping the growth of their small businesses” (Papini, 2008). The company aims to create skilled positions which can be filled by community members, who will then receive entrepreneurial business education. This “business incubator” model guides participants in the program through placement in long-term, skilled occupations within the organization, enabling them to gain the necessary knowledge and experience to succeed in future endeavors (Rieckehoff, January 28, 2009). Through the Punto Verde incubation process, these workers can gradually be educated about park operation and coordination (Rieckehoff, 2008). Punto Verde PT expects to train up to 80 employees in this manner, and in time plans to create as many as 200 jobs (Rieckehoff, 2008 & Hernandez, 2009).

The Punto Verde park seeks to attract visitors both locally and worldwide. An inexpensive admission fee is aimed at allowing low-income families to take part in the experience. The concept of an environmental theme park in Puerto Rico is unique, and Punto Verde is expected to draw tourists as well, especially given its proximity to nearby hotels. Punto Verde’s attractions focus on interactivity in order to intellectually stimulate children to learn

about environmental issues. Each of the attractions in Punto Verde are separated into thematic sections, or “puntos” (Spanish for point) – for example, Punto Sonoro (Sound Point) is a sound and music themed world where children can interact with a variety of different musical elements. In each of these worlds, there are a number of different attractions, including a cave, a playground (Figure 2-1), a water fountain, tree houses, rope walkways, a simulated archaeological dig, and an open-air theatre for plays and shows (Figure 2-2) (Blasor, 2007 & Hernandez, 2009). In this manner, Punto Verde combines environmental education with fun, engaging activities.



Figure 2-1: Punto Chiquitines (Little Children’s Point)



Figure 2-2: Open-Air Theatre

(Photos courtesy of Angelita Rieckehoff)

Punto Verde’s holistic educational mission will be continued in the ten acre expansion, incorporating a variety of new attractions which will be geared toward social and environmental education, continuing the park’s mission of promoting awareness of individual “cause and effect” and the consequences of one’s actions. The impact of the current Punto Verde park and its future extension is meant to be far-reaching, and positively impact the well-being of Puerto Rico and its children.

2.3 Environmental Concerns in Puerto Rico

In order to better appreciate and incorporate Punto Verde’s goal of environmental education into the park’s attractions, we investigated some of Puerto Rico’s chief ecological concerns. The two most pressing are water pollution and the effects of global climate change. By addressing these issues through park attractions, Punto Verde will raise public awareness and better communicate how visitors can make individual impacts on improving their environment.

2.3.1 Water Pollution in Puerto Rico

The industrialization of Puerto Rico has brought a wealth of environmental troubles. According to the Puerto Rico Water Resources Research Institute, the island has some of the highest levels of toxic releases into the environment when compared to the rest of the U.S. states and territories. In addition to higher demand on energy (which causes increased emissions and fuel consumption), the manufacturing sector is responsible for much of the water contamination (Skanavis, 1999). The government advertised the island's abundant water resources in the mid-twentieth century, when industries were being enticed to relocate to Puerto Rico. It is these very industries that are now misusing this precious resource (Huntera, 1995).

A major issue in the past and present has been the contamination of surface water bodies and groundwater with raw sewage. Urban and industrial centers expanded so rapidly in the past century that infrastructure like wastewater treatment facilities were unable to keep up, resulting in discharge of raw sewage. Absence of federal and local regulations in the past and an overall lack of planning along with inadequate financing compounded this problem. This is a serious public health concern, and several outbreaks of illness have occurred since the 1970's that were associated with water contamination (Huntera, 1995).

Pharmaceutical companies were particularly drawn to Puerto Rico, and since their arrival on the island, they have been the leading polluters of all industry. Community drinking water supplies were contaminated on numerous occasions, resulting in public health situations. In these situations, chemicals such as carbon tetrachloride (a suspected carcinogen), mercury, and methyl cyanide have leaked from underground storage tanks, causing community evacuations and the designation of governmentally-organized Superfund cleanup sites (Skanavis, 1999).

For decades, Puerto Rico was also severely lacking in regulations with regards to waste disposal, and both the environment and the people of Puerto Rico have paid the price. What may be most alarming is the fact that most of the people who are potentially affected by this are unaware of the dangers they are being exposed to, as is the case with many other environmental crises. It is therefore the responsibility of both the public and private sector to educate people about these hazards and inform them of ways to mitigate these situations.

2.3.2 Climate Change in Puerto Rico

Climate change is a global issue that is likely to have a destructive impact on the island of Puerto Rico. Concern over this problem continues to grow around the world, and calls to address it are mounting with an increased sense of urgency. Punto Verde hopes to feature this issue in park attractions in order to educate children about the potential consequences of climate change and how they can individually make a positive impact.

Climate change is a worldwide phenomenon caused by the burning of fossil fuels, which releases carbon dioxide into the air. Carbon dioxide and other gases such as methane and water vapor are greenhouse gases, meaning that they absorb and trap heat in the atmosphere. The greenhouse effect is perfectly natural and without it, the earth would be too cold to support most life. However, since the Industrial Revolution, so much carbon dioxide and other greenhouse gases have been released into the atmosphere that it is intensifying this effect, and will begin to significantly alter Earth's climate (Wilensky, 2007).

One of the main threats posed by climate change to an island like Puerto Rico is a rise in sea level. This is expected to occur as the earth's average temperature gradually increases and the ocean expands with water from melting northern glaciers. Much of Puerto Rico's population lives on the coasts, very near sea level. If the oceans continue to rise, as anticipated, vast urban areas could be permanently flooded. Crucial coastal ecosystems and nesting areas would also be negatively impacted (Wilensky, 2007).

Climate change is also predicted to alter weather patterns and occurrences. Being a small island in the Caribbean, Puerto Rico is regularly hit with hurricanes. It is theorized that, as the surface temperature of the oceans rises, evaporation will increase, leading to more hurricanes of greater intensities. An already elevated sea level will provide a higher starting point for storm surges, causing more extreme flooding, especially in low-lying urban areas such as San Juan. On the other side of the spectrum, altered weather patterns could also result in frequent droughts and irregular rainfall. This would have a devastating effect on the native species, especially amphibians, as well as on the water supply for the densely populated island (Wilensky, 2007).

The destruction of coral reefs is another consequence of climate change that would have a negative impact on both Puerto Rico's economy and biodiversity. Coral reefs are delicate natural ecosystems whose existence depends heavily on maintaining a careful balance of its

environmental conditions. Though these reefs are often damaged by natural occurrences, such as storms and disease, human activities, such as pollution and damage from physical contact, have increasingly become the source of destruction for coral ecosystems (Wagner, 2004).

These concerns have been studied and documented for years, but now the effects of climate change on reefs are being examined with growing alarm. Coral reefs are exceedingly sensitive ecosystems, and an increase of less than one degree in ocean temperature puts the coral in the upper limits of its tolerance. The types of corals that create coral reefs have hard skeletons and their tissues contain microscopic organisms that produce food for the coral. When water temperature rises, these microorganisms can no longer survive and they leave the coral, which causes coral bleaching. If the environmental conditions do not improve and the organisms do not return, the coral die (Creary, 2008). Another threat to coral reefs has nothing to do with climbing temperatures, but is caused by higher levels of carbon dioxide in the atmosphere. Amplified concentrations of atmospheric carbon dioxide react with surface ocean water, creating carbonic acid, resulting in a gradual increase in the acidity of the world's oceans. Carbonic acid corrodes the skeletons of the corals, wearing them away faster than they can regenerate (Tedesco, 2005).

Awareness of the dangers facing coral reefs is a subject that could be dealt with in Punto Verde's efforts to promote environmental education. It constitutes a threat, not only to a vital ocean habitat, but also Puerto Rico's economy. Loss of revenue from activities such as tourism and fishing would be a crushing blow to a Caribbean island. Individuals and communities need to take actions that prevent further damage and ameliorate what has already been done.

2.4 Pro-Active Environmental Strategies

Climate change is a high priority issue for Punto Verde. The park's goal is to provide economic development and promote environmental awareness in a manner that has the least negative impact on the environment. One feature that the Punto Verde development team would like to see incorporated into the attractions is alternative energy sources. By displaying these technologies, the park can set an example for both visitors and local businesses.

The most direct way to combat climate change is to reduce emissions. In the year 2005, Puerto Rico was responsible for emitting over 32 million metric tons of CO₂, consuming 230,000 barrels of petroleum per day, and burning 1.5 million short tons of coal (Energy Information

Administration, 2008). Worldwide, public electricity generation and the auto industry are the leading contributors to CO₂ emissions (Earth Trends, 2003). Puerto Rico has no proven reserves of any fossil fuel, so nearly all of their energy come from imported sources (Energy Information Administration, 2008).

Implementation of clean, renewable energy sources would decrease Puerto Rico's economic dependence on the imports, which are regularly subject to fluctuations in price and supply. It would also address the issues of climate change and the previous lack of environmental responsibility, which are already beginning to show their potential for ecological destruction on the island's environment. The introduction of such technologies into Puerto Rico's economy also has the potential to create jobs (American Council on Renewable Energy, 2007). Two "green" energy technologies, wind and solar, stand out as being feasible given the island's resources.

2.4.1 Wind Energy

Currently, Puerto Rico is severely lacking in any efforts to exploit wind energy. Puntro Verde sees wind energy as a resource that could be drawn on to familiarize visitors with alternative energy. Studies have shown that the wind resources exist on Puerto Rico to make such a project feasible. Wind energy is a clean, domestic energy source, which has no emissions once installed and is completely renewable. It can also be one of the cheapest forms of energy, depending on the quality and quantity of wind at the project site (U.S. Department of Energy, 2008).

There are some issues that surround wind energy that could raise opposition or prevent a venture from moving forward. At this point in time, research and development is still being performed to increase efficiencies and lower initial costs for applications in offshore or lower-wind areas (American Council on Renewable Energy, 2007). Also, there is a higher start-up cost associated with wind energy systems compared with traditional fossil fuel power plants. Moreover, wind does not blow constantly; therefore energy generated using wind may not be available at all times unless batteries are used to store power. Another problem is the inadequacy of the current power transmission infrastructure. Wind is often most abundant in remote locations where the power is not needed, and current transmission lines have neither the capacity

to handle the output of wind energy, nor the ability to transmit it long distances to densely populated areas. In a part of the world known for its natural beauty, there may be opposition from parties concerned with the scenic impacts of wind turbines. There have also been cases of birds being killed by flying into the rotor blades.

