Mapping and Planning for Spatial Redevelopment of Monwabisi Park, Cape Town

An Interactive Qualifying Project proposal to be 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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Chapter 1: Introduction

All over the world, dispossessed people have built informal settlements in reaction to economic, social, or political shifts. Based on the definition given by the UN Habitat Programme, informal settlements are defined as residential areas where a group of houses have been formed even though the owners have no legal rights to the land, or these houses are not up to standard building practices (WHO). The people living within these settlements do not do so by choice, but by necessity. Many times the shacks in informal settlements are created for temporary housing because of new economic opportunities that can arise in large cities. The people who live in informal settlements are not uneducated. On the contrary, many possess the skill set to be competent in various jobs. Unfortunately, the temporary dwellings gradually transform into permanent residences as the economy fails to provide an adequate number of jobs. In the end, this unexpected shift from temporary housing to permanent housing brings forth some major, equally unexpected, issues. Lack of formal infrastructure, access to water, and sanitation facilities plagues many of these informal settlements, creating a sub-standard location for living. Informal settlements introduce major issues for both the residents in the settlements, and the city around them such as physical land invasion and an increase in crime (Oelofse & Dodson, 1997).

One such informal settlement is Monwabisi Park, which is situated on the outskirts of Cape Town, South Africa and is one of 220 informal settlements in Cape Town. Due to a rapid migration to Monwabisi Park, the current design of the community lacks sufficient infrastructure and formal roads. The city has implemented some improvements such as rudimentary water taps and bathrooms; however the majority of these are in a poor state of repair. This community's need of a redevelopment plan for a sustainable environment is common to many informal settlements throughout South Africa since most have population growth issues. In 1999, a case study estimated that more than 70,000 shack dwellings existed in the Cape Metropolitan Area, while Monwabisi Park housed only 2,189 of them (Sharp, Broadbridge, & Badstuebner, 1999). A 1999 census yielded a total population of 7,356 residents in Monwabisi Park (Sharp, Broadbridge, & Badstuebner, 1999), while in 2008 the population was estimated at 20,000 residents indicating that in less than ten years the population nearly tripled (WPI CTPC, 2008). This rapid population growth has reduced space for essential features such as community centers, public land, relocation housing, and most importantly roads. Since the dominant method of transportation within the community is walking, small dirt paths are utilized as roads. These types of roads are dangerous and ineffective in a case of an emergency, as only one-third within Monwabisi Park are accessible to fire trucks and other emergency

vehicles. Further, residents refuse to use many of these roads at night for fear of crime (WPI CTPC, 2008). Developing a new spatial design including formal roads would not only provide a safer environment for the residents of Monwabisi Park, but would also organize the current haphazard situation so it can more easily be improved in the future.

The current layout and conditions of Monwabisi Park have been extensively studied and mapped through a variety of previous work. Studies of other informal settlements provide insight into the conditions in Monwabisi Park as well as some successes and failures in trying to improve those conditions. One study done in Phola Park, Cape Town, discusses the building of an electrical grid and roads, as well as the need to move shacks to create space (Haferburg, 2002), three problems that are also involved with redeveloping Monwabisi Park. In 2005, the Shaster Foundation started a project to build community centers in the Park in an effort to spur development. In 2007 and 2008, students from Worcester Polytechnic Institute joined the Shaster Foundation and several other sponsors to study the area and continue redevelopment efforts. These projects have covered areas such as laundry facilities, sanitation, energy, building houses, and the economy. (WPI CTPC, 2008). One of these projects created a geographic information system (GIS) map of the park and displayed the graphical results of each project. The project also proposed a network of roads that could be implemented to improve travel and accessibility in the park (Franck, Mayo, Tomasko, & Xie, 2008). In addition, the Violence Protection for Urban Upgrading (VPUU) has done detailed research into these problems, proposing improvements in many areas, especially pedestrian safety (VPUU, 2006). This work presents a strong foundation from which to tackle the many remaining problems found in Monwabisi Park.

Every informal settlement faces unique challenges, so despite all the research that has been done in Monwabisi Park and the best practices found from other informal settlements around the world, there is still no definitive plan for development acceptable to both the residents of Monwabisi Park and the City of Cape Town. A detailed, comprehensive plan that is possible for the City to implement and fully endorsed by the community at large must be found. As a first step towards accomplishing this goal, a better method of visualization would be valuable. Currently the park has only aerial pictures and hand drawn maps; such two dimensional representations are useful under many circumstances, but not sufficient for all purposes. Areas requiring topography (such as drainage or sewer systems) need more planning and visualization aids. Such aids could dramatically help with other problems as well, such as how to build roads in such a cramped environment. The construction of formal roads would aid in development immensely through increased commerce, safety, and accessibility, but would require extra planning to create the necessary

space. In addition to a lack of vehicle roads, the roads and paths that currently provide access to the park are considered unsafe by the residents due to a high crime rate. Monwabisi Park needs a complete plan for the redevelopment process including roads, safety, and organization but this must be taken one step at a time.

With these needs in mind, it is our project's mission to propose improvements to roads in Monwabisi Park while increasing the safety of the residents traveling through the Park. We will collaborate with both external organizations as well as the residents of Monwabisi Park to propose possible redevelopment designs and to create a three dimensional model of the park that can serve as a visual aid for redevelopment planning now and in the future. More specifically, our group will focus on five major goals while in Cape Town:

- Identify current road conditions, and create a plan to improve the roads and propose an implementation plan
- Investigate current pedestrian safety measures and propose improvements
- Collaborate with other groups on a topographic model of Monwabisi Park and the immediately surrounding area in order to illustrate key redevelopment principles
- Propose improvements to path and street lighting
- Propose further improvement to housing layout and organization

The completion of these goals will be heavily dependent on our ability to collaborate with other groups, outside stakeholders, and most especially the residents of Monwabisi Park. Key stakeholders include our sponsor organization, the Violence Prevention through Urban Upgrading (VPUU) of Khayelitsha along with Informal Settlement Upgrading Programme (ISUP). These liaisons, along with others, shall help us achieve our goals and more during our time working in Cape Town.

Chapter 2: Background

2.1 Monwabisi Park

Cape Town is arguably the most cosmopolitan city in Africa – a coastal paradise that is the chic jewel of South Africa. Internationally ranked hotels and restaurants pepper the city and artisans flourish under the generosity of Cape Town's visitors. Consequently, it is a strange sight to behold that just outside the city lays Khayelitsha, a massive black township comprised mostly of makeshift dwellings and few amenities. Because settlement in parts of Khayelitsha is illegal, the exact population of the township is unknown - but estimated to be over 600,000 residents. Monwabisi Park is in the southernmost portion of Khayelitsha and is plagued by an

array of disadvantages, such as unreliable access to electricity and sanitation, lack of economic opportunities for residents, and erratic layout that has resulted in dangerous neighborhoods and difficult access for emergency services. A child of South Africa's tumultuous past, the why's and how's of Monwabisi Park need to be fully understood in order for comprehensive improvements to be made.

2.1.1 Migration to Monwabisi Park

In 1997 residents of the Harare district of Cape Town "invaded" Monwabisi Park. These migrants had no money and could not afford a place to live. As a result, they set up what they thought would be temporary housing on public land such as Monwabisi Park, which has been a nature reserve and a landfill, and is now home to nearly 6,000 shacks (WPI CTPC, 2008). Because of the temporary intentions of the informal homes, there was never any time spent on developing infrastructure or even building in an orderly manner. The residents could neither afford to build the typical infrastructure of a city, nor did they have the knowledge to leave space for it.

The predictable result of this unorganized expansion was an unorganized community. Since the community was not constructed with any thought to urban planning, it cannot easily be developed; there is no infrastructure already in place, and no space in which to place new structures. Consequently, a significant amount of urban planning must be done now in order to remedy the problems caused by overexpansion in the past. The planning must incorporate many different factors and satisfy both the people, who should be involved in the planning itself, and the city government, who will most likely be responsible for implementing it.

2.1.1.1 Apartheid

Following the end of the apartheid government in South Africa, blacks were faced with a newfound freedom that many had never felt before. During the peak of the apartheid era, segregation had gone so far that "there was not only a major structuring of legal constraints upon the population as to where people may live, work and enjoy recreation, but a major exercise in land use zoning to achieve the aims of the legislators" (Christopher, 1987). When these restrictions were lifted hundreds of thousands of black South Africans moved from rural areas to urban areas in search of work. Since none of the migrants had held political or municipal power before, they lacked the experience and resources to plan an urban neighborhood. Many things that would have been set up by an educated, fully funded urban planner were left unconsidered, including such basic necessities as

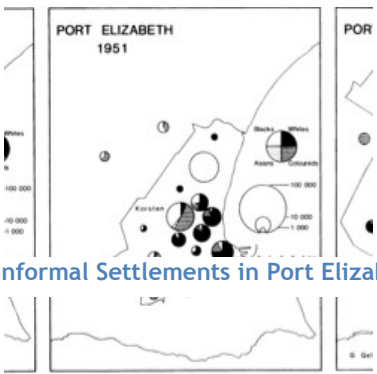


Figure 1: Growth of Informal Settlements in Port Elizabeth (Christopher, 1987)

water, electricity, and roads. They also did not realize that the job market would not support the influx of available labor, forcing most of them to remain in inadequate housing far longer they had intended on doing so, stretching months into years (WPI CTPC, 2008).

