

LAND-USE PROPOSALS FOR THE LIESBEECK - BLACK RIVER CONFLUENCE AREA

**An Investigation into the Key Constraining Factors for Land-use
Decision-making**

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Research Report prepared in partial fulfilment of the requirements of the degree
of Master of Philosophy in Environmental Science

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“...The rivers are our brothers. They quench our thirst. They carry our canoes and feed our children. So you must give to the rivers the kindness you would give to any brother.”

Chief Seattle

SYNOPSIS

BACKGROUND

In South Africa, the implementation of Apartheid policies, along with dominant urban management practices have resulted in cities with inefficient urban environments. These cities are characterized by three main patterns: urban sprawl, fragmentation, and the location of the lower income segment of the population primarily on the outskirts of the city.

The Cape Town City Council (CCC), in an attempt to rectify the inefficiencies associated with the traditional South African city, have recognized the importance of forward planning. In post-Apartheid South Africa, as Cape Town enters an era of rebuilding, development pressure and the demand for land is mounting. The pressure for development of open land close to the Central Business District (CBD) is even more intense, thereby making informed land-use planning more crucial.

The study area, referred to as the Confluence Area (CA) is located 5.5 km from the CBD, and represents a classic example of the conflicting needs of development and conservation. The CCC recognizes that environmental information is required for this area, in order to promote informed land-use planning. Hence, the CCC supported the suggestion that a multi-disciplinary research group (second year Master in Philosophy students), from the University of Cape Town (UCT) undertake the task of providing baseline information on the environmental characteristics and conditions of the study area.

AIMS OF AND OBJECTIVES OF THIS DISSERTATION

The primary aim of this dissertation is to analyze the information gathered in the baseline report, and evaluate the factors influencing land-use in the CA. The objectives are to identify the key constraining factors to land-use planning in the CA, and to propose appropriate land-uses in light of these key constraining factors. These proposals must bear in mind the local and metropolitan significance of the CA. Finally, this dissertation is completed in partial fulfilment of the Master in Philosophy (Environmental Science) degree at UCT.

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environment by constructing on riparian land has served to degrade the natural functioning of the Liesbeeck and Black Rivers. In addition, catchment hardening, erosion, siltation and weed growth exacerbate the flooding potential of the rivers. Also, the Black River drains most of the Cape Flats which results in multiple authorities in control of river management. This results in disjunct catchment management. Thus, for an integrated holistic approach to river management under one administrative unit needs to take place. The lack of legal provisions to control the activities within floodprone land is another problem associated with managing the Black and Liesbeeck Rivers. Finally, the difficulty in predicting floodlines requires a prudent approach to developing on riparian land.

Although engineering solutions such as canalization and detention dams are possible, they are expensive. Given the current economic and political situation in South Africa, where emphasis lies in providing basic needs for the majority of the population, these projects lose priority.

Furthermore, given the problems of urban river management and the difficulty of predicting floodlines, engineering solutions could become irrelevant over time.

LAND-USE OPTIONS

In light of the propensity of the rivers to flood in the CA, open space is the primary land-use proposed. Land below the 1:50 year floodline should not be developed upon. Aside from preventing loss of life and structural damage in light of a flood, open space in the CA has many other benefits for both the local and Metropolitan population.

The dense urban environment around the CA benefits from open space in a number of ways. Open space allows for a buffer zone between intensive urban land-uses thereby promoting mental and physical well-being for nearby residents. Ecologically, open space as a land-use in the CA would prevent destruction of the wetlands which host a variety of avifauna and indigenous grasses. These wetlands serve an anthropogenic function as well by alleviating flood peaks and settling sediments which contribute to flooding.

Open space also serves an educational function by promoting an appreciation for nature. The Raapenburg Bird Sanctuary and the wetlands promote biological education. The historic buildings such as the Valkenberg Homestead and Nieuwe Molen enrich the study site, and serve an educational function as well.

Open space in the CA is also desirable for purely aesthetic reasons. It gives visual relief from the monotonous urban surrounds, and provides a visually attractive land-use from a tourism point of view. This is especially significant for tourists arriving from the airport via the N2 freeway.

Recreationally, the provision of open space offers several opportunities to serve both the local and Metropolitan population. Walking trails, water sports, sports fields and picnic grounds are amongst the uses which are compatible with flood prone land. By implementing a variety of open space options, a variety of recreational needs can be catered to thereby promoting a multiple-use park.

In a Metropolitan context, the retention of the CA as open space would allow for the 'Coast to Coast Greenway', a green corridor linking Rietvlei in the north to Rondevlei in the south. Furthermore, the 'rescue effect' which allows species from one urban reserve to re-habitate another close reserve in the case of catastrophe is facilitated.

I&APs are in favor of having open space as a land-use in the CA. They claim people in urban environments have a need for therapeutic environments, and visual open space is important. Other comments in support of open space are that the CA was historically an open space, and should therefore be retained as such, and that the provision of open space in the CA is especially significant in light of the dense urban surroundings.

COMPATIBLE LAND-USES

Beyond the open space, the periphery of the CA is developed with the Valkenberg Hospital, the South African Astronomical Observatory, Alexandra Care and Rehabilitation Centre,

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Other areas of concern which affect future land-use in the CA are:

- the outcome of the Culemborg-Black River study which is currently underway;
- the acquisition of land for the use of open space;
- the final result of the proposed river widening, and
- funding for the management of open space.

Finally, it is recommended that any future development proposal in the CA undergo the IEM process in order ensure environmental compatibility and the integration of community concerns.

Having suggested a multi-use open space near a high density, low income area, would set a precedent for South African cities. Socio-economically disadvantaged people would have direct access to environmental education and recreation facilities. In light of the post-Apartheid area, this type of change is desirable.

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ABBREVIATIONS

asl	above sea level
CA	Confluence Area
C-BR	Culemborg-Black River
CBD	Central Business District
CCC	Cape Town City Council
CMA	Cape Metropolitan Area
COCCOS	Co-ordinating Committee for Community Open Space
CPA	Cape Provincial Administration
DNHPD	Department of National Health and Population
EEU	Environmental Evaluation Unit
I&APs	Interested and Affected Parties
IEM	Integrated Environmental Management
IMDF	Interim Metropolitan Development Framework
M.Phil	Master of Philosophy
MOSS	Metropolitan Open Space System
<i>pers.comm.</i>	Personal Communication
SAAO	South African Astronomical Observatory
SARCC	South African Rail Commuter Corporation
UCT	University of Cape Town

CHAPTER ONE

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INTRODUCTION

1.1 Background

In the new South Africa, as cities enter an era of rebuilding, development pressure and the demand for land is mounting. As a consequence of dominant urban management practices, and the vigorous implementation of Apartheid policies (Dewar, 1992), the South African city has been described as an inefficient and inhuman urban environment (Watson, 1992). These cities are characterized by three main patterns. The first is low density sprawl (Dewar, 1992). The second is separation, which has succeeded in promoting land-uses which are widely separated, mono-functional and at great distances between places of residence and main places of work. This is especially true of the lower income segment of the population, who are primarily located on the outskirts of the city (Watson, 1992). The final pattern is fragmentation, which has urban developments occurring in pockets of under and unutilized land.

In an attempt to rectify these inefficiencies, which are mainly attributed to the implementation of Apartheid policies, authorities have had to respond in a much and a more development oriented and less control oriented, more pro-active and less reactive, more process-oriented and less blueprint oriented manner to town planning (Fuggle and Rabie, 1992).