2.4.2 Solar Energy

Approximately 18 latitude degrees north of the equator, Puerto Rico is bathed in sun for much of the year, making it an ideal location to benefit from solar power. The island receives between 5.0 and 6.0 kWh/m²/day in direct normal solar radiation (Figure 2-3).

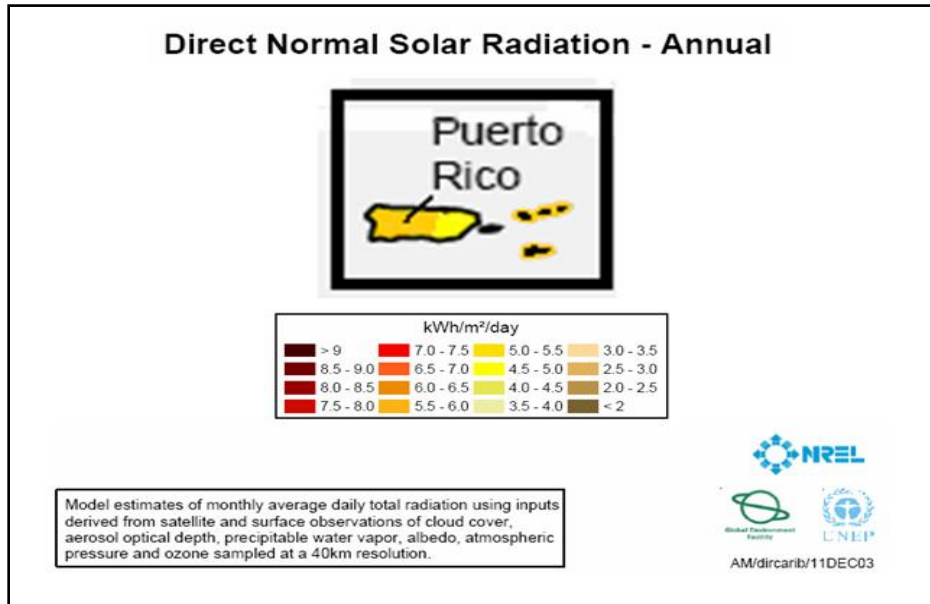


Figure 2-3: Direct normal solar radiation

(Adapted from U.S. National Renewable Energy Laboratory, 2003)

The most feasible solar technology for Puerto Rico and most appropriate for Punto Verde's attractions is photovoltaic solar panels.

Photovoltaics directly generate electricity from sunlight by using semiconductor materials. These systems can be implemented at nearly any scale, from a one-panel standalone system to a utility-sized project aimed at providing power to numerous consumers. Batteries can also be used to store power generated during the daylight hours for use at night (U.S. Department

of Energy, 2008). Though they are a zero-emission source of energy once installed, photovoltaic arrays require extensive energy to manufacture, therefore contributing to CO₂ emissions and the release of other pollutants. This must be reconciled with the amount of renewable energy that they will produce in their service life, and consequently, the net amount of emissions reduced (Shah, 1999). Integrating education about alternative energy, including wind and solar, into park attractions fits the educational and environmental sustainability goals of Punto Verde.

2.5 Environmental Park Case Studies

Established environmental theme parks were a valuable source of ideas and inspiration for designing Punto Verde's extension. The Xcaret park in Mexico and the INBioparque in Costa Rica have a variety of nature themed attractions. The success of these parks in education and entertainment is evidence of their effective design.

Due to its seaside location on the Yucatan peninsula, the Xcaret park is able to offer environmental themed activities on the land and in the water. Attraction categories include the native flora and fauna, performances, and culture. The park is not directly aimed at education, but the nature-centered attractions inherently educate and raise environmental empathy and awareness. Though swimming with dolphins and manatees is not feasible for Punto Verde, the performance and cultural aspects of Xcaret are a useful model to take into account. Local drumming, dancing, and historical sports are exhibited at scheduled times daily. Culturally relevant paintings, photography, and sculptures are also displayed (Xcaret, 2008). Integrating these types of activities with environmental education would be an effective method of piquing visitor interest at Punto Verde.

INBioparque, located north of San Jose, has a more similar mission to Punto Verde, striving to "promote an awareness of the value of biodiversity and the importance of its conservation, through recreation, by educating visitors" (INBioparque, 2009). The park consists of trails, wildlife stations, a farmyard, a lagoon, an aquarium, a butterfly garden, and multipurpose exhibition halls.



Figure 2-4: Geology display at INBiotour

(<http://nature.berkeley.edu/~poboyski/costarica/costa%20rica%20inbio%20parque1.jpg>)

The attractions are all set in an educationally motivated environment, with signs that inform visitors (Figure 2-4), and employees who walk around educating visitors and answering questions. The exhibition halls provide a walk-through environment, which briefs visitors on environmental issues in Costa Rica through creative displays and hands-on activities for kids. Specific strategies utilized at INBiotour provide an already tested template ready for further development and innovation, and possible implementation at Punto Verde (INBiotour, 2009).

2.6 Educational Techniques

The Punto Verde park's specific goal of environmental education aims to immerse children in nature, promoting an appreciation of it while combining this atmosphere with the teaching of specific environmental issues. The goal of spreading environmental awareness is a worldwide initiative that demands innovative solutions and education techniques, especially those focused on the youth population, who will inherit the problems our world faces.

2.6.1 "Nature-Deficit Disorder" in Children

A recent book by Richard Louv (2008) has coined the term "nature-deficit disorder" and drawn attention to the growing detachment of today's youth from nature. Parents' fears of crime and the inherent risk of injury outdoors lead them to keep their children confined within the walls of their homes (Driessnack, 2009). Children's lives are increasingly supervised and structured in

an effort to make them better, well-rounded students, leaving little time for independent play. This scarce leisure time is often consumed by electronic entertainment, such as video games and television, so the nature that they do end up seeing comes from documentaries and looking through windows (Louv, 2008). Not surprisingly, children often know more facts about foreign environments that they learn about in school and on television than the ones in their own backyards (Driessnack, 2009). This exposes a glaring disconnect between children and nature that could jeopardize the ability of future generations to address environmental challenges.

A problem with environmental education is that it is often approached from an adult's perspective of fact-based learning, instead of catering to children's innate interest in exploring their surroundings. This perspective is too abstract and overwhelming for children who have not already gained an appreciation for nature, and simply leaving them to explore and exercise their natural curiosity would be more effective. Studies have been conducted that strongly link contact with nature to numerous psychological and developmental benefits. Such effects include, but are not limited to, diminished symptoms of Attention Deficit Disorder (ADD), increased ability to reason and concentrate, better response to stress, and reduction or elimination of anti-social and violent behavior. Children who regularly interact with nature are shown to be more imaginative, creative, and independent as well (White, 2004).

If a holistic approach is to be taken in environmental education, it is less important that children be educated in a classroom about environmental issues at an early age. Instead, children must first develop a love of nature, and the way to encourage this love is to promote and allow contact with it. The more familiar they are with their natural environment, the more emotionally attached to it they will be. Later on, when they learn concrete facts about issues threatening their environment, they will be more willing to take action to protect it and place a greater value on environmental stewardship (White, 2004).

2.6.2 Childhood Educational Strategies

With a target group of primarily children, we established a special focus on communicating environmental issues and possible solutions to children in a way that addresses their connection with nature and that they can understand and remember in a positive way.

The manner in which children learn effectively has been studied at great lengths by educational psychologists. One technique, recommended by R. Wells and P. Zeece in the *Early Childhood Education Journal*, is known as “place-based education”, which suggests that children learn most effectively in visual, hands-on situations (2007, p. 285). The authors go on to cite Knapp, who recommends educators “provide meaningful contextual experiences – in both natural and constructed environments – that complement and expand classroom instruction” (2007, p. 286). Punto Verde and other environmental theme parks make use of this type of contextual education.

Integrating fact-based learning with real-world experience is a highly effective strategy to encourage children to take interest in whatever material is being presented. This is directly applicable to education about environmental issues, and would be effective for creating educational attractions at Punto Verde.

2.6.3 Strategies for Environmental Education

Punto Verde’s vision for environmental education is dependent on immersing children in nature, in order to activate awareness in visitors and influence them to live a more eco-friendly life. Experts in childhood psychology and education on the United Kingdom’s National Curriculum Council have recommended three criteria for teaching about environmental issues, which complement and expand the strategy of place-based education (Strong 1998):

- Education *in or through* the environment –using the environment as a resource with emphasis on inquiry and investigation and the pupil’s first-hand experience.
- Education *about* the environment – basic knowledge and understanding of the environment.
- Education *for* the environment – concerned with the values, attitudes and positive action for the environment.

These three learning objectives give students a thorough exposure to the broad scope of environmental issues, as well as to the practical scale of what they can do to make an individual difference.

The entire concept of a theme park promoting natural appreciation and environmental awareness coincides fully with the first criterion, education *in* or *through* the environment. Bringing children into the natural atmosphere of Punto Verde gives them an experience that they will not forget. This opportunity to grow and learn is integral to the mission of Punto Verde, and will continue to be a great learning tool.

The second criterion, “education *about* the environment” requires an interesting way to convey critical background information, which could otherwise be viewed by some children as bland or boring. A visual, place-based approach could include posters, displays, or informative demonstrations. Children need to understand the essential facts and underlying scientific concepts in order to fully grasp the complex nature of environmental issues. Communicating this information in a creative, engaging way will be a priority in the design of park expansion elements.

Education *for* the environment teaches the ways in which we can positively impact the local and world environment through direct and indirect actions. Again, this would be best communicated visually and in an interactive manner. Actions like reducing, reusing, and recycling would be focused on to meet this environmental education objective. Encouraging and enabling kids to be positive and pro-active toward the environment is crucial in the world’s future, as the youth generation faces the multitude of existing problems.

Incorporating these three environmental criteria into the attractions proposed for the park extension was a key focus for our group. Strategic education using new and interesting techniques were the foundation on which the attractions were based. The park’s theme of environmental and cooperative education will have an impact on every visitor, so each additional person drawn to the park through effective design strategies can be a direct positive impact on the local community and Puerto Rico as a whole.

Chapter 3: Methodology

This project addressed the completion of a design proposal for an extension to the Punto Verde park. We reviewed the existing site analysis, designed an array of educational attractions, and prepared a budgeted cost estimate of the proposed attractions.

3.1 Review of Site Analysis

In order to plan for attraction placement, design, and budgeting of site work we reviewed the existing site analysis, which included topographical and environmental analyses, as well as location of key infrastructure. After reviewing the provided site plan and speaking with the construction manager, we performed an informal analysis of the local environment by walking the site and made note of important topographical features. An existing site map of the extension was scanned and traced into AutoCAD, and additional information gathered in the field was input.