A similar situation arose in Port Elizabeth through slightly different methods. In Port Elizabeth, blacks were segregated as part of the Apartheid era, rather than as an inadvertent economic after effect. The concept of the "Apartheid city" is something that developed in South Africa starting in the 1950's until about 1985 (Christopher, 1987), although the concept of segregation had been present for much longer. The primary focus of the apartheid city design was to completely segregate the city, keeping whites separate from all people they deemed inferior. Because of the extreme measures the city officials went to in order to enforce segregation, the urban layout quickly became a nightmare for future planners.

After the founding of the city, the population quickly grew as more people came in search of jobs in what had become a major trading post. Once the population became large enough around 1855, "as a result of increasing numbers of rural Blacks migrating to the town in search of work, notably in the harbour, the municipality issued the first set of segregationist regulations" (Christopher, 1987). There was a separate housing area where the Blacks had to live unless they had enough money to purchase their own house elsewhere. Later on, the Natives Land and Trust Act of 1936 prohibited Blacks from living outside of designated black housing areas, and prevented them from being able to vote. By 1985, only "3.4 percent lived outside their own designated group areas (Christopher, 1987). Figure 1 shows the expansion of Port Elizabeth's segregated areas. The mess left behind from many years of human relocation is very similar to the lack of infrastructure in Monwabisi Park. The once designated "black housing areas" that became so overcrowded are undergoing redevelopment to try and make the city more appealing to businesses, tourists, and most of all, the residents.

2.1.1.2 Current Structure

Due to the saturated job market, the majority of people in Monwabisi Park did not find work and therefore could never afford to move out of their "temporary" housing. It has become semi-permanent, although it was never designed to be. The settlements as a whole were also not designed to be permanent, with no formal planning or structure to them. Most paths that exist through the settlements are only wide enough for foot travel and what vehicle roads do exist are not laid out in a logical manner. Other basic necessities, such as schools, crèches, bathrooms, and

community centers, were not constructed or even planned. No space was left for any future development, as each person built their shack next to the previous one.

The result of such a rapid, disorganized expansion is near chaos from the view of urban planning. Putting any structures in, even as simple as vehicle roads for emergency access, would require moving shacks from their current locations. Interviews conducted with the residents concluded that they have serious reservations about relocating. Certain conditions must be met before they would agree to do so. Any move would have to be to upgraded housing, be close to their existing home, and be the only move they had to make (WPI CTPC, 2008). This last consideration is the most difficult because permanent housing in a good location must already be set up for them. Since the area is so densely and randomly occupied, it is extremely difficult to find space inside the park boundaries on which to build a new structure. This makes it difficult to build permanent housing within a reasonable distance of the current housing, another key consideration for the residents.

2.1.2 Redevelopment Efforts

The redevelopment of Monwabisi Park is clearly a massive undertaking. Because of the expansive nature of the project and all of the different issues redevelopment faces, it was necessary for the involved parties to try to combine for a more cohesive effort. In addition to the WPI team, the key players in this redevelopment initiative are the Shaster Foundation, the VPUU, the City of Cape Town, and the residents of the park itself. The advantage of this group mentality is that each organization is truly able to focus on their respective major concerns, while simultaneously melding them all together into one united front.

2.1.2.1 The Shaster Foundation

The Shaster Foundation is a South African humanitarian organization dedicated to fighting poverty through sustainable development. Focusing primarily on Cape Town's informal settlements, the Shaster Foundation seeks to implement environmentally friendly improvements that help elevate the quality of life for residents of the settlements, as well as to promote the growth of a permaculture that is essential for these settlements to develop into self-sufficient and sustainable communities (The Shaster Foundation, 2008). In terms of architectural philosophy, the Shaster Foundation is very similar in principle to that of the renowned Laurie Baker. They too believe in designing for the individual, creating solutions to problems

that are concise and unique, as well as cost effective and appropriate to the location (Baker, 2007). The Shaster Foundation's pioneer project is the Indlovu Project, which resulted in the construction of the Indlovu Center. The Center was created to provide to the community valuable resources, such as a soup kitchen, crèche, and clinic. Simultaneously, the purpose of these amenities and resources is to encourage residents to develop more efficient and sustainable practices in many of their everyday undertakings, such as through use of the new laundry facility. The Indlovu Center is maintained and operated completely by the community and is based upon their needs, while experienced volunteers from across the globe collaborate to maintain a safe and effective community center. Although the 2008 fire that almost completely destroyed the center was a major setback, the work of the Shaster Foundation in conjunction with the students and faculty of WPI has set a precedent that will no doubt spawn further improvements and innovations.

2.1.2.2. Violence Prevention through Urban Upgrading (VPUU)

Just as the name implies, the VPUU seeks to combat violence in Khayelitsha through promoting the improvement of the urban environment. A partnership forged between the City of Cape Town and the German Development Bank, the VPUU has an expansive vision of improvement for Khayelitsha (WPI CTPC, 2008). The VPUU feels that the level of crime in Khayelitsha is strongly tied to the quality of life of the residents, thus making improvements on the socio-economic condition essential to violence prevention (VPUU, 2009). They plan on attacking the park's problems

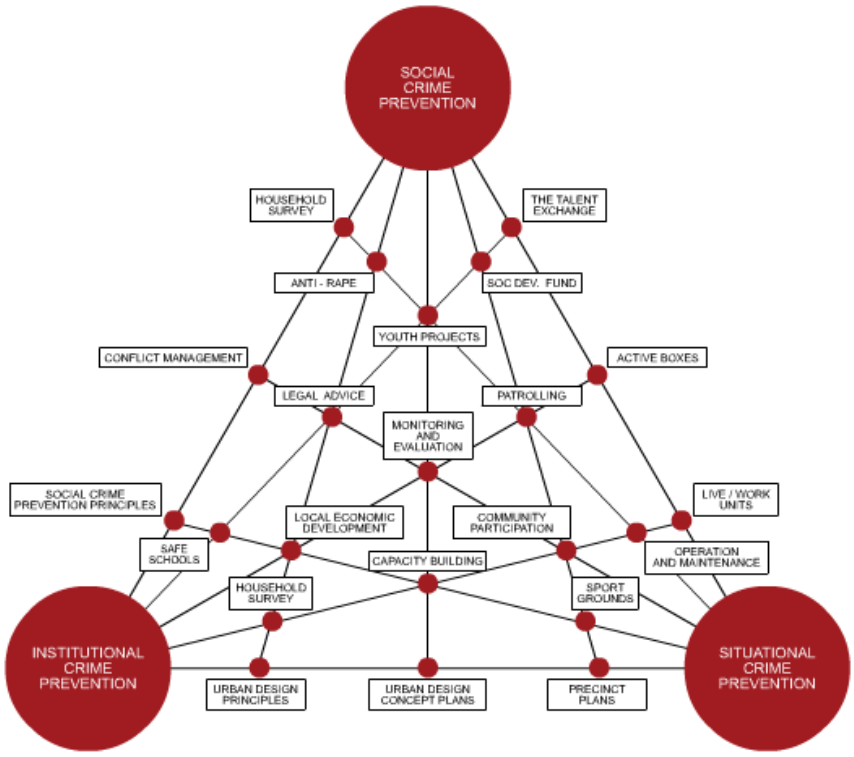


Figure 2: The VPUU Planning System (VPUU, 2006)

through targeting social, institutional, and situational crime as demonstrated in Figure 2 below.

The VPUU envisions a "node system" that peppers the settlement with safe, community areas that are regulated and staffed by members of the community (VPUU, 2009). The key concept concerning the node system is that they will promote connectivity throughout the park. Working in conjunction with the VPUU, the students and faculty of WPI are attempting to help implement this nodal system in Monwabisi Park.

2.2 Spatial Mapping and Planning

Since the 1980's, spatial mapping as a form of redevelopment planning for sub-standard housing developments has grown in popularity. The use of Geographical Information Systems (GIS) presents a rich medium for both technical experts and community members alike. It is believed that the first use of GIS in informal settlement upgrading was in Brazil, and since then it has been used numerous times not only in third-world countries but also in the United States and Europe (Abbott, 2003). In the context of our project, many different organizations have been referring to GIS maps since 1996 to test the applicability of the approach taken in Brazil in other settlements such as the ones in South Africa (Abbott, 2003). The maps are used both with co-researchers and with the community as a communication tool because they are so effective from a planning standpoint.

The interesting part of spatial planning is that there is no single, standard way of doing it. Our project is unique in that much of its design is based on input and feedback from the community. Some people have taken a more logical, and mathematical approach to spatial mapping. The method of procedural mapping is an

Figure 3: Spatial Planning vs. Procedural Analysis (Glass, Morkel, & Bangay, 2006)

interesting topic in computer science and mathematics that can be applied to generating roads for informal settlements using mathematical equations. It is a process that "eliminates the need for direct human interaction" (Glass, Morkel, & Bangay, 2006). A computer program scans an aerial map of an informal settlement and finds the optimal road layout using various mathematical procedures that can

provide nearly infinite possibilities, shown in Figure 3[1]. There are some pros and cons to this approach. The pros are that a computer program is doing all of the hard work for you and it can come up with endless possibilities by only tweaking a few simple user settings. The cons are that the process does not take into consideration community involvement at all, which is extremely important to our work.

