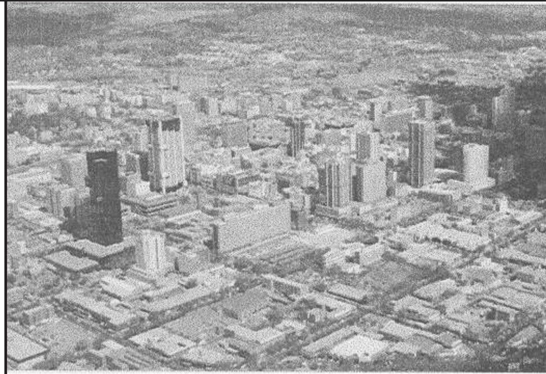
Chapter 4



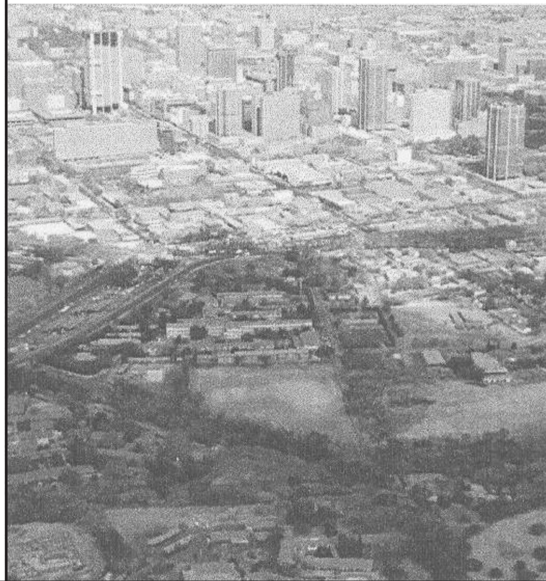


FIGURE GROUND (MACRO)

FIGURE GROUND, GROUND FIGURE (MESO)

ECONOMICAL
SOCIAL

MOVEMENT

NOISE

AIR QUALITY

GEOLOGY

TOPOGRAPHY

HYDROLOGY

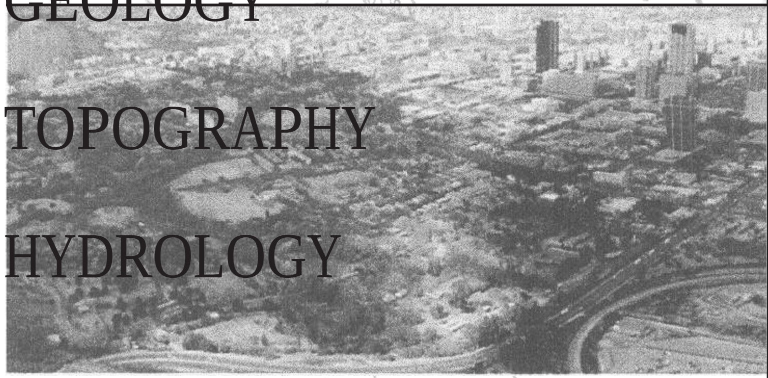
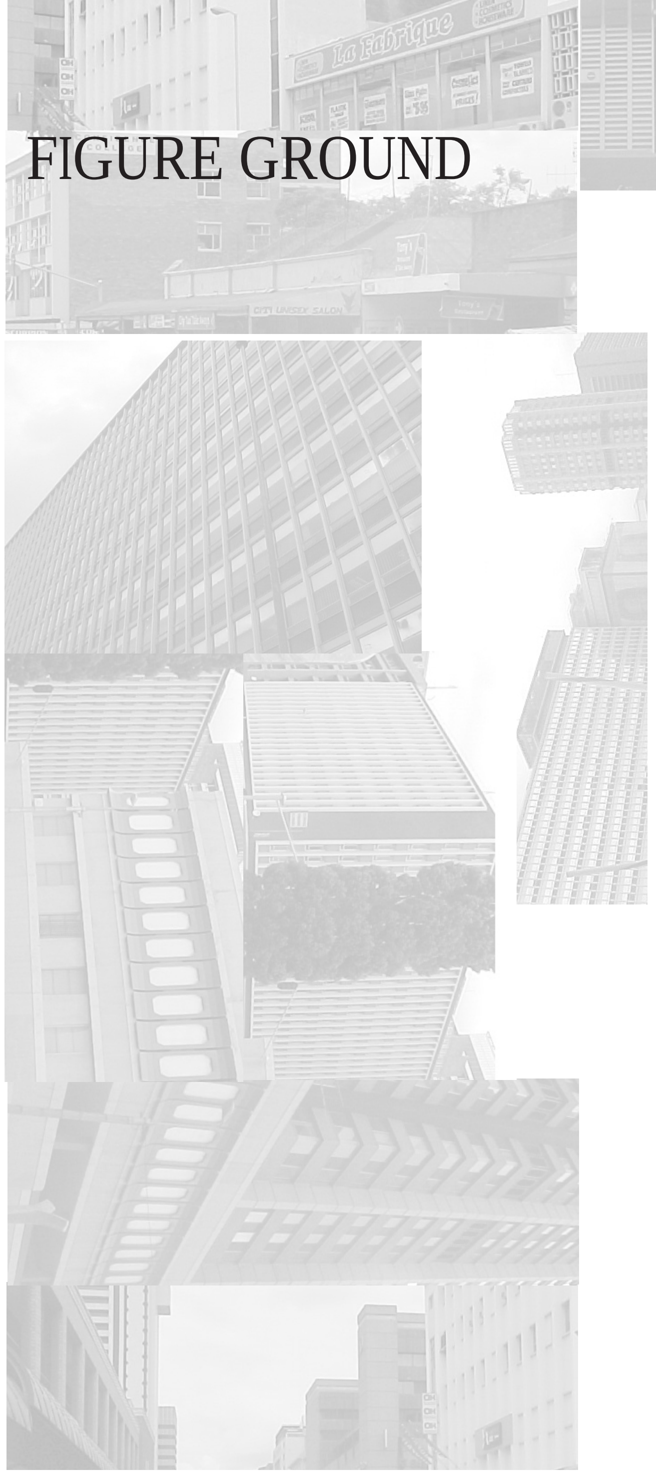


FIGURE GROUND



Macro

Fig 13: Ground Figure [Author, 2003]

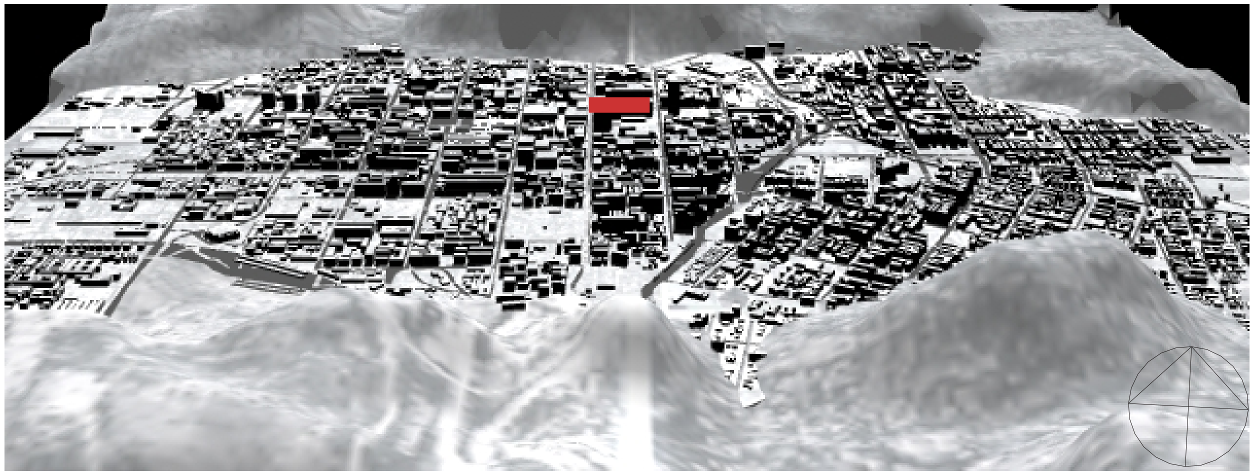


Fig 14: Mass model [Author, 2003]

Meso

Fig 15: Figure Ground (meso) [Author,2003]

FIGURE GROUND

Fig17: Mass model (meso) [Author, 2003]

Fig 16: Ground Figure(meso) [Author,2003]

GROUND FIGURE

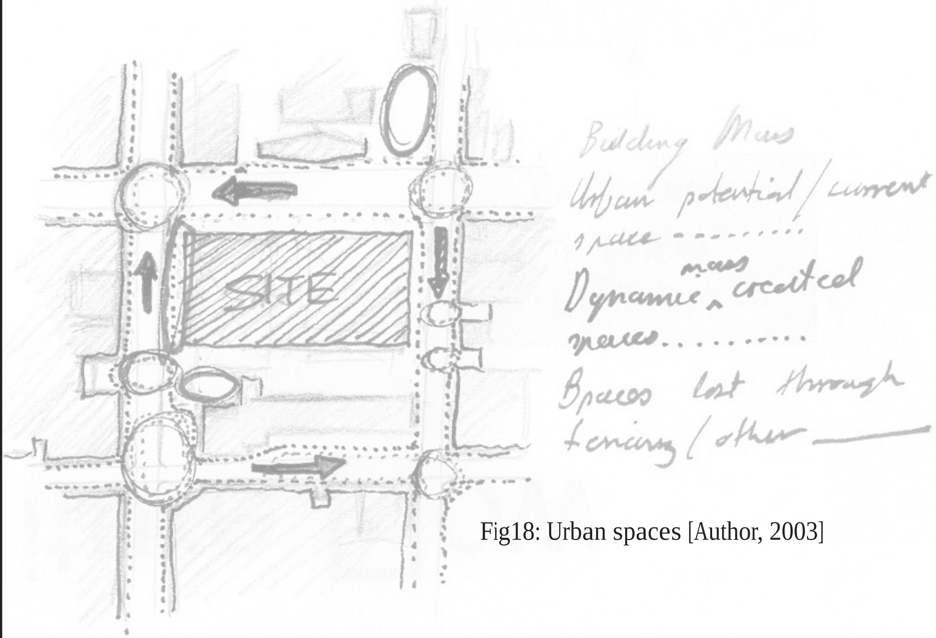


Fig18: Urban spaces [Author, 2003]

ECONOMICAL

The area north to my site contains low density mixed land use, with a strong formal and informal retail component with heavy taxi traffic accompanied by vibrant human activity
[Capital Consortium. Pretoria Inner City Integrated Spatial Development Framework, Part 1]

The area around my site contains land uses of retail, informal retail, offices and services with other mixed activities areas.

