STAGE B.1

Urban environment ans structure

Figure B.1.1
Pretoria's city realm

B.1.1 INTRODUCTION

This analysis is guided by the Pretoria inner City Integrated Development Framework with the urban principles set out for the inner city precinct, being continued through into the adjoining precinct in which the selected site is located.

Capitol Consortium.
Part 2, Volume 4.

The public realm is made up of sense of spaces, streets and places that users of the city pass through or use as part of their every-day experience of the city.

Capitol Consortium.
Part 2, Volume 4: 1

The urban design framework defines the city in terms of varying spheres or scales of influence:

The location of the selected precinct and site within a South African Context. [Fig. B.1.2]

The South African city being referenced to, through this document, is the capital city of South Africa, Pretoria. [Fig. B.2.1]

The specific precinct within the Pretoria context being referenced to in this document is the precinct of Pretoria-West.
[Fig. B.4.1]

Figure B.1.2
Global positioning of context

"Context"
Involves the translation of generic ideas into specific forms. The form of adaptation of abstract ideas to the specific physical and social realities of a particular context animates those ideas: indeed, in places, context generates them. Generic ideas can thus be captured in many forms: the specifics of context mould warp and enrich ideas. However, in this process, the idea should never be destroyed.

Dewar
and Uytenbogaardt
1991:16

B.2.1 THE FORM OF SOUTH AFRICAN CITIES

Spatial issues are mostly concerned with identity, capital image, and linkage to the wider metropolitan area.

Capitol Consortium.
Part 2, Volume 4: 1

When approaching the subject of South African City layouts, governing powers must be taken into account. The ideals set by the Boer and British governing powers did not include Equal rights for all those who formed part of the pallet of cultures in our country. Many of the modernist, physical town planning constructs (to form systematically) neatly complemented the ideological construct of the apartheid era, which consciously sought not to integrate people, particularly low-income people, into the city.

The application of these apartheid philosophies has resulted in three spatial characteristics, which describes South African Cities:

The First:
Low-Density sprawl.
(The spread of cities outwards)

The Second:
Fragmentation.
(The lack of cohesive development entities within the city)

The Third:
Separation.
(city typologies being governed by segregation through the separation of cultures, land uses, urban elements, income groups, which resulted in a dispersed urban fabric)

The utilization of these apartheid patterns, together with the changing of Political powers, has rearranged the urban form of our cities. Along side the changing of Political powers, came a change in our views towards our cities' surrounding context and cultures. Our attention is drawn from the historically fixed divide of our city spaces, to the mobility and interaction between them. The general acceptance and interest in our countries diverse cultures, has increased an enthusiasm and desire to change, adapt and review our city spaces, with the ambition of delivering meaning to those who dwell within its spaces. The unfortunate situation exists in that these acceptance levels are only between people with an interest of the inter city and not the general public.

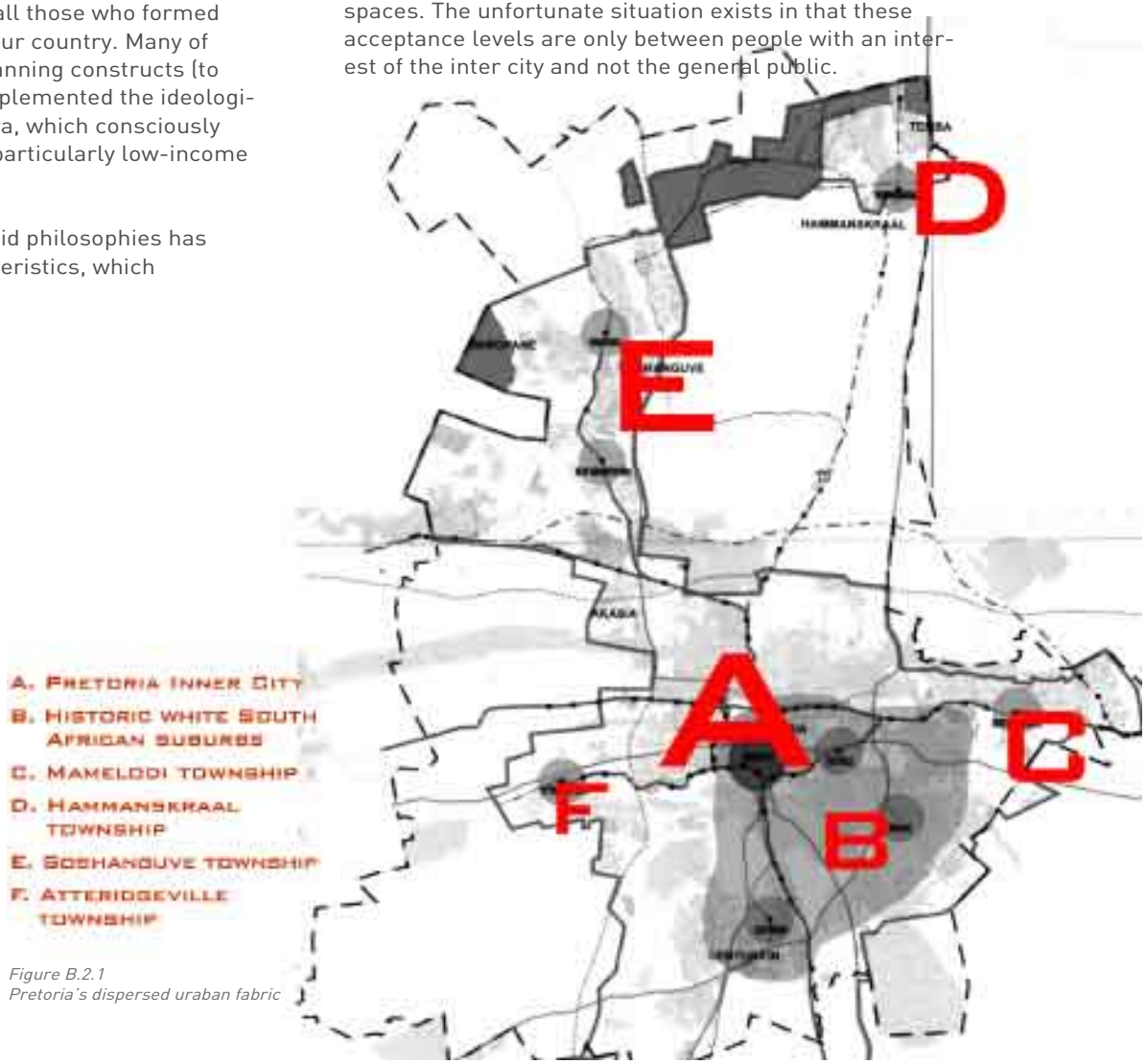


Figure B.2.1
Pretoria's dispersed uraban fabric

B.2.2 THE FORM OF PRETORIA

Pretoria is situated in the valleys between the Magaliesberg and the Daspoort ranges as well as Meintjies Kop and Timeball Hill. The city was structured on the principle of the modernist grid system with Church Square being the original energy source of the city.

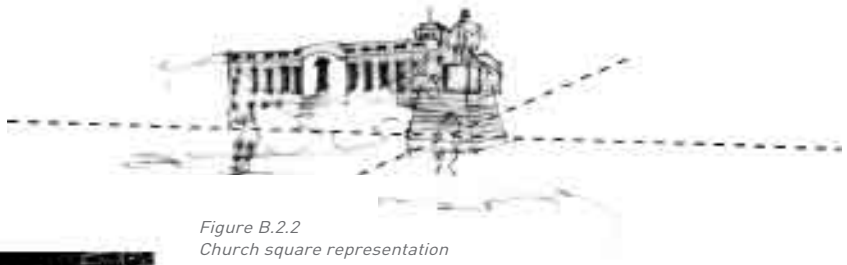


Figure B.2.2
Church square representation

Figure B.2.3
Energy source of pretoria [Church square]

Pretoria is easily accessible (Fig.B.2.4) owing predominantly to the major vehicle mobility routes, namely the N1, the R28 or Ben Schoeman motorways (north/south), the newly developed Nelson Mandela Corridor (north/south), and the N4 (east/west). Pretoria has obvious residential and commercial benefits considering its location, which is in close proximity to the corporate capital of South Africa, Johannesburg (South of Pretoria) with a direct link to the Johannesburg International Airport along the Nelson Mandela Corridor and plans for a high-speed rail system being developed (The Gautrain).

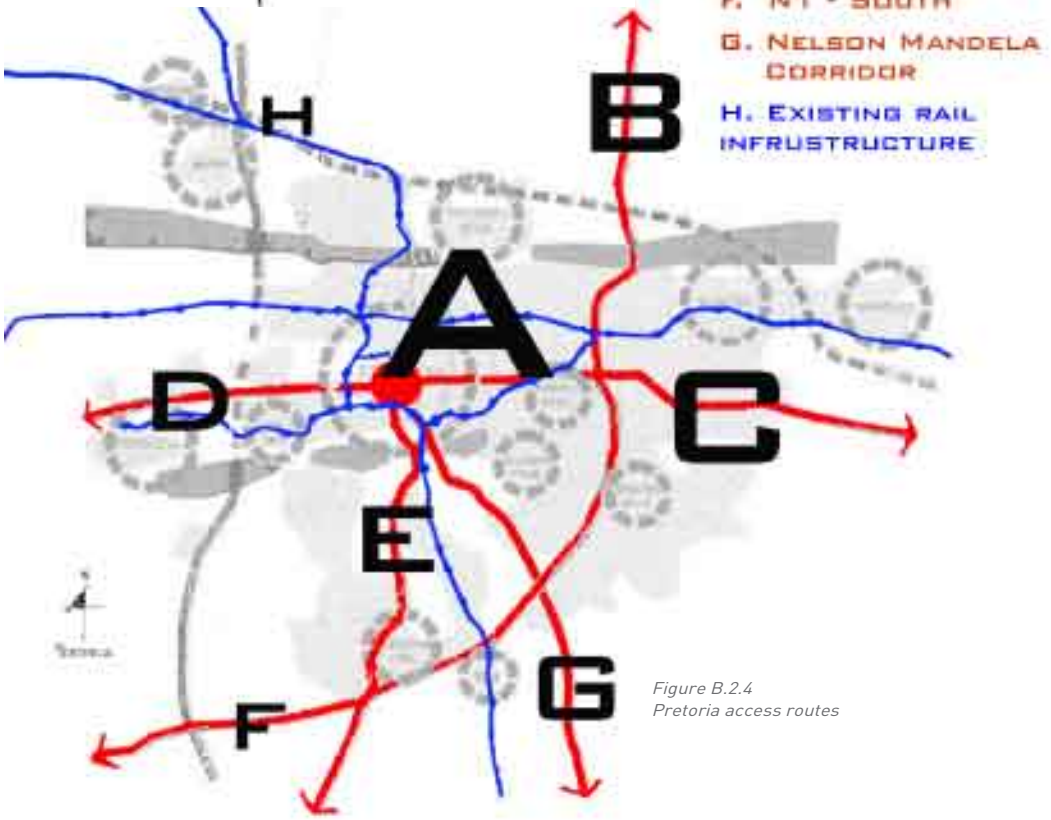


Figure B.2.4
Pretoria access routes

B.3.1 PRETORIA CITY SHAPE

Spatial issues relate to the natural environment, the legibility of the city, inter-precinct linkages and the edge interface.

Pretoria ISDF: 1.

The Urban shape of Pretoria is not inconsistent with that of the majority of South African cities with the consequence of these apartheid patterns, on the lives of the urban poor, being disastrous. The major development issues of poverty, unemployment and inequality, are intensified by the enormous amounts of movement, lack of associated infrastructure and the cost thereof, as well as changes to the nature of the inner city.

These far-reaching changes in Pretoria's urban structure has had an impact on all those that inhabit the city center, and so too the outlying suburban areas. The reality of Pretoria's context is that there is an underlying contest between wealth and poverty, between luxury and subsistence (managing to live), excess and need. A state of segregation still exists throughout Pretoria's context (Fig.B.2.1). The former residents and tenants of the inner city have generally joined the flee eastwards, to preserve the illusion of their beneficial life styles. This great exodus has left the inner city of Pretoria as a place for the jobless, but also a place for the Entrepreneur, resulting in the reinvention of the nature of the city spaces. The Formal city avenues and parks have evolved into vibrant informal city spaces with people jostling for space to trade.

In understanding the motivation behind this eastern sprawl of Pretoria, it is herewith theorized that:

1. This relocation is surrounded by people's inner fears of the unknown. This insecurity within the commercial or residential sectors, through the introduction of further cultural groups, has initiated this apprehensive approach to their work and living environments.

