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precedent studies

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GREENHOUSES

5.1	Facility
Kirstenbosch conservatory, Cape Town, SA	
Typology	Conservatory for public interest
Reference	Visited by author

5.2	Facility
Reganwald haus greenhouse Vienna, Austria	
Typology	Fauna and flora greenhouse for public interest
Reference	Visited by author

5.3	Facility
Quarantine greenhouse Wageningen, Netherlands	
Typology	Research and contaimnet facility
Reference	Bibliographical

SEED HEALTH TESTING LABORATORIES

5.4	Facility
Seed health testing unit, Laguna, Philippines	
Typology	Research
Reference	Bibliographical

5.5	Facility
Plant quarantine regional sation. Rajendranagar, India	
Typology	Research
Reference	Bibliographical

SUSTAINABLE DEVELOPMENT

5.6	Facility
Sustainability institute, Lynedoch, Stellenbosch, SA	
Typology	Educational centre and community eco-village
Reference	Visited by author

5.1 Botanical Society Conservatory

Location: Kirstenbosch, Cape Town, South Africa
Design: Julian Elliott, MLH Architects, 1994-1996
Area:1695㎡
Cost: ZAR 5.5 million

Situated at the Kirstenbosch Botanical Gardens in Cape Town on the warm northern face of Boschheuwel, Table Mountain, the purpose of this conservatory is to showcase the succulent species of South Africa (Fig. 5.1- 2). Although designers visited related projects in the United States and Europe, they were advised by chief horticulturist Ernst van Jaarsveld to invent a design that will be appropriate for the South African climate and conditions, as glass houses based on European principles tend to overheat during the summer months, because of the markedly different climatic conditions. According to Mr. van Jaarsveld, and due to the fact that the succulent species would be sourced from their natural habitats, the only thing they need to be protected from is the winter rainfall of the southwestern Cape.

5.1.1 Program

Conservatory:

- Main room/ Arid house - 548㎡
- Exhibition area/ foyer
- Four corner (artificially climate controlled) units - 90㎡ each
- Evolution garden on the Southwest
- Ablutions, kitchen and offices.

Vehicular access is provided at the back for deliveries and three other smaller greenhouses are use for preparation and preservation of species showcased in the main conservatory. An existing substation houses all electronic and mechanical operations.

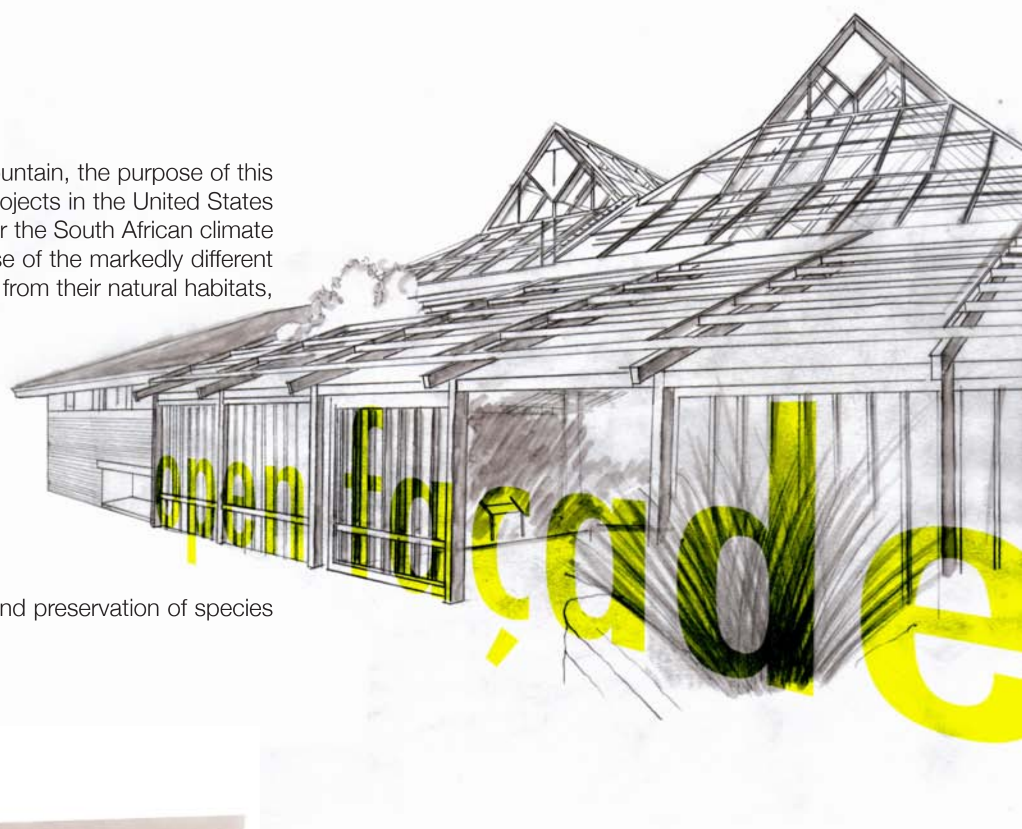

FIG 5.2 View of the Western façade with openings that allows for free-/open ventilation