In the past, many people have taken a method-based approach to settlement upgrading, with varied success. John Abbott defined such an approach as "a structured and inter-related set of actions that have a logical framework and an internal cohesion, and which lead to a defined outcome" (Abbott, 2001a). In a study done by the University of Cape Town, they determined that there are three main approaches to informal settlement upgrading (Abbott, 2001a):

1. An incremental approach to physical provision
2. Micro-planning at a community level
3. The creation of an holistic plan

Each method has its pros and cons; however, the first method is the most popular. Unfortunately, this method tends to put too much emphasis on building infrastructure, and thus makes the planners forget about the other important things in informal settlement upgrading such as community involvement and flexibility. The second method is something that we will be doing a lot of, as specified later in our methodology. Micro-planning is a useful tool because it allows for the creation of an upgrading process or prototype in a relatively small area that can be replicated across a larger area. By developing small sections of the park at a time, it greatly reduces the complexity of the redevelopment process and makes it much more manageable and flexible on a case-to-case basis. Ideally, we will strive to create a holistic approach[2] to urban planning taking into consideration the needs of the residents, organizations, and the city.

A major problem with informal settlements that planners have to deal with is how to handle space during redevelopment. A balance must be made between public spaces and private spaces, which is not an easy goal to achieve. Well-maintained roads are very important to emergency vehicles and sanitation services, but at the same time you can't compromise too much space so that all the residents can no longer comfortably fit into the new settlement design. Things such as this introduce a sense of vulnerability, which can happen if the planning process focuses too heavily on only one or two elements and ignores the rest of the factors that need to be considered. John Abbott proposes the following list of concepts that should be taken

[1] As seen in Figure 3. The aerial photographs are the result of normal planning and mapping, whereas the red and black images are the result of computer procedural analysis.

[2] Holistic in the sense that the planning process takes equal consideration to the thoughts of all involved parties and does not leave any group "vulnerable" and is used to emphasize the importance of the separate parts (residents, outside organizations, City of Cape Town) working together for a common goal

into consideration while proposing improvements to informal settlements (Abbott, 2002):

- Physical risk associated with the site
- Personal risk
- Livelihood
- Ability to withstand shocks
- Ability to withstand negative trends
- The recognition of intangible assets
- The social value of tangible assets
- The social value of communal assets
- The impact on informal sector activity
- Spatial relationships

It is obvious that there is always a certain level of risk when entering into a project this large, thus this risk must be kept to a minimum through careful planning. The livelihood and strength of the community is something that is especially important, as is their culture and their understanding of the work we do. It is important that we help the residents understand the big picture of what we envision while at the same time adhere to their suggestions and cultural standards. Understanding the impact that infrastructure development, especially roads, has on business is also extremely important. Community centers such as the one at the Indlovu Center and the safe nodes proposed by the VPUU are examples of recognizing the social value of communal assets.

2.2.2 GIS Mapping

The Geographical Information System, or GIS, is a continually growing resource used to visualize and understand geographical data. The system reveals relationships and trends in a particular area through maps, reports and charts. It is used throughout the world to connect the social, economic, environmental, and physical aspects of a community in a way to allow the members of that community to "work in a much more interactive way to address the multi-faceted nature of [their] informal settlements" (Abbott, 2003). GIS mapping is a tool used in urban planning, which makes it especially beneficial to informal settlements due to their lack of infrastructure and framework and their need of redevelopment. GIS is effective because it can express the social, economic, and demographic changes that can be expected when a physical change is proposed in the area (Abbott, 2001b).

GIS maps are very versatile and can show themes, patterns, individual features, quantitative data, density data, and much more (ESRI, 2009). They use three different types of images: points, lines, and polygons. Points represent a

specific location, such as an address. Lines represent features including area boundaries, roads, and contour lines. Polygons represent different areas with similar characteristics. For example, a polygon of a certain color shown on a GIS map could indicate an area of a city that has over 70% Hispanic population, while a polygon of a different color could indicate an area with over 70% Asian population. Polygons can also represent structures such as churches, businesses, and schools (WPI CTPC, 2008).

By examining a GIS map one can determine the distribution of demographic features in a particular area and therefore can predict emerging patterns (ESRI, 2009). A GIS map can also exemplify certain demographics so that a community is able to plan accordingly. For example, most urban communities plan for an emergency evacuation in case of a natural disaster or a similarly dangerous event. By using a GIS map, the community can observe locations of low income families who may have difficulty evacuating a dangerous situation for reasons like lack of personal transportation. For that reason, it would be beneficial for urban planners to develop a public transportation system or any other evacuation plan particularly in the extremely low-income neighborhoods.

Usually, a GIS map is used to illustrate data that has already been collected. However, informal settlements have limited data due to the fact that they are less frequently analyzed than "legal" settlements or communities. This creates a more challenging approach to redevelopment in these areas. Most often, the only data provided by the settlement is an aerial view of the settlement itself. If an aerial map is not provided, a planner must either draw a layout of the city to the best of his ability by hand or using a computer program, or obtain an aerial photo from a different source. If an aerial map is provided, the different points, lines, and polygons are simply drawn over the map to indicate their locations. The process of locating these different features starts with conducting several mapping exercises with the community members and co-researchers. Mapping exercises could include locating street lighting, emergency access roads, or most popular routes of travel on the aerial map, followed by taking pictures of the map with the new data drawn on it. These pictures are then documented and digitized into GIS (WPI CTPC, 2008). The data shown on a GIS map of an informal settlement is similar to that of a formal community, including demographic and socio-economic data, economic opportunities, physical planning and design data, and housing data (Abbott, 2003).

One major objective of urban upgrading in an informal settlement is to educate the residents about what their existing community looks like compared to what a sustainable community looks like, and how this sustainability is achieved. GIS mapping will allow the community to obtain a physical image of "the interaction between the spatial and physical elements on the one hand, and the social and

economic opportunities on the other" (Abbott, 2003) that the changes will bring. This image creates a comprehensible technique for educating the community members. Furthermore, the maps created using GIS can be used in future redevelopment and urban planning and mapping efforts.

2.2.3 Case Studies

Urban planning and spatial redevelopment is a technique that has been used numerous times within South Africa, and even more so around the world. By studying the outcomes of other projects, we can learn what to do and what not to do in our own work. Of course, every project is different but there are some fundamental ideas to urban planning that are shared across projects, and many of the urban designs for other informal settlements in South Africa share quite a few similarities with Monwabisi Park

2.2.3.1 Responses to the Informal Settlement in Hout Bay, South Africa

The area of Hout Bay has followed a very similar path to Monwabisi Park, but also has some distinct differences. Hout Bay is split into three main segments: the predominantly white upper class, the "lower-income coloured residents, who reside in hostels and flats, and middle-income coloured and white residents" (Oelofse & Dodson, 1997), and finally the residents of Mizamoyethu.

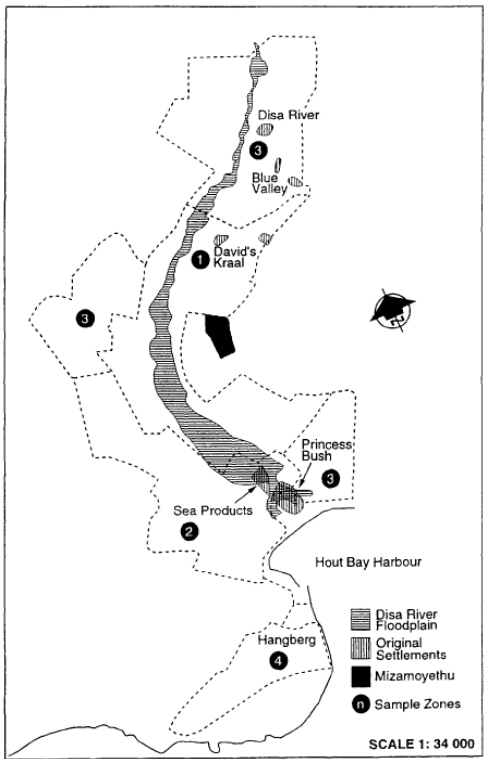
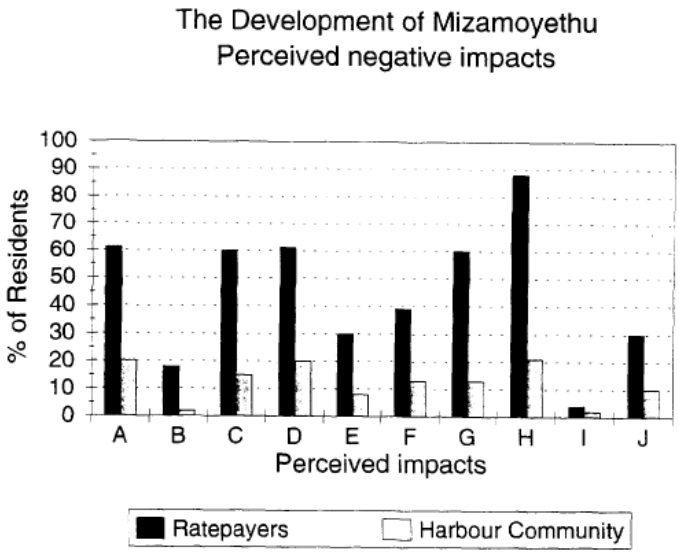


Figure 4: Map of Informal Settlements in Hout Bay (Oelofse & Dodson, 1997)

As the apartheid era came to a close, many people came and settled illegally on the land around Hout Bay looking for new economic opportunity. Since the government's policy about illegal housing was "challenged and was thus unclear" (Oelofse & Dodson, 1997), they decided that something had to be done. Unfortunately, forced removal of people from their homes would cause more problems than it would solve, so the government had to investigate other possible solutions. In fact, the land invasion happened so rapidly that by 1990, "there were approximately 2000 squatters living in five settlements around Hout Bay" (Oelofse & Dodson, 1997). Figure 4 above shows

how large the settlement of Hout Bay has grown due to this land invasion. In addition to this, the residents who had been living in the area since before the land invasion had become concerned with the large number of people illegally living so nearby. They said that health conditions would only get worse and security had become much more important[3]. Eventually, the residents in the informal settlements acquired the legal rights to land in Hout Bay, and all five districts moved there. Unfortunately, there still lacked any logical urban framework and a need for redevelopment arose over time.