Strong and dynamic economical activity in a block radius of my site is indicated in the following figures.

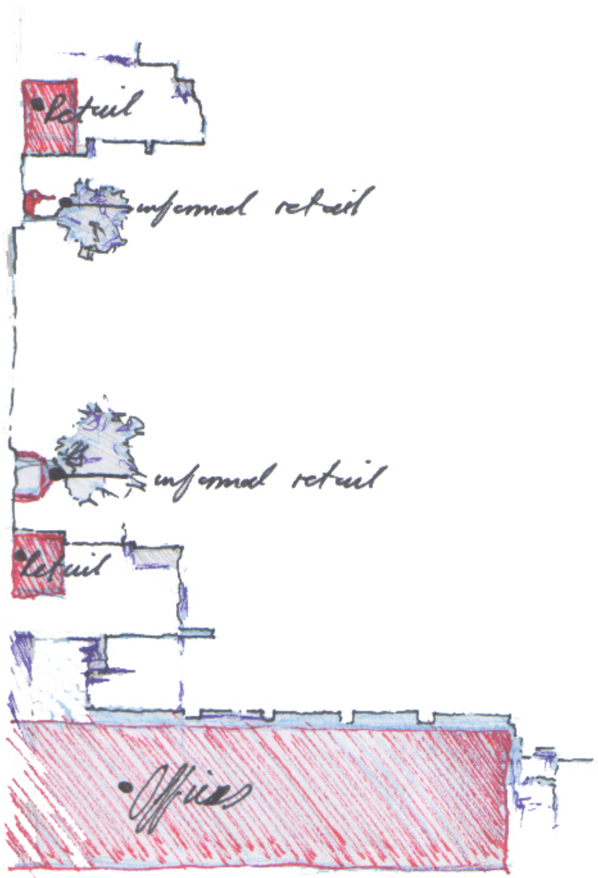
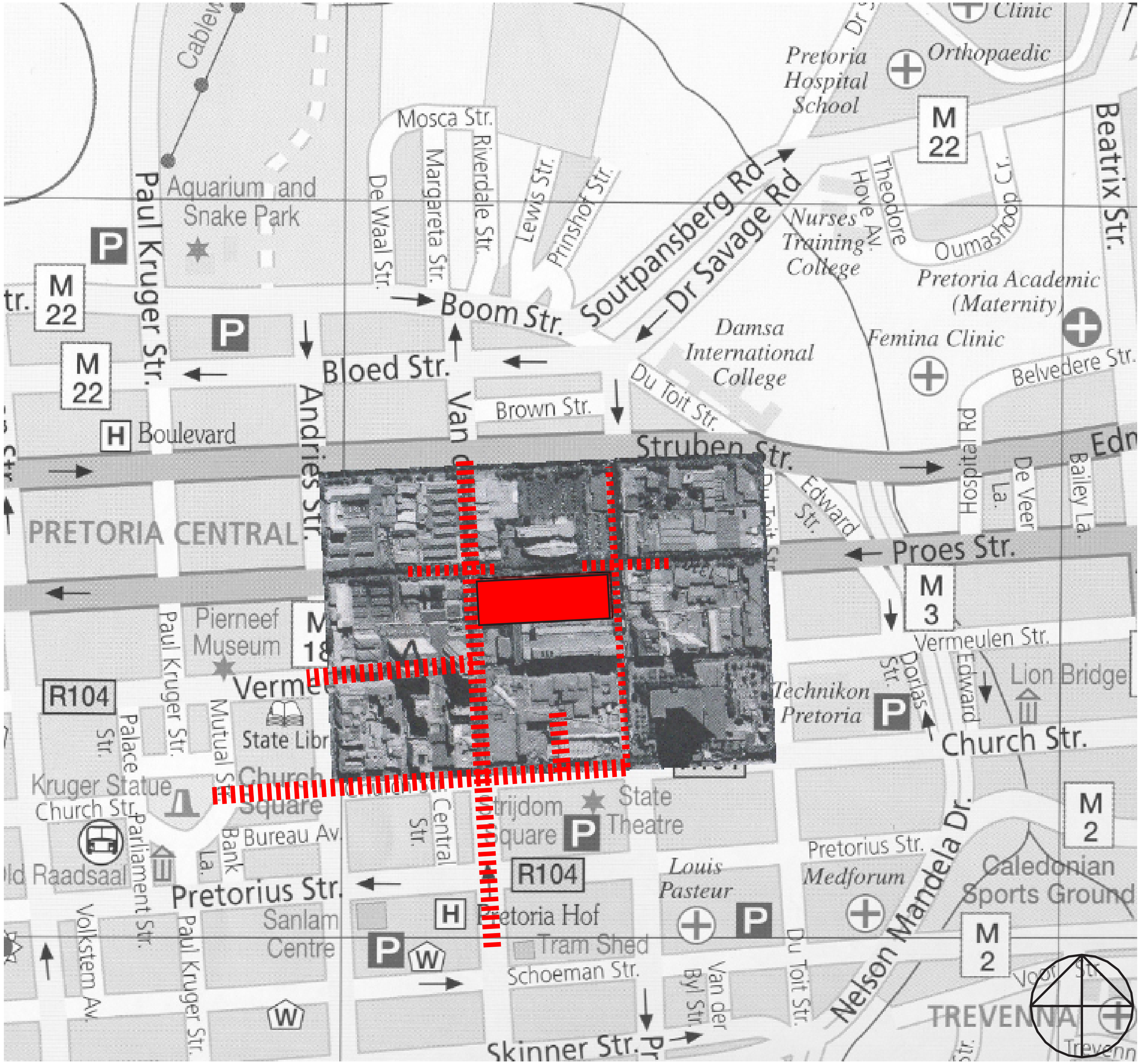


Fig 19: Typical Section of Inner City [Author, 2003}



20: Local Economical Energy [The Larger Touring Atlas of SA. 2001] + [Tshwane Council, 1996]

ECONOMICAL

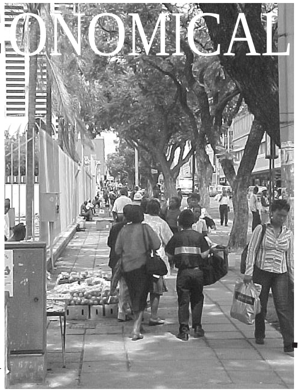


Fig 21

Fig 22

Fig 23


Fig 24


Fig 25

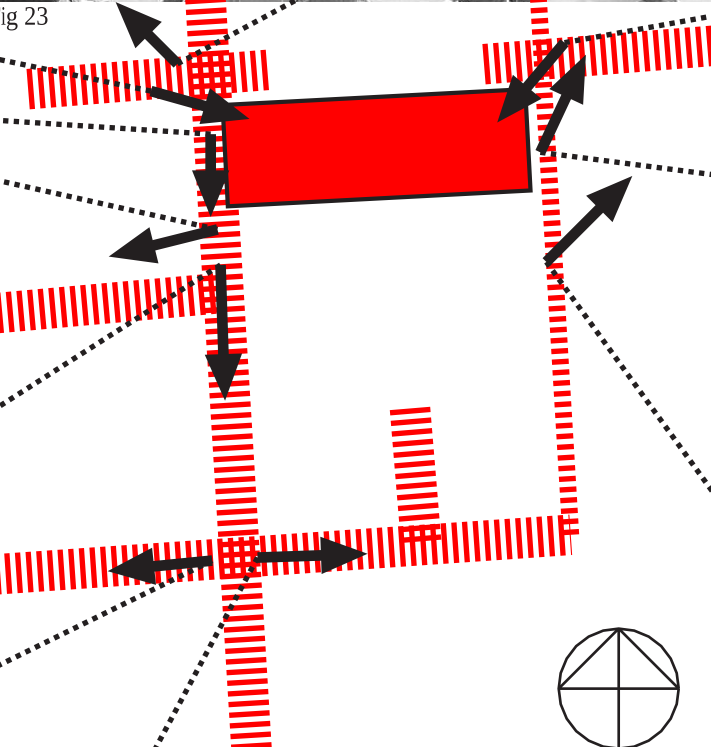



Fig 26


Fig 27

Fig 30


Fig 28


Fig 29

Fig 21-30: Images of local economic activity [Author, 2003]

SOCIAL

From all the social institutional nodes situated in the Inner City it seems that there is a lack of structure and appearance at regular intervals. Medical facilities seem to situate themselves close to each other.
Hospital Hill, which is situated to the north of my site, is a strong coherent institutional node. The rest of the social institutions in the Inner City are dispersed Educational and Cultural facilities, and lack the coherency that is portrayed by Hospital Hill.