2. With the recent improvement in communication technology within the business sector, the need for physical immediacy has been reduced and thereby increasing the spectrum for choice of locations available to the business community. The popularity of these peripheral business locations, such as Hatfield, Brooklyn, Menlyn and Centurion has therefore flourished, reshaping Pretoria's CBD, with a negative impact on the traditionally preferred business locations of Pretoria.

3. Furthermore, the innocence of the authorities of Pretoria, as a major role player in Pretoria's Urban sprawl, is somewhat disputable. Their role lies in the fact that they approved large-scale commercial developments outside of the CBD and that of a residential nature beyond the scales of natural city growth [at the expense of the inner city], with no indication of inhibiting any further extension of Pretoria's urban edge.

A. Inner City
B. Hatfield
C. Brooklyn
D. Menlyn
E. Centurion

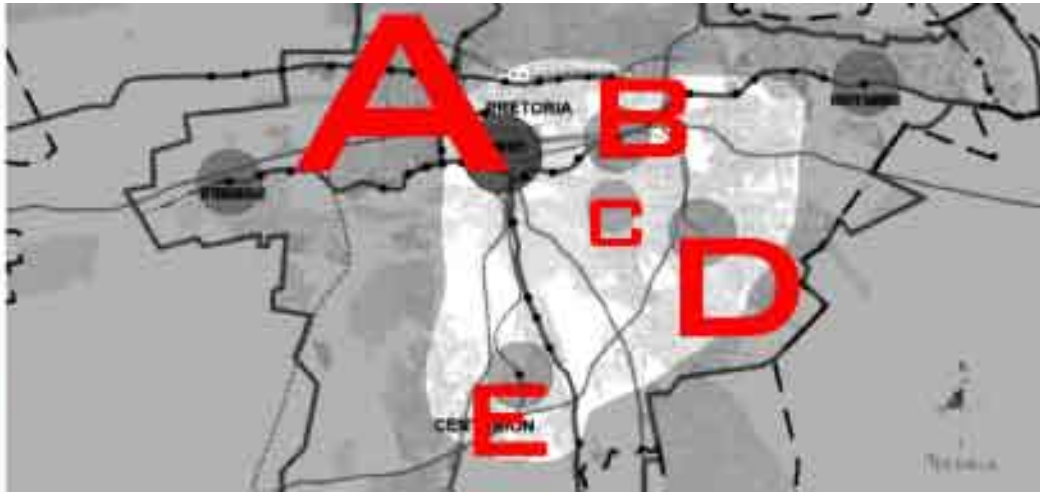


Figure B.3.1 Commercial sprawl out of Inner city

B.3.2 VISION FOR PRETORIA

The quest that lies before Pretoria's built environment designers and authorities, is that of an educational nature, that of reintroducing a faith[1] into the inner city. With the result of reintroducing commercial, residential and social activities, for the benefit of all those who dwell within the streets of Pretoria.

THIS DOWNWARD TREND IN THE URBAN ENVIRONMENT WILL NEED TO BE REVERSED THROUGH OFFERING A POWERFUL VISION FOR FUTURE DEVELOPMENTS WITHIN PRETORIA'S CONTEXT.

Figure B.3.2
Reversal of trends

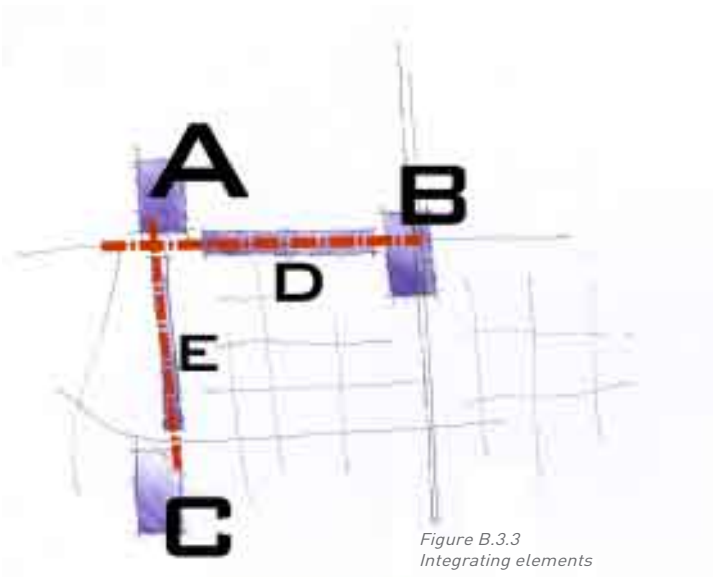


Figure B.3.3
Integrating elements

A. CITY INTERVENTION
B. CITY INTERVENTION
C. CITY INTERVENTION
D. INTEGRATING INTERVENTION
E. INTEGRATING INTERVENTION

Vision:
To be successful, this vision must:

- Be as comprehensive as possible.
- Be aggressively marketed and managed.
- Follow the basic preconditions of economically sustainable development.
- Allow for all interventions in the urban realm to be of an integrate nature, in order to maximize their effectiveness.

1. IT IS SAID THAT FAITH IS TO BELIEVE IN SOMETHING WE CAN'T SEE. IF WE DON'T BELIEVE IN THE PROSPERITY OF OUR EXERCISES LIKE THESE, THEY ARE THEN UNREALISTIC AND IN THAT SENSE FUTILE.

FOUCHE', P. 2001

B.4.1 INTRODUCTION TO PRETORIA-WEST

The mosaic of unique nodes and precincts reflects the confluence (coming together) of various cultures and identities. Major routes, activity spines or other open space elements further articulate each node and precinct because of the concentration of activities in the buildings that form their edges, or in the transitional spaces that link private properties to the public domain or realm of the city.

Capitol Consortium.
Part 2, Volume 4: 1

As there are no official frameworks set-up for the Pretoria-West precinct, this analysis is guided by the Pretoria City planning and development physical development services: Urban Design - Problems and Potentials of Pretoria-West, volume 1 and 2.

Erasmus, M 1997

Being one of the older residential areas of the City, Pretoria-West is exceptionally well located in relation to the Pretoria Inner city, as well as to employment opportunities in the vicinity. Its special relationship, situated due west along Church Street, is of particular importance to the inner city and is potentially a key ingredient in the revitalization of the western part of the CBD, including Church Square. Thus the residential component of Pretoria-West is a major asset of the city.

Due to its good accessibility, pressure to expand non-residential land uses into Pretoria-West is being increasingly experienced even though the area possesses a unique and homogenous architectural and urban character, which is eminently worthy of preservation. This process has already impacted negatively on the residential fabric in particular. Not only has the number of dwelling-units declined, but the residential character of large parts has almost completely been destroyed.

In the light of a steady stream of rezoning applications, it is clear that the present trend is not going to subside; in fact, owing to the favourable location of Pretoria West it can only intensify. In view of the nature of change that this process brings about, it is evident that the remaining positive qualities of Pretoria West will not survive if this process is not controlled.

Figure B.4.1
Pretoria-West precinct

B.4.2 PRETORIA-WEST CONTEXTUAL RELATIONSHIP

Figure B.4.2
Southwesterly representation of precinct

Pretoria West lies in a low lying part of the central valley running E-W between the extension of The Weskop and Magazine Hill in the south and Daspoortrant to the north. These natural linear hills, along with the existing city grid are prominent physical features and must have influenced the aligment of the grid of Pretoria West. At a more local scale, Pretoria West is framed by spruits on 3 sides: Steenoven Spruit in the East; Skinner Spruit to the north, and an unnamed spruit in the west, which joins the latter.

The clayey soil is typical of such relatively low-lying area and brick fields surrounded the area for several decades before the 1930's. The hills to the southwest contain iron ore, which attracted iron smelting plants and later Iscor.

B.4.3 HISTORICAL DEVELOPMENT

The street plan was setout out in 1892 by surveyor G.R. von Wielligh as an extension of Pretoria Central around the old 'Race Course' [current show grounds]. It was the first urban extension to the west of the city and followed shortly after Arcadia, Sunnyside and Muckleneuk. Although conceived as a compensation measure for Burghers, it was also indicative of the expansion and relative wealth of Pretoria during the 1890's, following the development of gold mining on the Witwatersrand. Fig B.4.3 indicates the area, together with the Central Area at round about the turn of the Century.

By 1910 the area was largely developed with single story middle class and workers houses. The Race Course remained as a large open space, with the Agricultural Society making use of the facility for its shows. Sporting activities were reduced since 1910/1911 when the City Council converted it into agricultural show- and sportgrounds.

During the early 1900's the railway line was extended to the north, cutting Pretoria West in two (running North/south along Schutte Street). Originally at grade with level crossings the lines were subsequently raised, with underpasses placed only on the major throughways.

Various institutions were located in and around Pretoria West at an early stage: the Power Station, military establishments, the Abattoir and Cattle Market, ISCOR. The development of the iron industry during the 1930's had major spin offs in the area and many factories developed along Mitchell Street.

Of significance is the broad band of institutions, running north/south, which formed a barrier between Pretoria West and Pretoria Central. From the south these include the Pretoria Jail, the Old Pretoria Hospital, the Artillery Barracks (later joined by the Defense Headquarters), the Pretoria Station, the Cattle Market, the Abattoir, Princess Park with Municipal Stores, the ISCOR Club, the Old Cemetery, Municipal Stables, Pretoria Sewerage Works at Daspoort and The Pretoria Portland Cement Factory. Two early racial neighborhoods, Marabastad (1888) and Bantule (1912) were also located within this band.

These features made the area socially less desirable for residential activities than the higher paying parts to the east of Pretoria Central (Arcadia, Sunnyside, Muckleneuk).

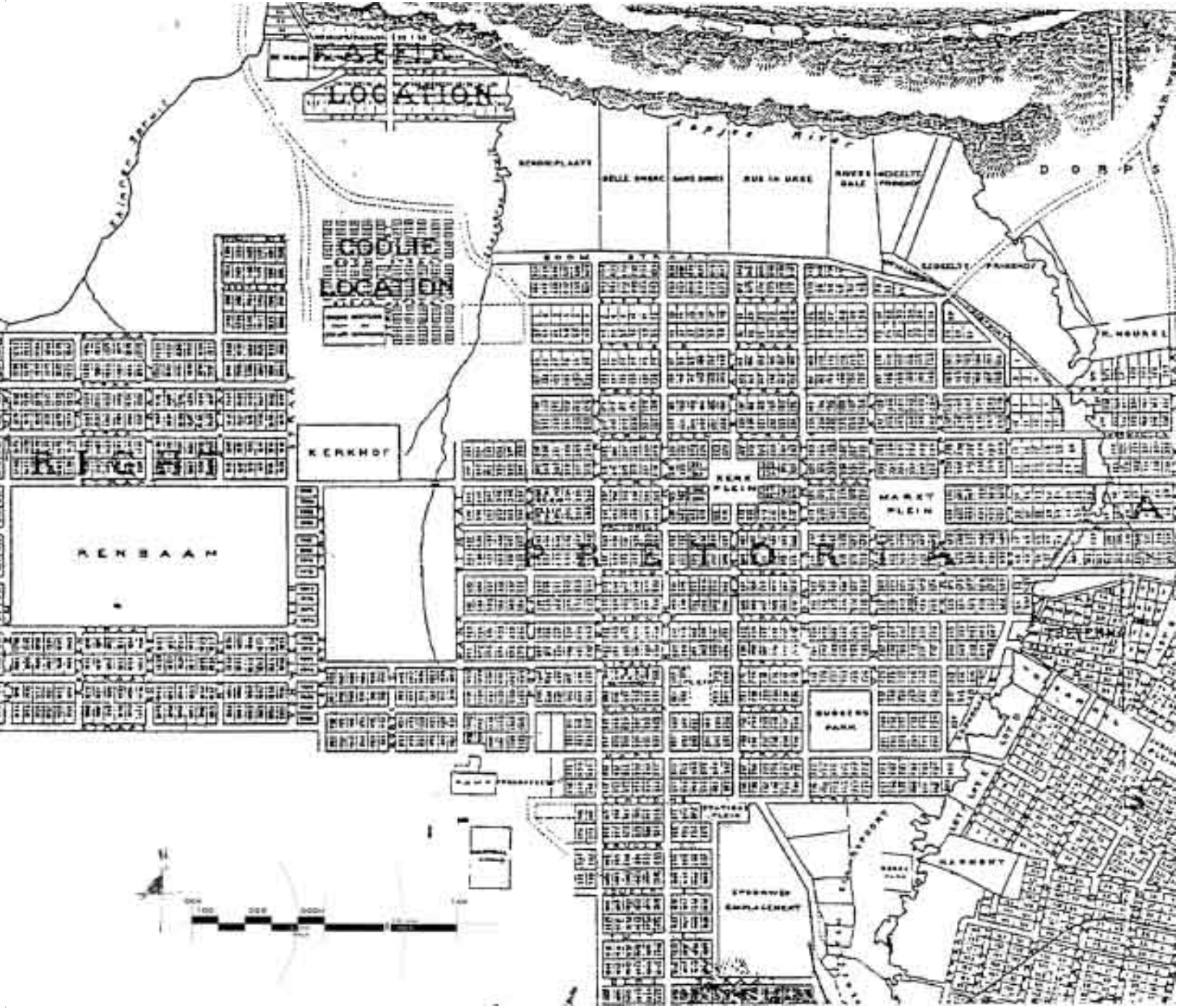
Apart from the aborted extension of Pretoria West around 1900, the suburb remained quite isolated and development in a westerly direction was limited. However, along with the growth of the iron industry a number of suburbs were established in the area: Pretoria Industrial in 1934; Proclamation Hill in 1936; West Park in 1939, Danville in 1942.

