Evaluation of the Feasibility of Establishing a Waste Collection Facility to Serve the Community of Cantera

WPI

An Interactive Qualifying Project proposal submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science

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Date:
December 18th, 2014

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Acknowledgements

Our team would like to thank the following individuals, organizations, and institutions for their support and contribution to the success of this project:

- Alfredo Perez-Zapata
- Luis Cintrón
- Members of the Consejo Vecinal
- Employees of the CDIPC
- Community of Cantera
- Pablo De Jesus of the San Juan waste transfer station
- Maria Santiago of the Cidra materials recovery facility
- Noelia Rosa from the Municipal Government of San Juan
- Rubén González of Reciclaje del Norte
- Sara Justicia and Ilsa Mendes of the Environmental Quality Board
- Maritere Padilla and Maria Oquendo of the Autoridad de Desperdicios Sólidos
- Professor Lauren Mathews
- Professor Tina-Marie Ranalli
- Professor Stephen McCauley
- CDIPC and WPI for the opportunity to work on this project

Abstract

The goal of this project was to assist La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC) with assessing the potential of a waste collection facility in Cantera in order to alleviate the environmental and social stress related to open dumping. First, we conducted a study to project waste generation and composition in the community. We supplemented this with field observations to evaluate the areas of high-density waste in the community. In order to understand the opinions of local stakeholders, we interviewed with government agencies, such as the Environmental Quality Board, and other waste collection facilities, such as the San Juan waste transfer station. Furthermore, we distributed and analyzed a community-wide survey in order to gauge public opinion of the establishment of a local collection facility. Following these information-gathering objectives, we devised a rating system to determine sites that would best suit the needs of the community. After this, we created a tentative diagram that outlined the characteristics that are most conducive to a successful waste collection facility. Finally, we created a plan to encourage community participation and education with regard to the proposed facility. This involved creating an interactive lesson plan; outreach materials for the community, such as posters, brochures, and a Facebook page; and strategies to promote the expected economic benefits of the waste collection facility. Our final deliverable was a preliminary operational plan for the prospective waste collection facility in the community of Cantera.

Executive Summary

Background

Waste generation is a global problem that continues to grow at an alarming rate. Currently, the world produces approximately one billion tons of solid waste per year, which is expected to double by the year 2025 (Hoornweg & Bhada-Tata, 2012). The United States commonwealth of Puerto Rico exemplifies this problem as it has a waste generation rate per capita that is about 25 percent higher than that of the mainland (Miranda & Hale, 2005). In recent years, there has been a push by environmental and waste management agencies of the Puerto Rican government to promote recycling, proper disposal of waste, and new facilities to correctly handle waste in cost-effective and environmentally friendly manners. Despite this push, some communities continue to suffer from the effects of waste mismanagement and collection problems. One example is the community of residents that live in the Península de Cantera in San Juan, which is a densely populated, impoverished community that suffers from many social problems including unemployment, high crime rates, and a poor standard of living.

Over the past few decades, Cantera has been facing a growing waste problem which has become increasingly hazardous for both the community members and the environment. Some of the issues that Cantera is facing are irregular waste collections and overflowing community bins, which have both led to widespread open dumping throughout the community, especially in the Martin Peña Channel, a waterway adjacent to the community. This has caused severe ecological damage to the channel itself and the surrounding bodies of water, as it has polluted the channel and hindered the natural flow of water from one lagoon to the other, as well as the connection to other main water ways including the sea.

For this project, we worked alongside La Compañía para el Desarrollo Integral de la Península de Cantera, a government organization that aims to improve the living standards of this community's citizens and to protect and restore its environment. Since 1992, the CDIPC has been responsible for many community projects in Cantera, such as installing up-to-date sewage systems. Additionally, the CDIPC has now helped to relocate about 60 percent of Cantera's residents into better living situations in subsidized housing, with the remainder still living in the *barriadas*, or densely packed informal settlements. The *barriadas* are characterized by homes built on collections of waste along the shores of the local channel and do not adhere to construction codes nor have access to basic services and utilities. The CDIPC's next task is to

find a solution that can help relieve the waste problem of Cantera.

Methodology

The goal of this project was to assist the CDIPC with assessing the potential of a waste collection facility in Cantera in order to alleviate the environmental and social stress related to open dumping. To accomplish this project goal we completed the following objectives:

1. Assessed the current state of the community's waste management
2. Identified the key stakeholders' opinions of the potential establishment of a waste collection facility
3. Evaluated and compared potential sites and design options for the waste collection facility
4. Developed plans to promote community involvement in the waste collection facility through operational strategies, education, and outreach programs

To assess the current state of the community's waste management, we conducted field observations in order to identify locations of open dumping, potential site locations for the waste collection facility, and other important areas in the community that would be crucial to our project. We also performed a trash bag audit to gather data about waste generation and composition in the community.

In order to identify key stakeholders' opinions, we conducted interviews with representatives from multiple agencies. These organizations included government agencies, such as the Municipality of San Juan, the Autoridad de Desperdicios Sólidos, and the Environmental Quality Board. Additionally, we interviewed representatives of an important local organization, the Consejo Vecinal. We also interviewed representatives of existing waste management facilities, such as Reciclaje del Norte, and the Cidra and San Juan facilities. We also distributed a survey to members of the community of Cantera to gauge their interest in the proposed facility and gather information regarding their disposal practices.

We evaluated seven potential sites for the waste collection facility through the use of a rating system we developed that considered a number of factors, including usable area, proximity to residences, flood potential, accessibility for users, and accessibility to utilities. Through interviews and consultations with the Cidra and San Juan waste management facilities, we

identified the necessary design characteristics that should be implemented into our facility.

During our interviews, representatives of the San Juan and Cidra waste management facilities identified community involvement and education as very important components for the establishment of a successful waste collection facility. Consequently, we developed short-term and long-term outreach materials for the CDIPC to implement once the facility is completed. Additionally, we devised operational strategies that included incentive programs, potential employment opportunities, and collaboration with Reciclaje del Norte (RDN).

Results

From our field observations we created a detailed document of locations in the community that are critical to this project. This document includes areas with the highest incidence of illegal dumping, potential sites for the waste collection facility, and other important locations that are relevant for the establishment of the proposed facility. From our trash bag audit, we estimated the community generates 11.23 tons of waste per day, with 34.02 percent of that amount being recyclables. We were also able to gain a preliminary understanding of the community's opinions on waste disposal through a corresponding open response survey.

Through interviews we conducted with representatives of the government agencies and other waste management facilities, we gained knowledge about the type of facility Cantera needs, and improvements for the current domestic waste management system as well as effective design and operation components, operational strategies, and methods for educating and involving the community in the facility. Additionally, to better understand the opinions of the community, we consulted the Consejo Vecinal and distributed surveys to the residents. We used this knowledge to create a more effective site, design, and community outreach plan.

We developed a site evaluation sheet in order to rank each of the seven sites, and, in combination with consultation with the CDIPC and the Consejo Vecinal, we identified three sites as the best potential locations for the facility. Furthermore, from our interviews with representatives of the Cidra materials recovery facility, Reciclaje del Norte, and the San Juan waste transfer station, we identified a list of important design characteristics. For example, the facility should be enclosed and surrounded by foliage to seclude the area and reduce noise and odors.

Our community involvement plan incorporates operational strategies, community

outreach oriented for adults, and youth education. Under operational strategies, we developed plans for employment and volunteer opportunities, incentive strategies to motivate the community members to use the facility, and a potential business cooperative between the proposed facility and the RDN. For the community outreach plans, we developed both a short-term and long-term strategy to address community awareness and education once the facility is open. For the short-term plan, we determined that distributing brochures to local organizations, businesses, and schools and placing posters at popular open dump sites in the community would be an effective way to advertise the proposed facility. For a long-term strategy, our community survey revealed that many residents have access to the internet. Social media is an effective tool for marketing a business, especially in recent years. As a result, we determined that the CDIPC should create and maintain a Facebook page containing the information regarding current events, operations, and facts about the facility. The final component of this deliverable was the development of a brief educational supplement which includes a one-hour lesson plan to teach elementary-aged children about the hazards of improperly disposed waste, and how to manage it correctly. We found in our research that children in this age group have the most impact on social change compared to older age groups (Hiramatsu, 2014). This plan will include an interactive presentation along with a series of visual activities.

Recommendations

In conclusion, we helped the CDIPC determine the feasibility of the establishment of a waste collection facility. We have presented the CDIPC with a plan for moving forward with establishing a facility through a set of detailed recommendations. One of our key recommendations was that the community should establish a waste collection facility that can handle both recyclables and large-scale waste. We also recommended that the CDIPC should consider and further evaluate the top three sites we chose from the site assessment process and consult with the community throughout this process to ensure that there is public support. Another notable recommendation was that the CDIPC should work with local schools to implement the lesson plan we proposed, distribute the brochures and posters we designed, and establish incentive and outreach programs in order to educate and involve the community.

Chapter 1: Introduction

Each year, over one billion tons of solid waste is produced around the world. This number is expected to at least double within the next 25 years as a result of numerous factors, including economic development, industrialization, climate, and poor disposal habits (Hoornweg & Bhada-Tata, 2012). In many low income communities, there are very inefficient waste collection programs that leave more than 50 percent of solid municipal waste uncollected. According to Hoornweg and Bhada-Tata (2012), because of insufficient waste management, low-income communities rely on open dumping, a behavior that contributes to "flooding, air pollution, and public health impacts such as respiratory ailments, diarrhea, and dengue fever."

The Caribbean islands have one of the highest per capita solid waste generation rates in the world. On the island of Puerto Rico, comprising about four million people, the per-capita generation of daily waste is almost 25 percent higher than the US mainland (Miranda & Hale, 2005). Puerto Rico's dense population and fast economic growth have contributed to the high waste generation rate. In contrast, waste collection programs and agencies have not been able to adjust to the higher rates of waste generation. This problem is especially evident in low income communities in Puerto Rico, where there is a lack of an economically viable method of transporting waste from the community to a waste disposal site, as well as poorly planned and developed infrastructure and access.

An effective solution to this problem begins with the implementation of a waste collection facility. These facilities are crucial for successfully managing waste, and establishing a connection between small communities and waste management facilities. This allows small communities to consolidate their waste so that larger, high-volume vehicles can transfer it more economically to distant disposal facilities. In addition, waste collection facilities offer a variety of benefits such as improvements to the local environment, employment opportunities for residents, and waste separation. However, such facilities are not without their drawbacks. For example, local residents often voice their concerns about health problems, odors, traffic and vermin from nearby collection facilities (UNEP, 2013). This is still an underutilized solution to Puerto Rico's regional waste problems as there are very few waste collection facilities on the island (Caribbean Update, 2009). The need for an effective waste management and collection service is especially evident in Cantera.

The neighborhood of Cantera is located in the district of Santurce in San Juan. Cantera is a small peninsula of approximately 1.2 square miles consisting of about 10,000 inhabitants. This is a very impoverished community that consists of approximately 40 percent informal settlements and 60 percent subsidized housing. In 1989, Hurricane Hugo struck northeastern Puerto Rico and destroyed most of Cantera's infrastructure. Government aid was insufficient and delayed, leaving the community to attempt to rebuild using the remaining debris. The waste that was initially helpful to the community has now become a burden. The waste problem Cantera faces is just one example of situations faced in similarly poor communities throughout the island. Our sponsor, La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC), is interested in assessing the feasibility of a local waste collection facility to address the waste issue. In 2012, the CDIPC collaborated with a community group called Leaders for the World to mitigate open dumping through educating members of the community. Despite the efforts made by Leaders for the World and the CDIPC, the educational program has not completely mitigated the waste problems in Cantera and there is now a need for a physical solution, in the form of a waste collection facility.

The goal of this project was to assist La Compañía para el Desarrollo Integral de la Península de Cantera with assessing the potential of a waste collection facility in Cantera in order to alleviate the environmental and social stress related to open dumping. Our team assessed the current state of the community's waste management services, identified the key stakeholders' opinions of the project, evaluated and compared potential site and design options for the waste collection facility, and developed plans to promote community involvement through operational strategies, outreach programs, and youth education. We used these insights to develop a preliminary operational plan for a prospective waste collection facility.

Chapter 2: Background

Communities around the world are increasingly burdened by the growing volume of waste and a lack of an efficient waste management system to properly address the issue (Hoornweg & Bhada-Tata, 2012). Many communities have been able to develop systems that effectively dispose of waste, while others have failed to reach this point. This problem is more prominent in developing communities. When not handled properly, waste can create health problems and environmental hazards. The lack of an efficient waste management system in Puerto Rico negatively affects its citizens every day. In this chapter, we will explore the components of waste management and their value to a community. Furthermore, we will break down the factors that have contributed to the problem in Puerto Rico. Waste collection facilities are widely accepted as an effective tool for an efficient waste management system. We will evaluate the benefits and concerns with the implementation of a waste collection facility as well as review relevant case studies. By establishing a waste collection facility, the CDIPC believes that there will be an improvement to Cantera's waste management system.

2.1 The Waste Management Crisis

In this section we will explore the growing problem of waste around the world, the implications it can have on human and environmental health as well as the benefits of an effective waste management system.

2.1.1: Global Waste Problem

Each year, roughly four billion tons of total waste are generated globally (Bourbon-Séclet et. al, 2012). Approximately 1.3 billion tons of this total are made up of municipal solid waste, which averages out to roughly 1.2 kilograms, or 3.65 pounds, of solid waste per capita per day. Municipal solid waste can be loosely defined as domestic, commercial, and institutional waste that is not considered hazardous (UN Habitat, 2010). Based on current growth rates of population and per-capita consumption, the projected generation rate of municipal solid waste is expected to almost double to 2.2 billion tons in the next 25 years, increasing the average per capita to 1.42

kilograms, or 3.13 pounds (Hoornweg & Bhada-Tata, 2012). As urbanization and affluence have increased, the percentage and consumption of inorganic, non-biodegradable goods has risen as well. This is causing many communities around the world to implement better waste collection programs and higher efficiency waste management facilities and to promote recycling and materials recovery programs (Hoornweg & Bhada-Tata, 2012).

Despite a number of initiatives to establish better control over the growing waste problem, there are still major issues in the global waste collection process. In a successful waste management system, collection is the most important component. Without collection, the entire system is inefficient and incomplete (UN Habitat, 2010). More than 3.5 billion people, or half of the world's population, do not have access to efficient and sustainable waste management and collection programs (UNEP, 2013). According to Hoornweg and Bhada-Tata (2012), this problem is magnified in impoverished countries, which collect less than 41 percent of their generated waste, as opposed to 98 percent in developed countries. In the past, many communities without a feasible solution have participated in illegal dumping and open burning (Hoornweg & Bhada-Tata, 2012). This illegal dumping can create a number of health and environmental problems. For example, in 1994, the city of Surat, India was struck with a flood caused by illegally dumped, solid waste clogging the sewage system, which killed 56 people from waterborne illnesses (UN Habitat, 2010). For most of the world today, this problem of waste malpractice still exists, requiring more innovative and dynamic solutions.

2.1.2: Waste in Impoverished Communities

Waste management is a global problem, but it is especially evident in impoverished communities. These communities often lack the infrastructure to remove and properly dispose of waste in regulated waste management facilities. Often, these communities only have the financial support needed to fund an inefficient collection program that collects 30 to 60 percent of their total waste (UNEP, 2009). An example of this can be seen in Kuala Lumpur, an impoverished community in Malaysia, where the municipality's collection program only collects half the waste. Due to these inefficiencies, approximately 65 percent of the uncollected waste is burned while the remainder is disposed of in open dumps and rivers. As a result, this community is susceptible to floods, air irritants and noxious odors, as well as vermin and insect-related

illnesses (Murad & Siwar, 2007).

Most impoverished communities struggle to fund their collection programs because the cost constitutes approximately 80 to 90 percent of their municipal waste budgets (Hoornweg & Bhada-Tata, 2012). Currently, these communities collectively spend approximately $46 billion per year on their solid waste collection and management programs. However, an additional $40 billion is still needed to advance the current state of waste programs in the developing world to that of the programs in developed countries. Because of this high cost, Bourbon-Séclet (2012) argues that individual municipalities cannot afford to close this gap without trying to acquire financial support from other sources. One major asset that these local governments are now drawing from is the private sector. Through investments and direct funds, the private sector's involvement can create a more efficient waste management service because these businesses have a financial incentive to minimize losses and maximize profits. In addition, local businesses usually have a better understanding of how to provide effective, but inexpensive solutions to their communities (Bourbon-Séclet et. al, 2012).

Compared to the higher income residents, people living in impoverished communities generally have a much lower per capita waste generation rate, but they are forced to cope with inefficient collection programs that remove less than 50 percent of the waste in these areas (Hoornweg & Bhada-Tata, 2012). As a result of poor collection programs in impoverished communities, limited funds, and minimal access to new materials, many people in these regions become great waste reducers, re-users, and recyclers (Murad & Siwar, 2007). This induces a phenomenon in many urbanized cities, like Lima and Cairo, where a group of people, known as waste pickers, help to mitigate the waste collection problem. This group forages through municipal waste and collects items that could be recycled or sold for a profit, or re-used in their own homes (Bourbon-Séclet et. al, 2012). Waste pickers, on average, make up about one percent of the urban population (Medina, 2008). In areas where an overabundance of uncollected waste is the norm, waste pickers help divert up to 15 to 20 percent of waste from open dumps (Bourbon-Séclet et. al, 2012). However, some businesses cannot or will not dispose of hazardous wastes appropriately and instead illegally dispose of it in open dumps. This leads to increased risks of exposure to hazardous waste for waste pickers (Murad & Siwar, 2007).

2.1.3: Effects of Waste on Health and Environment

When solid municipal waste is mishandled, there are often both health hazards and environmental consequences that ensue. In impoverished areas where waste collection is limited, human health is compromised because open dumping areas quickly become prevalent. If these dumps remain stagnant, they often become a breeding ground for disease-carrying species such as insects and rodents (Murad & Siwar, 2007). In these locations, acute respiratory infections have increased six fold, and outbreaks of diarrhea, cholera and other water-borne diseases are common if the waste runoff contaminated local water sources (UN Habitat, 2010).

Conversely, even if solid waste is collected and transferred to waste management facilities, improperly regulated incineration plants and landfills can still cause adverse health effects. The most common problem concerns poorly built landfills and the expulsion of leachate into the environment around it. Leachate, which contains hazardous, carcinogenic compounds from the natural breakdown of waste, can seep through the surrounding soil and contaminate local sources of drinking water (Hoornweg & Bhada-Tata, 2012). Some examples of harmful chemicals that can leach out are vinyl chloride monomers and benzene, which have been classified as carcinogenic by nationally recognized organizations such as the United States Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (U.S. Department of Health and Human Services, 1997).

Much like the public health concerns, improperly treated waste can also result in dire consequences for the surrounding ecosystems. In regard to open and illegal dumping, many communities set fire to these sites to replenish the necessary space for further waste disposal. However, these fires release environmentally damaging volatile organic compounds and air pollutants. This same problem also persists in poorly regulated incineration facilities (Hoornweg & Bhada-Tata, 2012).

Poorly regulated landfills also contribute to environmental dangers. Landfill gas is a mixture of natural byproducts of anaerobic digestion. When these landfills do not conform to standard regulation, landfill gas can disperse into the atmosphere in large quantities. Comprising about 50 percent methane, landfill gas from these facilities contributes up to 12 percent of the global methane emissions, which can accelerate the rate of global climate change. Some of these facilities try to alleviate this problem by flaring, or combusting, the methane gas, but further poor

regulation can lead to the release of dioxins and dioxin-like products, which are also ecologically damaging (Palmiotto et al., 2014). On the other hand, volatile organic compounds that are found in leachate will readily vaporize and cause damage to the atmosphere as well. For example, vinyl chloride monomers will readily evaporate from surface water and can break down into products like hydrochloric acid, carbon monoxide, and carbon dioxide (U.S. Department of Health and Human Services, 1997).

2.1.4 Benefits of Waste Management Systems

Waste management systems are necessary for effective waste disposal in communities. An effective system is made up of many components including waste pick-up, transfer, organization, and disposal. This system introduces the possibility of an enhanced state of the environment and health, more economic opportunity, and a higher social standard (UNEP, 2013).

The United Nations Environmental Programme (UNEP) lists environmental health benefits including: improved human health in communities and facilities, the minimization of hazardous waste exposure, improved occupational health, reduced greenhouse gas emissions, reduced litter and odor, avoided flood risks, and the encouragement of resource efficiency. The Waste and Resources Action Programme (2006) asserts that, in the United Kingdom, around 10-15 million tons per year of carbon dioxide are not released because of their recycling and waste management practices.

The UNEP goes on to list some economic benefits including: increased business opportunities, contribution to the gross domestic product through formal job creation, an overall higher standard of living, lower medical and ecological costs, more productive land use, and conversion of raw waste to new, profitable materials. There is economic value in every piece of waste, and by disposing of it properly, the waste's economic value can be maximized (State of Washington Department of Ecology, 2010). An example of this economic impact can be seen in the United States recycling efforts. Having once amounted to $182.4 million in 2003, the recycling revenue has nearly doubled to $320 million in 2008 (State of Washington Department of Ecology, 2010).

Lastly, there are social benefits of waste management systems outlined by the UNEP. Some of these include creating low, medium and high-skilled jobs, developing more opportunity

for the informal sector of waste pickers, developing more social respect as a result of a higher standard of living, and encouraging changes in community attitudes and behaviors. In developing countries, the only income of about 15 million people comes from a waste management job. In Buenos Aires alone, there are approximately 40,000 waste pickers that contribute $178 million to the gross domestic product of Argentina (Medina, 2008). The implementation of waste management systems in communities that lack them can provide substantial benefits.

2.2 Challenges to Implementing a Waste Management System in Puerto Rico

Puerto Rico's primary concern in waste management comes from the over-production and improper disposal of waste. The 300 mile long and 100 mile wide island of Puerto Rico is populated by roughly four million people, resulting in approximately 1,000 people per square mile (Miranda & Hale, 2005). The distribution of the population tends to be denser in metropolitan areas. According to the 2010 census data, currently 93.8 percent of the population lives in Puerto Rican urban areas (United States Census Bureau, 2010). It has been estimated that Puerto Rico's citizens generate twice as much waste per capita than the world's average (Miranda & Hale, 2005). A majority of this waste is rarely disposed of or recycled properly. This continuous accumulation of refuse contributes to the overflowing landfills that are already struggling to contain Puerto Rico's waste.

Illegal dump sites have sprung up in the *barriadas*, or densely populated neighborhoods that do not follow construction codes and regulations, including Cantera. These communities are often densely packed and are not easily accessible for waste collection vehicles. This creates a significant barrier to waste management in these areas.

2.2.1 Historical Events

Puerto Rico has undergone significant changes since it first became a United States territory in 1898, but the most significant change was the introduction of industrialization in the early 1950s (Bosworth & Collins, 2006). Before the 1940s, Puerto Rico had an economy reliant on agriculture, but it was soon shifted to manufacturing because political leaders considered agriculture to be a characteristic of an underdeveloped country. The government then launched

"Operation Bootstrap", which encouraged investments, importation of materials, and exportation of goods to the United States. As a result, Puerto Rico went from producing food, tobacco and leather to pharmaceuticals, chemicals, machinery, and electronics (Rivera, 2014). Between 1950 and 1980, worker productivity rose from 30 to 75 percent but the rate of employment plummeted by a fourth and soon after 1975, the growth in income per capita slowed substantially (Bosworth & Collins, 2006). Bosworth and Collins (2006) suggested that Puerto Rico's economic growth could be divided into two periods, the rapid productivity growth and economic success from 1950 to 1975 and a sharp drop in productivity from the mid-1970s to present day.

Puerto Rico currently suffers from an unemployment rate of 14.8 percent, the highest in the United States, and the lowest labor force participation (defined as people who are employed or actively looking to be employed), at 47.5 percent (Columna, 2012). Enchautegui and Freeman (2006) argue that the relationship between the poor economy of Puerto Rico and the rich economy of the United States creates economic conditions that sustain low employment and discourage work (known as the 'rich uncle' hypothesis). In a situation like this, the federal government provides financial assistance when needed to another economy. In general, this financial support can also significantly impact the labor supply and practices of the dependent economy (Enchautegui & Freeman, 2006). Puerto Rico's economy relies largely on federal aid from the United States government, since the island has very few natural resources of economic value to contribute. Puerto Rico currently has a public debt of $65.2 billion and has the lowest income per capita for any U.S state or territory. About 41.4 percent of the population is below the poverty line and the average hourly wage is $8.08, which is less than that of any state in the United States. Currently, Puerto Rico is poorer than Mississippi, the poorest state in mainland America. In 1989, Puerto Rico received up to 72 times as many food stamp benefits as Mississippi and about half of Puerto Rico's residents are receiving food stamps today (Rivera, 2014).

Another issue that has further complicated this waste problem occurred from a natural disaster. In 1989, Hurricane Hugo struck the eastern coast of Puerto Rico, devastating the commonwealth and leaving a path of destruction behind. It is estimated that about 90 percent of the infrastructure of the eastern and northeastern coastal communities was destroyed, including Cantera. Furthermore, more than 28,000 people were left homeless from this disaster (Washington Post, 1989). The hurricane also decimated the transportation and business sectors of

northeastern Puerto Rico. The Washington Post went on to report that many bridges and roads had been washed away, and nearly all of the commonwealth's agricultural sites had been lost. The total cost of damages amounted to over one billion dollars. In the years following the storm, the stricken communities began to rebuild with little to no government assistance (L. Cintrón, personal communication). It took many years for the communities to fully recover, and large deposits of uncollected waste were a major impact of the storm. This waste has remained and grown in these communities since and has become a burden and a danger to the residents of Puerto Rico.

2.2.2: High Waste Generation

According to La Autoridad de Desperdicios Sólidos (2010), on average, Puerto Rico generates more than 11,000 tons of solid waste per day, more than double the waste generation of 1988. This total is equal to 5.4 pounds per capita per day. When compared to the mainland United States, where the figure is 4.38 pounds per capita per day (Miranda & Hale, 2005), the need for reform is evident. The very high population density, combined with high individual rates of waste production, result in overall waste production that is far beyond the island's capacity to process and store.

In the past 50 years, Puerto Rico has experienced rapid economic growth as a result of industrialization. This economic growth has outpaced the ability of the local infrastructure to effectively process the quantity of waste generated (Hunter & Arbona, 1995). Hunter and Arbona (1995) further suggest that better economies allow for increased standards of living, which promote a more consumer-minded society. Such societies generate vast quantities of waste in the form of plastics, papers, and food scraps. In 1988, the Puerto Rican government's Solid Waste Authority estimated an average of 5,700 tons of solid waste produced per day and expected 6,684 tons per day to be generated in 2000 (Hunter & Arbona,1995). These expectations have been easily surpassed, detailing the rapid growth of the waste generation problem. The increased amount of waste produced in Puerto Rico is a problem that requires consideration and a revised management program.

As such, the need for cooperation and compliance among stakeholders to create an effective plan of action is evident. According to Hunter and Arbona (1995), proper monitoring

and implementation of policies is often ineffective in Puerto Rico because “there is a lack of collective synergism”. The groups and agencies attempting to implement change, such as the Department of Health and the Environmental Quality Board (EQB), are unable to initiate significant change because they do not cooperate effectively amongst each other (Hunter & Arbona, 1995).

2.2.3: Problems with the Current Waste Management System

In addition to high waste production, Puerto Rico’s waste management system, such as waste collection, recycling programs, and landfills, is far below average compared to other industrialized nations. This combination is clearly unsustainable and can create environmental problems for Puerto Rico if it is not addressed in the coming years. Landfills are currently the primary method of waste disposal, and according to Miranda and Hale (2005), the EQB claims that all but two of the landfills on the island were filled up to the capacity limited by Subtitle D Landfill regulations during initial investigation in 1989. Subtitle D is an EPA regulation that limits location, operation and design of landfills, as well as enforces closing procedures and ensures proper financing is available (Sharma, 1994). Since 2010, ten landfills have been shut down, leaving a total of 14 in operation (Autoridad de Desperdicios Sólidos, 2007). The residents of Puerto Rico are rapidly running out of appropriate spaces for landfills. Delia Muniz, an overseer for the landfill in the city of Carolina, says “You just can't dig a hole anymore and start throwing tons of garbage in it like the old days" (Ray, 2007). The topography, climate, and limited space all pose problems (Miranda and Hale, 2005). Much of the Puerto Rican terrain consists of mountainous regions and coastal plains, both of which are inappropriate as landfill sites. The presence of aquifers that are used for local drinking water supplies also limits the possible landfill locations because of the risk of contamination.

Currently, the amount of waste needs to decrease while the percent of recyclable goods that are actually recycled needs to increase. The Puerto Rican government set a goal to recycle 35 percent of the total goods that are discarded by the year 2006 (Youkana et al., 2007). As of 2003, the recycling rate was at a mere 0.05 percent (Miranda & Hale, 2005) and was only 18 percent as of 2006. Recycling coordinators in Puerto Rico believed that this number was inflated due to illegal landfilling and would more realistically be 13 percent (Youkana et al, 2007). This

number is well below their goal, and has not increased significantly since 2006. Increasing the amount of recycled waste would dramatically decrease the amount of waste being added to landfills, thus extending the landfills' lifespans (personal communication, A. Perez-Zapata). Adequate recycling accommodations are already sparse and Puerto Rico's lack of a glass recycling facility makes it even worse (Kantrow, 2014). Recycling is not as commonly practiced in Puerto Rico as it is in many communities in the United States. As of 2009, the recycling rate of the United States was 33.8 percent, which nearly doubles Puerto Rico's 2006 recycling rate of 18 percent (EPA, 2010). Without an effective waste management system, communities resort to harmful practices such as open dumping.

2.2.4 Illegal Dumping in Puerto Rico

Illegal dumping is a fast and cheap alternative to proper waste disposal that is commonly practiced by the citizens and businesses in Puerto Rico. According to Ray (2007), Delia Muniz expressed the growing concern from local officials about the rise of illegal dumping. Muniz also states that the fastest solution for municipalities in the past was simply to dig a hole and fill it with trash, without considering the environmental strains and pollution (Ray, 2007). According to Brack and Miranda (2005), illegal dumping is primarily practiced among rural and low-income communities but is not necessarily income-related, contrary to common belief.

As previously noted, the United States introduced "Operation Bootstrap" in the 1950s which shifted Puerto Rico's economy from agriculture to industry. This industrialization in Puerto Rico brought the development of pharmaceuticals, chemicals, machinery, electronics, apparel, and food. Most of these materials, such as non-biodegradable goods, are inorganic and have negatively impacted environments, ecosystems, communities and human health through improper disposal (Skanavis, 1999). These changes ushered in a period of commercial and municipal dumping that continues today.

Examples of illegal dumping that Brack and Miranda (2005) have witnessed include plastic bags filled with hazardous household waste, washing machines, refrigerators, abandoned dead domesticated animals, and dilapidated automobiles. Illegal dumping can take place in ravines, mountainsides, limestone sinkholes, rivers, streams, or bodies of water. Using official per capita estimates from 1995, Brack and Miranda (2005) calculated that 6,657 to 7,231 tons of

solid wastes are generated daily in Puerto Rico but only 5,700 tons are actually sent to landfills. This means that about 960 to 1,530 tons (14 to 21 percent of waste generated daily) do not reach landfills and are probably disposed of illegally, incinerated, or kept (Brack & Miranda, 2005).

Some studies in the Caribbean have suggested hotels and resorts produce more waste than residents do. Garbage produced by hotels and tourist may end up on beaches and local attractions if it is disposed of improperly (Caribbean Alliance for Sustainable Tourism, 2001). Ray (2007) interviewed a local trash picker who has spent the past ten years picking from Puerto Rico's local beaches, and who reported that tourists have a huge influence on illegal dumping and trash disposal. The tourism industry in Puerto Rico plays a very crucial role in its economy, providing up to $1.8 billion in revenue and establishing over 60,000 jobs. Thus, it is imperative to Puerto Rico's economy to protect and maintain the natural attractions and environment that makes up its tourism industry (Caribbean Alliance for Sustainable Tourism, 2001).

A major problem Puerto Rico experiences from illegal dumping comes from one of its most lucrative industries: pharmaceutical manufacturing. In 1991, the EPA's annual toxic release inventory stated that there are over 300 toxic chemicals released into Puerto Rico's atmosphere and groundwater. This is a very important issue because it has direct impacts on human health and recreation (Skanavis, 1999). Several manufacturers simply discharge their industrial waste into the environment. In 1978, Technicon intentionally dumped mercurial waste into Frontera Creek, which then fed directly to Ciudad Cristiana and ultimately to the Caribbean Sea. The EQB proceeded to fine Technicon in 1978 once the Puerto Rican Department of Health (PRDH) determined above average mercury levels in the residents' blood and urine samples. As a result, the governor of Ciudad Cristiana called for an immediate permanent evacuation. Fishing and swimming in the local stream was an important part of the communities' lifestyle that was affected by illegal dumping of waste. Even though many pharmaceutical and manufacturing companies have been fined for their actions (EPA Region 2, 1983), Skanavis (1999) states that, "the governmental monitoring and enforcement of standards, in both the public and private industrial sectors, are poorly effective in Puerto Rico because of piecemeal programs and a lack of coordination." In other words, Puerto Rican organizations and programs are too disconnected and small to properly manage and coordinate effective environmental solutions. For example, there were also a multitude of investigations conducted by the EPA and the Puerto Rico Aqueduct and Sewer Authority (PRASA) over illegal discharges of waste and sewage (Brack &

Miranda, 2005). Hunter and Arbona (1995) state that the problems between the EPA and PRASA reflect a lack of planning and infrastructure within the Puerto Rican government, with regard to environmental protection. Skanavis (1999) and Hunter and Arbona (1995) agree that Puerto Rico lacks coordination and planning between the federal and local governments.

Illegal dumping is practiced by many branches of Puerto Rican society and one group cannot be solely blamed. According to Ray (2007), Javier Quintana, the executive director of Puerto Rico's Solid Waste Authority in 2007, believes that the open dumping issue can be resolved, but it will require the commitment and support of the entire island.

2.2.5 Waste Problems in Cantera

Cantera's waste problems are typical of the waste problems that many communities face globally. Over the past few decades, the community has undergone many changes as a result of government sponsored urban development plans. According to the CDIPC, the community of Cantera comprises approximately 60 percent subsidized housing and 40 percent *barriadas*, which are densely-populated neighborhoods that do not follow zoning regulations (personal communication, A. Perez-Zapata). In the *barriadas*, there is a poorly organized and used waste management and collection system. Although there are some waste bins and barrels in the communities, these are not collected often enough to satisfy the needs for the waste produced by the thousands of residents living there. These community bins were specifically meant for household domestic waste, but when large items are left alongside the bins the municipality does not dispose of them for extended periods of time (personal communication, N. Rosa).

Figure 1: Example of overflowing waste bin in Cantera

As a result, a number of improper waste disposal practices have become the norm. One practice is illegal dumping of construction debris, household furniture and appliances, and even the abandonment of cars. These items are often dumped in abandoned houses or into the Martín Peña Channel as seen in figure 2.

Figure 2: Examples of waste in the Martin Peña Channel (left) and abandoned homes (right)

Prior to the 1970s, the Martín Peña Channel was wide, clean, and accessible by boat, as outlined in red in figure 3. As San Juan continued to urbanize, more Puerto Ricans from rural areas moved into Cantera. Many settled into *barriadas* within the community, which had no access to any proper waste management services. This resulted in overpopulation and an overabundance of waste along the shorelines of the Martín Peña Channel. The community's waste began to build up in and fill the channel. As outlined in red in figure 4, this process has caused the channel to become significantly narrower than it had been in previous decades. The channel is no longer free-flowing and has completely eliminated tidal flow to that isolated part of the lagoon, which can have negative ecological impacts. This has significantly contributed to the pollution of the lagoon bordering Cantera.

Figure 3. Aerial image of Cantera in 1936 (Courtesy of the CDIPC)

Figure 4. Aerial image of Cantera in 2007 (Courtesy of the CDIPC)

Certain sectors of Cantera lack an organized system of roads, which prevents proper collection and disposal of waste. Instead, residents typically resort to dumping their waste in unofficial dump sites such as those shown in figure 5. Since Hurricane Hugo, there has been an overabundance of waste in the community. The effects of this storm were so detrimental to the community that the government created the CDIPC and designated them the task of creating a "Comprehensive Development Plan". This plan laid out a series of projects to develop and revitalize the community, and gave the CDIPC the power and the financial support to complete

them. The organization receives its funds from a public-private partnership where two-thirds of its funds are from public and the rest are from private organizations. One project that the CDIPC has worked on was the installation of a new sanitary sewage system to treat the community's wastewater. Another project they are working on is relocating many residents from the shorelines at the south and east into their own free-selection housing. Next, they are looking to construct better streets that will help to improve the access to current waste management systems. They strongly believe that a waste collection facility will provide an effective tool for a final solution to the problem.

Figure 5: Photo of an open dump in Cantera, courtesy of the CDIPC

2.3 Waste Collection Facilities

A potential solution that we are exploring to reduce the waste disposal problem in Cantera is the implementation of a waste collection facility. A waste collection facility is a holding facility where local citizens can drop off waste which can then be consolidated and transported to disposal sites using larger trucks (EPA, 2002). Without a collection facility, waste would typically be brought directly to the disposal site without any prior separation or screening. However, at collection facilities, there is an opportunity to screen waste, dispose of hazardous waste properly, and even separate recyclables (PublicWorks, 2006). When learning about waste collection facilities, it is also important to understand their siting and design protocol, a crucial

step in the overall implementation. Despite concerns, a waste collection facility can be an integral part of a successful waste management system in a community (Bovea et al, 2007).

2.3.1: Benefits of Waste Collection Facilities

Coupled with a sound waste management strategy, waste collection facilities play an important role in communities, and provide a number of significant benefits. For example, in the absence of a waste collection facility, many trucks with relatively small amounts of waste would have to travel long distances to dispose of the waste. However, if waste is coordinated through a waste collection facility, there is a reduction of traffic created by trash trucks in the community. A supplemental benefit of this would be the reduction of fuel, pollution, and road wear and tear (EPA, 2001). Economically speaking, collection facilities reduce the cost of disposing of waste because it is cheaper to transport fewer consolidated loads of waste from the collection facility than it is to transport more small loads of waste directly to the disposal site (PublicWorks, 2006). Since fewer vehicles are needed, transportation and gasoline costs and money spent fixing transportation infrastructure are reduced (EPA, 2002). Waste collection facilities also create an opportunity for proper handling and sorting of materials prior to its transportation to a landfill. These facilities can provide a number of capabilities in order to handle a variety of waste including: scrap metal, appliances, tires, mattresses, yard waste, e-waste, and hazardous and non-hazardous household waste. Many have also implemented full recycling capabilities (PublicWorks, 2006).

One of the most important components of a waste collection facility is the availability of a waste drop-off area at the facility. Many communities lack a system to collect waste, so this drop-off center is a crucial tool for residents (EPA, 2002). This gives the residents an easy, accessible, and safe way to dispose of waste properly, waste that would have otherwise been illegally and harmfully dumped (EPA, 2001). An example of an effective drop-off center can be seen in the Palm Beach County waste collection facility. At this facility, the citizen drop-off area and the pick-up areas for the trucks are located at different parts of the facility, which allows for two separate flows of traffic. The waste transport vehicles do not intermingle with the citizen's vehicles. This creates a safe and accessible environment for disposal that encourages community participation (SWANA, 2012).

2.3.2 Siting and Design

One of the most important factors to consider in the creation of a waste collection facility is the siting and design of the facility. Without careful consideration of these two factors, the plans to develop a waste collection facility can often be shut down or slowed significantly (BBC, 2012). There are many concerns expressed by community members regarding the implementation of a waste collection facility. The most pressing issues include: proximity to the community, personal health risks, noise, odor, and dust (EPA, 2001). When developing a waste collection facility it is important to address these factors. This can be accomplished through adhering to zoning laws to ensure optimal siting while reducing adverse effects, creating measures to curtail noise, odor and aesthetic problems, and finally establishing trust between the community and the company involved (EPA NEJAC, 2000).

Proximity to the community and negative effects on personal health are often the residents' most serious concerns about waste collection facilities. A collection facility should be sited close enough to the community so that it is economically viable for the business to collect and transport the waste, but far enough away so that the community does not suffer adverse effects such as upper-respiratory illnesses (EPA, 2001). As opposed to rural areas, this problem is much harder to address in urban areas since there is a lack space (BBC, 2012). Another problem that may occur is that a waste collection facility can lower the values of the properties in the area. This can severely hurt a community's economy and drive away potential businesses and homeowners (BBC, 2012). Many factors should be considered when siting a waste collection facility, and siting the facility itself should be a carefully planned process (EPA, 2002).