The Cape Town City Council (CCC), the local authority for Metropolitan Cape Town, in an effort to dispel the patterns associated with the South African city, have recognized that urban sprawl in Greater Cape Town cannot be allowed to proceed unchecked. Thus, it is of paramount importance that forward planning, which includes consideration of environmental issues and community concerns, is undertaken. The Interim Metropolitan Development Framework (IMDF) is a recent document produced for Metropolitan Cape Town. It focuses on the need for change in the pattern of urban development in the Cape Town Metropolitan Area.

The pressure for development of open land close to the Central Business District (CBD) is intense, thereby making informed land use planning even more crucial. The study area, referred to as the Confluence Area (CA), is located 5.5 km from the CBD (see Map 1) and represents a classic example of the conflicting needs of development and conservation.

Presently, the CCC has numerous planning exercise underway for areas adjacent to the CA. The CA itself however, shows a gap in the information. This dissertation is the outcome of the CCC recognizing that this omission of information needs to be filled in order to promote informed land-use planning for this area. Hence, the CCC supported a suggestion that the 1993/94 Masters in Philosophy (M. Phil) class from the Department of Environmental and Geographical Science at the University of Cape Town (UCT), undertake a study which provides baseline information on the environmental characteristics and conditions of the study area. These environmental characteristics and conditions are all encompassing, taking note of the bio-physical, social and economic environments. In doing so, the study followed the principles of Integrated Environmental Management (IEM), which takes environmental factors into consideration in the planning process.

This exercise is an environmental analysis of the study area, to identify key constraining factors to land-use, in order to provide input into the planning process. The study is divided into two main stages.

(a) The Production of the Baseline Document

This stage entailed the organization of a multi-disciplinary team of 9 second year Masters students from the Department of Environmental and Geographical Science at UCT (see Appendix 1) to undertake the research. Under the supervision of the Environmental Evaluation Unit (EEU), the information was gathered in order to provide baseline environmental data; in particular the identification of opportunities and constraints which must be considered in any land-use plan for the CA.

MAP 1

Location



■ Confluence Area

ATLANTIC
OCEAN

CAPE TOWN

Salt River CONFLUENCE AREA

Rondebosch

Wynberg

Retreat

Hout Bay

Noordhoek

Fish Hoek

FALSE BAY

Simon's Town

Scarborough

Cape Point



Protected Natural Environment



Roads



Railway



Rivers/Vleis

0

6000m



In compiling the Baseline Report, the following methods were employed:

i) Secondary data pertaining to the environmental characteristics and conditions of the CA, and its surrounds, was collected and analyzed. The information gathered in this literature search was described in the document under the biophysical, infrastructural, and social environmental components. A series of site visits were also undertaken to confirm the secondary data;

ii) Once the secondary data was reviewed, omissions were identified. Where it was deemed necessary, expert input was sought and new information was generated;

iii) Each of the environmental components were assessed using the criteria appropriate to that particular component, in order to determine the key controlling factors to land-use (which is done in the second stage of the project). Although the assessment procedure was as neutral as possible, a certain level of interpretation was required, and

iv) Throughout this procedure, a programme of interviews to solicit I&APs issues and concerns associated with future land-use in the CA was undertaken. By means of a chain referral system, the I&APs were identified. I&APs were selected for their expert input, and on the basis of the various organisations which they represented. Interviews with individual members of the public were not conducted.

(b) The Production of Individual Dissertations:

The second stage of the study involved the Masters students individually analyzing the data from the baseline report, with a view to suggesting land-use guidelines or proposals for the CA. A requirement of this dissertation was that the land-use proposals/guidelines suggested be arrived at using a logical thought process, and be presented in an understandable manner.

1.2 Aims and Objectives of this Dissertation

The writing of this dissertation represents Stage 2 of the study. The primary aim of this dissertation is:

- to synthesize and evaluate the environmental factors influencing land-use planning in the CA.

In addition, these are the objectives of this study:

- to identify the key constraining factor(s) to future land-use in the CA;
- to propose appropriate land-uses in light of the key constraining factor(s);
- to provide greater understanding of the environmental opportunities and constraints associated with the CA to an on going planning process;
- to take the metropolitan and local needs into account in proposing land-uses and,
- to fulfil the academic requirements of the M.Phil (Environmental Science) program offered at UCT.

1.3 Approach to the Study

The approach to this study is conducted in accordance with the broad principles and procedures of IEM. More specifically, a multi-disciplinary, participatory and holistic approach which incorporates both public opinion and expert judgement was adopted (Department of Environmental Affairs, 1992). By following this approach, accountable decision making can take place. This dissertation takes note of how IEM and land-use planning are related by examining how they are similar, how they differ, and most importantly, how they complement each other.

Factors affecting land-use were evaluated using criteria most appropriate to that particular factor. The significance of the factor to future land-use was determined by examining the ability to mitigate it. I&APs input was also used to anticipate whether or not the factor

would be a constraint for future land-use. Land-use proposals are made bearing in mind the key constraining factor(s).

1.4 Assumptions and Limitations

1.4.1. Assumptions

In analyzing and evaluating the factors which affect land-use in the CA, the following assumptions were made:

- information (especially from technical experts) in the baseline document is correct, and
- I&APs opinions and views published in the baseline document reflect those of the organizations which they represent.

1.4.2. Limitations

The following limitations are imposed on this study:

- The recommendations of the Culemborg-Black River (C-BR) study which seeks to come up with a “package of plans” approach to land-use planning, will have major implications for the CA. However, the CA study had to proceed without a full awareness of what those recommendations might be;
- Time and financial constraints precluded the undertaking of primary research and curtailed the extent of the public participation process; only representative I&APs could be contacted;
- The identification and evaluation of key constraining factors involved subjective value judgement;

- The catchment modelling exercise, which is particularly relevant to this study, being undertaken by the CCC is not yet complete, therefore some relevant information may be pending on the completion of the exercise;
- A geotechnical survey conducted by Van Niekerk, Klein and Edwards (VKE) would have given some information on the toxicity and perhaps bearing capacity of the soils in the Liesbeeck Sportsgrounds area. This survey is not complete to date, and
- Ongoing supervision throughout the writing of the dissertation would have been desirable.

1.5 Report Structure

This dissertation begins with Chapter 1 which brings the dissertation into context. The background to the study is discussed, along with aims, approach, assumptions and limitations.

Chapter 2 outlines the theoretical underpinnings and procedural approach to this evaluation of environmental factors, with a view that land-use proposals can be reached. The relationship between the planning process and the IEM procedure is explored.

Chapter 3 describes the study area. It outlines the location of the study area in a metropolitan context and examines ownership. This chapter sets the stage for the remainder of the document by familiarizing the reader with the study area in general.

An evaluation of the environmental factors that affect land-use is undertaken in Chapter 4. This evaluation identifies the most significant factor(s) affecting land-use in the CA.

Chapter 5 outlines the problems associated with urban river management. It concentrates on the problems of flooding, and serves to support the idea that the hydrology of the CA is the key constraining factor to land-use. Management strategies for flooding are also discussed.

In light of hydrology being determined as the key constraining factor to future land-use in the study area, Chapter 6 proceeds to propose land-uses for the CA. Open space is explored as being the most suitable land-use while compatibility with open space is also examined.

Chapter 7 concludes the report and recommends areas of further study.