The area west of my site, including Marabastad, has a lack of social facilities.
There is an over shortage of accessible natural urban space in the Inner City and the green belt system that accompanies it.

Crime related issues near my site:

- Main problem is theft
- Car related crime

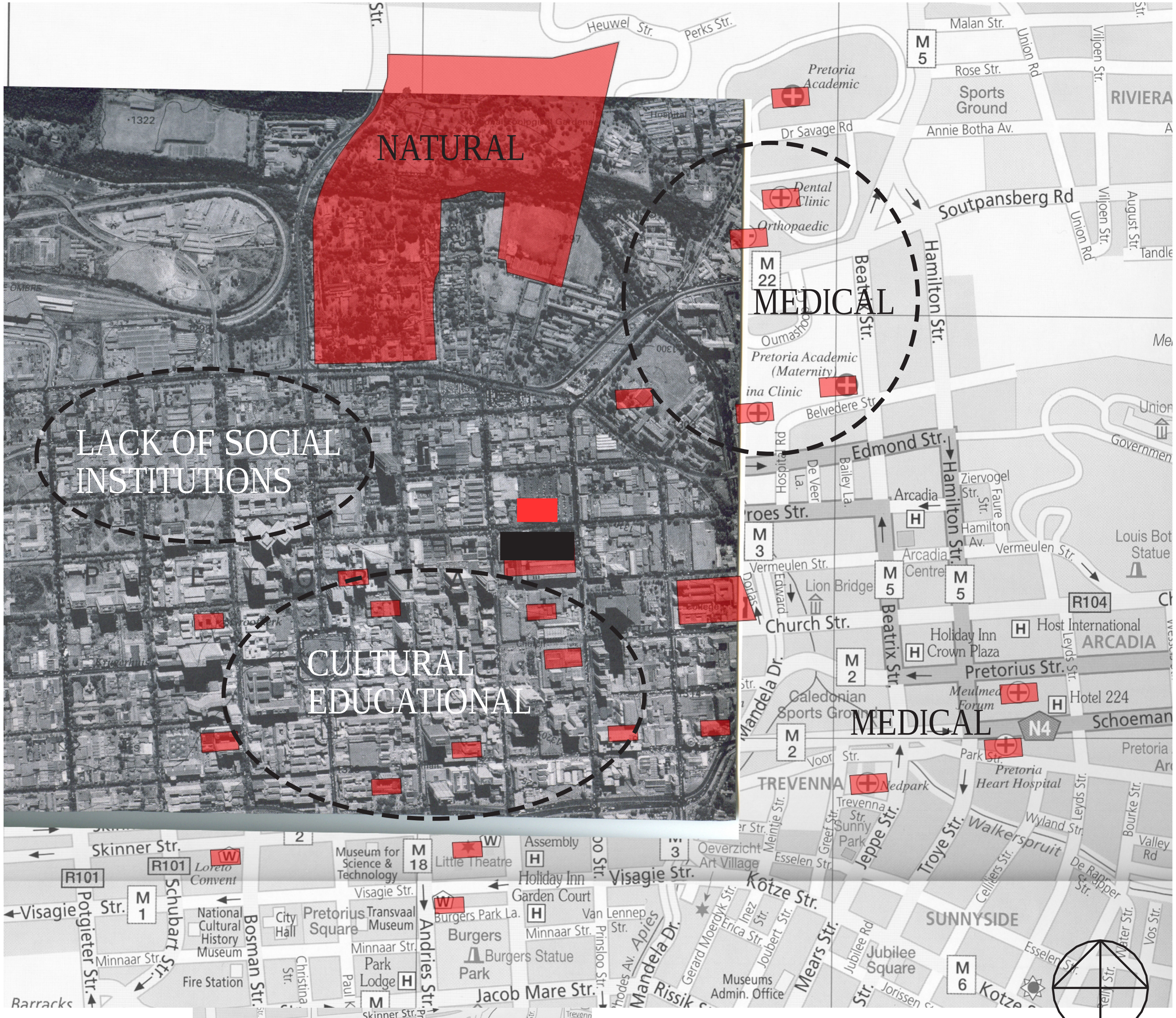


Fig 31: Social Indicators [The Larger Touring Atlas of SA. 2001] + [Tshwane Council, 1996]

MOVEMENT

All the adjacent roads to the site are one-way orientated.

- Struben is a major route towards the east, but is not directly adjacent to the site.
- Proes is towards the West.
- Vermeulen towards the East.
- Van der Walt towards the North, but not directly adjacent.
- Prinsloo towards the South.

Van der Walt terminates into a major transport node in the North. Belle Ombre Station is situated to the West of the site.

Reaching the site is not that easy, because of the one-way orientation of all the adjacent roads. It forces entrances and exits to specific locations.

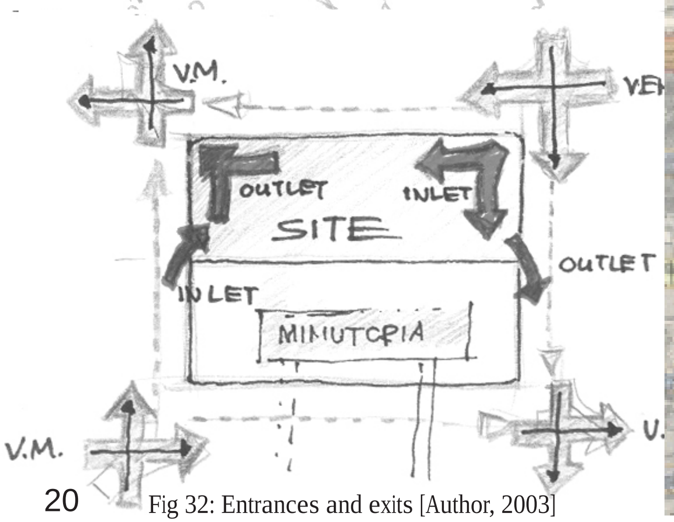


Fig 32: Entrances and exits [Author, 2003]

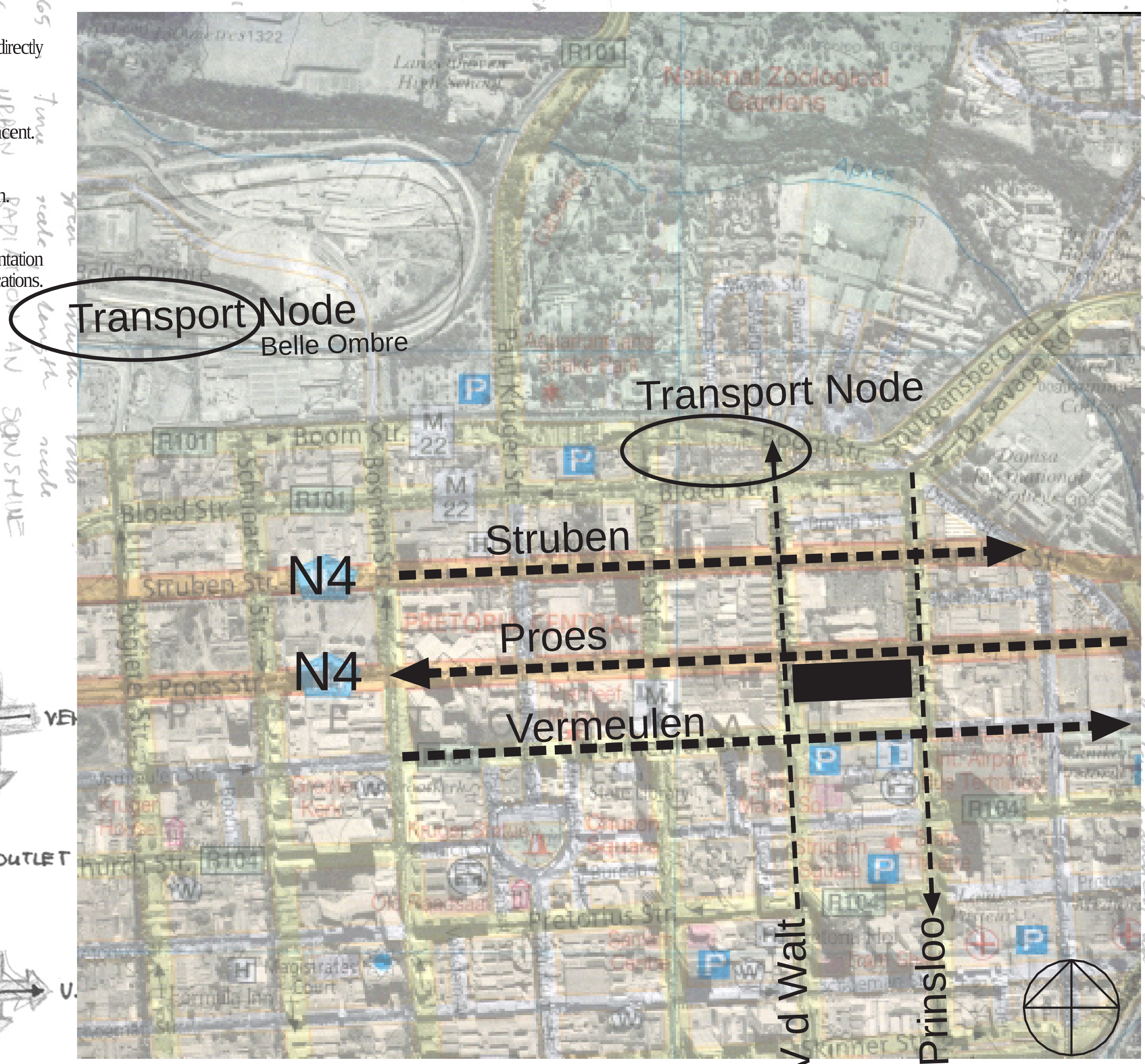


Fig 33: Major movement. [The Larger Touring Atlas of SA. 2001] + [Tshwane Council, 1996]