In order to address the issues of noise, odor, and dust, adjustments have to be made to the design of the facility to ensure reduced impact. A good example can be seen in the Solid Waste Association of North America, an organization who gives out an annual award to a waste collection facility that is economically efficient, environmentally safe, and built to address community needs (SWANA, 2014). Their most recent winner of the award was Bow Lake Recycling and Collection Facility. This station was built in the 1960s and for decades struggled with issues of dust, odor, and vermin. In 2010, a major rebuilding process was undertaken to address these issues. The new facility handles 2,400 tons per day, and contains a waste drop-off area, dust filtration and a misting system with odor-eliminating chemicals, internal and external

noise buffers, and a customer service sector to ensure community satisfaction. Figures 6 and 7 shows the layout of the Bow Lake waste collection facility made before and after the re-design process, including the features used to address problems with odor, dust, noise, and rodents. Past winners of this award show similar tendencies in creating an effective waste collection facility, all of which address common issues with great precision.

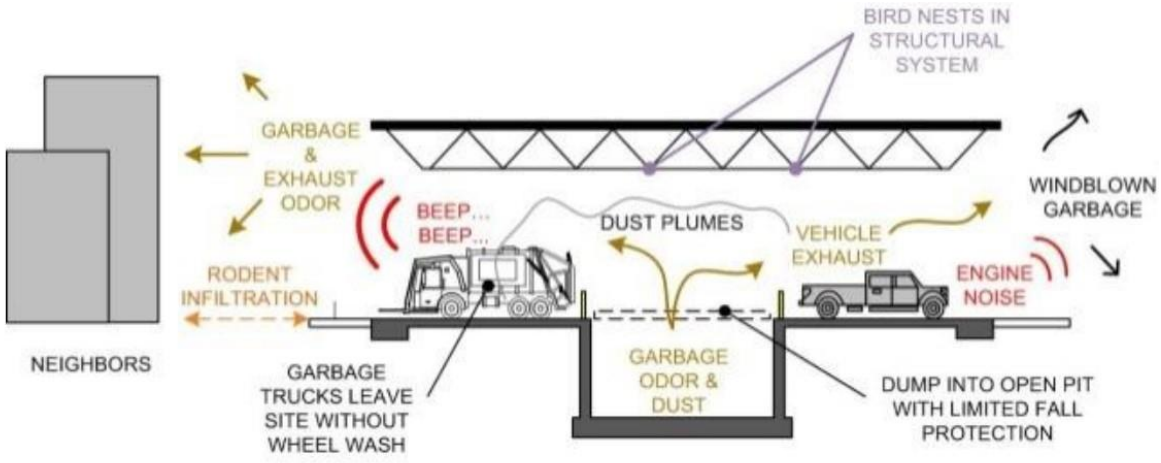

Figure 6: Poor design characteristics of the Bow Lake waste collection facility (SWANA, 2014)

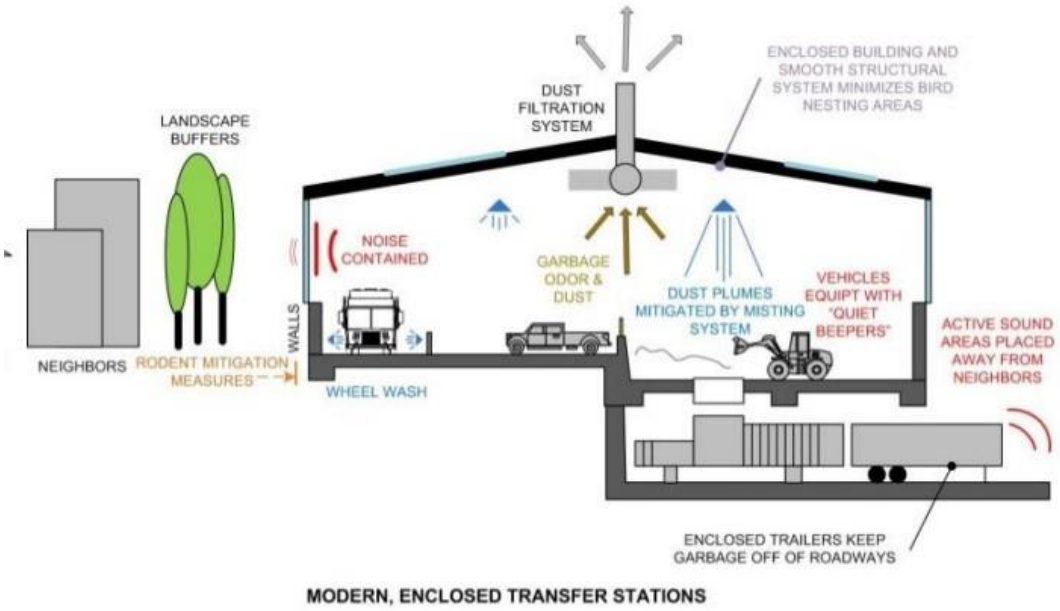

Figure 7: Redesigned Bow Lake waste collection facility (SWANA, 2014)

2.3.3: Case Studies of Waste Collection Facilities

When thinking about implementing a waste collection facility in Puerto Rico, it is important to look for examples of successful and unsuccessful facilities. Furthermore, these examples should parallel the situation in Cantera. Communities seeking to change their waste handling protocols can learn from the experiences of others that have undergone similar transformations.

In the city of Managua, Nicaragua, there are a number of *barriadas* that face the problem of managing their solid waste (Zapata Campos and Zapata, 2014). This community is made up of about 40 percent informal housing, where there are few transportation routes that are accessible for waste collection vehicles. Additionally, only 30 percent of the waste in the area was collected. Their solution to this problem was the implementation of three waste collection facilities into their solid waste management system. Through these facilities, the community was able to lower waste disposal costs by 50 percent. These facilities also brought a charge of less than two dollars per month for use, and allowed for up to 256 tons of waste collection a week. This particular case is interesting because of its similarity to the situation in Cantera. These are two impoverished communities that suffer from poor disposal practices. With this in mind, a lot can be learned from this case.

In the province of Castellón in Spain, there is a materials recovery facility that carries out the waste management for eight local towns. For five of these towns, the local facility is roughly 40 kilometers west. To alleviate the transportation costs for these towns, a single waste collection facility was implemented into the center of these five areas. By concentrating the five sources of waste and transporting it, a much more efficient disposal process was created and fuel costs were reduced. This case study compared the environmental impact of a waste collection facility using a variety of scientific indicators. In order to do so, environmental factors were measured in each step of the process shown below. Both systems that do and do not have a waste collection facility, were taken into account. Their findings suggested that instituting a waste collection facility had substantial environmental benefits. The first finding was that the case with the waste collection facility created more emissions with its process. However, this is supplanted by the waste collection facility's ability to separate waste for an energy recovery facility. This led to the

study's most notable finding, which was that the net environmental impact a waste management system has on the environment with a waste collection facility is roughly 17 percent below the impact of a system without a waste collection facility. Intuitively, adding more steps into the process would increase environmental impact, but it is important to note that in the end, there is a greater net value in implementing a waste collection facility (Bovea et al, 2007).

Another case study, performed by the EPA NEJAC (2000), details the accounts of Red Hook, South Bronx, and Greenpoint/Williamsburg, three parts of New York City that are home to waste collection facilities. In each community, there has been growing concern about zoning and regulation of the respective facilities, and according to investigators, even a belief that the facilities were purposefully placed in lower income communities. A tour of each community, followed by a town meeting, was held to address questions, concerns, and overall public opinion of the waste collection facilities. The concerns were extensive: higher rates of health problems, such as asthma, from airborne exposure to toxins, dust and odor, emissions from idling trucks, proximity of the waste collection facility to their community, noise, vermin, unregulated trash routes, truck traffic, deterred business from the community, and a lack of zoning review. This case study outlines some of the issues that go along with waste collection facility, when not executed correctly. These facilities were built in densely populated areas and did not go through meticulous consideration when looking for sites. In a case such as this, the concerns can outweigh the benefits, preventing a valuable waste management resource from performing to its fullest potential (EPA NEJAC, 2000).

2.4 Community Involvement

Community involvement is an important component for implementing and creating development initiatives. In this section, we first review the two different approaches to community involvement: the top-down and bottom-up approaches. Next, we identify and analyze the benefits of including community participation and opinion in local projects. Finally, we discuss how community involvement can be applied in the development of new waste collection facilities.

2.4.1 Top-Down and Bottom-Up Approaches

When it comes to community development and participation, there are two dominant approaches. The first is the "top-down" approach, in which government experts and/or other authority figures decide on most, if not all, of the major components of projects without consulting the other stakeholders involved in the community (Liedl, 2011). Next, there is the "bottom-up" approach, where collaboration occurs between the planning organization and local community to ensure that the local problems are addressed (Koontz, 2014).

These two different approaches rival each other ideologically, and have been the cause of much debate. The top-down approach has been widely used, but is often criticized for discouraging the discussion process prior to implementation because there is little availability for outside opinion (Liedl, 2011). The toughest critics of this approach state that it promotes capitalism and neo-liberal ideas with a separation of resources and power between the higher and lower levels (MacIntyre, 2003). MacIntyre (2003) further notes that organizations with little-to-no training or knowledge of the geography and culture of the area in which they are working have often used a top-down approach to initiate businesses enterprises rather than to create enterprises focused on positive social change.

According to MacIntyre (2003), one of the most important things that should be taken into account during project planning is that the beneficiaries should be informed and involved in the decision-making process. The reasoning behind this is that the people of a community know the problem better than the leaders of the organization. This is one of the key characteristics of the bottom-up approach (MacIntyre, 2003). With this approach, there are two main levels of implementation. On the higher level, the organization looks to develop the community, while the residents try to accomplish this in the lower level. In the bottom-up approach, the lower levels develop the ideas, while the higher level serves as a resource and organizer for the residents and communities (Liedl, 2011).

A statistical comparison of the top-down and bottom-up approaches was performed in a study done in Veracruz, Mexico (Larrison, 1999). This study intended to quantify and compare the two methods based on the satisfaction of a community's residents as well as the effectiveness of the development project. The results of the study found that the bottom-up approach is more

effective in community satisfaction as well as overall project effectiveness. Despite this, one of the most important findings in the study was the common strengths shared by successful bottom-up community development programs: a strong relationship between residents and the organization, providing services that both the community and the organization believe are needed, and the balance of external and internal resources (Larrison, 1999).

2.4.2 Benefits of Community Participation

Community participation is the process by which local residents participate in planning and executing community projects rather than solely experiencing the impact of whatever change is instituted. There are a number of benefits that may accrue to stakeholders through community participation, such as: an effective use of community's knowledge, social acceptance of the current project, and fair distribution of benefits. Community knowledge is a particularly important benefit of community participation, especially in the earlier stages of project design (Bamberger, 1986). The local community can provide useful information regarding climate, topography and local culture, so it ensures that the project is fully adapted to the area. Uphoff (1986) described several cases of structures such as bridges and irrigation channels that could not withstand the unaccounted-for natural disasters such as monsoon floods. Uphoff (1986) also indicated that a lack of knowledge of local culture may lead to a labor shortage during religious and community festivals, resulting in project delays. Community involvement can also contribute to the ultimate success of whatever project is to be completed. For example, in the absence of community involvement, social acceptance of the project may never be achieved, resulting in low participation levels or little to no use of provided services (Bamberger, 1986). Communities may possess many resources they can readily provide including labor, money, and materials. If members of the community do not feel involved in the project development and implementation, these resources may be much less willingly provided or not even made available. It is important for each group and sector of a community to be represented so that an equal distribution of benefits can be achieved. In order to ensure that the more powerful members of the community do not take all the benefits, the less powerful must be included in projects to ensure equal distributions (Bamberger, 1986).

2.4.3 Community Participation and Waste Collection Facilities

Community participation is an important part of many social initiatives. This idea is especially applicable to the implementation of a waste collection facility because community participation raises issues regarding a problem deeply rooted in the lifestyles of the residents of a specific community. The participation and feedback from the community is more important than the physical site and design in the creation of a waste collection facility (EPA, 2002). Organizations planning a waste collection facility should also educate and draw feedback from the community to ensure mutual understanding of the problem and the solution (EPA NEJAC, 2000). Public meetings, interviews with local media, press releases, advertisements, internet sites, community committees, educational modules, and presentations to environmental, religious, and other civic groups are all potentially effective ways to do so (EPA, 2002). Such programs with community groups create a sense of trust with the public. This allows for a more unified approach to creating a waste collection facility, one that balances the needs for the organization and the community. A failure of community and organizational cooperation can be seen in the historic trend of waste collection facilities being sited mainly in low-income areas in the United States. These facilities serve both low-income and high-income communities around it, but only the low-income communities are directly affected by the negative impacts. The lack of outreach to residents and participation from them has created a negative situation that could have been easily avoided. This has recently caused many communities to rise up in protest of the facilities once they have realized the problem (EPA NEJAC, 2000).

An example of effective community involvement during the implementation process of a waste collection facility can be seen in Santa Fe, New Mexico, detailed in a report by the EPA (2001). When planning this waste collection facility, the community was consulted extensively through public hearings, meetings with neighborhood associations, and door-to-door newsletter distribution. Each of these actions was intended to educate and draw feedback from the public about the design and decision-making process, which allowed the residents to better comprehend and challenge issues. The residents raised concerns of traffic, litter, odor, dust, and aesthetics which the town efficiently resolved. The organization interested in implementing a waste collection facility created a plan for transfer trucks to avoid major roads in town, preventing a

number of traffic and noise issues. Cleanliness was addressed by hiring crews to pick up litter on a daily basis as well as washing the collection facility down regularly. Furthermore, a ventilation system was established to curb the odor problem. The most important contribution was the community input on the design of the facility. Prior to the outreach to the residents, Santa Fe's distinct architectural style of "stucco-and-tile" was not considered an important part of the design. Upon further consideration, the town and citizens came to a consensus that integrating this waste collection facility with the same style of other buildings in the area would create a more community-friendly facility. This example shows that informed and involved citizens may have a large amount of power to impact the implementation of a waste collection facility, which can be used to help create an optimal facility (EPA, 2001).

2.5 Summary

Overproduction and improper disposal of waste is a pressing global issue. The existence of a waste management system is pivotal for the environmental, social, and economic health of a community. Puerto Rico is currently facing a solid waste epidemic that is negatively impacting its communities and ecosystem. The *barriadas* of Cantera are now experiencing the effects of this epidemic and are in need of a waste collection facility to alleviate it. Waste collection facilities are an integral piece to a successful waste management program, offering numerous benefits to communities. In order to guarantee the success of the waste collection facility, it is especially crucial to consider siting, design, and community involvement during implementation. Understanding the problem both locally and globally is important for developing a proper methodology that will guide organizations and communities facing similar problems.

Chapter 3: Methodology

Our goal for this project was to aid the CDIPC from October 27, 2014 to December 18, 2014 in their initial planning stages for a waste collection facility in Cantera.

We fulfilled this goal through the following objectives:

1. Assessed the current state of the community's waste management services.
2. Identified the key stakeholders' opinions of the potential establishment of a waste collection facility.
3. Evaluated and compared potential site and design options for the waste collection facility.
4. Developed plans to promote community involvement in the waste collection facility.

Addressing each of these objectives allowed us to leave the CDIPC with data on community waste practices and recommendations regarding siting, design, and community involvement. We expected that the final establishment and construction of the waste collection facility would occur after our departure and that the CDIPC would use our collected data and recommendations as a guide toward an effective and community-supported project. For the remainder of the report, refer to Appendix B for a list of English and Spanish translations of the organizations that were affiliated with this project.

3.1 Assess the Current State of the Community's Waste Management Services

Field Observations

We conducted field observations in order to help us gather information about the waste problem in Cantera. Our liaisons, Alfredo Zapata and Luis Cintrón, guided us around the area to observe instances of open dumping, the current ineffective waste collection system, and potential sites for the waste collection facility. Using a satellite image of Cantera from Google Maps, these important locations were recorded with photographs and qualitative comments. These comments included the compositions of dump sites and overflowing trash bins, locations of potential sites for a waste collection facility, and important locations around the community that are pertinent to

our project, such as the office of the Consejo Vecinal which is made up of Cantera's local leaders and explained further in section 3.2. Using this information, we created a detailed log corresponding to these locations, and a map identifying these points. We took a satellite image of the community from Google Earth and then we used the GoogleDraw function to label these points. We were able to identify these locations on an image because we took the GPS coordinates of each site. In this map, the blue circles indicated problematic waste areas, the red squares showed the location of the potential sites for the waste collection facility, and the yellow triangles marked the important agencies that are pertinent to the proposed facility. This helped inform the siting process we undertook later because it provided a clearer understanding of the physical layout of the community.

Trash Audit

In order for us to learn about Cantera's waste challenges, it was important to determine the amount and composition of the waste that the community produces. To do so, we performed a "trash audit", an experiment in which community members were asked to dispose of their waste in provided bags so the contents can later be quantified. Throughout the United States, trash audit campaigns have been a popular way to assess weight and composition of waste. A successful example of this practice is seen in Earth 911's waste audit of the Phoenix waste stream (True Life, 2010). Earth 911 is an organization that for the past 20 years has promoted environmentally friendly practices such as recycling and purchasing sustainable products. Their study found valuable information such as households throwing away a large number of recyclables.

To execute this, three trash bags were distributed to participating households, two 13 gallon white trash bags and one 30 gallon black trash bag. Participants were instructed to dispose of recyclables in the white trash bags, and the rest of their waste in the black bag. Recyclable items for this experiment include plastic, paper, glass, aluminum, cardboard, and newspaper. By separating the types of wastes we were able to quantify how much of the total waste was composed of recyclables. This information allowed us to explore the need for collaboration with Reciclaje del Norte (refer to section 4.4). This also allowed us to estimate the total amount of domestic waste that is on average produced by the citizens of Cantera. Items that participants were instructed not to dispose of include hazardous waste, sharp objects, liquids, batteries, and

construction debris.

The participating households were selected via recommendations from the CDIPC. These participants were provided a set of instructions (refer to Appendix C), a survey (refer to Appendix D), and the three trash bags. The survey was used to understand the waste habits of the individuals, as well as to gather information regarding waste composition and quantity from each of the sectors. To minimize the possibility that participants would alter their normal waste disposal practices, all participants were informed prior to participation that the content of their trash bags would remain private and that they should continue their regular disposal habits. In order to keep track of each participant, household, and survey, each set of bags was assigned a number between one and 32. We attempted to distribute our 32 samples evenly across Cantera, which comprises 16 sectors, as seen in figure 8 below.

Figure 8: Map of the 16 sectors of Cantera, courtesy of the CDIPC

In order to give a sufficient time period to accumulate waste, the participants were asked to begin accumulating waste in the bags on Saturday, November 8th at noon, and conclude on Monday, November 10th at noon. Some of the filled bags were dropped off at the CDIPC headquarters by the participants, while we picked up the rest at the participants' houses. We did not have access to anything more than a basic analog scale which was too small to weigh the

bags directly. Therefore, the weight of each bag was measured through one person standing on a scale and recording his or her weight and then repeating this while holding the bag as seen in figure 9. The difference between the two measurements provided the weight of the bag. The bags were not opened for a more detailed record of the waste composition.

Figure 9: Example of measuring the bags in the trash bag audit

Through this campaign, we collected data regarding waste composition and generation rates per household. Once the measurements of weight had been recorded and the corresponding surveys were collected, all the information was compiled in a Microsoft Excel spreadsheet. This spreadsheet included each participant's unique identifier, their demographic information, and waste measurements. The measurements of waste weight were used to project each person's annual waste production for both recyclables and non-recyclables. We assumed that this two-day period was representative of normal waste disposal. We used this information to extrapolate to the entire community, generating an estimate of the community's yearly waste production. We used the estimation of 10,000 residents in the community of Cantera, based on the demographic information provided by the CDIPC (refer to Appendix A). Using Excel's Pivot Table and Chart feature, we created multiple views of the data to assess the percentage of recyclables and other waste being disposed of. This feature was also used to investigate spatial variability in waste production between sectors. We did this by comparing the unit waste generation per person by

sector. A proper facility design that fits the community's needs was determined by quantifying the current weight and composition of waste in Cantera (objective 3). Finally, we used a two sample t-test to see if there was a significant difference between combined waste and recyclable generation in the *barriadas* and the subsidized housing. If there was a significant difference between waste generations in these types of household, accommodations would have to be made such as siting the facility in an area with higher waste generation, or education on how to reduce waste generation.

3.2 Identifying the Key Stakeholders' Opinions of the Potential Establishment of a Waste Collection Facility

To ensure that our recommendations for the CDIPC incorporated stakeholder perceptions of a waste collection facility, we conducted informal interviews with community groups and private and public agencies, and distributed surveys for the general public. We asked questions regarding what permits would be needed and how to obtain them, including what agency provides them, where to get the application, and how long the process takes. We also asked for any operational data and contact information for existing facilities that are nearby and similar to the facility we proposed. Other questions regarding involvement of the community and the availability of utilities were also asked. Through these informal interviews, we collected information regarding the selection of potential sites, community needs, demographics, available resources, interest in participation, and general suggestions regarding the waste collection facility. The community's responses were important to determine necessary factors to consider for the siting and design options (objective 3). This data also provided more effective methods for community education and involvement through participation and incentive programs (objective 4).

Government Agencies

We interviewed representatives from three critical agencies, in a single informal meeting. Table 1 contains the names and information of the representatives of the agencies who participated in the interview. We began the interview with a set of questions that we developed for the agencies (refer to Appendix F). Because we interviewed the representatives in a single setting, we received responses with different perspectives to most of our questions. Conducting

one interview with the three agencies allowed for a broader discussion of the questions we had prepared for each agency and provided more insightful information.

Table 1: Participants in the November 6th government agency interview and their affiliations and titles

Name	Agency	Position
Ilsa Mendez	Environmental Quality Board	Environmental Quality Inspector
Sara Justicia Doll	Environmental Quality Board	Environmental Quality Inspector
Noelia Rosa	Municipal Government of San Juan	Sub Administrator of the Municipal Government of San Juan
Maritere Padilla	Autoridad de Desperdícios Sólidos	Director of Planning Area
Maria Oquendo Padua	Autoridad de Desperdícios Sólidos	Director of Planning, Operations, and Engineering

We identified the Municipal Government of San Juan as an organization that will be closely involved in the establishment of a new waste collection facility since they are currently managing the waste collection in Cantera (refer to section 2.2.5). So, we worked with our liaisons at the CDIPC to schedule an interview with Noelia Rosa on November 6th. In order to obtain the permits necessary to establish a new waste collection facility, the Puerto Rican government requires that a new venture, like a waste collection facility, is sponsored by an organization that will support the project. In this case, the Municipal Government of San Juan would provide this for the possible facility in Cantera, although there is no formal agreement yet. In this interview, we asked questions about the requirements for utilities, siting and zoning of the potential sites, necessary components needed for a facility, safety regulations, and the construction process. Some potentially necessary components include conveyor belts for manual separation and scales to measure the weight of waste. Inquiries were also made regarding details of the current waste management system for the municipality of San Juan and how the proposed facility would be incorporated into it.

Next, we interviewed Maria Oquendo Padua and Maritere Padilla from the Autoridad de Desperdicios Sólidos (ADS), which is a government agency that oversees policy concerns,

collection of data, and information regarding solid waste management in Puerto Rico. We asked questions regarding operations and components needed for a successful waste collection facility. Additionally, we asked about necessary permits, different types of facilities, and the operational processes of other local waste facilities.

The last agency we interviewed during this process was the Environmental Quality Board (EQB). This group is in charge of enforcing compliance with environmental regulations on pollution to air, water, and soil. The EQB would issue the construction and the operation permits to certify that the proposed facility is built to standards. This agency has been delegated its authority from the United States Environmental Protection Agency (USEPA). Approval from the EQB is often the final step when constructing a waste collection facility. By interviewing this group, we sought to receive information regarding the environmental regulations that are applicable to our project. Furthermore, we wanted to learn more about environmental considerations that should be taken when siting and designing a waste collection facility, such as noise, odor, and vermin. This information is crucial to the establishment of a facility with the least environmental impact.

Reciclaje del Norte

Reciclaje del Norte(RDN) is a local recycling center in Cantera that collects and purchases recyclable materials brought in by members of the community. The RDN recycles various kinds of materials, such as paper, plastics, electronics, yard waste, and construction debris. Initially, the RDN started out as a non-profit organization, called People's Recycling, that was established and operated entirely by volunteers from the community. This organization went through a period of management difficulties that led to a merger between them and the RDN, which caused its development into the thriving, for-profit business that it is today (personal communication, R. González). The RDN is a successful model that provided us with useful advice for starting a community-run facility. We interviewed Rubén González, the Manager of Unit Operations in the Reciclaje del Norte Santurce branch, on November 6th. In this interview, we asked Señor Rubén González about the history of the company, operations and costs, and strategies for involving the community (refer to Appendix G).

Consejo Vecinal

We met with the Consejo Vecinal, Cantera's community council, to ascertain their opinions on the CDIPC's proposed waste collection facility project. The council comprises one elected official for each of the sixteen sectors of Cantera. This group serves as an influential governing body that is pivotal to the success of initiatives in the community, so convincing the Consejo Vecinal of the project's value was a necessary step. To help communicate our purpose, objectives, and methods of the project, we began by giving a brief presentation on the project proposal to the Consejo Vecinal (refer to Appendix H). Following the presentation, we held an open discussion with the council members to field questions, address concerns, and create new ideas. We used this session to create mutual understanding between us and the Consejo Vecinal to ensure their cooperation with the new waste collection facility.

Waste Collection Facilities

From recommendations provided through interviews with the agencies, we visited one waste transfer station in San Juan and a materials recovery facility in Cidra as shown in figure 10. The facility in San Juan is used by the entire municipality of San Juan, while the Cidra facility serves both the municipalities of Cidra and Aguas Buenas (ADS, 2003).

Figure 10: Map of the San Juan (red star) and Cidra (black star) facilities and their radius of operations (San Juan's radius is in yellow and Cidra's radius is in red) (ADS, 2003)

The facility in Cidra is smaller and more similar to the level of operation that we expect to be needed for Cantera. The facility in Cidra can only handle up to 70 tons of material per day, while the San Juan collection facility can take in up to 1,000 to 1,500 tons per day. The

collection facility in Cidra serves roughly 72,000 people while the station in San Juan serves almost 400,000 (for comparison, the population of Cantera is approximately 10,000 people). We expect that the waste collected at the proposed Cantera station would be brought to the facility in San Juan, and from there it would be transported to a landfill. In the San Juan visit, we were given a tour by Pablo De Jesus, who is the station's Site Operations Manager. For the Cidra visit, we were given a tour by Maria Santiago, the Director of the Department of Recycling for the Municipality of Cidra and the Vice President of la Coalición de Coordinadores de Reciclaje Municipal (CCOREM). CCOREM is a coalition of recycling coordinators from each municipality that are trying to develop new methods to promote recycling on the island (personal communication, M. Santiago). In these visits, we asked the employees questions about how the station was designed, operational components that they use and why they chose them, and what costs are necessary to run a waste collection facility. In addition, we visited both the San Juan and the Cidra facilities to identify the differences between their operations and the quantity and composition of the waste that they handle. With this knowledge, we determined the proper size and other design features of the facility in Cantera. We also asked about labor requirements such as how much technical training, licenses, specific education, and number of employees they may require.

The Community

We investigated community members' opinions on the development of a waste collection facility in both the subsidized housing and the informal *barriadas*. To do so, we distributed a questionnaire to the residents to gather data about community demographics, waste disposal practices, and opinions on a potential waste collection facility (refer to Appendix E). Since members of this community primarily speak Spanish, the questionnaire was in Spanish in order to reach all potential participants. After our initial presentation with the Consejo Vecinal, the council members agreed to help us distribute the questionnaire to their respective sectors. We provided each representative 15 copies of the survey to distribute in his or her sector. After collecting all the surveys, we entered the data into Microsoft Excel and analyzed the multiple-choice responses. For the multiple-choice questions, we analyzed and compiled the responses to determine the most frequently selected answers. Using the data we collected through the surveys, we analyzed the demographics to make inferences about who are the most receptive respondents,

compared internet use by age group, gauged community interest and willingness to participate in a waste collection facility, and analyzed respondents' recycling practices and opinions. In the open response section we asked questions to help us determine community opinions in greater detail in order to complete objectives 3 and 4.

3.3 Evaluate and Compare Potential Site and Design Options for the Waste Collection Facility

Evaluation of Sites

During our initial field observations, we visited each potential site and recorded a general description. Later, we visited each site again to physically assess them in greater detail. The CDIPC had seven potential sites for the waste collection facility (personal communication, L. Cintrón). In order to assess these sites, we created a rating system to rank the characteristics of these potential sites. To do so, we first used the information from our background research to determine the characteristics of a good site. Some of these characteristics included proximity to residents, accessibility for users, and size of the land (EPA, 2002). These characteristics have been historically important to successful siting of waste collection facilities. Other criteria that we considered included flood potential and accessibility to utilities (personal communication, A. Perez-Zapata).

Once the characteristics were established, we created guidelines to rate them accordingly. These guidelines included a number scale from one to four for each characteristic, with a description detailing what that number corresponds to. In this rating system, a score of four represented the most positive scenario and a score of one represented the most negative scenario for that characteristic (refer to Appendix I).

The first characteristic that we included in our rating system was proximity to residences. During our background research, we learned that waste collection facilities that are constructed too close to community members can pose health risks to nearby residents and can be detrimental to the success of the facility (refer to section 2.3.2). Cantera is also a very densely populated community so it is important to select a site that minimizes harm and disturbance to the community. Consequently, we considered proximity to residences to be a critical factor in siting the facility. Refer to Table 2 below for assessment categories and their definitions.

Table 2: Categories used to assess proximity to residences for each of the sites we assessed, along with scores assigned and definitions for each category.

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Our background research also indicated that accessibility to users was important to siting a waste collection facility, so we also considered this characteristic in our assessments. If the facility is not easily accessible, then it will not be used to its full potential by the community. Accessibility includes both routes for vehicles as well as convenient access for residents without vehicles. Consequently, we considered accessibility to users to be a critical factor in siting the facility. Refer to Table 3 below for assessment categories and their definitions.

Table 3: Categories used to assess accessibility to users for each of the sites we assessed, along with scores assigned and definitions for each category.

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to veh\icles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

The third characteristic taken into consideration for the facility was the size of the land. Information from our visits to the Reciclaje del Norte facility, San Juan waste transfer station, the Cidra materials recovery facility, and consultation with Señor Zapata informed us that a facility to serve the population of Cantera would need to be on a plot of land that is about 4,000 square meters. This number was reached using our daily waste generation projection from our trash audit. A lot this size leaves sufficient space for all the necessary features of a waste collection facility. We will further explore this in the design section, with a corresponding diagram of a potential site. We considered both the ability to establish a facility on this land as well as the ability to expand upon this facility if it services outside communities. Consequently, we considered the size of land to be a critical factor in siting the facility. In order to assess the size of the land we used Google Earth's path function which measures the distance between two points on a satellite image. Refer to Table 4 below for assessment categories and their definitions.

Table 4: Categories used to assess the size of land for each of the sites we assessed, along with scores assigned and definitions for each category.

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	4	Sufficient space for facility with additional space for further expansion

The fourth characteristic that we considered was flood risk. The Federal Emergency Management Agency (FEMA) states that any building that is constructed at or below 1.72 meters above sea level is at high risk of chronic flooding. In addition, we took into account a site's proximity to the shoreline, which is not as severe of an issue as the flood risk levels. In some cases, bordering a shoreline may not be a problem because the land itself may be elevated well above the flood risk potential that it would not result in damaging floods. Using a flood map

provided by the CDIPC, we determined the locations of the sites with respect to the shore line and flood zones. Refer to Table 5 below for a list and explanation of each category.

Table 5: Categories used to assess flood potential for each of the sites we assessed, along with scores assigned and definitions for each category.

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

The fifth characteristic that we considered for siting was the accessibility of utilities. To operate a waste collection facility, adequate accessibility to electricity, water and sewerage are required. Through our discussions with representatives from other waste transfer stations, the RDN, and our liaison, we determined that these three utilities were the most crucial to operating a facility. Table 6 below further details the categories and their explanations. We ranked on the utilities that are readily available. We recommended that the CDIPC consider the cost to access utilities for sites that do not have access to one or more utilities, in order to determine financial feasibility (see 5.2).

Table 6: Categories used to assess accessibility of utilities for each of the sites we assessed, along with scores assigned and definitions for each category.

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	4	There is access to water, electricity, and sewerage

We planned to visit a wide variety of sites with many different characteristics that would not be included in our assessment categories. As a result of this variety, we added a category to account for extenuating circumstances that would result in the waste collection facility not being feasible. This category was simply pass or fail, where failure results in the site no longer being considered for the facility. Other sites that were removed from consideration were sites that received a one on any of the previous rating scales.

The next step in this process was calculating the score of each site. In our background research, we did not find evidence that would indicate that any of these categories was more or less critical than the others, so we had no rationale for giving them unequal weights. This caused us to establish equal weights of 0.20 for each of the five categories. The scores were then multiplied by these equal weights and added together to calculate the final scores. After we determined the ranks of each site, we reconvened with the president of the Consejo Vecinal and Maria Santiago of the Cidra materials recovery facility. In this meeting, the attendees gave us their opinions on each of the sites. We asked them if there were any specific characteristics of each site that could not have been determined through physical site evaluations.

Evaluation of Design Options

After the site evaluation process, determining preliminary design options was crucial to further assess the feasibility of a waste collection facility. Based on input from the Autoridad de Desperdicios Sólidos (ADS), Environmental Quality Board (EQB), and the Municipal Government of San Juan, it was clear that there was a need for a facility that could serve as a

collection point and holding facility for several categories of waste, including large items, recyclables, and household waste. Thus, we evaluated alternative designs for a facility that could handle these three waste streams, focusing on important design factors such as estimated facility dimensions and physical characteristics that deter odor, noise, and vermin. Additionally, we asked for information regarding proper dimensions and infrastructure, strategies for limiting negative effects on the community, and guidelines on necessary equipment in our interviews with representatives of other waste collection facilities and the Reciclaje del Norte. Through these interviews, we asked questions regarding the total waste collected daily at their respective facilities, as well as the size of their facilities. We did not consider potential customers from outside the community in this projection.

From our general population survey results (objective 2), we asked whether or not people would be willing to use the proposed waste collection facility. The responses from this question helped us determine the approximate number of users for the station during its initial start-up by taking the participation rate and multiplying it by the total population. The results from the trash bag audit were also taken into consideration. These provided valuable information with regard to the composition of the recyclables that is expected to be processed by the waste collection facility. In our analysis of case studies (section 2.3.3), we learned about characteristics of established waste collection facilities. These characteristics include concrete floors, odor control, and pollution prevention. Using these findings, we developed a set of design recommendations for the waste collection facility in Cantera.

3.4 Develop Plans to Promote Community Involvement in the Waste Collection Facility

The last objective of our project was to develop a plan for sustained community involvement in the waste collection facility. This plan comprised three domains: operational strategies, community outreach aimed at adults, and education programs directed at local youth. Both suggestions and deliverable items that can be used if the waste collection facility is established were included in this plan.

Operational Strategies

In order to supplement our choice of a site and design for a waste collection facility, we addressed other challenges that can affect the long-term success of the facility. The first of these challenges was finding a way to create operational strategies for the waste collection facility. In the context of this project, we define "operation strategies" to include methods in which the facility can incorporate that result in economic benefits for the community. To accomplish this task, we first assessed the potential role of community members as employees in the waste collection facility. In the interviews with other waste transfer stations and the RDN, we asked them if they prefer to hire from within their local communities or if they seek employees from outside the community. Also, we asked about the benefits or drawbacks of employing members of the local community. We were also interested in exploring the potential role of the informal waste collection sector in a prospective waste collection plan for Cantera. Currently, this group is a contributing factor to the open dumping in Cantera. The informal waste collection sector comprises individuals who charge residents for waste disposal services and then proceed to illegally dump the waste they collect. If our team could direct this improper disposal method towards a proper facility, there may be a reduction of illegally dumped waste in the community. We consulted our liaisons at the CDIPC and the members of the Consejo Vecinal about the possibility of involving these residents in the operations of the waste collection facility. We incorporated this advice into the recommendations we left for the CDIPC.

Another opportunity we considered was the creation of incentive programs to encourage participation in the waste collection facility. To promote participation in the facility, we investigated what best motivates members of the community to exercise good waste disposal practices through interviews of representatives from other waste collection facilities, the Reciclaje Del Norte (RDN), the Consejo Vecinal, and the CDIPC. We asked the RDN and the facilities in Cidra and San Juan about examples of incentives that have worked for them or elsewhere. In combination with evidence from case studies, we identified strategies that are most likely to increase local participation. We used the information we learned to develop incentive strategies to motivate the community to use the new facility.

A final opportunity that we explored was the sale of recyclables, which the proposed waste collection facility would receive, to the RDN. Currently, this for-profit recycling facility (see section 3.2) purchases residents' recyclables such as plastic, paper, cardboard, metal, and

newspaper. Through discussions with Rubén González of the RDN, we hoped to initiate a potential cooperation between the new collection facility and the existing recycling facility. We also consulted Señor Rubén González about the prices of different recyclable materials that the RDN purchases.

Community Outreach

Our first goal of this section was to create a program aimed at adults to advertise and encourage participation in the facility once it is open. We wanted to first create materials that could be immediately used in the community. We determined an effective short-term outreach program for a waste collection facility using our background research as well as suggestions from other facility representatives. Potential outreach techniques that we assessed include brochures, posters, billboards, radio commercials, or door-to-door flyer distribution. We designed these materials as a way to educate the community on the use and operations of a waste collection facility, the environmental and human health hazards caused by improper waste practices, and the corresponding benefits from such a facility. We consulted the CDIPC for information on the group that would be most conducive to helping us create an outreach program. Such groups included schools, local businesses, and the Consejo Vecinal.

As part of this objective, we brainstormed initiatives that the CDIPC could use to promote awareness of the waste collection facility once the facility opens. Examples include tours, celebrations and festivities, and strategic employment. Since these will occur after our departure, we wanted to find a way to consistently update the community of these events when they occur. Using insights gathered from relevant scholarly literature, we investigated the best ways to encourage long-term continuous community participation, such as a website, social media, newsletters, or newspaper advertisements. Our general community survey informed us about the potential utility of online communication for a long-term outreach program. Specifically, we asked residents of Cantera to report whether or not they have internet access. We decided that since a substantial proportion of respondents reported that they have access to the internet, a web-based long term approach would be ideal. For those without internet access, other means of outreach would have to be established. We sought the best medium that would reach out to the most residents and effectively communicate our information to them. This way,

this information can help educate the community on the waste collection facility and good waste practices.

Youth Education

Our final goal was to increase community participation through an educational plan regarding proper disposal methods, health and environmental risks from open dumping, and benefits of a waste collection facility. To accomplish this, we developed a one-hour interactive lesson plan that was aimed at elementary-aged children. Research shows that educating children about environmental protection can indirectly affect the practices of a community in a positive manner (Hiramatsu, 2014). We expect that an educational program aimed at the children of Cantera could result in the same effect shown in Hiramatsu's study (2014) because children are likely to bring what they learn into their homes to share with other generations. On December 2nd, we consulted the four social workers from the CDIPC and representatives from the AmeriCorps service, who are currently serving in the community, through an informal interview to determine the best practices in educating the children of the community. Refer to table 7 below for a list of attendees we met with.

Table 7: List of participants in the informal interview that we carried out on December 2

Name	Affiliation	Position
Mayra Ramos	CDIPC	Social Worker
Idelisse Vega	Estudiante Universidad Metropolitan	Social Worker
Juana Silverio	Estudiante Universidad Metropolitan	Social Worker
Yarisel Lozano	Apoyo Empresarial	Social Worker
Alfredo Perez-Zapata	CDIPC	Engineering Consultant

Yoliana Vazquez	Estudiante Trabajo Social	AmeriCorps Volunteer
Viviana Martinez	Estudiante Trabajo Social	AmeriCorps Volunteer
Osualdo A Delvalle	Estudiante Trabajo Social	AmeriCorps Volunteer

Chapter 4: Results

4.1 Assess the Current State of the Community's Waste Management Services

Field Observation

The first task that we completed when we began our work with the CDIPC was an observation and analysis of the community's waste disposal practices. Within the first two weeks of our project, our liaisons Señor Cintron and Señor Zapata provided us with a brief tour of the community several times in order identify important landmarks in the community. As we traveled through the community we logged interesting examples of open dumping through descriptions and pictures. We also logged information on significant waste locations and buildings or facilities of importance. Figure 11 below shows a simple map of the peninsula with the identified areas of interest. To accompany this map, a log was developed for each of these locations with a brief description (refer to Appendix J).