Planning intervention during the 1970's has had the effect of further limiting development in a westerly direction. The 'Pretoria Policy Plan' of 1972 specifically advocates development to occur in a south/east direction, owing to the establishment of "non-white groups" (Bantu homelands) to the north/west of the city.

More recently there has been a marked increase in the proliferation of non-residential activities, predominantly car related. The nature of this change and the scale at which it is taking place is threatening to destroy the residential fabric of Pretoria West in total.

Erasmus, M 1997

Figure B.4.3
Historic plan of Precinct



B.4.4 PRETORIA-WEST IN THE SUB-METROPOLITAN CONTEXT

The commercial strip in Pretoria-West forms part of the historically developed Church Street spine of the city. This is an integrated urban system accommodating a wide range of public and private facilities. Regular 'pulses' of activities occur along its length (eg. Church Square, Sammy Marks/Strydom Squares). In the western part of Church Street the concentration of fine-grain commercial activities constitute an important node in Pretoria-West.

In terms of the Pretoria Structure Plan, 1993, the Church Street spine should be reinforced. This entails a strengthening of existing nodes by infill and selective redevelopment with complimentary functions/activities, It is of note that the commercial strip of Pretoria-West is one of the nodes which had been Identified in the Pretoria Structure Plan 1993, more specifically the intersection of Church and Rebecca Streets. Fig.B.4.4 illustrates the Church Street urban spine. The identified node in Pretoria-West is also clearly indicated.

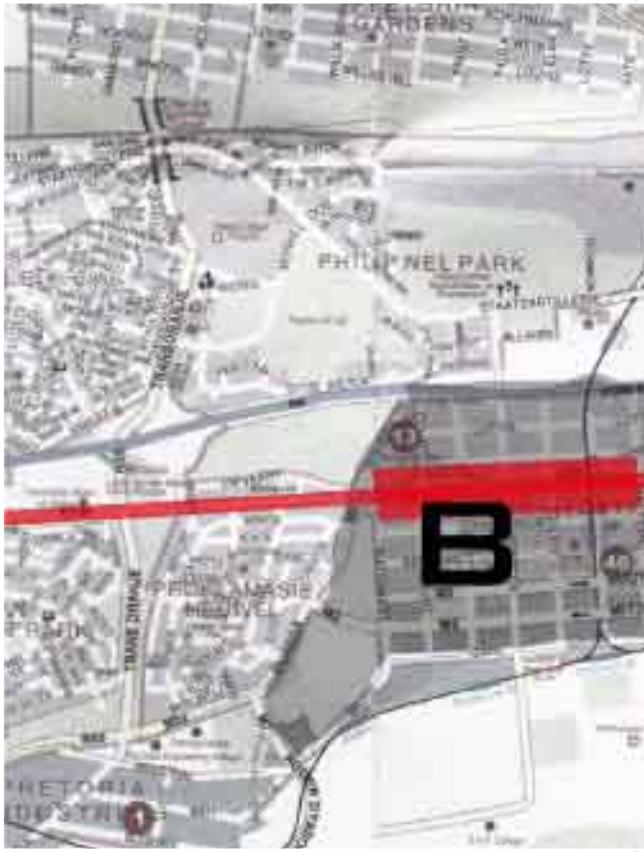
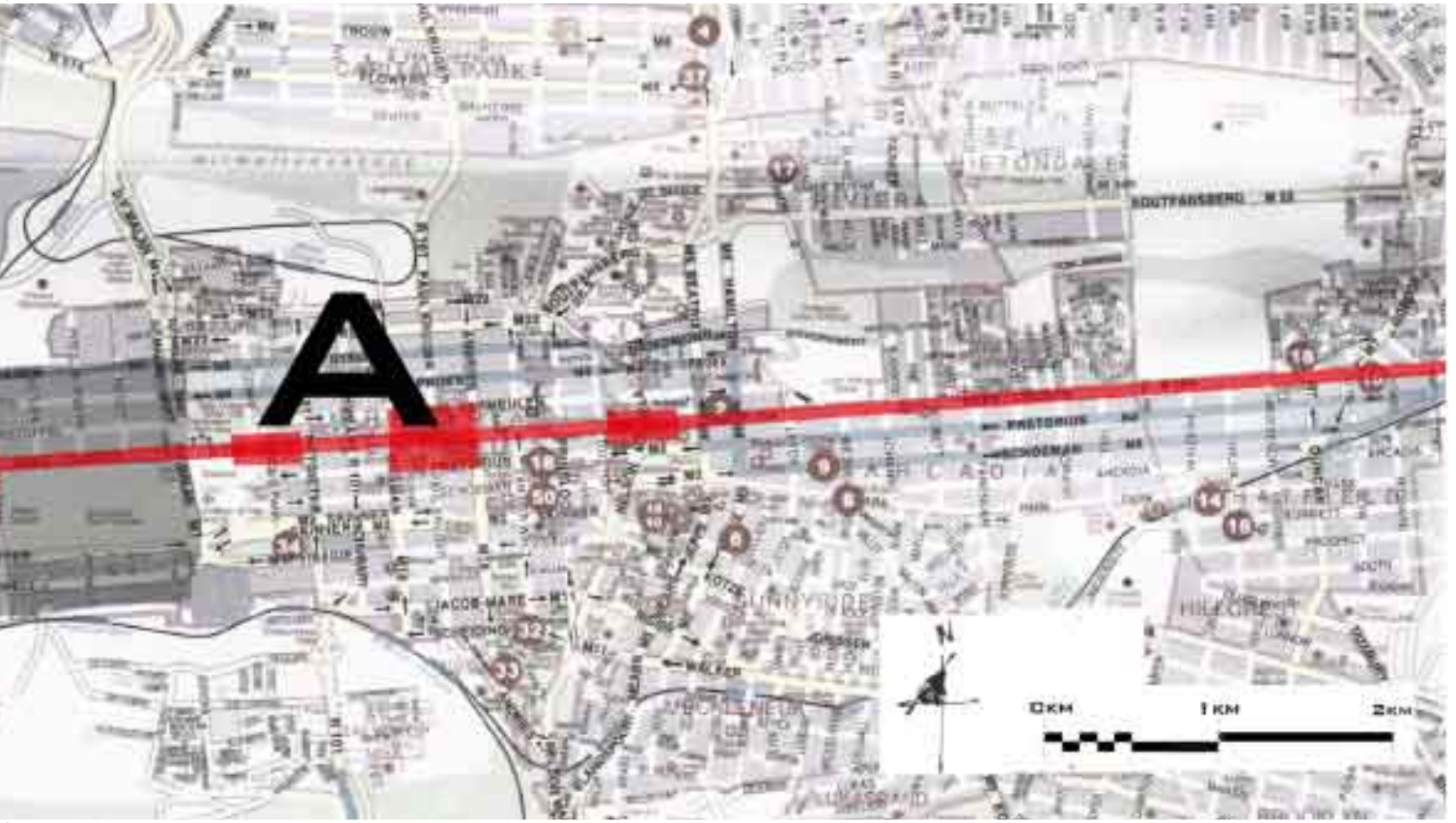


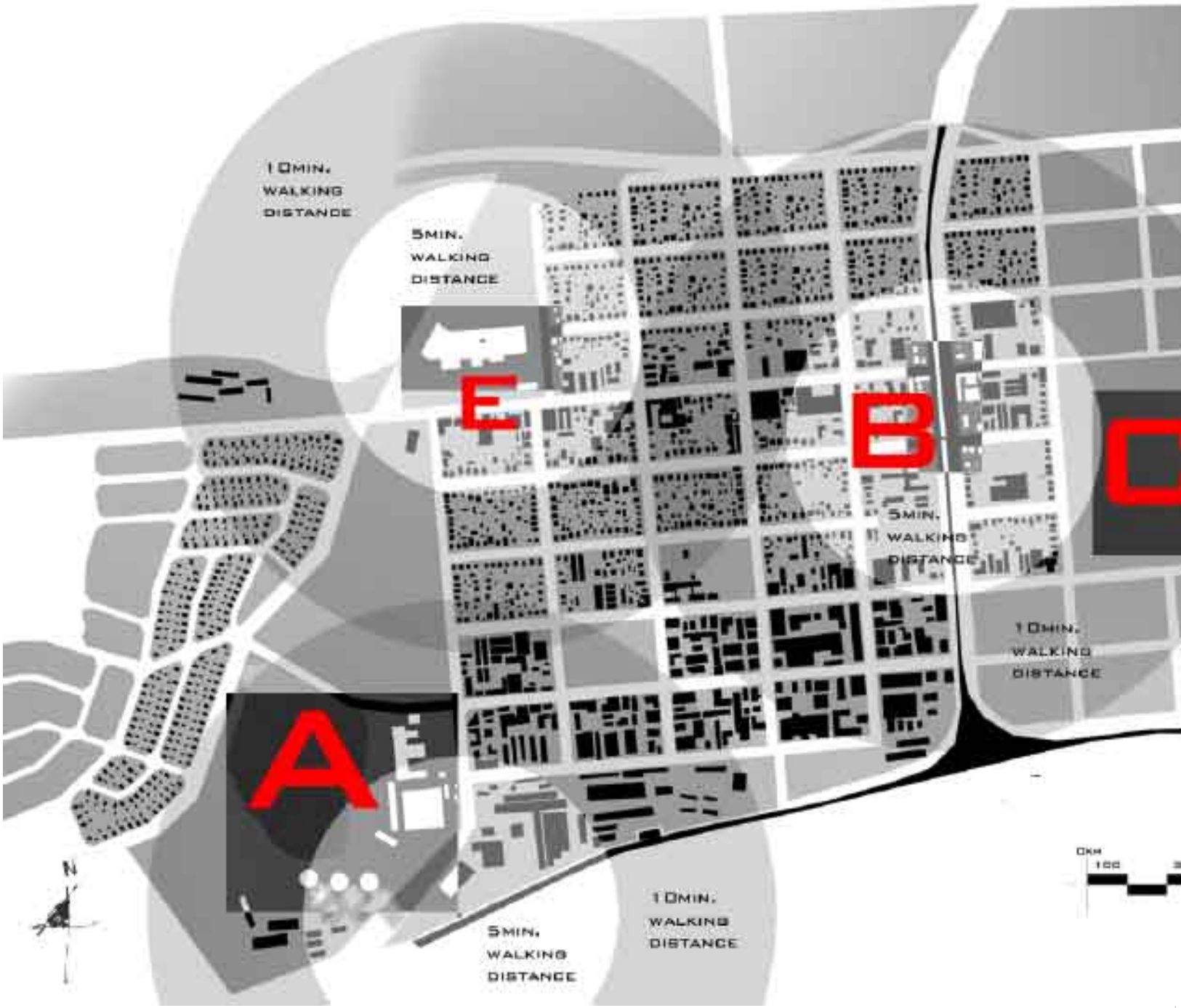
Figure B.4.4
Church street commercial spine



(The Church Street "Commercial Strip" exists on Church street between Maltzan and Buitenkant Streets.)

the Pretoria Structure Plan, 1993

Figure B.4.5
Pretoria-West major infrustructure



A. Power Station

B. Schutte Street Railway station

C. Pilditch Stadium

D. Pretoria Show Grounds

E. Kwagga shoping complex

B.4.5 PRETORIA-WEST MAJOR INFRUSTRUCTURE

Fig. B.4.5, shows the highest-order public infrastructure in Pretoria West, which comprises:

- The grid street network, together with services infrastructure.

