Envisioning The Future Development of Oude Molen Eco Village

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

ABSRACT

Oude Molen Eco Village is a community of approximately twenty residents and twenty micro-enterprises in Cape Town started by a group of social entrepreneurs to preserve the unique potential of the land. Oude Molen has created a proposal for future development that encourages social, communal, and sustainable growth. The goal of our project was to create a virtual three dimensional model that brings the Eco Village's written vision to life in hopes to gain support from the Provincial Government and other stakeholders.

This project report is part of an ongoing research program by students and faculty of the WPI Cape Town Project Centre to explore and develop options for sustainable community development in South Africa. For more information please go to
http://wp.wpi.edu/capetown/

The following is an executive summary of a set of project reports that have been implemented as a website available at:

http://wp.wpi.edu/capetown/homepage/projects/2011-2/omev/

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INTRODUCTION

Oude Molen Eco Village (OMEV) is a community located in Cape Town, South Africa that holds potential for a broad range of sustainable development opportunities including job creation, tourism development, environmental education, organic permaculture farming, hosting of cultural events, and renewable energy technology. Eco villages are communities that strive to reach these ideals by merging the principals of social, ecological, cultural, and economic sustainability. Oude Molen began as a vision by a social entrepreneur in 1997. Starting as an abandoned and vandalized mental institution, the area was transformed through the efforts of multiple entrepreneurs to a village hosting seventy-five micro-enterprises at its peak. The property was advanced through personal dedication; however, there has been difficulties obtaining a long-term lease for the property from the Provincial Government, and as a result investing in the property is risky for tenants.

MISSION STATEMENT & DESIGN CRITERIA

The Provincial Government is reportedly looking to use the area in Oude Molen to develop commercial building and low-cost housing establishments. Current residents of OMEV are also hoping to make developments to create employment and housing opportunities, while embodying eco-village principals. The Social Development Resource Center (SDRC) is an organization within Oude Molen trying to achieve this goal. They put together a planning

Figure 1: Welcome to OMEV

document of their ideas and objectives for future developments in OMEV. This document addresses issues of housing, jobs, and open space, and will be presented to the Provincial Government as an alternative to their current plan. Oude Molen has the opportunity to become a self-sustaining, income generating, diverse cultural, and green public space, which could be used as a model for other communities.

Figure 2: Existing Building

The goal of this project was to design a three-dimensional virtual model to represent a vision of the Oude Molen Eco Village; specifically focusing on expansion and analysis of opportunities for housing, business, sustainability and community.

Taking into account the priorities set by the Provincial Government and the OMEV Tenants Association, our group established a design process and adopted design objectives. The Provincial Government's vision for the future includes the following elements ("Cape town central," 2010):

- Generate economic activity and create new jobs and opportunities for empowerment
- City that comes alive as a diverse, globally connected and socially inclusive space that encourages an entrepreneurial culture and provides a welcoming and inspiring place for socially mixed communities
- Demonstrates sustainability in relation to the beauty of green and blue spaces, water and energy resources, the diversity and value of locally produced food and the resources which citizens and businesses recycle
- Types of property transaction achieves socio-economic and sustainability return
- Inspire and lead the way for replication elsewhere

The OMEV Tenant Association has its own objectives complimenting those of the Provincial Government. Those that pertain most to our visual model:

- An inclusive place for all cultural, community, economic classes and groups to visit and interact with one another
- A balanced building densification "*as much as what is necessary to ensure financial viability*" approach, that also ensures a sense of space and public interaction urban park character
- Generate a justifiable rental income from the OMEV property for Provincial Government.

