



# Executive Summary: Solutions for the Future Sustainability of Water and Sanitation in Monwabisi Park, Cape Town

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfilment of the requirements for the Degree of Bachelor of Science.

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## Monwabisi Park: A Seed for Sustainable Redevelopment

Monwabisi Park is an informal settlement on the outskirts of Cape Town. Similar to other squatter camps, Monwabisi Park was erected quickly with little infrastructure and without adequate resources. Since its rapid creation was without official planning and can in some ways be construed as illegal, the settlement received little government support leaving water and sanitation services scarce and deficient. Monwabisi Park's 20,000 residents have limited access to water pipes, clean drinking water, toilets, showers, sinks, and drainage pipes.

Sustainable redevelopment planning is a relatively new concept that would have a direct impact on the sanitation crisis in South Africa's Monwabisi Park. Water conservation techniques and recycling practices save capital while providing citizens with the benefits of safer drinking water and more effective drainage. Simple solutions include systems with positive by-products that kill pathogens onsite and are also environmentally safe. Increasing the quality of life for people within the settlement while preserving the environment is a viable possibility with the implementation of sustainable redevelopment in Monwabisi Park.

## Obstacles for Redevelopment

The redevelopment of Monwabisi Park is a challenging municipal undertaking due to financial restraints, administration and maintenance, and the vast technological hurdles that must be crossed. The city of Cape Town is under enormous pressure to improve over 200 informal settlements while eliminating a backlog in service provision. Many residents expect the city to provide water taps, toilets and cleaning services. However, there is not enough capital to fund such services.

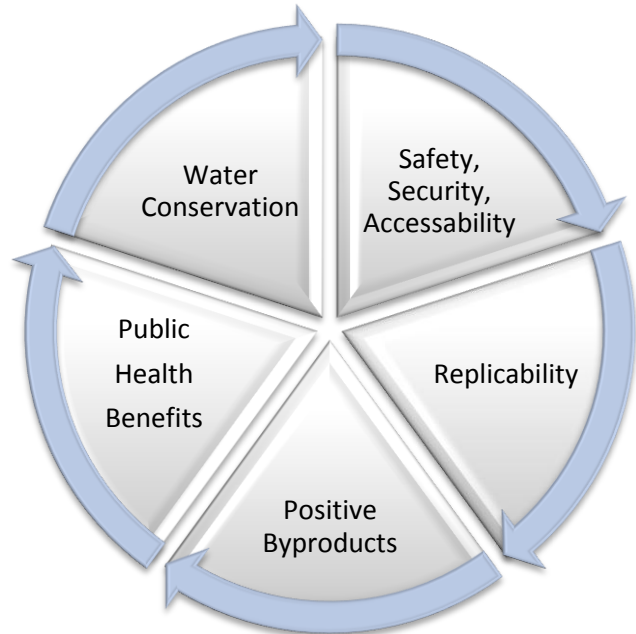
Current toilet and tap locations in Monwabisi Park are inadequate. Taps, toilets and hydrants are in poor working condition. However, it is not feasible to restructure sewage drainage in Monwabisi Park to use formal gravity based systems. Monwabisi Park is located in a topographical depression making it easy to supply water to the area, but impossible to drain water without the installation of expensive vacuum stations. This difficulty necessitates a new approach for water and sanitation in informal settlements that digresses from formalized infrastructural restrictions.

## Goals and Principles

The goal of this project is to improve the quality of life in Monwabisi Park by creating a design for a replicable public water and sanitation system based on the principles of permaculture and sustainability. To arrive at the final culmination of our project, it was essential to answer three main questions:

- Where are the water and sanitation service points, hazards, and other water-related infrastructure in Monwabisi Park and what does this data signify?
- What are the costs, benefits, and problems associated with the various services in Monwabisi Park?
- How can the community benefit from a water and sanitation specialist who acts as a liaison with city agencies and acts as a primary caretaker for a centralized water facility?