The most prominent topographical feature, the Río Piedras, is a river that runs through Punto Verde's extension site (Figure 3-1). It offers opportunities for attractions, but also may cause some problems for the surrounding land.



Figure 3-1: Aerial view of Punto Verde

(<http://maps.yahoo.com>)

If there were to be an excessive amount of rain in this area, it is possible that flooding may occur because the extension runs directly along the river. The river and other key features were considered throughout our design.

3.2 Design of Extension

Creating educational attraction concepts was the major focus for our group once in Puerto Rico. We developed and refined the attraction designs on site and shared them with the members of the Punto Verde development team to obtain feedback. Concepts were evaluated on an individual basis, taking into account the popular appeal, educational content, environmental impact, and consumer safety issues associated with each attraction.

Punto Verde is geared primarily toward the entertainment of young children, but the park's development team does not want attractions to be limited to such a narrow age group. In order to entertain and include as many people as possible, the park is planned to appeal to a wide range of ages, from toddlers to teenagers, and their parents. The learning-based activities of the park were designed especially to include teenagers. Our attractions were also adapted to be accessible to handicapped children. This inclusiveness carries through in our design, bringing children together by ensuring that no visitors are alienated.

Our main design goal was integrating educational elements into our proposed attractions. The major themes of the park, nature, adventure, discovery, and group interaction, were used to engage children in activities that promote appreciation of nature, social responsibility, and environmental awareness. Imaginative play and individual interpretation were encouraged through natural immersion, continuing the style of education to which Punto Verde subscribes. A sense of social responsibility was invoked by designing attractions which involve children in teamwork, cooperative play, and activities that teach the consequences of one's actions through "cause and effect". Utilizing the educational philosophy of "place-based learning", interactive attraction designs were chosen which focused on educating children about specific environmental issues and the consequences and impacts of specific actions. By entertaining and educating visitors, our design makes Punto Verde's message of social and environmental responsibility accessible to a large and diverse audience.

In order to obtain advice and ideas for integrating educational elements into the park extension, we created surveys to be administered to teachers from local public, private, and parochial schools. We chose to survey teachers who volunteer in an after-school program that Punto Verde runs that caters to students in need of extra help. We formulated a series of questions, with the objectives of identifying effective education and teamwork strategies,

obtaining outside input for park attraction ideas, and finding out what is being taught in schools regarding environmental awareness and stewardship. The director of the after-school program assisted the team by translating the surveys from English to Spanish, distributing them to the teachers, and collecting them several days later. The feedback aided in the process of designing attractions to maximize educational content and appeal.

The attractions were also designed to have a minimal impact on the environment. Energy efficiency was considered whenever possible during the design process for the continuation of the existing park. Alternative energy sources were investigated further to determine their feasibility for Punto Verde's attractions. The design also focused on the use and local availability of recycled materials for building, fully encompassing the theme of environmental sustainability. By incorporating environmental values into as many attractions as possible, visitors will experience the feasibility and versatility of sustainable design in an entertaining and interactive environment.

The safety of visitors was the most critical design element, especially since the target audience of this park ranges from toddlers to teenagers. We made sure to provide adequate space and opportunity for parental supervision within the park. Health risks associated with materials were also evaluated to eliminate inherent risk within the construction methods. Our proposed attraction concepts were chosen to be appealing to the public while balancing educational, environmental, and safety aspects in their design. This careful evaluation process enabled our team to determine the appropriate attractions to effectively synergize with the Punto Verde vision.

Once our attraction concepts were developed, we divided them into puntos according to unifying themes. After estimating the area required for each punto, we produced a site layout in AutoCAD to display the locations of these puntos, as well as rest areas, food stands, and bathrooms. To gather the necessary information to complete the layout, we met with Punto Verde's landscaping and construction coordinators Vilma Blanco and Carolina Nevares, who aided us by discussing the details of this task. With their input, we were able to create the basic layout for the extension site.

3.3 Budget

After designing our proposed attractions and completing a site layout, we generated an itemized budget entailing a cost estimate for each element. Companies and contractors were contacted and asked to provide quotes for the variety of construction tasks that would be required. These tasks included landscaping, paving, plumbing, electricity work, construction of infrastructure and attractions, and the required labor. For each task, multiple options were explored in search of the most cost-effective method of completion. Some of our more innovative attraction concepts have never been built before, so it was impossible to compute an exact figure. In these cases, we researched different construction methods and then consulted with Punto Verde's construction coordinators to approximate a cost.

Once all of these purchasing and construction quotes were gathered, we compiled the data in a spreadsheet displaying the cost, the source of our estimate, and the contact person for each item. Each individual projection was then summed, resulting in a total cost estimate for the proposed design. We compared this figure with the park's available funds to determine the feasibility of such an expansion. Generating the itemized budget completed our design proposal and provided a starting point for the Punto Verde design team to begin the construction process in upcoming years.

Chapter 4: Results and Analysis

By incorporating educational objectives into the attractions of our extension design, the results of this project satisfy the goals of Punto Verde's design team and our theoretical framework. Analysis of the existing site, design of the extension, and completion of the budget report are addressed in the following section.

4.1 Site Analysis

The site plan provided by Punto Verde's construction team was entered into AutoCAD, a drawing and design program, after locating the extension boundaries and water features. These features of the site determine potential problems that the attraction designers might encounter. The water source, Río Piedras, can be seen along the right hand side of Figure 4-1 and is the most difficult aspect of the area to address.

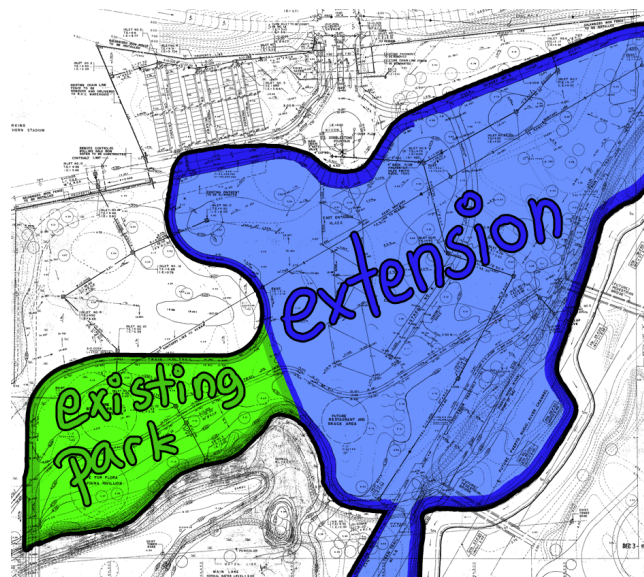


Figure 4-1: Punto Verde site map

Flooding is a major concern for the extension to Punto Verde because of its proximity to Río Piedras. After speaking with Ms. Rieckehoff, we learned that the area where Punto Verde is located was previously an estuary and has since been filled in. The potential for flooding was addressed in the design of attractions to ensure that if this does happen in the future, the park will

not be destroyed. In order to address this problem, our attraction layout and design took into account the potential rise in water level. Because there is approximately four to five feet of loam, the water is able to drain through that area and until it reaches the level of rock, which is not penetrable by water. Therefore, once the water level is above the four to five feet depth of the fill, it will have nowhere else to go and begin to flood.

Piles are rods used to anchor attractions into the layer of rock beneath the soil (as seen in Figure 4-2). In order to avoid both the sinking of attractions and to ensure that during a flood they do not move, piles are currently being used at Punto Verde and will also need to be implemented during the construction of the extension.

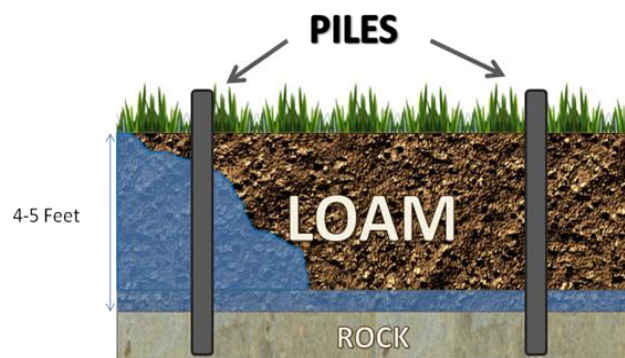


Figure 4-2: Cross section of extension with piles

These site complications were taken into account during the attraction recommendations as well as in the budget.

4.2 Design of Extension

To begin our extension design process, we sent out surveys to local teachers about their teaching methods and their opinions regarding an educational theme park. After reviewing their responses, it was evident that they felt the children of Puerto Rico need to be more immersed in nature, and also taught the social responsibilities of their actions at a young age. Many of the attraction ideas that the teachers recommended coincide with the attractions we have designed, or with those that are currently in Punto Verde. Some of the attractions that they would like to see in the park are gardens, exploration games involving the environment, and attractions that communicate the benefits of nature while teaching children that they should avoid misusing our limited resources. They also pointed out that the private schools normally have more

opportunities to take part in field trips and hands on experiences. Punto Verde and its extension will be able to accommodate children from all backgrounds and help to immerse them in a natural environment as well as educate them on their social involvement in the world.

We divided our attraction designs into puntos in a similar manner to the existing park. Each punto was proposed for its specific theme, containing larger anchor attractions as well as smaller attractions and activities. Our proposed set includes Puntos Air, Bug, Energy, Pollution, Recycling, Relaxation, and Water. The specific attractions and their educational objectives are discussed in the following sections for each of the puntos.