NOISE

Fig 34: Corner of Proes and Vd Walt

Fig 35: Noise along Proes

Fig 36: Activity on the corner of Prinsloo and Proes

Fig 37: View along Vd Walt

Fig 38: Along Vd Walt

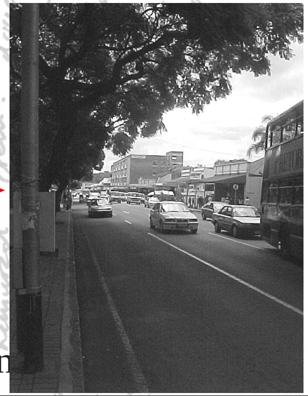


Fig 39: View along Prinsloo

Fig 40: Noise in context [Author, 2003]

Fig 34-39: Sources of noise [Author, 2003]

The main sources of beautiful vibrant human racket
Corners:
- The corner of Proes and Van Der Walt, and corner of Proes and Prinsloo. (Corner of Proes and Van Der Walt being most active)

Streets:
- Prinsloo and Van Der Walt Street. (Van Der Walt Street being the busier of the two)

Proes Street is not that active and seems to be used by taxis for on-street parking.

AIR QUALITY

Panoramic view showing the turbid air hovering above the Inner City, trapped by the two ridges on the northern and southern side of the CBD.

Fig 41: Pretoria Air Pollution [Author, 2002]

Model showing the two ridges with the trapped polluted air

Fig 42: Exaggerated topographic model showing how turbid air is trapped between the ridges [Author, 2003]

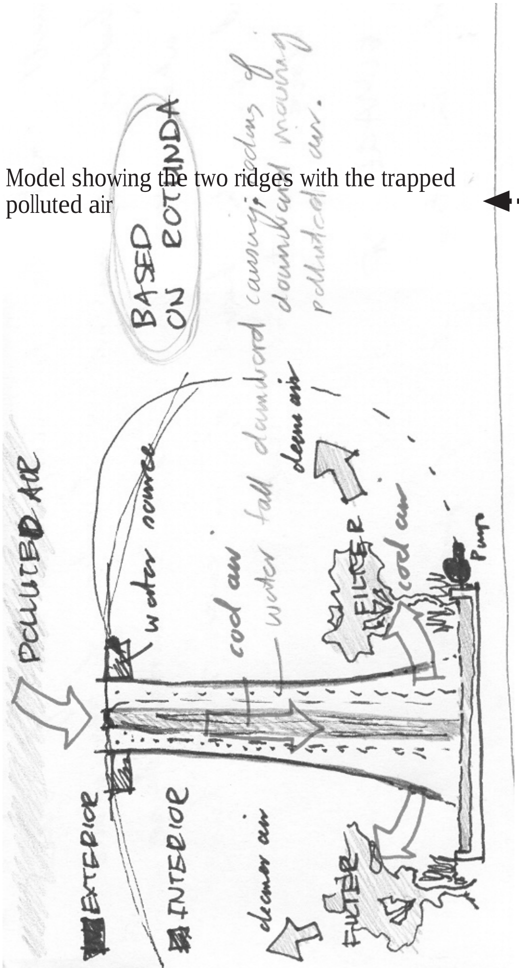


Fig 43: Air filter and cooling concept [Author, 2003]

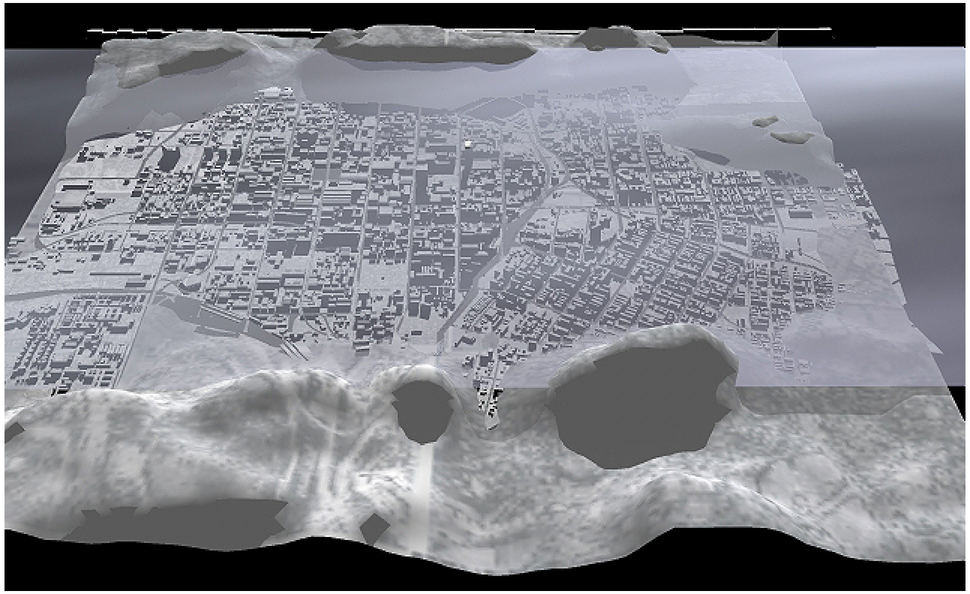


Fig 44: Aerial view of model with trapped air [Author, 2003]

Effect of air pollution

The two main families of pollutants have opposite effects on the urban climate. Greenhouse gases such as CO_2 and CH_4 absorb long-wave radiation emitted by terrestrial surfaces. This reduces the rate of cooling of these surfaces, resulting in a warming effect at ground level, thus contributing to the urban heat island effect.
Aerosols, on the other hand, obstruct solar radiation reducing the amount transmitted through the urban atmosphere and reaching the ground. One effect of such reduction is in the form of lower temperatures at ground level.
Another effect may be proportionate increase of the diffuse component of the solar radiation reaching the ground owing to the scattering caused by [Yannas, S. 2001.Towards more sustainable cities. 2001 Elsevier Science Ltd. Printed in Great Britain.]

GEOLOGY

Hekpoort Andesite
Residual soil from the Hekpoort Andesite
Soil:

- The residual soils of the Hekpoort andesite are silty clays and clayey silts, which are usually medium active in nature and usually produce an expected heave in the order of 15 to 20mm at the ground surface.
- Highly variable soil profile: ranges from hard rock within a few millimetres of the ground surface to thick residual clayey soils in the excess of 30m thicknesses.
- Investigation of the area underlain by andesite has to be carried out on site.
  Water can provide the triggering mechanism for failure of excavation faces along joint planes. (Ground water, leaking pipe)

Building construction:

- Precautions against heaving have to be carried out and may involve anything from deep piling to ordinary footings, or strip foundations carried down slightly deeper than normal
- With major structures pad footings may be carried down to 3m depths – beneath this depth it is generally more economical to use piled foundations, the foundation being extended until inactive material of a suitable bearing capacity is reached.
- The most effective building method appears to be a stiffened raft foundation.
- Flexible jointing should be provided in subsurface pipes and drains to prevent leakage and adequate drainage facilities should be provided to divert rainwater away from the foundations.
- It is advisable to provide some form of shoring technique on all excavation faces.
  Footings of a major structure may be founded on corestones with the mistaken impression that the corestones are bedrock.

Diabase and syenite
Soil:

- Syenite tend to weather to greater depths than the andesite
- As the syenite occurs in the form of a dyke, it is a renowned aquifer and consequently, strong inflows of water should be anticipated in deep excavation.
- Important characteristic of the residual soil is that it often exhibits the properties of a highly over-consolidated material.
- It appears highly compressible and often classified as to compressible, whereas in fact the soil behaves as if highly over consolidated and therefore relatively incompressible

Building construction:

- Diabase and syenite weather in a similar manner to andesite. Therefore refer to the above-mentioned construction methods.
- Where a building cannot be positioned so as to avoid straddling such a contact, carefully placed construction joints may be incorporated in the design.
- A notorious aspect of diabase and syenite in deep excavations is, perhaps the instability of the material in open excavations and tunnels.
- The diabase and syenite at a depth of 8 to 16m are extremely prone to ravelling or running and should be considered as a cohesionless mass of stability considerations. Consequently it is essential to support the face of the outer skin of this material excavation by conventional planking or shotcrete on mesh.

[Purnell, D.G. 1994. Bulletin of the Geological Survey of South Africa.
The Engineering Geology of Central Pretoria.Government Printer, Pretoria.]