Figure 11: A map of Cantera marked with observed locations. Complete description of numbered sites is in Appendix J.

This field observation provided us a great deal of basic information about the waste problem around Cantera. Upon arrival to the community of Cantera, it was easy to observe the significant contrast between the northern and southern parts of the community, the subsidized housing and *barriadas* respectively, with the north being more formalized and less densely populated and the south being more informal and densely populated neighborhoods (personal communication, A. Perez-Zapata). Calle A is a road which acts as a border that separates the public housing projects in the north and the *barriadas* in the south. Currently, these two sides of the community do not interact with each other and reside in very different living conditions. Señor Zapata suggested that the residents of the *barriadas* are less willing to adopt the lifestyles that are consistent with living in subsidized housing because residents of the *barriadas* have a stronger sense of pride from owning their own home (personal communication, A. Perez-Zapata).

There are several important facilities within the community. We observed the locations and buildings for the CDIPC, the Reciclaje del Norte (RDN), and Consejo Vecinal. The CDIPC is an important organization in Cantera previously explained in section 2.2.5. The RDN and Consejo Vecinal are two organizations we later interviewed as detailed in section 4.2. In addition, we noted the locations of the seven potential sites for the waste collection facility. We later evaluated these sites and the results are explained in section 4.3.

We walked and drove through the community and observed several locations of large, congested occurrences of waste. This waste included appliances, furniture, construction debris, and household trash. As we learned in the background, the locations of these mainly occurred in the Martín Peña channel, abandoned houses, and community bins (see section 2.2.5). From our field observations, we also learned that a majority of these waste locations are in the *barriadas* and along the shoreline, as opposed to us believing that the waste is spread throughout the peninsula. For images of these waste locations, refer to Appendix J.

After going through the community, it became evident that narrow roads are one of the major obstacles to solving the current waste problem. In Cantera, the municipality provides free service to pick up waste from every house but cannot reach them all because of poor road accessibility. This issue is especially prominent in the *barriadas* because many streets are designed for two-way access but only have enough space for one-way travel.

Figure 12: Example of narrow streets in the *barriadas*

This inefficiency is due to people parking their cars on both sides of the already narrow road, making travel by car, much less trucks, nearly impossible. Additionally, there are few to no sidewalks in most of the *barriadas* leaving people to walk alongside the dangerous roads with moving cars.

The field observations of Cantera were extremely important because they allowed us to understand the cultural and physical challenges that are present within the community. The issues that we learned regarding the overflowing bins, abandoned buildings, narrow roads, and the Martín Peña Channel were all very important to determining an appropriate solution for the community. The information learned in this section helped guide many of the factors in the siting and design stages of the waste collection facility. Refer to the field observation log in Appendix J for additional examples with images and descriptions of open dumping and important locations.

Trash Bag Audit

Through the trash bag audit, we collected waste generation and composition data. A total of 28 residences took part in this process, representing 14 of the 16 sectors of Cantera (shown in figure 8). The sectors that are classified as *barriadas* are Guano, Santa Elena, Condadito Final, Corea, Ultimo Chance, Bravos de Boston, and Los Pinos. There were 9 participants from these

sectors. The sectors that are classified as subsidized housing include Las Margaritas, Villa Pelicano, Parque Victoria, Las Casas, El Mirador, Villa Corozo, Habitat, Paseo Del Conde, and Villa Kennedy. There were 19 participants from these sectors. We were unable to find willing participants in Los Pinos and Las Casas.

We used the trash bag survey data to project waste generation per day in the community. Refer to Appendix K for the raw data from this survey. We initially calculated the weight of waste generation per person by taking the ratio of the total weight of the waste generated (341 pounds) and the total number of individuals who took part in the audit (76 people). This number came out to be 4.49 pounds per person for the audit period. Since this trash bag audit was done over a 48-hour time period, we divided this number in half to get the waste generation per person per day and got 2.25 pounds per person per day. It is interesting to note that this number is far below 5.4 pounds per capita, which is the average waste generation rate of Puerto Rico (Miranda & Hale, 2005). These results show that the community has a lower generation rate per capita than other more developed regions in Puerto Rico. This is an inference confirmed in section 2.1.2 of our background research that low-income communities generate less waste than high-income communities, but suffer from a much less efficient waste collection system (Hoornweg & Bhada-Tata, 2012). We then multiplied this number by the projected 10,000 people who live in the community to estimate Cantera's waste generation per day. We found that Cantera produces 22,450 pounds of waste per day, or about 11 tons. This number translates to about 4,097 tons per year. Knowing the waste generated per day allows for a better understanding of how many truckloads it would take to transport this waste. Assessing how many tons the bins can currently handle and comparing this to the weekly generation rate can help the municipal government understand the need for more bins or more frequent collection. This number gave us a rough approximation of waste generation in Cantera. Seasonal and weekend variability were not taken into account because of the lack of data on these variables.

Another important finding was the composition of recyclables and non-recyclables. By taking the total weight of all white (recyclables) and black (non-recyclables) trash bags separately and dividing them by the total weight of all bags, we found that 66% of the waste was non-recyclable and 34% was recyclable by mass. Using this information, coupled with the projection of 11 tons of waste per day, we were able to project that 3.74 tons per day of recyclables are produced. We got this number by multiplying the projection of 11 tons per day

by the 34% recyclables that makes up the waste. With this projection, we better understood how much the waste collection facility would need to handle on a daily basis regarding recyclables. We also used this information to give the RDN a better idea of the scope of our operations. This information was valuable in our conversations regarding potential collaboration.

The trash bag audit also allowed us to estimate waste generation by sector, and more specifically by *barriadas* and subsidized housing. For these calculations we used strictly weight, since it is the more widely used and valuable unit of measure in this context. In figure 13 below, the average waste generated in both the *barriadas* and subsidized housing can be seen. From this data, we were looking to observe a significant difference between the waste generation in these two types of households. It is important to note that this information is based on a relatively small sample size. Using a two sample t-test at the 95 percent confidence level, a t-score of 0.8092 and p-score of 0.4246 were yielded. The null hypothesis of this test was that the two sample means were equal. The high p-value suggested that the null hypothesis can be accepted, meaning there is no significant difference between which area of the peninsula one lived in (informal *barriadas* or subsidized housing) and waste generation. The standard errors of each type of household were relatively small, suggesting low variability in these pieces of data.

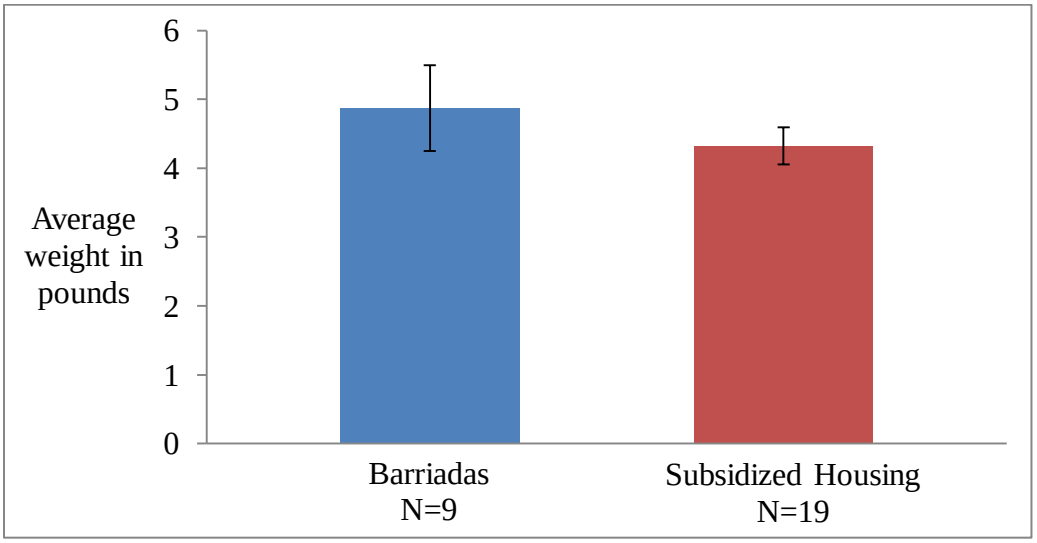

Figure 13: Average waste generation per person by household type. Error bars represent standard error of the means.

The surveys that were distributed to participants also provided a number of insights on waste practices and opinions. Only 27 of the 28 participants responded. One of the most interesting findings was that while 23 of the 27 (85%) respondents stated that they have access to

a formal waste disposal method, 20 out of 23 (87%) later answered that they would be interested in alternative methods of waste disposal. A waste collection service provided by the Municipal Government of San Juan exists in the community of Cantera, however larger waste items prevent the effective pick-up at these collection points. One respondent noted, "It bothers me that there is so little pick-up of construction debris." All quotes referenced in this section are translated from Spanish to English. These survey results suggest that the respondents have the resources to dispose of household waste but want a better way to dispose of larger waste items.

From this survey, we also hoped to understand the level of satisfaction of improper waste disposal practices, such as open dumping. We found that 21 out of the 27 (78%) respondents were not satisfied with the waste disposal practices. Five of these respondents left comments condemning the informal sector that gets paid to collect trash whereupon they throw it into the Martín Peña Channel. For example, one respondent stated, "There are people in the community that are receiving money for throwing away trash, but they are irresponsible. They throw it away in areas close to the canal and into the municipal containers of the Margaritas." These residents are aware of this problem, and know it is negatively affecting the community.

The final piece of information we were looking for through this survey was a more detailed understanding of the respondents' waste disposal practices. To obtain this information we asked whether or not the respondents recycled. There is currently access to recycling in the community through Reciclaje del Norte. This is not a pick-up service, but instead a place where residents can drop off and sell their recyclables. We found that 20 of the 27 (74%) respondents did not recycle, meaning their recyclable waste is not separated and disposed of properly. Despite having a facility to handle recyclables in the community, only seven respondents actually reported that they recycle. This is a potential opportunity for education and economic growth. On the topic of recyclables one respondent noted, "There are ways to take value from trash. There is a saying that the trash from one person can have value to another." As we discussed in our background chapter, there is economic value in waste, especially recyclables. This can become an important operational strategy in the waste collection facility and we further explored it in later results.

This small-scale survey gave us a preliminary understanding of some of the community members' waste disposal practices and opinions on the topic. We hoped to further explore these topics on a larger scale by distributing a community-wide survey. This survey is detailed in the

following section.

4.2 Identifying the Key Stakeholders' Opinions

Interview with the Reciclaje del Norte

Rubén González of Reciclaje del Norte (RDN) provided us with information on how to integrate and operate a waste facility in Cantera. From this interview, we learned that in 1997, the Santurce branch of the RDN began as a recycling collection initiative, named the People's Recycling, which started off as group of volunteers organized by the Consejo Vecinal. Through community participation and support from the CDIPC, People's Recycling was able to provide five years of free collection services without reimbursement for recyclable materials. Additionally, they focused on educating the community on proper recycling practices. After five years of free operations, People's Recycling's funding could no longer support their growing operations, which led the organization to merge with the RDN, the largest private recycling company in the Caribbean. This merger resulted in Señor Rubén González maintaining management of his recycling facility, but it was now under the ownership and supervision of the RDN. By joining the RDN, they were able to receive more funds and began to invest in equipment and services. At this point, they began reimbursing residents for dropping off their recyclables and stopped their collection services throughout Cantera.

From our background research (see 2.4.1) and case studies on waste collection facilities, we identified community participation and involvement as a key component to a successful facility. Señor Rubén González was able to support this component by describing how important community participation has been to People's Recycling. First, the organization went to a majority of the community residences in order to gain valuable insight into the practices and composition of the residents' recycling. They accomplished this through surveys, brochures, and meeting with households to explain his facility and how to properly use it. As a result, Señor Rubén González further encouraged our trash bag audit and community involvement plan because they are critical to understanding the community's waste generation and gaining their trust. The Santurce RDN currently has thirty employees, with twenty-five being community members. This practice is important because it raises community support and sympathy for the facility, as supported by our background research (see 2.4.1). Our interview with Señor Rubén González illustrated an example of how a small, successful community-driven initiative has

developed into a profitable business within Cantera.

Siting and design are important components to a waste collection facility and discussing these parameters of the RDN with Señor Rubén González provided helpful feedback. As a supplement to our background research, Señor Rubén González further emphasized convenience and ease of access as two of the most important components that he had to consider for his facility. As a result, we considered accessibility to users as a key component in our site assessments. The RDN is located in a very convenient location in the community, as it is accessible to a large portion of the community. This ease of access and convenience for the community promotes usage of the facility. This site is surrounded on all sides by residences. From our background research, we know this is not an effective siting strategy. However, Señor Rubén González explained his facility does not cause problems with odor and vermin because the facility does not handle domestic waste. Potential noise problems could still be present, which will be taken into consideration for the design of our proposed facility. When asked about the most important utilities that are used in his facility, he said that electricity and water are crucial because electricity is used to power the necessary equipment and water is used for sanitary purposes. As a result, access to these two utilities was considered during our site assessments. While conducting our background research, we discovered that vermin and pests were common problems that waste collection facilities had to address. However, facilities like the RDN do not encounter this common nuisance because large amounts of domestic waste are not handled there. Since the proposed waste collection facility in Cantera will seldom handle domestic waste, we determined that this is not a strong concern that we had to take into consideration in our design recommendations. Through the community involvement plan, the residents will be informed that odor and vermin from domestic waste will not be a concern. This interview provided valuable information on how to start up and operate a new facility in the community of Cantera. For the full transcript of this conversation, refer to Appendix L.

Interview with Agencies

We conducted an informal interview with the representatives of the Environmental Quality Board (EQB), the Autoridad de Desperdicios Sólidos (ADS), and the Municipal Government of San Juan. From Sara Justicia and Ilsa Mendes of the EQB, we learned about the environmental compliances that waste facilities have to follow and we discovered that they were

the last agency that the facility would have to get approval from before being constructed. We also learned that before the facility is built, the EQB would have to approve the operation and construction permits. In addition, Señora Sara Justicia and Señora Ilsa Mendes gave us valuable insight into other permits that we would need. This includes adhering to health, noise, and sound compliances via permits that are issued by the San Juan Office of General Permits.

The representatives for the ADS were Maritere Padilla and Maria Oquendo. From this discussion with them, we learned about the different types of waste facilities that are present here on the island and which ones are the most similar to ours. The ADS gave us suggestions and contact information for smaller facilities, like the materials recovery facility in Cidra, that are more similar in size and operation to the facility that the CDIPC wants to establish. In addition, the ADS explained that the technical definition for the type of facility we are planning is a "waste collection facility". This facility is where local residents drop off their own waste instead of dump trucks picking it up throughout the community. Next, a truck picks up the waste at the facility and would not be designated as a "waste transfer station" because a waste transfer station is a facility where collection vehicles pick up the residents' waste. The trucks then drop it off at the facility, but the station we want to establish is one where citizens drop off their own waste. They suggested that our planned facility should primarily handle large items that cannot be thrown into the large municipal bins, such as furniture, tires, construction debris, and electrical appliances. In addition, our facility would take recyclables, which can be sold to the Reciclaje del Norte. In terms of domestic waste, they suggested that the facility should not focus its efforts on this waste stream, but that the CDIPC should try and get the municipality to place a larger number of waste bins in the community.

Furthermore, Noelia Rosa from the Municipal Government of San Juan also provided insight into how our proposed facility would fit into San Juan's current waste management system. If our planned facility gets established, the waste that is collected would be picked up by the municipality and brought to the San Juan transfer station. From there, the waste would then be transported to the Humacao landfill, as seen in figure 14. From Señora Noelia Rosa, we learned that the municipality has a service that picks up large waste items, but there is an excessive quantity of large waste and the service is so infrequent that it provides no relief to the community's waste problem. By establishing our proposed facility, it would save the municipality time and money because they would have a centralized location to pick up these

large items, instead of going to multiple locations and picking up each item individually. In addition, Señora Noelia Rosa also said that she would provide us with the accessibilities of utilities for our siting evaluations via the Municipal Government's GIS department once she received the GPS coordinates. For the full transcript of this conversation, refer to Appendix M.

Figure 14: Map indicating the Humacao landfill (black star) and the San Juan transfer station (red star)

Interview with the Cidra materials recovery facility and the San Juan transfer station

At the San Juan transfer station, Pablo De Jesus led us through a tour of his facility. We observed the different components and operations of the station. We learned that this is a publicly owned facility operated by the private business, EC Waste. They handle an average of 1,100 tons each day of both residential and commercial waste. We were told that they do not handle recyclables or hazardous materials at this facility but that they do separate yard waste. This waste is brought to the landfills to provide an organic cover for the landfill.

Señor Pablo De Jesus brought us to the scale station where he introduced us to the scale operator, who informed us that there are two work shifts from either 4am to 1pm or 1pm to 10pm. In addition, we learned that this facility charges a fee based on weight, or $35 per ton of waste. We learned that the municipality receives a daily report on the station's operations and that the EQB comes and observes the operations every two months.

At the loading dock we observed trucks dumping trash, which was then reloaded into a trailer for transfer to the Humacao landfill. We were informed that the building is approximately 18,000 square feet, or 1,700 square meters, and should have a concrete floor and enclosed with

walls and a roof. Señor Pablo De Jesus described the leachate tank that is located under the facility to collect drainage of hazardous fluids. This tank is brought separately to a different landfill where it can be properly disposed of. When we inquired about rodent problems he informed us that they are not a substantial concern at this station. We also learned that for successful operations, safety regulations and employee training and certifications are required. The government has requirements for truck driving permits while the company needs the employees to be trained to handle specific equipment in the facility, such as handling the trailers that contain the trash. In order to carry out these operations, the facility consumes a very large amount of electricity; an exact amount was not provided by Señor Pablo De Jesus. This tour helped us to gain a more in depth understanding of the structure and operations for collection facility, however, there is a much larger scale of operation here than what we are looking to establish in Cantera. For the full transcript of this conversation, refer to Appendix N.

Next we visited the Cidra facility where Maria Santiago, the Director of the Department of Recycling for the Municipality of Cidra as well as the Vice President of la Coalición de Coordinadores de Reciclaje Municipal (CCOREM), provided us with a tour. This facility was founded by the local municipality in 1992 when a new law established by the commonwealth of Puerto Rico required each municipality to have a recycling center. The Cidra facility began as a small facility but with time, they were able to pass proposals through the municipality to provide more equipment. The facility takes recycling and large items and deals with each type of waste in a separate area of the facility. This facility collects recyclables only from Cidra but accepts deliveries of recyclables from surrounding communities. In addition, we also learned that IFCO Recycling, a local contractor, works with the Cidra recovery facility by providing them with discounted equipment and bins to collect recyclables. In addition, IFCO Recycling also provides recycling services to the Cidra station, where they sell their collected recyclables back to IFCO for a discounted price. A system such as this one could be implemented between our proposed waste collection facility in Cantera and the RDN. Recyclables can be gathered at the collection facility and sold to the RDN.

During our tour, we learned about the operations of this facility. Bags of recyclables are first brought in by a truck and dumped onto the ground. From there, they are put into large, plastic bins until they are moved onto a conveyor belt to be separated into different types of recyclable materials by hand, as seen in figure 15. Also, these employees are all local residents,

which provides opportunities and encourages participation by the community. Additionally, we learned that the large waste items are brought in by individuals to a separate area of the facility where they are handled. This part of the facility is a large open area, where yard waste, construction debris, and large metal waste are separated into their respective categories. There are records kept for every transaction made here.

Figure 15: Photo of the Cidra's materials recovery facility's recycling operation

Through our background research in section 2.4.2 on benefits of community participation, we learned that in the absence of community involvement, adequate levels of social acceptance and participation may never be reached (Bamberger, 1986). This concept was supported by Señora Maria Santiago, who stressed that community education and involvement have been vital to the establishment of the Cidra facility and its continued success. The facility's community education program focuses on informing the local citizens about the health hazards of improper waste disposal practices, so that they become more sympathetic to the problem and recycle more. A key component to their education program is the provision of tours for the local community and schools, which provides them with knowledge of the facility and allows them to feel more involved in the process (personal communication, M. Santiago). To encourage more people to recycle, the facility currently provides the citizens with blue bags to collect their recyclables in and then separates them at the facility. However, Señora Maria Santiago said they

are trying to move to a system where people provide their own bins for collection. For more information, a full text of this conversation can be found in Appendix O.

Community Survey

In order to more fully assess the residents' opinions on the waste problem, we distributed a community-wide survey. Through the help of the CDIPC, we received 84 surveys accounting for 14 sectors. A few respondents either did not answer or selected "Decline to answer" for most questions. These answers were not included in our analysis of each question so that the total numbers of responses to most questions differs from 84, the total number of surveys we received. Analyzing this data without these answers allowed us to see a more precise representation of the community's responses. Refer to Appendix P for the raw data from this survey. The demographics of the survey respondents are as follows. We found that 55 out of 84 (65%) respondents lived in subsidized housing, and 29 out of 84 (35%) lived in the *barriadas*. This was close to the true population distribution of 67% in subsidized housing and 33% in *barriadas*. With regard to gender, 58 out of 82 (71%) respondents were female and 24 out of 82 (29%) were male. There were a disproportionately larger number of female respondents, so it is important to note this gender bias may affect our data. The age distribution included 39 respondents below the age of 50, and 43 above the age of 50. Lastly, 28 respondents were unemployed, 8 worked part-time, 17 worked full-time, 3 were students, 7 were retired, and 8 were disabled. We analyzed these employment statuses with respect to the type of household. We found a notable difference with those who work full-time and are unemployed (refer to figure 16). This led us to infer that there were a larger number of elderly residents in the *barriadas* who may be retired. Upon further analysis, we found that 68% of respondents in the *barriadas* were above the age of 50, compared to just 45% in the subsidized housing.

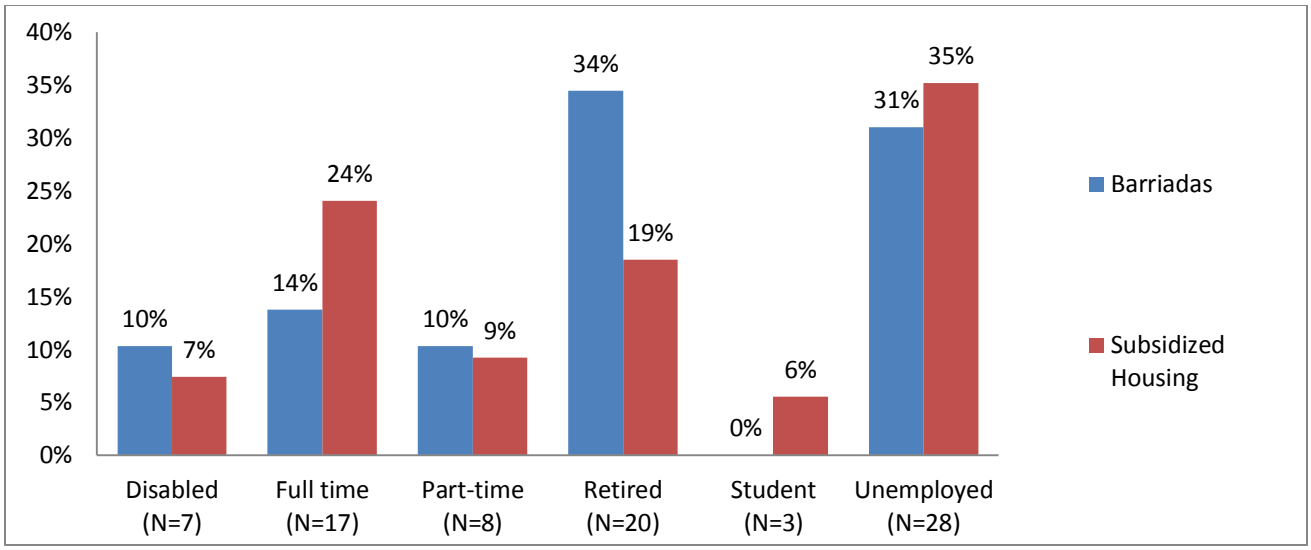

Figure 16: Number of respondents who reported type of employment based on household type

There were two main focuses on our analyses: comparisons based on age and type of household. The following two paragraphs focus on the comparisons based on type of household. During the trash bag audit survey, we assessed the residents' level of satisfaction with domestic waste disposal, large waste disposal in the community, and their specific waste disposal service. We wanted to further explore this in the general community survey. We found that 62 out of 80 (78%) respondents reported that their waste disposal service is effective or very effective. The distributions of responses amongst the *barriadas* and the subsidized housing were very similar, indicating unrecognizable differences in the quality of the waste disposal services from the respondents' point of view. About 65% of the respondents in the *barriadas* answered that they thought a collection facility would be very helpful, compared to 60% in the subsidized housing. Furthermore, roughly 27% of respondents in the subsidized housing and 23% in the *barriadas* stated that the facility would be helpful. A similar result was observed when the respondents were asked if they believed domestic waste was handled properly in Cantera. We found that 63 out of 73 (86%) respondents reported that they either agree or strongly agree. We also found that of the 10 respondents who reported that they either disagree or strongly disagree that domestic waste is handled properly, only one lived in the *barriadas.* There is a known problem with the collection service in the *barriadas* because of the narrow roads, so it is surprising to see such a small number of people who believe that there is a problem with the service. One possible explanation for this is that the respondents in the *barriadas* simply have no other standard to

compare against so they believe that their service is efficient. In contrast, the respondents in the subsidized housing have seen the benefits of their own more effective system and the problems of the *barriadas'* system. We additionally found that 19% of the respondents in the subsidized housing reported that they either disagree or strongly disagree, compared to just 4% in the *barriadas.* When asked if large waste was handled properly in Cantera, there was more indifference among respondents. We found that roughly 47% of respondents reported that they either agree or strongly agree large waste is effectively handled, roughly 42% responded that they either disagree or strongly disagree, and about 10% were neutral. These numbers indicate a belief amongst respondents that large waste collection is less effective than domestic waste collection. Despite this general ambivalence about this topic, there was again varying responses between the types of households. This can be seen in figure 17 below. About 63% of the respondents in the *barriadas* reported that they either agree or strongly agree that large waste is handled properly, compared to just 40% in the subsidized housing. In contrast, 47% of the respondents in the subsidized housing reported that they either disagree or strongly disagree that large waste is handled properly, compared to 33% in the *barriadas*. Many respondents in the *barriadas* have not identified a waste collection problem in their neighborhoods, despite known issues of overflowing dumpsters, and inaccessible collection points.

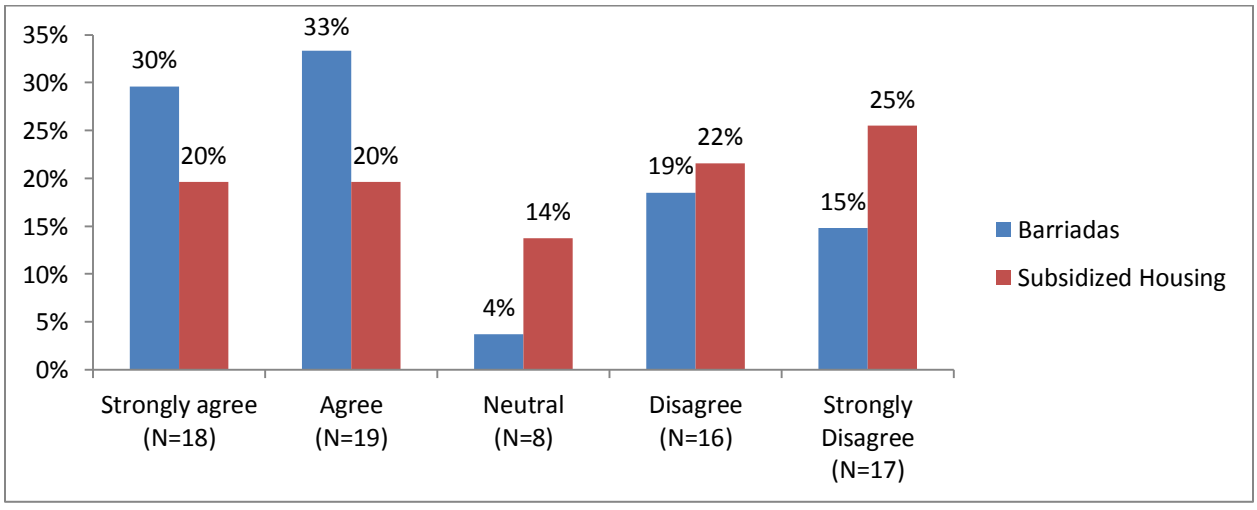

Figure 17: Number of respondents who reported satisfaction with large waste disposal by type of household type

Another piece of information we hoped to learn from the survey was the residents' level of interest in a potential waste collection facility. As seen in figure 18 below, the responses are

heavily skewed in the positive direction. Only one respondent answered that they were uninterested in the facility. It is also important to note that both the *barriadas* and subsidized housing expressed interest in this project. Furthermore, no respondents over the age of 50 reported that they were uninterested or very uninterested in the facility. Knowing that there is support among both types of housing and all age groups, we inferred that interest is not restricted to a single demographic. This supports our goal for a community driven and widely accepted initiative. To supplement this question, we asked the respondents if they thought the facility would be helpful. The answers were again overwhelmingly positive. We found that 71 out of 81 (88%) responded that the facility would be either helpful or very helpful, 50 of which responded very helpful. Only seven people responded that it would be either unhelpful or very unhelpful. Based on these responses, most of the community members are receptive to this idea, and aware of the positive impact it could bring. Even though interest and helpfulness are important pieces of information to gather data about, willingness to use the waste collection facility would ultimately determine the success of the facility. The results of this question showed 73 out of 76 (96%) respondents reported that they would be willing to use the facility. These data on willingness to use the waste collection facility is later revisited to project the estimated number of potential users (refer to section 4.3).

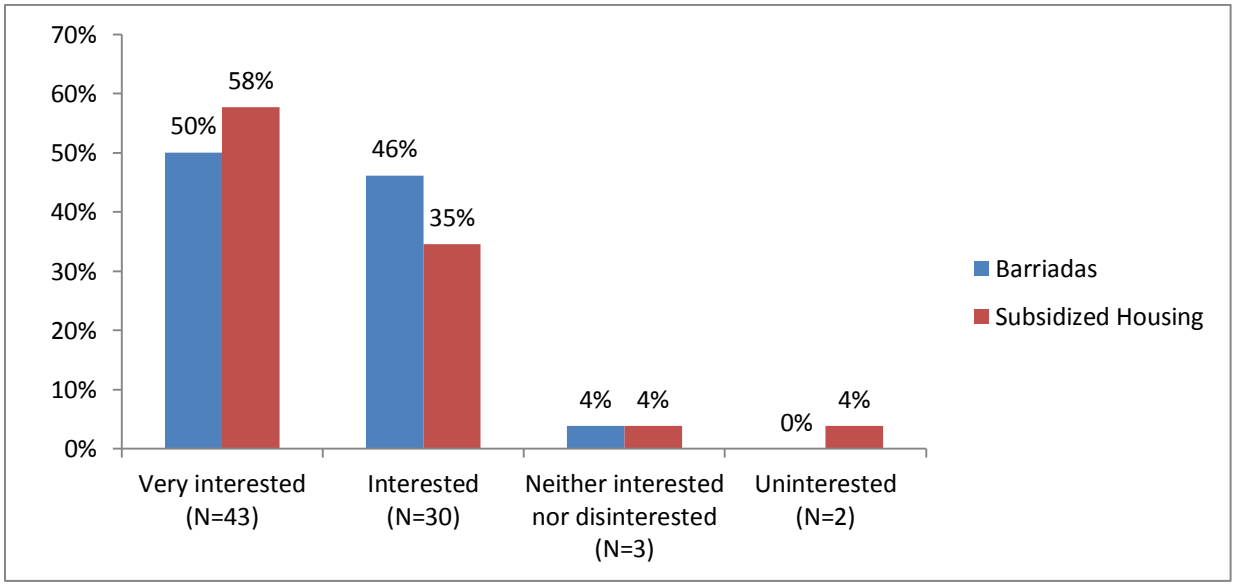

Figure 18: Number of respondents who reported interest in the waste collection facility by type of household

Our next focus was to analyze questions based on age. The following three paragraphs show these analyses. During our trash bag audit, we found that of the participants, 78% were not satisfied with the practice of open dumping in the community. We wanted to analyze this sentiment on a larger scale by asking the question again in the general community survey. We found that 75 of 81 (93%) respondents either agreed or strongly agreed that the practice of open dumping bothers them. This is an even higher number than received in the trash bag audit survey and further indicates the community may not be pleased with this waste disposal practice. We found an interesting pattern with respect to age. As seen in figure 19 below, the younger the age group that they are, the more likely they are to respond "Strongly Agree" to this question. This suggests that the older demographics are either more tolerant or uncertain about the practice of open dumping. Further supporting this, only those above the age of 50 responded that they either disagree or strongly disagree that this practice bothers them.

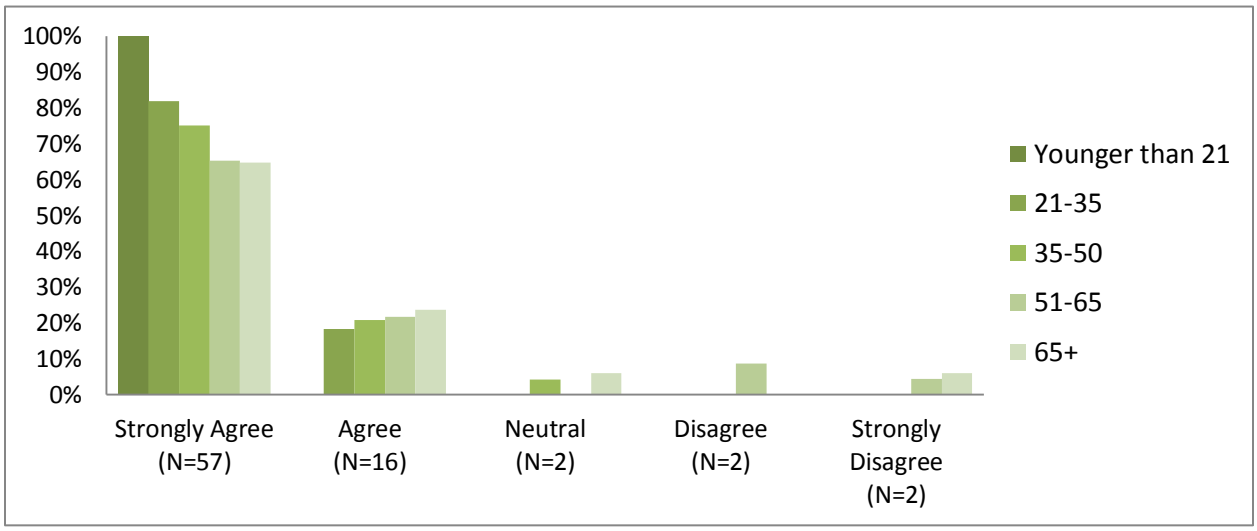

Figure 19: Percentage of respondents who report open dumping bothers them for each age group

We wanted to further assess the recycling practices and opinions of the residents. We found that 39 out of 82 (48%) respondents answered that they never recycle while only 8 out of 82 (10%) responded that they always recycle. Despite the high number of respondents who do not recycle, there was a high willingness to separate recyclables from domestic waste. We found that 68 out of 78 (87%) were willing to separate waste for recycling. Recyclables can be recovered and disposed of properly once they are separated from waste. The high willingness shown from the community indicates a receptiveness to participate in practices that could

improve the community's waste problem. An interesting finding was discovered when viewing this data by age. Roughly 60% of those who responded that they are not willing to recycle were below the age of 50, with 30% being in the 21-35 year old age group. This unwillingness to participate may indicate a knowledge gap among the younger demographic. Outreach programs focused toward this younger demographic would be helpful to reinforce the importance and benefits of recycling.

As part of our survey, we asked whether or not residents had access to the internet. In our community involvement plan, we wanted to assess the potential use of a Facebook page to advertise the waste collection facility. If a majority of respondents indicated they do have internet access, it may be feasible and effective to use this medium for advertisement. In total, 44 out of 82 (54%) reported that they do not have internet access and 38 out of 82 (46%) reported that they do. However, as seen in figure 20 below, 28 out of 39 (72%) respondents in the age group younger than 21 to 50 stated they have internet access. Conversely, 33 out of 43 (77%) respondents above the age of 51 stated they do not have internet access. There is a distinct shift in internet access around the age of 50. It is evident that the internet is a widely accessible amenity for the younger demographic. We believe creating a website for this demographic will not only be effective presently, but also for the increasingly tech-savvy generations.

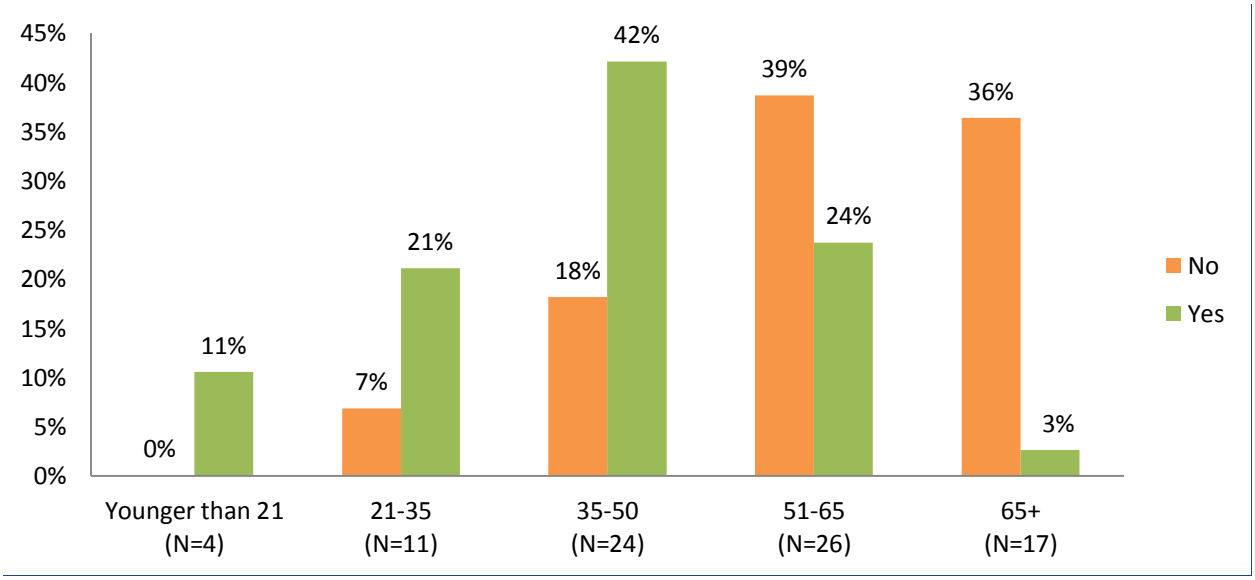

Figure 20: Number of respondents who report having internet access for each age category

Our final focus was to analyze the three open-ended questions from the survey. From our first open-ended question, 42 people out of the 84 people responded, and out of these 42 respondents, 21 people expressed positive notions concerning the potential establishment of a waste collection facility in their community. One respondent commented, "This is a perfect idea" while another one believes that the best option for Cantera is to simply clean up the community and try to maintain it. All of these written responses were translated from Spanish to English for interpretation purposes. Despite responses that expressed little to no worry, there were several concerns that were brought up by citizens. Some of these include vermin, poor management of the facility, non-adherence to regulations, and pollution. For example, one respondent was afraid that "if it is not watched over carefully it might become a landfill," while another respondent was afraid of vectors such as "rats, insects and bugs." It is important to note that this should not be a problem in our proposed facility because it will not handle domestic waste. Another concern that many people had was that the facility may potentially affect their lives negatively, with one respondent stating, "I am worried about the location and who is going to be in charge of the facility." These comments were taken into consideration while determining proper site and design options.

Our second open-ended response centered on determining what factors would make people more likely to use a waste collection facility in their community. Out of the 84 participants only 26 responded to this question. Of those that responded, some of the key factors to a waste collection facility they indicated were that it should be a large, clean, and organized facility that controls the presence of vermin and bugs and "complies with the regulations set forth by the EPA." Additionally, one respondent encouraged the development of a facility that would specifically focus on the disposal of "larger waste items so that people don't throw them away in the street." This comment regarding large waste items was taken into consideration when determining our design options for the proposed facility.

Finally, our last open-ended response was centered on any additional recommendations, concerns, or ideas that the respondents had regarding the facility. Several participants encouraged the need for community education through workshops and discussions that focused on proper disposal of waste. Additionally, some of the concerns that were expressed were properly controlling the facility so that it does not become a landfill and constructing the facility at a separate location in Condado or Miramar, two wealthier neighborhoods nearby. There was

also much confusion that seemed to be centered around the respondents' belief that this waste collection facility focuses on handling domestic waste, which will not to be the case for our facility. We want to ensure that from our community involvement plan, the citizens would be able to fully understand the scope and purpose of this facility. However, their concerns that were brought up from this question were taken into consideration while determining proper methods for the facility's tentative designs.