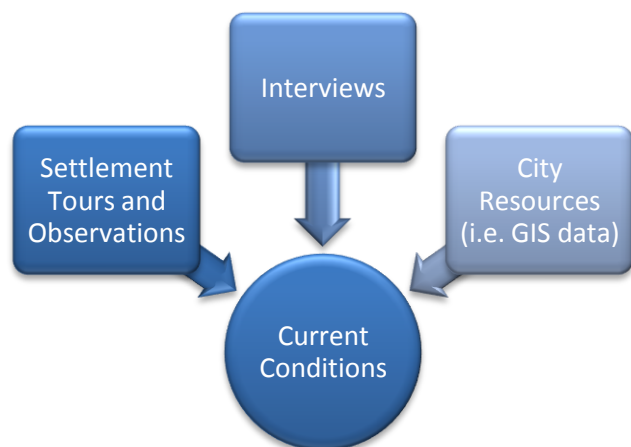
It was after addressing these key research questions that a water and sanitation facility was designed embodying the following principles: water conservation to provide “green” services, hygienic benefits and positive byproducts to increase health and sanitation, safety to ensure that people are able to use the facility without potential harm, and replicability for ease of implementation and future sustainment of the complex. All of these principles are incorporated in a master design that is both flexible and cost effective.



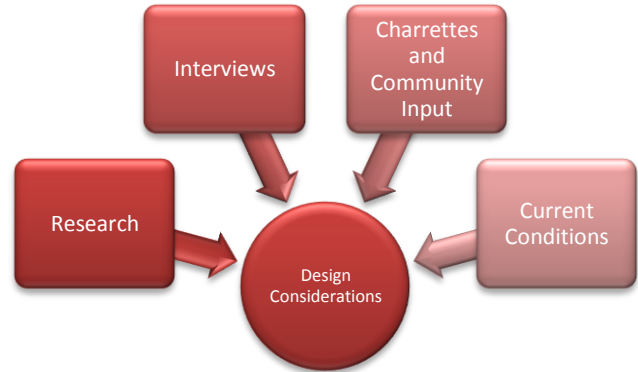
These core issues have been explored as part of an integrated research and planning project conducted in Monwabisi Park. The Shaster Foundation, the Violence Protection Through Urban Upgrading group, the City of Cape Town, EcoBeam and many other collaborators have directed their efforts at planning and implementing an ecovillage that will solve the problems listed above. Six study teams from the Worcester Polytechnic Institute have investigated several aspects of ecovillage redevelopment including: buildings, communications, energy, economics, and area mapping. All research data and proposed options for re-development have been compiled in a comprehensive atlas which includes an integrated plan. The full report can be accessed at [www.wpi.edu/Academics/Depts/IGSD/People/jiusto.html](http://www.wpi.edu/Academics/Depts/IGSD/People/jiusto.html).

### Methods for Data Collection

Many forms of data collection were used during the research phase to gather the necessary information for creating the communal water facility. The first week in Monwabisi Park was spent studying the existing water and sanitation infrastructure through informal interviews with project sponsors Di Womersely and Buyiswa Tonono, and with community members through the co-researcher program established by the WPI communications team. GIS maps of the area, outlining the locations of water taps and toilets, were