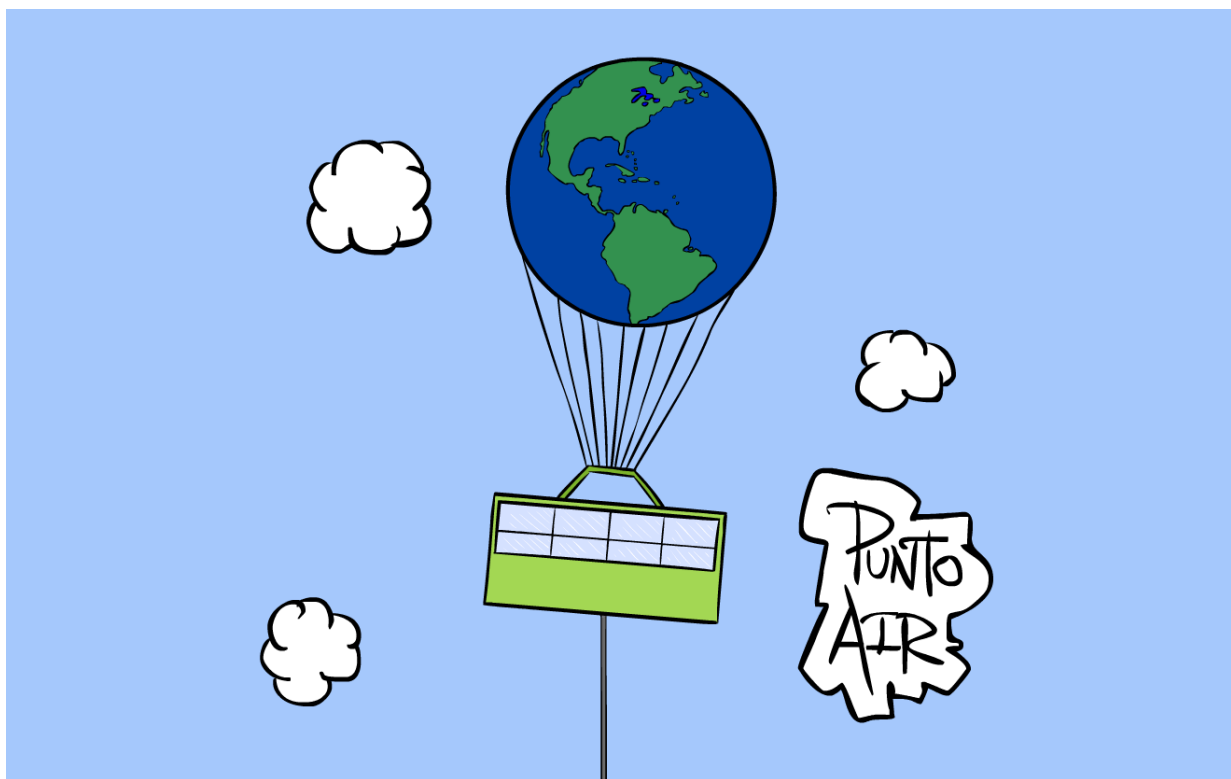


Figure 4-3: Punto Air

4.2.1 Punto Air

Punto Air is intended to teach visitors about the negative impact humans are having on the earth, and show how their environment is being affected, which will help them to visualize why a change is necessary. It features the AeroBalloon, a tethered helium balloon 73 feet in diameter with a gondola which can bring 30 people at a time up to 350 feet in the air (AeroBalloon, 2008). The AeroBalloon would be painted to replicate the earth, providing a

symbolic reminder to the entire park of what is occurring worldwide (Figure 4-3). The balloon would also be visible from the nearby highway, which will draw attention to the park and entice potential park guests. Bringing visitors this high in the air will enable them to see many miles around to the city, ocean, mountains, forests, and other bodies of water. A guide will accompany them and explain the causes and consequences of climate change, and also the human impact on Puerto Rico. This attraction is intended to help visitors relate pollution and climate change to their own lives, giving them a better understanding of their environmental impact on the world.



Figure 4-4: Punto Bug

4.2.2 Punto Bug

Punto Bug was developed to encourage children to explore, imagine, and work together while experiencing surroundings that allow them to imagine themselves as insects. Our attraction designs for Punto Bug include simulated insect flight, a spider web jungle gym, a beehive playground, and assorted natural objects scaled up to tower over the children (Figure 4-4). We expect that many of the attractions in this area will be most appealing to younger children, so we have adapted Punto Bug's anchor attractions toward a wider age range. Through the attractions and overall theme, we hope Punto Bug will give children a sense of empathy with small creatures and their habitats.

Snail Photo Booth (1)

In the existing park, there is a fiberglass snail that is hollowed out so visitors can go inside the shell. This space was not directly utilized in the existing design, so we propose that it be moved to Punto Bug and set up as a photo booth. This could provide additional revenue for the park, and taking home a photo could remind visitors of their learning experiences at Punto Verde when they view it later on.

Spider Web Jungle Gym (2)

Another anchor attraction we decided would enhance Punto Bug is the multilevel bungee web structure manufactured by EuroBungy, a unique style of playground that simulates a giant spider web (EuroBungy, 2008). The web's design will encourage children to imagine themselves as spiders living in the natural world. Punto Verde should also purchase housefly "stuffed animals", which could be located at the top levels of the web to provide an interactive role-play element to the attraction. Retrieving the stuffed fly would act as a goal for climbing, giving participants a reward for their effort. The children would not only be working to climb to the top of the spider web, but also to collect the fly and bring it back down, like a spider might. Integration of imaginative role-play and this goal-oriented element into the attraction aims to add to the overall bug theme and continue the park's style of interactive play.

Beehive Playground (3)

Another attraction concept we created for Punto Bug is a large beehive-shaped building with a multilevel interior playground. There could be a park worker dressed as the “queen bee” providing supervision. Additionally, our sponsor has suggested that we plan some of our attractions to be used during inclement weather, and the beehive will provide shade, and shelter from the rain. There will also have to be windows and/or air conditioning units installed to keep the hive a reasonable temperature for visitors. This proposed attraction is intended as a vessel to encourage imaginative environmental interaction.

Simulated Insect Flight (4)

The proposed anchor attraction for Punto Bug is simulated insect flight using an upward airflow flight simulator made by Ideas Extremas. The attraction utilizes a wing suit, a large encompassing guard net, and a porous padded bottom over a vertically blowing fan, which allows visitors to float above the fan with control (Ideas Extremas, 2009). We propose modifying the flying suits to look like butterflies and bees, which we hope will welcome both boys and girls to the attraction. The thrill of the ride is suitable for all ages, so we expect that the attraction will appeal to teenagers and perhaps adults as well. For this reason, multiple suit sizes will be necessary. By utilizing a suit that resembles a bug, visitors will be able to envision themselves as these creatures and exercise their imaginations. This attraction will encourage visitors to feel more connected with nature and help them to see the world from another creature’s perspective. The adventure of simulated flight could be an effective anchor attraction aimed to engage visitors’ imaginations while they gain an appreciation for the natural world.

Aesthetics and Landscaping

Spaced between the main attractions of Punto Bug, we designed areas containing scaled-up versions of natural objects such as tall grass, and large trees and rocks. These additional aesthetic elements will serve to increase the theme’s effectiveness, making the scaled-up world more realistic to visitors as well as letting them view the natural world from a different perspective. We propose building oversized flowers with ShockCrete, a quick setting material applied to wire mesh backing. Since the average height of an eight year old is 45 inches, we

suggest the flowers be at least this tall (Disabled World, 2008). Certain oversized grasses or leaves could also be planted which would add to the feeling of large scale. Rosemary would be a great candidate since it would serve this purpose, as well as deter ticks and fleas (Drugs.com, 2009). Along the same lines, large rocks could be “pebbles” integrated into the landscape. This final touch would complete the imaginative role-play theme of Punto Bug.

4.2.3 Punto Energy

The goal of Punto Energy is to promote and demonstrate the feasibility of alternative energy to visitors. Our main attraction proposal is a miniature city, which incorporates several sub-attractions to show an ideal “green” city in action. The city consists of non-polluting interactive energy sources, scaled-down skyscrapers, electric-powered cars, and educational signage (Figure 4-5). Punto Energy would additionally include a Ferris wheel powered primarily by solar power. These attractions would appeal to a wide range of ages and encourage children and teenagers to work together while learning about alternative energy, increasing their environmental awareness.



Figure 4-5: Verde City

Verde City

Verde City consists of an arrangement of environmentally friendly model buildings with a road traversing between them. The buildings act to integrate nature into the city by exhibiting green roofs, which are roofs covered with soil and plants that act as insulation. These types of roofs will be simulated using planters set into the rooftops and the buildings will be constructed so that they will be capable of supporting the weight. The buildings would contain electric lights to be powered by a number of clean energy sources, described below.

Solar energy could be incorporated into the “city” through the use of photovoltaic technology. Photovoltaic arrays would be set up in the shade of oversized, artificial palm fronds and mechanically linked to a large wheel. Children would have to work together to turn this wheel, making the palm fronds move and expose the panel to sunlight. As a reward for this

effort, the energy generated by the solar panel would cause lights in several buildings to turn on, displaying the effect of their actions.

To demonstrate the production of wind energy, several miniaturized wind turbines could also be placed next to the city. Children would be given bellows to create wind, which turns the turbine blades and generates electricity. This educational element of seeing wind energy transformed into electric energy allows children to witness how their efforts created a valuable result.

The final form of clean energy to be used by the mini-city is not viable for real-world application, but allows children to appreciate the energy required to produce electricity. Stationary bikes would be positioned outside of the city limits and connected to electric generators. Children would pedal the bikes and produce electricity to light up another part of the city. This is a highly interactive activity that presents a challenge for children to overcome and produces a satisfying reward.

Electric Miniature Cars

In the miniature city, streets would be woven between skyscrapers to create a course for visitors to drive electric powered miniature cars. Visitors would be encouraged to drive responsibly and safely, learning to interact and communicate with other motorists. This attraction would appeal to a large range of ages, especially teenagers.

Street signs would be positioned around the city, which instead of giving travel or navigation information, would present educational facts about climate change. Children would discover issues threatening their home and ways they can work to individually and collectively take action.

Through Verde City, children and adults will be able to witness the results of their actions, learn about valuable alternative energy sources, and see the beauty and achievability of integrating environmentally sustainable living into city living.



Figure 4-6: Solar Ferris Wheel

Solar Ferris Wheel

There is currently only one solar Ferris wheel in the world, located in Santa Monica, California (Kain, 2008). Building one at Punto Verde would demonstrate solar power in combination with the fun of the ride, achieving our environmental education objective in an interactive manner (Figure 4-6). It is likely that the park would receive media attention for this project, gauging from the large response to the Ferris wheel in Santa Monica. This attraction would also be visible from the highway, potentially drawing both locals and tourists who would see it in passing. We hope this fun, engaging attraction will show how alternative energy can be applied.