A survey was taken to see how people from various socio-economic groups felt about the formation of Mizamoyethu. It seems that the predominantly coloured community showed less concern about its development; however, both the upper class and the middle class showed signs of discontent. Many organizations were formed to try and bring peace and order to the conflicting classes. It seemed that a "perceived need for a buffer [zone] between the formal and informal community and the impact of the settlement on property values and security" were the most important issues as shown by the graph in Figure 5.



Key	Negative Impacts	Key	Negative Impacts
A	Security	F	Pollution
B	Burgled - yes	G	Deforestation
C	Property prices	H	Congestion
D	Beggars and hawkers	I	Health conditions
E	Environmental quality	J	Quality of life

Figure 5: Negative opinions towards the informal settlement (Oelofse & Dodson, 1997)

Since most of the residents of the informal settlements had acquired legal rights to the land they were living on by 1990, the state had to intervene to keep the nearby local residents happy (Oelofse & Dodson, 1997). Because of this, the settlement of Mizamoyethu was created. In order to make sure that the needs of everyone were met, Mizamoyethu was formally planned and kept in mind many of the issues that plague informal settlements. Once development of Mizamoyethu was completed, all of the residents of the informal settlements were moved there. Mizamoyethu is an example of informal settlement upgrading that has come to fruition and has been a relative success.

[3] Police data shows that crime had increased as the informal settlement grew and decreased again later after Mizamoyethu was founded (Oelofse & Dodson, 1997)

The development of the Hout Bay informal settlements shows that there is much more to spatial redevelopment than simply placing roads and buildings in locations that appear to be the most logical. People both inside and outside the community have very strong opinions about each other, and this is something that must be taken into consideration. It goes without saying that the image of Monwabisi Park needs to be improved, but the question centers around how to make both the residents of the informal settlement and the residents living in close proximity to the park happy. The focus of our project will be primarily on supporting the needs of the residents of Monwabisi Park; however, its location is right next to a major road (Mew Way) and across from the more formal settlement of Harare.

2.2.3.2 The Phola Park Informal Settlement

Phola Park is an informal settlement located in the Wetton-Lansdowne development corridor (Haferburg, 2002) that shares many similarities to Cape Town's other informal settlements including Monwabisi Park. It is an area that consists entirely of shacks and is very overcrowded, as seen in the Figure 6. There are very few businesses inside of Phola Park which makes finding work for the residents extremely difficult. Most families live as "small, two-generation families or as single mothers" and came to Phola Park in search of economic opportunity (Haferburg, 2002).

The infrastructure in Phola Park, like that in Monwabisi Park, is nearly non-existent. Phola Park experiences frequent flooding due to the lack of a proper drainage system and a severe lack of public facilities such as toilets and water taps.

There have been some redevelopment efforts for Phola Park however. The area has received a new electricity grid with newly installed poles, and the City of Cape Town has installed street lamps to help light the area at night. The only downside is that the residents have to pay for their electricity, which many of them refuse to do in order to save as much money as possible (Haferburg, 2002). Indirectly, installation of the electric lines caused some rerouting of the paths within the park to better accommodate vehicles. Shack relocation was an issue that

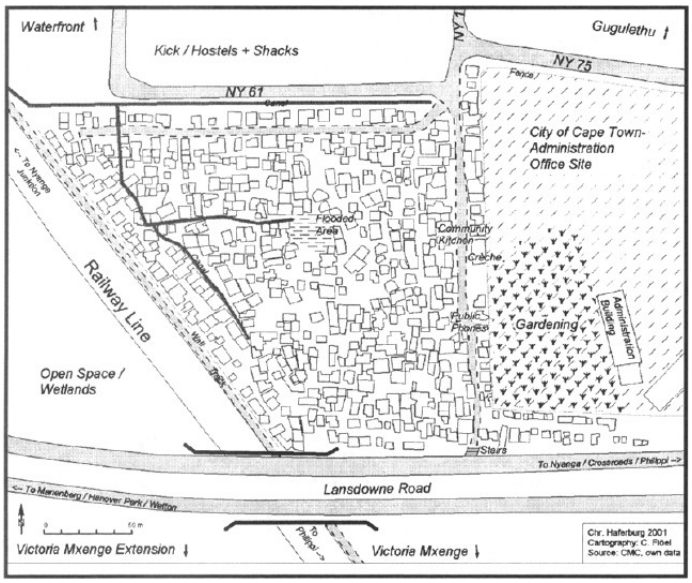


Figure 6: Drawn map of Phola Park (Haferburg, 2002)

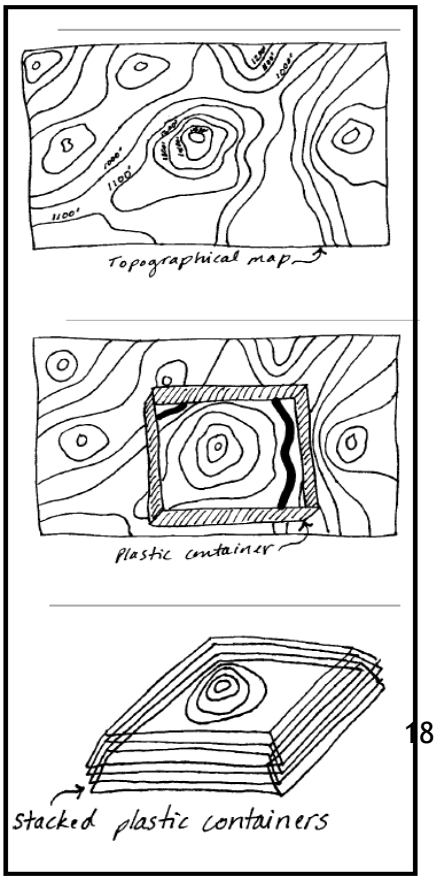
the planners had to deal with, and they did so in “close co-operation with the residents [which] was facilitated by community liaison officers” (Haferburg, 2002).

There still remains much to be done in terms of redevelopment; however the community there now is stable and better off than when the park first formed. One important thing to take away from Phola Park is that redevelopment has to happen gradually as opposed to numerous changes happening all at once. It is much easier to manage upgrading one thing at a time if at all possible, than trying to upgrade every aspect of the park all at once.

2.2.4 Three-Dimensional Modeling

Three-dimensional (3D) models are often used to portray proposed designs of redevelopment in scenarios where the public is greatly involved. These models demonstrate almost all aspects of a final product and give the public something tangible to explore. 3D models can not only accurately depict the physical features of a design, but it can also show relationships, such as the relationship of buildings to roads, and social aspects, such as public transportation to community centers. Usually 3D models show the topography of the area, meaning they show corrugated contour lines which represent relative positions and elevations of the region. They can also show what is beneath the surface, for example, water pipe lines. (Metzger)

3D modeling is especially useful when redeveloping an informal settlement, like Monwabisi Park, because it is a tool that will allow the public to get involved in the planning process and therefore aid them in their decision to accept changes before they occur. Since there are people currently living, working, and interacting in the informal settlement, their opinion is what matters the most. Also, a 3D model is something that can remain in the community so that future planners can use it as a prototype when redeveloping other areas of Monwabisi Park or similar locations.



2.2.4.1 Topographic Modeling

Topographic modeling is a useful resource when working on projects that require collaboration and creativity. As opposed to 2D GIS mapping, topographic models can provide a foundation for an integrated planning approach that really brings together many different topics into a single physical item.

Topographic models consist of a scaled down version of an area of land and contours that show change in elevation. The thickness of the contours, or the contour interval, varies based on the needs of the project, but in general thicker contours are more fitted for modeling very large changes in elevation whereas thinner contours give a smoother look and are good for models with smaller changes in elevation (Hutzel).

The materials used in creating topographical models vary but the general method is very similar. These materials include such things as corrugated cardboard,

Figure 7: Creation of a topographic model (Hutzel)

wood, putty or even plastic food containers. As shown in Figure 7, the model building process consists of analyzing a topographic map, then stacking the preferred building material to give the model depth. Topographic models are most easily created directly from topographic maps that show the contours of the land, although this is not absolutely necessary.

2.3 Infrastructure Design

Designing the infrastructure of an area is perhaps the most central concept to spatial mapping and urban planning. Infrastructure encompasses many integral elements of the urban environment, such as roads and paths, water and sewage lines, electricity and lighting, and building placement.