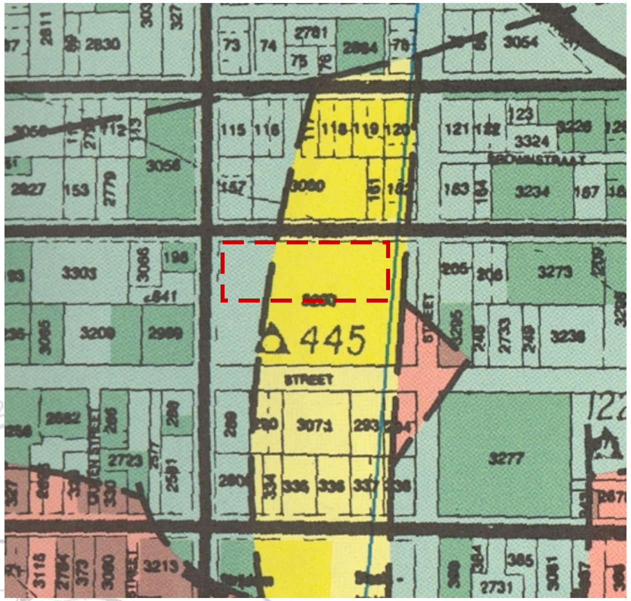
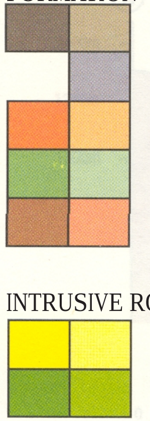


Fig 45: Geology of site [Purnell, D.G. 1994. p49]

GEOLOGICAL LEGEND
FORMATION

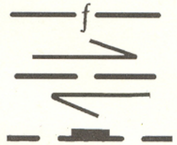


Silverton Shale
Daspoort Quartzite
Strubenkop Shale
Hekpoort Andesite
Timeball Hill

INTRUSIVE ROCKS

Syenite
Diabase

Light Shading = Rock-type inferred
Heavy shading = Information from reports or sightings



Tear-fault with direction of movement indicated
Inferred Fault
Fault with downthrow side indicated

HYDROLOGY

Drainage

The Main Streams of the area are the Apies River, Walker Spruit and Skinner Spruit, which all drain northward in conformity with the general slope. In the area under consideration the greater majority of the streams are canalised.

Groundwater

The general direction of groundwater movement in the study area is from south-east to north-west – consequently groundwater enters this area along the south eastern margins. Because most or all of the discharge of the Fountains Valley springs is taken by the Council, very little groundwater from the dolomite area to the south nowadays sinks back in to the ground to recharge the non-dolomitic area, north of the springs. Thus practically all the groundwater of the Middle Apies-Pienaar basin in which the Inner City lies, is derived directly from the rainfall of that basin.

The water—bearing capacity of almost all the geological formations in the Pretoria area is due to jointing and the effects of sub—surface weathering on otherwise impermeable rock. Weathering is almost everywhere confined to a depth of about 100 metres and to very much less in most places. Only along faults and perhaps in some arterial aquifers in dolomite (not encountered in central Pretoria) does recoverable groundwater reach greater depths.

In the city centre the water table in the shales is generally encountered at a shallower depth than in the andesites, often being encountered at about 3 m depth as compared to about 6m in the andesite. Structural aquifers may be permeable to depths considerably greater than that of the weathered zone of the country rock but they are generally most permeable at the base of their own zone of weathering which may be deeper or shallower than that of the country rock.

Therefore, although the general movement of groundwater is in the direction of topographical decline (in the case of Pretoria being towards the north), its movement in detail is determined by local factors; when the water table stands high, the flow directions tend everywhere to approach the overall gradient, but as the water table declines to approach the base of the aquifer, its form more closely simulates that of the topography in detail and the groundwater tends to move in diverse directions roughly corresponding to those of the surface drainage

Also, as the watertable declines from highly weathered to less weathered rock, the direction of groundwater movement becomes more closely related to the local geological structure. If structural aquifers are present, they act as conduits that may divert groundwater into directions other than that of the maximum slope.

The syenite in my site occurs in the form of a dyke, it is a renowned aquifer and consequently, strong inflows of water should be anticipated in deep excavation.
The rocks underlying the study area are well faulted, and contain several igneous intrusions, the most notable being tile north—south trending "Pretoria Dyke" of syenite. Therefore, although the general flow of groundwater is towards the north, locally it is more complex — the groundwater level to the west of the Pretoria Dyke, for example, is considerably higher than that to the east.

It should also be noted that the deep basements of structures in Central Pretoria require regular pumping to prevent the ingress of groundwater, the water being pumped into the stormwater system for discharge into the canalised streams. This has had the effect of lowering the groundwater level in the vicinity of these basements.

[Purnell, D.G. 1994. Bulletin of the Geological Survey of South Africa.
The Engineering Geology of Central Pretoria.Government Printer, Pretoria.]

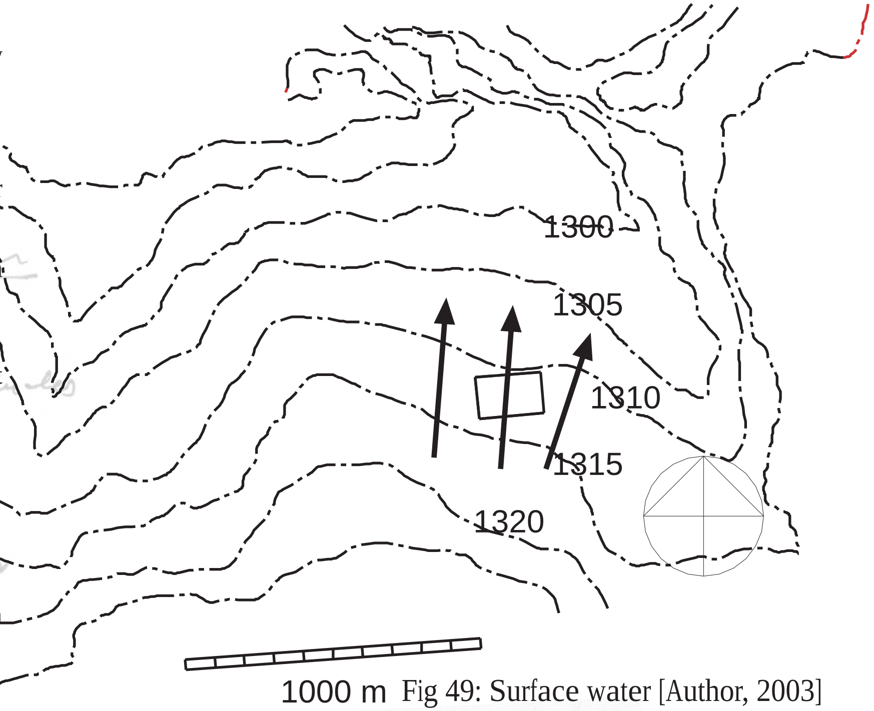


Fig 49: Surface water [Author, 2003]

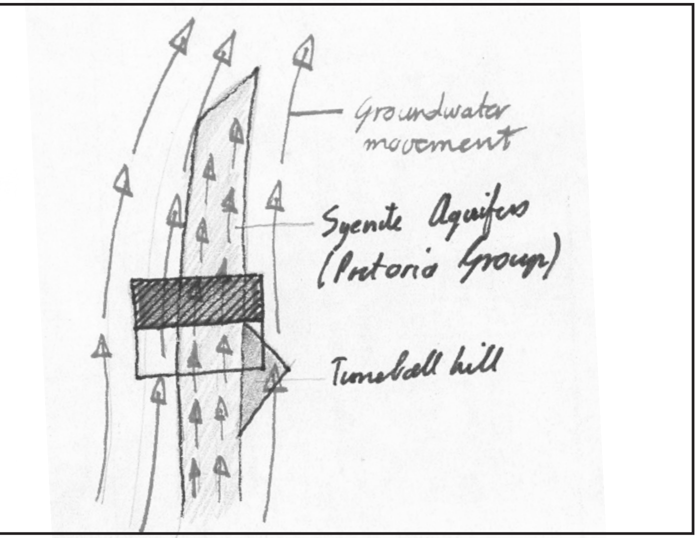


Fig 50: Subsurface water [Author, 2003]

TOPOGRAPHY

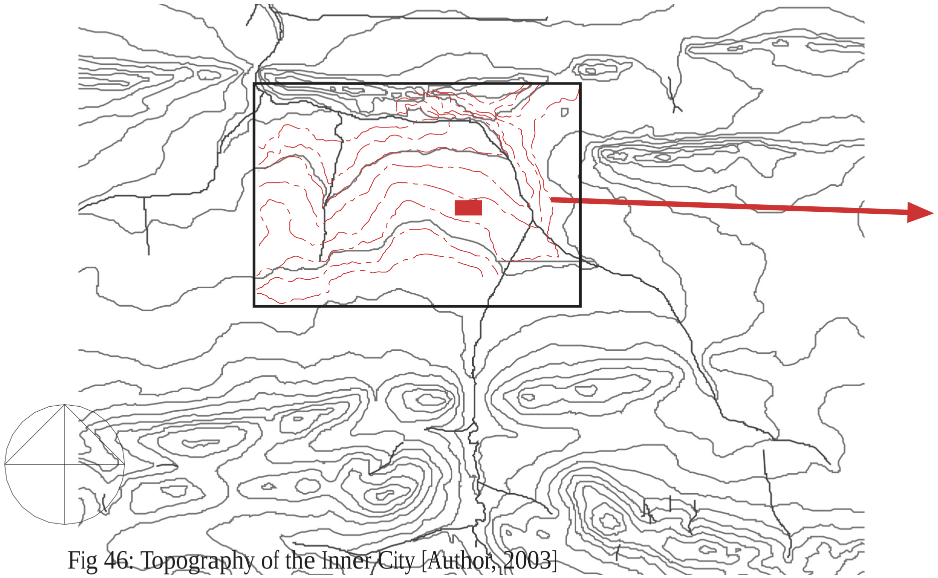


Fig 46: Topography of the Inner City [Author, 2003]