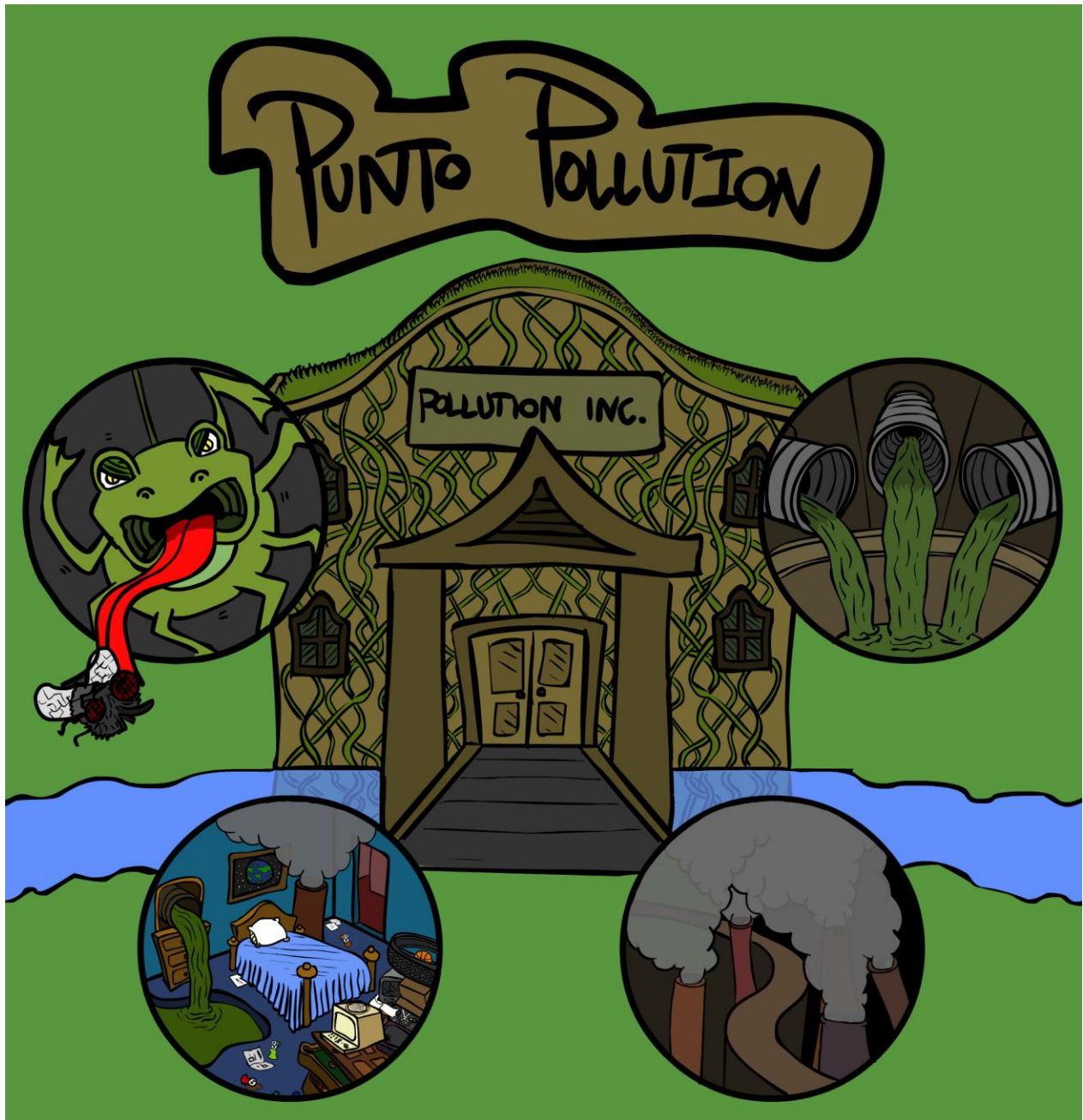


Figure 4-7: Punto Pollution

4.2.4 Punto Pollution

In order to discourage children from polluting, a haunted house was designed to inspire the next generation to end industrial and waste pollution by showing them the negative impact it has on the environment. To keep with the park's nature theme, the exterior of the house would be natural looking, with a green roof and vine-covered walls. A haunted house would

accommodate many people at once, and help park visitors to visualize the environmental perils that their island is facing. (Figure 4-9)

Inside the haunted house, the frightening effects of pollution on Puerto Rico would be displayed. Dark factories pumping waste into water, smokestacks spewing smoke from a fog machine, and sludge draining from a pipe into a pond with dead fish floating in it would send a dramatic message to park goers. Another way to communicate the negative effects of pollution to children would be to fill a child's bedroom with garbage and industrial waste (tires, old washing machines, car axles, sludge, etc.), likening it to humans dumping trash into wildlife habitats. A more frightening feature could be models of mutated creatures and animals entangled in garbage popping out and startling visitors. Before exiting the haunted house, there would be a room with a more optimistic presentation of what the world could look like if individuals do their part by helping the environment. When confronted with the ugly truth about human impacts on nature, followed by ways they can make a personal difference, visitors will be motivated to alter their personal habits and support change at the government and industry level.

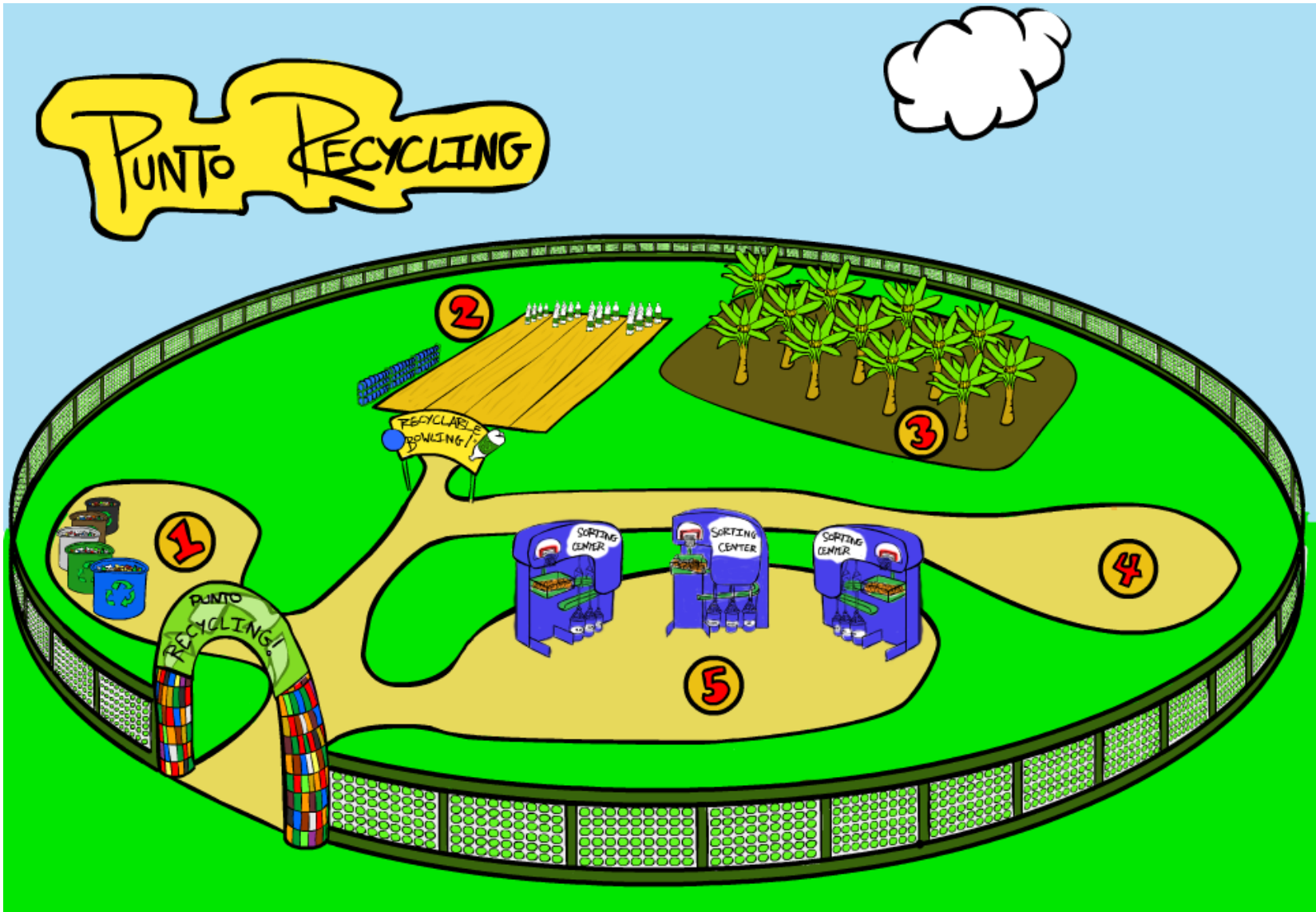


Figure 4-8: Punto Recycling

4.2.5 Punto Recycling

We designed Punto Recycling as a way to interactively engage visitors in order to gain a greater appreciation for the positive outcomes of recycling. Our proposed attractions are aimed to stimulate creativity and teamwork, as well as teach the causes and effects of our material usage on the environment. Collaborative sculptures, plastic bottle bowling, a compost garden, and infrastructure built from recyclables could be integrated into this area to address Punto Verde's objectives of environmental education and experiential learning (Figure 4-7).

Collaborative Sculptures (1)

Recyclable cans and bottles could be used to create large collaborative sculptures, which would be developed over time by large numbers of visitors, each adding their own touch. This type of group activity is reminiscent of the way individuals do their part in our world, contextualizing their own personal environmental impact by showing the result of many people working together. The sculptures could be periodically recycled by the park and new ones built in their place. The indirect but important teamwork inherent in this activity could remind visitors that their actions have consequences not only for the present, but also for the future of the sculpture, just as others added to it previously. One would hope to see emergent shapes take form as more people came to see a common theme for the artwork during its progression. An extended concept of teamwork is promoted by this collaborative attraction.

Plastic Bottle Bowling (2)

A method of creating a bowling game with two-liter soda bottles can be achieved if the labels are removed and paint is swirled on the inside of the bottle for decoration. We designed bowling lanes made of recycled wood and stocked with balls for bowling. For this attraction to work, participants will have to take turns bowling while others reset the pins. This is meant to encourage teamwork, and show one way that manufactured materials can be reused in a creative, fun way.