CHAPTER TWO

CHAPTER TWO

LAND-USE PLANNING AND IEM

2.1 Introduction

This chapter examines the theoretical approach followed in determining the opportunities and constraints for land-use in the Black River and Liesbeeck River CA. The theory and principles of the Integrated Environmental Management (IEM) procedure (Department of Environment Affairs, 1992) are used as a tool in assisting in the process of identifying appropriate land-use proposals.

To begin with, the goals of land-use planning will be explored, followed by the strategies that are utilized in achieving these goals. Secondly, the principles and procedure of IEM are discussed. This chapter also explores the relationship between the land-use planning process and environmental evaluation. In the process of identifying opportunities and constraints for land-use proposals, this study has attempted to integrate the two procedures.

2.2 Land-Use Planning

2.2.1 Goals

Land-use planning is the term used for the designation of the future use of particular pieces of land (Whitaker, 1984). Wood (1988) describes physical or land-use plans as methods in assisting in the regulation of the spatial distribution of activities and environments within a prescribed geographical area. The following considerations are addressed when land-use planning takes place:

- 1) The use or uses to which land can (or should) be put;
- 2) The interaction between multiple uses of the same piece of land, and the cumulative interaction of these with the environment;
- 3) The juxtaposition and spatial interaction with land use(s) on adjacent and nearby pieces of land;
- 4) Statements of objectives in the context of which future decision-making should occur, and
- 5) Conditions under which specific uses can be permitted.

These objectives are undertaken with the idea of improving the quality of life and the general welfare of the community concerned. It embraces the creation of better living environments which is achieved both by development and conservation (Fuggle and Rabie, 1992).

Painting (1992) states that land-use planning should be a consideration of what land resources are available and what they are suitable for on the long term and short term continuum.

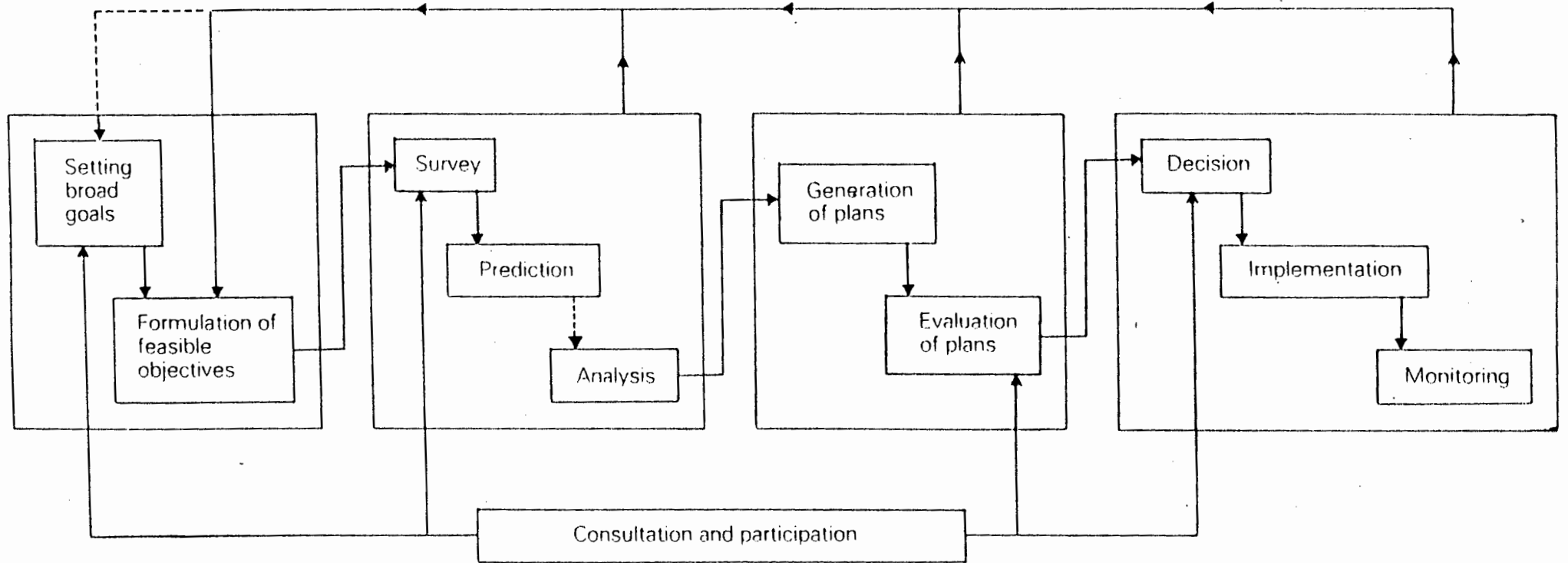
At the policy level, land use planning goals are normally designed to:

- (a) specify and maintain particular land uses, consistent with public goals and values;
- (b) limit uses that are incompatible with the ecological processes of the land (Westman, 1985), and
- (c) provide a fair, just and efficient process for arbitrating conflicting land uses (Fuggle and Rabie, 1992).

2.2.2. Main Stages of the Planning Process

Cook (1988) identifies four main stages of the planning process. Namely, the formulation of goals and objectives; survey prediction and analysis; the generation and evaluation of alternative plans; and decision implementation and monitoring. Figure 1 diagrammatically explains the process.

FIGURE 1
LAND-USE PLANNING



The formulation of goals and objectives involves the establishing of broad planning goals and more detailed objectives which, at a later stage will be refined into a more specific operational form.

Survey prediction and analysis in the second stage involves the survey of existing conditions, the prediction of future conditions over the planning period, the identification of planning problems, and the revision of objectives and goals in light of these problems.

Stage three, which is the generation and evaluation of alternative plans, entails the development of plans likely to meet agreed goals and objectives. Also, the development and application of evaluation criteria is generated. Land evaluation, an essential part of land-use planning would enter the process at this stage. Land evaluation strives to systematically look at various options available. It considers the environment in which these options are likely to operate so that the results of alternative courses of action can be predicted (Painting, 1992). As well, it requires the dedication and co-ordination of all disciplines to address the many conflicting requirements inherent in development and land-use planning.

The fourth and final stage involves the revision of plans in light of implementation problems and monitoring.

2.2.3. Strategies for Implementing Land-Use Planning

In order to attain the goals put forth by land-use planning, various strategies have traditionally been used (Westman, 1985):

- (a) Comprehensive plans set forth broad guiding principles for future development. They are sometimes accompanied by maps indicating natural hazards, and other ecological constraints and attempt to limit development to the estimated carrying capacity of the region's natural resources.

- (b) Zoning schemes specify the exact locations in a region where particular land uses will be acceptable, and addresses matters such as building densities. These scheme can also be used to restrict the extent and nature of development in hazardous areas such as floodplains, unstable slopes and fire prone areas.
- (c) Subdivision controls and construction codes regulate design, building and grading practices within a zone. Items such as height, setback of building, amount of angle of grading on slopes, drainage and open space may also be specified. This aids in minimizing the effects of natural hazards on urban development.
- (d) Environmental performance standards specify the ultimate level of some ecological process that must be retained after development is completed. For example, it may be required that stormwater runoff following development in an area not exceed the natural amount of runoff in that area.
- (e) Transferable development credits are another method of controlling land-use. Instead of being restrictive, this method is flexible. Each parcel of land is assigned a development right according to it zoned level of use at the time of onset of controls. The development credit can be transferred to another parcel of land.
- (f) Development taxes levy a sliding fee on land according to the intensity of land use. Great Britain for example has periodically taxed profits arising from major changes inland use.