4.3 Site and Design Evaluation

Evaluation of Site

The first stage of our site evaluation process was to compare and evaluate the potential sites for a waste collection facility in the community. After communicating with local residents, community leaders, our liaison Señor Zapata, and representatives of other waste facilities we established seven possible locations for the waste collection facility (refer to the figure 11). We rated each of the sites based on five characteristics: proximity to residential areas, accessibility for users, size of the plot of land, flood potential, and accessibility to utilities. Tables 8 and 9 show these weights and the scores that we assigned to each site during the rating process.

Table 8: Raw siting score sheet for site evaluation

Raw Siting Score Sheet								
	Weight	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Extenuating Circumstances	-	Pass	Pass	Fail	Pass	Pass	Fail	Pass
Proximity	0.2	2	4	2	3	3	2	2
Accessibility	0.2	4	3	4	3	4	2	2
Size	0.2	3	4	4	4	4	2	2
Flood	0.2	3	4	4	4	3	1	1
Utilities	0.2	2	3	4	2	4	4	4

Table 9: Weighted siting score sheet

Weighted Siting Score Sheet							
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Proximity	0.40	0.80	0.40	0.60	0.60	0.40	0.40
Accessibility	0.80	0.60	0.80	0.60	0.80	0.40	0.40
Size	0.60	0.80	0.80	0.80	0.80	0.40	0.40
Flood	0.60	0.80	0.80	0.80	0.60	0.20	0.20
Utilities	0.40	0.60	0.80	0.40	0.80	0.80	0.80
Totals	2.80	3.60	3.60	3.20	3.60	2.20	2.20

In figure 21, the locations of the possible sites are shown on a flood risk map. Site 2 is not located in this flood risk map but we were able to determine that the site was at least seven meters above sea level. The individual assessments, location, and pictures for each site can be found in Appendix Q. This appendix includes pictures with an aerial view and projected size.

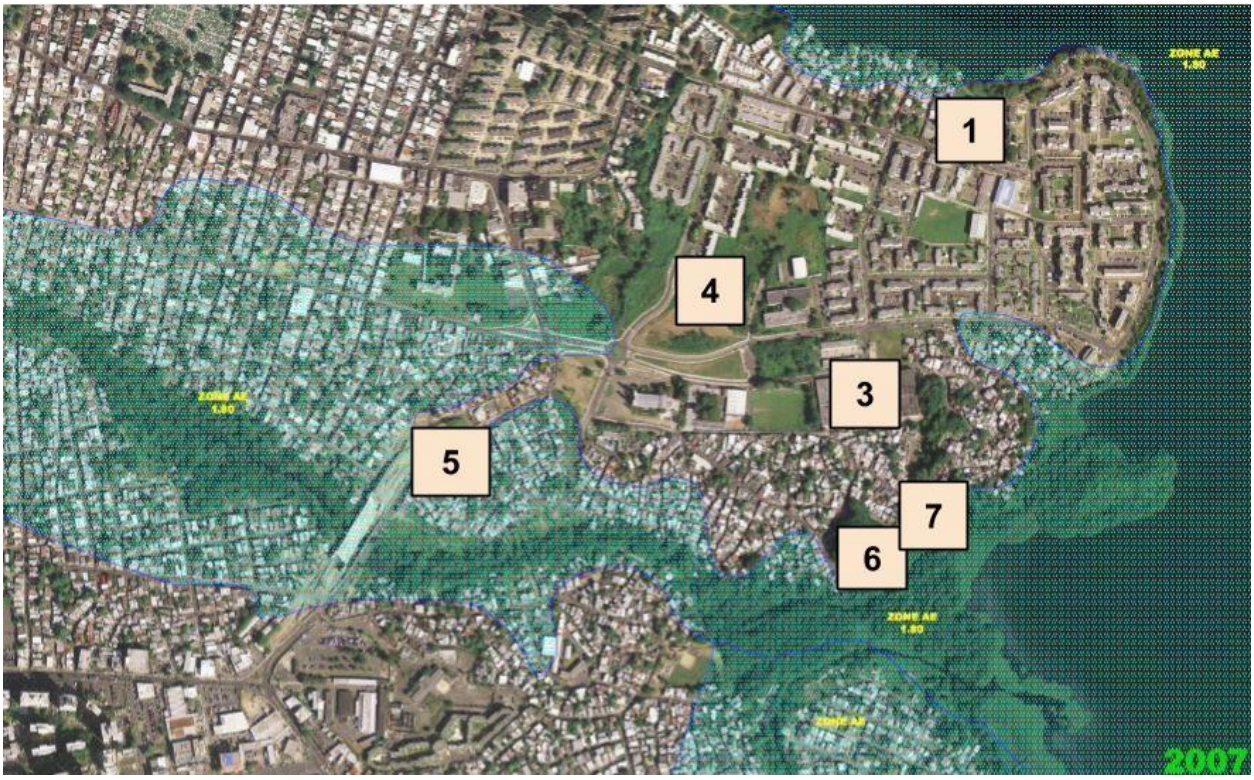

Figure 21: Flood risk map with the possible site locations (courtesy of the CDIPC)

Using these evaluations, Sites 2, 3, 4 and 5 received the highest scores as seen in table 9 above. Site 2 received this score because it is secluded from residential areas, easily accessible to

the community, well above the potential flood levels, and can easily attain the utilities that would be needed to operate the facility. Although Site 3 scored very high in our rating process, we determined that this was not a feasible site. Site 3 is currently made up of three vacant warehouses that are owned by Winer Properties, each of which is about 15,000 square meters, in size. This site received a failing grade as a result of an extenuating circumstance, immediately disqualifying it from consideration. Selecting this site would not be ideal because the three warehouses on this lot cannot be easily converted into a safe and functional waste collection facility. Site 5 is on a commercial street located off of a main road, making it easily accessible to both Cantera residents and outside communities. This site is also located in the southern part of the peninsula and is adjacent to the Martín Peña Channel. The Martín Peña Channel, being adjacent to this site, allows for more proper disposal of waste already present. The *barriadas* are located in the southern part of the peninsula and are a large source of improper waste management issues and major locations for illegal dumping. This site's nearby location could encourage more proper disposal practices for this area.

Site 4 was another high-rated site with a score of 3.2, and was the most favorable choice by Idalia Morales, the president of the Consejo Vecinal. We considered this to be a strong site because it is central to the community, allowing for easy access by all parts of the peninsula. The plot of land is also 5 acres and would easily allow for expansion if the operations needed to expand in capacity. This area is far from the flood zone as well. The most notable negative characteristic is a lack of all utilities. Currently, the only electrical line within the site's vicinity has only enough electricity to power the street lights around it.

The sites with the lowest scores from the site rankings were Sites 6 and 7. Both were deemed infeasible because they are located in the flood zone. In addition, both of these sites also have very poor accessibility for automobiles because the roads are far too narrow and can only fit one vehicle at a time. These two sites are also currently in residential areas but the CDIPC has plans to acquire and demolish many residential buildings within and surrounding the potential sites. Until this is done, the size of the land and disadvantageous locations make these sites infeasible for a waste collection facility.

Evaluation of Design Options

One important design aspect we wanted to address was the total expected users of the waste collection facility in the community of Cantera. In order to gauge this, we placed a question in the general community survey asking if the respondents would use the proposed waste collection facility if it is established and 73 out of 76 (96%) respondents answered that they would use this facility. For more information about the respondents' willingness to use this facility with respect to age, refer to the general community survey analysis section (section 4.2). From this result, it is evident that the community sees value in this facility and that they are willing to use it. To calculate the expected number of users, we multiplied this percentage of respondents that answered "Yes" by the estimated population of 10,000 people. From this calculation, we projected that this facility will serve approximately 9,600 citizens. During our interviews with other waste collection facilities, we referenced this calculation along with the expected daily waste generation from our trash bag audit. These numbers allowed us to compare site sizes, and for the interviewees to provide size suggestions. The final site size that was decided on was 4,000 square meters.

During our interview with the Municipal Government of San Juan and the ADS we discussed the issue of domestic waste in the community. They informed us that currently there is a sufficient system for collection of domestic waste. The problem occurs when large waste items accumulate in collection areas and prevent domestic waste collection from taking place. From this feedback, we concluded that our facility should focus its efforts on large-scale waste rather than domestic waste. In order to address the open dumping of domestic waste in the community, it was suggested by the ADS and the municipal government that there should be an increase in the number of community bins in easily accessible locations around the community because the bins that are currently available have insufficient space for the residents' domestic wastes. This would allow the municipality's collection trucks to collect more trash per instance than they are currently in Cantera. By having a centralized facility in the community that stores large waste, the municipal government believes that this will make it easier for its collection and alleviate some of the open dumping that occurs throughout the community. In addition, the municipal government also believes that with a centralized location for the community of large items, the community bins will not be filled with these items anymore, allowing more room for domestic waste.

From our background research and our visits to the other facilities, we developed a tentative diagram for the proposed facility with the assistance of Señor Alfredo Perez-Zapata. From our background research (refer to 2.3.2), we determined that there should be a steady flow of traffic around the facility to help ensure both safety and efficiency as seen in figure 22. There is a two-way street, as shown in the upper-right hand corner of this figure, where cars can enter and exit the property. There were a number of features of a waste collection facility that we incorporated into this diagram. Such features include the facility itself, containers for large waste, recyclables, and domestic waste, an office, a parking lot, and extra space. Since our facility is focusing on collection of large waste items, there will be only one container for domestic waste in case it is brought by a customer that is unaware of the facility's main purpose. These features were partially determined from our background knowledge of components of waste collection facility. We combined this knowledge with insights from the facilities that we visited to create a diagram of what the property would contain.

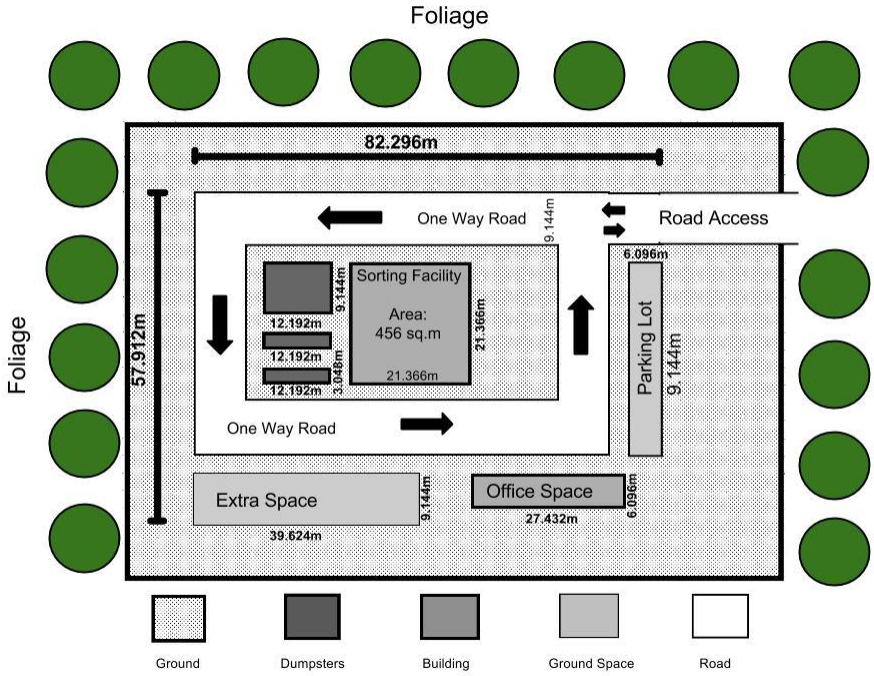

Figure 22: Tentative diagram for the proposed Cantera waste collection facility

We also compiled a series of design recommendations based on our background research from section 2.3.2 and interviews with the ADS, Municipal Government of San Juan, San Juan waste transfer station and the Cidra recycling center. From our case studies on waste collection

facilities that earned the Solid Waste Authority of North America's Waste Collection Facility of the Year awards, we determined that incorporating concrete floors into the design would reduce the presence of vermin and ease vehicle maneuverability. Additionally, these award-winning facilities often use foliage in order to alleviate any possible odors and noise that may arise. Foliage would provide the facility with seclusion from the community, making the facility appear less obtrusive. The use of Caribbean pine trees to reduce noise is a common practice used in Puerto Rico (personal communication, A. Perez-Zapata).It was suggested by each waste collection facility that the operations should remain enclosed within a building with a roof, walls, and wide doors for easy access and ventilation. The walls and roof of the facility would help protect and prevent further damage to the stored waste from inclement weather conditions, such as hurricanes or rain storms. For the formal set of design recommendations, refer to section 5.2.

4.4 Community Involvement Plan

In this section, we explored a number of different ways to promote community involvement. To do so, we sought information through interviews and background research regarding operational strategies, community outreach, and education. The final suggestions for each of these components can be found in section 5.3 of the recommendations.

Operational Strategies

The first component we assessed for our operational strategies was potential employment opportunities for community members. We spoke with the RDN and other waste collection facilities about their employment practices, and specifically about the level of success they have experienced in the past when employing members of the local community. We found that they both sought to hire from within their community, and have seen an increase in usage by doing so. Señora Maria Santiago of the waste collection facility reasoned that workers from your own community raise support and awareness of the operations, leading to higher usage. Aside from basic employment, it was suggested by Señora Maria Santiago of the Cidra recovery facility and Señor Rubén González of the RDN that there should be a service to assist community members with transportation of large waste items. This could be another potential role for a community member to undertake through voluntary efforts. We also assessed the possibility of incorporating

the informal sector in the facility, but we found that this was infeasible. Through communication with the CDIPC and answers from our open response questions in our surveys, this group was reportedly unreliable, disorganized, and unsympathetic to the idea of proper waste disposal practices. One survey respondent stated that "they are irresponsible. They throw [waste] away in areas close to the canal and into the municipal containers of the Margaritas."

The next operational strategy we wanted to address was incentive strategies to motivate community members to use the waste collection facility. Studies on waste management incentive programs have shown that the most effective and fair financial technique to stimulate use in a waste collection facility is a "pay-as-you-throw" cost structure (Batllevell, 2008). What this entails is that a customer only pays for the waste they bring to the facility, as opposed to a cost structure in which everyone in the community is charged a flat yearly or monthly cost, regardless of facility use. The "pay-as-you-throw" technique is fairer and has been shown to reduce waste disposal into landfills by up to 50 percent and to improve recycling rates by up to 40 percent (EPA, 2001). During our communications with the Consejo Vecinal, we learned about another incentive strategy. In past years, there was a competition in the community of Cantera to see which local residents could recover and dispose of the most illegally-dumped waste. The winner of this competition received a high-value prize for their efforts. This program was successful because a large amount of waste was removed and a lot of community members participated. Knowing that this program motivated the community, we recommended the reestablishment of this initiative, but this time have it directed towards large waste items and recyclables that can be brought to the collection facility. This competition would be similar in structure, where citizens of Cantera bring in as many large waste items and recyclables as they can within a specific time period. The winner would receive either free access for an extended period of time, or a high-value prize such as a television. This initiative could provide monetary benefit for some community members, environmental benefit, as well as exposure for the collection facility. One final incentive strategy we devised was reducing the cost of using the facility for the citizens of Cantera. This, however, would only be feasible if the operations expanded to serve other outside communities.

Another operational strategy that we took into consideration was a potential business cooperative between our waste collection facility, Reciclaje del Norte, and the Municipal Government of San Juan. The results of our trash bag audit revealed that a third of the waste

generated by the participants is recyclable materials. With this information, we believed that there could be an opportunity for a business cooperative between our facility and the RDN. In a follow-up interview, we discussed the possibility of a future cooperative with Señor Rubén González. After we presented our concepts about the design options for the proposed facility, he provided us with additional insight as to how the RDN and our facility could work with one another. One of the major points that was discussed was that there would be little to no cost to the collection facility to properly dispose of paper, cardboard, newspaper and plastics by giving them to the RDN. The RDN's rates for recyclable materials are $50 per ton of cardboard and paper, and $45 per ton for newspapers. Unfortunately, the RDN does not pay its customers for plastics unless they are of industrial grade. Additionally, the RDN has different procedures when dealing with items such as domestic waste, construction debris, vegetation, and metals. For these materials, one has to rent a dumpster for $200 per month, pay $130 for pickup and transportation, and pay a fee for proper disposal that varies with the materials. When dealing with metallic waste, the RDN provides customers with appropriate dumpsters and transportation and then sells these metals to outside contractors. The RDN then returns a portion of the profit back to the customer, but keeps the remainder as a service fee.

In our discussion, Señor Rubén González expressed high interest in having a stake in the project in the future to help alleviate Cantera's waste problem. Señor Rubén González said that collaboration with the RDN could aid our facility by providing equipment and discounted services. Additionally, he said the RDN would be willing to provide support through the facility's initial startup by discussing how to maintain proper management and effective economic strategies for self-sustainability. Upon the facility's completion, Señor Rubén González would like to further discuss these opportunities through a formal business proposal.

Community Outreach

We wanted to create a way to raise awareness of the facility in the community of Cantera if it is established and to provide the opportunity for education on the facility, proper disposal habits, their benefits and the harmful effects of improper disposal habits. Since our education plan is directed more at children, we wanted this outreach to be more for the adult demographic. It is important to reach out to all parts of the community to ensure educational opportunities among several age groups. In order to provide a continuous source of information we decided

that a Facebook page could be an appropriate and effective option. With millions of Facebook users, many businesses have begun to use this social media outlet as a method for marketing their products and services. Through Facebook, businesses have been able to increase their number of customers and sales by simply creating a new avenue for continuous advertisement (Kuhikar, 2013). In many developing countries, Facebook is currently being used as a means of sharing information and marketing. As of 2012, there were 1.8 million Facebook users in Puerto Rico, which accounts for roughly 57 percent of the population. This number increased seven percent from the previous year (Kantrow, 2013). Facebook has a number of useful features to analyze viewership and post reach. The "Insights" feature allows the user to see statistics on the number of people who read the material the user posts, the number of likes the user gets on their page, demographics about the viewers of the page such as age and gender, and other information that could help a user gain knowledge of their client base.

The CDIPC currently has a Facebook page that they continuously update as seen in figure 23, so they are familiar with this interface. They could use this website as a place for consumers to find information about the facility and updates on any upcoming events. The CDIPC's Facebook page is set up as a personal account, not as a fan page, so it does not have the insights feature. The CDIPC can create a fan page for the collection facility linked to their current Facebook page to access these insight features.

Figure 23: A screenshot of the CDIPC's Facebook page

As a supplement to the long-term outreach plan, we wanted to provide the CDIPC with ideas for events that would increase community involvement and participation. Such events would be held to promote awareness of the facility. Through our background research on community involvement in waste collection facilities, we found that hosting festivities periodically throughout the year could be an effective way to positively publicize the facility (EPA, 2002). Currently, there are over 50 environmental holidays recognized globally. Some of the most familiar days are Earth Day, Arbor Day, Clean Up the World Weekend, America Recycles Day, World Environment Day, World Habitat Day, and United States National Green Week. Having the new facility host festivities that are associated around these "green holidays" multiple times a year could effectively reinforce both the importance of the waste collection facilities and environmental awareness within a community (Department of the Environment of Australia, 2014).

Another outreach option we learned about arose during our background research. Multiple case studies have shown a lack of knowledge from local residents regarding the operations of similar facilities when they initially open. This often leads to misconceptions, mistrust, and negative sentiments about the facility (EPA, 2002). Tours are often used since they give a kinesthetic and visual educational experience to the citizens of a community. The EPA (2002) recommends these tours be held frequently in the opening phases and available at the citizens' request from thereafter. This outreach option was further reinforced during our interview with Señora Maria Santiago when we asked her about effective community outreach methods at her facility. She informed us that tours have been an effective way to inform citizens and children about the purpose and operations of the Cidra facility. Currently, the Cidra facility still uses these tours as one of their key outreach plans as it continues to help inform and attract local customers.

To provide short-term awareness and education, we assessed a variety of potential outreach techniques. The community of Cantera is densely packed, with a population of roughly 10,000 people in an area of about 1.2 square miles, equating to a population density of about 8,300 people per square mile. In comparison, the municipality of San Juan has a population density of about 3,500 people (refer to Appendix A). With this many people in such a small area, it is practical to use a visual medium that can be distributed quickly across an area, and that would present messages or information about the facility. From outside research, we found that

posters could be effective in Cantera, because they are easily viewed in high-density areas, capable of being displayed anywhere, cheap, and can physically remain in the community for an extended amount of time (Kansas University, 2014). We found that an effective poster should include large colorful images and brief text to draw the attention of the viewer. We learned that using the colors red, orange and yellow with a dark-colored font may attract the most attention to posters, so we chose the color red for our design, as can be seen below in figure 22. It is also important to use dark text with a lighter background to accentuate the message the poster is intended to send (Colorado State University, 2010). It was recommended to us by the social workers at the CDIPC that we maintain a positive tone that promotes community respect. Based in this information, we created a preliminary poster for distribution in the community (refer to Appendix T). Important information that we recommend the CDIPC edits and includes on this poster is the address, hours, phone number, and the Facebook page link for the facility. Aside from placing posters in dense areas throughout the community, we recorded the sites where open dumping in Cantera frequently occurs in our field observations. Using this information, we suggest that the CDIPC hang the posters at these locations so that they can best reach out to the community and encourage use of the facility.

In the community, there are many social institutions such as churches, schools, and community organizations. For example, in the immediate vicinity of the CDIPC, there are nine schools, ten community organizations, and three major churches (refer to Appendix U). These institutions have worked closely with the CDIPC in the past and could be valuable assets for the distribution of information following the opening of the waste collection facility. This led us to choose a brochure as the next means for community outreach. A brochure can explain an organization's purpose, answer frequently asked questions, offer how-to instructions, explain how to learn more, and educate the reader in a more in-depth way than mediums such as posters, billboards, or advertisements (Kansas University, 2014). From outside research, we found that it is important to follow a theme with a brochure (University of Nebraska, 2011). For our purposes, we established an environmentally-focused theme with green coloring, plant-like features and pictures that supplement this theme in order to emphasize the benefits the waste collection facility could have on the environment, as can be seen in figure 24. During the design of the brochure, it is important to address the questions of "who, what, when, where, why, and how". In this brochure, we addressed the "who" as the community of Cantera, the "what" as the waste

collection facility, the “when” as the times the facility will be open, the "where” as the location that we selected for the facility, the “why” as the benefits the user will gain from using the facility, and the “how” as the proper methods to effectively use the facility correctly. It is also important to include small blocks of text, often bulleted, to maintain the attention of the reader (University of Nebraska, 2011). We considered this when determining what textual content to include in the brochure. Similar to the poster, the hours of operation, location, and the Facebook page should be edited and included in the brochure if the facility is established and these parameters are determined (refer to Appendix S).

Figure 24: Smaller-sized images of the poster (left) and front page of the brochure (right) for the community outreach plan. Refer to appendices T and S for the complete and full-sized images.

Community Education

The last piece of the community involvement plan was the creation of a one-hour lesson plan for children of Cantera that is focused on proper waste disposal techniques and environmental awareness (refer to Appendix V). As stated in the methodology, there is empirical data that suggests educational exposure to elementary-aged children influences the actions of their household (Hiramatsu, 2014). This lesson plan includes a presentation, a coloring activity, a word search, a physical activity, an open discussion, and a letter to bring home to parents. We plan for these components of the lesson to take place in this order, and expect that the entire lesson can be completed in the one-hour period. One of the most effective ways to educate

elementary-aged children is “hands-on” visual and kinesthetic learning (Concordia University, 2012). A hands-on activity is one where the student is guided through the activity by an instructor and receives beneficial feedback and aid throughout the exercise. This led us to the creation of an interactive storybook presentation. The presentation follows a story of “Martín the crab” and “Peña the dog”, two cartoon characters in the community of Cantera. The two characters travel through the community and learn about the harm of improper waste disposal, what constitutes a waste item, and how to dispose of it appropriately. This is done in a fun, interactive way to ensure that the students are engaged.

In contrast, another effective learning strategy for elementary-aged children is a “hands-off” approach, where the student completes an activity without the help of the instructor. Despite the importance of hands-on learning activities, children need time to work independently on an activity to critically think on their own (Concordia University, 2012). This led us to the next part of the lesson plan, the coloring sheets and word search. During our meeting with the social workers at the CDIPC, it was recommended that we include drawing and word activities to encourage individual thinking and work. Refer to Appendix R for a full transcript of our meeting with the social workers. The EPA provides a number of free learning materials to encourage proper waste disposal practices. We incorporated one of their drawing activities into our lesson plan. Additionally, we included a series of “color-by-number” drawings with an environmental theme, to encourage environmentally-friendly behavior.

A final effective technique for teaching elementary-aged children is a collaborative exercise or game. These kinds of activities promote problem solving, communication skills, and interactive learning (Concordia University, 2012). For this activity, we again referred to educational material developed and provided by the EPA. The game involves gathering a large pile of different common waste items and encouraging the students to work together to properly organize them and dispose of them. The culmination of this lesson plan is an open discussion with the students to let them talk about what they learned and ask any questions that they may have. After this, they will be sent home with a letter to their parents, the brochure from the outreach sections, and instructions for a poster contest. This contest involves students creating posters promoting positive waste disposal habits. These posters will be published in full-size copies and hung up around the community. The poster contest is meant to serve as an activity that children will do with their parents at home to help spread awareness of the waste problem.

As Hiramatsu (2014) stated, there is a spillover effect of environmental awareness on families when you educate elementary-aged children. This poster contest could be used to expedite that process. For the full lesson plan, refer to Appendix V.

Chapter 5: Recommendations and Conclusion

The goal of this project was to assist the CDIPC with assessing the potential of a waste collection facility in Cantera in order to alleviate the environmental and social stress related to open dumping. Our conclusion is that a waste collection facility is a feasible option for Cantera as it may provide critical relief to the severe open dumping crisis in the community. We determined that there are many areas in the community that could be used for this facility, a number of interested agencies, and supportive community members. Our survey results suggest that a majority of people would be willing to both use the facility if established and separate their recyclables if need be.

A waste collection facility can be very beneficial to Cantera because it would provide the local residents with a central location to properly dispose of their large waste items and recyclables, improving the municipality's waste collection system. This facility could be a vital piece in cleaning up the community and alleviating its drastic waste problem. With this facility, projects to clean the Martin Peña Channel or create a bio-tourism area in Cantera can begin to flourish. This can lead to higher economic activity, attraction of new businesses, and more employment opportunities within the community. Most importantly, however, this facility could change the culture that has persisted for decades, and promote a more positive future for the community of Cantera.

However, it is of the utmost importance that this facility is properly managed and adheres to environmental and governmental regulations. An improperly managed site could potentially lead to waste problems that are just as bad, if not worse, than the community's current state. Precautionary measures need to be taken to reduce the effects of pollution, noise, odor, and vermin. If not, this project can ultimately result in a failure, which could become dangerous to both the community's health and environment, and the relationship that the CDIPC has with the community. If these measures are not properly executed, the community could be displeased with the establishment of the facility, and may be less apt to use it. To prevent these circumstances from occurring, it is important to incorporate the local residents in this part of the process, and address their concerns appropriately.

Despite our conclusion that the establishment of this facility is a feasible option, there are still many tasks that the CDIPC must work with the community to accomplish prior to the

facility's construction. These can be organized into three main categories: site and design selection, collaboration with pre-existing waste management agencies, and community involvement. The most important of these is community involvement. It is imperative that the CDIPC consults with local residents throughout this decision-making process because the success of this project is heavily dependent on their participation, as they will be the users and supporters of the facility. This chapter will present our recommendations to the CDIPC on how to effectively establish this station with considerations to site, design, operations, and community involvement.

5.1 Siting and Design of the Waste Collection Facility

We recommend that the CDIPC establishes a waste collection facility in Cantera that can handle both recyclables and large scale waste.

With input from the Municipal Government of San Juan and the Autoridad de Desperdicios Sólidos, we determined that the construction of a waste collection facility that would primarily collect large waste items and recyclables would be the CDIPC's most feasible option in trying to solve Cantera's waste problem. The general community survey results indicated that residents believed domestic waste was handled properly, but large waste was not. By primarily handling recyclables and large waste, it would be easier for the CDIPC to obtain the necessary permits. Furthermore, our general community survey showed us that a majority of the community believes a waste collection facility would be useful in the community of Cantera. Respondents also reported high willingness to use the facility. Additionally, if domestic waste is not included, problems with odors and vermin would be minimized, leading to a much cleaner facility. We recommend that this facility does not primarily handle domestic waste because there is currently a collection system in place to handle this waste. Below, we provide recommendations on how to improve that system, which is already overburdened.

We recommend sites 2, 4 or 5 from our site assessment to be considered as potential locations for the waste collection facility.

From the results of our site assessment, we concluded that three of the seven potential sites should be given further consideration. We think that site 2 qualifies as a strong candidate

for the facility, but through further consultation with the Consejo Vecinal, it was revealed that some community members believe that it could serve a better purpose. Some of these members have been advocating to the mayor of the municipality for the establishment of a small shopping center in this area. If the CDIPC decides to consider this site for the facility, it is important to take this alternative purpose into consideration.

Site 4 was another strong candidate that, despite having a lower score than sites 2 and 5, was a more appealing location to the Consejo Vecinal for a waste collection facility. They preferred this location for its seclusion from nearby residents and centrality to the community. This site would be easily accessible to both the public housing and *barriadas,* allowing for a more widespread use and a higher level of acceptance since its centralized location would not favor one group over another. However, this site currently lacks access to sewerage and water, which should be further analyzed by professional consultants to address these faults. This site has partial access to electricity, but it may not be sufficient since the power lines only carry enough electricity to power the nearby street lamps.

Site 5 was another strong candidate for consideration. However, some issues that may require further attention are that the site borders the flood zone and has uneven terrain. Despite the fact that the site is on the border of the flood zone it is not expected to experience damaging floods. In order to address the uneven terrain, the land may need to be filled in prior to the construction of the facility. The Consejo Vecinal felt that because the site is on a commercial strip, it has potential for the construction of other businesses.

We recommend that the CDIPC consult and communicate with the community throughout the site evaluation and establishment process to ensure public support.

In order to implement a facility that can suit the needs of the community, it is important to address any concerns that the public may have regarding the site evaluation and establishment processes. From our background research, we determined that a bottom-up approach to community outreach projects results in higher acceptance and success of the project. A bottom-up approach is a practice in which the community is informed and involved throughout the decision-making process. Using this practice creates trust between the community and the overseeing agency. This led us to create a set of suggestions for the CDIPC to follow prior to establishment of the facility and once the facility is established.

Approaches to employ prior to and during facility construction

- Further communicate with residents about the project itself. This can be done through public meetings, interviews with local media, press releases, advertisements, internet sites, community committees, educational modules, and presentations to environmental, religious, and other civic groups.
- Engage in extensive outreach to the community to communicate the benefits of the project. It is imperative that the community have a sufficient understanding, so they can give informed opinions on the matter. This can be done by:
    - Working with community leaders, such as the Consejo Vecinal, to ensure each sector is knowledgeable about the project. Teaching these leaders about the project creates a line of trust between the CDIPC and the community.
    - Ensuring the community understands the functions of such a facility by bringing in expert speakers who can discuss or address their concerns regarding the project, such as Maria Santiago from the Cidra transfer station.
- Gather feedback from the community regarding their interest and concerns in the project. The success of the project hinges on the opinions of the community. Taking the citizens' concerns into consideration through public forums is an effective tool to accomplish this.
- Involve the community in the site assessment process. This facility will be built in the community of Cantera, which means the final site will be in one of the 16 sectors. By involving community members from each sector, their opinions will be taken into consideration for the final site. It is important that the citizens who live in the sectors with proposed sites attend the meetings where a final site decision is made.
- Establish a monthly meeting that the community can rely on and attend to learn about the project's developments and provide feedback. It is important that these meeting times be flexible to ensure a group that represents the whole community can attend. It is also important to leave open the possibility of more meetings at the request of the community.
- Encourage community members to visit other waste collection facilities or similar facilities to learn about operations and procedures.

Approaches to employ after the facility is functioning

- Establish workshops that could inform the public about proper recycling practices and the harmful consequences of improper disposal.
- Hold regular community meetings where the ongoing developments of the project can be discussed between the residents and the facility's managers.
- Coordinate with community organizations and leaders to update the neighborhoods with the project's developments
- Implement our community involvement plan in Cantera. This plan will be further discussed in section 5.3, and includes:
    - Advertising for community meetings, workshops, and events through a Facebook page that we recommend the CDIPC create if the facility is established
    - Distributing informative brochures and posters throughout the community
    - Educating elementary-aged children in the community by using our 1-hour lesson plan

We recommend incorporating design options that will reduce odor, noise, vermin, and other nuisances to the community.

Based on our background research and interviews with other waste facilities, we recommend the consideration of many characteristics in designing this facility so it can operate safely and effectively. These include:

- an enclosed facility with walls and a roof
- concrete floors
- foliage surrounding the facility
- a leachate catcher
- a facility of roughly 4,000 square meters

Professional engineering consultants should further analyze our suggestions about the design plans listed above. Furthermore, these consultants should consider any further ideas, such as the materials needed for construction and further design plans that would ensure environmental compliance with the regulations set forth by the Environmental Quality Board. We left a tentative diagram for the CDIPC to follow that outlined important features of the facility such as a one way traffic route, containers for each category of waste, office space, and

extra space.

5.2 Collaboration with Pre-existing Waste Management Agencies

We recommend that more collection bins be placed throughout the community, specifically in areas of high-density waste deposits.

Despite frequent occurrences of overflowing waste collection bins, we found from our trash bag audit that Cantera seems to generate less waste per capita than the average of Puerto Rico. From our interview with the Municipal Government and the Autoridad de Desperdicios Sólidos, we determined that a potential solution to these overflowing bins and subsequent open dumping of domestic waste is to increase the number of community bins and place them in locations that are more accessible by the municipal collection vehicles and the residents. These two government agencies believe that by incorporating this solution into the community, it will help alleviate open dumping as well as make it easier for domestic waste pickup by the municipal collection vehicles. During our field observation, we identified areas of the community that had large deposits of waste. These were mostly along the shoreline and in the *barriadas* (refer to figure 11). Bins should be placed in these problem areas to provide a place for community members to properly dispose of their waste. We further suggest distributing these bins by sector. In doing so, the generation of waste in each sector's bins can be assessed, and more can be added accordingly. The CDIPC should continue to work with the municipal government in order to coordinate the placement of these community bins.

We recommend that the CDIPC continue to consult the Reciclaje del Norte about potential collaboration on the project.

Through our trash bag audit, we found that the community of Cantera produces a large amount of recyclables, which we recommend that the proposed facility accept. We suggest the CDIPC continue to consult the RDN on opportunities for collaboration. The recyclables brought in could be sold to the RDN to generate some revenue for the facility. Señor Rubén González expressed great interest in the project and would be willing to help guide and support the establishment of the waste collection facility. In the future, when there is a more in-depth analysis of the facility from professional consultation, Señor Rubén González would like to further discuss the details regarding equipment and services through a formal business proposal.

The CDIPC should continue to consult with Señor Rubén González during the development of the collection facility because of his experience and his potential role in a cooperative with this community effort.

5.3 Community Involvement Plan

We recommend that elementary-aged children be the primary focus of the environmental awareness lesson plan that we designed to be implemented as a learning tool for local children.

Through background research, materials gained through the EPA, and discussions with the CDIPC's social workers, we developed an educational model for elementary-aged children in the community of Cantera. In our research, we found that the education of children in a community is most effective because their knowledge has a "spill-over" effect on their families, meaning their families become more aware and educated on what the children learned (Hiramatsu, 2013). We were encouraged to make our plan interactive and visual so we included a storybook presentation, a coloring activity, a word search, a physical activity, a discussion, and a take-home poster contest. All of these activities are structured to educate the children on awareness for their environment in an enjoyable setting. We recommend that the educational plan be reviewed and critiqued by professionals before being implemented in local schools.

We recommend the distribution of informational brochures and posters throughout the community once the facility is established, as well as the establishment of a Facebook page for the facility

We determined through discussions with the social workers that distributing brochures and strategically placed posters would be an effective short-term way to reduce open dumping in the community. We created tentative designs for these posters and brochures that the CDIPC can edit and use upon completion of the waste collection facility. To effectively advertise the waste collection facility, we recommend that upon its completion the CDIPC use our brochure and distribute them to local businesses, churches, and schools. It was suggested that posters should be placed near common open dumping areas so that people can become aware of waste disposal alternatives, as well as throughout the community to publicize the facility. We suggest that the

distribution of these posters be integrated with the poster contest that is completed by the students who participate in our educational lesson plan. By using both the students' posters in addition to the one that we created for the CDIPC, we will be able to establish a sense of community that our professional posters alone cannot do.

We also identified an effective long-term way of reaching out to the community. From our general community survey, we found about half the community has access to internet. However, there was elevated usage among those younger than the age of 50. This led us to conclude that the creation of a Facebook page might be an effective tool to inform the community about the waste collection facility. There was increased usage of the internet as the age group decreased, so we believe this could be a tool that could increase in effectiveness over time.

We recommend that the CDIPC establish incentive programs and outreach initiatives, using our ideas as a guideline.

With help from our discussions with Maria Santiago, the social workers of the CDIPC and our background research, we devised several incentive and outreach programs for the completed facility. We recommend that the CDIPC complete the design and implementation of these programs once the facility is completed.

Some incentive programs include:

- A "pay-as-you-throw" cost structure so that one will only have to pay for the amount of items that they bring during each visit to the facility. The exact cost structure would have to be determined after complete operational costs for the facility are known.
- A program in which residents can compete against one another to collect the greatest amount of trash in a given area. The winner can be rewarded with either discounted trash services or a prize.
- Provide subsidized costs for members of the community while charging people from other communities full price to drop off waste items and recyclables.

Some outreach initiatives include:

- An opening day celebration for the community that includes a ribbon-cutting ceremony, food and refreshments, a speech by a popular public figure, a brief

tour, and live music.

- A celebration on both Earth Day and America Recycles Day which could include community workshops, guest speakers, live music, raffles, competitions, and trash art showcases. Trash art is made from a collection of waste items that have been turned into sculptures or designs.
- Tours of the facility, which should be provided most frequently when first opened and offered regularly afterwards. They would be preceded by a brief video we recommend the CDIPC create and end with an open discussion.

5.4 Conclusion

The capstone of this project was to hold a town meeting to deliver our final presentation to the community. There was positive social interest in the possible establishment of the waste collection facility, which indicates that the facility might be feasible not only in a practical sense, but also in terms of the probability of acceptance. By having the CDIPC follow the aforementioned recommendations, the community can greatly benefit from this facility. Some of these recommendations require further consultation with experts. However, our project represents an important first step that the CDIPC can readily use in their continued pursuit of establishing a waste collection facility in Cantera.