Compost Garden (3)

Another concept we propose that will provide a practical learning experience focusing on the benefits of recycling is a compost garden. Visitors can be given a banana upon entrance to Punto Recycling. They could first consume the bananas and then deposit the peels into a provided compost bin, where they would biodegrade in 2-10 days. (Speer, 2007) The bin could be emptied regularly into a compost pile set apart from the main attractions to let the peels decompose into soil without smell being an issue in the actual park area. This soil would then be moved back to the Punto Recycling area, where banana trees would be planted. The renewing cycle of nature, or “circle of life”, could be directly displayed through this garden, giving visitors the experience of knowing that their peel will eventually beget more fruit. With this system implemented, eventually the trees would provide the fruits that visitors eat to begin with, incorporating a real ecological process into the park’s infrastructure. This garden would address environmental education by concretely demonstrating natural renewal and prompting visitors to consider and appreciate the recycling abilities of nature itself. We hope this will provoke a greater appreciation of recycling and gardening, and their importance to an environmentally sustainable world.

Artist’s Sculptures (4)

Local artists could be contacted and asked to make their own recyclable works of art. These would add to the atmosphere of Punto Recycling, and set an example for the collaborative art, which will be continuously in progress in the area. These works could be periodically switched, giving other local artists exposure.

Sorting Station (5)

We propose a recyclable sorting station that would let kids practice and understand the concept of sorting recyclables. This would be accomplished in an interactive manner where they work towards a goal, in this case releasing basketballs to be shot into a hoop. Three buckets attached to ropes would pull down on a release lever for a container of basketballs when the recyclables are sorted correctly based on their weights. The hoop would be positioned above the container, so once the recyclables are sorted correctly, the participants are able to shoot the

basketballs into the hoop, so that they fall into the basket, resetting the activity. This activity responds to the focus group results that kids would like to see ball type games at the park, while teaching visitors about recycling and rewarding them for their efforts, a case of positively reinforced cause and effect.



Figure 4-9: Punto Relaxation

4.2.6 Punto Relaxation

A suggestion made by the Punto Verde design team was to implement a large shady rest area with benches, where parents and children could take a break from the sun and the energetic park atmosphere. Punto Relaxation, a grassy area with trees and other plantings, serves this function (Figure 4-10). It would be centrally located so that parents could access it easily from any attraction area. This would allow visitors with children of different ages to venture around, while always having the option to rest with younger ones. It would also be landscaped so that children could climb on and through small hills while being sheltered by trees and bushes. This would provide children with invaluable playtime in a natural setting, allowing them to develop a love for nature at an early age. It would also connect them with nature, and help them to associate it with relaxation. The earlier they connect with nature, the more likely they are to appreciate it later on in life.

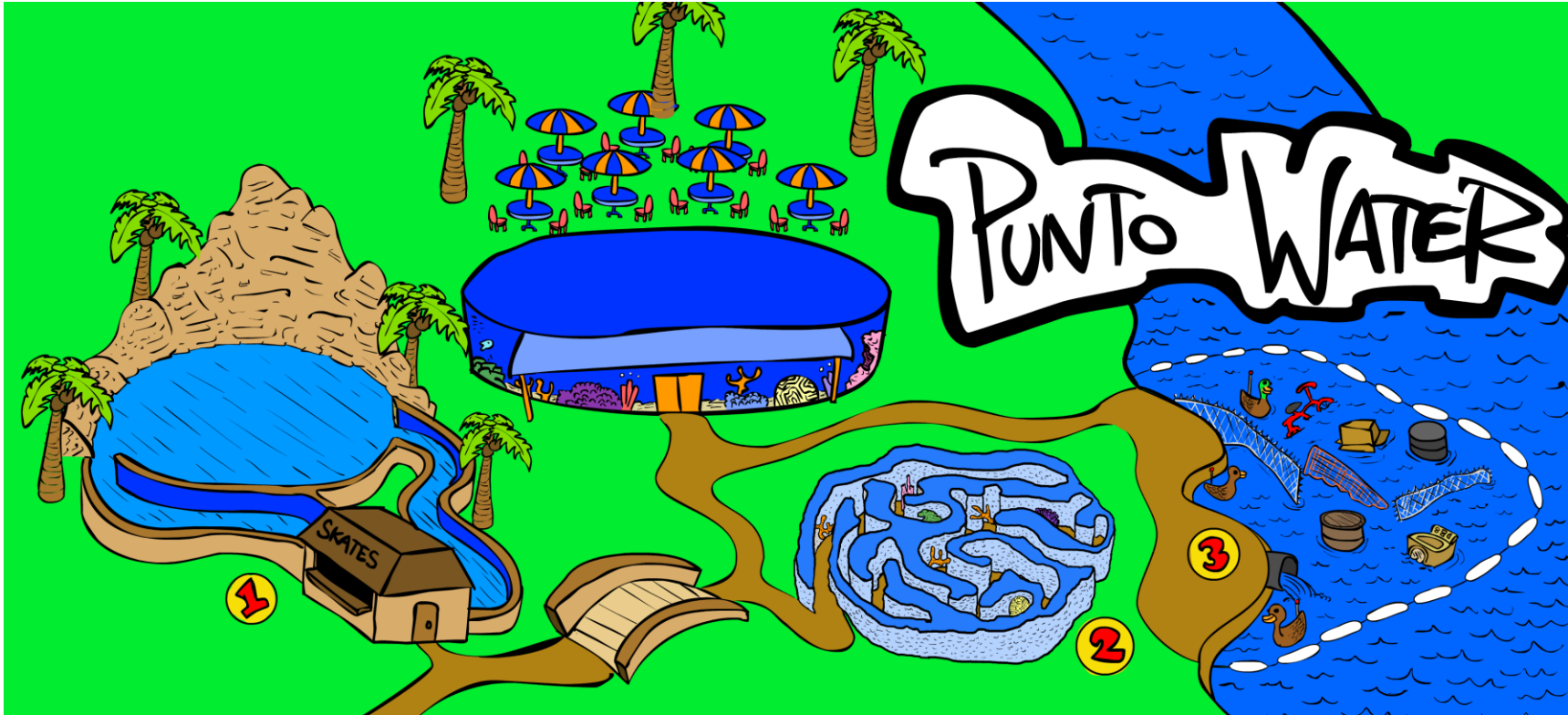


Figure 4-10: Punto Water

4.2.7 Punto Water

As the Rio Piedras is a large feature of the extension, we suggest an area of the park be dedicated to water and water-themed attractions, hence Punto Water. Our proposed attractions for this area are an eco-friendly plastic skating rink, a remote control dolphin obstacle course, and coral reef maze (Figure 4-8). These concepts are meant to reinforce appreciation for eco-friendly development, teach about the negative effects of water pollution in an interactive way, and give children a unique explorative experience.

Plastic Skating Rink (1)

The anchor attraction of Punto Water could be a plastic ice skating course made by XtraIce, a company that has designed an eco-friendly method of ice skating using a hard plastic surface. This type of rink uses no energy, compared with conventional ice rinks, which can use the equivalent daily power of 300 average households (XtraIce, 2008). To fit with the water theme, we contacted XtraIce and confirmed that the surface could be made blue instead of white. Our design proposal consists of a long meandering “river” leading into a large “lagoon” area, which would create an opportunity for inexperienced skaters to gain skills with walls for support close by before emerging into the open area. Normally, a skating rink in a tropical climate would obviously be impossible, but this attraction demonstrates the power of eco-friendly designs. The interactive fun of skating is intended to open a window to experiencing and appreciating proactive environmental strategies.

Coral Reef Maze (2)

To teach kids not to touch or otherwise damage coral reefs in an interactive manner, we propose a maze of “coral” which kids will navigate without touching. This activity will advocate responsible behavior towards reefs.

Remote Control Duck Obstacle Course (3)

The man-made pond at the south end of the extension could be used to create a pollution-inspired obstacle course through which visitors would guide remote control ducks. Participants controlling the duck would navigate a course consisting of dumped trash and fishing nets. This attraction would integrate interactivity with the educational objective of teaching the negative

effects of pollution. This could help them to relate previous and/or future experiences with what they learn at Punto Verde.

4.2.8 Site Layout

Through meeting with the existing park's designers, we were informed that the way Punto Verde has been built was unconventional in the sense that there was not a firm plan designated for the specific construction tasks. Rather, the park's key features were planned for a given space, and the more specific development and construction decisions were made during the building process. For this reason, we proposed a general layout of punto locations based on estimated area rather than laying out each individual attraction blueprint.

For this type of design, we focused on strategically locating "anchor attractions", the ones with the most popular appeal and excitement factors, which are able to draw crowds from one end of the park to another. Ms. Rieckehoff explained that the park should mirror the design concept of a shopping mall, where the anchor establishments are placed at the ends, with the smaller stores located in between. This type of design provides flow in malls, and is meant to do the same in a theme park. We used this concept to designate locations for our proposed anchors and then space smaller attractions throughout (Figure 4-11).