There are several topics that are central to infrastructure planning. One such topic is the "five elements" of a city as specified by Kevin Lynch. The first of the five elements is the concept of paths. They don't have to be strictly sidewalks, but simply commonly traveled routes (Lynch, 1960). Often times the paths are decorated to be visually appealing, although that is not a primary concern for redeveloping informal settlements such as Monwabisi Park. The second concept is the idea of edges. In the context of Monwabisi Park, an edge could consist of a wall or perhaps the edge of the informal housing area along the back side of the park. Districts are the third element of a city and are an important part of our planning. They are sections of the city, or park, "which the observer mentally enters inside of, and which are recognizable as having some common, identifying character" (Lynch, 1960). An example of a district in Monwabisi Park that has already been implemented is the area around the Indlovu Center. The next concept is central to the VPUU's design plan. Nodes are "strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is traveling" (Lynch, 1960). Nodes don't have to be a singular, physical object, but in the plans that the VPUU has proposed, their "safe nodes" are just that. By making these safe nodes the primary focus of many people in the

immediate area, the VPUU hopes it will deter crime and promote a sense of community safety. Finally, landmarks are the other element of a city. They are fairly self explanatory, consisting of a single unique element that stands out from the rest or has some kind of significance. In a way, the VPUU's safe nodes are also landmarks as they can help with navigation throughout the park and are easy to spot.

2.3.1 Roads

Roads are a fundamental piece of the urban planning puzzle. In the practical sense, roads are a way to get from point A to point B. In reality, though, one must consider that the quality and layout of roads significantly affects the dynamics of transportation in the community. Because Monwabisi Park is such a tightly knit community, any major change in their current infrastructure is bound to change the social climate of the area. Adding structured roads throughout the area will inevitably change the way in which people travel, and will alter the flow of people and vehicles within the park. Figure 8 shows the current roads (in red) as well as the roads WPI students proposed in 2008 (in yellow). Currently, people travel in very direct paths from one place to another, walking between shacks and on very informal footpaths. The addition of more permanent infrastructure would draw people away from obscure (and potentially dangerous) means of navigating throughout the park and promote regular routes of travel. This could have economic implications as well, as businesses may benefit more from being on a heavily trafficked street than they would from being on a footpath or alleyway. As mentioned before, emergency vehicle access is something that is severely lacking in Monwabisi Park. Sanitation services also have a difficult time reaching any of the public facilities and are thus unable to tend to them. The obvious problem is a lack of structured, well-maintained roads; however the solution to the problem is not so simple. The layout of the roads will play a pivotal part in the security of the park as well as its economic efficiency and communal benefits. Indirectly, the layout of the roads will also affect the sewage system design and the electricity grid.

Figure 8: Proposed Roads for Monwabisi Park (Franck, Mayo, Tomasko, & Xie, 2008)

Since flooding is a major issue in Monwabisi Park, roads also serve as a primitive irrigation system by collecting and channeling water to either sewage pipes or other drainage areas away from the informal shacks. These roads don't necessarily have to have a blacktop surface, but they need to be durable, able to withstand a high level of pedestrian traffic, and be impermeable so that water doesn't soak through. The main objectives of designing an efficient storm water drainage system using roads are defined by Wong et. al. as (Wong, Breen, & Lloyd, 2000):

1. The protection of natural water systems with urban developments
2. The integration of storm water management into the landscape, creating multiple use corridors that maximize the visual and recreational amenity of urban development
3. Protection of the water quality draining from urban development
4. Reduction of the volume of runoff flowing from urban development and the minimization of impervious surfaces
5. Minimizations of the drainage infrastructure cost

Some of these points may seem like obvious goals but they can be easy to forget during the planning process. The main concept to take away from this during the redevelopment process is to design roads that will effectively channel storm water away from houses while keeping the water as uncontaminated as possible. This will provide great health benefits while causing fewer problems for the residents during the rainy season. The planning process will have to be done on a micro-level because drainage situations can vary greatly within the park itself depending on the topology of the area and the arrangement of the buildings.

A very important part to road design and storm water management is the composition of the road itself. There are many different approaches to building roads, some of which are shown in Figure 9, and every design has its pros and cons. Porous pavements are very popular in most normal urban landscapes which include items such as parking lots and driveways (Wong, Breen, & Lloyd, 2000). As the name suggests, this type of road design is built to provide strong structural support while allowing rain water to seep through the surface. Unfortunately, many studies have shown that this road composition has a high rate of failure when located in "high traffic volume areas" often after only a few years (Wong, Breen, & Lloyd, 2000). Whether or not Monwabisi Park would be considered a "high traffic volume area" is unclear, although "high traffic volume" seems to relate vehicle traffic as opposed to pedestrian traffic so this could be a viable solution since vehicles are scarce within the park. Either way, this downfall is something that must be taken

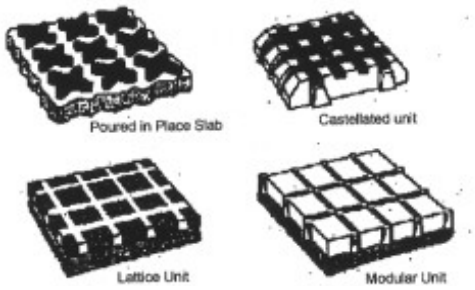


Figure 9: Various designs of porous pavements (Wong, Breen, & Lloyd, 2000)

into careful consideration when determining the road composition during the planning process.

An alternative type of road water drainage system is “swale drains”. These are large ditches alongside the road that the storm water is channeled into by the slope of the road itself. This design helps to prevent erosion and water contamination, but unfortunately it requires a large amount of space – something that is most certainly not present in Monwabisi Park although this could be something to consider along the backside of the park for water drainage provided by other methods.

Buffer strips are an interesting concept that works to remove contaminants from the water so that they don’t infect the water supply and cause health issues. They have had varied success but they are also very efficient. Studies have shown that a “98% removal efficiency for sediment was found regardless of the initial sediment load and overland flow rate” (Wong, Breen, & Lloyd, 2000).

An interesting development with storm water runoff that focuses on water detention or retention has shown promising results. The main idea behind the concept is that water contaminants and pollution is separated from the road runoff using some kind of filtration system. The contaminants are then disposed of properly to prevent contamination of the underground drinking water supply. A complete diagram of how this system works is displayed in Figure 10. Systems such as this are widely used throughout the United States, Japan, Europe and Australia (Wong, Breen, & Lloyd, 2000). Before installing infiltration systems, some studies will have to be

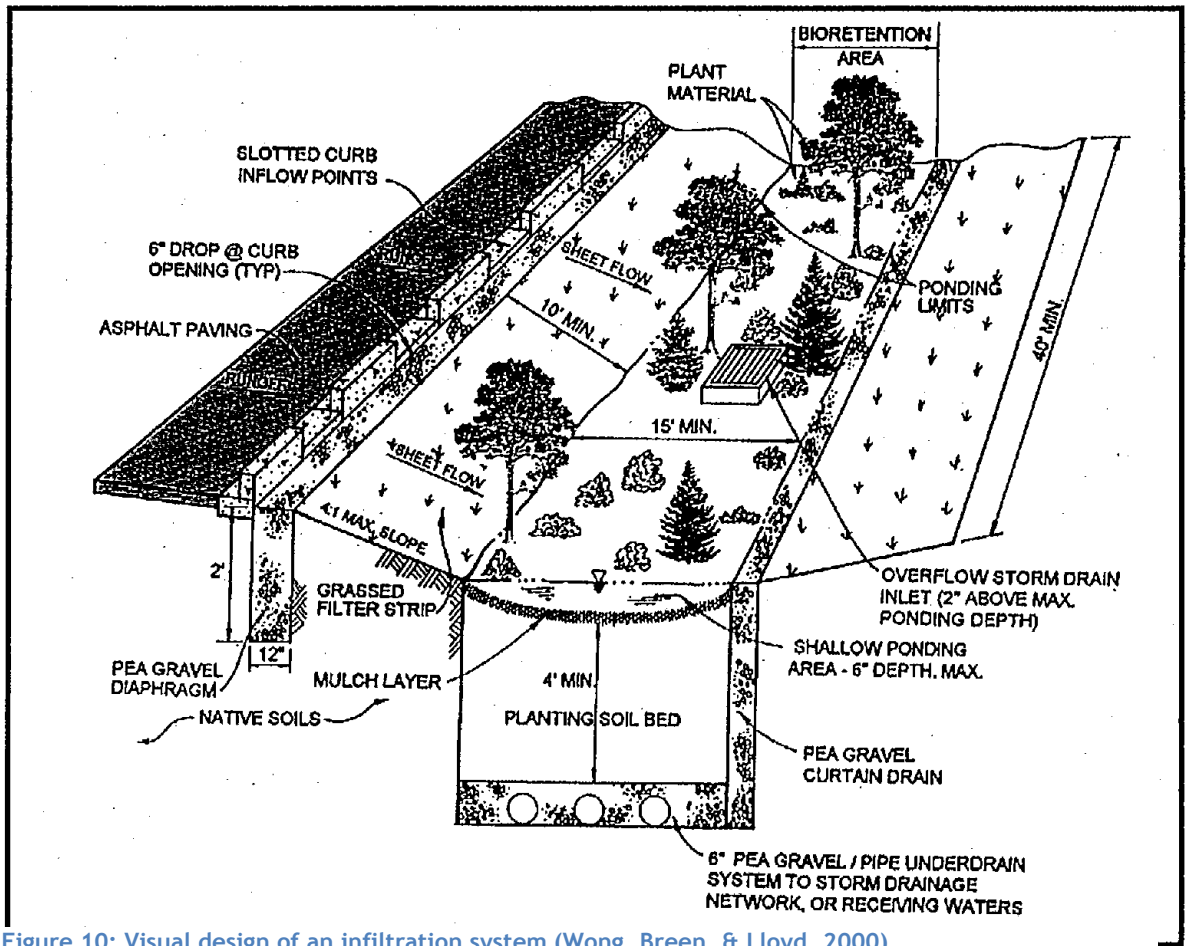


Figure 10: Visual design of an infiltration system (Wong, Breen, & Lloyd, 2000)

conducted to see where the primary source of water pollution originates from within Monwabisi Park, but this could be extremely valuable data to have available.