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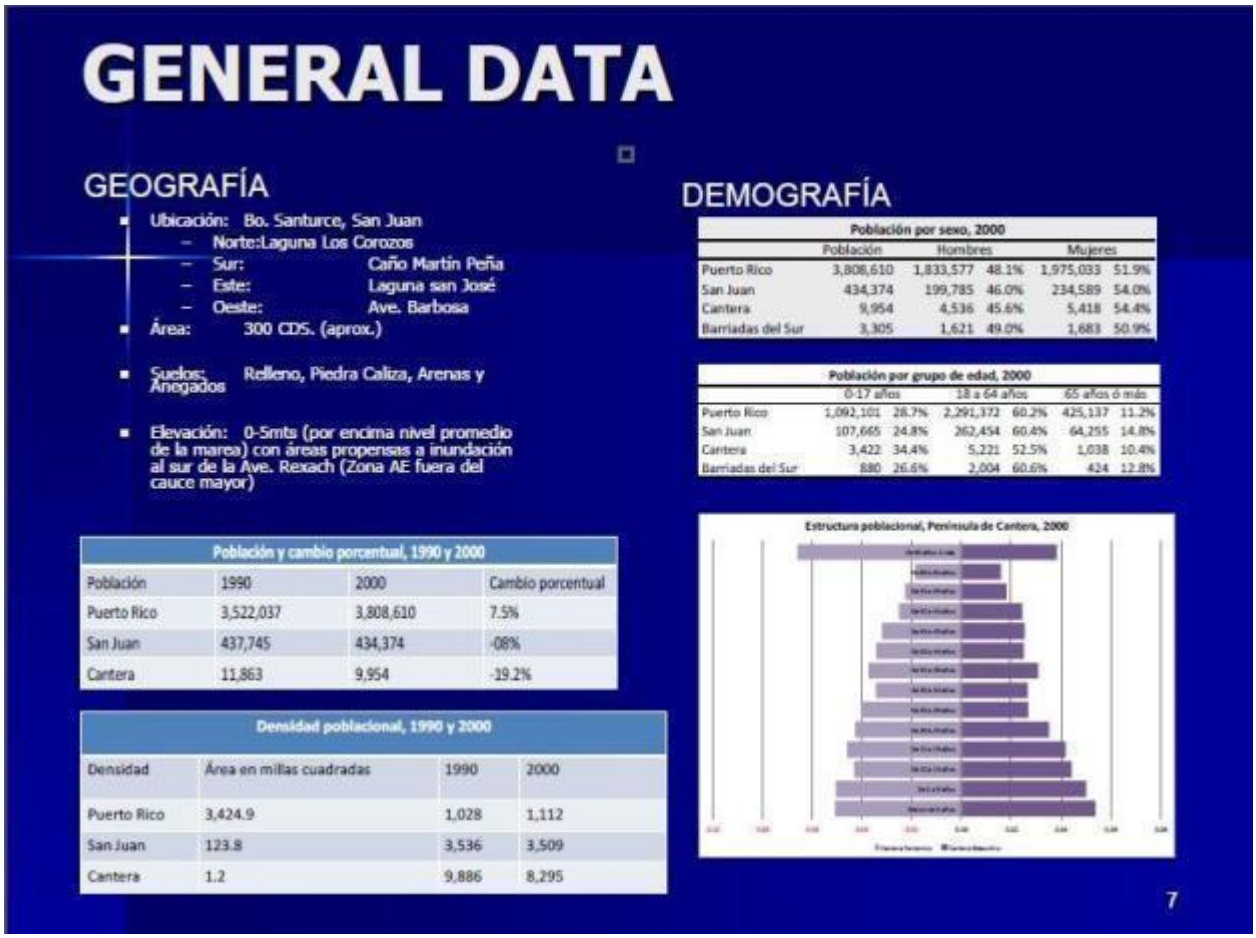
Appendix A: General Geographic and Demographic Data for the Neighborhood of Cantera (CDIPC, personal communication)



GENERAL DATA

GEOGRAFÍA

- Ubicación: Bo. Santurce, San Juan
  - Norte: Laguna Los Corozos
  - Sur: Caño Martín Peña
  - Este: Laguna san José
  - Oeste: Ave. Barbosa
- Área: 300 CDS. (aprox.)
- Suelos: Anegados — Relleno, Piedra Caliza, Arenas y
- Elevación: 0-5mts (por encima nivel promedio de la marea) con áreas propensas a inundación al sur de la Ave. Rexach (Zona AE fuera del cauce mayor)

Población y cambio porcentual, 1990 y 2000

Población	1990	2000	Cambio porcentual
Puerto Rico	3,522,037	3,808,610	7.5%
San Juan	437,745	434,374	-08%
Cantera	11,863	9,954	-19.2%

Densidad poblacional, 1990 y 2000

Densidad	Área en millas cuadradas	1990	2000
Puerto Rico	3,424.9	1,028	1,112
San Juan	123.8	3,536	3,509
Cantera	1.2	9,886	8,295

DEMOGRAFÍA

Población por sexo, 2000

	Población	Hombres		Mujeres	
Puerto Rico	3,808,610	1,833,577	48.1%	1,975,033	51.9%
San Juan	434,374	199,785	46.0%	234,589	54.0%
Cantera	9,954	4,536	45.6%	5,418	54.4%
Barriadas del Sur	3,305	1,621	49.0%	1,683	50.9%

Población por grupo de edad, 2000

	0-17 años		18 a 64 años		65 años ó más	
Puerto Rico	1,092,101	28.7%	2,291,372	60.2%	425,137	11.2%
San Juan	107,665	24.8%	262,454	60.4%	64,255	14.8%
Cantera	3,422	34.4%	5,221	52.5%	1,038	10.4%
Barriadas del Sur	880	26.6%	2,004	60.6%	424	12.8%

Estructura poblacional, Península de Cantera, 2000

7

Chronology

92

The Cantera Peninsula Project incorporates Apoyo and the Company, both created by Law 20, and the existing Neighborhood Council to accomplish the comprehensive rehabilitation of this community.

93

First leadership workshop; graduates 50 leaders from the Peninsula.

Tu Casa de las Artes RJ Reynolds provides free art classes to the community for five years.

94

The Mother of all Cleanups: First community cleanup of Caño Martín Peña, collects 150 tons of trash.

Environmental Quality Award: Awarded by the Environmental Protection Agency (EPA) for our commitment to rehabilitate the canal.

Population and Housing Census of the Cantera Peninsula Project.

95

Renovation begins at Las Margaritas and Fray Bartolomé de las Casas housing projects.

The Planning Board approves the Cantera Peninsula Comprehensive Development Plan.

First Guachinanga Environmental Festival.

The Peninsula's Young Leaders Workshop created.

96

The Neighborhood Council halts the closing of the Albert Einstein High School and obtains a commitment from the government to revitalize the school with a $5 million investment in new vocational and commercial programs.

Habitat for Humanity selects the Peninsula for its first project in Puerto Rico.

The AmeriCorps proposal provides training and work for 20 residents involved in the environmental impact initiative.

The Neighborhood Council receives the JC Penney Golden Rule Award.

The Robert Wood Johnson Foundation approves a grant of $500,000 to establish the Initiative for the Promotion of Health and Alternatives for the Family (IPSAF, Spanish acronym).

97

IPSAF is founded and is located in a renovated building which had been abandoned in the Bravos de Boston sector.

We create the Community Economic Development Office to increase job opportunities and provide entrepreneurial training.

98

The Peninsula Development Center at IPSAF opens its doors: we provide services to the community and child care for 24 children.

99

Cantera Community Center opens, $1,0000,000 invested in the building.

The Legislature approves a credit line of $36 million to facilitate the rehabilitation of the barriadas and construction of new housing.

00

The Neighborhood Council opens the Center for Studies and Educational Resources (CERE), an electronic library that provides Internet services, computers and tutorials to students in the community.

Construction of Villa del Corozo, Villas Pelicano and Parque Victoria begins, as new housing alternatives for 62 families who live next to the Martín Peña Canal.

The central government and the municipality grant property titles to the families in the barriadas.

The Municipality grants the Project an abandoned building on Barbosa Avenue and a donation to establish Plaza Cantera as a micro-business incubator.

01

Construction of Paseo del Conde begins. This 107 unit housing complex will also be used to relocate families from the banks of the Martín Peña Canal.

The Highway and Transportation Authority begins construction on the new entrance to the Cantera Peninsula.

02

First families living alongside the Martín Peña Canal are relocated to Villas del Corozo, Villas Pelicano and Parque Victoria.

The road plan for the Peninsula begins.

Appendix B: English and Spanish Names of Important Organizations

English Name	Spanish Name	Name used in paper
Company for the Comprehensive Development of the Cantera Peninsula	La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC)	La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC)
Environmental Quality Board (EQB)	Junta Calidad Ambiental (JCA)	Environmental Quality Board (EQB)
Solid Waste Authority	Autoridad de Desperdicios Sólidos (ADS)	Autoridad de Desperdicios Sólidos (ADS)
Community Council	Consejo Vecinal	Consejo Vecinal
----------	Reciclaje del Norte (RDN)	Reciclaje del Norte (RDN)
People's Recycling	----------	People's Recycling
Municipal Government of San Juan	San Juan Ciudad Patria	Municipal Government of San Juan
----------	La Coalición de Coordinadores de Reciclaje Municipal	La Coalición de Coordinadores de Reciclaje Municipal

Appendix C: Instructions for Trash Bag Audit (English and Spanish)

Instrucciones para la evaluación de la recolección de basura

1) El estudio va a durar dos días. Desde el sábado, 8 de Noviembre, hasta lunes, 10 de Noviembre.

Vamos a medir el peso de la basura lunes, 10 de Noviembre, a las doce.

2) Quisiéramos que tira su basura en las bolsas plásticas que proveeremos. Le vamos a proveer tres bolsas. Las bolsas blancas son para que tiras "reciclable" y las bolsas negras son para "no reciclables". Ejemplos de reciclables son periódicos, papeles, vidrios, latas de metal, plásticos, cartones, etc. Lo demás se puede echar en "no reciclables".

3) Para la salud y seguridad de todos por favor **NO** tire materiales peligrosos, baterías, líquidos, objetos afilados, y desperdicios de construcción

4) Los contenidos de la basura nos ayudarán a entender la cantidad y que clase de basura que se dispone en la comunidad.

5) Por favor, trata de mantener sus prácticas normales. Para mantener su privacidad solo vamos a medir el peso de las bolsas. No vamos a abrir ni a buscar entre su basura.

6) Si tiene preguntas del programa, del estudio, o del proceso aceptable, no dude en llamar o mandar un texto al número (857)-272-4902 o al Proyecto Península de Cantera (787)-268-3138.

¡Gracias por su participación!

Instructions for the Trash Bag Audit

1) The study will last two days. From Saturday, November 8th, until Monday, November 10th.

We will pick up the trash on Monday, November 10th, at noon.

2) We would like you to throw away your trash into the plastic bags that we will provide. We will be giving you four bags. The white bags are for "Recyclables" and the black bags are for "Non-Recyclables". Examples of recyclables are newspapers, paper, glass, aluminum cans, plastics, cartons, etc. Everything else can go into non-recyclables.

3) For the health and safety of everyone involved please do **NOT** throw away hazardous materials, batteries, sharp objects, and construction debris.

4) The contents of the trash will help us understand the amount and the types of waste that the community throws away.

5) Please try to maintain your normal waste disposal practices. To maintain your privacy, we will only be weighing the bags and will not be searching through them.

6) If you have any questions regarding the program, the study, or the process do not hesitate to call or text Alejandro Miranda at 857-272-4902 or call the Proyecto Península de Cantera at 787-268-3138.

Thank you for your participation!

Appendix D: Survey for the Trash Bag Audit (English and Spanish)

Evaluación de la producción de basura

Somos un equipo de estudiantes de Worcester Polytechnic Institute, una universidad de Massachusetts. Estamos trabajando con La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC) y queremos analizar la posibilidad del establecimiento de una estación de transferencias de desperdicios sólidos en la comunidad y deseamos considerar sus opiniones.

1. Por favor marca la opción que prefieres.

   ▢ Podemos usar tu nombre y tus respuestas para el estudio
   ▢ Podemos usar tus respuestas para el estudio pero mantener tu nombre anónimo
   ▢ No podemos usar tus respuestas y mantener tu nombre anónimo

2. ¿Cuántas personas viven en su casa y cuántos años tienen?

3. ¿En qué sector de Cantera vive?

4. ¿De qué está compuesta mayormente la basura? (i.e. los plásticos, la comida, el papel, etc.)

5. ¿Típicamente, cómo dispone su basura?

6. ¿Tiene acceso a un método de eliminación de residuos formal? Con qué frecuencia se dispone su basura?

7. ¿Típicamente reciclan materiales plásticos y/o papel? ¿Con qué frecuencia recicla su basura?

8. ¿Está satisfecho con la práctica de depositar basura en solares vacíos en Cantera?

9. ¿Está usted satisfecho con el servicio de recogido de basura?

10. ¿Está interesado en otros alternativas adicionales para disponer y controlar el problema de la basura?

11. Si tiene más consideraciones, ideas, opiniones, o otros preocupaciones que le gustaría informarnos, usa el espacio abajo para escribir.

Trash Bag Audit Survey

We are a team of students from Worcester Polytechnic Institute, a university in Massachusetts, working with La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC). We are interested in establishing a local waste collection facility and gauging local opinion. We encourage you to answer in the language you are most comfortable with, English or Spanish.

1. Please check off the option that you prefer.
   - ▢ We can use your name and your answers for our studies.
   - ▢ We can use your answers for our studies but we will keep your name anonymous
   - ▢ We cannot use your name nor answers for our studies.

2. How many people live in your household and what are their ages?

3. What district of Cantera do you live in?

4. What makes up the majority of your waste composition? (i.e plastics, food, paper, etc.)

5. Where do you normally dispose of your trash? How frequently do you dispose of it?

6. Do you have access to a formal waste disposal method?

7. Do you recycle plastics and/or papers? How often do your recycle?

8. Are you satisfied with the current waste disposal practices and the availability of a formal method

in the community?

9. What is your interest in alternative methods of waste disposal in the community? For example, a waste collection facility.

If you have any more comments, questions, or concerns, please write them down below.

Appendix E: General Public Survey (English and Spanish)

Sondeo Público

Información: La Compañía para el Desarrollo Integral de la Península de Cantera es una organización local que está interesada en el establecimiento de una facilidad de desperdicios sólidos en Cantera. Una facilidad de desperdicios sólidos es una facilidad donde la gente puede depositar materiales reciclables, basura doméstica, y artículos de gran tamaño. Ejemplos de artículos de grande tamaño son refrigeradoras, muebles, aparatos electrodomésticos, y escombros de construcciones. El establecimiento de una facilidad de desperdicios sólidos en Cantera le proveerá una ubicación donde pueden depositar su basura sabiendo que se va disponer correctamente.

La información recopilada durante este estudio puede ser usada y publicada en más estudios.

Si hay unas preguntas que no desea contestar, marque la opción "se niega a responder"

Responda a las siguientes preguntas si está de acuerdo con esta solicitud de información:

1. **Por favor marca la opción que prefiere.**
   - ▢ Podemos usar su nombre y sus respuestas para nuestro estudio. Por favor escriba su nombre en la linear abajo.
   - ▢ Podemos usar sus respuestas para nuestro estudio pero mantener su nombre anónimo. No escribas tu nombre abajo.
   - ▢ No podemos usar su nombre ni sus respuestas para nuestro estudio. No escriba su nombre abajo

   Nombre _____

2. **¿Cuántos años tiene?**
   - ▢ menos de 21
   - ▢ 21-35
   - ▢ 35-50
   - ▢ 51-65
   - ▢ 65 años o más
   - ▢ se niega a responder

3. **Genero:**
   - ▢ masculino
   - ▢ femenino
   - ▢ se niega a responder

4. **El sector donde yo vivo es:**
   - ▢ Bravos de Boston
   - ▢ Corea
   - ▢ Condadito
   - ▢ El Mirador
   - ▢ Guano
   - ▢ Hábitat
   - ▢ Los Pinos
   - ▢ Parque Victoria
   - ▢ Paseo del Conde
   - ▢ Res. Las Casas
   - ▢ Res. Las Margaritas
   - ▢ se niega a responder
   - ▢ Ultimo Chance
   - ▢ Villa Corozo
   - ▢ Villa Kennedy
   - ▢ Villa Pelicano
   - ▢ Santa Elena

5. ¿Cuánta gente viven en su casa (incluyendo usted)?

- ▢ 1
- ▢ 2
- ▢ 3
- ▢ 4
- ▢ 5+
- ▢ se niega a responder

6. Mi situación laboral es:

- ▢ trabajo a tiempo completa
- ▢ tiempo parcial
- ▢ incapacitado
- ▢ estudiante
- ▢ desempleado
- ▢ retirado
- ▢ se niega a responder

7. ¿Tiene acceso a la internet?

- ▢ sí
- ▢ no
- ▢ se niega a responder

8. ¿Estás de acuerdo se recolecta y dispone en Cantera?

- ▢ muy de acuerdo
- ▢ desacuerdo
- ▢ acuerdo
- ▢ muy desacuerdo
- ▢ se niega a responder

9. ¿Está de acuerdo de que artículos de gran tamaño son dispuestos correctamente?

- ▢ muy de acuerdo
- ▢ desacuerdo
- ▢ neutral
- ▢ acuerdo
- ▢ muy desacuerdo
- ▢ se niega a responder

10. ¿Qué tan interesado está en una facilidad que pueda disponer artículos de gran tamaño correctamente?

- ▢ muy interesado
- ▢ desinteresado
- ▢ no interesado ni desinteresado
- ▢ interesado
- ▢ muy desinteresado
- ▢ se niega a responder

11. ¿Se preocupa con la práctica de depositar basura en solares vacíos en Cantera?

- ▢ muy interesado
- ▢ desinteresado
- ▢ no interesado ni desinteresado
- ▢ interesado
- ▢ muy desinteresado
- ▢ se niega a responder

12. ¿Qué tipos de métodos de eliminación de desechos tiene acceso?

- ▢ depósito común
- ▢ individual (zafacón)
- ▢ depósito en acera o calle
- ▢ ninguno
- ▢ otro: _____
- ▢ se niega a responder

13. ¿Qué tan efectivo es su método de recogido de desechos?

- ▢ muy efectivo
- ▢ muy inefectivo
- ▢ no efectivo ni inefectivo
- ▢ efectivo
- ▢ inefectivo
- ▢ se niega a responder

14. ¿Estás preocupado con la posibilidad del establecimiento de una facilidad de

desperdicios sólidos en su comunidad? ¿En caso afirmativo, cuáles son sus preocupaciones?

15. ¿Qué tan útil cree que una facilidad de transbordo y reciclaje de desperdicios sólidos pequeña se ubique en Cantera?

- ▢ muy útil
- ▢ útil
- ▢ no útil
- ▢ no muy útil
- ▢ no útil ni útil
- ▢ se niega a responder

16. ¿Si Cantera tuviera una facilidad donde la gente puede llevar sus desperdicios sólidos, lo usarías?

- ▢ sí
- ▢ se niega a responder
- ▢ no

17. ¿Cuáles características de una estación de transbordo y reciclaje de desperdicios desea tener?

18. ¿Con que frecuencia recicla (plásticos, papeles, latas de metal)?

- ▢ nunca
- ▢ mayoría del tiempo
- ▢ infrecuente
- ▢ siempre
- ▢ de vez en cuando
- ▢ se niega a responder

19. ¿Estaría dispuesto separar sus reciclables de su basura doméstica?

- ▢ sí
- ▢ se niega a responder
- ▢ no

20. Si tiene más consideraciones, ideas, opiniones o preocupaciones que le gustaría a informarnos, por favor usa el espacio abajo para describirlos.

21. Si desea contactarnos para más información o para aprender más de nuestro proyecto, no dude en contactarnos a través de pr14cantera@wpi.edu o al teléfono (857)-272-4902.

¡Muchas gracias por su participación!

General Public Survey

Information: La Compañía para el Desarrollo Integral de la Península de Cantera is a local organization that is interested in establishing a waste collection facility in Cantera. A waste collection facility is a facility where a residents would be able to drop off recycling, domestic and larger scale items for proper disposal. Larger scale items include furniture, appliances, and construction debris. The establishment of a waste collection facility in Cantera will give the community a location where they can drop off their waste knowing that it will be disposed of properly.

The information collected may be used and published in further studies. **If there are any questions that you prefer not to answer, please check "decline to answer".**

Please answer the following questions

1. **Please write in your name and check off your option that you prefer**
   - ▢ We can use your name and your answers for our studies.
   - ▢ We can use your answers for our studies but we will keep your name anonymous
   - ▢ We cannot use your name nor answers for our studies.

   Name _____

2. **How old are you?**
   - ▢ less than 21
   - ▢ 21-35
   - ▢ 35-50
   - ▢ 51-65
   - ▢ 65 and over
   - ▢ decline to answer

3. **I am:**
   - ▢ male
   - ▢ female
   - ▢ decline to answer

4. **The sector that I live in is:**
   - ▢ Bravos de Boston
   - ▢ Corea
   - ▢ Condadito
   - ▢ El Mirador
   - ▢ Guano
   - ▢ Habitat
   - ▢ Los Pinos
   - ▢ Parque Victoria
   - ▢ Paseo del Conde
   - ▢ Res. Las Casas
   - ▢ Res. Las Margaritas
   - ▢ Santa Elena
   - ▢ Ultimo Chance
   - ▢ Villa Corozo
   - ▢ Villa Kennedy
   - ▢ Villa Pelicano
   - ▢ decline to answer

5. **Total number of people living in your household (including yourself)?**
   - ▢ 1
   - ▢ 2
   - ▢ 3
   - ▢ 4
   - ▢ 5+
   - ▢ decline to answer

6. **My current employment status is**

- ▢ full-time
- ▢ part-time
- ▢ disabled
- ▢ student
- ▢ unemployed
- ▢ retired
- ▢ underemployed
- ▢ decline to answer

7. Do you have access to the internet?

- ▢ yes
- ▢ no
- ▢ decline to answer

8. Do you agree the household waste is handled properly in Cantera?

- ▢ strongly disagree
- ▢ disagree
- ▢ neutral
- ▢ agree
- ▢ strongly agree
- ▢ decline to answer

9. Do you agree that large waste (appliances, cars) is handled properly in Cantera?

- ▢ strongly disagree
- ▢ disagree
- ▢ neutral
- ▢ agree
- ▢ strongly agree
- ▢ decline to answer

10. How interested are you in a facility that can dispose of large waste items properly?

- ▢ very uninterested
- ▢ uninterested
- ▢ neither interested nor uninterested
- ▢ interested
- ▢ very interested
- ▢ decline to answer

11. Are you concerned with open dumping? If so, why? (Please write in your answer)

12. What kind of formal waste disposal method do you have access to?

- ▢ community bins
- ▢ drop-off
- ▢ curbside pick-up
- ▢ none
- ▢ other:_____
- ▢ decline to answer

13. How effective do you find your disposal method?

- ▢ very ineffective
- ▢ ineffective
- ▢ neither effective nor ineffective
- ▢ effective
- ▢ very effective
- ▢ decline to answer

14. Are you concerned with the possibility of establishing a waste collection facility in your community? If yes, what are some of your concerns?

15. How helpful do you think a waste collection facility could be to Cantera?

- ▢ extremely unhelpful
- ▢ unhelpful
- ▢ neither helpful nor unhelpful
- ▢ helpful
- ▢ extremely helpful
- ▢ decline to answer

16. If Cantera had a waste collection facility, would you use it to dispose of your waste?

- ▢ yes
- ▢ no
- ▢ decline to answer

17. What factors would make you more likely to use a waste transfer station?

18. How often do you recycle (plastics, papers, and metal cans)?

- ▢ never
- ▢ rarely
- ▢ sometimes
- ▢ most of the time
- ▢ always
- ▢ decline to answer

19. Would you be willing to separate your recyclables from your domestic waste?

- ▢ yes
- ▢ no
- ▢ decline to answer

20. If you have anymore considerations, ideas, opinions, or concerns that you would like to share, please write it in the space provided below.

21. If you would like us to contact you for an additional information or to learn more about our project, please feel free to contact us at pr14cantera@wpi.edu or (857)-272-4902.

Thank you very much for your participation!

Appendix F: Potential Questions to ask the EQB, ADS, and Municipal Government of San Juan

Stakeholder Group: _____
Interviewee: _____
Interviewer: _____
Date and time: _____

We are a team from Worcester Polytechnic Institute, a university in Massachusetts, working with La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC). We are interested in establishing a local waste collection facility and gauging local opinion.

1. Are you comfortable with us using your responses in our report with your name? If not are you comfortable if you remain anonymous? Are you comfortable with us recording this conversation?

2. Do you have any information about zoning regulations that we should be made aware of in Puerto Rico?
    a. If not, who can we contact?

3. More for the municipality, how can we best determine the accessibility of utilities such as water, electric and their potential costs.

4. What are some of the key major components that you see in a waste collection facility?
    a. Recycling, Composting, Separation?

5. What are the safety regulations that should be addressed when developing a waste collection facility?
    a. What are some of the environmental hazards that can arise from a waste collection facility?

6. What are some of the key issues that one can encounter when trying to determine an adequate site for a station?
    a. What about key issues for designs?

7. What are some good ways to deal with the following waste collection facility issues?
    a. noise, odor, vermin, traffic, & cleanliness

8. Do you have any studies as to how other waste collection facilities were developed and designed?

a. Do you know projections of the cost and how many people it serves?
b. How many waste collection facilities are there in the San Juan area? What about Puerto Rico?
c. If we were to visit one, would you have a suggestion to which is the best facility?

9. What are some good ways to recover costs from the service?

10. Do you know of any effective incentive or involvement programs that could get the community to use the station?

11. Will workers need to go through some kind of training? If yes, how and where do they go for training and education?
    a. Is it advisable to have people from the community work at the station?
    b. Is there a recommended number of people that are required to run a waste collection facility?

12. What are some recommendations or final advice that could be suggested for implementing a waste collection facility in Cantera?
    a. Are there any other documents, case studies, statistics, or further individuals that you think we should take a look and communicate with?

13. Would you be willing to provide contact information if we may have further questions? Do you have any business cards that we can have?

Appendix G: Potential Questions for the Reciclaje del Norte

Stakeholder Group: _____
Interviewee: _____
Interviewer: _____
Date and time: _____

We are a team from Worcester Polytechnic Institute, a university in Massachusetts, working with La Compañía para el Desarrollo Integral de la Península de Cantera (CDIPC). We are interested in establishing a local waste collection facility and gauging local opinion.

1. Are you comfortable with us using your responses in our report with your name? If not are you comfortable if you remain anonymous? Are you comfortable with us recording this conversation?

2. How long have you been working at the recycling station?

3. What is your specific role in this recycling center? Do you manage multiple responsibilities or do you have a single one?

4. Do you hire members of the community?

5. How many people do you have use this recycling center on a daily basis? What communities use this facility?

6. What is recyclable here and what is not?

7. How did this recycling center get started?

8. Do you know of some creative incentives that could get the people from the community to participate?

9. What kind of equipment do you use to manage your materials?

10. How do you deal with the following factors? If you deal with them at all?
    a. Vermin
    b. Odor
    c. Noise
    d. Traffic

11. Are you familiar with waste collection facilities? Do you think there is some overlap between both facilities?

12. Were you here when they first began the startup of the facility?

13. Do you know the start up costs for this facility? How much money does it take to manage the whole facility on a monthly basis?

14. If you were here during the establishment phase, what kind of studies did you do to and what other groups and organizations did you consult to determine the design options of the facility?

15. What other organizations or groups would you recommend we consult with regarding the establishment of a facility similar to this one?

16. Do you think nearby communities could benefit from a waste collection facility?

17. How did you determine an appropriate size for the facility?

18. Do you have anymore comments or questions for us?

19. Would you be willing to provide contact information if we may have further questions? Do you have any business cards that we can have?

Appendix H: Presentation to the Consejo Vecinal

El establecimiento de una facilidad de desperdicios sólidos

Alejandro Miranda Cotter
Hannah Reinertsen
John
Victor Hu

¿Quiénes somos?

- Estudiantes de Worcester Polytechnic Institute
- Estudiando ingeniería y matemáticas
- Dos meses para trabajar con ustedes y la CDIPC

Los Desperdicios Y El Problema

- La basura
- Efectos a la salud
- El medio ambiente
  - Martin Peña Channel

Facilidad de Desperdicios Sólidos

- Función
- Beneficios
- Consideraciones
- Ejemplos

Metodología

- Observaciones
- Entrevistas y estudios
- Evaluación de sitios y diseño para el estacion
- Viabilidad económica
- Participación comunitaria

Discusión

Ideas

Preguntas

Opiniones

Preocupaciones

Appendix I: Guidelines and Rating Sheet for Siting

Site: X
Coordinates:

[insert pictures of site here]

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments:

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments:

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by	3	This site is easily accessible to vehicles but can be dangerous

road		and inconvenient for people to access by foot
Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments:

Size of the land

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	4	Sufficient space for facility with additional space for further expansion

Comments:

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments:

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	4	There is access to water, electricity, and sewerage

Comments:

Appendix J: Field Observation Log

Corresponds to high-density waste locations.
The number corresponds to the blue circles that are located in figure 11

Corresponds to organizations affiliated with this project
The number corresponds to the yellow triangles that are located in figure 11

High-Density Waste Locations

1

In this location, there are several abandoned houses that are filled with illegally dumped waste. This waste is mostly furniture and bags that are filled with domestic waste

2

In this location, there is illegal filiing activity occurring, where large items and domestic waste are being disposed of into the pockets of Martin Peña channel until it becomes "land"

3

This image further shows the problem of illegally dumping waste into abandoned houses.

4

Within the crate-like figure, there use to be a municipal dumpster, but it has been taken out of the community. However, the residents still throw away their waste here.

5

A big problem that this community faces is that they don't have a place to dispose of their furniture.

6

As shown in this image, the Martin Peña channel is filled with construction debris, wood, and plastics.

7

More illegal dumping into abandoned houses

8

Even in the subsidized housing complexes where there are larger municipal waste bins, there is still the problem of large furniture items, as seen to the right of the containers.

9

Another problem that the communtiy is facing is with squatters. These people will raise houses, as seen in the right, in unclaimed lands.

10

Another big problem that this community is facing is with construction debris. Because there is no facility to collect it, it is often left in open areas such as this one.

11

Because tires are considered a hazardous material in Puerto Rico, many tires do not end up being properly disposed of, leaving Cantera with the duty of trying to either find a purpose for them or illegal disposing them.

12

In addition, abandoned cars are also a very serious issue in Cantera.

13

On a small island in the lagoon, the currents wash up a lot of the waste in the water here.

\

1

This is La Compania Para el Desarollo Integral de la Peninsula de Cantera (CDIPC). This is the office building of the company where we work from

2

This is the Reciclaje del Norte (RDN). This is the only recycling facility in Cantera.

3

The office building of the Consejo Vecinal, who are the community leaders of Cantera.

Appendix K: Trash Bag Audit Raw Data

Participant	District	Family Size	White Bag Weight (in pounds)	Black Bag Weight (in pounds)	Total Weight
1	LM	5	2	6	8
2	LM	2	2	5	7
3	BDB	2	5	10	15
4	C	3	5	10	15
5	C	Unknown	1	9	10
6	BDB	2	2	4	6
7	UC	7	2	5	7
8	LM	2	2	4	6
9	LM	4	4	8	12
10	EM	4	3	11	14
11	SE	3	1	14	15
12	PDC	3	3	8	11
13	PDC	4	5	12	17
14	PG	1	1	2	3
15	EM	4	8	10	18
16	EM	1	2	4	6
17	EM	4	14	10	24
18	SE	3	6	15	21
19	PV	2	5	0	5
20	VK	1	2	1	3
21	VK	1	5	5	10
22	VP	2	4	7	11
23	VP	Unknown	3	5	8
24	VC	3	3	8	11
25	VC	Unknown	8	10	18
26	LH	4	10	17	27

27	LH	7	5	8	13
28	CF	2	3	17	20
Totals		76	116	225	341

Key

Sector	Abbreviation
Bravos de Boston	BDB
Condadito Final	CF
Corea	C
El Habitat	EH
El Mirador	EM
Las Margaritas	LM
Parque Victoria	PV
Paseo del Conde	PDC
Puente Guano	PG
Santa Elena	SE
Ultimo Chance	UC
Villa Corozo	VC
Villa Kennedy	VK
Villa Pelicano	VP

Appendix L: Transcript for the Meeting with the Reciclaje del Norte

Interview Transcription with Rubén González

Date : November 6th, 2014
Location : Reciclaje del Norte facility
Attendees : Alejandro Miranda, Alfredo Zapata, Hannah Reinertsen, John Cotter, Rubén González, Victor Hu

Alejandro Miranda (AM): Before we get started is it okay if we record because I'm the only one that speaks Spanish and information may go past me so it would be good to have something to review later.

Rubén González (RG): Yes that is fine

RG: We started in 1997 and I was born and raised in Ultimo Chance. I was leader of the "Consejo Vecinal" for almost 14 years. I was elected by the community. This recycling effort started out with the Consejo Vecinal. Do you know or have you talked to the Consejo Vecinal?

Alfredo Zapata (AZ): Yes, we have and we have already talked about what we are trying to do.

RG: The community council is the one that started out this transformation and is the one that has provided all these changes to the community.

RG: We noticed that in the Martín Peña Channel and around the shore, there was a lot of waste being thrown in and that many of the materials were recyclables. It was being thrown into the water. Why were they being thrown away there? Well, because there was no formal recollection method, people had to find a way to throw away their trash so they just threw it into the channel. It started filling and thus the channel no longer flows. We started a recycling program where we went house by house, sector by sectors, every Thursdays, and we started educating people. We also started picking up paper, plastics, aluminum, newspapers, cardboard, and glass.

RG: We started out as People's Recycling in 1996. We didn't know anything about starting a business. We were functioning solely through volunteers. We started learning a little bit by a little bit and it wasn't easy. People began accepting the program and we started recycling in 11 sectors of Cantera. We were picking up, free of charge, for about five years and that brought charges up to $3,000 a week in diesel and employees. The community and the CDIPC supported us and this initiative. At first it was hard, but people started to become educated and they became more and more open to the facility. Little by little people started becoming more and more educated and they were throwing away less and less.

RG: People began separating their recyclables from their domestic wastes. Every Thursday, people would throw and separate their recyclables into a blue bag that we provided them with. And the people started recycling more and more and the number of participants also increased, as well as their conscience over the matter. Unfortunately, after five years we couldn't keep up with the free service because of the cost. So we made a proposal with the San Juan municipality so that the same way private companies are paid to pick up waste that they should contact us for that service as well but they never accepted it. Later on, we incorporated the collection of rubbish in the community which was a huge problem. The president of the company and the Junta Ambiental bought a truck that we still have and a mini charger. We then began recycling and picking up rubbish that the municipality never picked up. The ***(inaudible)*** contracted People's Recycling for that service and every week they picked up rubbish per sector. Since then the municipality has been the one picking up the trash free of charge. The municipality would charge the truck four or five times a day with the trash because they would have to make multiple trips. Later, there was no more funding and the company cut the service so thus the problem arises like it once was like you can see today. While the service was active, the community was clean and educated and once a week they used to pick up washing machines, stoves, big items, which were another problem because they threw it anywhere. In that time we had a very noticeable change. The service was cut and People's Recycling had to keep up but couldn't because of the charges and the necessary work. So they had to combine themselves with another community group, which was Reciclaje Del Norte. In 1986, they started gathering companies like ours where the group was run by the workers. Initially there were 16 but now there is only 3 facilities in the island. One in Hatillo and us. There is actually only 2. We have been active since 2003 as RDN. We lost the name but we didn't lose our identity. Then we decided investing in equipment and services. We now have three plants. We are a total of 123 employees in total. And we recycle all types of materials such as fiber, cardboard, newspapers, plastics, aluminum, construction debris, and metals. We want to stay away from trash, because we are in industry. Pharmaceuticals and manufacturers want one provider for all their needs and so we began preparing ourselves to handle that responsibility.

AZ: So you are working with all different kinds of solid wastes?

RG: All different types, minus the dangerous, and thus we have to get some specialists who can help us with that. But we are in hospitals, government, pharmaceuticals, and private groups. You can look at our website for more information regarding what we handle and how we handle it. We have lots of confidential documents that you can have access to. We have 2,000 clients. Each route has about 20 clients. We cover about half of the island. ***(inaudible)*** We are a leader in recycling. We have competed with companies with more than 40 years of experience. But people have really liked our model, our service, the preparation that we have, and being a community-run organization and so they contract us. We had to educate ourselves because we didn't know anything at the start. We got our contracts because we have been prepared to deal with what we

have to. We are prepared to give all types of services. We do not have to depend on the government in any way shape or form for our services.

RG: The municipality and the RDN at one point thought of developing a type of waste transfer station, it was proposed but I understand that something must be done.

AZ: We are looking to make a really little waste transfer station..

RG: But the importance was that the community got involved in the situation and that they would do things right and things should be in their place. Here we all know each other and made everything easier. Even though we might not pick up trash house by house, there are a lot of people who come here to drop things off. The ones that don't have vehicles, they call us and we do it once (the first time) to explain to them that they need to find other ways to bring their recycling here. The municipality worked with the project to work on a transfer recycling center. The main factor is that nothing can be done for free and one has to pay. We started out doing everything for free as a community organization for five years and did very well but every business has great costs.

AM: How were you able to keep people going for so many years?

RG: Community Participation. What people sold us was for diesel and there was a lot of encouragement from groups such as Americorps, and the volunteers from the sectors that helped us. Leaders for the World and the Consejo Vecinal also helped us go house to house so we didn't have to pay and it helped us greatly. But we couldn't keep doing everything for free. The cost of maintenance, diesel, paying the workers began getting to be too much.

AZ: Everything that you guys have done in order to address the issue is very amazing and I have to congratulate you for your efforts.

RG: If we continued with that model, the people would have been happy and everything would have been great but we were lacking in one major part. The costs. We are prepared for everything and we can do just about everything. We recycle a lot of components and we pay by the pound. People are willing to pay to bring their recyclables.

AM: Did you always pay your customers in order to get them to bring their materials?

RG: Before we used to pick up for free in the community. Now we are buying what they bring and because of our contracts with other companies we can buy and resell and make profits. In that sense we have grown. But we still have a lot to learn especially with the hard times. ***(inaudible)*** We have a social responsibility where "What we gain, we share". We have a committee that focuses on social responsibility and education. It is a committee that socializes,

communicates and focuses on providing or asking aid to or from residents. That committee is responsible for providing medical aid through trips and operations. Additionally, they are in charge of distributing and keeping record of weekly reviews if there is any issues. If there is, then someone comes and investigates any relating issues. We have that other component where anything we get, we share with the rest of our employees and community. Traditionally, most models for businesses have one or two owners but in ours we have 32 owners.

AZ: How does your model work? You have 32 owners, so how does everything get organized?

RG: These owners are part of a cooperative and a directors board where projects get approved and we have extraordinary meetings to evaluate the necessary quantity of money. They evaluate our facility every three months to see how we are doing and what has progressed.

AM: One thing we wanted to know about the our transfer station do people need some kind of training or license in order to work in a facility such as this?

RG: About 75 percent of the employees work in the area of the given facility. If they are not from the community, then it is usually because they need someone who is especially prepared or trained in some way. Many of the employees we once had didn't know anything about the facility or didn't have licenses. We have them today with licenses. To work in a facility like this one, one needs first an understanding. We have an officer of security that is helping us maintain all the precautions. Pharmaceutical companies have helped us understand how they work and operate and how to implement that into our cooperation. One doesn't need to be so selective. If there is a specific issue then one just contacts an individual to handle that. Whatever equipment we don't have, we can just get. We have our card and information on the table if you would like to get further references or talk to other people. We also provide additional service to companies on the mainland, and even Mexico. ***(inaudible)* a brief discussion about Pepsi Co. in Mexico.**

AM: What kind of equipment do you guys use?

RG: We have a clean plant. Our operations are clean versus a dirty plant where everything comes mixed in, the trash and the recyclables, food. This creates problems with health since we are very close to a community. What comes here, we have educated the people to bring cardboard, newspaper, paper, and that they cannot bring solid waste or dirty trash.

AM: Do you guys have any problems with rats or vermin?

RG: No, since we don't move that kind of waste that attracts them. Regardless we have control over insects and vermin through fumigation and proper procedures. We don't have a line of separation either. We just separate the items that we have based on materials and then compost

them as needed. A line of separation requires a lot of space and thus we don't have enough space for that.

AZ: Do you have wood and metals too?

RG: Yes. Metals and vegetation. Industries produce lots of vegetation and so we take to recycle those to Guaynabo. When customers ask, we try to find a way to provide them with the services they need.

AZ: What you can't do then you bring in an expert or specialist that can?

RG: Exactly. We contract other people for things such as lamps, light bulbs, etc. Which is very hard to move around.

AZ: Do you recycle construction debris or things of that sort?

RG: We do not recycle construction debris unless we do it on a much larger scale.

AM: Do you have a good idea of a place where we can have this site for our waste transfer station?

RG: You will need to take a good look around the community and look and compare and understand what the company can have access to. There are certainly places around the community. In order to find suitable places for the station, one just needs to take the time to find them.

AZ: Hopefully working alongside the municipality we will understand the impacts.

RG: This could be convenient for the municipality, because we can work hand in hand with them and help them.

AM: Do you have an estimate as to the startup costs for this facility?

RG: Well, we started out with a grant up to 100,000 dollars, enough for a truck and for an compressor and that is it. We started out for the first seven years by using abandoned buildings, and then we identified this lot behind the bus station, and then we cleaned and conditioned it. We did a contract for 10 years and we went six years without paying. This whole office used to be empty. The structure we bought and had it brought in from Columbia. And the rest we bought from the Dominican Republic. This would have cost us 25,000 dollars, so it was cheaper to import it from other places. Most of the equipment here is used because it would be expensive otherwise.

AZ: Where do you get the necessary equipment? From different places or areas or do you have like a specific person that deals with that?

RG: We buy outside from various places and we usually go to our mechanic. He at one point started out as a simple mechanic but he has become our technical specialist with dealing with our equipment.

AZ: How many employees do you have in this plant?

RG: Here we have about 30 employees. We do a lot of outsourcing. Everyone is full time. We have people working in the industry and they are moving. In the pharmaceuticals we have people moving and separating the materials. We also have some people working in the hospital. What you would call outsourcing.

AZ: How much do you pay for electricity?