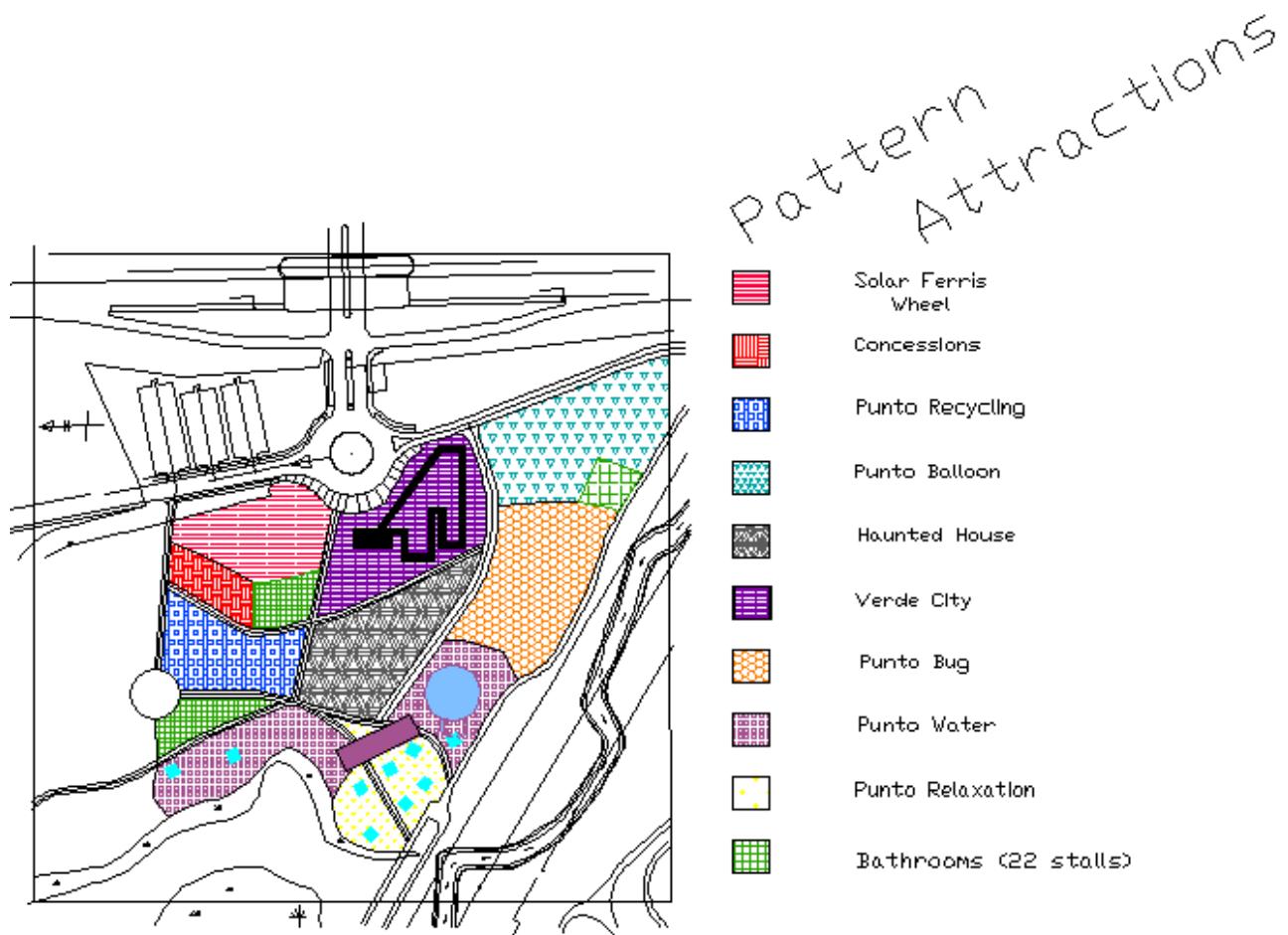


Figure 4-11: Site layout

(Created by Heather Trowbridge)

The arrangement of food, water, rest areas, and bathrooms was also included in our site layout. Visitors should not have to walk across the entire park to find these necessities, so we chose strategic locations for the amenity stations that allow access throughout. A concessions area was designated near the center of the extension. Also, water fountains should be widespread due to the heat and physical activity inherent in the park. The Occupational Safety and Health Administration (OSHA) has designated a formula to determine the number of bathrooms needed based on the number of visitors: 6 bathrooms for the first 150, then 1 bathroom for each additional 40 (OSHA, 1998). With an estimated visitor count of 800 based on projections by the consulting firm International Theme Park Services Incorporated (ITPSI), the number of toilets works out to 22, which will be spread out and split between men’s and women’s facilities

(ITPSI, 2008). Though not specifically related to the educational goals of our attractions, these additional decisions for our proposed layout were necessary to create an accurate cost estimate.

4.3 Budget

Our itemized budget is displayed in Table 4-1. Each punto is addressed and broken down into its component costs, listed in the item columns. The cost column provides an estimate for each item. The method we used to approximate the cost is detailed in the source column. Strategies included obtaining listed prices from companies, personal correspondence with contractors, extrapolations gauged from construction costs of the existing park, and estimates guided by consultations with Punto Verde's experienced design coordinators. If relevant to the item, the contact column then lists the name and e-mail address of the person we contacted for the cost and attraction information. A separate column for additional notes is also included for certain items to explain how we arrived at our figure. The total estimated cost is about \$7.5 million, which is a feasible number well under the maximum allotted budget of \$15 million. This leaves \$7.5 million for any unexpected costs during construction.

Table 4-1: Itemized budget

Punto Verde Extension Itemized Budget					
Punto	Item	Cost	Source	Contact	Notes
Air	AeroBalloon	\$1,000,000	Personal Correspondence	Douglas Hase dhase@aeroballoon.com	AB-30, largest model
	Balloon Painting	\$402,000	Personal Correspondence	Douglas Hase dhase@aeroballoon.com	\$6/ft ² , Surface Area = 67,000 ft ²
Bug	Simulated Insect Flight	\$200,000	IdeasXtremas Catalog	Juan Pablo info@ideasxtremas.com.mx	Butterfly and bee modifications free of charge
	Giant Spiderweb	\$45,000	IdeasXtremas Catalog	Juan Pablo info@ideasxtremas.com.mx	
	Plush Flies x 15	\$120	www.stuffedanimals.com/product_p/gmus-pd-0405.htm		\$8.00 each
	Beehive Playground	\$50,000	www.playexcel.com (Custom recycled playground company)	info@playexcel.com	Estimate based on similar size playgrounds
	Beehive Shell	\$120,000	Personal Correspondence	Paul Cuevas localrockart@hotmail.com	\$50/ft ² , Surface Area = 2400 ft ²
	Air Conditioner	\$2,000	www.routeac.com/goodman-3-ton-16-seer-r-410a-central-air-conditioner-1.html		
	Giant Flowers x10	\$40,500	Personal Correspondence	Paul Cuevas localrockart@hotmail.com	\$50/ft ² , Surface Area = 81 ft ² /flower
	Rosemary Plants x20	\$1,400	www.henrysplantfarm.com/app/results.cfm?category=2		
	Rocks x10	\$2,000	Personal Correspondence	Vilma Blanco vilma blanco@aol.com	
Energy	Ferris Wheel	\$1,500,000	Personal Correspondence	sales@chancemorgan.com	Cost of similar Ferris wheel in Santa Monica
	Verde City Buildings	\$30,000	Rough Estimate for Carpentry and Construction		Estimated based on existing park budget

	Custom Educational Street Signs x 10	\$250	www.urnproducts.com/custom.htm	\$25 per custom sign
	Oversize Display Windmills x 2	\$160	http://www.northerntool.com/webapp/wcs/stores/servlet/product_6970_61489_61489	
	Exercise Bike Generators x 6	\$3,600	www.windstreampower.com/Bike_Power_Generator.php	
	Hand Crank Generators x 3	\$1,700	www.windstreampower.com/Human_Power_Generator.php	
	Mini Wind Turbines x 10	\$1,400	www.kidwind.org/xcart/product.php?productid=42&cat=4&page=1	
	Solar Panels x 4	\$1,720	www.affordable-solar.com/kyocera.kc85.85.watt.solar.panel.htm	Kyocera KC85T; 85 Watt, 12 volt, (LWH): 39.6" x 25.7" x 2.2"
	Oversized Cover Leaves x 4	\$400	Rough Estimate	Based on construction with wood and paint
	Electric Toy Cars x 10	\$3,000	www.micromotorx.com/horarecoelri.html	
	Paving for Verde City	\$30,000	Quote from Paving Company	\$30/yd ² , Area = 1000yd ²
Pollution	Haunted House	\$200,000	architecture.about.com/cs/buildyourhouse/a/costs.htm	Estimate \$100/sq.ft. building costs
Recycling	Sorting Station Supplies x3	\$30,000	Rough Estimate	
	Basketballs x 30	\$390	www.target.com/Wilson-Official-Size-Rebound-Basketball-29-5/dp/B001ASQ08C?node=14235271	\$13/ball
	Recyclables	\$0	Donated/Saved	
	Paint	\$30	www.dickblick.com/products/blickrylic-student-acrylics/#itemspecs	

	Wooden Bowling Lanes	\$21,000	Recycled Bowling Lanes	1-856-297-8228	\$175/ft. x 30 ft. x 4 lanes
	Playground Balls for Bowling x10	\$60	www.wolverinesports.com/categories/products.cfm?category=Prem934568&bc2=2		\$5.40/ball
	Banana Trees x20	\$350	www.prlog.org/10118437-tyty-online-nursery-now-shipping-banana-trees.pdf		
	Banana Stand	\$2,000	Existing Park Budget		Price of constructing kiosks
Relaxation	Recycled Benches x20	\$6,000	www.belson.com/rpmb2.htm		
	Landscaping	\$40,000	Personal Correspondence	Vilma Blanco vilmablanc@aol.com	
Water	Ice Rink w/ Ice Skates for Rentals	\$150,000	Personal Correspondence	Viktor Meier viktor.meier@xtraice.com	
	Ice Skating Learning Aids x15	\$500	www.skate-buys.com/trainingaids.html		
	Coral Maze	\$150,000	Personal Correspondence	Paul Cuevas localrockart@hotmail.com	\$50/ft ² , Surface Area = 3000 ft ²
	Remote Control Ducks x 15	\$2,100	www.remotedeek.com/page2.html		
	Duck Obstacle Course	\$500	Rough Estimate		Assuming construction using recycled materials
Other	Food Stands x 6	\$12,000	Existing Park Budget		Price of constructing kiosks
	General Landscaping	\$1,162,000	Personal Correspondence	Vilma Blanco vilmablanc@aol.com	\$10/ft ² , ≈ 33% of area = 116,160 ft ²

General Labor	\$1,560,000	Personal Correspondence	Angelita Rieckehoff angelita@puntoverde.com	\$15,000/week x 104 weeks
Professional Labor	\$400,000	Personal Correspondence	Angelita Rieckehoff angelita@puntoverde.com	Estimate for engineering, architects, etc.
Bathrooms x22	\$80,000	Itemized Budget of Existing Punto Verde Park Construction		Extrapolated based on acreage comparison of existing park and expansion
Plumbing	\$10,000	Itemized Budget of Existing Punto Verde Park Construction		
Electricity Setup	\$40,000	Itemized Budget of Existing Punto Verde Park Construction		
Trees x 50	\$10,000	Personal Correspondence	Vilma Blanco vilmablanca@aol.com	\$200/tree
Walkway Paving	\$105,000	Quote from Paving Company		\$30/yd ² , Area = 3500 yd ²
TOTAL:	\$7,417,180			

Chapter 5: Conclusion

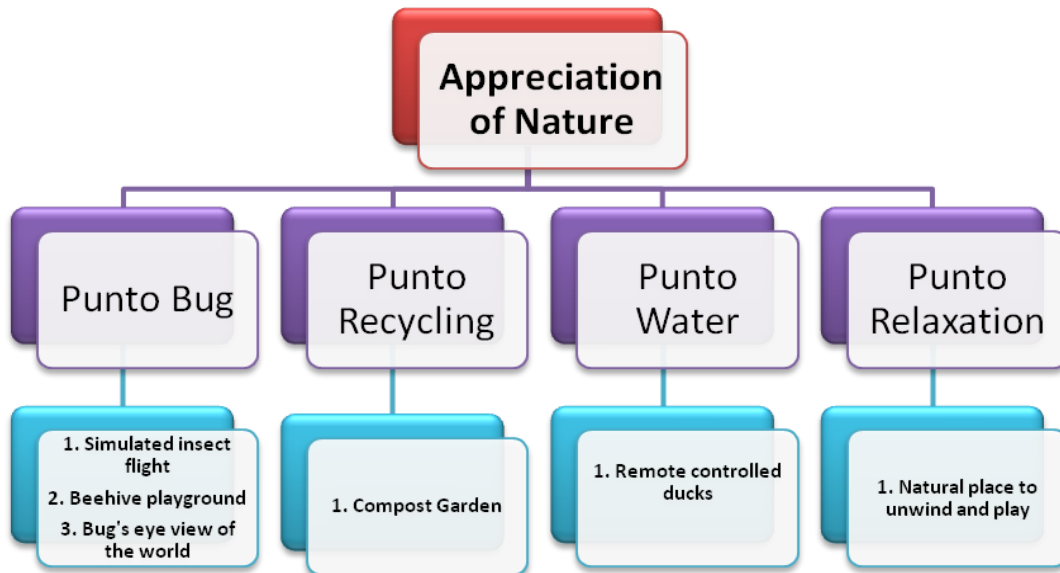
Consisting of seven puntos, our design proposal complements the holistic nature of Punto Verde, and provides a starting point for construction of the extension. Our attractions integrate the park's existing themes of adventure, creativity, discovery, challenge, interactivity, and sociability with our own educational objectives in order for visitors to gain an appreciation of nature, social responsibility, and environmental awareness.