Through reviewing the Provincial Government and OMEVTA goals, we compiled our own list of objectives:

- Create job opportunities for Oude Molen & surrounding communities
- Respond to South Africa's growing housing demands in a mixed income environment
- Create a community with a diverse public space encouraging social activity through the unique resources available on the property.
- Underpin a self-sustaining entity generating justifiable income for the Provincial Government
- Capitalize on readily available renewable resources to create an ecologically sustainable community beneficial to surrounding neighbourhoods

METHODS

To get to the final design, we used the following methods:

- **Analyzed the OMEV proposals**, the foundation for our design, developed by the SDRC. Through analysis we incorporated the concepts that pertained to the layout and design of different characteristics in the village. These concepts include a live and work model, ecological sustainability, and direct calculations for building footprint.
- **Interviewed OMEV stakeholders** to get a cross-section of the current tenants and their views about the future development of Oude Molen.
- **Visited several different local enterprises** with our sponsor to take note of key elements of what Oude Molen hopes to include in future developments. Characteristics we found aesthetically and functionally viable influenced the designs that we wanted to consider in future plans such as the courtyard area from The Old Biscuit Mill, the integration of parking from Montebello and the commercial arrangement of De Noordhoek. We wanted form to follow function; meaning that very early in our brainstorming process, sustainable design was integrated in our overall model.

Figure 3: Old Biscuit Mill Courtyard

- **Analyzed design options** by systematically considering design elements we had researched, ranging from parking scenarios that blend seamlessly into the land, to roofing designs that not only provide continuity between current and future buildings, but are also optimised for the photovoltaic conversion of solar radiation into electricity. Sketches were produced to explore a variety of design options and shared with project sponsor Hudson McComb, advisors and others. The advantages and disadvantages of the different designs were identified before including them in our model. Various sustainability options were then integrated into the designs to comply with the principles of an eco-village.
- **Input designs into Revit.** We constructed our designs and data into Building Information Modelling (BIM) software called Autodesk Revit Architecture. We first used a CAD drawing of the property lines and current building location to create a topographic surface. On this topographic surface we replicated the current buildings on the property, to give an accurate representation of what currently exists. From this it was determined which buildings would remain original, which would be renovated, and which buildings would be demolished. Basic conceptual masses were then created to generate the optimum spatial layout for the Oude Molen property. Once, the spatial layout was finalized, the new buildings' designs were addressed. This presented a new challenge of creating a cohesive design, which integrates the existing and new buildings. Our group achieved this through the use of a common design element which we have integrated into every building, the roofs. By choosing a common roofing design we were not only able to capitalize on underutilized space in existing buildings, but also optimize the entire village for renewable energy. Once all of the main aspects of the village were input, details such as trees and streetlights were added to achieve a life-like feel. From this finalized model we accurately represented each building footprint and calculated the needed rentable space for future commercial and residential areas. The model was then rendered; rendering is the process of translating a virtual wire frame model into a detailed image. Over the course of seventy-two hours, six computers were utilized to complete all the final images in order to demonstrate various aspects of the model. The software allowed us to create a precise three dimensional visualization of the village.

Figure 4 & 5: Oude Molen as it exists (above) Oude Molen as planned in our model (below)

RESULTS: VISIONS AND RATIONALE

This section describes the stages of design and illustrates the layout to best maximize the available area and demonstrate how the Eco Village can grow into a vibrant, multi-purpose space.

The buildings highlighted in the top image in Figure 4 represent the major building footprint currently existing in Oude Molen. We examined these major building footprints while constructing our virtual model to determine which we could expand on. The buildings outlined in red represent buildings we removed in our model and include prefabricated, uninhabitable buildings as well as those that do not have the foundation to support more floors. The remaining seven blue buildings were either preserved or renovated in our model.

The bottom image is a representation of the changes that were made in our model. The blue blocks still represent the preserved or renovated buildings, while the yellow represents those structures that were added in our model.

BUILDING LOCATION AND ORIENTATION

To preserve the unique atmosphere of Oude Molen, we sought balance between open space and built environment. This balance was achieved through configuring a spatial layout of the property, tailored to the social and community dynamics. We separated the village into three distinct zones: residential, commercial, and multi-purpose area.

Figure 6: Planned Zones

As highlighted in Figure 6, the residential area (orange) is located in the southern corner of the property to separate it from the businesses, to allow for a more secluded living space. The location of the buildings optimizes for the view of the river/ wetlands and Devil's Peak while also protecting the residential recreation area from strong south-easterly winds. The commercial sector (blue) is located on the northern border of Oude Molen with the multi-purpose area (green) located on the western side. The multi-purpose area contains the recreation corridor, community centre, museum, and four pre-existing renovated buildings that will house commercial enterprises on the ground floor and residential units on the first and second floors.