RG.Here we pay about $1200 per month for electricity, but we operate the stronger things with a generator. It takes about $6,000 dollars weekly, in order to maintain the generator and our trucks. The trucks go from three in the morning and return at six at night. The trucks consume more than the plant itself. We don't spend a lot on water here. We spend about $280 monthly on water.

AM: Do you have any other costs aside from the diesel, water, and electricity?

RG: Money that we need to send to the government, paying for people's wages, each service that we perform takes out more money.

AZ: Of all the 30 employees, how many of them are from Cantera?

RG: Of the 30 employees that we have only about 3 or 4 are from outside the community. Almost everyone is from here. Our main focus here is to hire people from inside the community. Every day we get a lot of resumes for working here.

AM: Does everyone work here at the same time?
RG: No, there are shifts, some people start from 3am and others start at 6am and others at 8am. We operate here until 5pm. Saturdays we don't work, at one point we did but the materials that came in did not compensate for the amount to keep the facility working.

AM: Do you have any studies that you can refer to us to or do you know of any programs similar to ours.

RG: The study we did we had to go house to house street by street and back then, there was no

information. Even up till now I don't think there are any statistics or information regarding pick ups or of any sort.

AM: How much time did it take for you guys to go house to house?

RG: With community aid it took us about a month. We went after 5pm because people would get back from work around that time and we would do this until 7pm.

RG: If you have any other questions I am happy to speak with you further or refer to you to any other people. Next time we can talk to our president, Luis Sanchez, who is a very creative person and has a lot of experience and an extraordinary vision. He is a visionary.

The Group: Thank you for all of you help. The information we used will be very helpful with determining an appropriate solution for the community.

Appendix M: Transcript for the Meeting with the Government Agencies

Transcription of the Informal Interview with the Environmental Quality Board, Autoridad de Desperdicios Solidos, and the Municipal Government of San Juan.

This informal interview was conducted in a mixture of English and Spanish

Date : November 6th, 2014
Location : CDIPC Office
Attendees : Alejandro Miranda, Alfredo Zapata, Hannah Reinertsen, Ilsa Mendes, John Cotter, Maria Oquendo, Maritere Padilla, Noelia Rosa, Sara Justicia, Victor Hu

Alfredo Zapata (AZ): This project is, number one, focused on picking up the waste from the environment. Number 2 especially towards the communities in the inaccessible areas.

Sara Justicia (S): The beach is around over there?

AZ: The beach is around there.

Phone rings, Sara excuses herself

Ilsa Mendes (I): Is the company for the community?

(inaudible)

AZ: Many of the families that we have been helping have now moved to the north and now we want to address the situation regarding solid waste.

S: I just passed the office and I saw that there was a mini illegal dump sites on the right.

AZ: They are experiencing some problems because the trucks from the municipality don't fish the area. That is the first point. The second point is that they do not take the big (**S:** The big waste) waste or mattresses.

S: And you don't have any special trucks that can pick that up for you?

AZ: They come every one, two or three months. That is the problem. Because they don't have those services.

S: And the generation is ***(inaudible)***

AZ: And there is a bigger problem. Most of the people on the island don't have a place where they can deposit that. So what do they do?

S: They just drop it anywhere.

AZ: They go to Cantera. Cantera is used to receive garbage and solid waste.

S: Or they put in the water.

AZ: Yes, that is most of the way people think here. So we are trying to change that. We are trying to provide solutions. So that is the reason we have Worcester University. I am going to let Alejandro, who speaks Spanish and English present a short presentation.

S: Before we get started I want to mention (inaudible) , the president of the agency, we visited Playita which is a community and we talked about this same problem. They have a big waste accumulation and it is all over the coast.

AZ: So Alejandro this is your meeting.

Alejandro (AM): We used this presentation for an earlier meeting with the community council. So you already know who we are. We are some students from Worcester Polytechnic Institute and we are going to be here for two months in order to analyze the viability of establishing a waste transfer station here in Cantera. We aren't sure if you know the problem that has occurred in Cantera over the last 50 years, from 1950 to 2007. Population between these years have grown extensively and the the Martín Peña Canal, which was once free flowing and wide, is now filled with various kinds of waste. This includes things such as plastics, domestic waste, sofas, cabinets and it is a big problem. They did it in order to fill up the canal to make more and more space. Before there used to be lots of people around the shore, but as population grew people required more space and then they started filling. The CDIPC has focused a lot of its efforts toward moving people from the south and the shore lines towards the center and northern part of the peninsula.

S: About how many people do you have living here in Cantera.

AM: About 10,000.

AZ: We are rechecking the census about population but it should be around 10,000.

S: And that picture to the left… ***(inaudible)***

AM: That picture was taken back in 1936. So you can see that within the 70 years. there has

been lots of change. So next, we have some images of waste around the community. Here is a photo of the Martín Peña channel, enough trash that people are capable of walking across it.

AZ: Actually the canal is more of a marsh now.

AL: One of the problems of Cantera, is the big waste materials. Such as big construction waste, walls, construction debris, furniture, and it's too big. In certain areas, the roads are so narrow that trucks and pick up vehicles are unable to enter thus leaving the waste to be dumped.

I: Excuse me, there is a new law that I am not too familiarized with that deals with and regulates construction debris waste. It was issued on the 30 of September of this year. I believe it is called Law Number 22. I need to verify it but I think I can provide it for you and might be helpful.

AL: And what we are thinking for this project is the establishment of a waste transfer station, like what Alfredo was trying to explain to you earlier. A place where people can take their trash, it can go under the required processes such as separation. Another thing that we are looking forward to is community participation and interaction with the station. We want to give them the opportunity to work there and help pick up the waste around the community. We want to encourage habits such as separation, and really educate the people. Right now, we are at a stage where we are trying to figure out how much waste does a house here in Cantera produce and gauge the interest of a waste transfer station here in Cantera. And some additional things that we are thinking is visiting other waste transfer stations such as Guaynabo, or Cataño, and learn what are the characteristics that waste transfer stations should have and how we can apply that to this community. So far, Alfredo has taken us around the community to take a look at some sites and he has also taken us around to some of the areas where illegally dump waste is prevalent. Something that we want to learn from the other waste transfer station, examples, such as Guaynabo and Cataño, are the designs and infrastructure. We are not looking for something as big as the Guaynabo station but something much much smaller. We are also interested in the economic viability so that the people use and pay for the service. We are also currently trying to come up with creative incentives so that people can get accustomed with it. We want to take this moment to open a discussion to gather information, opinions, etc.

I: *(inaudible)*

AZ: Like they were saying earlier, there was a culture from about 50 years ago. Where people filled the canal in order to make for more space, but now people understand that that they need a control of waste. That is why we are doing the trash bag survey in order to get people informed and trying to play an active role in the situation.

***(inaudible)* -Multiple people talking at the same time**

S: I think we should proceed with the questions we want them to participate in the conversation. Go ahead and I am going to make some statements.

AM: Okay, first we wanted to know if you are familiar with zoning regulations or policies that are needed to start a waste transfer station.

I: I don't know about zoning regulations, for a waste transfer station, you are going to need an "Operation permit" or "DS2" you are going to need that and I brought it for you. You are going to need to fill that out.

Representatives from the Autoridad de Desperdicios Sólidos enter.

I: When you have the installation ready, then you ask for this. There are two steps. you can ask for a permit of construction when you are constructing the station, and then when installation is finished then you ask for a permit of installation. It is all in Spanish. First, the construction permit and then the operation one. And here is the instruction that you need to do that. **(Shows permit papers)** You need the plan of operation, you know with all the details, the days of work the number of workers that will be working there. And the cost are over here…**(Inaudible)**… Here you fill out the one you want to do and you can keep this one. Make a copy of it since it is the same form for both things. And this is the instruction and all the documents that you going to fill with it and take to the agency.

S: I want to stop and establish our role in the process. The EQB is the Environmental Quality Board and all our regulations are for water, air, and soil. We are focused on preventing pollution. With the Solid Waste Authority, you will be able to discuss the flow of the garbage and all the generation issues that you were talking about. And we are more concerned with the environmental compliance of this installation so I wanted to make that clear. It is different from the Solid Waste Authority.

I: Okay, in the instructions of the papers we ask for everything you need in order to approve the permit. So you need the endorsement of the ADS, and you need the Solid Waste Authority and you are going to the need the permit of use by OGP.

S: OGP is the Office of General Permits

I: What we are really trying to get to is that we are the last agency that you need to talk to all the other agencies first, and then talk to us. Because if you do not have their approval, then we do not approve you either.

AM: We are just all new to this process. So there is a lot to figure out.

S: That is okay we are here to answer any questions you may have.

John Cotter (J): Do you guys have an impact on the other waste transfer stations in the area, so like the waste transfer stations in Cataño and Guaynabo?

S: The ADS will be able to answer that for you

J: Yeah, information about how they are environmentally sound, and how they deal with sound, vermin, cleanliness.

I: I think that is OGP. But remember you need the environmental compliance. And that is all OGP.

S: No, no but what he is asking is what permits that Catano, that is 10C2.

I: In Caguas I think there is one you can see. it is a very small one, very clean, and that would be good to see.

AZ: I just want to take a minute to introduce the ADS. I have already given them a brief description of what we have been talking about so that they can catch up and integrate themselves with the discussion.

***(inaudible)* discussion between ADS and the EQB**

AM: Yes, we are currently at the point where we are interviewing to gather interest on waste transfer stations in the community. We are also considering the permits that will be required for the station that we are not currently familiar with. That is why we are here, where we are trying to learn a little bit more about waste transfer station.

(inaudible)

J: Let's talk more about how this process works. I think that is the best way to do it.

(Inaudible Spanish discussion)

AM: In order to start a waste transfer station, what would you say are the required steps for this process?

Maritere Padilla (MP): For us it wouldn't be a waste transfer station. For us it would be a collection center. Or recycling center. It would be a recycling collection center and everything else would be given to the municipality… ***(inaudible)****… A center of collection, where I segregate and discard.

AM: So both processes where collection of recycling and transferring of waste doesn't happen in one facility at a time.

MP: Yes, but it wouldn't be called a waste transfer station but actually a center for waste collection… ***(inaudible)**…* it is not the same as waste transfer station with the docking platform where the truck can enter. If you were going to have something like that. It would depend on what scale of a facility you are thinking of. If you want people to come and bring materials… ***(inaudible)**…* Center of recovery materials.

AZ: Materials recovery facility plus segregation.

MP: If the focus of the materials on separation then that would be a facility of waste segregation like what they have in Cidra. Cidra has a small center of collection in a single stream process.

AM: For Cantera we are not looking into facilities the size of Guaynabo but something much smaller.

MP: Something much more basic.

(Inaudible)

S: She says that the Guaynabo facility receives everything already clean and it has been picked up by the recycle workers. I understand that what you want to do is something different because what you want to do is that you want people to come out of their houses and bring the garbage, all of it in one package, to here. I'm thinking that you shouldn't visit Guaynabo because it is not what you had in mind. Is there a civic facility that receives the trash mixed up into one?

MP: Are you thinking to require the citizens to at least segregate plastics, aluminum, paper, that they have single stream recycling material. Single stream, everything mixed? Because that would be a materials recovery facility, that the citizens would bring their bags with recyclable materials all together in a single bag and then you can segregate and anything else that isn't useful you can send it to the landfill. Cause that is one thing. Another thing is that you have a separate trash bag for the materials.

AM: That's what we were thinking.

MP: I think that in time, you can educate the people to do that.

S: But you can also consider that if your first step is interviewing you can ask the person are you willing to only bring the trash bag with all the materials inside or are you willing to commit to

this initiative and at least separate your recyclables in one bag and everything else in another. That way you can measure for a good participation rate with your analysis and in your results you can say whether or not they are ready for separation in their homes.

MP: Another thing is that with regard to permits it is easier to get the permits when dealing with larger wastes such as mattresses, home appliances, etc.

***(inaudible)* for a minute**

AZ: We are just looking for the houses in the areas where the municipality cannot enter.

S: The street are very narrow.

S: Why dont you have community bins where people can just take their trash where municipality trucks have access to.

MP: *(inaudible)* (" big bins" "the huge ones"). Something about getting big huge bins installed

MP: That is not a transfer station. A transfer Station is when you have a truck it goes to a platform and it just throw the trash truck ***(inaudible)*** and then another truck goes to the landfill. If you need a place where the municipal truck can have access to take the trash all you have to do is take big cans / containers in a place with access for the truck. For people to take the trash there. But it would be a great opportunity to try to integrate the recycling program not only to get people to bring all the trash together but to try to segregate the recyclable material so that you will be sustainable.

I: My worry is that all the trash is going to have food (etc.) are you ready to deal with all of that?

S: I have a question. Okay, your idea is for people to take to the installation all the garbage, domestic, all the mattresses and all that.

AM: With greater emphasis on the large scale items like the mattresses.

AZ: This is an example. This the margaritas ***(shows an image)*** which can not be thrown into the bins. This is recyclable… .

S: But not excluding the packages you know the domestic waste, ***(inaudible)*** I agree with ADS in terms of the vision the name.

MP:THE NAME!!

S: Not only the name but also…

MP: He is already fine with the vision it is just the name!

S: You should pursue for citizens to at least recycle and have them put their recyclables in one bag. You can have three containers in the installation (facility) for big waste, domestic, recyclables, understanding it would be aluminum, paper, plastics. Are you currently taking glass?

I: For the moment no, unless they can find an alternative that they can… ***(inaudible)***

S: At this point we are not recycling glass at this point. If you find someone that is willing to recycle glass then...

AZ: There is someone looking into that. Reciclaje Del Norte

(inaudible)

I: (repeats what she said before about the waste bins)

MP: It is possible to do it that way but the best way is to educate the community about education and separating the recyclables.

MP. The problem is the access and the capacity of the community bins. You can find a place where the municipal trucks can have access and pick up the trash and at that point you can have trash bags for solid waste and the bulky material, there is another truck of the municipality that will pick up that too, and that would not be a transfer station, that would be a recollection station, but you should try to establish a segregation facility and the easiest way is to ***(inaudible)*** insist single stream from those citizens that will be voluntarily bring the recycling material at least in a single stream.

***(inaudible)* Spanish speaking conversation with multiple people**

S: I think you should visit Cidra because it is not an expensive station and is a good example of segregating materials. You will have to coordinate with the municipality of Cidra for a visit.

S: There in Cidra they receive only recyclables, which are already cleans and comes from the trucks that pick up recyclables in the community. It is single stream.

MP: They have a conveyer where they have bags that they open up and then segregate, when things that cannot be separated and recycled are sent to the landfill.

(inaudible)

MP: Also they are very good about their statistics and record keeping.

Victor Hu (V): Do we get that from them or do we ask you?

MP: I am going to find the information from the recycling coordinator in cidra and send it to you and make contact with them.

AZ: Any other place you would recommend to go see?

S: Send these questions to me in an email and I would be willing to work those out with you and working alongside with ilsa.

(inaudible)

S: You have a question here regarding, noise odor, traffic no , we at the EQB we have a noise pollution division and we can also do inspection to the installation regarding noise. You are pursuing a change in culture but the ET in Caguas it receives and it has a bad odor if you are in the building.(***(inaudible)* everyone talking at once for a brief moment)** The Caguas transfer station is a real transfer station because it has the trucks coming in, so that is not what you are thinking. The only way to keep the odor down is keep everything clean. The one in Caguas is almost exactly like the one you showed in the PowerPoint.

S: There are some questions that we cannot answers.

I: You can send the questions to our email.

S: We are going to do the same thing. I have a question which is your final objective. Do you want an analysis of the viability? Or what is your final objective?

AM: We wanted to leave a set of recommendation so that the CDIPC can have and it is not going to be a final say.

AZ: The idea is to create a station that is self sufficient, so that anybody that goes they would have to pay and that we are giving them the opportunity to not throw it anywhere. Most of the people come here to Cantera and throw their trash.

MP: But are you guys thinking about picking up and take it to Reciclaje Del Norte?

AZ: That is a possibility.

AZ: One to two dollars or whatever.

I: So if I want to go I have to pay to get rid of my recyclables?

AZ: If you have a fridge and you want to throw it away.

S: You will have to figure out what they are going to have to pay for one mattress. You will have to build some kind of incentive plan. How you will promote change from what has been the historic pattern here that is the challenge? Understand that you have to charge a fee, one dollar to dollar, whatever.

S: Maybe people leave the mattress in front of the house because I don't have the transportation and then if I have to pay transportation and then pay you…

AZ: It will cost them to dispose a mattress about 10 to 20 dollars.

(inaudible)

S: It would be an extension of the municipality services

AZ: Anything that we do will have to be coordinated with the municipality. You want to make it feasible we need the municipality. If you have a big item, a mattress or such, big huge, there is no way you can handle that. You will have to pay and you will have to pay a lot of money for something it in a truck and put in the next area. So that is a lot of time, gasoline so it will cost you 20 dollars or more. So the way we see it they just take the garbage and throw and for one or two dollars. The municipality would pick it up.

***(inaudible)* due to muffled sounds**

AZ: The problem that we are facing is that the municipality takes a long time one two or three

***(inaudible)* because people talking all at once**

MP: But not the whole municipality. in the case…

***(inaudible)* because people talking all at once**

MP: The regular trash…***(inaudible)****… single stream.

***(inaudible)* due to muffled sounds**

MP: What one has to see, depending on the volume of what you have if it cost effective. because

it is going to cost you in employment

***(inaudible)* due to multiple conversations**

MP: I think that if you guys are looking to do something really small where one can take and receive so that it isn't just placed anywhere I would put much larger containers where the municipality does have access and also I would have a single stream recollection center that would hopefully have the municipality pick it up there as well.

(Inaudible)

I: In order to sell your trash but also pick it up. There are municipality with the capacity of recollection if it would cost effective

MP: It goes to the recycling center to sell the recyclables and I just put here and I just dispose. I dont see it as bad, I see it as (***(Inaudible)* Summary: Discussion about about a place where where one can take his/her items and sell the items, materials, etc. for cash.)** With a small community group that is in charge in order to do pickups. That way you can have employee opportunities and you can encourage the community to take part and at the end of the year you can have an activity.

AM: So you suggest to organize a group in the community that could coordinate the picking up of trash around the neighborhood?

I: Maybe not like that in the beginning you can start introducing the idea people and you can introduce a business. You want them to feel part of something and create opportunities for them so this might be a good way

S: Send this email to us with these questions. They have the information regarding the DS2 permit.

AZ: No hazardous materials.

I: Remember to check out Law 22. I think you should meet with the municipality. You have to meet with them.

S: You can ask them in more detail about what they are doing here. If they have any plans for expanding their services to the community. How many trucks come here to the community? They are the only provider of the services. The actual services that is being provided you have to direct that to the municipality. Do not be afraid to contact me, I support educational products.

AZ: Thank you very much and we will be talking to you at some point.

AM: Thank you for everything, and we will email you soon

AZ: The lady with the permits is this one, Noelia

Noelia Rosa (NR): Hi

AZ: She is the ***(inaudible)*** here in Puerto Rico

AZ: She has a lot of knowledge on environmental systems and her advice is going to be very important. We can do this in Spanish, English or Spanglish

NR: Spanglish, I am the Sub Administrator for the city, I work for the environmental themes and other waste management of the municipality. So you have a project right?

AM: We are trying to figure out the viability of a facility that we at first thought was going to be a waste transfer station in Cantera in order to address the open dumping that is going on around the community. We want particular emphasis on refrigerators, cabinets, construction debris. We also are hoping this will give people an opportunity to come in and drop their things and then that can get it transferred to other places. So we have a lot of concerns regarding regulations and zoning.

NR: Do you have a site in mind?

AM: We have a couple of sites in mind. There are sites that we think would be suitable in cantera where they can remain hidden in the community and lots of space. What is a good way to determine site locations?

NO: The zoning is very important. If you have the sites I can check for you what is the zoning for those.

MP: Who picks up the trash from here?

(inaudible)

AM: We have a couple of questions we wanted to ask. We do have some sites planned but currently we are waiting until those locations are a little bit more concrete.

NR: Send it to me through email and I can check with the planning area of the municipality what is the zoning and the regulation of the OPE to see what is permitted. I don't know if that applies to special waste, environmental waste documents have a disclosure statement for transfer station

but I have to check the specification.

NR: If you have the sites send them to me.

AM: With the sites we still need to analyze them so we wanted to know the best way to determine accessibility to utilities.

NR: You would have to check with the water and electric authority the access to utilities. We have a GIS, Interactive Puerto Rico, which will tell you what kind of utilities you have in the area. That is an internet application in the planning board site. "Puerto Rico interactivo" . If will help you determine if you have access to power, water, electricity, or sewage systems on the site.

AM: What does GIS stand for?

NR. Geographical information system, which layers all of the information with the utilities. That can be obtained from the Puerto Rican planning board.

*ADS packs up and leaves

AM. Thank you very much for all of your help.

I. You learned a lot today. A lot of information was discussed so I know it may be hard for you to understand what to do from here. It is good to do it in steps, first clear up what you want, we evaluate it, and then we talk about permits, costs, ***(inaudible)*** too much information and to many ideas. But soon everything will begin to shape up.

NR. So the utilities, we have a GIS that can be very easily obtained from the Puerto Rican Planning Board website. The costs we have to check how you want to do this.

AZ: We are getting a good idea from the guys from Reciclaje del Norte and we are just trying to get some ideas to have a preliminary basis on this.

AM: We had a visit with them earlier today. They started out as a non-profit community organization that built itself up over the decades. That is kind of community run facility that we are looking to establish. We are currently not sure of some of the key components that we want to include in this waste transfer station with respect to the design options.

***(inaudible)* Speech between Alfredo and Noelia is muffled**

NR: We have a waste transfer station in San Juan that is operated by a private contractor so it receives everything right now and we pay them by ton.

AM: We are looking for something on a smaller scale with high emphasis on big waste.

NR: I would focus on special waste that is consumption waste, maybe tires, and aluminum, there is a big problem of that here in this community, see that is why we have all the illegal dumping. We have small contractors that pick up and dedicate their lives to picking up construction debris but do not want to pay when it comes time to go to the waste transfer station of San Juan. So we have been thinking about a container where people can deposit but then if you don't have someone that is dedicated or watching it is going to convert to an illegal dumping site because there won't be any order. What you are trying to do will need to be viable but you can't be charging people, if you do then the charge will have to be a very low price. By talking witht he municipality you could form an agreement where they would only pick up from one designate location rather than many from around the peninsula.

AZ: The point here is that we don't want to compete with the municipality but we want to understand how we can work together to establish something.

NR: You are not competing with us, if you do something like that. I think you are helping us.

J: A topic that came up in the discussion with the ADS and EQB was how would the process of collection change if it was a facility for special waste. What does the municipality do with special waste?

NR: What I am telling him that if I can go to just one place and pick it up I have some kind of savings in diesel, in employees, in time, and work.

AM: That is what this waste transfer station could provide for the municipality. One area where they can come by and minimize travel. Another thing that we are thinking about is how can we change people's' habits from open dumping or getting them to actually use the station.

NR: You have two ways. One is through education and teaching, campaign, telling people that this is a place where you can throw away your construction debris. The second is through penalties.That is a little bit difficult because in order for me to give you a ticket I have to see you. That is a little bit more complicated. I think that people would do it. These small contractors, that is just throwing this out in illegal dumping areas. If they can take their trash to this place I think they would do it.

AZ: We are expecting to charge them per the weight.

NR: That is something that I was going to ask, how were you going to finance it.

AZ: For it to work we are going to need to charge something. We have talked with the RDN

regarding a cooperative so we are currently exploring some options.

AM: Are you familiar with any of the safety regulations that need to be addressed or is there someone that we need to question for that?

NR: We have the OSHA regulations that are the same as in the states. and as part of the EQB permit you have to an emergency plan. Maybe they can help you with that information. But for further safety regulations that is through OSHA.

J: So we have been looking at two waste transfer stations, Cataño and Guaynabo and I guess what was your role in the establishment of those ones?

NR: In the waste transfer stations of Cataño and Guaynabo I do not know. I can tell you about San Juan. In San Juan we have the big transfer station on Kennedy Avenue, you can visit that one. I have a contract with a private company and I pay them a quantity for tons. That is the final disposing of the waste and they take the waste to the Humacao landfill.

AZ: Does the municipality have something similar to what we are discussing right now?

NR: No, I don't know of any. One that may be similar is Martín Peña Recycling and Reciclaje del Norte.

AZ: We were also recommended to go to Cidra, which is a small recycling recovery facility that recovers all different kinds of materials at the scale that we are referring to. It has to be a very small scale facility, very simple.

(inaudible)

NR: In the case of construction, if you guys are to pick up construction debris without the **barrilla,** then it is cheaper to dispose of. They can use the recycled material for the roads, some tips and tricks that would be helpful to know. But the scale you are talking about it would make it more manageable. Inades Rodriguez, is the one in charge of the San Juan waste transfer station.

AM. Thank you for all your help Noelia. I am sure we will come into further contact and communication. You have been a great help to us and have provided us with valuable information for our project.

Noelia leaves and that concludes the interview

Appendix N: Transcript for the San Juan Waste Transfer Station Interview

Date : November 14th, 2014
Location : San Juan Waste Transfer Station
Attendees : Alejandro Miranda, Alfredo Zapata, Hannah Reinertsen, John Cotter, Pablo De Jesus, Victor Hu

Alejandro Miranda(AM): Do you know a little bit of the history of this how this facility started.

Pablo De Jesus (PJ): Well uhh well when the San Juan landfill closed, that was in the year 2000 2001. They needed other facilities to handle their garbage so they constructed this transfer station ok. Uhh since then uhh we receive all the garbage from the city of San Juan, also commercial garbage and uh construction and demolition debris. And uhh several of commercial customers such as private companies that handle garbage. Our daily volume is uhh around 11 hundred pounds a day. and all the garbage we receive in these facilities goes to the Humacao landfill. 'H' 'U' 'M' 'A' 'C' 'A' 'O'. Those facilities where that landfill is located is on the east part of the island. The garbage we handle is just residential and commercial, no hazardous waste or tires or chemicals so and so.

John Cotter(JC): What about big items like mattresses and appliances? Like furniture and dishwashers and stuff like that.

Pablo De Jesus(PJ): We receive all that kind of stuff as long as they can fit in our transfer trailers. transfer trailers are the ones that we use to move the garbage from San Juan to the landfill in humacao. To show you or let you know how we work we will start at the scale house so you will have an idea of how we work. So if you have a minute or two we will go to the scale house. And I will show you how we handle all the incoming volume and you can see what the scale pays per tons on a daily basis. If you have any questions just let me know if I am talking too fast.

AM: Oh no no.

JC: You're fine.

PJ: If you can't understand me let me know also. Ok, let's go to the scale house and you can see how the scale works and then we can go to the tipping floor and you can see how the tipping works. How we load the trailer and then you can see the outgoing trailers and how we manage them.

AM: Is it ok if we take pictures?

PJ: Yeah of course. This your first time in transfer station?

JC: Yeah. Yeah it is.

Hannah Reinertsen (HR): We drove through the one in Guaynabo.

JC: Yeah we've seen a bunch, we've seen one in guaynabo but we didn't get to take a tour of it so.

PJ: This is the biggest one on the island.

JC: Yeah.

PJ: Come with me.

(inaudible)

PJ: That is an outgoing trailer, it is going to the landfill at this time.

AM: To the landfill?

PJ: Yeah to a landfill. It will take him around 3 hours to go on the round trip.

AM: Wow okay.

PJ: That truck should have around 26 tons around 52 thousand pounds.

JC: Which communities did you day this station serves?

PJ: Mainly the metropolitan area but our principal customer ,our main customer, is San Juan municipality.

JC: Okay thank you.

AM: What is this for?

PJ: This is the scale.

JC: Yeah, that way they can weigh what comes in.

PJ: This way in here. This is Hector Diaz he works in the am, 4am until 1pm. Then we have another scale operator that works from 1pm to 10pm. This is a scale ticket from a truck from the city. It came in ten minutes after 9 this morning and the weight 1.40 tons. Ok? This is the gross weight with is the fare for the truck, this is the net garbage that is in tons. Okay? You divide 2800 by 2000 to have this.

HR: How much does it cost?

PJ: Of course it doesn't show it over here but we charge the city a fee of 35 dollars per ton to handle it to deposit it at our landfill.

HR: Do you guys have like other small transfer stations that come through you before going to landfills?

PJ: No no. As a matter of fact here on the island I don't think that there is no more than 10 transfer stations on the whole island. Yes, we have some landfills and for example in the island they have a landfill that ***(inaudible)*** but in the near future they are going to close those landfills so they will have to move to transfer stations so they will have to construct them and move the garbage to transfer stations. Let's see if one uhh we'll have a truck incoming truck so you can see how our operation. Do you have any question?

JC: Yeah, you said you charge 35 a ton, do you know how many tons you get a day or a week or a month at a time?

PJ: Well our daily average is around 11 hundred tons. But that is combined for our operation we have commercial garbage also from private customers and from citizens but our main customer is the city of San Juan. And that is the reason why this facilities were constructed just to serve the city of San Juan.

JC: Yeah, so before this did it just go straight to a landfill. Did the trash just go?

PD: That was the old landfill that was closed in 2000. If you want to take a look to the landfill you can see as soon as the garbage or the truck gets onto the scale and he is properly weighed then he goes to the tipping floor so he can dump his garbage at the tipping floor and after that we have to reload it and we put that garbage in our transfer trailers. This is a little slow at this moment but soon we'll have a truck so you can observe the operation okay.
Alfredo: Can you tell me about the permits and uhh supervising agencies do you have the ADA or the municipality.

Alfredo Zapata (**AZ)**: Environmental quality. Waste management.

PJ: The ADS, the city ***(inaudible)***

AZ: EPA is not.

PJ: Yes yes they've never been here but they can visit us and supervise our works.

AZ: ADS is Autoridad de Desperdicios Sólidos.

PJ: The Environmental Quality Board, they visit us every two months more or less and they stay here around 5 or 6 hours and they take a look at how we manage the operations. Another thing that I would like to make you know is that on a daily basis we send reports to the city regarding all the incoming garbage, no matter what. Okay? If it is commercial or industrial or residential whatever we send them daily reports so they can get an idea of what's the incoming garbage into the station. Okay? And here comes the truck. That truck is from the city of San Juan.

(inaudible)

PJ: Okay so soon as he gets onto the scale the driver should get off the truck. Nobody is allowed to stay in the truck so we can have the set weight. He then defines the number of the truck and the number of the truck is that four digits after the 13 its 7914 that is the ID for that truck.

AZ: This guy knows, knows the operations.

JC: Yeah he is great.

(inaudible)

PJ: It's going to show the transaction you can see at this moment. So number ID, customer ID see the San Juan driver name. Okay, this is the fare for the truck and this is the weight that you will see on the ticket. That is a private customer the next one is a private customer. It's from the ports authority. That is the ticket. It's gonna wait for us so you can see the whole process. Okay?

(inaudible)

PJ: An average truck weight should be around 7 or 8 tons more or less but it depends on the type of garbage that it is handling.

HR: Do you guys do anything with recyclable?

PJ: No, no they have separate trucks for recycling and all of those trucks go to the other facilities. But we segregate all the trees and stuff that is not garbage you will see.

HR: What do you guys do with the tree debris?

PJ: All the debris it goes to the landfill but in a separate place and they they mulch it and they use as landfill cover. Okay?

HR: And what do you think about something like this in a smaller town like cantera, do you have any advice for a smaller scale of operation?

PJ: You are talking about?

HR: Like a smaller waste transfer station in a smaller area.

AZ: Let me explain just a little bit more. We have a big garbage problem in Cantera.

PJ: Yeah I know.

AZ: Everybody throws wherever they may think that it is on the corners and in the streets. So it is just a very small scale transfer station.

PJ: Probably in the future you will see that this moment I haven't seen an operation like that one in the island. But you have a lot of places here in the island that most people don't get involved in you know handling the garbage publicly so it should help problem and also if we do some kind of small transfer station probably it will resolve that situation.

AZ: They are looking for the needs of facilities you should provide in order to operate that kind. Just incase what fineness in the soil, what permits, how is the operation do you need a building or can it be in an open space?

PJ: Transfer station should be in a closed space with concrete floor and proper sewers for all the leakage so the leakage can go to a holding tank and then from that holding tank we will pump it up and dispose it correctly.

(inaudible)

PJ: Well it's some kind of sort that shouldn't go to the public systems, or I don't know how to say it. That's the reason why landfills have liners so the leakage it.

AZ: Does not out on the groundwaters.

PJ: Yeah.

JC: Do you guys have a place here where civilians can come and drop stuff off if they have it

like an?

PJ: Yes.

JC: That's kind of what we were thinking about like a place where the people in this community that we work in can come and drop their stuff off so that way it doesn't clog the whole municipal collection system area.

PJ: We have several private customer, small customer, and all the people that use the facilities to dispose of their you know since their domestic garbage or all the furniture or whatever. So lets go upstairs so we can have a look at the operations.

(inaudible)

PJ: Feel free any questions you think you may have that the guy is doing and how it happening.

VH: I'm just trying to be the recorder.

(inaudible)

VH: How big is this facility?

PJ: 18 hundred square feet. That's an initiative that we are doing, we are separating all that cardboard in that corner you can see that cardboard we are segregating the material in that corner. Okay? These facilities were not designed for recycling that is something that we are doing as an initiative to segregate all that cardboard.

(inaudible)

PJ: That is a compactor, press compactor, we use these facilities also as a company for our private customers so that's one of them.

AM: There is a lot of birds here do they cause a problem?

PJ: Yeah, yes they do, it is same at the landfill.

AM: Have you tried to find ways to get rid of them?

PJ: You've got to be careful with that.

VH: Do you guys have any trouble with like mice or vermin or rats or anything?

PJ: Well not a problem, we have an exterminator company, but we see them especially at night.

AZ: How many employees you have here?

PJ: For these we have around 30, 35. We have four heavy equipment operators that are the ones that are handling the garbage and all the loading the trucks and the trailers. We have two in the morning shift and two in the afternoon shift.

(inaudible)

PJ: That operator is loading a trailer at this moment.

AZ: Is that a trailer over there?

PJ: Yes that, that is a trailer we cannot go inside it is too dangerous.

JC: Yeah.

PJ: Are you gonna stay on the island for a couple of weeks?

HR: We are here until December.

PJ: Oh yeah? And when did you arrive?

HR: End of October.

PJ: Okay. Gonna stay two months.

HR: Do you need a lot of training to be an employment here?

PJ: Yes, yes.

HR: A lot of it?

PJ: Yes.

HR: Does it come with like a license do you need to get certified?

PJ: Yes, we emphasize this area's security issues. That's the reason why that guy is ***(inaudible)*.**

HR: Is he just watching like is he security?

PJ: He is waiting for a truck, he has a a harness as you see a truck going out with a trailer he knocks in all the borders of trailer and he gonna install the tarp so the trailer can go out to the landfill.

HR: And he has the harness so he doesn't fall?

PJ: Yeah it keep him from falling. ***(limited audibility)*** This is another is also very important all those those ***(inaudible)*** are equipped with focus scale system so the driver or operator knows once he is moving into the trailer so he can lower it correctly. No overloading and no underloading.

HR: Where do people get the permits to work here, like how do you get trained?

PJ: We train them and there are certain requirements from the government of Puerto Rico like they should have a CDL, a drivers license, special DL also certain knowledge of the laws on ***(inaudible)*** certain experience handling trailers, those are some of the work requirements?

HR: That a company requirement?

PJ: Yeah.

HR: Okay.

PJ: Let me call that guy so you can take a look at the interior of the…

(inaudible)

PJ: We are moving rather constantly, we start here the operations start at 2am in morning and conclude at around lets say 10pm at night. At this moment we are moving from San Juan to the landfill and after 2pm we are done and what we start working with all the empty trailers loading them for the next day, so when the our drivers start at 2am they have loaded trailers and they have also spare trailers that are already loaded. We call that operation 'truck and hook'. They bring an empty trailer from the landfill and they pick a loaded one and they go again to the landfill and we continue doing that throughout the whole day.

HR: How many trucks do you have that go to the landfill?

PJ: We have 16 and around 30 to 32 transfer trailers, working constantly, and we have a station in our facilities. I don't know it takes probably 6 or 8 hrs.

HR: Does this place take a lot of utilities to operate? Do you need a lot of electricity and water?

PJ: Yes, mostly electricity for our shop.

HR: And you have like a sewage tank you said for like all the leakage?

PJ: Yes there are some drains in the floor and there is a holding tank. And after the tank is full we pump it up and move our leakage to an industrial landfill in the south part of island in Puerto Rico and we dispose of that leachate in that industrial landfill.

HR: Okay.

(inaudible)

AZ: Did you ask about electricity and utilities?

HR: Yes, he said it's mostly electricity, he didn't give any specifics.

AM: I don't think he knows them off the top of his head.

HR: We can ask him to send the utilities, like the costs.)

(inaudible)

PJ: With those tires, solid tires, there is no flat tires and no downtime for tires. Without that time caused by tire problems.

JC: How long do those last for?

PJ: Around 8 months more or less. We will have to replace those tires by end of the season.

(inaudible)

PJ: Any questions?

HR: We were wondering if you could send us your utility costs and operational costs in an email later? Would that be ok?

PJ: I don't have that kind of information but our business manager should can probably have that information for you.

HR: Can you get that contact for us?

PJ: Yeah of course.

HR: Thank you.

PJ: If you have any further questions you can call me i gave you my card.

HR: Thank you.

PJ: But you should visit the landfill, in Humacao.

HR: How far away is it?

PJ: Around an hour and half.

(inaudible)

PJ: They can show you facilities it would be good experience. A little bit of bad odors but thats it. Are you studying some kind of environmental, studying some kind of environmental…

HR: We're thinking of making like a smaller scale transfer station in Cantera.

PJ: Ahh okay.

AM: Something much smaller than this.

HR: Either a holding one or a transfer one.

AM: A place residents can bring like their waste.

PJ: Been in Cantera for a couple of times?

HR: Yeah it's just when we got here in the end of October we started.

PJ: In Cantera?

HR: Ohh we work there every day.

PJ: Ohhh yeah. Well I used to pick up the garbage in Cantera we had that contract for domestic garbage and I did it for around 8 years and it is a big mess, always. And we used the small trucks, pickups…

(inaudible)

PJ: To pick up the garbage in those narrow streets. Questions?

JC: You've given a lot thank you.

PJ: I told them if they need some information can call me. If want to visit call us again. You should visit landfill sometime. It is big landfill and very well equipped with wells to extract leaching. Some kind of extracted gases from landfill also produce energy, if you have an opportunity you should visit it. Just let us know and we can set arrangements. Ok?

AZ: Thank you we appreciate it. Shall we go? You have an email so they can contact you?

PJ: Yeah they have my card no problem.

VH: Thank you.

JC: Thanks.

PJ: Not a problem.

Appendix O: Transcript from Cidra Materials Recovery Facility Interview

Cidra Materials Recovery Facility Transcription

Date : November 20th, 2014
Location : Cidra Materials Recovery Facility
Attendees : Alejandro Miranda, Alfredo Zapata, Hannah Reinertsen, John Cotter, Maria Santiago, Victor Hu

This interview/tour took place in a noisy environment that made it difficult to accurately record conversation
This interview and conversation was done in Spanish and transcribed into English

Alejandro Miranda (AM): We are considering developing a waste transfer station in the community of Cantera similar to the size and design of the recycling center that you have here in Cidra. So we are interested in observing similarities and comparisons between this station and the station that we are expecting to develop.

Maria Santiago (MS): I was just talking to Alfredo about one of the most important things that you need to take into consideration is education. Community education ***(Inaudible)*** and understanding the laws and regulations. When you begin the implementation of the facility one of important phases that you have to overcome is the community education. The people of the community are sometimes alienated from the importance of the project but by educating you can make them feel important and significant in their roles. When we first started this facility it was a little difficult to gain sympathy and understanding but when they started getting involved over what was the purpose and the benefits of the facility people began protecting and participating their environment and community . I think you guys may encounter a similar result in your facility development.

AM: When did you first open the facility?

MS. We have 18 years of experience doing this but the facility was constructed about 8 years.

AM: How long did it take to gain acceptance and participation from the community?