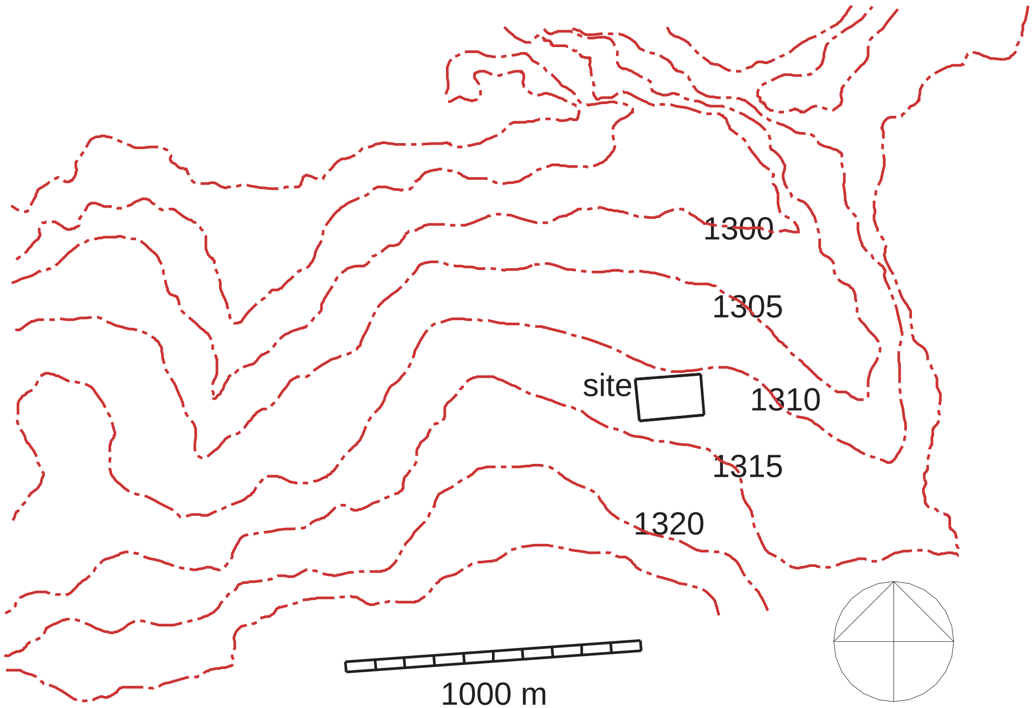


Fig 47: Topography at local scale [Author, 2003]

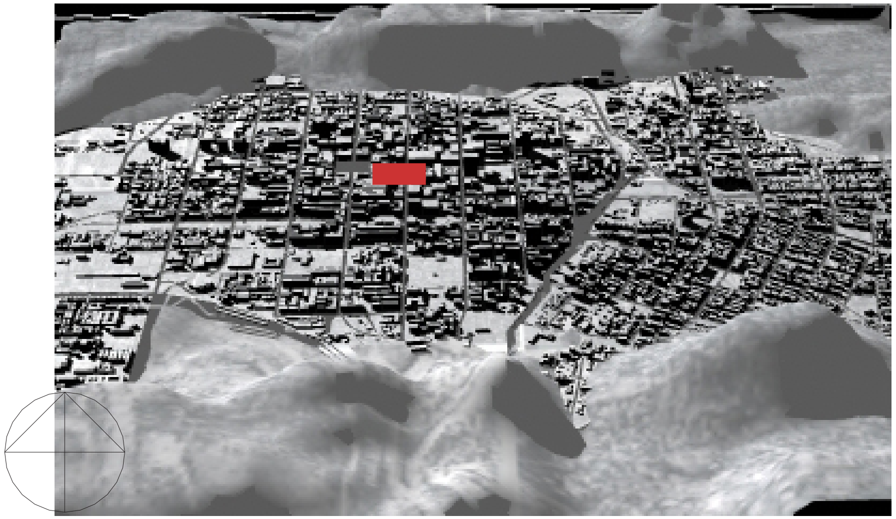


Fig 48: Exagerated topographic model [Author, 2003]

Central Pretoria falls in the "Middleveld" (or "Bankveld"), which is characterized, by roughly parallel hills, ridges and escarpments with longitudinal valleys between.

The average altitude of the central area is 1320m above sea level, with a general slope downwards towards the north. The highest altitude of the region is 1430m in the north-east.
[Purnell, D.G. 1994. Bulletin of the Geological Survey of South Africa. The Engineering Geology of Central Pretoria.Government Printer, Pretoria.]

The problem with Pretoria CBD's topography is that the two ridges prohibit polluted air to disperse beyond the ridges, causing the turbid air to hover above the city.

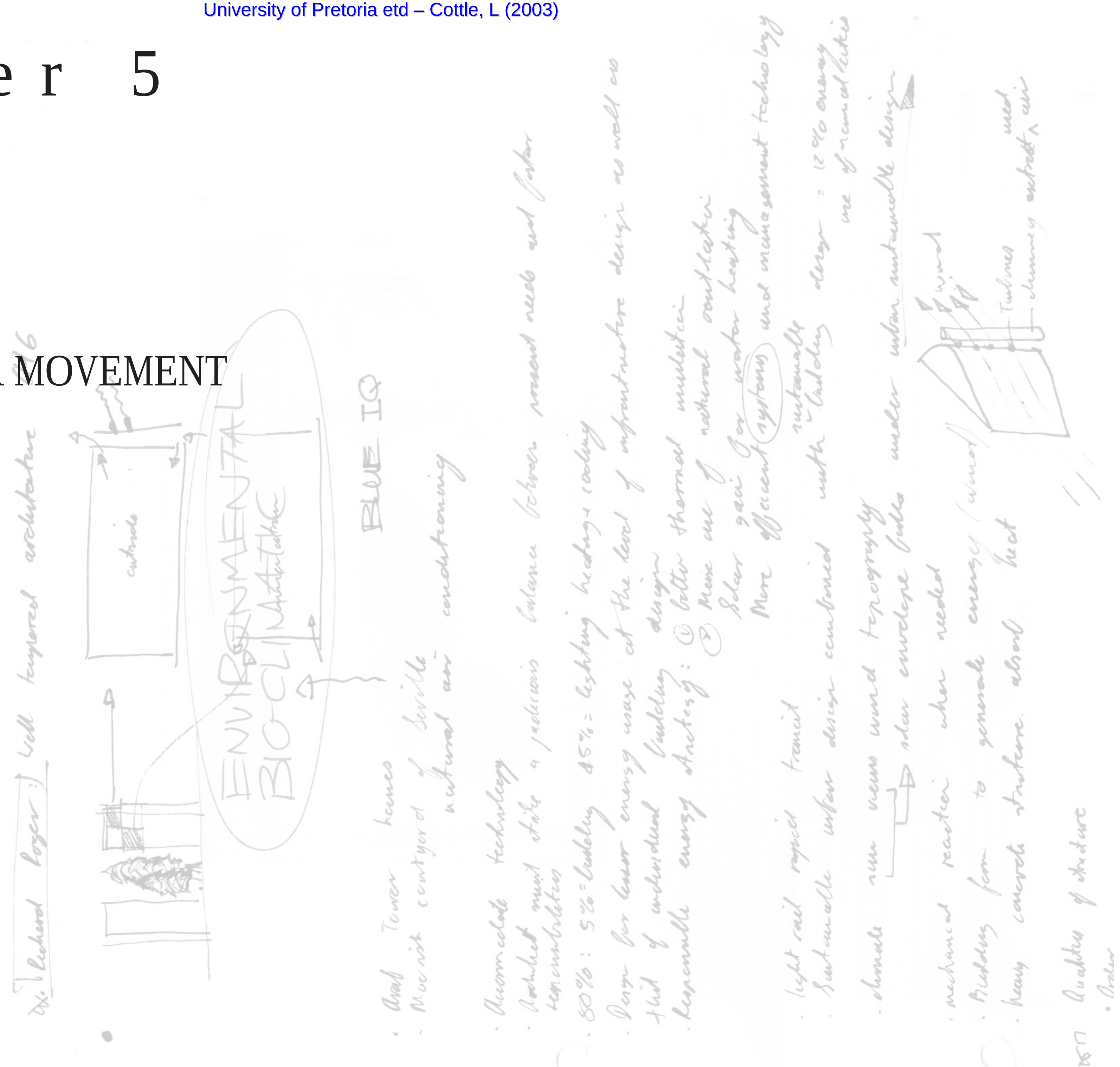
Chapter 5

CLIMATIC DATA

SUN

DIURNAL SOLAR MOVEMENT

WIND



CLIMATIC DATA

Climatic data for Pretoria

	Jan	Feb	Mar	Apr	Ma	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Ave
Maximum average monthly temperature (^{0}c)	28,6	28	27	24,1	21,9	19,1	19,6	22,2	25,5	26,6	27,1	28	24,81
Minimum average monthly temperature (^{0}c)	17,4	17,2	16	12,2	7,8	4,5	4,5	7,6	11,7	14,2	15,7	16,8	12,13
Average monthly amplitude (K)	11,2	10,8	11	11,9	14,1	14,6	15,1	14,6	13,8	12,4	11,4	11,2	12,68
Average monthly relative humidity (%)	58,0	59,5	60,0	59,5	55,0	53,0	50,0	46,0	45,0	49,5	54,0	56,5	53,83
Average monthly rainfall (mm)	136	75	82	51	13	7	3	6	22	71	98	110	56,17

[Holm, D. 1996. Manual for energy concious design. Pretoria.]