This study attempts to evaluate environmental information using the principles of the IEM procedure in order to inform a comprehensive plan.

2.3 Integrated Environmental Management

2.3.1. Goals of IEM

IEM is a procedure designed to ensure that the environmental consequences of development are adequately considered and understood in the planning process (Fuggle and Rabie, 1992). In the development of the IEM procedure, an attempt was made to address the inadequacies in the Environmental Impact Assessment (EIA) process, in order to be more appropriate to conditions in developing countries such as South Africa.

EIA was the procedure adopted in the USA after a growing awareness of the adverse impacts of development on the environment (Fuggle and Rabie, 1992). The result of this increased awareness was the enactment of the National Environmental Policy Act (NEPA) in 1969 in the United States. NEPA served to introduce the environmental evaluations into the realm of public policy. Researchers involved in developing environmental evaluation procedures for South Africa were reluctant to simply import EIA procedures from the Western industrialized countries, since the application of EIA would be reactive, excessively negative and the cause of expense and delay in the development process (Fuggle and Rabie, 1992). As opposed to EIA, IEM strives to guide rather than impede development, a preferred option in developing countries. Instead of the “yes/no” approach to development, typical of EIA, IEM aims to formulate “yes/but” or “yes/if” alternatives in implementing projects (Hill and Fuggle, 1988). Furthermore, community concerns are integrated throughout the planning, assessment, and decision-making stages. In doing so, IEM promotes the idea of sustainable development.

Furthermore, by providing a positive, interactive approach to gathering and analyzing useful data, and presenting findings in a form that can easily be understood by non-specialists, IEM serves to:

- stimulate creative thinking in the planning and initial design stage, and
- provide a systematic approach to the planning and evaluation of proposals (Fuggle and Rabie, 1992).

2.3.2. Principles of the IEM Procedure

The following principles underpin the IEM procedure:

- informed decision-making;
- accountability for information on which decisions are taken;
- an open, participatory approach in the planning of proposals;
- consultation with I&APs;
- an attempt to ensure that the 'social costs' of development proposals (those borne by society, rather than the developers) be outweighed by the 'social benefits';
- democratic regard for individual rights and obligations;
- a broad meaning given to the term environment (i.e. one that includes physical, biological, social, economic, cultural, historical and political components).

In keeping with the aims of IEM, application of these principles to the planning process will support and facilitate the goal of improving the quality of life, and the general welfare of the community. And, by ensuring that the community is involved in the decision making process, land-uses which are consistent with public goals and values are promoted.

2.4 The Relationship between Land-Use Planning and IEM

McHarg (1969) was one of the first planners to integrate environmental considerations into land-use planning. The main emphasis of his work was to devise a set of indicators to guide developments to 'areas of opportunity' and away from 'areas of resistance' such as vulnerable sand dunes (Wood, 1988).

Land-use planning also referred to as forward planning (Whitaker, 1984) shares a common goal with IEM. Forward planning "...seeks to facilitate development while simultaneously conserving those social and physical environmental attributes of a community or locality that have been identified as being of value. It is, in some ways, an attempt at mediation". The principles underpinning the IEM procedure advocate the same goals put forth by forward planning.

This section describes the similarities and differences between the land-use planning procedure and the IEM procedure. As international references were used to explore the relationship between the two procedures, the terms IEM and EIA will be used interchangeably.

Despite similar goals, these two processes have existed in isolation of each other in the past (Wood, 1988). Whitaker (1984) claims that a common frustration, is that EIA takes place in the absence of land-use plans, or in the context of completely inadequate land-use planning documents. Thus, by integrating the two processes, EIA, can suggest environmentally sound land-use options before any development proposals actually take place. The undertaking of this anticipatory IEM procedure during the formulation of land-use plans also permits consideration of cumulative impacts.

Furthermore, by integrating the IEM process into the planning process, the achievement of planning objectives will be enhanced (Whitaker, 1984). This is accomplished as the environmental context and ground rules to determine acceptable, and unacceptable development will be stated with greater precision, and potential land-use conflicts may be defined more clearly (Whitaker, 1984).

Aside from being complementary to land-use planning, IEM actually feeds into the land-use planning process. In order for land-use planning to be holistic, it is essential to have access to adequate baseline information of the existing biophysical and socio-economic environment, as well as opinions of affected communities. However (Whitaker, 1984), argues that there are few planners equipped to interpret the baseline information. Interpretation and evaluation of the baseline should include the following areas:

- (a) The status of the environmental resources in a regional context;
- (b) The dynamic functioning of the environmental system (i.e. How resilient is the system? How well it can recover from extreme events?) At this point, those trained and experienced in looking at the ecosystem holistically, have an understanding of

ecosystem structure and function. succeed in feeding this information into land-use planning as they are routinely confronted with such questions.

Wood (1988) also points out that the environmental objectives in plan making are not sufficiently comprehensive. He claims this weakness stems from the inadequacy of the identification of environmental factors which affect the planning process. This could be remedied through the preparation and use of checklists which are provided by the IEM procedure.

Another complementary aspect of the two processes is described by Wood (1988, p. 139) stating, "The concepts and methodology of IEM offer much to assist the land-use planner in determining the optimal use for a piece of land as s/he seeks to answer critical questions such as:

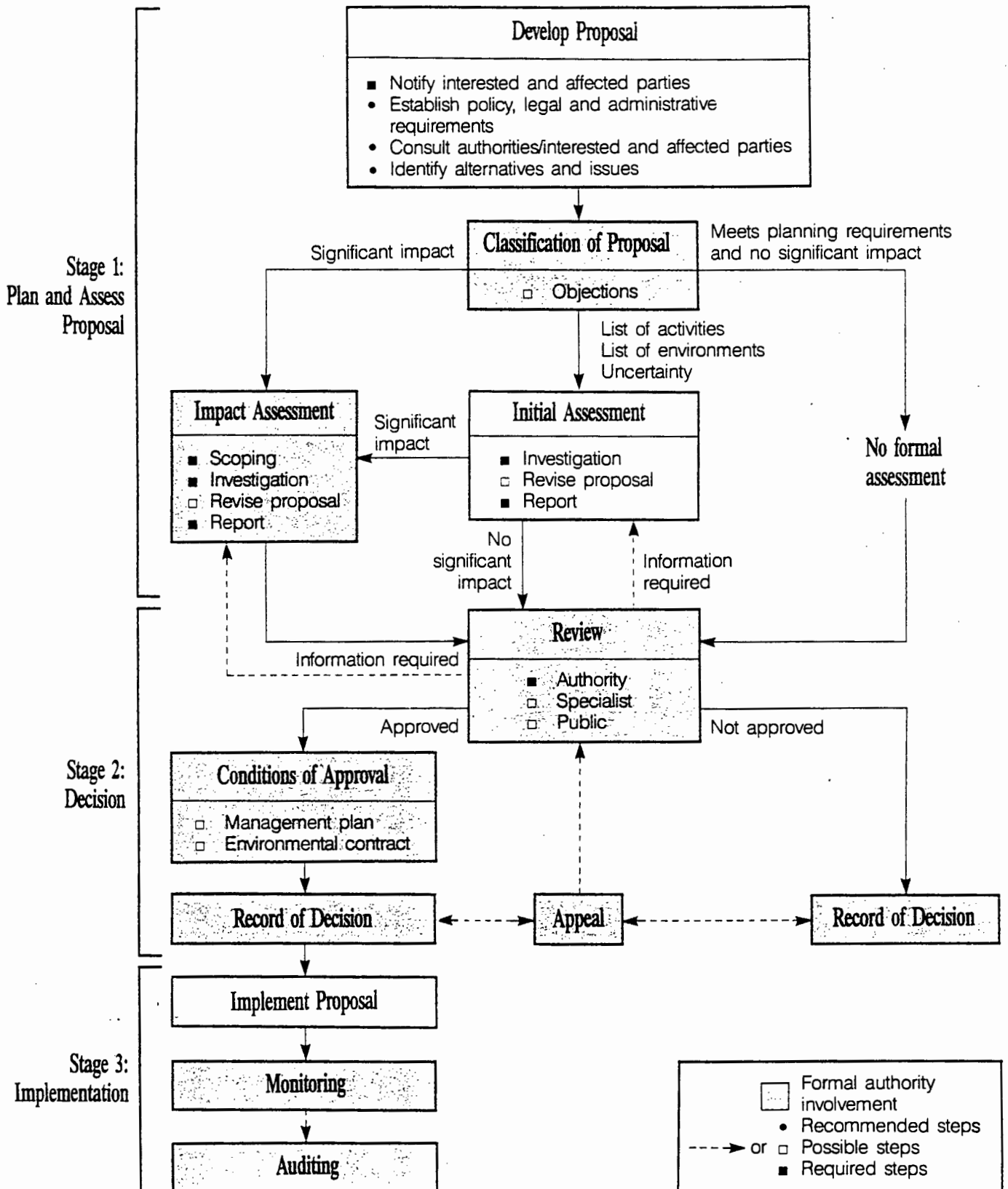
- (a) Will the proposed use be sustainable in the long term?
- (b) Will the proposed use prejudice a different future use of the land?
- (c) How should a proposed use be managed?"