FIG 5.1 Interior view of the conservatory at Kisrstenbosch, Cape Town

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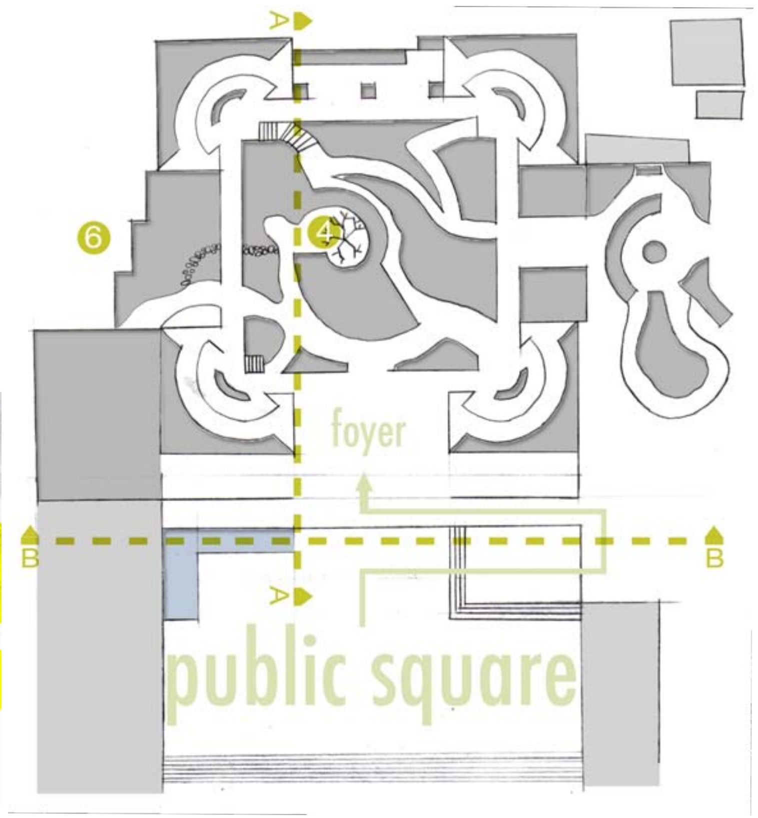


FIG 5.3 Plan of the conservatory

Visitors centre:

- Ticketing offices
- Deli
- Restaurant
- Security checkpoint
- Information desk/ points and offices
- Public squares

Ideas and constraints informing design:

- Four seasons and four variables: sun, heat, humidity and ventilation.
- Spiral floor plan with Baobab tree at centre
- Logical garden layout: North – South orientation of garden and planting representing the nine provinces of South Africa with natural rocks from each.
- Six-metre fall across entire site

5.1.2 Design:

PLEASE REFER TO FIG 5.3- 5

1. Design based on open-frame houses. Three of the four sides of the building are permanently open. Thermostatically controlled underground heating coils is installed in the arid house.
2. Thermostatically controlled, hydraulically operated, roof windows open automatically at 28˚C – automatic gauges measures wind velocity and closes them accordingly.
3. Two extractor fans are situated at both ends of the glass house and starts up when the interior temperature reaches 34˚C. The natural ventilation system works so well though that this was never necessary to use the extractor fans.
4. The spiral ramped (1:12) floor plan allows for a more inclusive building to wheelchair users
5. A cascading roof allows for maximum light in winter at midday, but reflects the sharp early morning and late afternoon rays in summer which are most likely to damage the type of plants housed within the conservatory. (Knoll 1998:8)
6. Camphor trees, blinds and tinted laminated glass shade the house from the western sun.
7. Subsoil drainage system that proves to be very affective.