These existing and planned graphs demonstrate the changes in ground area that various parts of Oude Molen occupy. The change of the building footprint displayed in the chart is an increase of only 37%. The open space has only decreased by 17% thus constituting a decrease of 13,870 m^2. The increase slightly changes the amount of open space while generating rents sufficient to allow OMEV to be economically self-sustaining.

LIVE AND WORK

There are four buildings in Oude Molen that we renovated in our model. We adopted OMEV's commitment to a "live and work" concept within the village in which employees live in very close proximity to their work areas. This concept reduces the carbon footprint by reducing the need for transportation. In our vision, living quarters will be on the first and second floors while the commercial space will be on the ground floor. The model also includes apartments in a separate residential section close enough to the commercial area to embody the live and work concept.

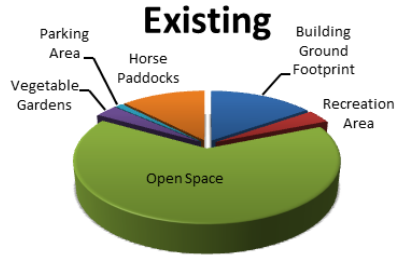

Figure 7: Existing Space (m^2)

Figure 8: Planned Space (m^2)

Figure 9: Renovated Building

In order to optimize the available space, renovations were included to expand the length of the building and raise it one level to double the residential space. The extensions on the ends of the building are about 20 metres long to increase the commercial space. The added second floor is comprised of glass to minimize stress on the foundation of the building, creating a new floor at an inexpensive cost. On the outside walls a balcony was added to provide access to the first story, as well as to serve as protective covering for shops to extend beyond the building. Having the balcony on the exterior of the building will also prevent the need for hallways or staircases within the building. The second floor will be used for multiple-story apartments.

ROOF

Another significant aspect of these buildings was the roof design. It covers the courtyard area, protecting it from rain and wind, while creating an open atmosphere. We analyzed over a hundred different design options to find one that best incorporated feasibility, functionality, and aesthetic appeal. Using a single roofing design throughout the model unifies the old and new buildings. This roof will be comprised of "Building Integrated Photovoltaics," a material that integrates solar panels into the structure in order to increase energy efficiency, provide power generation, and allow sunlight to enter.

Figure 10: Residential Buildings

COMMERCIAL SECTOR

The commercial buildings continue the structural style of the existing buildings, but are larger in size in order to maximize space. In our model, we visualized the bottom floors consisting of enterprises such as restaurants and craft stores that will expand into the courtyard. Businesses that do not involve direct consumer interaction will be located on the upper floors.

The buildings are designed to allow flexibility for micro-enterprises. With main utility lines running the length of the building, all businesses will have the option to expand or decrease the area needed for their enterprises simply by changing the placement of the non-load bearing walls.

With these additional buildings, Oude Molen will be able to host a hundred micro-enterprises including twelve Non-Governmental Organizations and educational institutions. This will create roughly 500 jobs for residents of Oude Molen and surrounding communities. Job shadowing and other educational programs would allow youth to develop the skills needed to create a sustainable living for themselves.

RESIDENTIAL SECTOR

The residential section will consist of four buildings located where the prefabricated buildings currently reside. These buildings, in addition to the upper floors of the existing buildings, will accommodate 600 apartment units which will house approximately 1,500 people. To provide privacy, the residential section is separated from the commercial area.

The available apartments vary from a bachelors' suite at 35 square meters to three bedroom apartments at 100 square metres. These apartments will vary in price depending upon location in the building, holding potential for mixed income living.

PARKING

In our model, we planned to accommodate about 1,500 people; a sizeable parking area was needed to fulfil both commercial and residential needs. One parking space was allocated for each residential unit, while each commercial enterprise was designated an average of five spaces resulting in six hundred spaces for residential units and five hundred spaces for commercial enterprises. For events such as craft markets, musical and other cultural events, we proposed parking be located outside the premises. It would best suit the aesthetic appeal of Oude Molen to not accommodate the large number of automobiles that such events would attract. There is a stretch of provincial land outside of Oude Molen that could be utilized for parking for the influx of people.