- Power Station: It is of interest that part of this utility has been phased out. The buildings, together with the 3 cooling towers and dam, are landmark elements. Constructed during the 1920's. A large part of the complex is conservation worthy. The opportunity to rehabilitate this facility should be investigated.

- Railway infrastructure, including all stations.

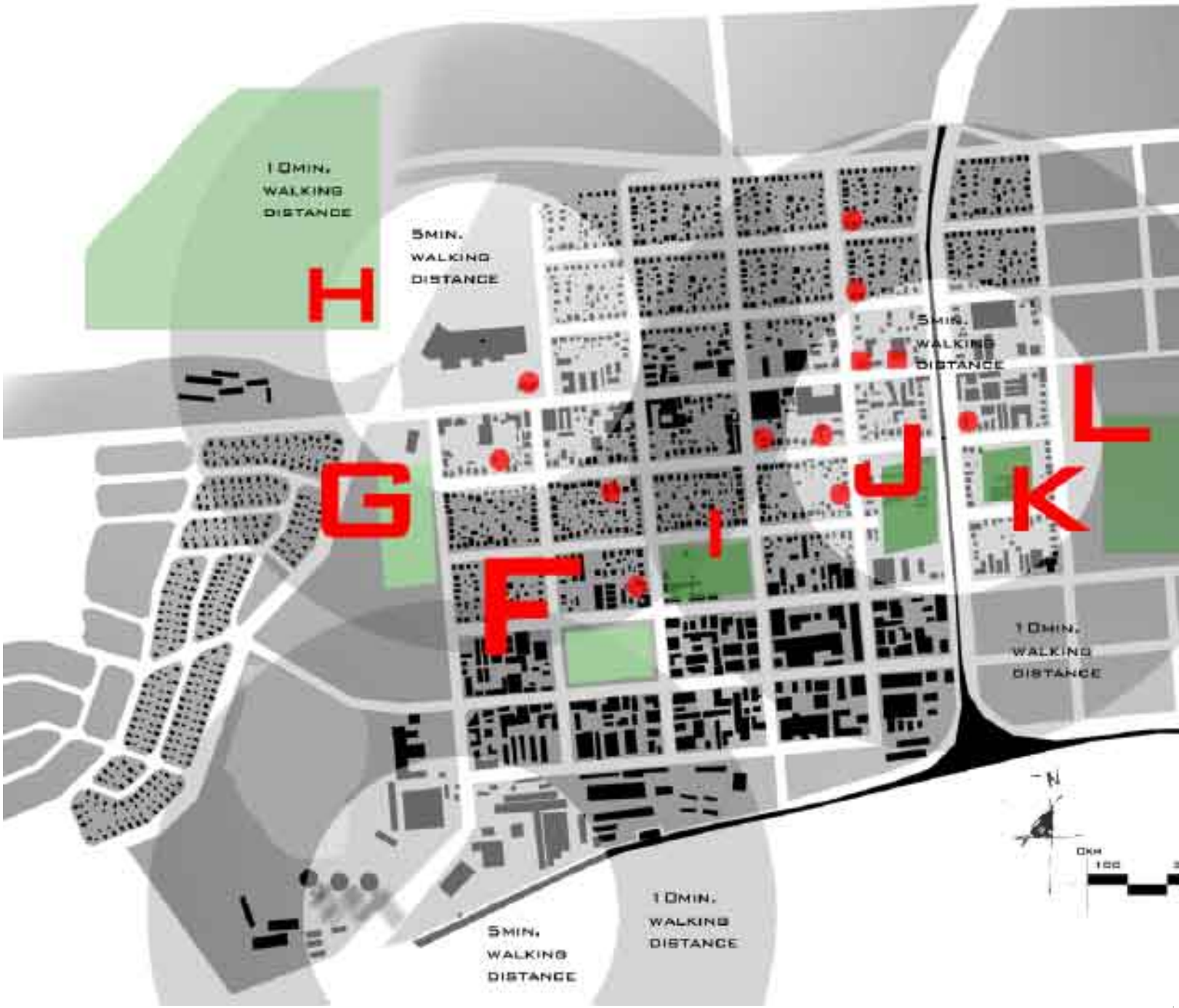
- Pilditch Stadium.

- Pretoria Show Grounds.

- Derilict Iscor Club.

- Kwagga shoping complex (the success thereoff is debatable, but the complex does exist and any urban concept in Pretoria-west, should utilise the existing infrustructure).

Figure B.4.6
Pretoria-West social structure



B.4.6 PRETORIA-WEST SOCIAL STRUCTURE

The collective institutions that have traditionally been valued by society constitute the Social structure. Generally these are facilities and places to which the public have unlimited access.

A fair concentration of institutions are located in Pretoria West and the immediate area. Several of these are of metropolitan significance, such as the Pretoria Show Grounds; Pilditch Stadium, SAP College; Heroes Acre. Other functions, which are of sub-metropolitan significance, include the Salvation Army facilities; Pretoria West High School; West Koppies hospital; Sports Centre for handicapped people - various churches of many different denominations, Community and sports facilities. More local functions include 3 primary schools, public library, 2 Post Offices; Police Station; Kruger Park and various sports facilities.

Implications
This concentration of facilities entails that:

- large numbers of people are drawn to Pretoria West on a regular basis, which displays potential for supporting and reinforcing commercial structure;

- people living in the area have convenient access to these facilities as well as other commercial opportunities;

- ample choice and variety exists in Pretoria West, adding to its urban quality.

Public open spaces:

F. Kruger park

G. Sports club

H. Golf course

● Churches

■ Public Buildings

Restricted open spaces:

I. Primary school

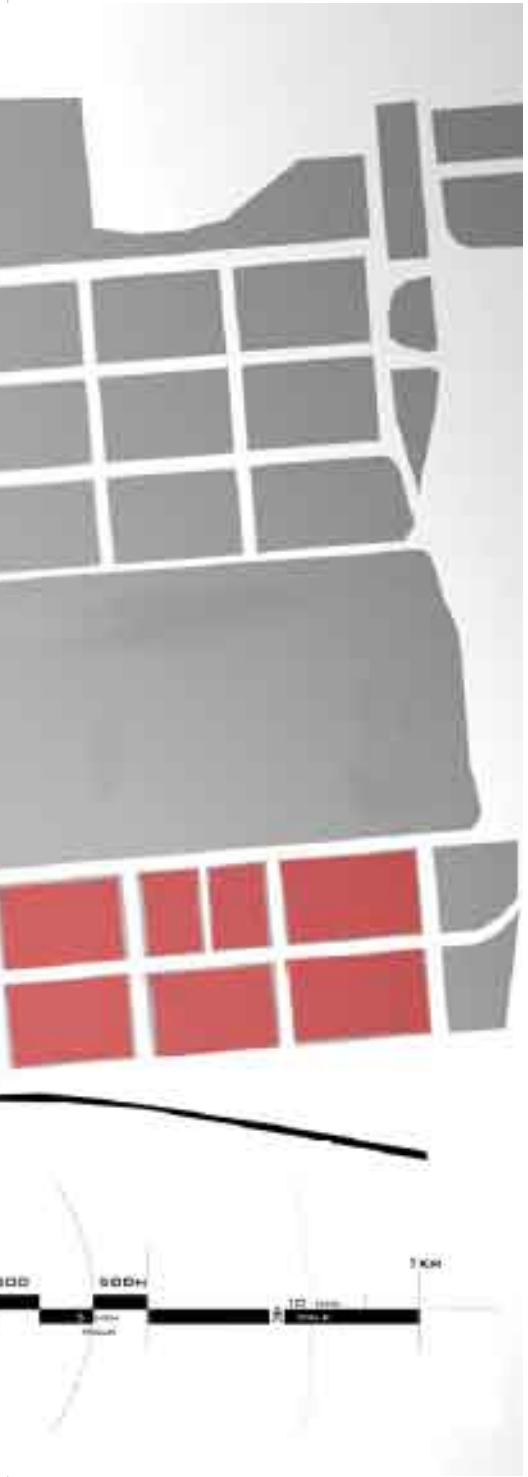
J. Primary school

K. Primary school

L. Pilditch Stadium

M. Pretoria showgrounds

Figure B.4.7
Pretoria-West commercial structure



N. Manufacturing industry

O. Commerce (formal)

P. Concentration of activities [energies]

B.4.7 PRETORIA-WEST COMMERCIAL STRUCTURE

Commercial Strip

The main "activity patterns" are indicated on Fig.B.4.7. These are in response to concentrations of commercial activities, which are frequented on a daily and regular basis by large numbers of people (e.g. corner cafe's, food shops, liquor outlets, clothing stores) and occur at intervals along both Church and Mitchell streets. The finest grain commercial activities are those along Church Street, which is also part of the historically developed urban spine of Pretoria. Activities along Mitchell Street tend to be predominantly car related, other than the occasional corner cafe.

Shopping Centre

The higher-order nodal commercial development - Quagga Center is a typical modern suburban shopping center, which does not relate to unique generators in the local context, but rather assumed the form of a large inward-oriented shed, located within an extensive parking lot. As such it is predominantly car-related and does not contribute directly to the urban qualities of Pretoria West.