This study uses the principles of IEM to guide the gathering and assessment of information for the baseline document. In doing so, it feeds into the land-use planning process by identifying key environmental factors which need to be addressed in land-use decision making in the CA.

2.5 The Integration of the IEM Procedure and Land-use Planning at the CA

The IEM procedure provides guidelines for the environmental evaluation and management of a proposal, and follows 3 main stages from initiation to completion (see Figure 2). Stage 1 is concerned with the development and assessment of proposals, Stage 2 with decision making, and Stage 3 with the implementation of proposals (Department of Environment Affairs, 1992). Within the IEM procedure, the examination of the environmental opportunities and constraints for land-use falls within Stage 1 of the procedure.

**FIGURE 2
THE IEM PROCEDURE**



For the study at hand, there is no specific land-use proposal in question for the CA. However, the principles and procedures of IEM apply equally to policy and plan formulation.

The gathering of the baseline information falls into developing a proposal, the first step of Stage 1. The following recommendations were undertaken:

- notify neighbours and interested and affected parties (I&APs);
- establish policy requirements;
- establish legal requirements;
- establish administrative requirements;
- establish purpose or need;
- consider IEM requirements;
- consult with authorities;
- consult with I&APs;
- identify and consider alternatives;
- consider mitigatory options, and
- consider management plan options.

By synthesizing and evaluating the environmental factors which influence land-use planning (the primary aim of this dissertation), the classification of the proposal was determined. Several environmental factors were determined to be significant to land-use, and therefore, the Impact Assessment route was followed. The Impact Assessment phase includes scoping, investigation, and the production of a report. In the scoping phase, the extent and approach to the investigation was set. The investigation phase was guided by the scoping decisions which provide the authorities with information on the positive and negative aspects of the proposal (Department of Environmental Affairs, 1992). The final step is a documentation of the findings. Within the Impact Assessment phase, the following objectives were fulfilled:

- the identification of the key constraining factors to future land-use in the CA, and
- the proposal of appropriate land-uses in light of the key constraining factors

This dissertation represents the documentation of the findings, the final step of the Impact Assessment.

CHAPTER THREE

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.1 Location

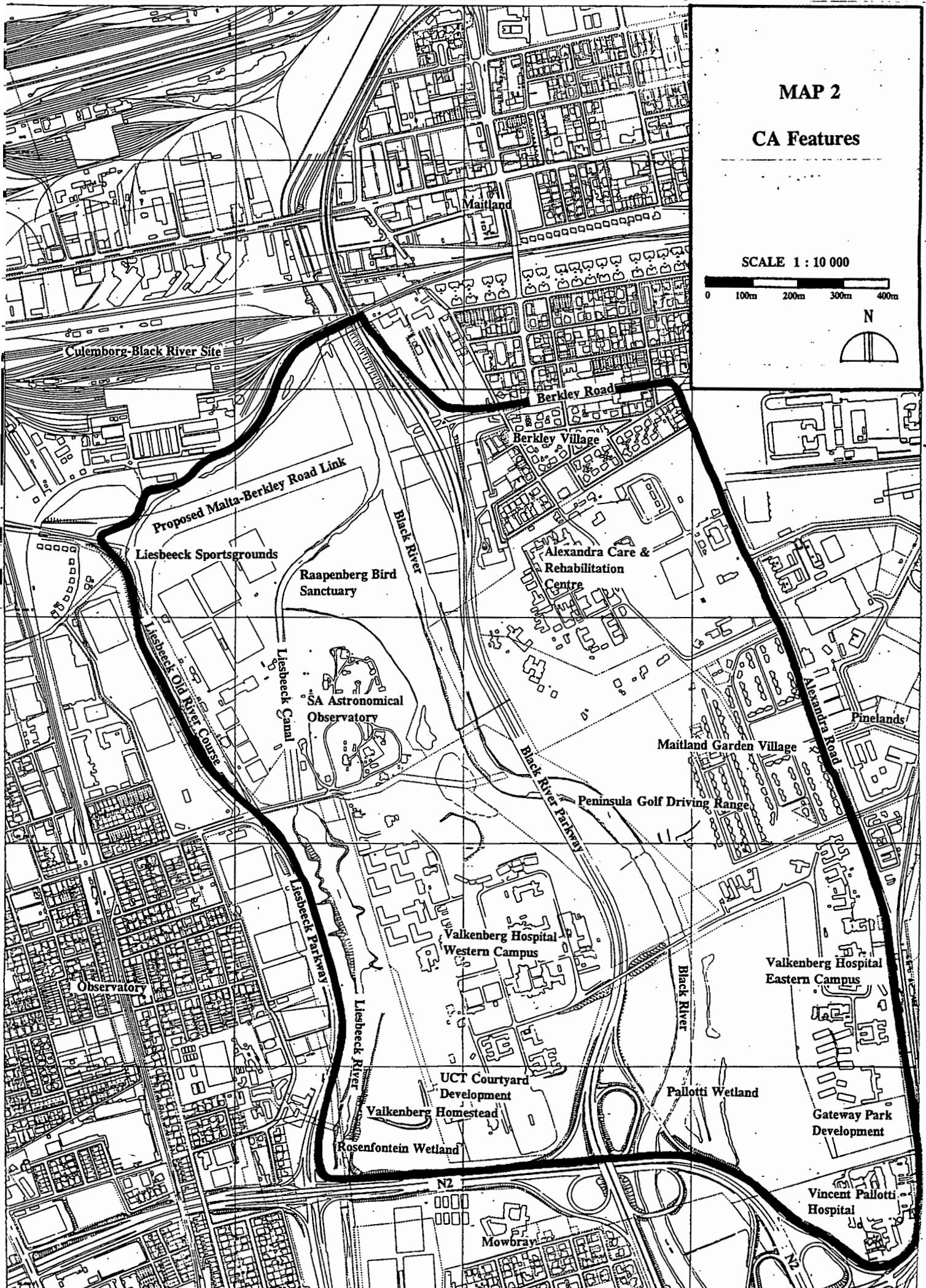
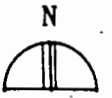
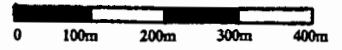
The CA is located approximately 5.5 km east of the Cape Town Central Business District (CBD) at the point where the more fertile lowest slopes of Devil's Peak meet the sandy soils of the Cape Flats (see Map 1). The north-flowing Liesbeeck and Black Rivers run through the study area and meet in the extreme north. The Black River flows into the Salt River which feeds into the Atlantic Ocean. Within the study area, the Liesbeeck River drains into the Liesbeeck Lake, at which point the river is diverted beyond Observatory Road to form the remainder of the Liesbeeck River and the Old Liesbeeck Channel. Both these rivers have been considerably altered, having been channelised, canalized and re-routed. The area has a flat to gently undulating character: towards the north, elevation is as low as 3 metres above sea level (a.s.l.) while the interfluvium and the eastern bank of the Black River are more elevated.