Parking was considered early on in the design process due to the size limitations of the property and projected number of cars that will be in the village. We considered many parking options such as parking structures and underground parking. The addition of a parking structure was considered because it would allow for a large number of cars to be held in an area that would occupy a smaller ground footprint. Another option considered was to implement underground parking in scattered areas around Oude Molen and underneath buildings. However, parking structures and underground parking were not economically viable, so parking areas were all accounted for on the ground level.

BIO-DIGESTER

In keeping with the theme of sustainability, we integrated a bio-digester in one of the parking areas, creating a multi-purpose space. The bio-digester would be located underground and would absorb sewage and organic waste, which will produce methane, electricity and grey water. The digester will be able to accommodate 5,000 people, which includes the population of OMEV, Maitland Garden Village, and the tourist influx.

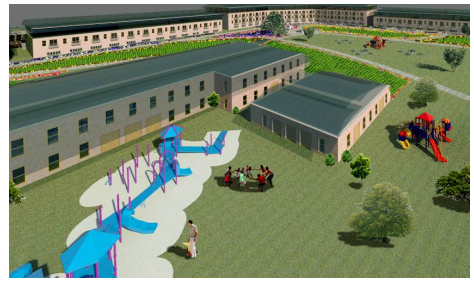

Figure 11: School & Crèche

EDUCATION

The building and play area of the Gaia Waldorf School currently in Oude Molen will be relocated next to the farmhouse, closer to the residential buildings to seclude it from the busy commercial area, and make it convenient for families living in the residential buildings. It will be expanded to account for the projected population increase. A crèche will also be added next door with its own playground. Areas such as the school, community centre, gardens, and other designated recreational areas can be utilized for future youth programmes. These programs would foster a sense of community and inspiration for future generations.

Figure 12: Picnic & Playground Area

RECREATION CORRIDOR

We wanted to create a community with a diverse public space encouraging social and communal development. The recreation corridor will be the focal point for community activity; including a picnic area with tables and grills for family and other social activities, as well as a playground for kids to enjoy themselves. The amphitheater is able to host a large audience of over a thousand people, for various types of plays, music and cultural events; it would blend right in with the environment because of the sloping topography. The pool area will be revamped with new buildings, such as changing rooms, toilets, and snack shack. The horses, which constitute an important part of Oude Molen, will be located in the recreation corridor during the day and stay in paddocks on the edge of the Oude Molen property at night. The location of the daytime paddocks was chosen to attract tourists and enhance the natural aesthetics of Oude Molen.

CONCLUSION

With the planned layout we tried to take into consideration as many of the objectives identified by the Provincial Government and OMEV Tenants Association that pertained to the village design as we could.

- By including more space for commercial activity, our model accommodates five hundred job opportunities for OMEV and surrounding communities.
- Capitalizing on space available in existing buildings and apartment buildings, our model addresses the need for housing accommodating mixed income communities by providing 600 apartment units, with a mix of affordable to high-end rents.
- Various recreational opportunities within the recreational corridor exemplify a diverse public space for social activity. An assortment of educational entities provides opportunities to build a strong community through youth development, recreational, and educational activities.
- Through the opportunities offered in both the residential and commercial spaces, an estimated income of R22,500,000 will be generated annually for the Provincial Government.
- By including different sustainable design aspects such as the solar cells, a bio-digester, and wind turbines, our virtual 3-D model is able to create a template for an ecologically sustainable community that will benefit surrounding neighbourhoods.
- By creating a feasible and affordable model, we hope that the design will serve as a template for development in other communities.

Our proposals and architectural renderings were presented to the SDRC, the OMEVTA, the Provincial Government, Maitland Garden Village community members, and the local press, which was well-received. We hope that this mode coupled with the SDRC's vision document, will help convince stakeholders that moving forward with this alternative development plan will be beneficial for all those involved.

Figure 13: Oude Molen Eco Village

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