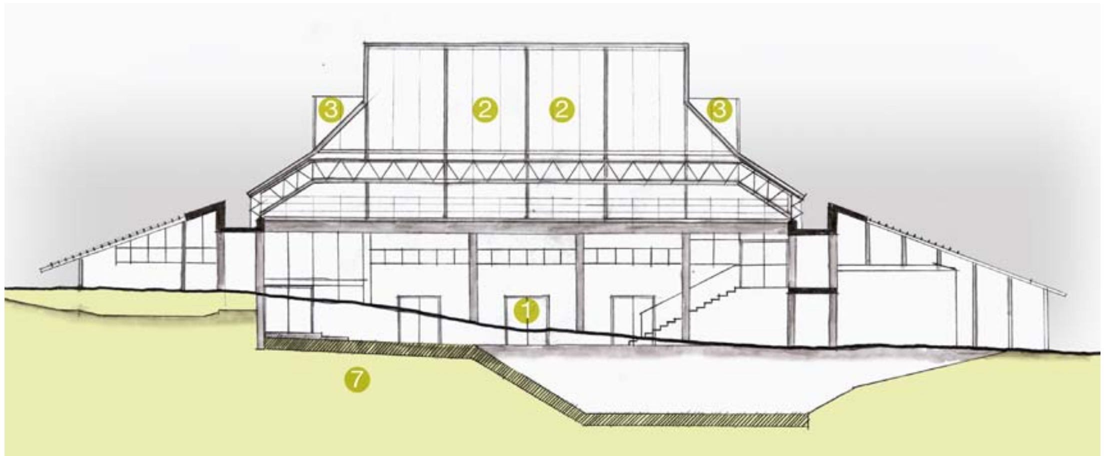


FIG 5.4 Section AA

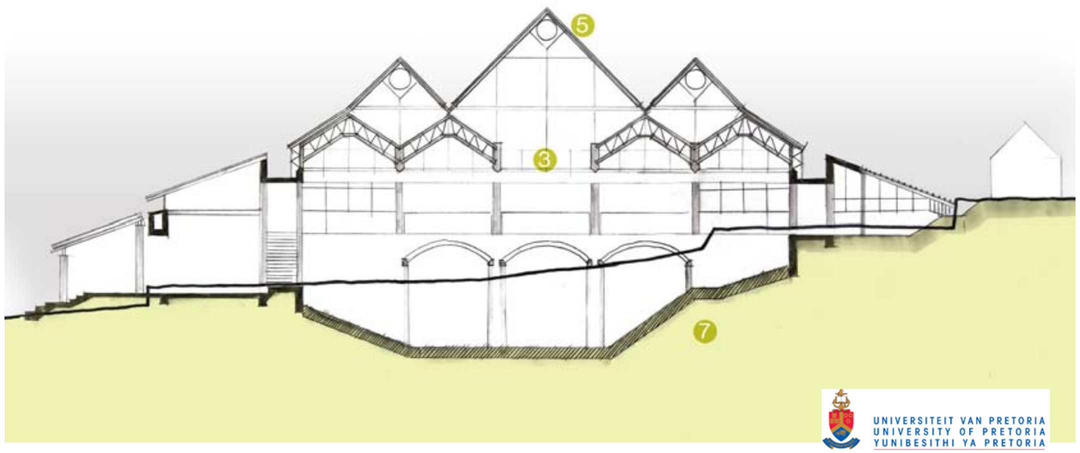


FIG 5.5 Section BB

5.2 Reganwald haus – Zoological “rainforest” glasshouse

Location: Schönbrunn Tiergarten, Vienna, Austria
Design: ARGE Architekten Neversal and Edelbacher & Hartmann, 2000-2002
Area:1000㎡
Cost: €10.17 million (ZAR 128 million)

Just west of the CBD lays the Schönbrunn tiergarten (zoo) where the glasshouse is located just off the main entrance. Construction on the Regenwald haus (Fig. 5.6) was completed in 2002 and mimics biological and climatic conditions found in the Borneo rainforest at Kalimantan Island, Indonesia. Amongst the over 300 plant species that are found within the structure is also a carefully controlled biome that sustains life for selected fauna that is found within its real life counterpart.

The glasshouse is used as a visitors’ centre and has a vast labyrinth of meandering footpaths (Fig. 5.7), elevators and hidden caves to entice visitors to get closer to the exhibitions. Upon entering the facility the visitor is directed to different areas within the compound, such as the mangrove swamp, dripstone caves, etc. The facility is built on a steep slope and as visitors progress through the interior, they later find themselves amongst the treetops, looking down on the entire rainforest area (Fig. 5.8).

An ambient temperature ranging from 25 to 27°C during wintertime, and reaching a maximum of 35°C during summer with a relative humidity of 60-90%, needs to be sustained. As a result of extensive dynamic climatic simulations, the ambient climate within the facility is maintained by using an adiabatic thermodynamic desalinated water process for heating and cooling. This eliminates the need for solar preventative measures for the glass (Fig. 5.9-10), and mechanical cooling apparatus for the rest of the compound. During summer natural ventilation panels are opened when needed. During the winter months the facility is mainly heated by making use of passive heating processes such as thermal retention through wall and floor mass, and the trapping of daytime warm air in under-floor rock chambers (similar to the system discussed in Fig. 5.21). Growth-promoting UV lamps are used for plants in dark areas.