Apart from the eastern section along Alexandra Road, the area is relatively underdeveloped and is largely open space. This open space is not in pristine condition. It forms part of the green corridor which links Rietvlei in the north to Rondevlei in the south which has been termed the 'Coast to Coast Greenway'. The Peninsula Mountain Chain aside, this greenway is one of the major tracts of open space within Metropolitan Cape Town.

The study area (see Map 2) is bounded by the N2 Freeway to the south; the Liesbeeck Parkway to the west; and Alexandra Road to the east. In the north the boundary runs along Berkley Road to the Black River Parkway, then follows the western edge of the Parkway to the railway bridge across the Black River. The boundary continues westwards, along the northern border of the open space immediately above the Old Liesbeeck River course, until it meets the Liesbeeck Parkway. The study area is 232 hectares in extent.

MAP 2 CA Features

SCALE 1 : 10 000



3.2 Land-use in and around the CA

The CA is surrounded predominantly by residential, recreational and light industrial areas. Adjoining the CA in the south are Mowbray and the Rondebosch golf course. Mowbray, Woodstock and Observatory abut the western side of the CA and are primarily residential. Pinelands residential area and Ndabeni industrial complex are found to the east of the study site, and to the north, are the C-BR marshalling yards and the Maitland residential / commercial area.

Within the study area, there are only a few principal land-uses. The Liesbeeck Sportsgrounds and some vacant land occupy the northwestern corner of the study area. The South African Astronomical Observatory (SAAO) is located between the two rivers, as is the Valkenberg Hospital. A development initiated by UCT, known as the UCT Courtyard Development has recently commenced in the area. Located on the eastern strip of the study site are the Vincent Pallotti Hospital, Maitland Garden Village and some light industry. The Raapenberg Bird Sanctuary (RBS) occupies a small area adjacent to the SAAO. The Black River Parkway bisects the area and is bounded by fairly extensive, inaccessible open space. The Peninsula Golf Driving Range is located between the Black River Parkway and Maitland Garden Village. With a few minor exceptions, this configuration of land-use has remained constant over the last 25 years.

Landownership is limited to a comparatively small number of institutions and individuals. Major landowners include the state (in various guises), the CCC, Transnet, the National Monuments Council (NMC), a semi-private parastatal organization, UCT, the privately owned Vincent Pallotti Hospital and various individual owners of small residential and commercial properties.

3.3 Recent Developments in the CA

There are currently 3 sets of development underway in the CA. These include:

- (a) Transnet and the South African Rail Commuter Corporation (SARCC) are undertaking a national rationalization exercise, and as part of that process examining the most profitable way of releasing up to 300 ha of prime land in the C-BR area immediately northwest of the CA. This is the major transport corridor into Cape Town and also constitutes a significant barrier between the city and the sea. Any developments here would impact significantly on surrounding areas, including the CA. A separate five year study of the C-BR area is already underway.
- (b) Proposed projects such as the hosting of the 2004 Olympics in Cape Town have precipitated an interest in the optimal utilization of the CA.
- (c) There is increasing pressure for immediate development in the CA which is indicated by projects such as the Gateway Park development, and the UCT Courtyard development.

The Gateway Park development and the UCT Courtyard development have elicited a vocal public response, thereby emphasizing the need for the formulation of a development plan in the CA. By adhering to the principles of IEM, the key environmental factors which control development in the CA are identified. Furthermore, consultation with I&APs incorporates community concerns and public values into decision making, thus reducing the probability of conflict.

CHAPTER FOUR

CHAPTER FOUR

EVALUATION OF THE ENVIRONMENTAL FACTORS AFFECTING LAND-USE

4.1 Introduction

This chapter assesses each of the environmental factors examined in the baseline document, and evaluates the importance of these factors for land-use decisions. First, an overall evaluation is made to determine which factors are actually significant. A core part of this evaluation is drawn from the 'Summary Assessment' found at the end of each chapter in the baseline document. Where appropriate, to supplement the Summary Assessments, I&APs views are considered in aid of supporting or refuting the relevance of the factor to land-use decision making. From this, key factors are narrowed down and the most significant factor(s) for land-use decisions revealed. The analysis and evaluation which follows, focuses particularly on constraints to land-use, rather than opportunities, since it is the constraints which are difficult to mitigate and ultimately influence what land-use options can be considered.

The various elements of the bio-physical environment dictate the suitability of the land for different land-uses. Westman (1985) states that landscape characteristics predict the suitability or vulnerability of the land for various uses. Hence, the bio-physical characteristics of a landscape must be examined first.

4.2 The Bio-Physical Environment

The bio-physical environment and its various elements are perhaps the most crucial factors to consider when planning for land-use, as they may impose constraints which cannot be overcome. McHarg (1967) states that ecology provides the single indispensable basis for landscape architecture and regional planning. Landscape architecture is the study of physical and biological processes, as dynamic and interacting responsive laws, having limiting factors

and exhibiting certain opportunities and constraints employed in planning and design for human use.

By examining the bio-physical environment of the CA, and pointing out opportunities and constraints, an exercise similar to the one dictated by landscape architecture is fulfilled. With respect to what would be appropriate in the CA, the examination of the physical environment, namely the topography, climate, geomorphology, geology and soils, and hydrology provide valuable clues as to what land-uses are suitable within the study site.

4.2.1. Topography

Examining the topography of an area reveals the flooding potential of the land, construction difficulties, and the possibility for view obstruction with the construction of new buildings. Within the CA, the slope ranges from 1% to 10%. The gently, undulating nature of the land poses no constraints for the construction of buildings. Flooding potential is a constraint in the low lying areas of the CA, but is mainly associated with hydrology, and will be discussed under the hydrology section (see Section 4.2.4). Further development in the Valkenberg area, and the SAAO vicinity will have to be considerate to building heights so as to prevent obstructing the mountain view for Maitland Garden Village and its surrounds. To address any problems associated with obstructing views, the application of subdivision controls and construction codes could impose height restrictions. In terms of construction activities, topography offers no major problems. Thus, this factor poses no constraint for future land-use decisions.

With regard to the topography, there were no comments from I&APs.