MS. Okay. Look, in the beginning when we first started one of the first projects, I'm not sure if you are familiar with it, but there was project of "Blue Bag Recycling" in Puerto Rico it started in the municipality of Cidra. ***Something about a book that logs the waste management practices in Puerto Rico and that explains that Cidra was one of the first municipalities to push and create this initiative*** The facility didn't gain acceptance by telling people that they

needed to recycle. The way we did it was creating a **"raw"** education program(Note: By saying "raw" she means explaining to people a harsher perspective or reality of the problem at hand). When I say **"raw",** I mean what bad things am I doing from my house that could harm my family. When you touch the fibers ***(Inaudible)*** with what I (the citizen) am doing the people begin to react. For example, one of the things that have greatly impacted the community is explaining the mismanagement of trash in people's households. I talk to residents about when you open a food container to consume it that begins the process of bacteria growth ***(Inaudible)*** which can create ulcers, cancers, which can heavily impact the public. So the idea is how can you prevent the enemy in your own homes. We can have homes to be really clean but we have an invisible enemy. And that instead of throwing these materials into the trash bin, by recycling and not keeping it ***inaudible phone ringing*.** Other things you can do is education. Another alternative that has also worked is the the alteration ***inaudible*** is starting ***inaudible*** showing the community the consequences. ***inaudible*** People throw away their trash creating bacteria which is ***inaudible*** and creates illnesses which is passed on to rats, and then to man. 25 million people ***inaudible*** many of the current infections that we suffer from comes from solid waste. By making the information you present to them "**raw"** it makes people experience greater impact. What is hard is not creating awareness but creating that sense of being a member or susceptibly experiencing the effects that waste and bacteria can have an effect in your family and your lives. Once you gain sympathy like that then you can start pushing awareness and education much easier. Okay lets go see the plant and you can ask questions as we walk around.

AM: Is it okay if we take pictures and record?

MS: Yes that is fine.

AM: *Inaudible there is a large amount of wind* Aluminum cans, cardboard, newspaper, large metals, all of which we classify daily.

AM: Do the workers need to go through some kind of training?

MS: Yes, they need to be familiar with the recycling categories, materials, operating machinery, they have to be very publicly oriented because they need to keep in communication with our customers and residences ***something about chemicals and protecting their health***

inaudible way too windy

AM: About how many workers do you have working here?

MS: About 23. About nine people are responsible for collecting. We have four trucks that go different routes every day collecting the recyclables. Each vehicle has one driver and one helper. There is always seven employees working in the facility at a time. Employee number one is

responsible for newspaper the next person is responsible for plastics, and everything else is taken by the last person. ***inaudible*** Then we have a separate area here on the ground for aluminum and the boxes of cardboard. We also have an additional box with plastic bags. If a material doesn't have value or isn't processed here in Puerto Rico then we do not manage that material. If there is something that a company looks for that we are throwing away and that they need it then we are willing to incorporate that into our separation processes. Everything depends on the current market for such items here in Puerto Rico.

Alfredo Zapata (AZ): Do you guys sell it to other recycling companies such as Reciclaje del Norte?

MS: Not to Reciclaje del Norte but to another company called IFCO Recycling. It is one of the largest companies in Puerto Rico regarding the recollection of recyclable materials. If one has a good production then they can make ***(inaudible)***. If you created negotiations with them then they can provide you with containers which they have provided for us. So they give us containers and we sell our products to them at a cheaper price maybe one or two cents below what we would sell them to other companies. If I had to buy the containers it would come about to me using one or two cents for these. In the end it comes out to the same thing

AZ: All the employees that are paid here are…?

MS: No, we have a job that is *inaudible* just starting to generate now, we have a job aside with the municipality what we generate here is for all the operational costs, maintenance, electricity, water, computers and etc.

AM: Does this facility only cover Cidra?

MS: It is for Cidra, despite that we still get lots of people from all around the island to orient themselves, many other municipalities use our recycling center as a model. But service is only given to the residents of the community.

AM: How big is the area here?

MS: I don't know it off the top of my head but I can give you that information later on. The facility here was in fact made by our very employees. Initially, this was an abandoned site that that was once a slaughterhouse. We utilized every person we had when we first began, construction, mechanics, each person positively contributed to the development and maintenance of the facility. By utilizing our resources here it came out much more economic to build this with what we had. As you can see around the odors are very minimal, and it maintains very clean.

AZ: If someone brings you something that is not recyclables.

MS: We orient it. But we do not take it.

AZ: About how much trash do you guys pick up every day?

MS: The minimum of recyclables we pick up everyday is about 9 trucks filled. For trash there is another contract. We pick up every Friday and distribute bags of 55 gallons picked up weekly. Based on the different sector there is a different day of the week that gets its recycling picked up. The community of Cidra is greater than 50,000 and 17000 inhabitants.

AZ: About how many pounds of recyclables do you deal with everyday?

MS: Annually, we are picking up between nine and ten million pounds

***Inaudible strange sounds in the background (5+ mins) ***

MS: This coalition was created because we were well oriented it was decided to create this coalition because for us to enter the coordinators we have much more experience that we can help assist

inaudible for 9+ minutes extremely loud noises and windy

MS: I can get you that information at a later time, currently the person who maintains the statistics is not here at the moment. But last year we had approximately nine million pounds but this year it will be much more because we have more routes and collection areas.

AZ: For maintenance, how much do you spend on things such as electricity, water, and other utilities.

MS: The municipality provides service, so they don't pay the usual rate for the electrical power. ***inaudible 3+ mins***

MS: Cidra is a class D medium sized facility. Facilities of class A are large such as the one in San Juan, Caguas, etc. Cidra has been put to compete with A class municipalities because we serve as if we were an A class municipality. The quantity is enormous and have won many awards for environmental projects. ***Inaudible*** in education we were very advanced.

Inaudible

AZ: *Alfredo wanted some more information regarding the quantity of what they gathered*

MS: I can give you further information about that later on because the person in charge of the statistics isn't here at the moment. But we had about nine million pounds of recyclable materials collected. This year it will be much more because we have increased the number of routes throughout the community to target more people.

AZ: You guys pretty much recycle everything right?

MS: Right. We have a separate container for cement in the conditions of the municipality. Not for the residential.

Inaudible

MS: We also recycle oil and butter from the kitchen. In order to collect this we needed to introduce another community education program in order to encourage people to separate these as well. ***Sounds like she is describing the process or dealing with people and how people were given a container, and they are responsible with filling it with the oil***

Inaudible 3+ mins

AM: Do you guys deal with large scale items such as refrigerators, sofas, furniture, etc.?

MS: Yes we do, but it doesn't come down to this plant, it goes down towards the other one by the ***Inaudible***. That is where things such as washing machines, metals, construction debris, vegetation, are dealt with.

Inaudible

MS: The quantifications, the statistics of the communities that participate, understand the necessities of the community, see who administrates.

AZ: They keep record of everything coming into and out of the plant in order to understand projections and costs they require. Do you guys manage dangerous things?

MS: No we do not manage any dangerous materials. There have been people that have brought things in and we ***inaudible***

AZ: So what you accept here is paper, plastics, oil?

MS: Plastics, aluminum, papel, newspaper, etc. Plastics with categories between 1 and 5 are recycables but we don't deal with anything higher because there are no proper ways to deal with them on the island. The lower the number the more potential that item has to be recycled. ***she describes how its gradually becomes harder to recycle higher and higher plastics numbers***

Paper can be separated into high and low quality where higher quality paper has to do with computer and thicker cardboard, while low quality is similar to newspaper.

AZ: All the people that work in this facility are from Cidra?

MS: Yes all of them are.

AZ: Because we want our waste transfer station to provide opportunities for people who live in the community.

MS: We do a similar thing where we hire as many people from the community as possible.

AZ: Have you guys picked up on most of what has gone on? I am sorry that we have been speaking in spanish this whole time.

MS: Education is very important because it is what is going to decide if it is going to make your facility successful. It is very important to find ways to gain sympathy from the community.

AZ: We understand the education is an important thing for this effort in order to show people the effects of proper waste disposal practices. How would you recommend us to go about doing that?

MS: Every community has its community association ***I think she meant committee*** and you have to figure out what inspires them. The schools, the kids, it is important to target the youth. Create some community volunteering opportunities, educative programs or series, establish tours when you first open up the plant. Many schools come down in order to have a field trip so we give the kids a brief movie regarding what we do and the importance of recycling. That part of integrating with the community is very important. I think the community is very conscious of its environment. The people know that the environment is important and they are willing to work to conserve their environment.

AZ: Those are the machines that the recycling gets the recycling, correct?

MS: We utilize some tubes with more or less, and they invented some poles, for when things get stuck in the tubes they can use that to remove any waste that is stuck inside. And they come pick it up when it gets close to full and they take the machine and get another one ready.

AZ: Did they also donate this machinery to you?

MS: Yes they did, they also supply maintenance.

AZ: How many trucks do you have? Three?

MS: We have 4 trucks. We additionally, have a much smaller truck that can go to harder to reach areas. Here we have the place that I was talking about earlier. This is so that we can properly clean it here and we don't impact the ground. All this area we are organizing because we fixing some containers that were initially in very poor condition, and we repair it with the people who know how to weld, and we painted them to look just like new. But it looks just like new. You don't know necessarily need to contract people to do every job you need them to do for you. If you have workers that know about construction, welding, resourcing then we are going to utilize them. All of those containers that were damaged they fix it for me and now we have new containers.

AZ: Do you provide the people with some kind of equipment where they can put their recyclables there? I know in El Dorado they provide us with a yellow...

MS: We are currently working with a program called "Blue Bags", yeah they provided blue containers ***Inaudible***. I am going to provide the containers for you but you have to put them in the correct bin for collection. We are giving them an incentive , but we are planning to eliminate the blue bags. ***She is saying that at first they used blue bags to distribute to the people in order to get them into the habit but once that is done slowly eased them into a program where they put their recyclables in any bag color besides a black one*** We have to teach everyone that there is a problem, that we need to collaborate. We need to have people grow independent of the aid of either the government and the municipality and they need to begin addressing the current problems. Many municipalities spend lots of money buying equipment and bins but because the community isn't in the habit they begin using the bins for other materials or uses. We dont want to avoid throwing away but we want to encourage reusing. We want to encourage the average citizen to work with the stages in the development of a project. But if you tell the citizen or show that you are always willing to give them something and the more you give them the more they are willing to cooperate. You have to teach them that we will maintain you but you will have to cooperate.

inaudible

AZ: So you bring all the waste here and then you separate the waste correct?

MS: Yes, we classify it.

AZ: And what about glass?

MS: *I think she said something about they do not*

Inaudible

MS: In order satisfy safety regulations we have a kitchen here where our employees can prepare and eat their food. This small kitchen was built and designed by the workers here and was made through available resources. Everything here we are making in order to be resourceful and economic. We have also set up these bins and a station to hold them that was also made by our workers here. We also have these stations that are distributed to events around the community. These stations are distributed to events around the area and we have them labeled as trash and recyclables. So we supply the bins, people throw away their waste accordingly, and then we collect. We have nine stations like that around Cidra, this is for when there is activities. We like to give a clean, new, educative environment. We like to have our workers working with enthusiasm and happiness. An employee needs to have some background, such as the categories and information regarding recycling. There is still a lot left for us to learn, but we are proud of our process and every day we are doing better. Now we are going to see the ***Inaudible*** in order to see how the large scale waste is handled.

AM: I asked for places where she got information regarding recycling in Puerto Rico and community education

***She refers some materials / books that we should and take a look at and she briefly describes ***

She recommends a video regarding global warming and Al Gore

We move to the other location

MS: Over there is where all the vegetation and the machines are ***Inaudible*.**The machine was given to us by the municipality. If you can have an effective proposal then anything can be attained.

AZ: The items you bring here are things such as laundry machines, refrigerators, etc. But instead of transporting them as is you crush them correct?

Inaudible

MS: We don't want a landfill, we want to give the community a place where they can come and properly dispose of their larger scale waste.

AM: So the trucks that go to the landfill come here?

MS: Yes, they take the large scale items ***inaudible*** It is always good to have extra space in the case of emergency, during natural disasters, bad weather, etc.

Inaudible

MS: Something else that is good to have is a form for every individual that comes so that we know how much waste we are getting, where is it coming from. If they are bringing vegetation, metals, washing machines, etc. It all gets documented.

She shows an example of the form that she distribute to people who come to use the facility

AM: Is it okay if we keep a copy for our references?

MS: Sure that is fine. This is very important because with that form I can tell how many private vehicles are coming in during the month. The number of trucks that come from the municipality per month. Here we can identify if a material is ferrous or non-ferrous. That way we can gather statistics of each of the areas that come through here. And it is very important to keep records and forms. Additionally, there is another form that has to do with equipment or certain problems that may arise. This would include things such as having a piece of equipment not working because of some reason. It is more like a report regarding problems that occur. Or if there was an accident then describe what happened.

MS: We divide the facility by the types of the materials. We can't have large scale waste with house waste because we want something that keeps itself clean, and attractive especially to the people that come here. We sell the metals that we crush here as well as the recyclables.

AM: How big is this area?

MS: Approximately 10 squares. So this number includes the recycling facility but this one area is about 3 squares.

AM: How many years have you been working here?
M. Approximately 19 years. So I have a lot of experience but there is always more to learn. There is a lot of people that come here in order to learn more about how we operate. In fact before you got here I was talking to the municipality of *Inaudible* about their personnel.

AZ: How did this facility or operation begin?

MS: This started out from the municipality in 1992 a law number 60 of solid waste disposal and recycling where every municipality needs to have a center for recycling. Initially we started out very basically, with little to no space but an office. We were something very small. We had our space in the shape of an L with only five employees. And the program began growing more and more. We became educators, collectors, and etc. We needed to convince the municipality of the

things that we needed and we slowly gained more and more employees. But it is something that takes a lot of time and requires a lot of patience. But when you first start you may want to encourage community volunteering opportunities or you can create programs of correction. Where people may need community service hours so we can supply them with easy to handle jobs that they won't require too much training or hands on experience. many people who require service hours come to us and they learn a little about the process and how everything works.

Appendix P: General Community Survey Raw Data

	Q.2	Q.3	Q.4	Q.4b	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10	Q.11	Q.12	Q.13	Q.15	Q.16	Q.18	Q.19
1	35-50	F	BDB	B	5+	U	Y	A	N	N	SA	B	VE	VH	Y	SO	Y
2	< 21	M	BDB	B	1	FT	Y	SA	SA	I	SA	B	VE	VH	Y	SO	Y
3	51-65	M	BDB	B	3	FT	Y	A	D	I	A	B	I	H	Y	SO	Y
4	65+	F	PV	SH	1	U	N	A	N	I	SD	B	I	NVH	Y	M	Y
5	51-65	M	C	B	2	U	N	SA	NA	I	SA	S	I	VH	Y	NV	Y
6	35-50	F	PDC	SH	4	PT	Y	A	D	NA	SA	B	I	VH	Y	M	Y
7	35-50	F	PV	SH	2	D	Y	A	A	I	SA	CA	VE	NVH	Y	M	Y
8	35-50	F	PV	SH	3	FT	Y	SA	N	D	N	B	VE	VH	Y	NV	N
9	21-35	M	PV	SH	3	FT	Y	SA	SD	VI	SA	CA	VE	VH	Y	NV	Y
10	51-65	F	PV	SH	3	PT	Y	SD	N	VI	SA	CA	VE	VH	Y	SO	Y
11	51-65	M	PV	SH	3	DTA	N	SA	SA	VI	SA	CA	VE	VH	Y	M	Y
12	35-50	F	PV	SH	3	U	N	A	A	I	SA	CA	N	VH	Y	NV	Y
13	65+	F	PV	SH	1	R	N	DTA	SA	I	N	CA	I	NH	Y	SO	Y
14	51-65	M	SA	B	4	D	Y	DTA	DTA	DTA	DTA	B	VE	NH	NA	NV	Y
15	65+	F	C	B	1	R	N	A	D	VI	SA	B	I	VH	Y	B	Y
16	51-65	F	C	B	3	R	Y	A	SD	I	SA	B	I	VH	Y	M	Y
17	21-35	F	BDB	B	2	FT	N	SA	SA	VI	SA	B	VE	VH	Y	NV	Y
18	65+	F	BDB	B	2	R	N	SA	D	I	SA	B	VI	VH	Y	NV	Y
19	35-50	F	LM	SH	3	PT	Y	SA	SD	VI	A	B	N	H	DTA	SO	DTA
20	35-50	F	LC	SH	4	U	Y	NA	SD	N	A	CA	N	H	Y	SO	Y
21	< 21	M	EM	SH	NA	S	Y	SA	SD	VI	SA	B	VE	VH	Y	SO	Y
22	< 21	M	EM	SH	4	S	Y	D	SD	VI	SA	B	VE	VH	Y	SO	Y
23	35-50	M	EM	SH	4	FT	Y	SD	SD	D	SA	B	I	N	Y	NV	N
24	21-35	M	EM	SH	4	PT	Y	A	D	I	A	N	I	H	N	NV	N
25	51-65	F	EM	SH	2	U	Y	A	D	VI	SA	CA	I	VH	Y	NV	Y
26	35-50	F	EM	SH	4	U	N	A	D	VI	SA	CA	I	VH	Y	NV	Y

27	35-50	F	EM	SH	5+	U	Y	A	SD	VI	SA	CA	VI	VH	Y	NV	Y
28	21-35	F	EM	SH	3	U	Y	D	A	VI	SA	CA	I	VH	Y	NV	N
29	21-35	M	EM	SH	3	U	Y	D	A	VI	SA	CA	I	H	Y	NV	N
30	35-50	F	EM	SH	4	FT	Y	D	SD	VI	A	B	VE	VH	Y	A	Y
31	35-50	F	LM	SH	2	FT	Y	A	D	I	SA	CA	NA	VH	Y	SO	Y
32	51-65	F	LC	SH	2	FT	N	D	SD	N	A	CA	N	H	DTA	SO	Y
33	51-65	F	VP	SH	2	U	Y	A	N	I	SA	CA	VE	VH	Y	NV	Y
34	35-50	M	VP	SH	1	FT	Y	SA	SA	VI	SA	CA	VE	VH	Y	NV	Y
35	21-35	F	VP	SH	4	FT	Y	A	D	I	SA	CA	I	H	Y	B	Y
36	51-65	F	VP	SH	2	FT	N	A	SD	I	D	CA	I	H	Y	NV	Y
37	65+	F	VP	SH	1	R	N	A	SD	VI	SA	CA	I	VH	Y	NV	Y
38	65+	F	VP	SH	2	R	N	A	SD	VI	SA	CA	I	H	Y	NV	Y
39	51-65	F	VP	SH	1	U	N	A	SA	I	SA	CA	VE	VH	Y	NV	Y
40	35-50	F	VP	SH	3	R	N	NA	D	VI	SA	CA	VE	VH	Y	NV	Y
41	DTA	M	VP	SH	DTA	R	DTA	SD	SD	VI	SA	B	DTA	N	N	DTA	DTA
42	51-65	M	VP	SH	2	R	N	SA	NA	VI	SA	CA	I	VH	Y	A	Y
43	51-65	F	VP	SH	1	PT	N	A	N	NA	SA	CA	I	VH	Y	A	Y
44	51-65	M	VP	SH	1	D	N	SA	SA	VI	SD	B	VE	VH	Y	NV	Y
45	65+	F	VP	SH	3	R	N	SA	D	I	SA	CA	I	H	Y	NV	Y
46	35-50	F	G	B	2	U	N	A	A	I	SA	CA	I	H	Y	A	Y
47	65+	M	G	B	2	R	N	SA	SA	VI	SA	B	VE	VH	N	NV	N
48	51-65	F	G	B	5+	U	Y	A	A	I	SA	B	I	H	Y	NV	Y
49	65+	NA	SA	B	5+	R	N	A	A	I	A	N	I	DTA	Y	B	Y
50	51-65	F	G	B	4	R	Y	NA	SA	VI	SA	B	I	H	Y	NV	Y
51	NA	M	G	B	4	U	N	A	SD	I	SA	CA	I	N	Y	SO	Y
52	65+	F	G	B	3	PT	N	SA	SA	VI	SA	CA	VE	VH	Y	NV	Y
53	65+	M	C	B	2	R	N	SA	SA	VI	SA	B	I	VH	Y	A	Y
54	35-50	F	EM	SH	1	FT	N	SA	A	VI	SA	B	VE	VH	Y	NV	N
55	51-65	F	EM	SH	2	U	N	A	A	I	SA	CA	VE	VH	Y	NV	Y
56	51-65	F	EM	SH	2	R	N	DTA	DTA	DTA	DTA	CA	I	H	Y	SO	DTA

57	51-65	F	EM	SH	3	U	N	DTA	A	I	NA	CA	VE	VH	Y	M	Y
58	21-35	F	EM	SH	3	U	Y	SA	SA	VI	SA	CA	VE	VH	Y	SO	Y
59	51-65	F	EM	SH	1	U	N	NA	SA	VI	SA	CA	VI	VH	Y	NV	Y
60	21-35	F	EM	SH	2	U	Y	SA	SA	VI	SA	B	I	VH	Y	SO	Y
61	35-50	F	EM	SH	4	FT	N	SA	N	VI	SA	S	I	VH	Y	B	Y
62	35-50	F	EM	SH	4	U	Y	SA	NA	VI	SA	CA	I	VH	Y	SO	Y
63	35-50	F	EM	SH	3	U	Y	DTA	N	I	A	S	I	H	Y	SO	Y
64	21-35	F	EM	SH	4	FT	Y	SA	SA	I	A	CA	I	H	Y	SO	Y
65	21-35	F	SA	B	2	FT	N	SA	A	I	SA	B	VE	VH	Y	NV	Y
66	51-65	F	SA	B	2	PT	N	SA	A	NA	D	CA	VE	VH	Y	NV	N
67	51-65	F	SA	B	5+	D	N	A	A	I	SA	B	I	NH	N	B	N
68	65+	NA	SA	B	2	R	N	SA	A	VI	SA	B	I	VH	Y	NV	N
69	51-65	F	VP	SH	1	U	N	SA	D	VI	A	CA	VE	NVH	DTA	NV	Y
70	65+	M	VP	SH	2	R	N	A	D	VI	A	CA	VE	NVH	Y	B	Y
71	65+	F	VP	SH	2	R	N	A	D	I	A	CA	VE	VH	Y	NV	DTA
72	35-50	M	G	B	NA	U	N	NA	SA	VI	SA	CA	VE	VH	Y	B	Y
73	35-50	M	LP	B	2	D	N	SA	A	I	A	CA	I	H	Y	SO	Y
74	51-65	M	BDB	B	1	R	N	A	A	I	A	CA	VE	H	Y	SO	Y
75	< 21	F	LC	SH	4	S	Y	A	A	VI	SA	CA	VE	H	Y	SO	Y
76	51-65	F	EH	SH	5+	U	N	SA	SA	VI	A	CA	I	VH	Y	NV	Y
77	35-50	F	EH	SH	1	FT	Y	A	D	VI	SA	B	I	VH	Y	A	Y
78	35-50	F	EH	SH	5+	D	Y	A	A	I	SA	B	I	H	Y	NV	Y
79	65+	M	EH	SH	2	PT	N	D	DTA	DTA	SA	N	DTA	VH	Y	NV	Y
80	21-35	F	G	B	3	U	N	A	SA	VI	SA	B	I	VH	Y	A	Y
81	65+	M	CF	B	NA	R	Y	NA	A	VI	A	NA	NA	NA	NA	NA	NA
82	51-65	F	CF	B	2	U	Y	D	D	VI	SA	B	N	NA	NA	NA	NA
83	65+	F	CF	B	1	D	N	A	SD	VI	SA	B	N	H	Y	A	Y
84	35-50	F	UC	B	4	U	Y	A	SD	VI	SA	B	N	VH	Y	NV	Y

Key:

Question 3	Abbreviation
Female	F
Male	M

Question 4
See Appendix K

Question 4b	Abbreviation
Barriadas	B
Subsidized Housing	SH

Question 6	Abbreviation
Full-time	FT
Part-time	PT
Retired	R
Student	S
Unemployed	U

Questions 7,16, &19	Abbreviation
Y	Y
No	N

Questions 8,9,& 11	Abbreviation
Strongly agree	SA
Agree	A
Neutral	N
Disagree	D
Strongly disagree	SD

Question 10	Abbreviation
Very Interested	VI
Interested	I
Neither interested nor disinterested	N
Disinterested	D
Very Disinterested	VD

Question 12	Abbreviation
Bin	B
Common area	CA
Sidewalk	S
None	N

Question 13	Abbreviation
Very effective	VE
Effective	E
Neither effective nor ineffective	N
Ineffective	IN
Very ineffective	VIN

Question 15	Abbreviation
Very helpful	VH
Helpful	H
Neither helpful not unhelpful	N
Unhelpful	U
Very unhelpful	VU

Question 18	Abbreviation
Always	A
Most of the time	M
Sometimes	SO
Rarely	R
Never	NV

All Questions	Abbreviation
Question N	Q.N
Declines to Answer	DTA
No Answer	NA

Appendix Q: Siting Evaluation Sheets

Site 1: Vacant Lot
Coordinates: 18.435854, -66.037497

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments: This location would also be good for a smaller collection area. There is some surrounding foliage to disguise a facility as well.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	**2**	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: This property is in the sector Los Pinos and directly borders Las Margaritas across the street. There are residences bordering this site on three sides, so we expect potential problems with noise, odor, or dust.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	**4**	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This site is located right off the edge of a two-way road that can provide sufficient

access for cars and trucks. This is one of the major roads in Cantera and is sufficiently paved and cleaned. This site is located in the Northern part and may be less accessible to the *barriadas*.

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	**3**	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	4	Sufficient space for facility with additional space for further expansion

Comments: This is roughly 4,500 square meters in area.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: This site is bordering a flood zone, but is relatively safe from flooding problems. It is about 3 meters above sea level, which is above the mandated 1.72.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	**2**	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	4	There is access to water, electricity, and sewerage

Comments: This area will require some modification in order to provide electricity. There is access to water but there is a lack of proper sewerage system.

Site 2: Vacant Lot
Coordinates: 18.437683, -66.042236

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments: Before any actual construction and installation is done, one needs to consult Maria Barrios, who has been asking the mayor of San Juan to do something with the empty lot. Also, there is a three level building that appears to be abandoned but actually belongs to a man with a small business.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	**4**	Not expected to cause issues of noise, odor, or dust for residences

Comments: This site is between Villa Kennedy and Paseo del Conde. There is also a small

business bordering this site. This site also borders the shoreline. Despite these borders, the bulk of this land is very large and secluded from residents. This will minimize the impact of odor, dust, and noise for residents.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	**3**	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This area is off a main road and has an accessible road which is wide enough for cars and trucks. There may be some difficulties dealing with two way traffic going in and out of the site. This site is in the northern part of the peninsula, so it is not as accessible by foot for the residents of the *barriadas*.

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	**4**	Sufficient space for facility with additional space for further expansion

Comments: Large piece of land, roughly 8,000 square meters, that ensures space for expansion and strategic planning of the site.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	**4**	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: The site has 50 - 70m between the bay and its possible location. This site borders the shoreline but is on land that is 25 feet above sea level.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	**3**	There is access to two of the following: water, electricity, sewerage
All already accessible	4	There is access to water, electricity, and sewerage

Comments: It would be easy to get electricity and water at this site, however, sewerage will present a bigger problem.

Site 3: Warehouse
Coordinates: 18.431885, -66.039421
Owned by: Winer Properties

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass **Fail**

Comments: Winer Property is the owner of this location. At this site there are three large, closed off buildings with an empty lot in between each one. This building used to be a warehouse but closed six months ago. The lot is already paved and is surrounded by a 10 foot tall gate. This would be a misuse of the property.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	**3**	Expected to cause minor and infrequent issues of **noise,** odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: This site sits on the border of Bravos de Boston and Pelicano, and there are no

physical barriers to prevent issues of noise, odor, and dust. This is located on the main road that runs through Cantera. The facility is also located across the street from a housing complex.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	**4**	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This plot of land is accessible by roads on all sides and is in a central location to the community.

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	**4**	Sufficient space for facility with additional space for further expansion

Comments: This is a very large lot but may be too big for the scope of this facility. The facility is about 15,000 square meters.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	**4**	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: The buildings are right in the center of the peninsula and are not within the flood potential area.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	**4**	There is access to water, electricity, and sewerage

Comments: The site currently has access to water, electricity, and sewerage.

Site 4: Vacant lot
Coordinates: 18.433855, -66.040390

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments: This is a dangerous area in the community and is a hub for illegal activity.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	**3**	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: This is a location that is central to the whole peninsula and very secluded. However, there is a school that directly borders a school but we do not expect it to create issues of noise, odor, and dust.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	**3**	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This location is central to the community and is directly off a main road. This road is only a one-way (left image below) so this may cause problems with traffic. The road leading to the lot is currently closed (right image below) and will also have to be repaved,

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	**4**	Sufficient space for facility with additional space for further expansion

Comments: The size of the site is approximately 5 acres, or roughly 20,000 square meters.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	**4**	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

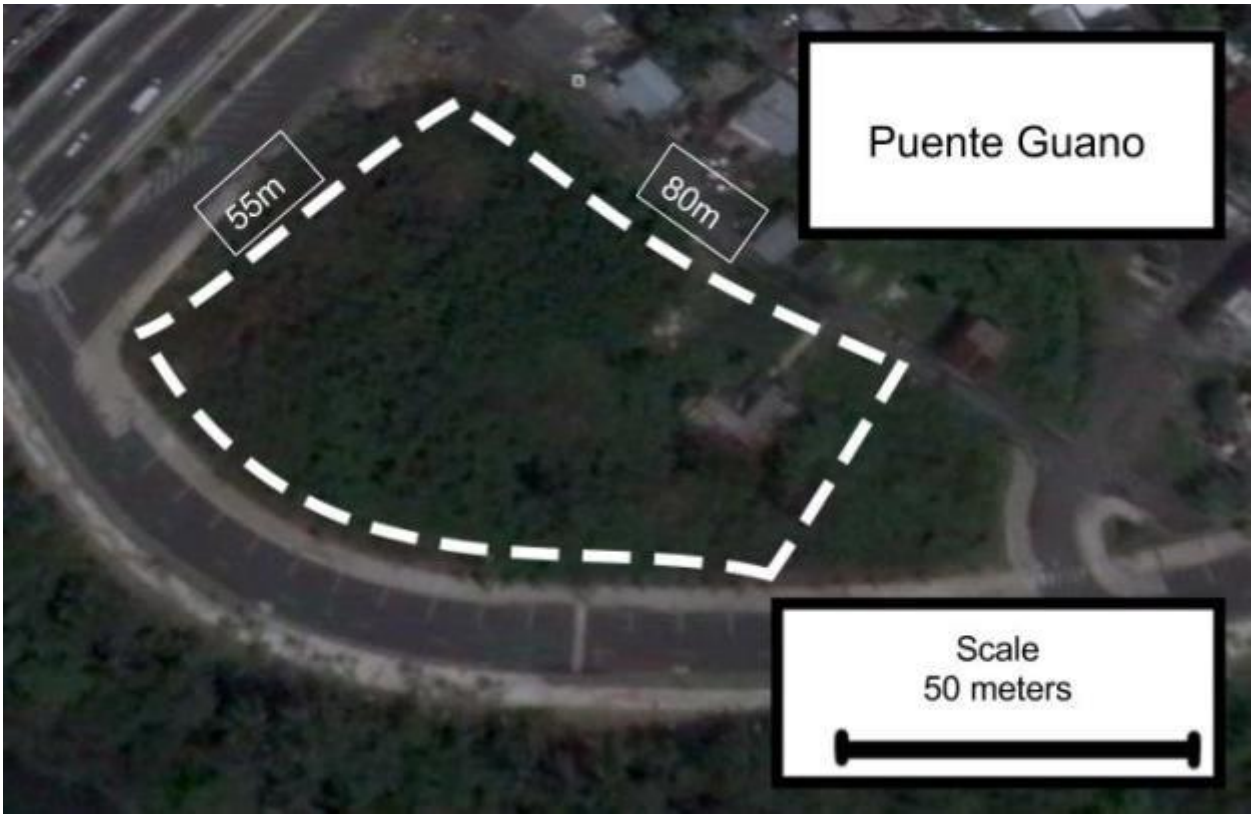
Comments: This area is not in the flood zone and has no threat of flooding.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	**2**	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	4	There is access to water, electricity, and sewerage

Comments: This area is far from sources of electricity, water, and sewerage, so it would not be easy to establish access for these utilities.

Site 5: Vacant Lot
Coordinates: 18.429659, -66.046753



Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments: This site is located in a commercial area that is easily accessed by Cantera and the surrounding communities. This area of the community is mainly commercial, so this facility would be a natural fit. It is also located near the Martin Peña Channel and can help with cleanup efforts. Also, there are several abandoned properties that have been purchased for additional space

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences

Close to residences	2	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	**3**	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: This site is in Puente Guano right next to nearby businesses and is almost completely free of residents. There is a lot of vegetation surrounding the site which could provide camouflage.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	2	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	**4**	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This site is very close to one of the main roads in Cantera and can be easily accessible by both cars and trucks. The *barriadas* are near to this site since it is in the southern part of the peninsula, so it is close to the root of the waste problem.

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	1	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	**4**	Sufficient space for facility with additional space for further expansion

Comments: The size of the site is approximately 7500 square meters. There are several different possible placements within the site to avoid disturbing the surrounding area while still being accessible

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	1	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	**3**	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: This site is bordering the flood potential area and has reasonable distance from the Martin Pena Channel. Depending on the location within the site, the elevation ranges from three meters to zero meters above sea level.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	**4**	There is access to water, electricity, and sewerage

Comments: This site has easy access to water, electricity and sewerage.

Site 6: Vacant lot
Coordinates: 18.428844, -66.039452

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass **Fail**

Comments: The CDIPC is currently acquiring households here that they can demolish in order to provide space for other projects. Currently some residents in the area already bring their waste to dump at this site. There is an aqueduct facility right next to this site, as well as the transmission running over the proposed location.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	**2**	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: This is in Condadito Final, a southern sector of Cantera. Despite the abandoned and acquired buildings and the open lot the site is close to other residences.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	**2**	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot

Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: This site has access to one major road that is wide enough for cars and trucks. There is limited space for two way traffic and larger sized dump trucks. In the case that the facility is built further past the abandoned buildings then the site may require the construction of additional roads and may not provide easy access to people on foot or vehicle. Refer to photo in "Proximity to residences"

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	**1**	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	4	Sufficient space for facility with additional space for further expansion

Comments: Variable size of lot due to potential removal of residents (one example is shown below). It would be roughly 2500 square meters.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	**1**	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: This site is in the flood zone and is close to the shore of the Martin Pena Channel.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	**4**	There is access to water, electricity, and sewerage

Comments: This site will have accessibility to electricity, sewerage and water.

Site 7: Vacant Lot
Coordinates: 18.429375, -66.038689

Circle the appropriate score below and provide comments accordingly

Extenuating Circumstances- Any factors that would result in this location not being feasible

Pass Fail

Comments: The CDIPC is currently acquiring residences at the site that will provide more space, and are planning to build a larger main road to connect the area to the rest of the community. This location is home to one of the few remaining mogote formations in the San Juan metropolitan area, which the government is trying to preserve them.

Proximity to residences

Category	Score	Definition
Extremely close to residences	1	Expected to cause major and frequent issues of noise, odor, or dust for residences
Close to residences	**2**	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Far from residences	3	Expected to cause minor and infrequent issues of noise, odor, or dust for residences
Secluded	4	Not expected to cause issues of noise, odor, or dust for residences

Comments: A large number of residences that live along the edge of the proposed siting area will be evacuated and their houses purchased by the CDIPC. Currently, there is a fair number of people that live in the area.

Accessibility for users

Category	Score	Definition
Not accessible by road or by foot	1	This site provides is inconvenient for access by foot and provides no access to vehicles
Accessible only by foot	**2**	This site provides convenient access to people on foot but provides no access to vehicles
Accessible only by road	3	This site is easily accessible to vehicles but can be dangerous and inconvenient for people to access by foot
Accessible by road and by foot	4	This site is easily accessible by vehicles and convenient for people to access by foot.

Comments: The road is very narrow and only provides sufficient space for smaller sized vehicles. There is no way to accommodate two way traffic along this road.

Size of the lot

Categories	Score	Definition
Less than 3,000 square meters	**1**	Insufficient space for expected size of the facility with no space for further expansion
3,000 to 4,000 square meters	2	Minimal sufficient space for expected facility with no space for further expansion
4,000 to 5,000 square meters	3	Sufficient space for the facility with little space for further expansion
More than 5,000 square meters	4	Sufficient space for facility with additional space for further expansion

Comments: The size of lot for the site is very small and lies on uneven land. Unless the neighboring residences are demolished and the size expanded upon then a properly sized facility could be established in the area. It is roughly 2,500 feet.

Flood Potential

Category	Score	Definition
Directly bordering the shoreline and in the flood zone	**1**	A facility in this area would frequently suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but still in the flood zone	2	A facility in this area would occasionally suffer from floods, resulting in water and soil contamination from leachate
Not bordering the shore line but bordering the flood zone	3	A facility in this area could potentially suffer from floods, resulting in water and soil contamination from leachate only in rare circumstances
Not in the flood zone	4	A facility in this area would be well above the flood zone levels, resulting in water and soil contamination from leachate only in extremely rare circumstances.

Comments: This site is located in the flood zone.

Accessibility to Utilities

Category	Score	Definition
Not accessible	1	There is no accessibility to water, electricity, and sewerage that can be incorporated into the facility
One already accessible	2	There is access to one of the following: water, electricity, sewerage
Two already accessible	3	There is access to two of the following: water, electricity, sewerage
All already accessible	**4**	There is access to water, electricity, and sewerage

Comments: This site can easily gain access to water, electricity, and sewerage.

Appendix R: Meeting with the Social Workers Transcript

Interview Transcription with Social Workers of the CDIPC

Date : December 2nd, 2014
Location : CDIPC Office
Attendees : Alejandro Miranda, Alfredo Zapata, Hannah Reinertsen, Idelisse Vega, John Cotter, Juana Silverio, Mayra Ramos, Osualdo Delvalle, Victor Hu Viviana Martínez, Yarisel Lozano, Yoliana Vazquez

Alejandro Miranda(AM): After communicating with people in the community we have learned that education is a very important concept that needs to be addressed and something that we are thinking of doing is educating the youth. That way they can influence their parents when they go home and that the idea of a clean community and having proper disposal. We have an idea of a one hour presentation alongside some coloring activities so that they can get engaged in what is going on. That way we want to give them a brochure that can be sent home to their parents and they can explain what they learned that day. We have a rough idea of what we want to do but we want to get your ideas and opinions as to the most effective method to implement.

Yarisel Lozano(YZ): The majority of the children in these schools are academically lacking, have problems with lectures, writing, and if you give them a written material it has to be very easily understood by them. A language that is very simple and not too long.

AM: Is it okay if I can record?

YZ: Y that is fine. It has to be a very simple language and something very visual. It shouldn't be too long. Preferably with visuals.

AM: We are currently thinking of having some characters called “Martín” and the other names “Peña” and they are going to have an adventure where they are going to participate in a community clean up alongside a brief presentation. During this presentation Martín and Peña go on an adventure and they go about learning what is recycable and what isn’t. It is something short just so that kids can understand what the point of having a clean community.

YZ: What it occurs to me, after having worked on a conservation project with the youth what we tried to transmit to the youth is the Cantera peninsula is a natural treasure. (*She is saying that we should portray the community’s natural treasure and that they should be respected and cared for) * In conclusion, that when you make this animation of Martín and Peña you should utilize the search for tresure. Like the bodies of water, some sectors of the community. That would be a good idea. In the end you want them to have a connection with certain areas in their community

and that they have a role in this very environment. Then they will want to be a part of the community and conserve what they can. I have some material from that conservation project that may be helpful to your efforts. We can sit down and talk about and figure things out from there.

AZ: All suggestions are welcome!

YZ: Y, like I was saying before something very visual with game like concepts.

AZ: We were also considering an physical education game where certain balls are labeled as a certain material and then there may be several teams where the person who can collect and correctly classify the types of trash wins. Something like that.

Mayra Ramos (MR): Y, but something you should include might be an activity of some sort. Something like a word search.

AM: Yeah we were thinking of something similar to that.

AZ: What is the age group?

YZ: What we understand is that this is an age group between 12 and 16 years. Like I explained before their level of education is a little behind from what you would expect. And many of them have problems dealing with lectures and writing.

MR: Are you going to work directly with the children?

AM: No, we are expecting to leave you all the required materials in our report for the CDIPC since we are not going to be here. This will be included in the recommendations on how these activities should be carried out.

YZ: I would like, and it doesn't have to be right now, but if you can send me an abstract of what you did here because I have a bulletin about things that go on in Cantera.

MR: I was thinking that maybe you could make some kind of drama since you will be communicating with kids and such. But since you are leaving relatively soon, that would be hard to make. Something similar to the Muppets.

AM: We weren't planning on doing that but if you think it can be a good idea then that is something that we can try to consider.

YZ: What you guys want to do is hand in material or is it an activity?

AM: We want to have a presentation and an activity. Where we can have two students stand up

and act out the parts of Martín and Peña but also have a series of simple educational activities. We are going to give them time to complete the wordsearch and we will give them the brochure so that they can take it home.