The above information was gathered from the author’s notes during a visit to the

FIG 5.10

FIG 5.8 FIG 5.9

FIG 5

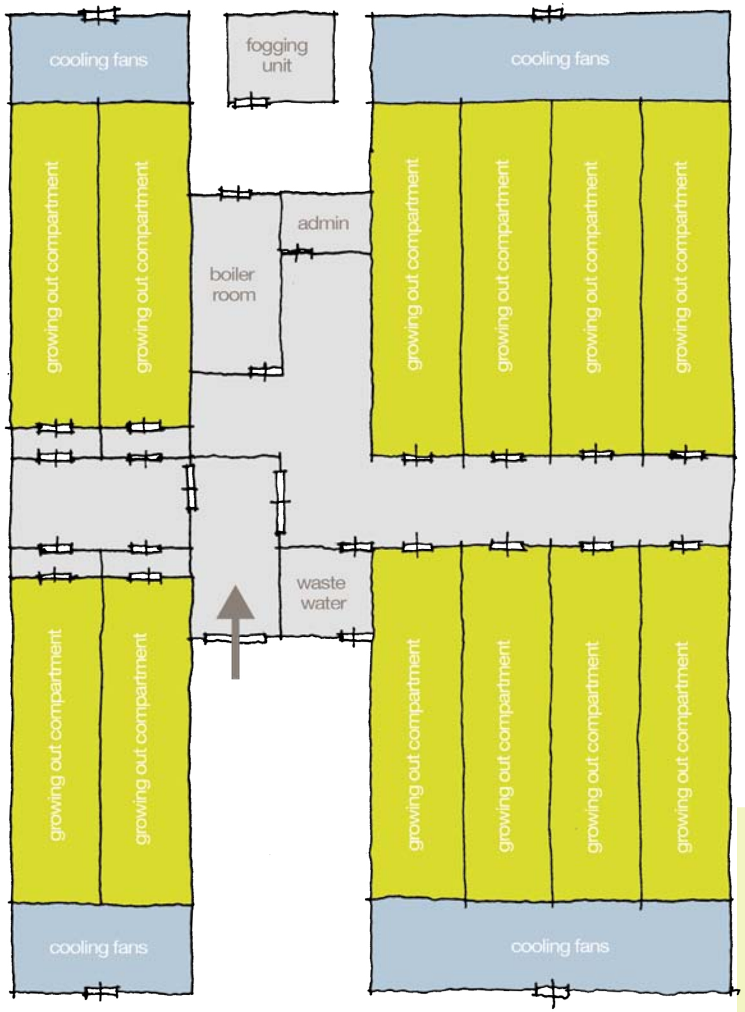
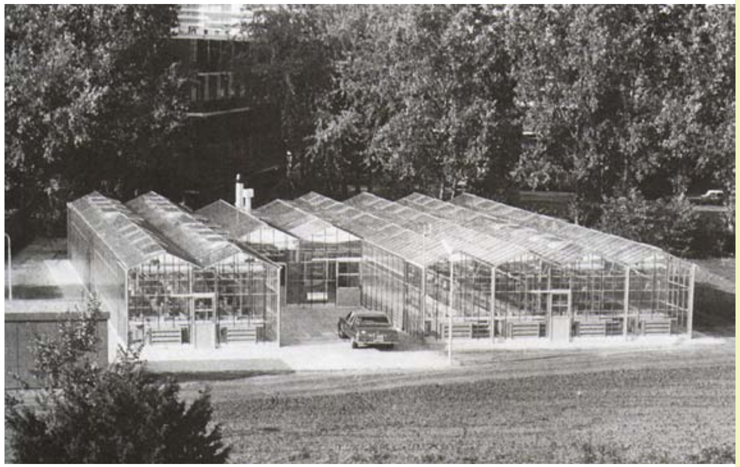


FIG 5.11 Plan of the facility

FIG 5.12 Main compound (Kahn 1999:109)



5.3 Dutch Plant Protection Service quarantine greenhouses

Location: Wageningen, Netherlands
Design: Completed in 1981
Area: 700㎡
Cost: N/A

Plant quarantine greenhouses represent a specific typology of quarantine facility that allows for specialized conditions and research. Other types of plant quarantine facilities include quarantine trial fields (open-air with isolation facilities) and quarantine stations that house phytotrons and laboratories.

Common criteria for evaluating plant quarantine facilities (as listed in Kahn, 1999: 109-11)

- Layout and accessibility of the experimental facilities
- Phytosanitary practices to avoid contamination
- Confinement of quarantine organisms
- Cleaning, disinfection or sterilization of equipment and materials
- Prevention of accidents
- Maintaining, safeguarding, clearing and destroying plant pathogenic organisms and infected materials

PLEASE REFER TO FIG 5.11 & 5.12

The main programme of the facility consists of twelve growing-out compartments, each being 40㎡. Computers remotely control the environmental conditions in each compartment. When trials are completed, each compartment can be disinfected or disinfested without disturbing trials in other compartments.

Access to the greenhouse is only granted to authorized personnel, and protective clothing must be worn after entering the greenhouse and while handling plant material. Plant material is treated as potentially infested and as such inspected twice a week for symptoms or signs of unwanted pests and diseases. Synthetic screens are used to separate plants involved in different experiments.

Outcomes on studying conservatories, glasshouses and quarantine greenhouses:

Kirstenbosch conservatory:

According to van Jaarsveld, a dispute concerning balustrade details erupted at Kirstenbosch between the project architect and the director of the botanical garden at the time. As a result, the architect lost the contract to design the public courtyard and visitors' centre that precedes the conservatory and is located just inside the main entrance.

According to the critique by Peter Dyson (1998:55) the simplicity of line, muted colors and subtle details of the visitors' centre both enhance and complement the focal point of the glass house, but the absence of greenery brings into question the relevance of the setting of the botanical garden to the architect's design approach.

The difference in the design approach of two different architects unfortunately undermines the entire project's architectural integrity. People tend to pass through the visitors' centre fairly rapidly, heading directly for the garden route to the Northeast. Few people take the trouble of taking a detour and walking through the conservatory. This can be blamed on three factors:

- **Scale:** The vastness of the two public squares preceding the conservatory with no means of proper shading from the harsh Cape summer sun, apart from a series of pergolas on the periphery.
- **Direction:** Although the symmetry of the square forms a visual axis, the path that the users have to follow along the steps does not conform to this logic.
- **Flow:** Once people have passed through the conservatorium they have to backtrack to the entrance and cannot simply pass through the glass house en route to the main Botanical garden.