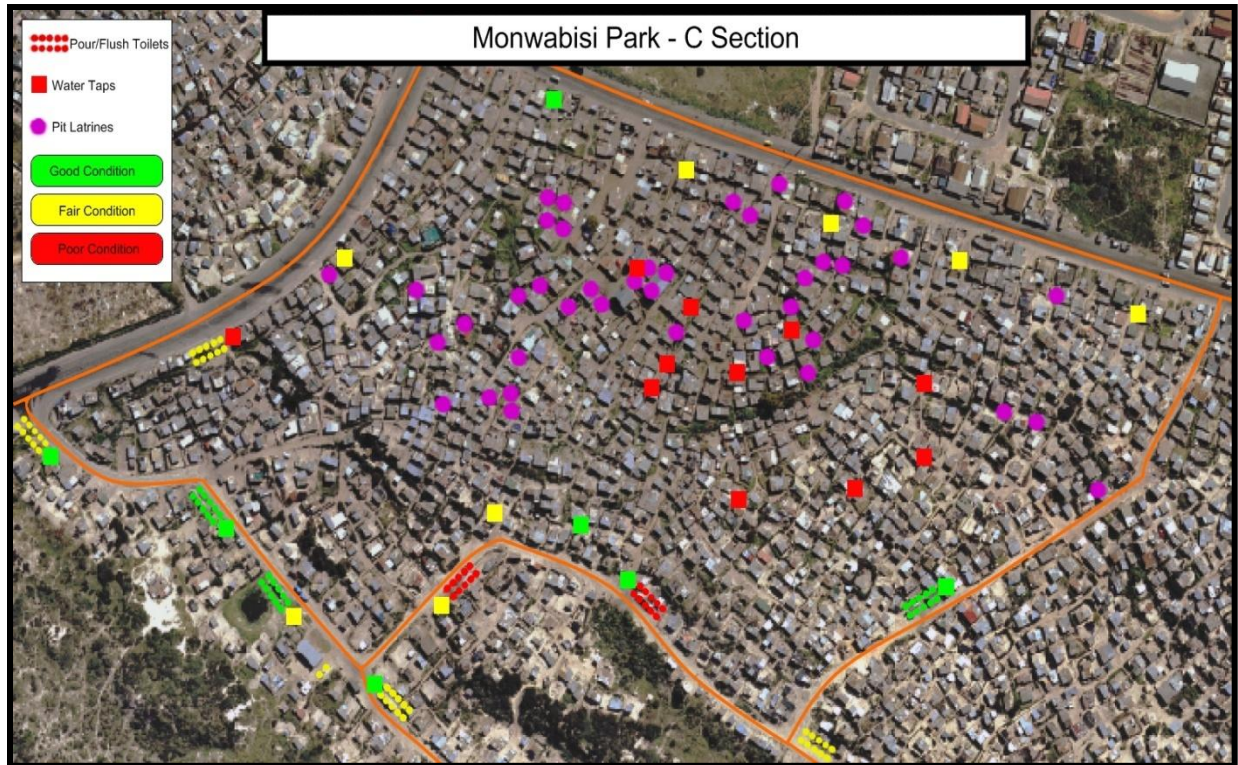
obtained from the Cape Town Water and Sanitation Department. This data was used in conjunction with the information aforementioned to create a map showing the locations and conditions of all water related infrastructure. Information regarding new toilet technologies and the city's decision making processes for implementing new utilities were likewise acquired from the city department to further the conceptualization of the possible implementation of modern facilities. Health data was then collected from interviews with Glenn Vondo, the nurse who runs the local clinic in Monwabisi Park, and Elroy Plaatjies, from the City of Cape Town Environmental Health Department. Through the use of charrettes, preliminary designs for a water facility were presented to the community. Discussions followed these planning sessions to determine what designs were the most popular and practical for use within the settlement. Through emails with the Forgreen and AIDG companies, further information was attained regarding specific systems such as the Hybrid Sanitation System and biogester technologies. The data gathered proved vital in designing the communal water and sanitation facility.



### Findings and Recommendations for Redevelopment

Our findings within Monwabisi Park are both multi-faceted and informative. In general we found that existing taps and toilets in Monwabisi Park are in poor condition due to theft, vandalism, and a lack of maintenance. Out of the 27 taps, 7 are in good working condition, 8 are in fair condition, and 12 are in poor or non-functional condition. Large amounts of water are wasted because there is no promotion of recycling and disease spreads from standing water pooling around the taps. Underground piping that supplies the taps with water is often severed and redirected to facilitate private needs. This causes small leaks in the splits which reduces the water pressure in the entire system. Fire hydrants are especially affected by this because they require a high system pressure to operate effectively. Without this water pressure, fire brigades are unable to extinguish shack fires that present a serious, ongoing public health threat.

Pour flush toilets in the area are unsanitary, blocked, and expensive. Maintenance costs for the toilets total R 117 000 per year. 23% of the toilets are in good working condition, 32% are in fair condition, 15% are in poor condition, and 31% of the toilets are informal and unregulated pit latrines. In addition, the placement of these facilities is limited because they need to be located on main roads for servicing by large sewage pumping trucks. Since these toilets are located along routes of high population traffic, they are more prone to vandalism. Many facilities are located far from any streetlight and far from the surveillance of the general public. Resultantly, crimes such as rape and burglary are frequent in the unsafe areas surrounding water based utilities during the night. A map is shown that depicts the different toilets, taps, locations, and conditions.



Due to the lack of ownership, unsanitary conditions, and limited servicing areas common to most municipal toilets, many residents prefer building pit latrines outside their shacks. Pit latrines are both an environmental and public health threat because they do not dispose of waste safely. As a direct result, the people using them come into contact with pathogens. Also, the pathogens that collect in pit latrines seep into the high water table present in Monwabisi Park. The waste is thusly able to contaminate the natural aquifer that runs below the settlement.