4.2.2. Climate

Climate may affect land-use if there are extremes in either temperature, wind or precipitation. In relation to the rest of Cape Town, the CA does not exhibit extreme conditions. Wind exposure on site is high, and thus has implications for human discomfort, and consequently for types of land-use. The high winds can be abated using trees as barriers,

which would also add to the aesthetic appeal of the area. In addition, the presence of temperature inversions promotes the concentration of air pollutants in the winter months. This inversion is not a problem in its own right, but since the site falls into the 'Smokeless Zone' (see Section 4.2.5), the control of air pollutants may restrict some land-uses. Climate per se is not considered to be a constraint to land-use.

4.2.3. Geology, Geomorphology and Soils

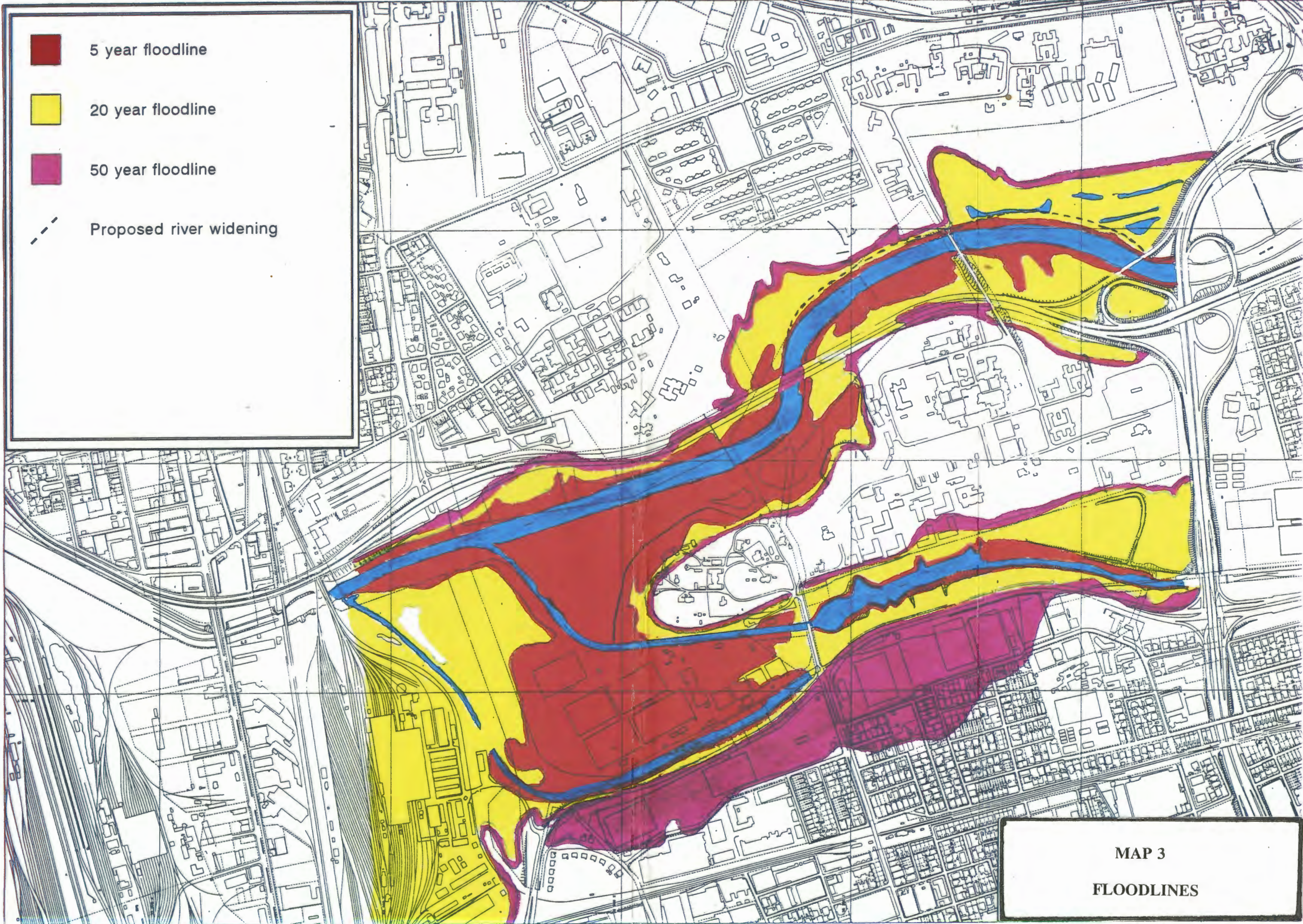
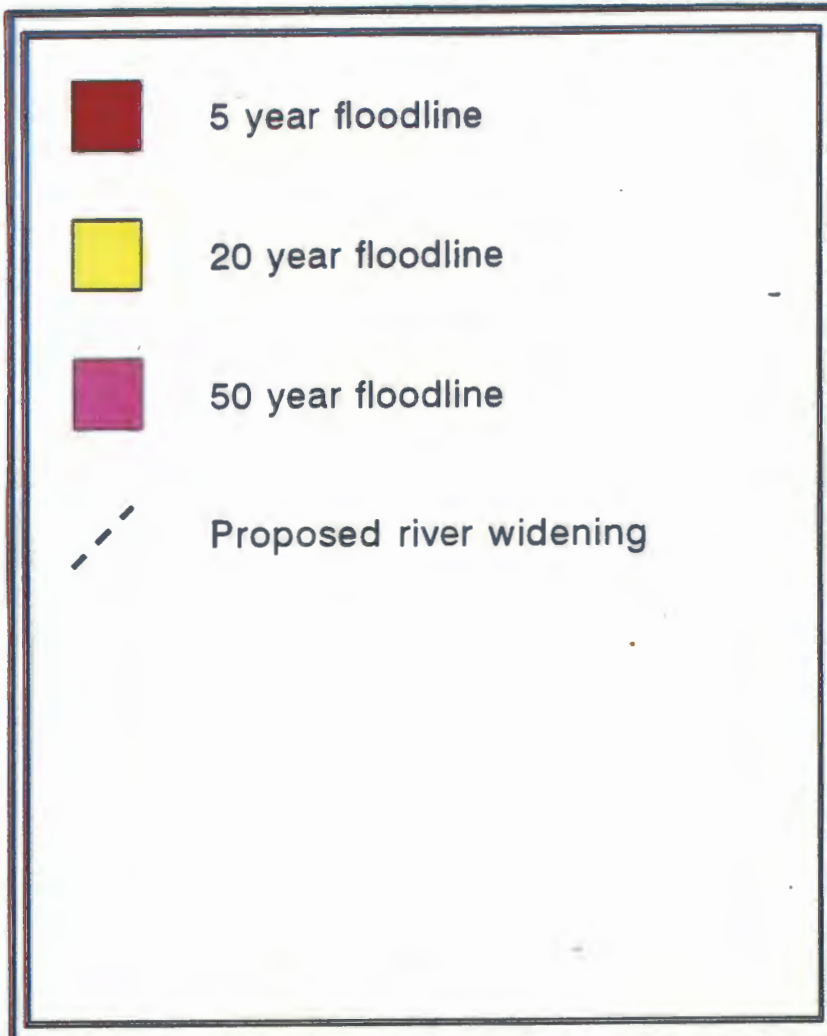
Suitability of the land for construction and agricultural activities are dictated by the geology, geomorphology and soils. The low bearing capacity of the alluvium found along the edges of the river (see Appendix 2) would constrain land-use requiring the construction of buildings. Areas with ferricrete, Malmesbury Shales and greywacke show the most promise for construction purposes. These areas are predominantly occupied by the SAAO and Valkenberg Hospital. Vincent Pallotti Hospital and portions of Valkenberg are built on light grey sandy soils. It is noteworthy that this leaves limited undeveloped land for construction.