The conservatory proves to be very successful and the mode of its operations undeniably represents a very sustainable approach to running such a facility in the South African climate. Sadly, the conservatorium relies greatly on the success of the visitors' centre, and unfortunately a great opportunity to illustrate how the built environment can be fully synthesized with its natural surroundings has bee[illegible]he construction industry has resulted in a loss of design intuition.

Glasshouse at Schönbrunn:

There are clear similarities between the facility at Schönbrunn and Kirstenboch:

- Conservatories-/glasshouses for public interest and education seem to have a clear organic floor plan that gives the impression of strolling through a garden
- Most of the above mentioned facilities conduct research as well, but these areas tend to be hidden from the public view. They are perceived as being Back of House facilities.
- The displays and way of communicating information at Schönbrunn is a lot more interactive allows for visitors to touch the displays. At Kirstenbosch glass screens between visitors ad displays makes the conservatory a lot less interactive.
- Free ventilation during the daytime in summer makes the glasshouse a lot more pleasant to move through. Because of the very humid conditions at Schönbrunn to sustain the rainforest climate inside causes people to stay shorter periods within the facility.

Glasshouse at: Wageningen

- Access into containment facilities is very restricted and can also be accessed by authorized personnel. Such is the case at Wageningen as well.
- Planning is pragmatic and modular. Optimum usage of floorspace with wide enough corridors for crate trolleys and wheelbarrows.

5.4 Seed Health Testing Unit, International rice research institute

Location: Los Baños, Laguna, Philippines

Design: Completed in 1987

Area: 343 m^2

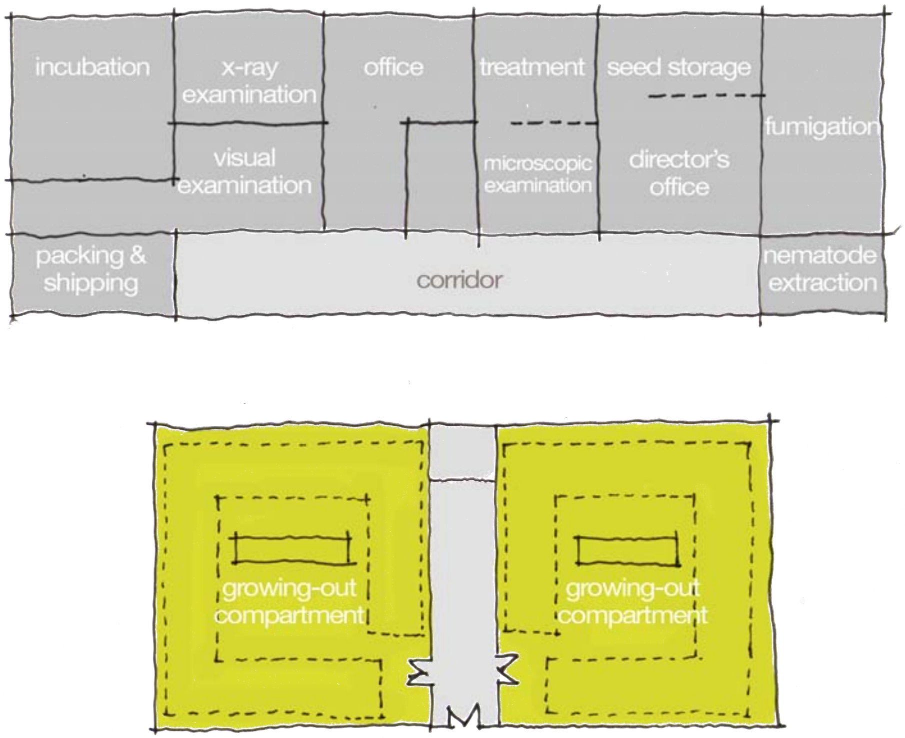


FIG 5.13 Layout plan of the main facility at Laguna (Kahn 1999:60)