5.1 Appreciation of Nature

Today's widespread problem of "nature-deficit disorder" (Louv, 2008) has been addressed in our design for the extension through attractions chosen specifically for their ability to give children an appreciation of various aspects of nature. Punto Bug is meant to develop empathy with nature at smaller scales. The unique perspective of experiencing the world through a "bug's eye" view is meant to teach children about the beauty of the environment at all levels. Adventure and imagination are combined to address this issue through the simulated insect flight and the beehive playground, integrating our educational objective into a fun, interactive setting.

The renewing cycle of nature would be displayed directly through our compost garden in Punto Recycling, which shows visitors firsthand the circle of life, a broad concept not necessarily considered on a daily basis. In Punto Water, the remote control ducks are intended to help children relate to wildlife in an environment familiar to locals and tourists alike. This type of activity shows the negative effects of pollution in a water environment, enabling visitors to empathize with its creatures and ecosystems. Punto Relaxation places young children directly in a natural setting to play and take a break from the energetic theme park atmosphere. This will help children to think of nature as a fun, healthy, and stress-free place. Our hope is that through these attractions, visitors will gain this sense of appreciation, which will open them to the concepts of social responsibility and environmental awareness (See Table 5-2).

Table 5-2: Appreciation of nature overview



5.2 Social Responsibility

We live in an age and society where a strong sense of social responsibility has been largely neglected, so communicating this necessity for teamwork and responsible actions is important for the youth who will inherit our world's problems. Our concept of the collaborative recyclable sculpture activity in Punto Recycling is designed to build a sense of responsibility to future park visitors, with the integrity of the entire sculpture based on individual actions, mirroring the workings of a responsible society. In a similar way, the composting concept is recommended for its creation of a sense of responsibility and group accomplishment. Additionally, the recyclable bowling will depend on children working together and taking turns setting up the "pins" and bowling. This is aimed to develop teamwork skills and collaboration. Punto Pollution shows the importance of social responsibility by promoting pollution prevention. Punto Energy directly addresses social responsibility in its presentation of an idealized city that is run with the individual inputs of the children, and rewarding them for their efforts by lighting up the city. Showing visitors a model of environmental sustainability through Verde City also develops our educational objective of environmental awareness (See Table 5-3).

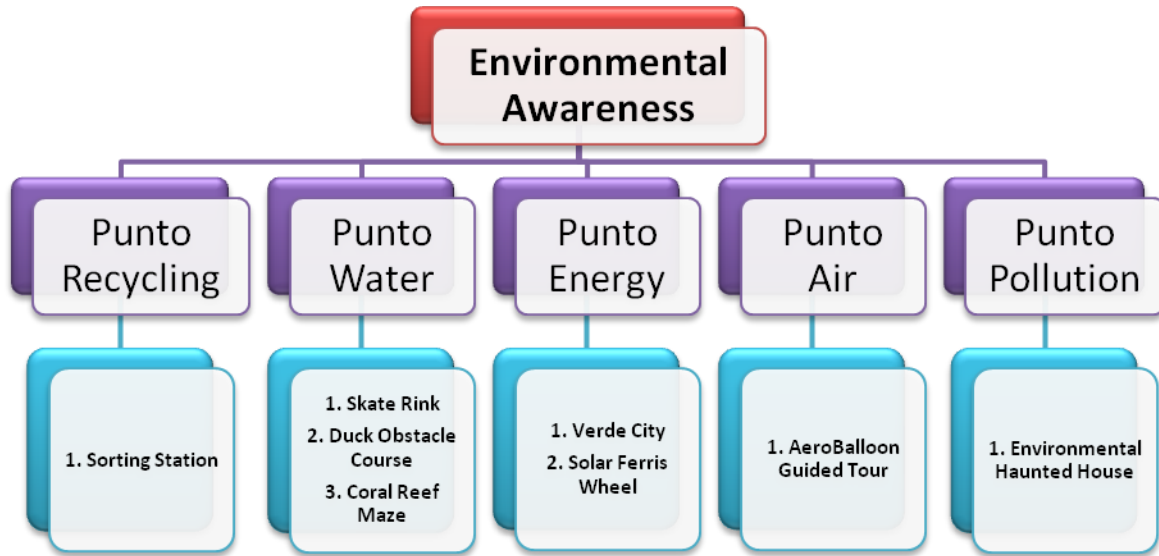
Table 5-3: Social responsibility overview



5.3 Environmental Awareness

The environment is degrading and will continue to do so according to predicted trends of climate change and increased pollution due to further industrial expansion. Educating today's youth is an increasingly important issue if the Earth is to remain suitable for human life and the preservation of ecosystems. Punto Pollution directly shows a compilation of the negative effects that humans are having on the environment using shock value to provoke awareness through the environmental haunted house. The overall theme of Punto Recycling is that of environmental awareness, and our proposed sorting station interactively teaches visitors the recycling process and encourages them to continue the practice at home. Punto Energy and Verde City address environmental issues in an interactive setting by presenting an ideal green city that children work together to power and operate. In Punto Water, the eco-friendly skating rink presents the concept of how traditional technology can be redesigned with an environmentally friendly objective. The balloon ride will use a guided tour to teach visitors about the environmental issues most pertinent to Puerto Rico, expressing the need for action on a local level. Through these attractions, visitors will go home with an increased environmental awareness, and understand their personal potential to act positively (See Table 5-4).

Table 5-4: Environmental awareness overview



Our variety of proposed attractions achieves the holistic educational mission of the Punto Verde park while maintaining a fun environment for children and adults. The specifically targeted attractions we designed will help visitors to establish a deep appreciation of nature and a sense of social responsibility. Succeeding in this mission will prime visitors to be interested in learning more about the environmental issues facing the world. Through attraction recommendations promoting nature, teamwork, and environmental awareness, visitors will want to become active in making positive impacts on the natural world and the people around them.

This proposed site plan and budget will enable the Punto Verde development group to approach the local governing body about acquiring the land for the extension. Overall, our project presents how this plot of land could best be used to positively affect individuals, the community, and the environment.

We are confident that the strategies we have proposed are suitable for the Punto Verde park based on its educational objectives and natural theme, and look forward to following the park's future progress and perhaps coming back to visit ourselves one day. The future of humanity is dependent on how we live every day, and Punto Verde has the potential to be a guiding light to the local community, aiding in making the necessary changes to promote a healthy planet of responsible individuals.

Afterword

On April 23, 2009, during our final days working at Punto Verde, the park had its ceremonial opening. It was attended by Puerto Rico's governor, Luis G. Fortuño, who toured the existing park and was shown our attraction concepts for the future. During his speech, he publicly committed to granting Punto Verde the extension land, solving the problem which we had been addressing since the beginning of our project. This conclusion to our time in Puerto Rico was a uniquely rewarding moment in the lives of our team and the Punto Verde staff.

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Appendix A: Punto Verde Mission Statement

“It is essential to underline that Punto Verde is, before all else, an incubator of businesses and a micro-enterprise center for persons of limited and moderate means. As part of its community mission, Punto Verde has formalized an alliance with residents and organizations in the Nemesio Canales Public Housing seeking their participation in the community development activities proposed by Punto Verde.

“In order to develop a social interest project which at the same time is a profitable venture it is necessary to structure it in such a manner that it has growth potential and that it has enough time to develop roots, grow and develop. To those ends, a group of socially committed persons undertook the task of carefully planning all the details that will ensure the success of this social interest project, in its economic aspect as well as in its social aspect. Punto Verde fosters the process of talent development related to nature subjects, providing for it formative and practical support as well as physical facilities with minimal equipment. In this manner, the development of an entrepreneurial culture will be integrated into the development of the persons that come to participate in the program.

“Furthermore, Punto Verde is committed to offer all children and their parents the opportunity of participating in educational activities of ecological and conservation nature in a safe environment at prices below market value.” (Rieckehoff, 2008)

Appendix B: Puerto Rican History

Located approximately a thousand miles southeast of what is now Miami, Puerto Rico was first encountered by Europeans in 1493 on Columbus' second trip to the New World, where he set foot upon the home of the native Taíno people. The island was then conquered, colonized and controlled by Spain for over four centuries, which were marked by the cruel enslavement of the native peoples before being ceded to the United States as a spoil of the Spanish-American War in 1898 (Rivera, 2009).

The first official U.S. Census of Puerto Rico was conducted in 1899, at which point the island was home to almost one million people, only about 15% of which were classified as living in an urban environment (Berry-Cabán, 2008). As of 2007, the population had quadrupled to nearly four million people, the majority of whom are now living concentrated in cities and urban sprawl. While still considered a territory, the island is nearly as densely populated as New Jersey, the most crowded state in the U.S. (Central Intelligence Agency, 2009). Although residents of Puerto Rico were awarded U.S. citizenship in 1917, the self-governed political status of the island is still an ambiguous issue in politics today, one which President Obama has vowed to solve during his first term of office (Rivera-Lyles, 2009). The unfortunate historical circumstances of Puerto Rico are still distinguishable below the surface of its socioeconomic and environmental problems today.