2.3.2 Lighting and Safe Nodes

There are two main types of lighting: indoor and outdoor lighting. Indoor lighting falls outside the scope of this project and will not be considered here. It may be a topic considered by the Building or Electricity teams. Outdoor lighting, though, is a critical aspect to urban planning and is typically installed along roads. Outdoor lighting typically serves several functions: traffic safety, pedestrian safety, and crime prevention (LonMark International).

In terms of traffic safety, not much is needed immediately within Monwabisi Park because very few people own cars. There are also only a few roads on which cars can travel. One area to consider would be Mew Way and the other paved roads that border the park. It should be determined whether they need more lighting to increase safety or if the additional lights would not be worth the cost. Pedestrian safety is the larger factor in these areas, so areas where people cross roads should be given a higher priority than strictly vehicle areas. The people of Monwabisi Park have identified these roads as very hazardous areas, especially the road located at the back of the park (WPI, 2008). Additional lighting improves visibility for pedestrians and motorists, reducing the number of collisions and accidents (LonMark International).

Inside the park, the largest problem lighting can reduce is crime. Crime is rampant and many people will not go out at night for fear of being attacked (WPI, 2008). Adding lighting can help reduce crime in two major ways: increasing visibility and increasing pride. It has been shown through 13 case studies that adding lighting can reduce crime in an area. Interestingly, both daytime and nighttime crime is reduced. It is hypothesized that this results from a greater pride in the community, more than the added visibility (Farrington & Welsh, 2002). This is a significant principle of our work and would greatly benefit all the projects to increase the sense of pride in the community.

There are several methods to put up lighting and lots of different lighting types. In Milton Keynes, UK, the city recently put in a network of high efficiency lights that both improve lighting and reduce costs. They also adjust for the amount of daylight throughout the year, monitor themselves, and can be controlled from a central location by the city's transportation department (LonMark International). There are large numbers of lighting solutions that exist, the most recent of which is LED lighting. Although it has been in existence for years, LEDs are only recently being used for larger tasks such as area lighting. These could save even more energy than traditional bulbs. Typical bulbs are High Pressure Sodium (HPS) lamps and Low

Pressure Sodium (LPS) lamps that provide a long life but poor color rendering or Metal Halide (MH) lights that provide better color but are less efficient (Fotios & Cheal, 2007).

One can also install the lights in several ways. High street lights are typically seen around roads, but lower lights are often used in pedestrian only areas. These have the effect of making the lighting brighter, but do not cast light over as wide an area. More lights are required to cover the same area, but each light does not have to be as powerful to provide the same level of lighting. More lights also reduce shadows, but increase maintenance and vandalism. Lights can also be placed on existing buildings rather than putting up new poles specifically to hold them. A final consideration is how to power the lights. Because only half the park gets electricity, new lines would have to be strung to power them from the central grid. Other possibilities such as solar or wind power may be used instead.

Lights should be placed along travel routes to be used as efficiently as possible. As a result, they must be planned in conjunction with any plans for new roads or footpaths in addition to planning for the current situation. With changing foot traffic patterns, the lighting system may also have to change and it would be optimal to have flexible lighting that can be easily moved or adjusted for such occurrences.

In addition to improved lighting, the VPUU has proposed a design that includes the "safe nodes" previously mentioned. The VPUU describes them as "mixed use areas that provide in comparison to the rest of Khayelitsha safer residential areas, a variety of social and commercial services, recreational facilities as well as safe pedestrian movement routes" (VPUU, 2009). They will primarily be public community centers where people can congregate, have access to VPUU sponsored programs, and enjoy various other resources the centers may provide. Because the nodes will be approximately three stories tall, members of the public will be able to see a great deal of Monwabisi Park and will thus be able to spot any crimes happening in the area around the safe node. Having this "watch guard" style building will hopefully simultaneously deter crime along the roadways, as well as promote the use of the formal roadways that connect the nodes. More review by the people of the Monwabisi community is necessary in determining whether or not the "safe node" plan is desirable to residents.

2.3.3 Pedestrian Safety along Mew Way

Another area of concern for residents is walking along or across Mew Way, the busy, vehicle road running along the north side of Monwabisi Park. There are numerous methods of improving the safety here. The simplest and cheapest method

would be placing warning signs by the side of the road or similarly, painting them directly on the surface of the road. Some South African signs pertaining to pedestrians are shown in Figure 11 (Traffic Signs, 2005). Somewhat more expensive would be placing lights and crosswalks with a button that allows pedestrians to stop traffic and safely cross. A drawback is unnecessary disruption to the flow of traffic. A third possible solution is making a physical change in the road surface, such as a speed bump or grooved pavement. WPI students discussed several such solutions in 2008 (WPI CTPC, 2008). A final improvement can be made by better educating the residents on how to cross the road and use existing safety features. This can be done in the community education centers inside the Community Centers.

Figure 11: Pedestrian Safety Street Signs in South Africa (Traffic Signs, 2005)

2.4 Housing Organization

Determining the optimal layout of the redeveloped houses is something that is essential to urban planning. Since the final goal is to form an efficient infrastructure, this simply cannot be done by rearranging the currently built shacks around in some manner. Either way, this would be doing a great injustice to the residents of Monwabisi Park because the living conditions inside of the informal shacks are substandard.

There are many different possible housing layouts that can be considered. EcoBeam and the Indlovu Project has already proposed a housing redevelopment plan that includes row housing with public grounds in between rows, and a communal row of

Figure 12: Proposed housing layout for redevelopment (VPUU, 2006)

bath facilities at the end as you can see in Figure 12. Their housing layout could solve the problem of overcrowding. They feel that having a single house on a single plot of land is problematic because it does not provide any means to allow for "households of varying sizes and composition" (VPUU, 2006). The way in which public space is manipulated by the housing layout is an important factor in determining the safety of the immediate area. Poorly planned housing units can inadvertently create dark, dangerous areas that are host to various forms of crime. The VPUU's primary focus behind its housing layout proposal consists of the following points (VPUU, 2006):

- Greater access to residents to public transport and social and economic opportunities
- A safer environment
- A greater choice in forms of housing which are more responsive to need
- Maximize the economic possibilities related to housing development

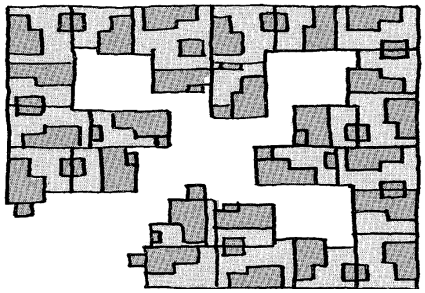


Figure 13: Correa's Module (Correa, 1989)

Consequently, road design parallels housing design because the housing layout needs to be compatible and efficient with the proposed road design, especially so that emergency services can access every house in Monwabisi Park if needed. This will promote a safer environment for the residents. Having a clean, structured housing and road layout will also promote economic activity because travel will be easier and will naturally become somewhat restricted to the roads themselves. Creating predictable human traffic patterns is beneficial to a business's financial success, as you can see in well-structured urban cities around the world.

The layout can be broken down into several different levels, as shown by Charles Correa in *The New Landscape* (Correa, 1989). Here he discusses the typical use of row houses for low-rise, high density housing as well as a hierarchy of spaces. It starts at the plot level for each house, and then the plots are formed into a cluster of 7, which joins two other clusters to form a "module" (Correa, 1989). A module can be seen in Figure 13, where each dark grey rectangle is a single family's house and the surrounding light grey is their plot. The module is made of three clusters of 7 houses and one cluster of 4 houses that abut the entrance to the entire module. There is communal space in the middle of each cluster. This method is fairly versatile as each family can build on their own plot, and each cluster can use their communal space as they see fit. Modules can also be moved together to form larger sections and so on, until the level where schools and other large public buildings are located (Correa, 1989).

Each plot provides enough space for a house and garden or terrace space. The family can use the extra space to add on to the house, if needed, and a second level can always be added as well. Since the houses are located around a main entrance, there is only one place that requires a road per section, significantly reducing the number of roads required versus row housing. In addition to the layouts, Correa offers designs for the houses, with several levels of increasing development and expansion. The houses can be built upwards and outwards to become two stories and fill the plot, if the family needs extra space (Correa, 1989). Such a layout is a possible alternative to row housing.

Chapter 3: Methodology

The main goal of this project is to contribute to urban planning in Monwabisi Park including a road network that will increase the safety of the residents and improve the layout of residential, commercial, and community buildings. The team will collaborate with both external organizations as well as the residents of Monwabisi Park to propose possible redevelopment designs in the form of maps and a topographic model to aid in future redevelopment efforts.

We will be in Cape Town from October until December 2009. However, the VPUU and the Shaster Foundation have been working diligently in our absence in order to try and start redevelopment as soon as possible. Much of our work consists of prototyping and proposing possible redevelopment solutions. It is unrealistic to say that redevelopment based on our ideas will start while we are on-site; however, we hope that in the near future some of our proposals will come to fruition.