5.5 Plant quarantine regional station and National plant protection-training institute

Location: Rajendranagar, Hyderabad, India

Design: Completed in 1992

Area: 255 m^2

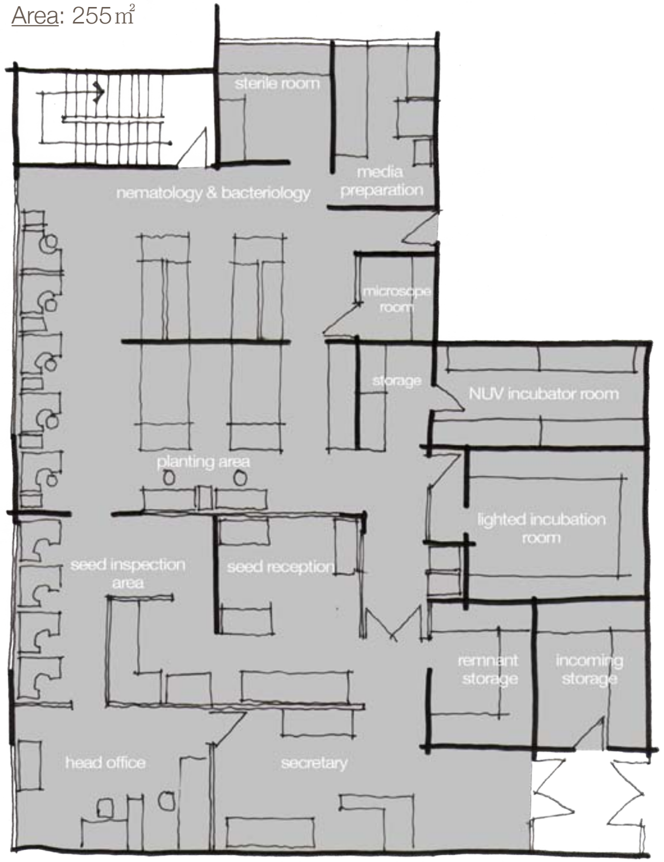


FIG 5.14 Layout plan of the main facility at Rajendranagar (Kahn 1999:39)

5.6 Sustainability institute, educational centre and community eco-village

Lynedoch eco village outside Stellenbosch, Western Cape, South Africa
Design: Prof. Mark Swilling & ARG Design
Duration: 2000 - ongoing project
Cost: Approx. ZAR 22 million (including land purchase)

This project contains a primary school, a post-graduate sustainability institute, a centre for performing arts, and businesses and offices, all within a residential community that is intended to be socially mixed. The five-hectare property is situated in the rural community west of the Spier wine estate just outside Stellenbosch. It is located near an important regional route that links Stellenbosch with the N2, and adjacent to a commuter train line linking Stellenbosch to Cape Town.

According to Darroll (2002:36), people from the Lynedoch community, many of whom work at Spier, had voiced the need for new primary school premises to replace the existing prefabricated facility. The client's intention was to create "a settlement that reflected the social and economic diversity present in this area…" (Unknown Author, Leading Architecture and Design, 2004:40).

Darroll (2002:36) explains that part of the Integrated Development Plan (IDP) acknowledges existing urban centres in the district of e.g. Stellenbosch, and seeks to contain urban sprawl around these centres by fostering medium-sized hamlet developments such as Lynedoch.

"The most significant aspect of the Lynedoch case from a sustainable design and construction point of view is that it provides a working example of an *integrated sustainable development*: *integrated* because it connects social, economic and ecological objectives and because it incorporates technologies that span the energy, water, sanitation, and building materials fields; *sustainable* because of the commitment to a long-term vision of social, economic *and* ecological sustainability; and *developmental* because of the anti-poverty and local economic development objectives" (Annecke & Swilling, 2006:2).

5.6.1 Development program:

Phase I: Acquiring of land, new buildings and readapting exiting buildings
- A primary school for 450 children
- A pre-school for 40 children
- Old Stellenbosch University dance hall: converted into a multipurpose hall
- Offices and classrooms for the Sustainability Institute
- Drie Gewels hotel and residential house: converted into 18 residences to serve as a guesthouse facility for participants in the postgraduate programme at the Sustainability institute, as well as for general use (Annecke & Swilling, 2006:3).

Phase II: Residential and hamlet (currently under construction)
- 42 dwelling units of which 14 are government subsidized
- Commercial space for offices or small manufacturers and crafters
- Village green and landscaped areas (using indigenous plants)
- Parking

Phase III: Community expansion
- The nature and extent of Phase III will be determined by community opinion and the outcome of Phase II.

FIG 5.19

FIG 5.18

FIG 5.15 FIG 5.16 FIG 5.17

5.6.2 Main building:

The site slopes steeply towards the main road. An old dance hall adjacent to the Drie Gewels hotel has been unused for years. It consisted of a double volume shed with a wraparound mezzanine level overlooking what used to be the central dance floor (Darroll, 2002:37). The following modifications were made:

- **Multipurpose hall**: The old dance floor was converted into a multi-purpose hall that serves the school, but can be leased out for performances, meetings and workshops (Unknown Author, Leading Architecture and Design, 2004:42).
- **Upper level**: Offices for the Sustainability Institute and Classrooms along the existing north and south wings.
- **Western wing**: An upper ground level entrance to the school that complements the steep gradient of the site, and classrooms that occupy the new extension.
- **Eastern wing**: Administration offices and computer laboratory.
- **Existing squash court**: Converted to hall for school sport/ other activities.

4.6.3 Ecological sustainability:

- **Wind scooping ventilation ducts:** To optimize the natural airflow through the hall by taking advantage of the direction of the prevailing winds (Darroll, 2002:37).
- **Rooflights** as **convection ventilators** – hot air extraction.
- **Extended roof overhang** and pergolas (covered with deciduous vines).
- **Rock chambers** (local river boulders): (using local river boulders): In **summer** cool night air is drawn from outside to cool the rocks. Fresh cool air is stored during the night and distributed to classrooms the following day via underfloor ducts. The same process is applied in **winter**, apart from the fact that warm air is drawn from the roof space at around 10:00 and flushed through the rock stores in order to be immediately distributed via the same underfloor ducts.
- **Adobe bricks** and concrete blocks are manufactured on site, but concrete was used for the exterior walls of the main building.
- **Potable** (municipal) and **recycled** water supply (for e.g. irrigation, flushing of toilets)
- **Open channel stormwater run-off** planted with kikuyu grass.
- **Rainwater harvesting**
- **Sewerage**: - Primary sewerage treatment through septic tanks
  - Secondary treatment via existing biolytic plant and constructed wetland
- **Energy**: - National grid (ESKOM)
  - Solar power: For water heaters and LED streetlamps
  - LP gas for cooking