Erasmus,M: 1997

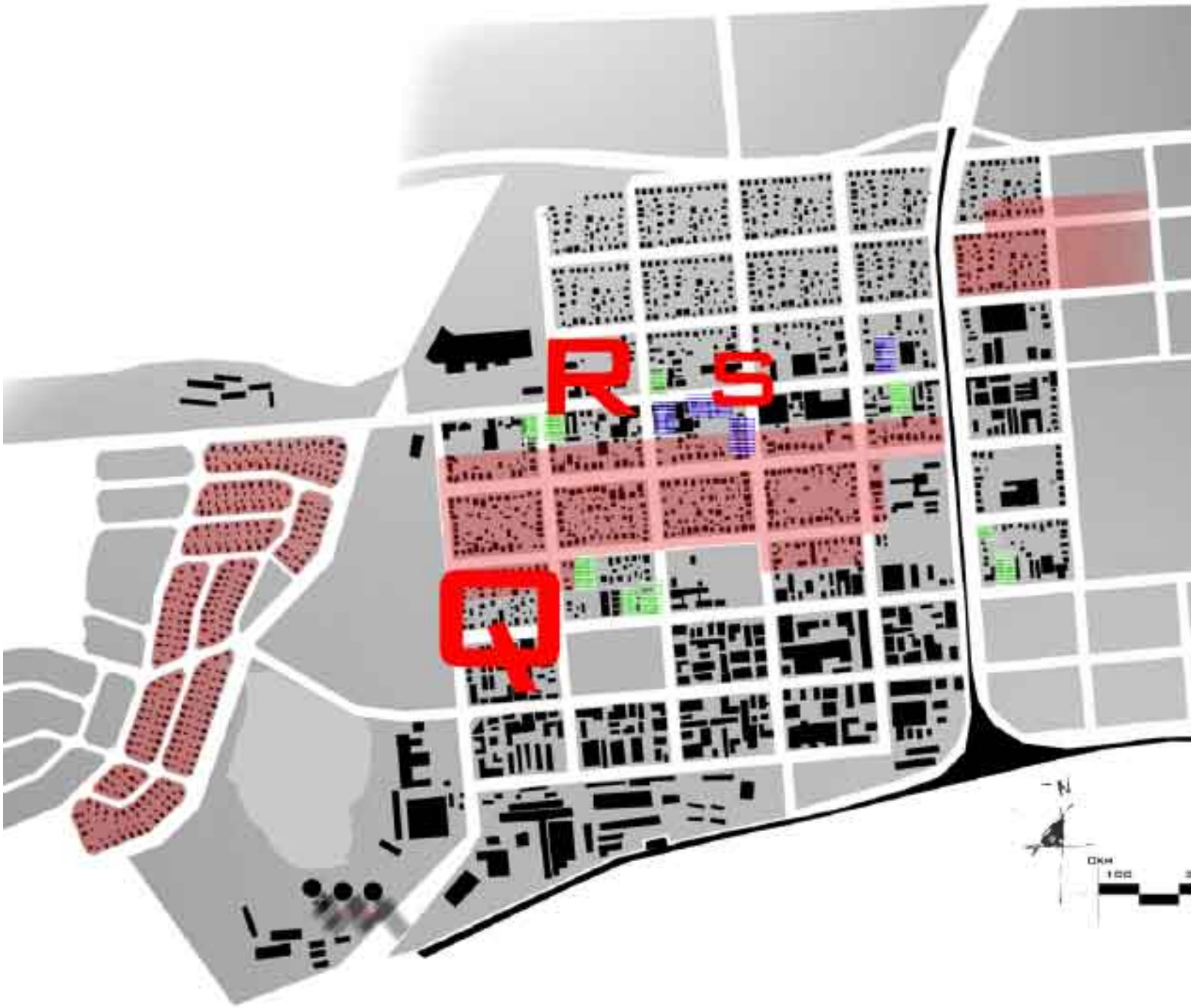
Corner shop

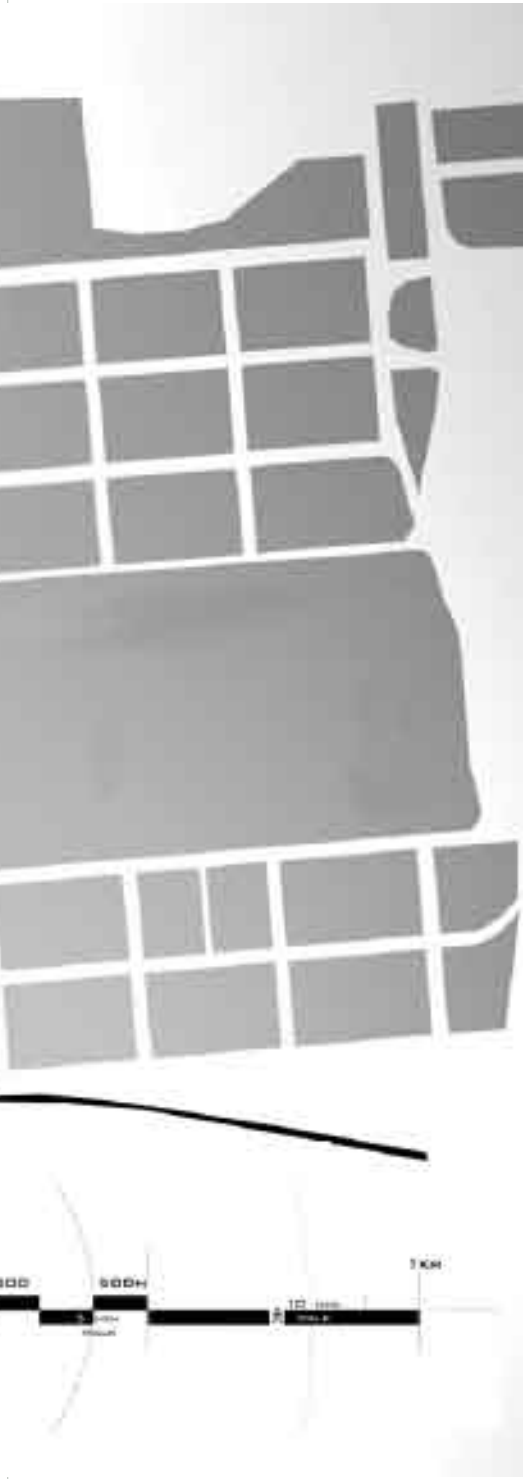
Several smaller corner café-type shops occur within the residential fabric. These facilities contribute to the area and make convenient urban living possible.

Informal Trade

Limited informal trading activity is found in the vicinity of Schutte Station, and at the intersection of Church and Schutte streets. This type of activity is of course subject to great fluctuations. Generally peak periods coincincide with peaks in the public transport cycle. The greatest intensity occurs during the afternoon/early evening peak period.

Figure B.4.8
Pretoria-West residential structure





Q. Most residential precinct

R. Multi storied dwellings (flats)

S. Mixed used dwellings

B.4.8 PRETORIA-WEST RESIDENTIAL STRUCTURE

Single Residential

Pretoria West has quite extensive "single residential" pockets situated on either side of Church Street-West, which constitutes approximately half of the entire area. This fabric consists of fairly closely packed predominantly single storey houses lining the streets. Apart from this housing stock being in a structurally sound physical condition, it possesses a unique and homogenous architectural and urban character, which is worthy of preservation. Three areas are particularly sensitive (Fig.B.4.8) because of their locations to surrounding activities and the exisitng residential nature of the units. The process of sub-division has resulted in a number of newer residential buildings located deeper in the city blocks, made accessible by "pan-handles". This process has not impacted negatively on the area, since the older houses fronting onto the streets have generally been kept intact. The average density (nett) for this area, is approximately 26 Dwelling units/Ha.

Flats

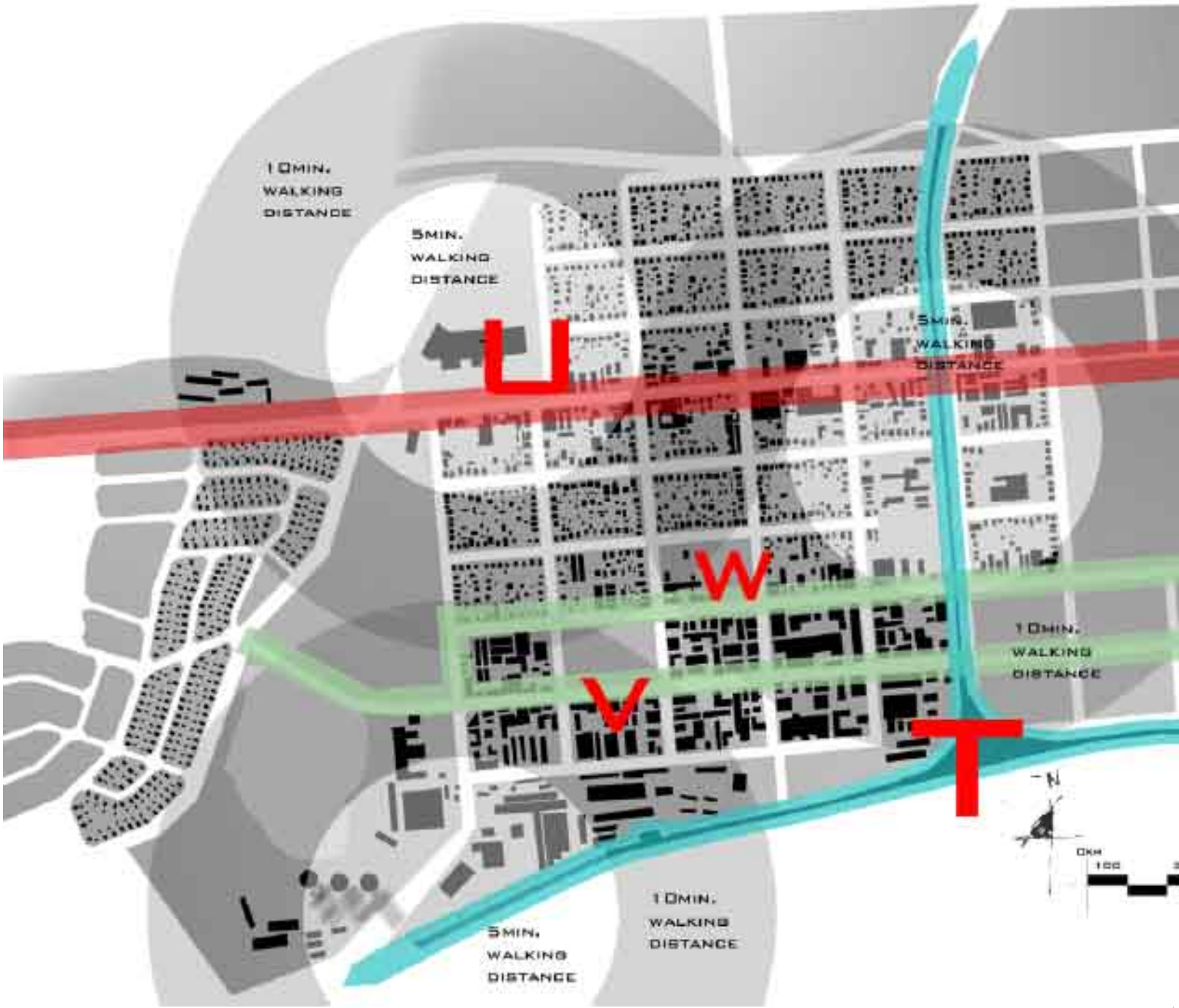
Flat development (3-7 storeys) has occurred along the northern and southern edges of the Pretoria Show grounds as advocated by the Pretoria Town Planning Scheme, along Church and Soutter Streets.

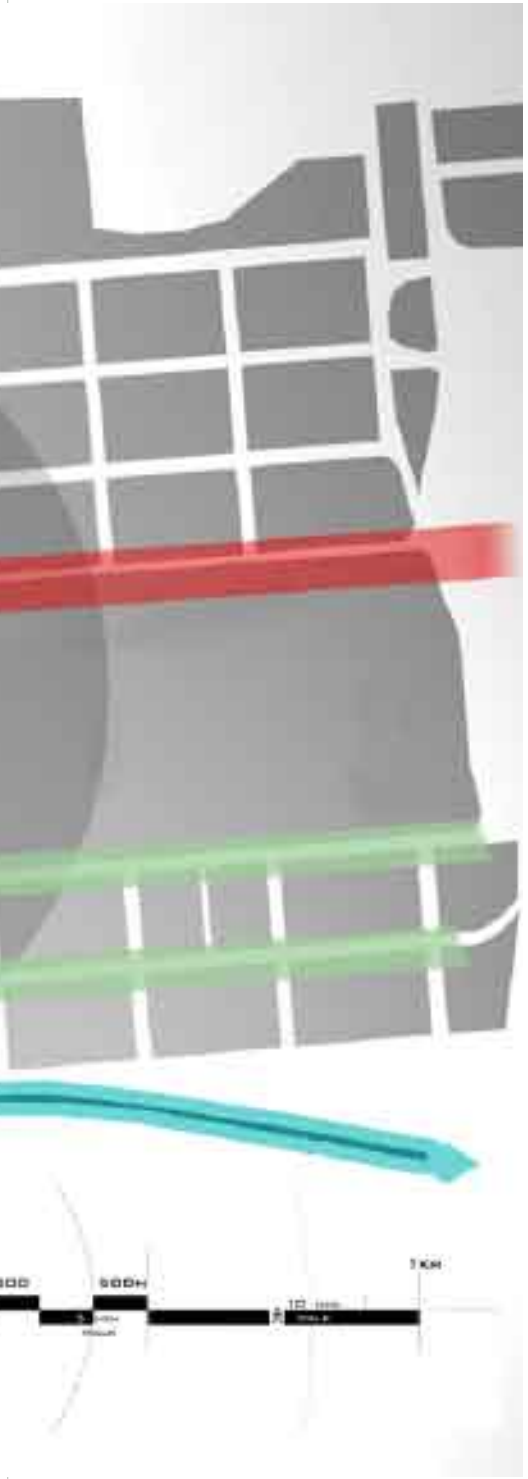
Isolated blocks were also developed in the more western central city blocks of Pretoria West (between Church and Soutter Streets), particularly along Church Street. It is of interest to note that a number of these incorporate mixed activities, i.e. line shops on the ground floor, with flats above,

Implications

The residential component of Pretoria West is a major asset to the city, being exceptionally well located in relation to the CBD and also to employment opportunities and facilities in the area.

Figure B.4.9
Pretoria-West movement structure





T. Rail infrastructure

U. Church street

V. Mitchell street

W. Souter street

B.4.9 PRETORIA-WEST MOVEMENT STRUCTURE

Public transport
Public transport is an important part of the movement system in Pretoria West, regarding foot as the highest order, 3 further components exist:

Rail
The commuter rail system, with a number of stations at close intervals, serves the industrial area adequately, as well as regionally significant facilities such as Pilditch stadium and the Pretoria Show Grounds. 10 Minute walking distance radii (± 800 m) from stations are indicated on Fig.B.4.9, revealing that all-important destinations are within convenient walking distance from railway stations.

Bus
The municipal bus service runs along Church Street (both directions), as well as along Mitchell and Soutter Streets. Bus stops along Church Street occur along most blocks, whilst intervals along the other 2 routes are less frequent. 5 Minutes walking distances (±400 m) are indicated in relation to these transport systems, again revealing a potentially high degree of accessibility by bus. (Since busses should be more frequent, shorter walking distances than for railway stations are applicable).

Mini Bus-taxis
Large numbers of mini busses operate in the area, particularly along Church Street. Whilst they provide a viable alternative for people living further afield they do however add to vehicular congestion along Church Street.