Our team has a set of objectives that we will strive to complete during our project. The general workflow is outlined in Figure 14, but the specific objectives are:

- Collaborate with other groups to create physical models of Monwabisi Park and the immediately surrounding area to support planning activities
- Identify current road conditions, create a plan to improve the roads, and propose an implementation plan
- Propose improvements to path and street lighting
- Investigate current pedestrian safety measures and propose improvements
- Propose further improvement to housing layout and organization

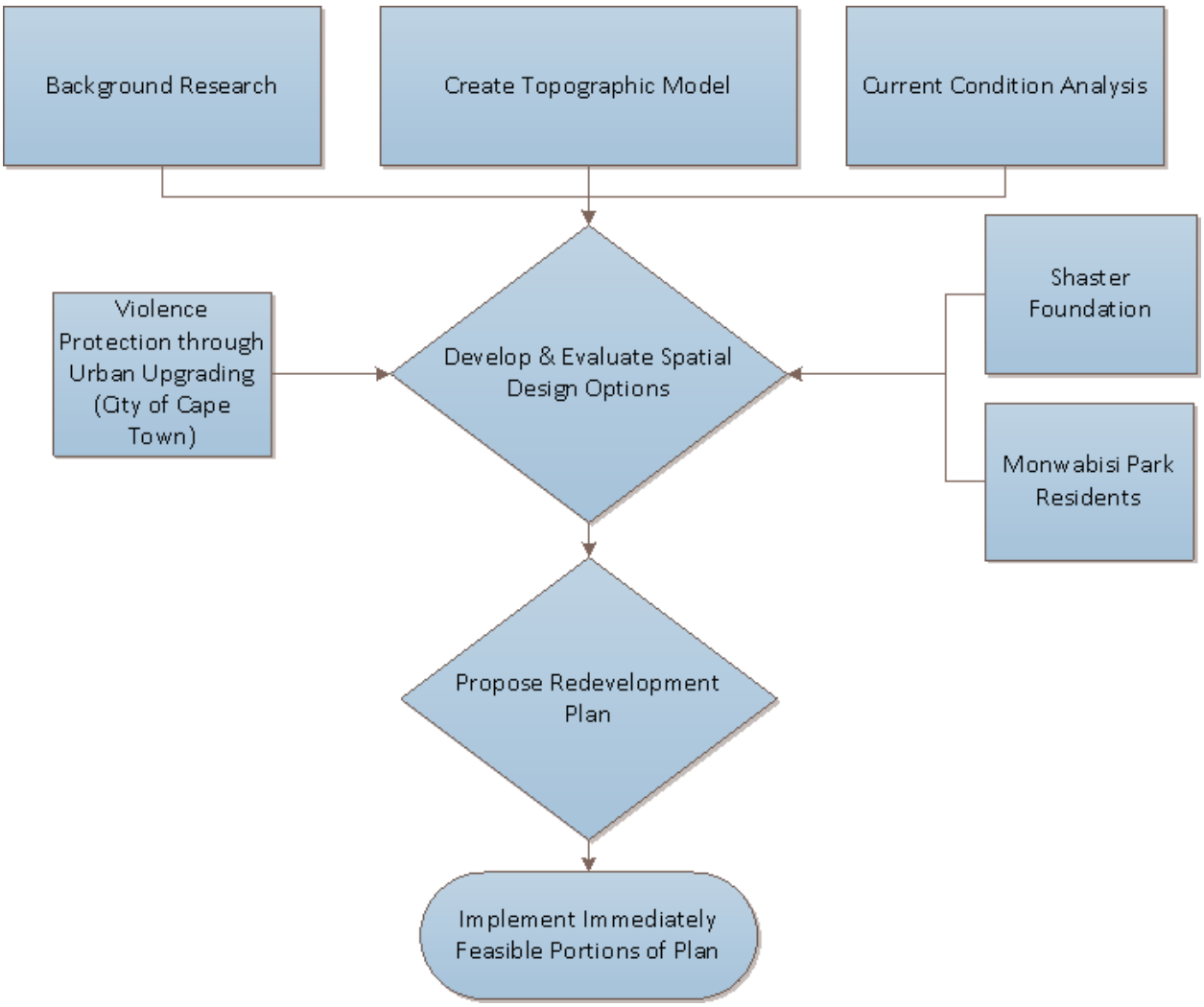
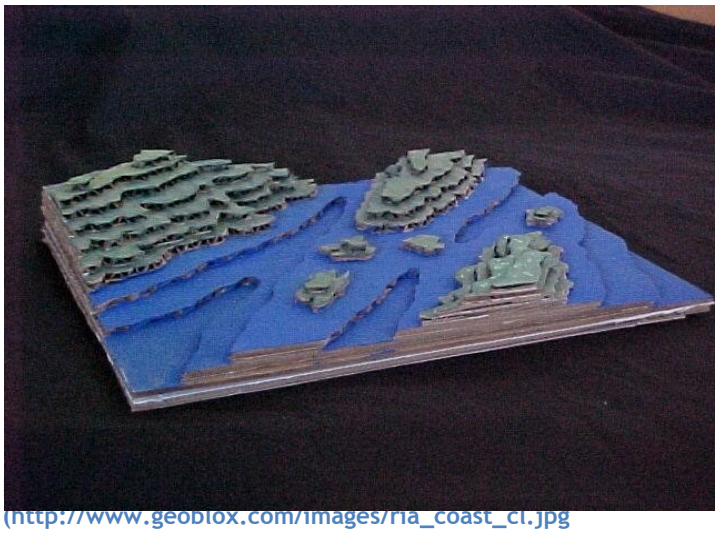


Figure 14: Methodology Flowchart

3.1 Build Topographic Models

Two of the most valuable things our team hopes to leave behind are detailed topographic models for our fellow researchers to use in the Monwabisi Park planning process. One model will include the entire Monwabisi Park and some of the immediate surrounding areas such as Harare and the land along the ocean.



(http://www.geoblox.com/images/ria_coast_cl.jpg)

Following the suggestions of our liaison Michael Krause, the model will be at a 1:1000 scale. The section of the park represented in this model is estimated to be 2.4 kilometers (1.5 miles) in length and 0.5 kilometers (0.3 miles) in width, meaning the model will have to be approximately 2.5 meters (8 feet) long and 0.5 meters (1.5 feet) wide. One of the most important objectives of the model is to express the topography of the land. In order to demonstrate this, the model will be constructed with layered cardboard to give it a dimensional look along the contours, shown in Figure 15. The contours will be accurate to either a half-meter or a whole meter depending on how the model building process commences and upon further inspection of the land. Since this is a small scale model, minute detail, such as water pipelines, will not be displayed. However, it is essential to locate the "redevelopment seeds" and "safe nodes" throughout the park by observing the model. Redevelopment seeds are centralized facilities that include a community center, a relocation facility, a water facility, and a general social environment (WPI CTPC, 2008). Therefore, features such as toilets, water taps, community centers, commercial areas, transportation nodes, and general redevelopment seed locations will be main focal points on the park-wide model. Also, the VPUU notion of "safe nodes" will be another key focus, and their locations will be represented on the model.

The other model will be of Section B in Monwabisi Park, which is shown in Figure 16, and will be of a larger scale. This section of land is about 0.6 kilometers (0.4 miles) in length and 0.3 kilometers (0.2 miles) in width. Using a scale of 1:500, double the size of the park-wide model, this model will be approximately 1.2 meters (4 feet) long and 0.6 meters (2 feet) wide. This will also be a topographic model but will include minute details not shown on the smaller scale model plus other social, structural, and technological features of redevelopment. Some of these features include housing, proposed and existing roads, people, drains and drainage systems, electricity lines, and vegetation.

Figure 16: Monwabisi Park Sections (Section B in Blue) (WPI CTPC,

Building a model will serve a few different purposes. The most apparent of these is that it is a great planning tool. It is much simpler to move model houses and roads around on a tangible 3D model than to try and redesign the entire park using something like GIS software[4]. Secondly,

[4] Not to say that GIS won't be a part of the planning process. On the contrary, GIS is a very useful tool but it is not something that the community can easily continue to use in our absence.

the model will be a valuable tool for the community because it is something that everyone can easily use to express their opinions about the redevelopment process. Since the co-researchers and Monwabisi Park residents will be helping to create the model, they will be more involved in the planning process and more accepting of changes being made to their community. Thirdly, it is a great way to bring together all of the WPI Cape Town projects into a single proof of concept. Every team will contribute and benefit from the creation of this model in some way, whether it is visualization of data or ease of planning.

There is great value in building the two separate models, since they are different and both can be used as a visual aid and as a redevelopment tool. However, the teams have limited time in Cape Town to construct the models along with their other tasks and we are concerned that they will not be completed with the highest quality and accuracy if the building process is rushed. Therefore, other possible options must be considered. The first alternative option is to recruit more people to help build the model. It is essential for the community to be involved in this building process, and if enough residents, co-researchers, and other organizations are involved, then completion of the two models can be achieved. The other option is to make the models in stages. This would mean that the majority of the time would be spent on designing the Section B model. This will ensure quality rather than quantity since the team will be completely focused on perfecting this model. It will be left as an example for other teams and planners in the future who will further explore the park and build similar models of all other sections. Eventually, all the separate parts can be combined to make the full park, which will resemble the proposed small-scale model but will be more detailed and double the size.