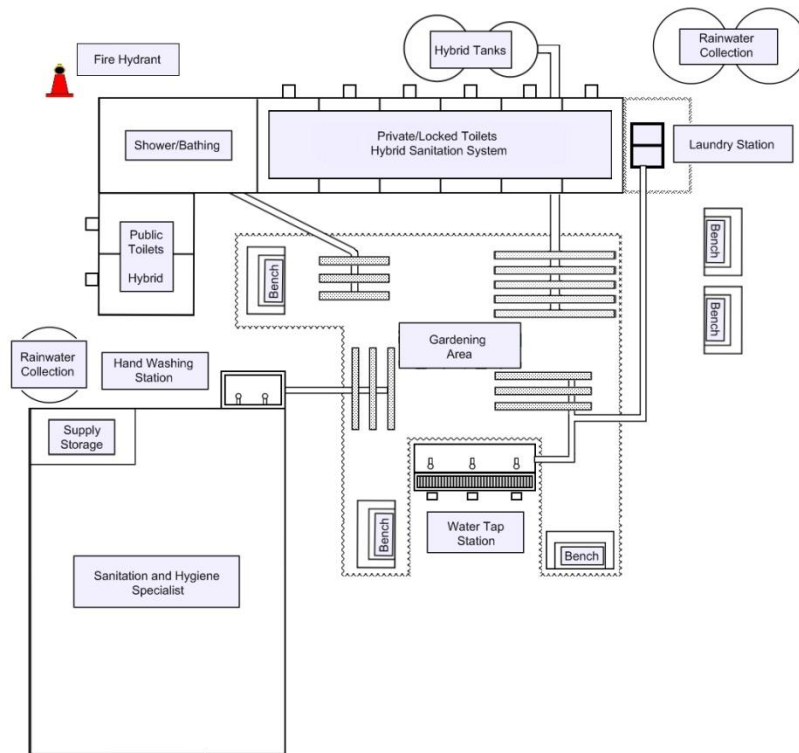
Thirty percent of the facilities implemented by the city fail within the first six months, partly because they are unprotected. By incorporating an onsite technician and hygiene specialist, facilities could be monitored and protected to increase their effective life spans, thus decreasing the annual cost of toilets by perhaps fifty percent, we estimate.

The public health issues in the area can be directly correlated to the contaminated taps and toilets. The spread is facilitated by poor hygiene when people use toilets and proceed to touch taps without washing their hands. As a result, the clean municipal water supply becomes contaminated and spreads disease. An example of this is the rota virus, the leading gastro enteric killer of children under age 1. The virus, like other waterborne diseases, is spread via fecal oral transmission.

Based on these findings, a centralized facility with an onsite caretaker is an option that should be explored for addressing current issues in Monwabisi Park. A facility that incorporates water conservation, public safety, eco-conscious systems, and proper hygiene is necessary in improving the public health of the community.

## Integrated Plan

The plan for redevelopment in Monwabisi Park includes the implementation of a communal water facility that provides services for daily tasks involving the use of water in a safe and health conscientious way.



A communal water facility, capable of serving 60 people, is shown which has the ability to be installed anywhere and embodies the principles discussed earlier. The facility will be semi-enclosed by an L-shaped structure that allows access from only one direction. This opening will be directed toward a public area where many people have constant view of the complex. This will help deter crime as well as promote a communal area to perform daily tasks in an enjoyable environment. A garden is located in the middle of the grounds to provide a place for drainage from various

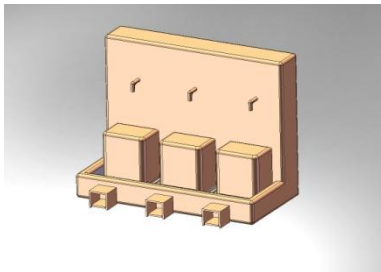
parts of the complex through a series of leach fields. Benches are incorporated into the design to provide a comfortable area to wait for a particular service while also acting as a communal gathering area. Taps are conveniently built near the entrance to the facility for residents of the community to gather their water for cooking, drinking, and all other daily needs. A building is placed at the corner of the complex to house an onsite specialist who cares for the facility and monitors the area. A sink for hand washing is built onto this house to promote healthy practices. Rainwater collection tanks are incorporated into the design to allow for the gathering of additional water from rain to supplement the already taxed municipal water infrastructure. Toilets and wash areas are installed in the L-shaped building with entrances facing the main courtyard. Finally, a fire hydrant is added for the safety of the community.