B.5.1 LOCATION OF SELECTED PRECINCT SITE

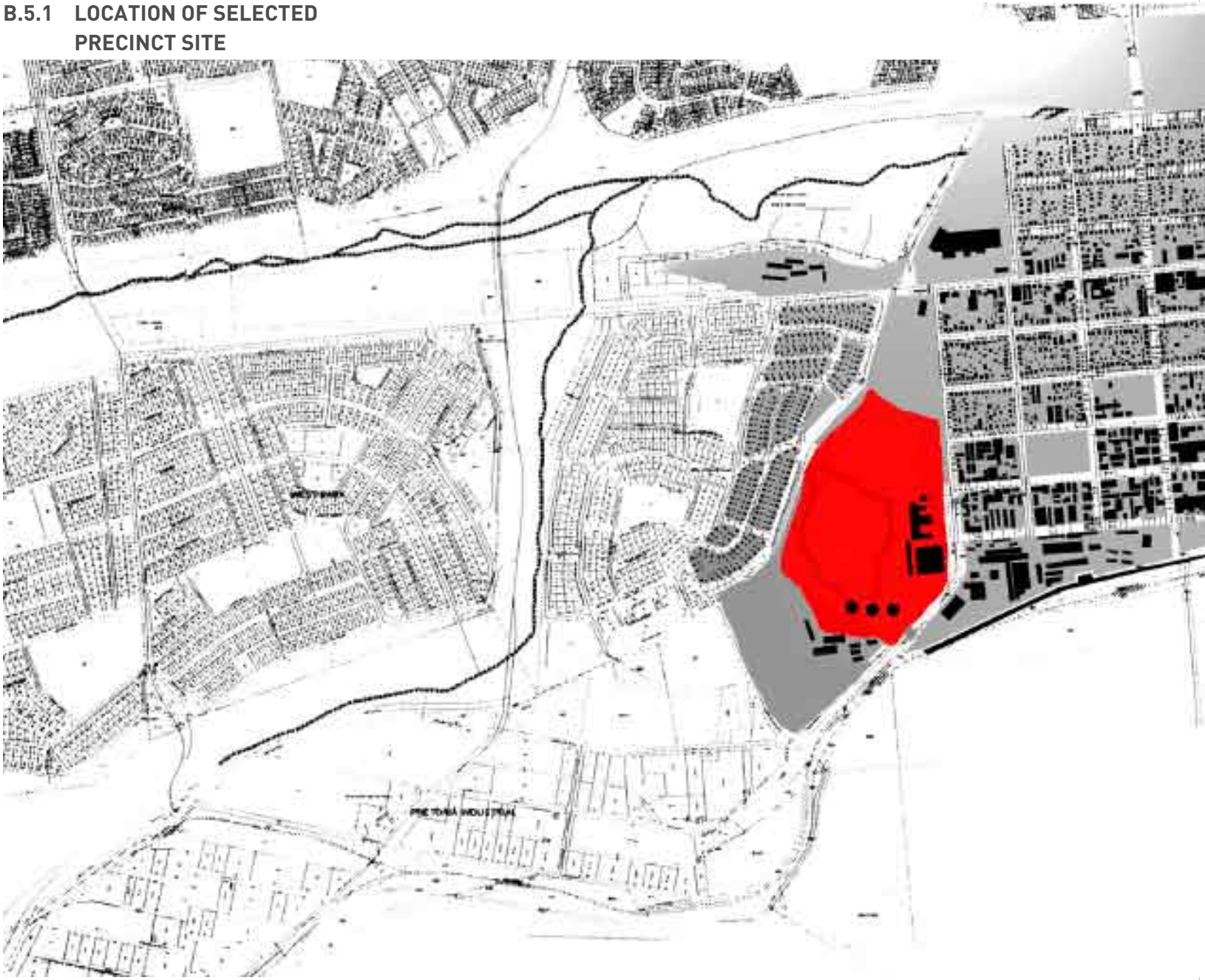


Figure B.5.1
Pretoria-West precinct selected site location

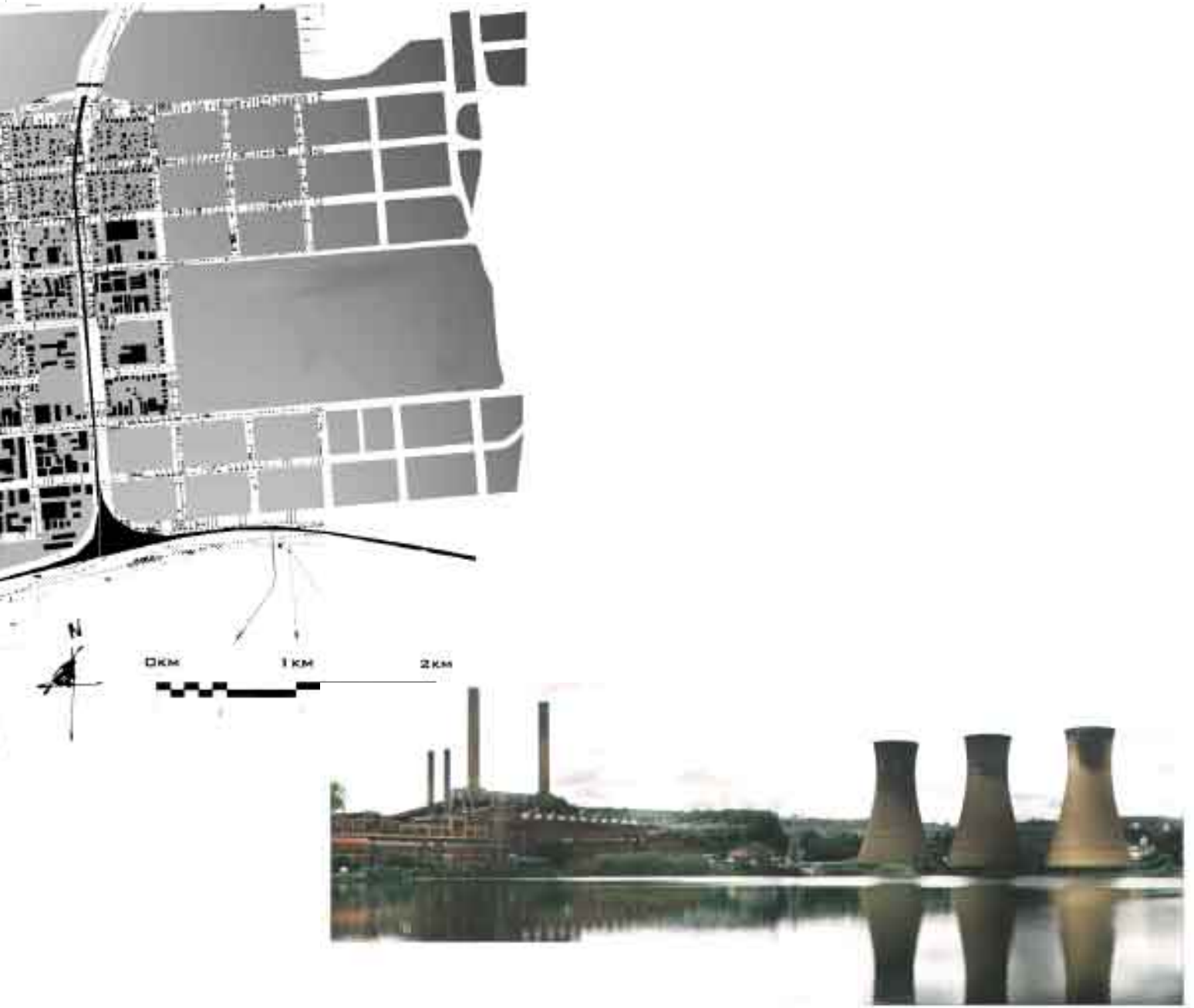


Figure B.5.2
North / West view of selected site

B.5.1 LOCATION OF SELECTED PRECINCT SITE

The selected site is in effect divided into two sections, that of functional value and that of heritage value. This adds to the complexity of the design scheme, as the functional elements are integrated within or around the historical fabric.

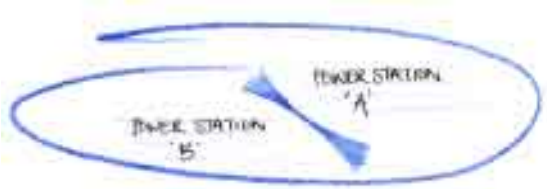


Figure B.5.3
Two stations in one concept

The challenge of this concept as a design intervention, is that it must utilise the existing historic structures while maintaining the function of the power station

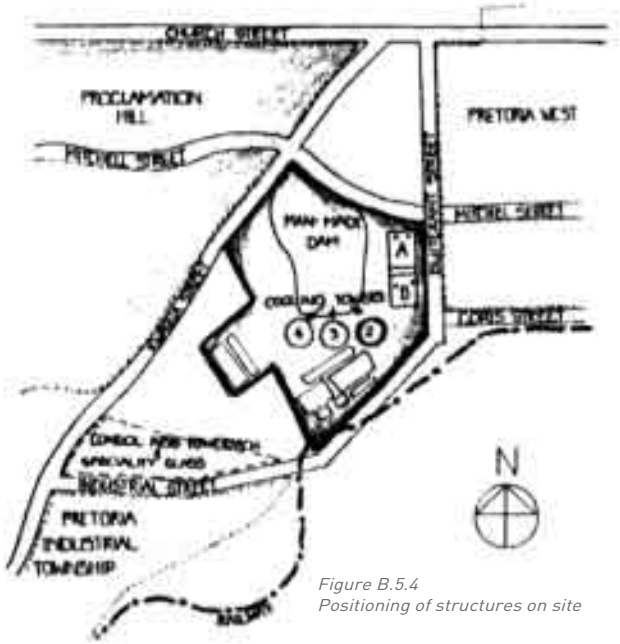


Figure B.5.4
Positioning of structures on site

Figure B.5.5
East view of Power station B

Figure B.5.6
East view of site down Michell street

Figure B.5.7
North / East view of site

Figure B.5.8
Elevated view of Buitenkant street

Figure B.5.9
Elevated view towards Church street

B.5.2 HISTORIC ANALYSIS OF SITE

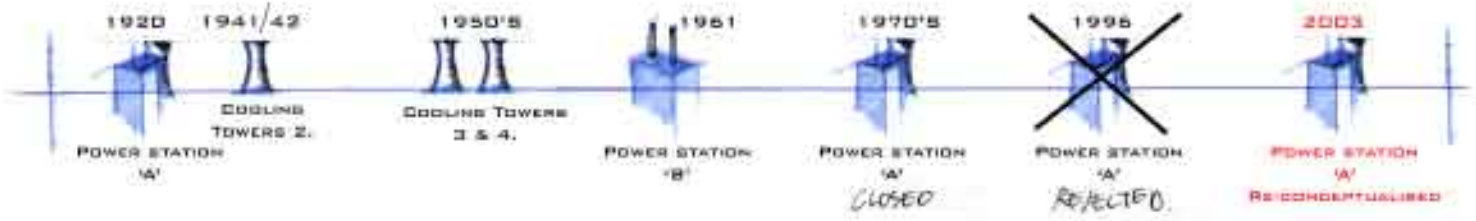
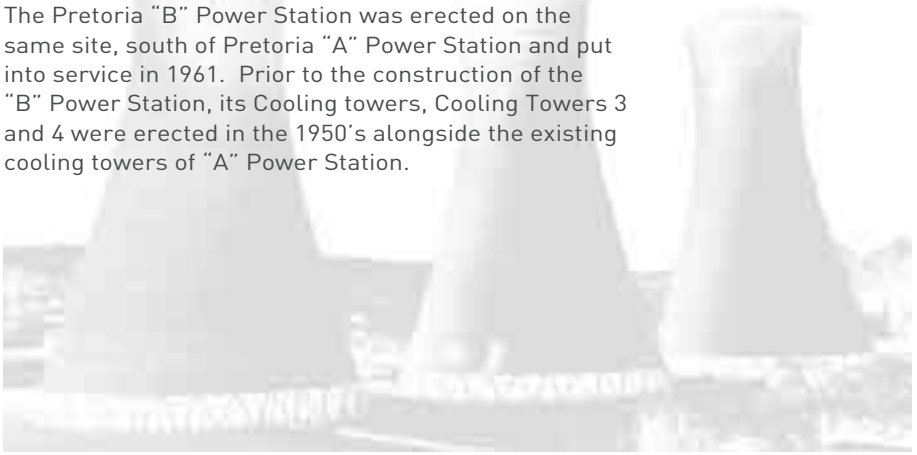


Figure B.5.10
Power station A time line

The function of the site as a power station began in 1920 with the erection and installation of the Pretoria "A" Power Station. With a growing demand for more electricity, a proposal for a new Power Station was submitted, with the decision that the "A" Power Station must be developed and expanded, and that another cooling tower (cooling
Tower 2) must be erected to assist in the production of the additional energy demands.