In order to accurately construct the model, GIS software will be utilized as a guide and as a separate redevelopment tool. Photos of the park will be laid out at a certain scale in GIS so that we can accurately depict the size of the land and structures for the large-scale and small-scale models. Data collected throughout the team's research will be added at the accurate location to the GIS map, creating an easy guide to follow when placing data on the model.

3.2 Identify Current Road Conditions and Create a Plan

A major portion of this objective will be carried out in collaboration with both the VPUU and the residents of Monwabisi Park. By using the knowledge of both of these groups, we will propose a redevelopment strategy for the roads within the park based on their suggestions.

The first step to understanding the current road conditions is to simply record observations both within Monwabisi Park and along Mew Way. We will take many photos to use as reference during the planning process. Some of the things we will be looking for are:

- Road width, especially around corners
- Road quality
- Road composition
- Road connectivity and layout

Once we have done a fair amount of first-hand observation with our co-researcher, we will conduct interviews and group studies partly in the form of charrettes. The first interview we will conduct will be held with three separate groups of people: people who own cars, people who do not own cars, and people who live on major roads within and along Monwabisi Park. By splitting up the interviews this way we will be able to get varying opinions on the importance of what people will like to see when the roads are redeveloped.

When we actually hold the charrette, we will use a large aerial photo of Monwabisi Park, including Mew Way, and numerous large transparent sheets that will be drawn on. By making each person draw on their own transparency, we can later stack them up and easily see where the major areas of overlap are. We will also have a topographic model of Monwabisi Park to use as a planning guide and reference, the construction of which is described later in this methodology. The questions we intend to ask include:

- What are your most common travel routes through the park?
- Where would you like to see roads developed where they are currently non-existent?
- If you feel there is a need for a parking lot, where would you place it?

All of the questions asked in the charrette will be centered on planning and drawing on top of the map and utilizing our topographic model, whereas interviews outside the charrette will be for questions not directly related to geographical planning such as:

- If you were asked to move, would you be willing to?
- If you agreed to move, would you be willing to move only once or twice?
- (If willing to move more than once) how long would you be comfortable staying in temporary housing?

- (if not willing to move) would any of the following incentives change your mind about moving: upgraded housing, nearby clean toilets, better electricity, better location in relation to roads or paths
- Would you be willing to move to a different area of Monwabisi Park? How far would you be willing to move?

When thinking of possible redevelopment solutions, there are some important points that must be kept in mind, especially related to the last question listed above. The most common destinations will likely be either bus stops, school in Harare, or locations within the park such as water taps, sanitation facilities, or the community center. The interviews will help narrow down questions such as this so that we can easily keep in mind the most important travel routes of the residents.

3.3 Investigate Current Pedestrian Safety Measures

The pedestrian safety measures in this section pertain specifically to roads with vehicle access. Pedestrian safety on footpaths will be discussed in Section 3.4 Improving Path and Street Lighting. This objective will be completed in three major steps: identify current traffic and pedestrian measures employed by the South African and Cape Town governments, identify the areas that require the most attention, and propose reasonable, affordable measures to increase the safety of pedestrians in the area.

First, we must identify any current safety measures that are in use in the area. This includes familiarizing ourselves with South Africa's road signs and safety devices in general as well as identifying the ones that are specifically implemented in the area of Monwabisi Park.

Secondly, we must identify the areas that need the most improvement. From previous research, Mew Way was identified as a major problem area with little restriction on traffic speeds and a high number of pedestrians between Monwabisi Park and neighboring Harare. In order to confirm this and identify further dangerous areas, we shall work with our co-researchers and at least one member of each other section. With their support as well as seeing the areas ourselves, we should be able to determine the most dangerous places for pedestrians.

Finally, the project will include a proposal of what safety devices will improve traffic and where they should be placed. To do this, we will once again enlist the aid of our co-researchers in gaining information of how the people use these areas and what safety devices they are likely to employ.

3.4 Improving Path and Street Lighting

Many sections of paths and streets are very poorly lit, making nighttime travel extremely dangerous. Consequently, we will compose a plan for the City of Cape Town that improves the lighting of problem areas.

Initially, we will compile information on which areas of the park are poorly lit and dangerous. This also includes noting what, if any, lighting fixtures are already in place and assessing why they are inadequate. As access to firsthand nighttime observation is not possible, we will need to draw upon the community and the help of our co-researchers with surveys and focus groups to gather this information and identify on a map areas that are lacking sufficient night lighting. Throughout this process we will keep in mind the ideas of the previous year's team.

Once we have a strong sense of what areas need improved lighting, we will be able to map out the trouble spots. We will utilize daytime field observation to note the physical features of the poorly lit areas and attempt to determine the best way to light them. With the help of the Energy Team, we will determine the most appropriate type of street lighting for the Park and the best way to get electricity to each light.

3.5 Determining Possible New Housing Layouts

The layout of houses is dependent upon several key factors: road layout, available space, house design, and culture. The road layout is also deeply entwined with the available space, especially in Monwabisi Park, where most land is already occupied. The house design is likewise deeply entwined with the culture where people's beliefs about the land and attitudes towards their family must be carefully considered. Based on these factors and many others, there are four main levels we must propose layouts for: plot (or each house), block (or cluster of houses), neighborhood, and community (or section of Monwabisi Park).

A setup we recommend must meet the needs of the residents of Monwabisi Park and be implementable according to their stated limits (such as only one move, improved housing, and access to water). The plot setup should be repeatable, but also customizable as each family has a tendency to add on to their house as they grow in numbers and resources. One such possibility is shown in Figure 17. Each plot starts small, but can be expanded as necessary to accommodate more people (Correa, 1989). This sort of plot provides excellent flexibility for the residents of Monwabisi Park. One concern is that people tend to add on to their homes as family requires and circumstances allow. This sort of plot allows them to do exactly that. A downside is that it is not conducive to some section layouts, such as row housing, that make a more efficient use of space. As discussed earlier, however, the decision is not entirely up to us, and we must bring this, with other possible solutions such as the VPUU's row housing, before the people of Monwabisi Park and the officials of the City of Cape Town to find their input. In addition to this, the WPI Building Team is deeply involved in the same project.

To begin, we will jointly host a series of charrettes with the Building Team and a small section of people from a single neighborhood in Monwabisi Park. The first will begin like a focus group to determine what the most important features of the plot level are, then move on to designing a good plot and even further to designing a cluster of plots. Once several cluster formations have been approved, a second charrette can be conducted to determine what an acceptable neighborhood layout will be. The three dimensional model could be invaluable for this discussion, allowing residents and researchers to physically display their ideas to everyone else. If consensus can be reached on the neighborhood layout, the exact locations of each plot, any roads, and any water and sanitation facilities must still be determined.

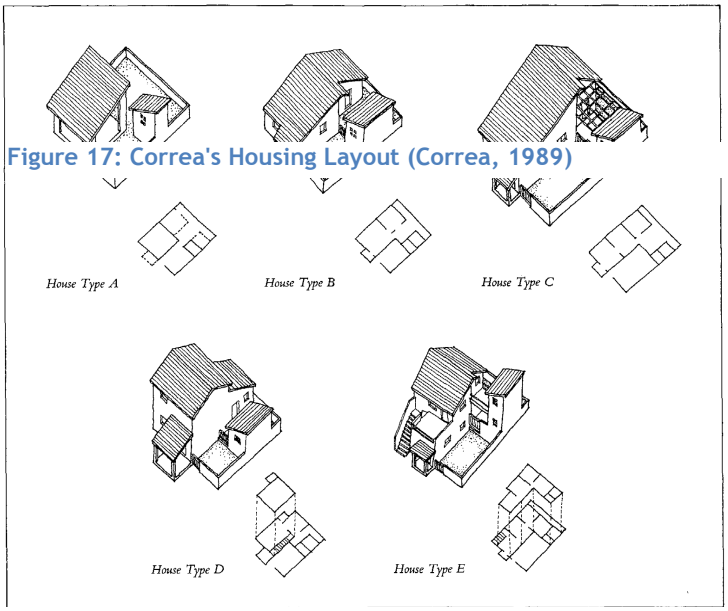


Figure 17: Correa's Housing Layout (Correa, 1989)

When we have created a final design, we will conduct a survey or town hall meeting to ensure it still meets the neighborhood's approval. After making necessary changes and the neighborhood approves the design, we must be determined how to make the plan a reality. For this, the City of Cape Town must become involved, as their resources will be necessary to build roads and facilities. The City must also approve the layout, and then all stakeholders must agree on a course of action. This course may require some movement of residents and the affected residents must be willing to undergo the hassle. If all parties agree upon the recommended course of action, it can be implemented. Once one neighborhood has a set plan, the adjacent neighborhoods will have to follow the same process until the entire section has a unified, comprehensive plan, and then each of the other three sections must follow suit.

Such a process will take a significant amount of time, but with each successive neighborhood, the process should become easier by experience. It is possible that a successful planning process in several neighborhoods may be enough to convince both the residents and City officials that a complete plan can be worked out and the first plans can be implemented while others are still being created. This requires a plan to redevelop the entire community as neither the City, nor the residents, wish to move forward if a plan to help everyone does not exist. A major problem is to then convince all stakeholders that a given plan will work, without having produced any tangible results, since both sides are afraid of resentment from residents who do not receive new housing towards those who do. In addition to getting everyone's approval, the stakeholders must get enough funding to accomplish the set plans. The city has some available funds, and the Shaster Foundation also has received significant donations, but much more will have to be raised to replace approximately 20,000 shacks with organized houses, roads, and related infrastructure.

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