The water and sanitation specialist will be responsible for all aspects of the communal water facility. The specialist will live on site at the facility and will have a supply closet located within his house to store necessities such as toilet paper, soap, and cleaning supplies. By living at the facility, the specialist can observe the activity at the taps, toilets, and sinks at all times. This person could inform users to wash their hands frequently by being stationed near the sinks. More duties include simple maintenance of the taps and toilets, such as fixing leaks or repairing blocked toilets. Preventative maintenance on municipally installed systems is important. In this regard, it would not be necessary to involve the City of Cape Town Water and

Sanitation Department with small problems within Monwabisi Park. However, if the specialist encounters more serious problems with the systems, it will be his or her job to act as a liaison and contact the city department to repair it.

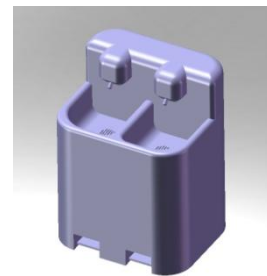
A major aspect of the specialist's job involves promoting health education. The specialist will educate the community on proper sanitation, such as bathing daily and washing hands frequently. This person will also make clear to the neighbourhood that disease transmission is directly correlated to poor hygiene making proper practices critical.

Another key component of the communal facility is the implementation of ecologically friendly toilets. Two types are considered for the facility based on their positive by-products and innovative designs. The hybrid toilet system is the first suggestion as a toilet system because of the minimal maintenance required for its continued operation. It is a non-flushing toilet that can be cleaned with organic chemicals and treated the same as any traditional flushing toilet. The hybrid system includes multiple toilets connected to a water filled tank. This tank catches the waste and breaks it down over about 140 days before it dispels it into a leech field or into a garden as irrigation. The only maintenance that the tank requires is the pumping of sludge that gathers at the bottom of the tank once every 5 to 7 years. The Enviro Loo toilet is the second consideration for this arrangement. It is a dry sanitation system that turns human waste into compost through dehydration. The system involves separating solid and liquid waste through ventilation and heat. Basically, the occupant uses the facility to deposit their waste in a container. This container has a glass panel on the side that absorbs heat to evaporate the liquids through a ventilation tube and dries solid waste to about 5-10% of its original mass. The maintenance of the system consists of raking the composted material from the drying plate and placing it in a drying bag internal to the unit. This servicing is necessary only once a year.



The water taps are central to the design of the new water and sanitation facility. Taps are the only source of water for the people in Monwabisi Park, and the current ones are insufficient because they are broken, dirty, and far from many residents. At the central facility, the residents will have access to taps. Rather than designing hand operated taps, the new taps will have foot pedals. The pedals both conserve water and increase cleanliness. Many diseases

are spread by contaminated taps, therefore if touching taps can be avoided, the spread of diseases via taps will be prevented. In order to promote hand washing, a sink will be incorporated into the design. The water will originate from the rainwater collection tanks. Soap dispensers will be used rather than bars so that it can be more evenly distributed. To prevent vandalism, the soap dispenser will be securely attached to the sink. The sink will be operated by foot pedals to maintain cleanliness.



A laundry facility will also be incorporated into the design. The water used for the laundry will, in conjunction with the sinks, come from the rainwater collection tanks. A laundry facility that was created during a WPI IQP project in 2007 was a safe place for people to



congregate, and the new laundry facility will be a larger version of that idea. The station will also help recycle water because it will drain grey water into the leach field rather than being disposed of in the road.

In the centralized water facility there will be a high pressure fire hydrant that will be maintained and easily accessible. As with other systems implemented in the facility, the hydrant will be the responsibility of the water and sanitation specialist He/she will keep it in good working condition and periodically check if it provides adequate water pressure for fire suppression.

The future redevelopment of Monwabisi Park will greatly benefit from the inclusion of these new systems and technologies.

The addition of a communal facility to the building plans will provide for the sanitation and hygiene needs essential to the health and livelihoods of all residents. Replicating such designs in other settlements would serve to help a greater population and could easily be accomplished due their ability to be propagated in various environments. A follow-on WPI team is working on further refining these ideas and preparing construction drawings, and WPI faculty are working with the Shaster Foudation and the University of Cape Town to secure funding for construction of an initial prototype facility.