FIG 5.20 Skylights and extractor fans in main hall

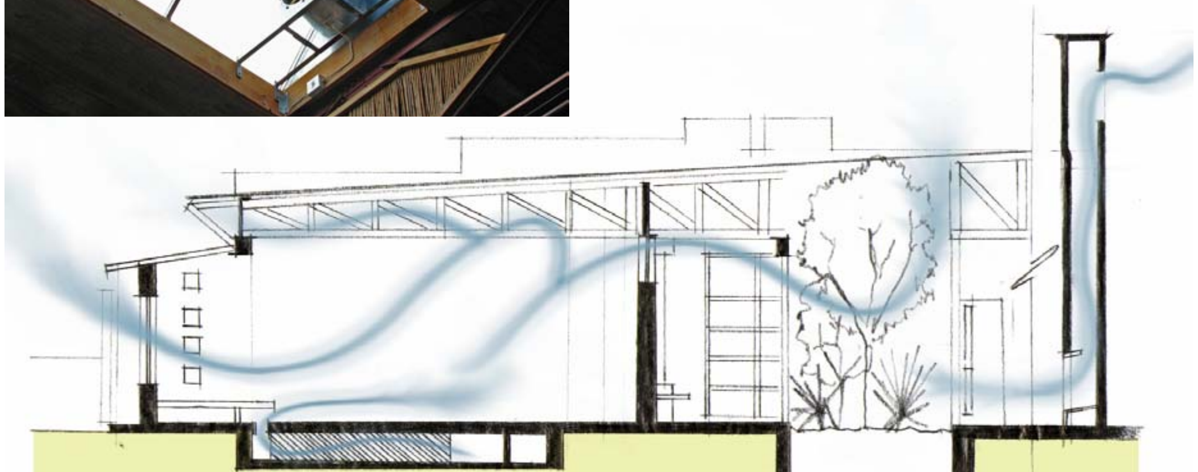


FIG 5.21 Section showing passive cooling and heating system

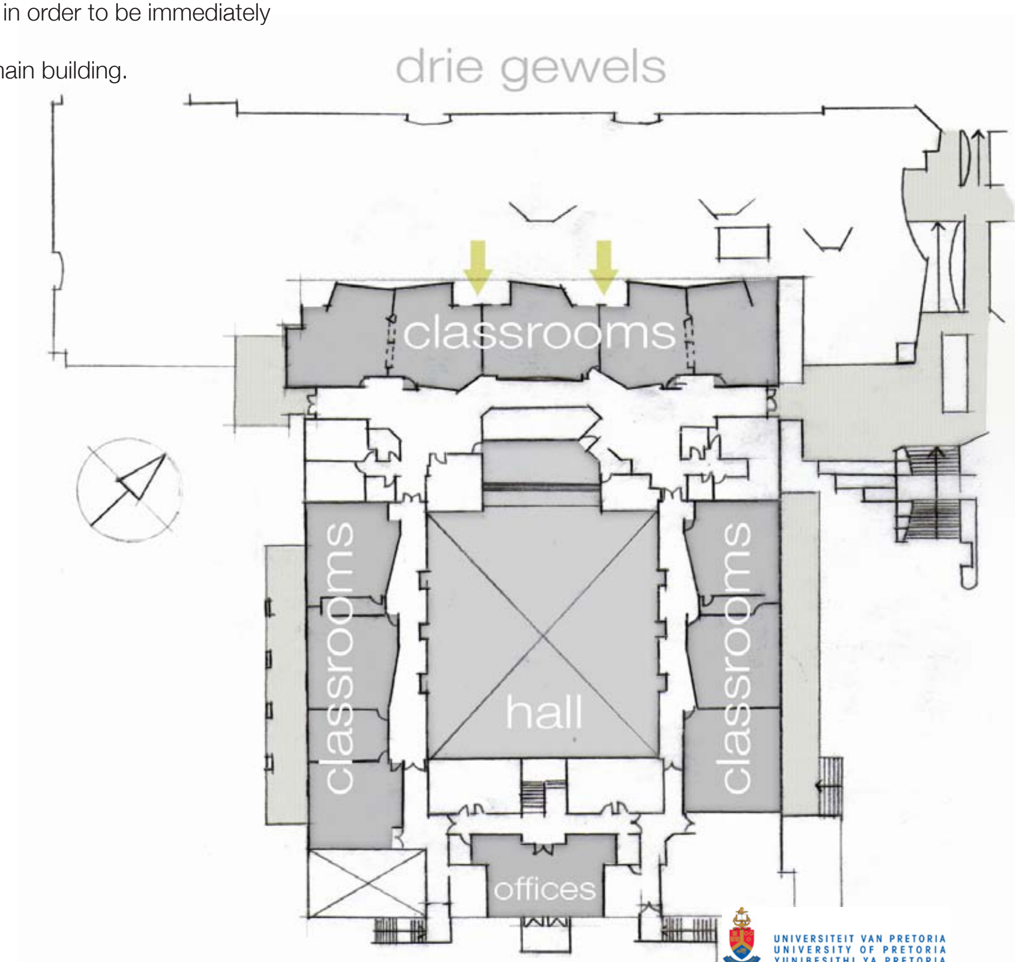


FIG 5.22 General layout plan of the institute

4.6.4 Social sustainability:

According to Annecke and Swilling (2006:11) there are three aspects of social sustainability that the Lynedoch Eco Village development addresses:

- **Governance**: All property owners, including the Lynedoch Development Company (LDC), are members of the Lynedoch Home Owners' Association (LOHA) that is responsible for all the community's service needs.
- **Maintaining a proper social mix**: People come from various walks of life, ranging from mainly black farm workers to self-employed professionals and government officials. The intent of the LDC has been to ensure a social mix through the provision of both commercially priced and subsidized plots.
- **Child centered approach**: Among many factors the most interesting is the development of an IT centre that links the primary school, the Sustainability institute and the University of Stellenbosch for the use of children, university students and community members.

6.4.5 Economical sustainability

Affluent communities can survive in enclosed local communities that do not need the poor, but the reverse is not true. Therefore, if spatial integration of low- and high-income households takes place, it becomes possible to create all sorts of markets that incorporate rather than exclude the urban poor (Annecke & Swilling, 2006:11).

Outcomes on studying Lynedoch:

- It is clear that from the research and practical applications done at Lynedoch that there is a clear sense of social responsibility within the community.
- The scheme is rural and similar thinking can be applied within urban areas, but with more sophisticated technology.

FIG 5.23 View towards classrooms down the western façade

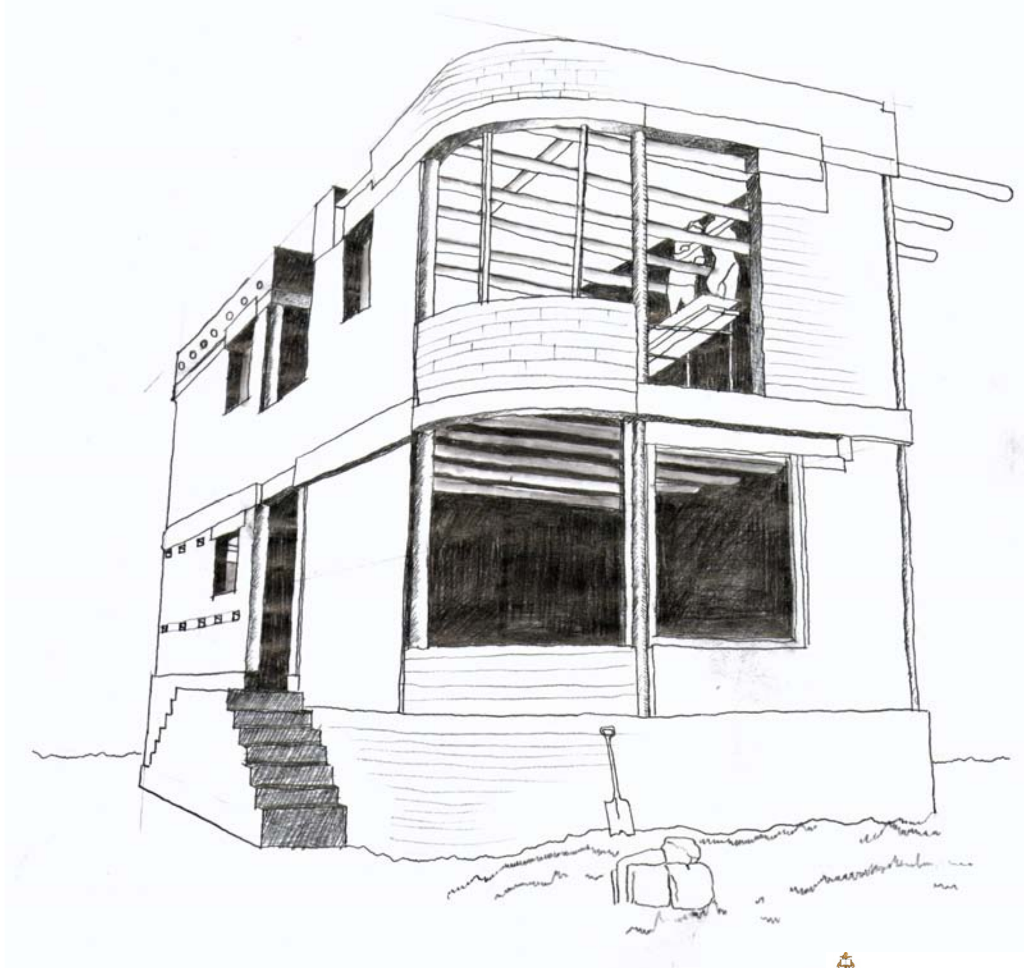


FIG 5.24 Building of low cost housing units