YZ: If you are going to do the activity then it should be directed towards a younger age group. It has to something dynamic. If you are going to be doing a presentation that they participate in some way with the lecture.

MR: I was thinking that it was going to be something more like a theatre or drama.

AM: Yeah we were thinking that it should be something like that. We have a couple ideas.

Idelisse Vega (IV): So it is through this characters that you guys are planning on teaching about recycling and proper waste disposal.

AM: Additionally, not only do we want to aim at educating kids but also want to teach people that don't have kids the proper waste disposal and recycling methods. One thing that we wanted to do is to create posters and hang them in areas where open dumping is the most common. Something saying like" Don't throw away your trash here, send it to the waste transfer station". Similarly in the brochure we were planning on distributing them to the business to see if they would also help with that. We wanted to know if you have any other ideas about how people should take care of their community.

YZ: Its always more effective when you don't say something as if you were scolding someone but more like " this is ours, take care of it, conserve it" etc. make it more positive than negative.

IV: Americorps has similar projects, where they saved certain locations around in the community. Americorp does similar projects regarding the youth and raising awareness.

Viviana Martinez (VM): I think I am leaning more towards the theatre idea because that will have a greater impact at the adolescents. If you can get your point across in a more creative, artistic method then that would be better. Maybe you may want to establish some kind of poster projects, or maybe some kind of art.

YZ: At one point we were working on a project where we identified art through the use of trash and recyclables. They used things such as plastic bags, paper etc. When we did this with the younger students we eventually developed an exhibition and it came out great.

AM: We have gone to many restaurants that share a similar idea of making art out of trash.

Juana Silverio(JS): Also, something that occurred to me since the kids are from 5 - 10 years

things such as movies about little dolls would be fantastic because they pick that up really quickly. You can encourage students to pick up waste through art where they can take the bottles of cans and make something really interesting from it.

YZ: From my experience, and what I have seen is that when kids create their projects they take better care of it. They make sure that no one hurts or damages it. When they feel like it belongs to them they are going to take care of that.

VM: You can have some kind of art on display here in the community. Which would make it great to bring in people from other communities to learn about Cantera.

Appendix S: Community Outreach Brochure

Consequences of Improper Waste Disposal

Health hazards:

- Stagnant dumps can become breeding grounds for disease carrying insects and vermin

- Increased risks of respiratory ailments, such as asthma, and water-borne illnesses such as diarrhea and cholera

- Infected dust can lead to eye irritations and respiratory problems

Environmental hazards:

- Run off from open dumps can leach into groundwater, which is a source of water for many organisms

- As waste decomposes, greenhouse gases and other dangerous chemicals can be released into the air, such as carbon dioxide, methane, and carcinogens

- Presence of chemicals an create soil contamination that arises from the leaching of improperly disposed of waste, which can be detrimental to the ecosystem

Proyecto Peninsula de Cantera

Hours:
Mon-Fri: ___am- ___pm
Sat-Sun___am-___pm

Contact us:
Address:_____
_____

Phone: (787)-268-3138
Fax: (787)-727-0278
E-mail: pencante@coqui.net

For more information visit our website at:
_____

The Cantera Waste Collection Facility

What Is a Waste Collection Facility?

A waste collection facility is a place where one can take his or her recyclables, domestic waste, and large scale items to be properly disposed of. In this facility, these items are separated and stored prior to being sold or transported to another waste management site.

How to use a Waste Collection Station

This waste collection facility is a community-run organization that wants to work the residents to help them properly dispose of their waste

Things to know:

- This is a supplemental facility that helps the municipal waste collection service

- Bring your waste to the waste collection facility. Transportation accommodations can be arranged

- You will be required to fill out a form and pay a small fee based on your items

Items to bring:

- **Large items:**
Furniture, appliances, construction debris, mattresses, tires
- **Recyclables**
Clean glass, plastics, paper, cardboard, metals

Benefits of A Waste Collection Facility

Bringing your waste to a waste collection facility provides a number of benefits for you and your community

These include:

- Easy and accessible way to dispose of waste properly

- Cleaner community and environment

- Less dangers to human health

- Conversion of raw waste into profitable materials.

Consequencias de Tirando su Basura incorrectamente

Riesgos para su salud:
· Vertederos estancadas can puede criar insectos, sabandijas y ratones

· El riesgo esta aumentaga para enfermedades respiratorios como asma, diarrea y cólera

·Polvo puede causar irritaciones de ojos y problemas respiratorios

Riesgos para el ambiente:
· Escorrentía de vertederos puede contaminar la agua de la tierra que provea agua para muchos organismos

· Cuando basura se descompone gases invernaderos y otras químicos peligrosos se pueden emitir al aire como bióxido de carbono, metano, y agentes cancerígeno

· La presencia de quimicos puede contaminar la tierra que viene de lixiviados de basura tirada incorrectamente que puede perjudicialmente afectar ecosistimas

*Add an additional image

* Añadir un imagen de una mapa pequeña marcando el direccion de la facilidad con una estrella con nombres de calles y puntos de referencias

*Añadir el logo del la facilidad

Horas:
Lunes-Viernes: ___am- ___pm
Sabado-Domingo___am-___pm

Contáctenos:
Dirección:_____
_____

Telefono: (787)-268-3138
Fax: (787)-727-0278
E-mail: pencante@coqui.net

Revisa neuestro pagina de Facebook:
_____
para infomacion addicional de eventos, horarios de visitas, y talleres comunitarios

La Facilidad de Acopio de desperidicios Sólidos

* Añadir un imagen de la facilidad de acopio cuando esta completado. Fijate que el imagen demuestra una facilidad limpia

Que es una facilidad de acopio de desperdicios sólidos?

Una facilidad de acopio es un lugar donde uno puede llevar sus recicables y basura grande. En esta facilidad la busura estara seperada y guardada antes de que su contenidos esta transportada a otra sitio de la gestión de residuos

*añadir un imagen de un ejemplo de una vertedero en la comunidad

Como se usa la facilidad de acopio

Esta facilidad de acopio es una operacion cordinado por la comunidad que quiere trabajar con las residencias para ayudarlos disponer sus basuras correctamente.

Cosas que debes de saber:

· Esta es una facilidad complementado que le ayuda a la corriente servicio del municipio.

· Trae su basura a la facilidad de acopio. Alojamiento de transporte se pueden organizar.

· Usted puede ser requirido a llenar una forma y pagar una pequeña cuota dependiendo a la basura que traes.

Objetos para traer:

· **Basura Grande:**
Muebles, escombros de construcción, colchón, y llantas

· **Recyclables**
Vidrio limpio, plasticos, papel , cartón y metales

Los beneficios de un Facilidad de Acopio en la Comunidad

Trayendo su basura a una facilidad provea numeroso beneficios para usted y su comunidad.

Esto incluye:

· Una manera facil y accessible para disponer basura correctamente

· Una comunidad y ambiente limpia

· Menos riesgos para la salud de los seres humanos

· Conversión de residuos crudos a materiales lucrativo

*añadir un imagen de un vertedero en la comunidad

*añadir de la imagen arriba pero despues de que la basura esta recojido y limpiada

Appendix T: Community Outreach Poster

¡La Península de Cantera es nuestro hogar!

¡Protégalo!

Si tiene cualquiera basura y necesita disponerla, lleve la basura a la estación de acopio en

Escriba la dirección de la estación aqui.
Escriba toda la fuente en negra

Añada su logo aquí

TEL : 555-555-5555

Correo Electronico
Escriba una dirección de correo electrónico

Appendix U: List of Organizations in the CDIPC's Network

ESTADO LIBRE ASOCIADO DE
PUERTO RICO

Directorio de Organizaciones

Península de Cantera

Áreas	Nombre	Organización	Teléfono
Escuelas e Instituciones Educativas	José Ricardo De Jesús Director	Esc. Sofía Rexach jricardodj@yahoo.com	787-728-8460
	Gloria Ortíz Medina Directora Luis F. Gutiérrez (Maestro Enlace)	Esc. Fray Bartolomé de Las Casas luismeister@gmail.com	787-726-5169 787-399-9172
	Luis Morales Director	Esc. Manuel Elzaburu y Vizcarrondo D63024@de.gobierno.pr	787-268-4913 787-688-4611
	Vilma Santiago Directora	Esc. Albert Einstein	787-727-5525
	Carlos Frabal Director	Esc. Haydee Rexach escuelahaydeerexach@gmail.com	787-727-5725
	Sor Magna Martínez	Colegio María Auxiliadora	787-726-4006
	Padre Luis A. Reyes Director Ejecutivo/Administrador Lissette Ruiz Principal	Colegio San Juan Bosco csjbpr@yahoo.com	787-726-1995 Fax. 787-268-1869
	Nereida Carreras Directora Evelyn Sierra Trabajadora Social	Centro John O. Connor New York Foundling ncarreras@nyfpr.org	787-268-1753
	Gabriel Hernández Director	Boys and Girls Clubs Las Margaritas ghernandez@bgcpr.org	787-727-7839
	Leticia Rivera Trabajadora Social	Head Start El Mirador	787-480-4564
		Head Start Las Casas	
Organizaciones Comunitarias e Instituciones de servicios a la comunidad	Luis F. Cintrón Piñeiro Director Ejecutivo Kimberly Figueroa Asistente	Compañía para el Desarrollo Integral de la Península de Cantera lfcintron@cantera.gobierno.pr kfigueroa@cantera.pr.gov	787-728-7641 787-268-3138 Fax. 787-728-7658 787-727-0278
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Compañía para el Desarrollo Integral de la Península de Cantera

Áreas	Nombre	Organización	Teléfono
Organizaciones Comunitarias e Instituciones de servicios a la comunidad	Margarita Mojica Organizadora Comunitaria	Casa Cultural y Centro Comunitario de Cantera Municipio de San Juan	787-268-0765
	Millie Ortíz Directora Wanda Matienzo Técnica de Trabajo Social	Centro Cultural y de Servicios de Cantera, Inc. cculturalcantera@gmail.com	787-728-0566
	Miguel Cappacetti Cotto Presidente Nelson Vázquez	Leaders for the World, Inc. expediciones.peninsula@gmail.com	787-268-3138
	Yolanda Logroño Directora / Trabajadora Social	Centro de Edad Avanzada Res. Las Margaritas	787-480-4504 Fax. 787-928-0743
	Alfredo Rivera Olivo Director	Org. Dando la Mano al Amigo en el Desierto, Inc. rivera52@yahoo.com	787-727-6250
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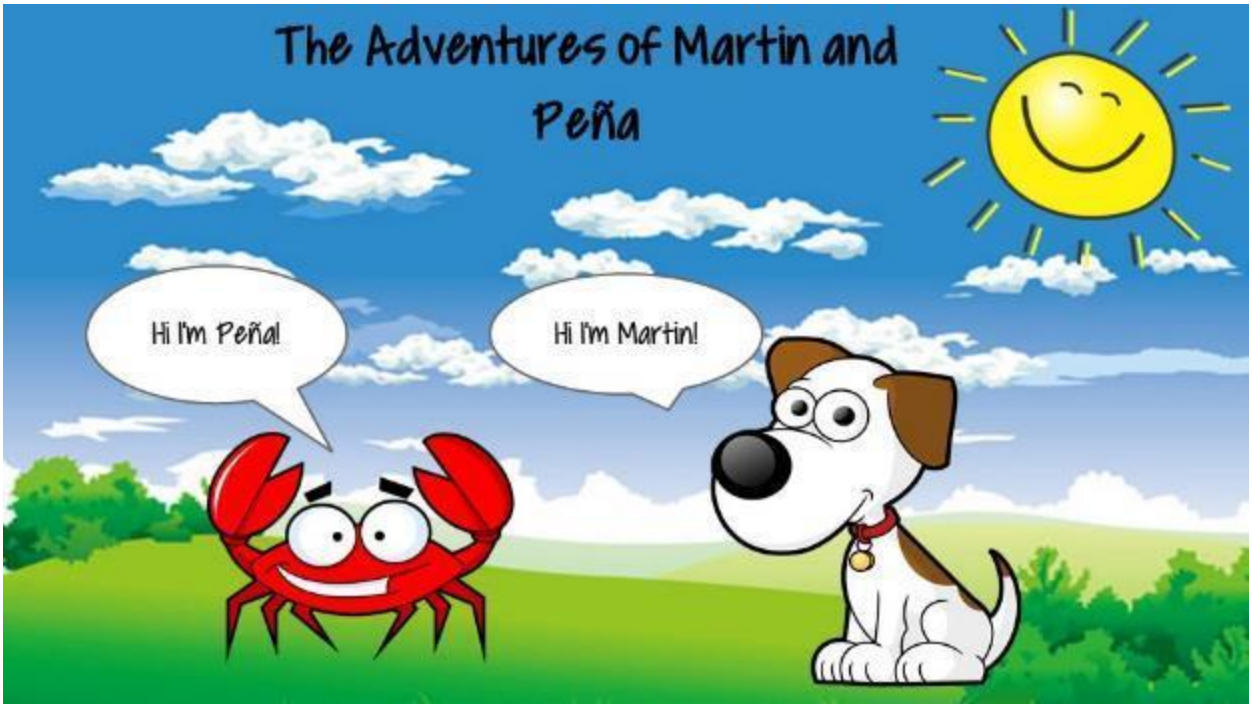
	Miguel Ojeda Ferretería La Feria		787-726-8215
	José Santiago Cano Auto Parts		787-728-1556
	Sebastián Cruz Olmo Presidente	Asociación de Pesca-Laguneros	787-607-4478
	Luis Sánchez Presidente	Corp. Reciclaje del Norte, Inc. info@reciclajedelnorte.com	787-726-0444 787-945-7052
Iglesias	Padre Nicolás Navarro Párroco	Parroquia María Auxiliadora	787-726-1995 787-727-5346
	Jorge Mercado Pastor	Iglesia Mission Board iglesiambdecanteramissionboard@yahoo.com	787-392-7420
	Rev. Juan A. Tejada Miranda	Iglesia Canaán Defensores de la Fe	787-727-3307 787-310-3688 787-750-5384

Appendix V: Youth Education Lesson Plan

English

Lesson plan timeline

Time	Activity	Materials required	Description
15 minutes	Presentation	PowerPoint presentation	An interactive story following the day of two cartoon children, Martín and Peña. These two learn about how to properly throw out waste, and meet some new friends along the way.
10 minutes	Coloring sheet	Coloring activity sheet	The first sheet shows a man with large amounts of trash in his backyard. The students identify and circle what can be recycled.
10 minutes	Word search	Word search sheet	A word search with vocabulary regarding the environment and waste.
15 minutes	Physical activity	Rule guidelines for the teacher	Bins are set up, each representing a different area for waste collection. This is an interactive activity where the students sort and dispose of various waste items to learn about proper disposal.
10 minutes	Open discussion	Provide a question bank for teacher	Time is given for the students to ask questions and discuss with the instructor.
5 minutes	Take-home materials	Brochure, letter to the parents	A letter to the parents about what the students did and a brochure with additional information are distributed.



Text: This is Martín the dog and Peña the crab. They're two best friends that live in Cantera.

Text: Martín and Peña wanted to go to school, but their path was blocked!

Ask kids: Can you point to what's in their way? What is it?

The trash was in their way and the two friends didn't know what to do.

Text: Trash man came to the rescue and cleaned the mess out of the way!

Text: Trashman introduced them to Mr. Recycling. He told them to always bring him their recyclables.

Text: Next, Trashman introduced them to Mr.Trashcan. Trashman told them to always give the rest of their trash to Mr. Trashcan from now on and to make sure all their friends do too

Text: Martín and Peña learned so much from Trashman, Mr. Trashcan, and Mr. Recycling and could go to school now!

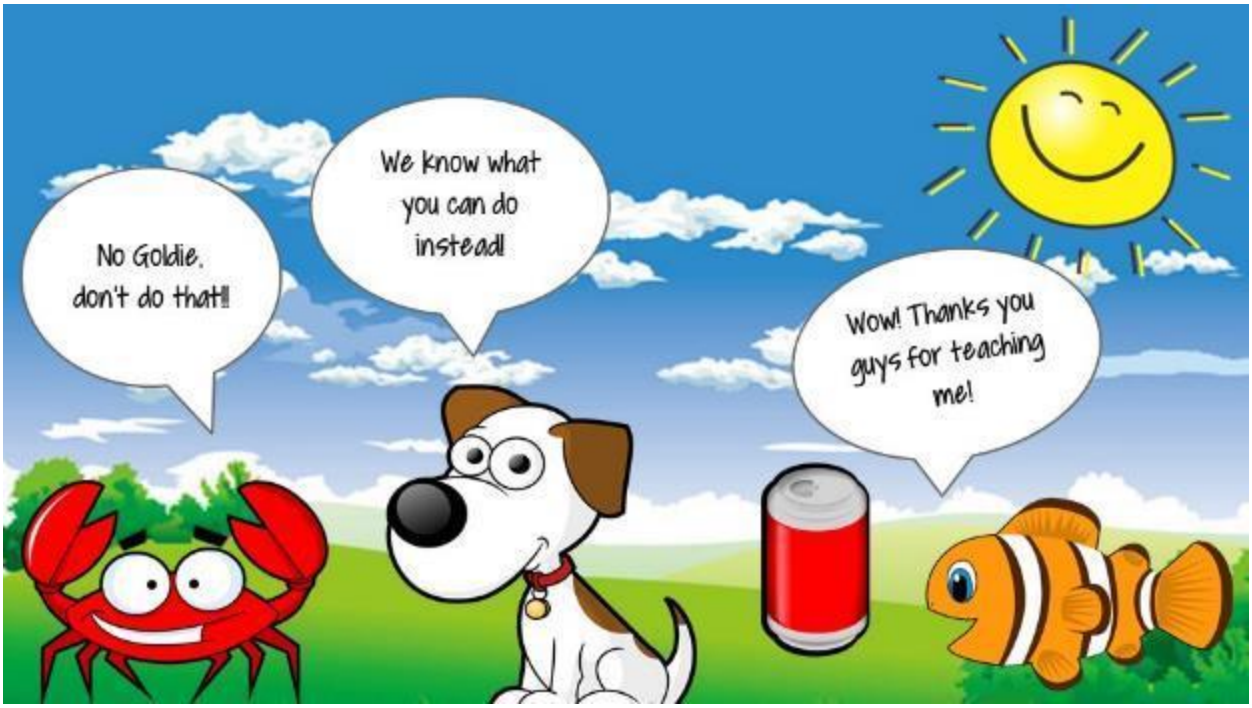
Text: The next day Martín and Peña wanted to play in the playground, but they couldn't!

***Ask kids: What is the problem here with the playground?**
Can you point out where it is to me?
What can Martín and Peña do to fix the problem?*

Tell kids that the trash and recyclables were in their way.

But Trashman taught us where to bring the trash and recyclables, so they brought it all to Mr. Trashcan and Mr. Recycling.

Text: Thanks to your help Martín and Peña could fix their problem. They were so happy they had met Trashman, Mr. Trashcan, and Mr. Recycling and could go and play now.

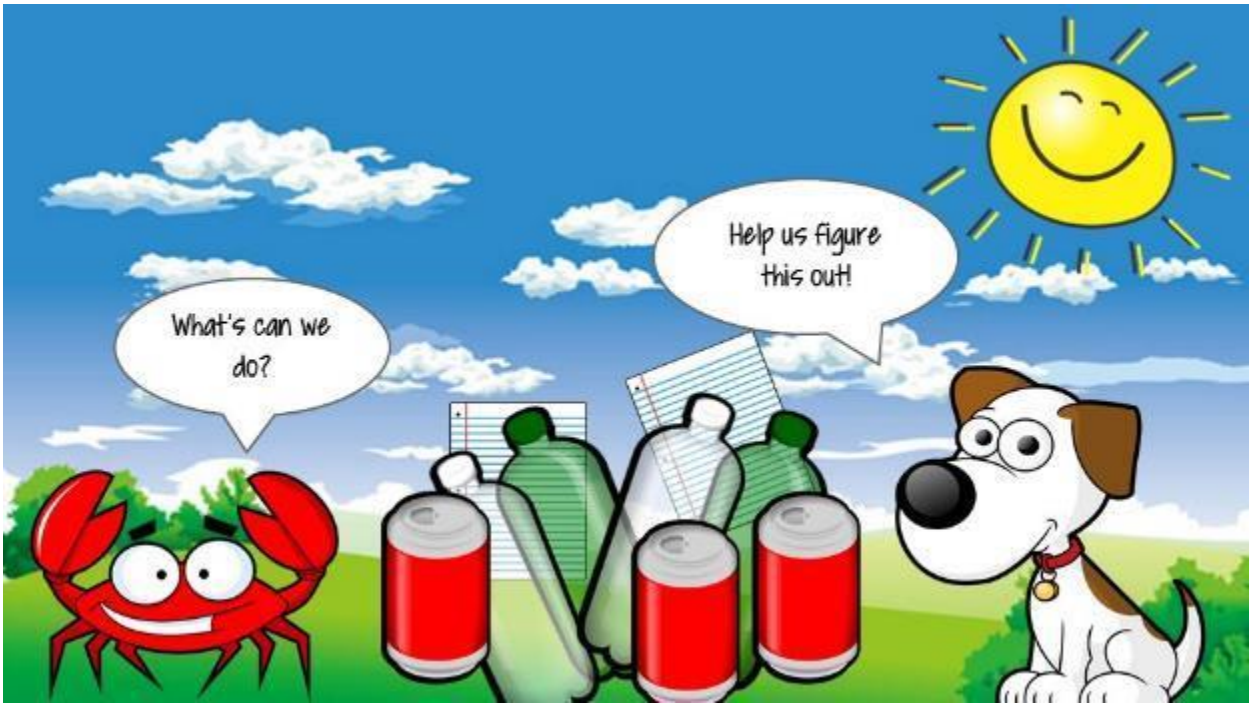


Text: Later on Martín and Peña saw their friend Goldie throwing her soda can on the ground.

What did Goldie do wrong and what should she do with the can instead?

Martín and Peña quickly told her what they'd learned from Trashman, to take the can and give it to Mr. Recycling. Goldie was so happy she learned what to do!

Text: Martín and Peña later ran into Mr. Rain. He wanted to thank them for keeping the neighborhood so clean and beautiful! Mr. Rain told them not to forget to also never throw trash or recyclables into a body of water so he can stay clean too.



Text: Later that week, Martín and Peña were walking through their neighborhood and encountered some problems. They couldn't remember the lessons they'd learned

Ask kids: What's the problem here? Can you point out where it is? What can Martín and Peña do to fix it?

Thanks to your help Martín and Peña remembered to take the trash and recyclables to Mr. Trashcan and Mr. Recycling.

Text: Martín and Peña are so grateful for all your help!

Say goodbye

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Link: http://www.epa.gov/osw/education/pdfs/k-3.pdf

Recycling

F Y S J U I W W X W
P L A N T B P E K R
M S F V B G W N E G
K E K T O U Z P W L
R Q T P T A A U A A
I E Y A T P M M S S
S H E A L T H U T S
U N C L E A N F E Z
A G P F Z Y L Q I K
K B W K W A T E R Y

BOTTLE CLEAN GLASS
HEALTH METAL PAPER
WASTE WATER PLANT

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Link: http://www.epa.gov/osw/education/quest/pdfs/sections/u2_chap2.pdf

Classroom Activity

Grades K-2

social studies

Recycling Rangers

Objective

To help children recognize the similarities and differences among common recyclable items.

Activity Description

Students play a sorting game and put different recyclables into the appropriate bin.

Materials Needed

- Four recycling bins
- Recyclable materials listed in the box below

Key Vocabulary Words

Paper
Plastic
Glass
Metals

Duration

1 hour

Skills Used

Communication
Observation/classification

Activity

Step 1: Set up the four bins in the classroom and label them "Paper," "Glass," "Plastic," and "Metals." Make a pile of all of the recyclable items on the floor and ask the students to gather around them in a circle.

Step 2: Explain to students that by the end of the lesson they will become "Recycling Rangers" and learn how to recycle different items. Discuss with the students how different "garbage" items can be recycled into new products. Note that it is important to separate these items into different categories before they are used to make new products. Refer to the Teacher Fact Sheet titled *Recycling* on page 101 for background information on the recycling process.

Step 3: Ask the students to look at the different recyclable materials and discuss how they are alike and how they are different. Ask them

Recyclable Materials

— Cardboard
— Newspapers
— Magazines
— Plastic soda bottles
— Plastic milk containers
— Glass jars or bottles
— Aluminum cans
— Steel food cans
— Other materials recycled in your community

Note: All materials should be cleaned and all sharp lids or edges should be removed or taped over to avoid injury.

to compare the colors, textures, and weight of the different objects. When handling the glass bottles, take great care not to accidentally break the containers. Also, note that some metal containers have sharp edges that can cause injury to the children.

Step 4: Moving through the pile one item at a time, ask the students to identify the material that each item is made from. Then, choose a student volunteer to place the item in the appropriate bin. For the older children, ask the student volunteer to also name another product that is made from that same material. If a student, for example, is holding a glass jelly jar, he or she could note that soda bottles are also made of glass.

Step 5: After the lesson is concluded, encourage students to go home that night and share what they learned with their parents.

1. Ask students to name some examples of recyclable items.
2. Have students explain why it is important to sort the different recyclable items.
3. Ask students what kinds of materials recyclable items are made from.

1. Select a few objects from the lesson, ensuring a good mix of shapes and sizes. Ask the children to trace outlines of the objects and then color them in. Put the pictures up on the classroom wall to create a recycling art gallery.
2. Organize the class into teams of four children and give each group a different recyclable item. Ask the students to make a new object from the recycled items such as a crayon holder or paper plane.

Dear parent(s)/guardian(s),

Today your child took part in a lesson about proper waste disposal practices and the effect that waste has on the environment when it is not handled appropriately. They were given a presentation on the harm that comes from waste not properly disposed of, how a waste collection facility can help, how to use this facility, and the benefits they gain from using it. Some activities were also provided, including a short coloring book, word search, and physical activity.

We hope your child enjoyed this lesson and will benefit from it. As a final piece of this lesson, each child is asked to participate in a poster competition. We ask that you work with your child on this project. These posters will be hung throughout the schools and community. The instructions for this presentation are attached. For additional information the location, contact information, and website for the waste collection facility are listed below. Thank you for your time and please feel free to contact us with any questions or concerns.

Sincerely,
The Cantera Waste Collection Facility

Address:
Phone number:
Facebook page:

Instructions for Environmental Awareness Poster Contest

Dear parent(s)/guardians(s),

Your child has been asked to participate in a poster design contest. This assignment will be a fun, educational activity where each student will design a colorful, creative poster that will help promote environmental awareness in Cantera. The participant is encouraged to use what they learned in their lesson at school. Parental aid is advised.

Things to include in your poster:

- Creative slogans, such as "Keep Cantera clean" or "Cantera is our home." Or even better, come up with your own creative slogan!
- Designs and drawings of the environment.
- Pictures and words to suggest safe practices, such as recycling.

Please submit your final poster to your teacher by **(Put Due Date Here)**.
The top three winners will be chosen by the teachers who delivered the lesson to the participants. Winners will be chosen on creativity, information included, and design.

All the poster designs will be hung in the schools and around the community and the top three winners will receive a certificate in recognition of their achievement.

Spanish

Cronología de la lección

Tiempo	Actividad	Materiales Necesarios	Descripción
15 minutos	Presentacion	PowerPoint Presentación	Una historia interactivo siguiendo el día de dos mascotas, Martín y Peña. Estos dos aprenden cómo deben de tirar basura correctamente y conocen nuevos amigos en su aventura.
10 minutos	Hoja para colorear	Hoja para colorear `	La primera página es de un hombre con mucha basura en su patio. Los estudiantes deben de identificar y marcar los reciclables.
10 minutos	Las sopas de letra	Hoja de busca de palabras	Una busca palabras con vocabulario centrado al ambiente y basura.
15 minutos	Actividad física	Hoja de reglas para el maestro	Zafacones se configuren, cada uno representando diferentes lugares de coleccion. Esta es una actividad interactiva que los estudiantes clasifican y disponen diferentes objetos y aprenden como disponer basura correctamente.
10 minutos	Discusión abierta	hoja de preguntas	Una discusión que los estudiantes pueden a hacer preguntas y discutir con el instructor.
5 minutos	Materiales para hacer en casa	Folleto,letra para los padres	Una letra a padres sobre lo que se enseñó a los estudiantes y un folleto con información adicional.

Estos son Martín el perro y Peña el cangrejo. Son dos amigos que viven en Cantera

¡Martín y Peña quieren ir a la escuela, pero su camino está obstruido!
*Pregunta los niños: ¿Puedes apuntar que es lo que obstruye el camino?
La basura está en su camino y los dos no saben que van a hacer

¡El hombre de la basura vino a rescate y limpió el lío del camino!

El hombre de la basura les presento al Señor Reciclar. Él les dijo que les deben de dar todos sus reciclables.

Siguiente, el hombre de basura les presento al Señor Zafacón! Señor Zafacón les dice a Martín Y Peña que le dan sus basuras y que se aseguran que los demás gente hacen lo mismo.

Martín y Peña aprendieron mucho del hombre de la basura, Señor Reciclar y Señor Zafacón. ¡Ahora pueden ir a la escuela!

El próximo día, Martín y Peña querían a jugar en el parque, pero no pudieron!
*Pregunte a los niños: ¿Cuál es el problema en el parque? ¿Lo puedes apuntar? ¿Qué puede hacer Martín y Peña para arreglar el problema?
La basura y los materiales reciclables están en su camino. Pero el hombre de la basura les enseñó a llevar la basura a Señor Zafacón y los reciclables a Señor Reciclar.

Gracias por tu ayuda, Martín y Peña arreglaron su problema. También están contentos de conocer al hombre de basura, Señor Zafacón, y Señor Reciclar. Ahora pueden a jugar en el parque.

Lueguito, Martín y Peña vieron a su amiga Goldie tirando su bote de soda al piso.
Pregúntale a los niños: Que es lo que Goldie hiso y que puede ser en vez de tirar su bote de soda al piso?
Martín y Peña le explicaron a Goldie lo que aprendieron del hombre de basura, Señor Bote de Basura y Señor Reciclar. Goldie se puso contenta después que aprendió lo que pudo ser en vez.

Martín y Peña se encontraron al Señor Lluvia. Él les quería agradecer por manteniendo la vecindad limpia y bonita. Señor Lluvia les dijo que nunca deben de tirar sus reciclables o basura en las aguas para que él también se puede mantener limpio.

Luego esa semana, Martín y Peña estaban caminando por su barrio y encontraron unos problemas. No pudieron a recordarse de las lecciones que aprendieron del hombre de basura, Señor Zafacón, Señor Reciclar, y Señor Lluvia.
Pregúntele a los niños: ¿Cuál es el problema aquí? ¿Lo puedes apuntar? ¿Qué puede hacer Martín y Peña para arreglarlo?
Gracias por su ayuda, Martín y Peña se recordaron que hay que llevar la basura y los reciclables a Señor Zafacón y Señor Reciclar.

Martín y Peña están agradecidos por todo tu ayuda!
Dígale a los niños: ¡Que digan adiós!

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Link: http://www.epa.gov/osw/education/pdfs/k-3.pdf

El Reciclaje

W N F L N K F Z O N
S K P P C F X M M R
A X A M T S A L U D
X N P Q E L E M V A
F C E Y L T I M I G
S I L E P T A M D U
G B T H N P Y L R A
N O C S L I M P I O
B A S U R A C V O Y
E W Z P L A N T A S

VIDRIO LIMPIO METAL
AGUA PLANTAS BASURA
PAPEL SALUD BOTELLA

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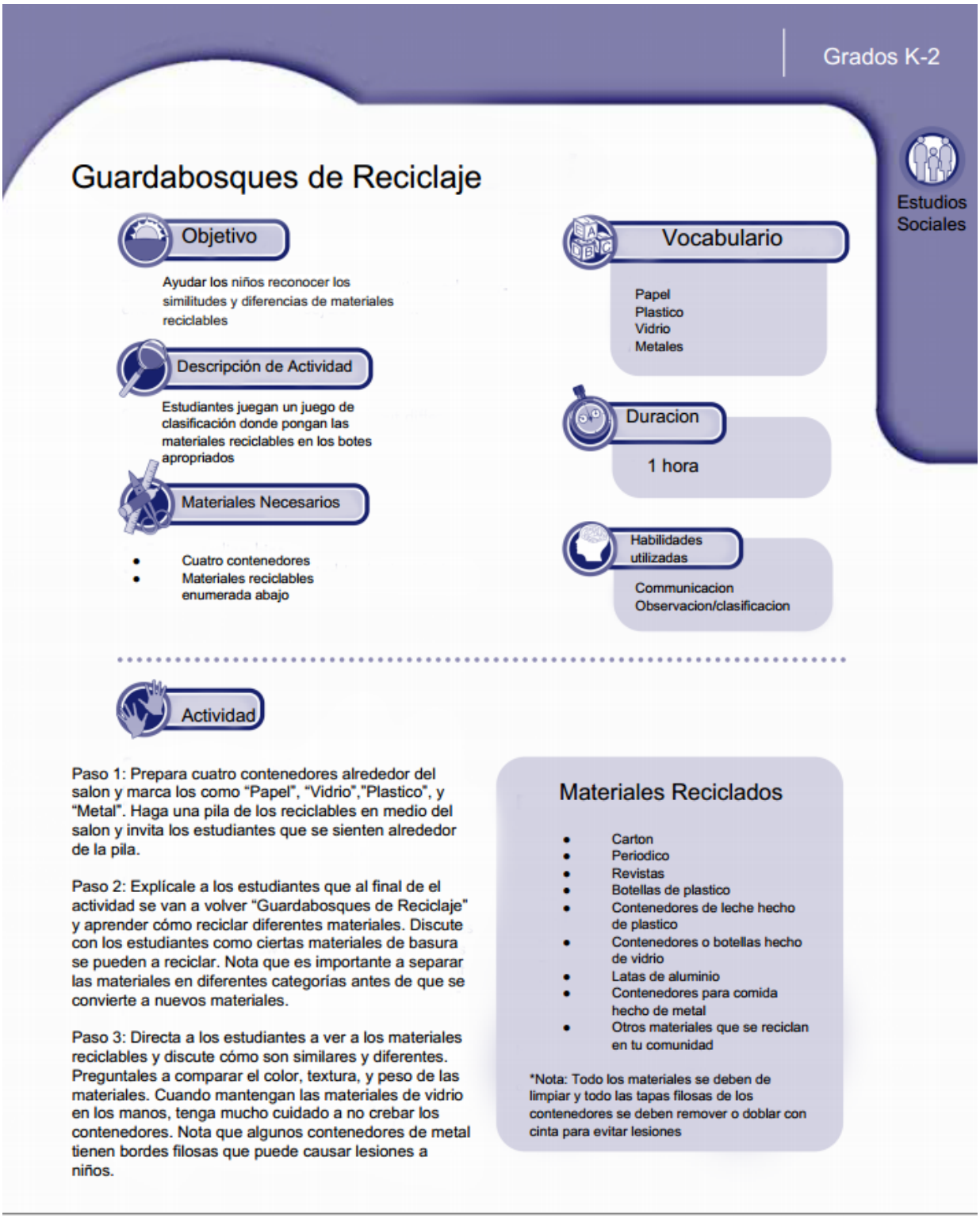
Link: http://www.epa.gov/osw/education/quest/pdfs/sections/u2_chap2.pdf



Grados K-2

Estudios Sociales

Guardabosques de Reciclaje

Objetivo

Ayudar los niños reconocer los similitudes y diferencias de materiales reciclables

Descripción de Actividad

Estudiantes juegan un juego de clasificación donde pongan las materiales reciclables en los botes apropriados

Materiales Necesarios

- Cuatro contenedores
- Materiales reciclables enumerada abajo

Vocabulario

Papel
Plastico
Vidrio
Metales

Duracion

1 hora

Habilidades utilizadas

Communicacion
Observacion/clasificacion

Actividad

Paso 1: Prepara cuatro contenedores alrededor del salon y marca los como "Papel", "Vidrio","Plastico", y "Metal". Haga una pila de los reciclables en medio del salon y invita los estudiantes que se sienten alrededor de la pila.

Paso 2: Explícale a los estudiantes que al final de el actividad se van a volver "Guardabosques de Reciclaje" y aprender cómo reciclar diferentes materiales. Discute con los estudiantes como ciertas materiales de basura se pueden a reciclar. Nota que es importante a separar las materiales en diferentes categorías antes de que se convierte a nuevos materiales.

Paso 3: Directa a los estudiantes a ver a los materiales reciclables y discute cómo son similares y diferentes. Preguntales a comparar el color, textura, y peso de las materiales. Cuando mantengan las materiales de vidrio en los manos, tenga mucho cuidado a no crebar los contenedores. Nota que algunos contenedores de metal tienen bordes filosas que puede causar lesiones a niños.

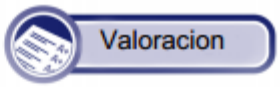
Materiales Reciclados

- Carton
- Periodico
- Revistas
- Botellas de plastico
- Contenedores de leche hecho de plastico
- Contenedores o botellas hecho de vidrio
- Latas de aluminio
- Contenedores para comida hecho de metal
- Otros materiales que se reciclan en tu comunidad

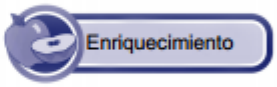
*Nota: Todo los materiales se deben de limpiar y todo las tapas filosas de los contenedores se deben remover o doblar con cinta para evitar lesiones

Paso 4: moviendo a través de la pila, un objeto a la vez, pregúntale a los estudiantes a identificar la material que cada objeto está hecho de.Después, escoja un voluntario para colocar el objeto en el contenedor apropiado. Para los niños de más edad, preguntale al voluntario a nombrar otro objeto hecho del mismo material. Si un estudiante, por ejemplo, tiene un jarra de vidrio, el o ella puede anotar que botellas de soda también estan hechas de vidrio.

Paso 5: Cuando se acaba el lección, encoraja a los estudiantes a compartir lo que aprendieron ese día con sus padres



1. Preguntale a los estudiantes nombrar algunos ejemplos de materiales reciclables
2. Haga que los estudiantes explican porqué es importante a clasificar diferentes materiales reciclables.
3. Preguntale a los estudiantes que clase de materiales estan hecho los reciclables.



1. Selecciona unos objetos del leccion, asegurando una buen mezcla de formas y tamaños. Haga que los estudiantes trazan el contorno y colorea los objetos reciclables. Cuelga los dibujos al las paredes de la aula para crear una galleria de arte.
2. Organiza la clase en equipos de cuatro niños y darle a cada equipo una material de reciclaje diferente. Pide a los estudiantes que hagan un nuevo objeto de la material reciclable como un detentor de lápices o un avion de papel.

Querido Padre(s)/guardián(s)

Hoy to niño aprendió acerca del nuevo centro de acopio en su vecindario de Cantera. Se les dio una presentación de los riesgos que vienen de basura que no está dispuesta correctamente, como un centro de acopio puede ayudar, como usar esta facilidad, y los beneficios que ganaran de usarlo. Algunas actividades que estaban proveídos incluyen la libreta para colorear, busca palabras, y un juego corto.

Esperamos que tu niño disfrutar esta lección y se beneficiarán de ella. Como del lección, los estudiantes les toca crear un póster acerca de disponiendo basura correctamente. Le pedimos que trabaje con sus hijos en este proyecto. Estos pósteres serán encajados en las escuelas y la comunidad. Las instrucciones están adjuntadas. Para más información el dirección, información del contacto, o el página de Facebook están anotado abajo. Gracias por tu tiempo y por favor no dudes en contactarnos para preguntas o preocupaciones.

Locación:
Numero de Telefono:
Pagina de Facebook:

Instrucciones para una competencia de la concientización ambiental

Querido(s) padre(s) / tutor(es),

Su niño va a participar en una competencia el diseño de un póster. Esto será una actividad divertida y educativa que cada estudiante va a diseñar un póster colorido que ayudaría a promover concientización ambiental en Cantera. La participante está animado a usar lo que hoy aprendieron en su lección durante su tiempo en la escuela. Animamos que las padres o tutores ayuden sus niños con esta actividad.

Cosas para incluir en su póster:

- Consigna creativos como "Mantenga Cantera Limpia" o "Cantera es nuestros hogares." O mejor, proponga sus propios consignas creativas.
- Diseños y dibujos del ambiente.
- Figuras y palabras que sugieren prácticas seguros, como reciclando.

Por favor entregue sus pósters a sus maestros antes de **(Ponga una fecha aquí)**
Los diseños mejores estaran escogidos de los maestros que dieron la lección a los participantes. Ganadores serán escogidos por creatividad, información, y el diseño de sus pósters.

Todo los pósters serán encajados alrededor de las escuelas y la comunidad, los mejores tres diseños recibirán una certificación de reconocimiento por su logro.