SUN

Johannesburg & Pretoria. Latitude (nearest) 26° South

Both cities taken as longitude 25,5° E (Add 4,5° or 18 minutes to solar time)

Solar times	6:00	8:00	10:00	12:00	14:00	16:00	18:00
Clock times	6:18	8:18	10:18	12:18	14:18	16:18	18:18
Azimuth 21/12	112E	101E	91E	0	91W	101W	112W
Altitude 21/12	10	35	63	88	63	35	10
Azimuth 21/3 & 9	90E	76E	53E	0	53W	76W	90W
Altitude 21/3 & 9	0	26	51	65	51	26	0
Azimuth 21/6	_	55E	34E	0	34W	55W	_
Altitude 21/6	_	14	32	40	32	14	_

Napier, A. 2000. Enviro-friendly Methods in Small Building Design for South Africa. Published by Author.

Maximum and minimum monthly mean sunshine duration

Pretoria (23 yrs.)	DES	MAR	JUN	SEP
Poss. Duration (hrs. /day)	13.7	12.2	10.6	11.9
Max. (%)	79	79	95	89
Min. (%)	46	48	69	53
Range (%)	33	31	26	36

Average and Maximum Frequency of Overcast and Dull days

Pretoria (20 yrs.)	DES	MAR	JUN	SEP
Average No. of days	2.6	2.7	0.7	1.3
Max. No. of days	14	12	6	8

Average and Maximum Frequency of Bright days

Pretoria (20 yrs.)	DES	MAR	JUN	SEP
Average No. of days	6.1	8.5	23.2	15.5
Max. No. of days	11	12	28	25

[Schulze, B. R. 1986. Climate of South Africa. Weather Bureau, Department of Environmental Affairs.]

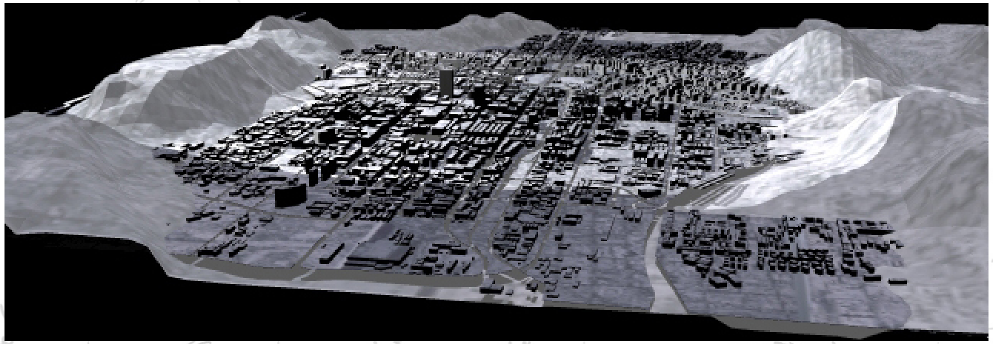


Fig 51: Pretoria Sun [Author, 2003]

THe Solar Envelope:
The sun is fundamental to all life. It is the source of our vision, warmth, energy, and the rhythm of our lives. Its movements inform our perception of time and space and our scale in the universe. Guaranteed access to the sun is, thus, essential to energy conservation and the quality of our lives.
The solar envelope is a zoning concept to provide urban solar access. The zoning would eventually result in a shift from fossil to sustainable energy. Furthermore, it would evoke a profound change in the way we identify with our environments, a different way of judging the aesthetics of buildings.
[Knowles, R. L. School of Architecture, University of Southern California. 2002. The solar envelope: its meaning for energy and buildings. Published by Elsevier Science B.V.]

It offers the opportunity for all neighbouring buildings to have solar access and have the opportunity to be able to harvest the sunlight.

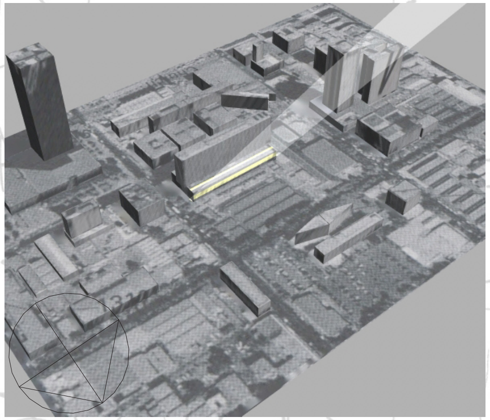


Fig 52: Winter angle reaching Munitoria [Author, 2003]

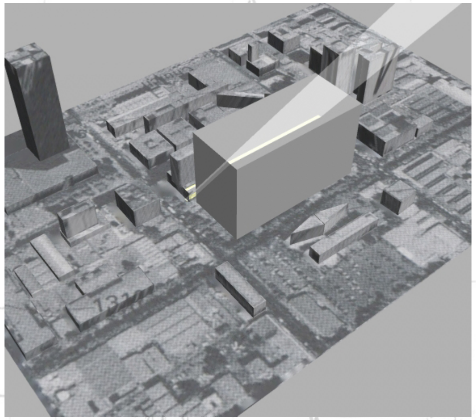


Fig 53: Bulk limit [Author, 2003]

Establishing solar access to adjacent buildings and street spaces that surround the site, the winter extreme altitudes need to be simulated in the physical context. In the first simulation the remainder of the Munitoria building were taken into account to establish a solar envelope that gives the Minutoria access to the sun in the middle of winter.
First the sun angles were placed in the physical context and then a larger mass entity was placed in the space to establish the maximum vertical envelope of the building.

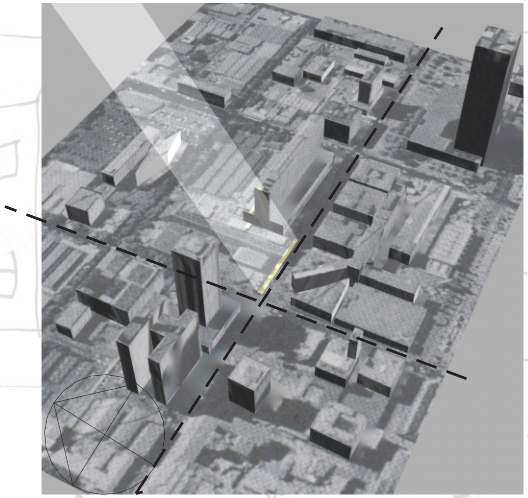


Fig 54: Winter sun reaching public realm [Author, 2003]

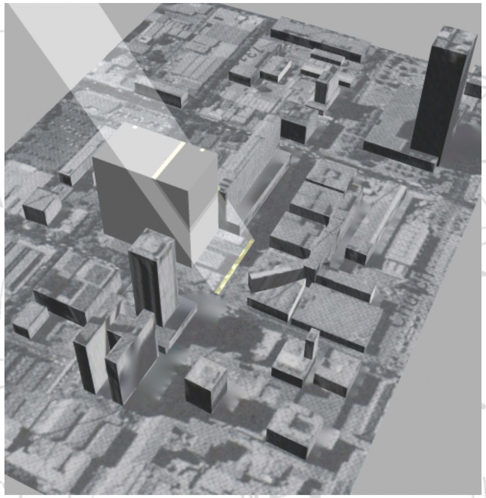


Fig55: Bulk Limit [Author, 2003]

The second simulation was conducted to allow enough sunlight to reach the corner of Vermeulen Street and Van Der Walt Street. This space is a vibrant and busy space. Sunlight reaching this space will create a sence of warmthts its movements inform our perception of time and space.

The last simulation is to establish an envelope to allow for sunlight to reach the adjoining streets. The simulation is combined to give an idea what the overall solar envelope of the building should look like.

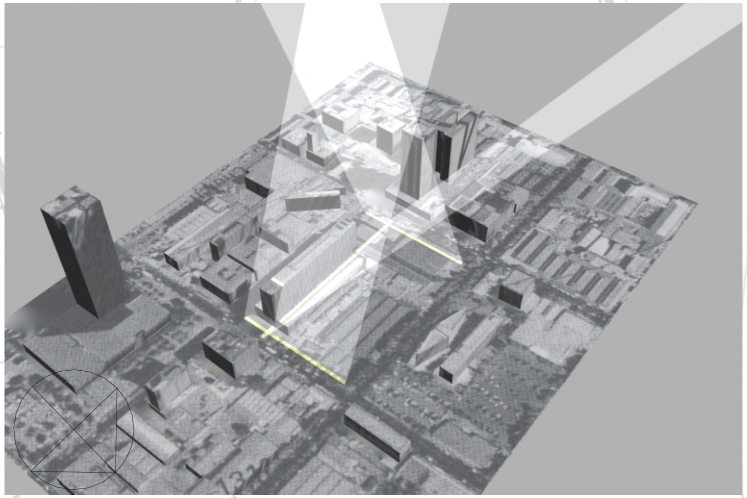


Fig 56: Solar angles to allow sun to reach the eastern and western sides of the site [Author, 2003]