The order for the development of Cooling Tower 2 was given in 1940, but because of the Second World War (1939- 1945), it was not utilised until 1949 even though it was erected in 1941/'42. The dimensions of the tower being 56m in diameter at the base and a height of 80m, made it one of the largest structures of its kind in the world.

The Pretoria "B" Power Station was erected on the same site, south of Pretoria "A" Power Station and put into service in 1961. Prior to the construction of the "B" Power Station, its Cooling towers, Cooling Towers 3 and 4 were erected in the 1950's alongside the existing cooling towers of "A" Power Station.



The 1970's saw the closing of Pretoria "A" Power Station and the total rejection of the station in 1996 because it was no longer economically beneficial to operate. However, the initial cooling tower remained in use for Power Station "B" until 2000. The "B" Power station cooling requirements were functional through the use of three cooling towers. Cooling Towers 2,3 and 4 were chosen to meet these requirements, which saw the demolition of Cooling Tower 1, leaving the landmark structures that dominate the Pretoria West skyline today. The original Power station equipment was sold off to finance the removal of the asbestos utilised in the original construction, leaving the building shell to be re-conceptualised.

Figure B.5.11
The erection of cooling tower 2

B.5.3 SITE SURROUNDING MOVEMENT PATTERNS

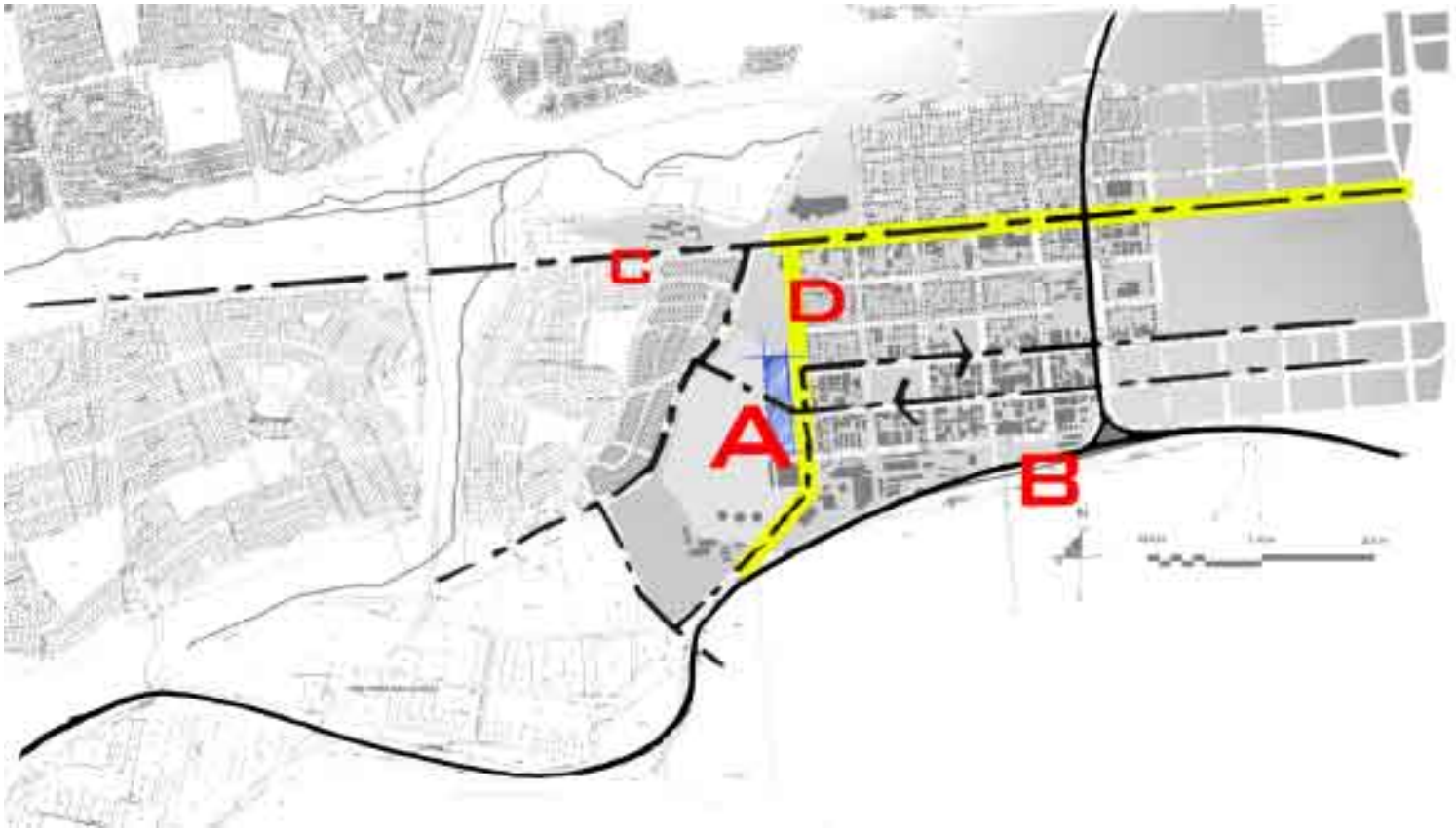


Figure B.5.12
Transport systems around site

B.5.4 TOPOGRAPHY

Pretoria falls in the "Middelveld" (or "Bankeveld"), which is characterised by roughly parallel hills, ridges and escarpments with longitudinal valleys between.

The average altitude of the area is 1320 m above sea level, with a general slope downwards towards the north. The highest altitude of the region is 1430 m in the northeast.

Purnell 1994:4

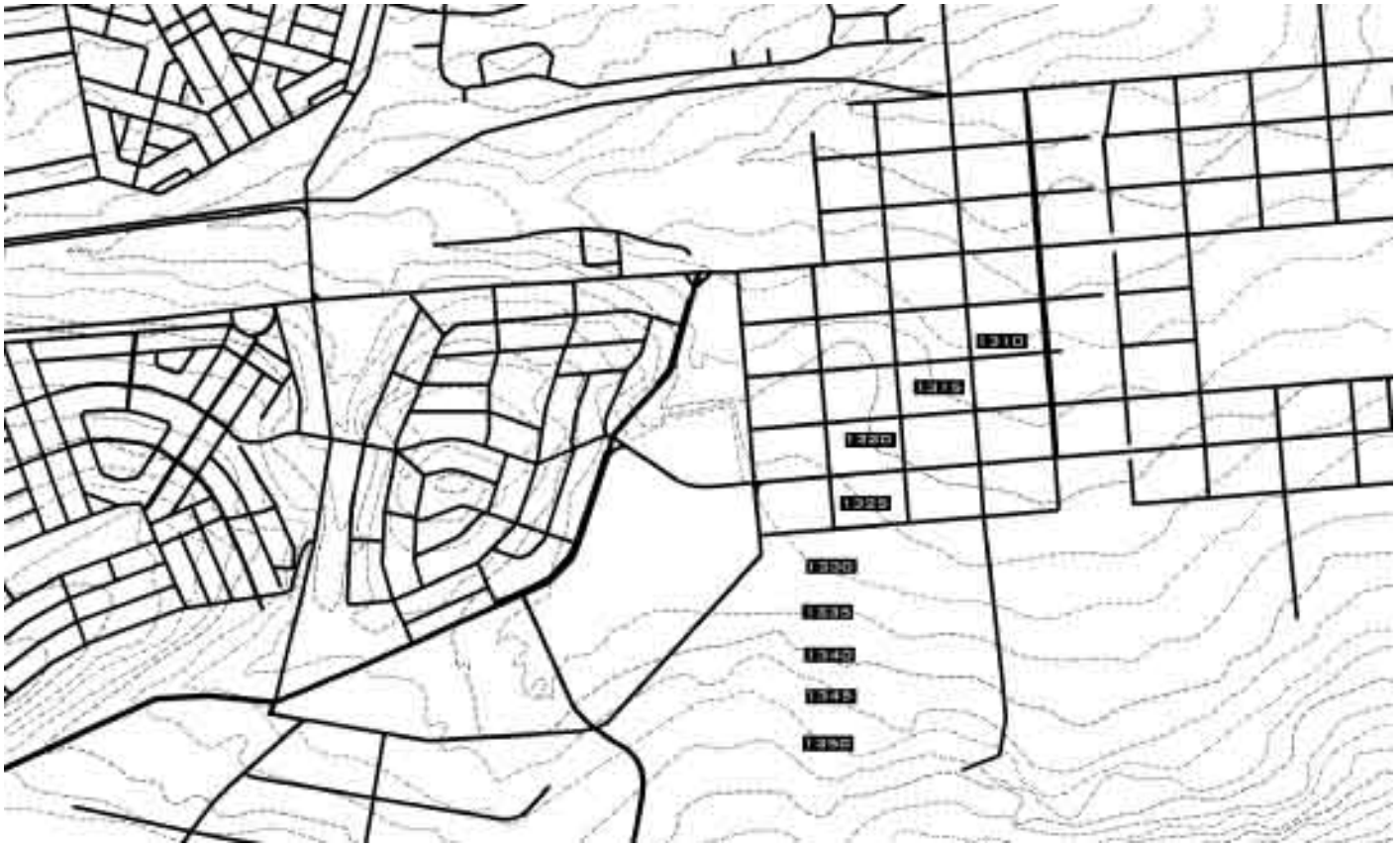


Figure B.5.13
GIS Contour information

B.5.5 PRECINCT ZONING

The existing use of the site is that of an industrial nature, but referring to fig. B.5.14, it can be seen that the city council of Tshwane does not indicate any form of zoning on the site. Therefore, there will be a need to submit a zoning application to meet the nature of the design concept.

Figure B.5.14
Zoning diagram

B.5.6 PRECINCT GEOLOGY

Introduction

The main purpose of this research is to understand the solid geology of the selected site within the Pretoria West precinct. This inventory is guided by, D.G.Purnell's, The Engineering Geology of Central Pretoria document.

Purnell 1994

Central Pretoria is underlain by andesite and shales of the Pretoria Group, Transvaal Sequence, with quartzites of the Pretoria Group cropping out in the northeastern part of the study area. The rocks have been intruded conformably by diabase sills in the northeastern and southeastern parts of the area and non-conformably in a north-south direction by a vertical syenite dyke. The general dip of the Pretoria Group web is 30 degrees to the north. The area has been subjected to major faulting, the faults being mainly reversed faults.

Water-table depths are generally shallow in the low-lying valleys between the quartzite ridges, being in the order of 3 to 18 m, and deeper beneath the ridges (50 to 80 m). The depth of the water table is affected by climatic conditions and is deeper during periods of drought and higher in times of high rainfall.

Purnell 1994:6

Pretoria Group

The deposition of the Malmani Subgroup was followed by a period of erosion. Eventually the depositional basin was re-established and in places quartzite of the Rooihoogte formation was deposited. The quartzite was followed by a shaly zone, which in some areas occurs directly upon dolomite of the Malmani Subgroup. Subsidence did not keep pace with the rate of sedimentation and consequently quartzite was deposited upon the shale, in the Pretoria area conditions changed rapidly, resulting in alternating bands of shale and quartzite. These conditions continued throughout the deposition of the sediments of the Pretoria Group. In addition to the shales and quartzites, the group includes four volcanic suites, the most persistent of which is the Hekpoort andesite near the base.

Purnell 1994:6

Shales

Pretoria is underlain by three different subgroups of shale:

- Timeball Hill shales
- Strubenkop shale
- Silverton shale

The shale rock is usually encountered at a relatively shallow depth, in order of 2.0 m. At this depth the rock is soft to very soft, becoming harder with depth, being medium hard at 4.0 m depth. Consequently, the rock usually provides suitable founding conditions for both minor and major structures as regards bearing capacity. However, the bedding planes of the shales are very smooth and even. As a result of this the shales have a reputation for sliding into excavations along the direction of dip, with the Strubenkop shale Possibilly the worst in this regard.