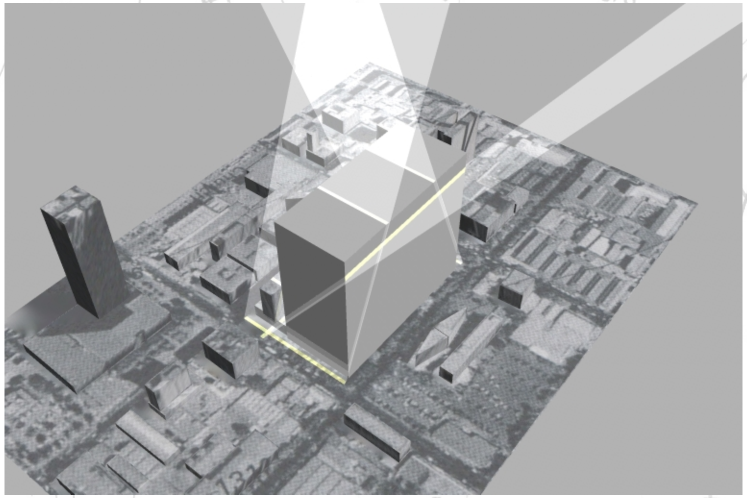


Fig 57: Bulk Limit [Author, 2003]

DIURNAL SOLAR MOVEMENT

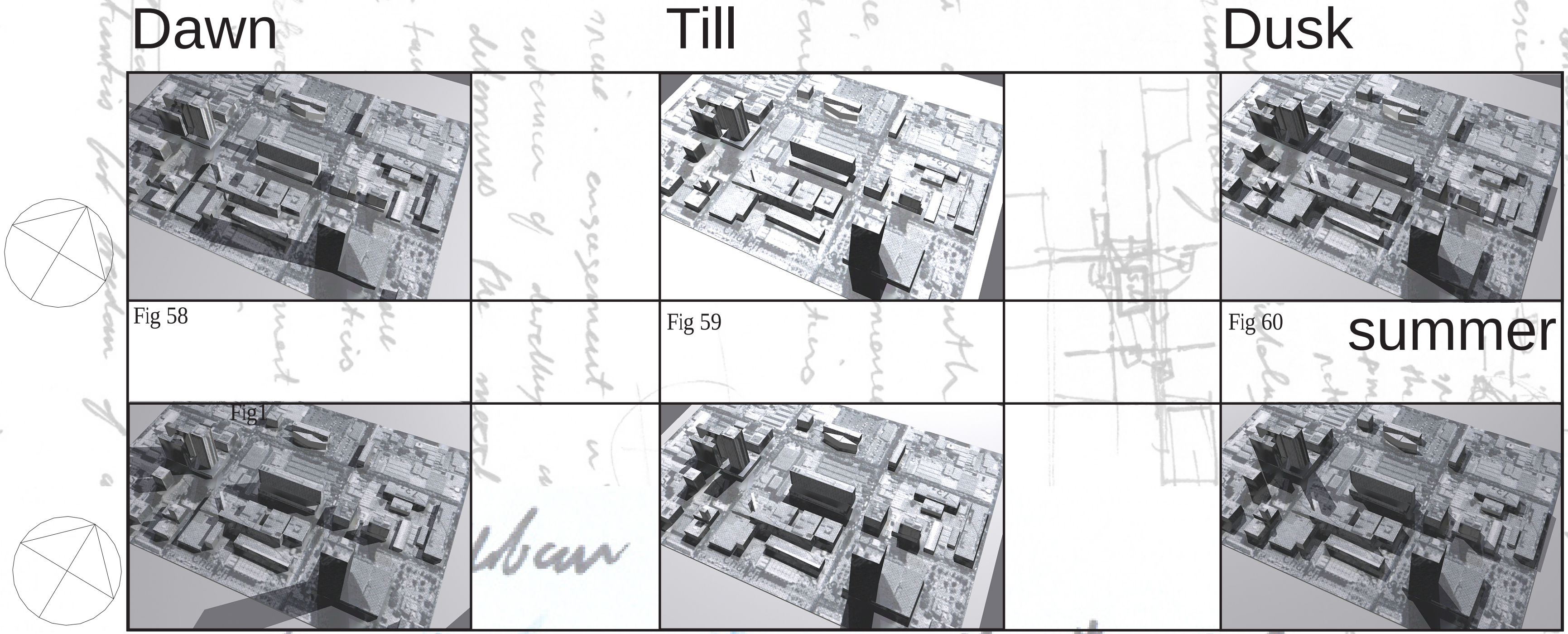


Fig 58 Fig 59 Fig 60

Fig 61 Fig 62 Fig 63

Fig 58-63: Solar movement on site through year [Author, 2003]

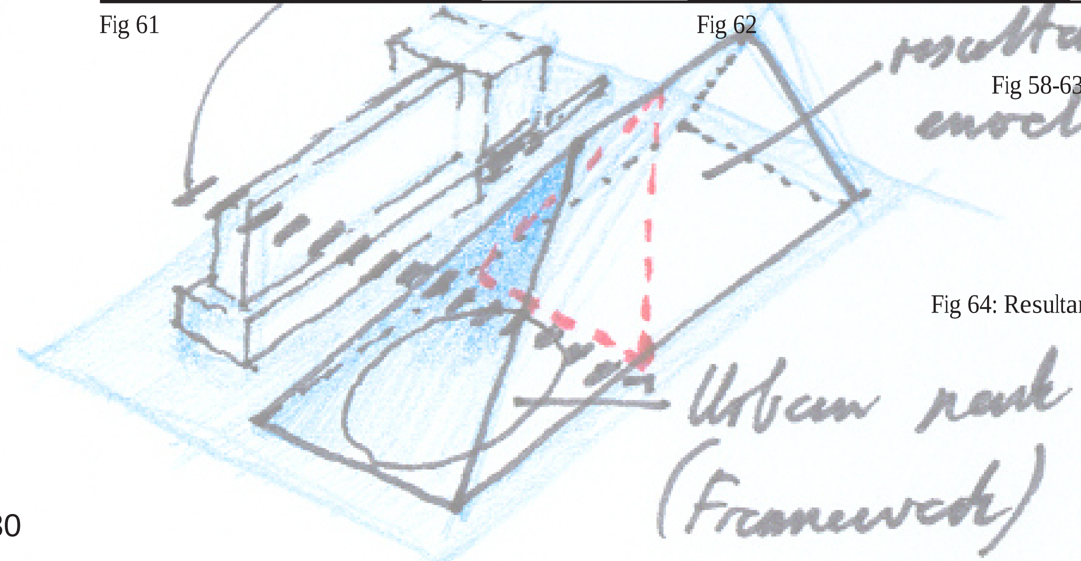


Fig 64: Resultant Envelope [Author, 2003]

WIND

Summer winds are predominately east-north-easterly to east-south-easterly. Winter winds are predominately south-westerly with a fair amount originating from the north-east.

[Holm, D. 1996. Manual for energy concious design. Pretoria.]

Street level air velocity and turbulence depends on the regional wind speed indicated, but are affected by urban design features. These main elements, which can modify wind conditions, are:

- The density of the urban area
- Size and height of the individual buildings; existence of high-rise buildings
- Orientation of streets
- Availability, size distribution, and design details of open spaces and green shelter belts

[Givoni, B. 1998. Climate considerations in Building and Urban Design. Van Nostrand Reinhold.]

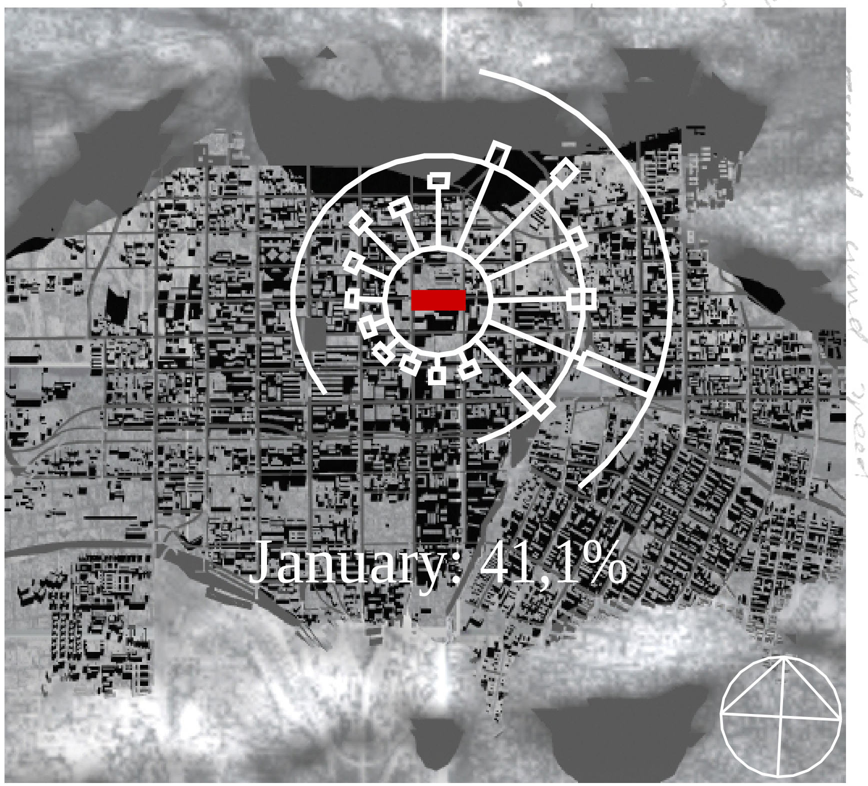


Fig 65: Summer windrose in context [Holm, D. 1996.p70]

Fig 66: Winter Windrose In Context [Holm, D. 1996.P70]

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