Purnell 1994:22

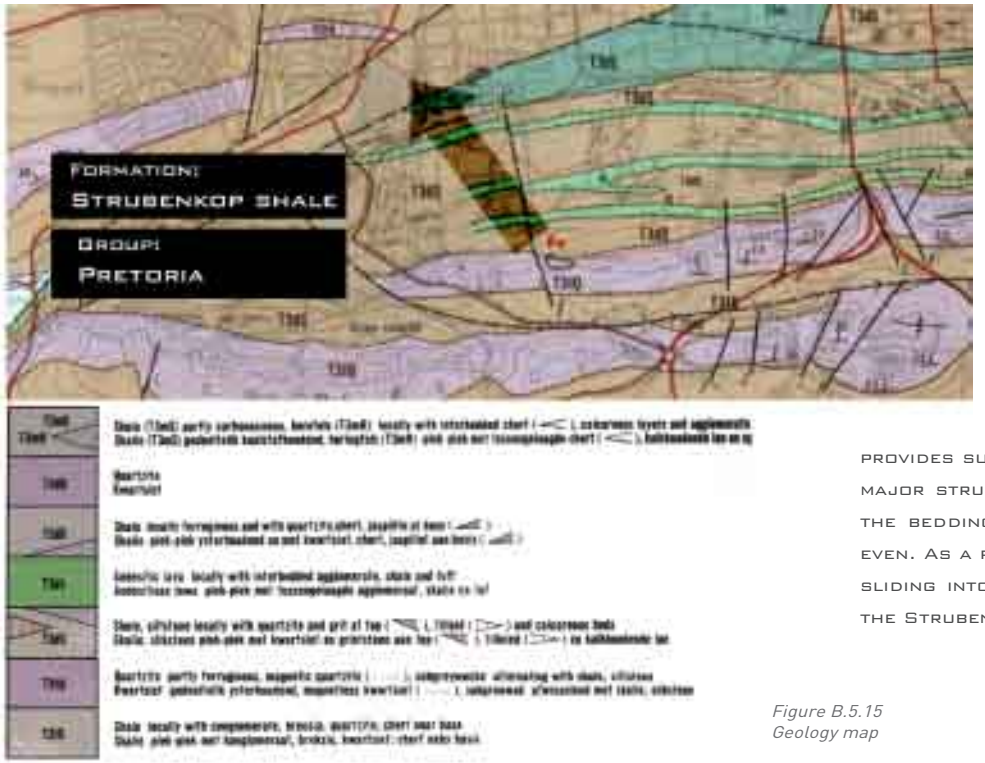


Figure B.5.15
Geology map

B.5.7 PRECINCT CLIMATE

This analysis is guided by, Dieter Holm's Manual for Energy conscious design document.

Holm 1996

Introduction
In order for the manmade environment to use the natural energy available to it most efficiently, it must be planned with consideration given to:

- Materials selection
- Building orientation within site
- Microclimatic conditions
- Landscaping
- Etc.

The environmentally responsive building should have:

- Minimal negative impact on its site
- Maximum human comfort

To economically incorporate alternative energy devices into buildings, energy conserving measures must be taken which diminish the total energy usage of the building and functions. Many different items relating to energy conservation should be considered and evaluated for possible use in buildings. Areas in which energy conservation practices can be employed, relative to the climatic zone, have been divided into the following categories:

a. Climate
b. Wind
c. Solar

Design considerations for Pretoria:

d. Urban
e. Plan form
f. Position of functions
g. Rain protection
h. Mass
i. Insulation
j. Properties of material
k. Lighting
l. Ventilation

Each aspect of a building should be planned for its best utilization of all energy, including passive systems which use the natural energies available form the sun, wind, water, and earth.

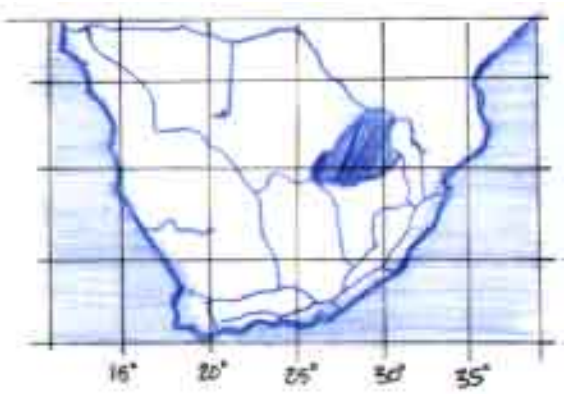


Figure B.5.16
Climatic zone location

A. CLIMATE

Location of climatic region:
25.8° to 30.7° East and 22.0° to 25.9° South.

Description of zone climate:
Temperate dry: distinct rainy and dry seasons exist with a large daily temperature variation and strong solar radiation. Humidity levels are moderate.

Humidity:
The average monthly humidity level is 59%.

Temperatures:
The maximum diurnal variation occurs in July.

B. WIND

Wind and air movement are the results of the sun's warming of different layers of the atmosphere and parts of the earth's surface.

Crowther 1977:70

Summer winds are predominantly east northeasterly to east southeasterly.

Winter winds are predominantly southwesterly with a fair amount originating from the northeast.

Holm 1996:69

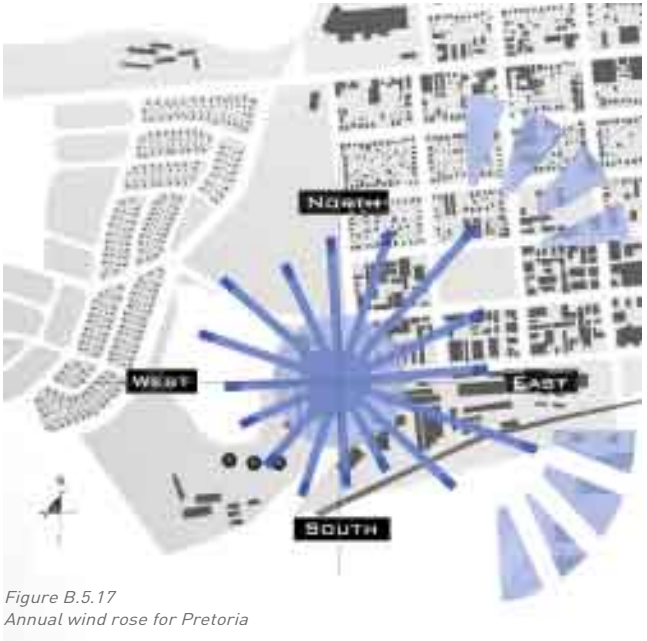


Figure B.5.17
Annual wind rose for Pretoria

C. SOLAR

It is recommended that summer sun be screened and winter sun be allowed to penertrate.

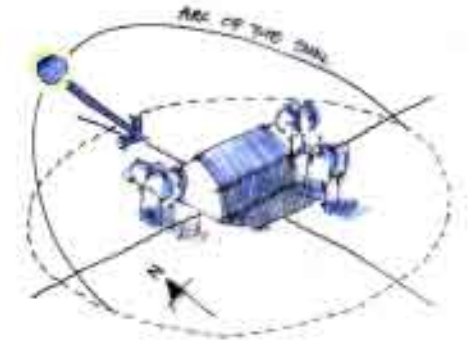


Figure B.5.18
Arc of sun

Verticle sun angle at 12:00 solar time Pretoria:

- 25.77°	Latitude (south)
- 64.23°	Solstice (21mar/23 sept)
- 40.73°	Winter (22 june)

Holm 1996:72

Figure B.5.19
Verticle sun angle

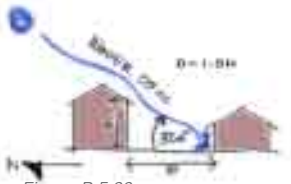


Figure B.5.20
Solar access for
building spacing in Pretoria

D. URBAN

Protection of pedestrians by trees, arcades or canopies. North facades of buildings receive high radiation during summer and should be tree lined.

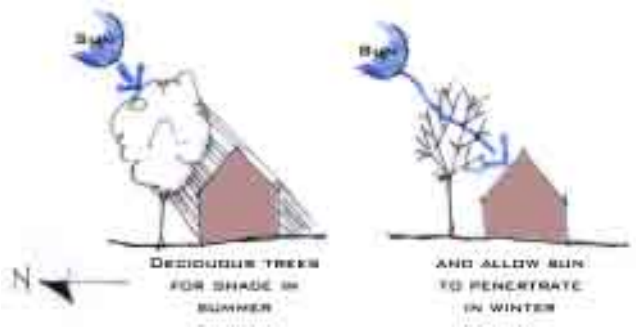


Figure B.5.21
Vegetation as solar control

E. PLAN FORM

Winter and summer requirements differ. The winter demands include a compact plan form, well-insulated envelope, and solar gain are desirable.

F. POSITION OF FUNCTIONS

External spaces should provide shade in summer for outdoor activities. Place buffer zones west and north.

G. RAIN PROTECTION

It will be convenient to shield entrances from sporadic thunderstorms.

H. MASS

Thermal mass is effective for approximately half of the under heated period and the entire overheated period. Thermal mass is required in Pretoria's climatic zone due to the large daily temperature swings. It can be provide by floors, roofs and internal partitions.

Holm 1996:70

I. INSULATION

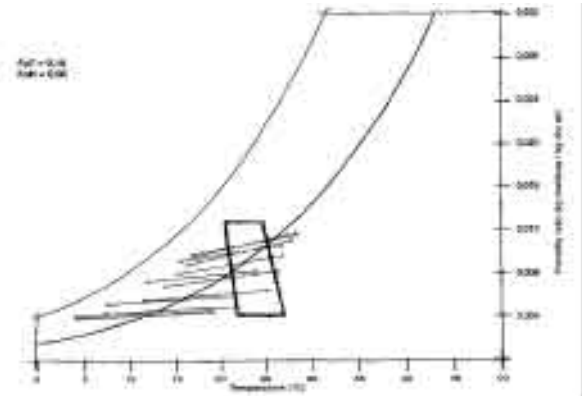
Lightweight insulated roofs are feasible in this climatic region provided that walls and floors give thermal mass.

Holm 1996:70

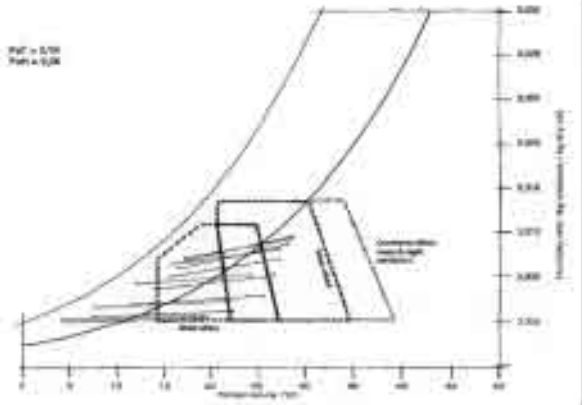
TEMPERATE DRY	MASS	ENVELOPE INSULATION	ENVELOPE SUPER INSULATION
ACCEPTABLE 1	HIGH	-	-
ACCEPTABLE 2	MEDIUM	-	-
ACCEPTABLE 3	CORE MASS	-	YES
ROOF 1	HIGH	ON THE OUTSIDE	-
ROOF 2	LOW	CEILING	
EXTERIOR COLOURS	MEDIUM		
VENTILATION	MORE IN SUMMER, LESS IN WINTER		
GLAZING AND OPENINGS	LESS SHADING, CONSIDER COLD BRIDGING		
ROOF SHADING	NOT TOO IMPORTANT		

Table B.5.1
Mass vs. insulation

Figure B.5.22
Psychrometric charts



Psychrometric chart showing the comfort zone's position relative to the climate lines - Pretoria



Psychrometric chart showing the enlarged comfort zone obtained by supplying thermal mass to the structure. The combined effect of ventilation and thermal mass is also shown. Night structural cooling is optional - Pretoria

J. PROPERTIES OF MATERIALS

External surfaces should be light coloured or reflective to minimize solar heat gain in overheated period.

Holm 1996:70

K. LIGHTING

Proper lighting of buildings is of major importance, accounting for up to 50% of the total energy expended in some nonresiential buildings. Lights produce heat, which in large buildings can be a substantial amount, either useful for heating, or an additional load against cooling.

Crowther 1977:157

Certain wavelengths of light help the eye to maintain proper levels of the chemicals necessary for vision. Lighting may also have the psychological effect of altering a person's mood, attitude, or efficiency.

Energy conservation in lighting can be accomplished in a number of ways:

- Design for use of natural light, reducing the load on artificial lighting (light trays);
- Specifing the correct efficiencyiy of light for the function required (Incandescent lamp type - output of 19 lumens/watt; Fluorescent lamp type - output of 75 lumens/watt).

(Light output, along with fixture design and surface reflectivity of walls and ceilings, affects the amount of useful light striking a surface).

L. Ventilation

Ventilation is effective for the overheated period. Night ventilation can be used to compensate insufficient mass.
Systems:
- Evaporative cooling.
Direct evaporative cooling is effective for most of the overheated period, but not really reccommended as the add in humidity levels may often cause sick building syndrome.
- Active.
Airconditioning is not a necessity, but the building function may require it.
- Mechanical.
Mechanical ventilation may be necessary to achieve the required ventilation rates.