Agricultural potential has not been thoroughly determined and needs further investigation. However, in the 1950's the fertility of the soils in the Valkenberg vicinity allowed substantial agriculture to take place. Today, most of this area is occupied by highways. Low agricultural potential has been documented in the northern areas of the site, which are quite sandy. Failing a thorough investigation, the soils at present show no real opportunity for intensive agriculture. Small pockets of market gardening could potentially occur.

Although bearing capacities are not presently available for the CA, it appears that the construction of buildings is predominantly constrained adjacent to the river. However, at a high financial cost, engineering solutions may be sought. Overall, this factor exhibits no constraint for land-use.

4.2.4. Hydrology

The flooding potential of the land makes hydrology a factor of paramount importance in determining future land-use. Map 3 delineates the area susceptible to the 1:5, 1:20 and



MAP 3
FLOODLINES

1:50 year flood. Approximately 104 ha falls below the 1:50 year floodline. Flooding in the CA is influenced by many activities in the catchment area. This is especially true of the Black River which is fed by the Elsieskraal and the Vygekraal tributaries and collectively drain most of the Cape Flats, an area equalling 169.95 square km. Aside from flooding, there are problems with siltation, and weed growth.

In an attempt to control the flooding of the Liesbeeck River, canalization was implemented. Once or twice a year, the flow in the river exceeds the canal capacity, and areas susceptible to flooding such as the Liesbeeck Sportsgrounds located, within the study site are affected. For the Liesbeeck River, the 20 year return period for floods rest at 4.3 metres above sea level (asl). The 1:50 year floodline is at 4.5 metres asl. These figures were calculated based on projections of development in the catchment. Despite these calculations, local residents claim that flooding is occurring more frequently than implied by these figures.

In the Black River, the development of the catchment will have an effect on the present floodlines. Floodlines in consideration of this hardening include 3.8 metres a.s.l. for the 1:5 year flood, 4.0 metres a.s.l. for the 1:20 year flood and 4.6 metres a.s.l. for the 1:50 year flood. Currently, the Black River will back up after heavy rainfall at the Confluence, and with the effects of spring tides.

Siltation is prevalent in the Black River. This is caused from the high sediment input from the catchment along with low channel velocities. The Vygekraal catchment produces the greatest amount of sediment contributing to siltation due to the medium grained size of sand which is easily mobilised and transported both by wind and water. This siltation impedes flow thereby causing flooding upstream. Also impeding the flow are the growth of waterplants which are promoted by the siltation. During high flow conditions these weeds are dislodged and cause blockages around bridges in the study area, thus increasing the possibility of floods. This weed problem is difficult to incorporate when calculating floodlines.

The quality of water in the Black River is influenced by Athlone and Borchard's Quarry sewage works. The Black River is used as a channel for transporting semi-treated sewage

out to sea. In 1979, CCC spent R31 million to improve the Athlone sewage works. Despite efforts by the CCC to improve the water quality, levels of pollution are still very high, in the Black River making the river unsuitable for any form of water-contact sport.

There are many factors which influence flooding, thus making it difficult to control. Clearly, the hydrology in the CA is a key constraining factor to land-use. Although water quality affects the recreational potential of the river, it can be mitigated.

I&APs have identified that the hydrology, more specifically, river management is an issue that must be addressed before any future land-uses can take place. They agree that the current management is inadequate, and that catchment management schemes need to be updated.

4.2.5. Pollution

(a) Air Pollution

Although pollution is not typically a natural physical feature of the land, it will be addressed here. With regards to air pollution, the most problematic of the pollutants are the non-methane hydrocarbons which originate from car exhaust. Since the study site has 3 major roads (N2, Liesbeeck Parkway, and the Black River Parkway) in and around it, the control of this pollutant is necessary. Future land-use would have to consider the already high levels of non-methane hydrocarbons. Other pollutants include oxides of nitrogen, nitrogen dioxide and sulphur dioxide which originate from the coal and oil burning industries in the Maitland area. Observatory also contributes to the pollution levels with the light diesel burning industry that exists in this area. These pollutants fall below the Department of National Health and Population guidelines. However, the CA falls into the 'Smokeless Zone' and, emissions of smoke have been restricted by the city, in order to ensure that the City Bowl does not experience a build-up of pollution when there is no wind blowing in the area.

Thus, the present pollution levels of nitrogen dioxide, nitrogen oxide and sulphur dioxide although acceptable, should not be degraded. Therefore, any future land-use would have to

consider this factor. Mitigation is possible by applying strict environmental performance standards so as to prevent the degradation of present pollution levels.

I&APs feel that air pollution should be minimised.

(b) Terrestrial Pollution

Terrestrial pollution (litter) is currently a problem but is easily abated. Due to dumping and filling of the land in the past, the soil may be toxic in the Liesbeeck Sportsground area. Further investigation is needed, but thus far, this factor does not impose a constraint on land-use, as it can be managed.

I&APs attest to the fact that currently, visual pollution in the CA is “appalling”. Wind blown litter, especially around Valkenberg Hospital is a problem which needs addressing.

(c) Noise Pollution

Noise pollution appears to be problematic for land-use in terms of human discomfort. Since there are various methods to mitigate against noise, this factor ultimately does not restrict land-use.

I&APs comment that noise is problematic, especially around Vincent Pallotti Hospital. Site visits confirm that noise levels in the area could be disturbing to some land-uses.

(d) Water Pollution

Water quality affects land-use in several ways. Firstly, it determines what kind of recreational activities take place (i.e. fishing, boating, swimming). Furthermore, it may determine the types of activities that are feasible for riverside development.

Nutrient enrichment leads to semi-eutrophic conditions in the Black River which has a negative effect on aquatic life. The main contributors of the nutrient rich effluent to the Black River are the Athlone and Borchard's Quarry sewage works. Trace metal pollutants were also investigated in order to determine whether the levels of these pollutants in the

Liesbeeck and Black Rivers are within acceptable limits for the continued survival of aquatic life. Levels of copper and lead on the site exceeded the General Effluent Standard (GES), Special Effluent Standard (SES), and the recommended value for the protection of aquatic life (Baseline Document, 1994). The biological consequences of these levels include no hatching or fry survival in minnows, and mass mortality of salmon and minnows. Hence, water quality affects recreational fishing.

4.2.6. The Biological Environment

Considering the biological environment in planning adheres to one of the principles of IEM, and in doing so, attempts to bridge the gap between development and conservation. This represents a refreshing change in attitude as traditionally, 'humanist' factions within the planning group would insist on planning for basic human needs in an urban form (Boddington, 1987).

(a) Flora

The investigation of the flora and fauna in the CA reveals the conservation priority of plants and animals. In general, the flora of the CA exhibits no floristic value. There are several highly invasive alien species in the study area. Briefly, some of these species are *Azolla filiculoides* (azolla), *Myriophyllum aquaticum* (parrot's feather), *Accacia mearnsii* (black wattle) and *Myoporum serratum* (myoporum).

Some botanical interest is evident in the 30 ha of wetlands where a large proportion of indigenous reed, grass and sedge species occur. From a biological perspective, the Raapenberg North site is most important as it has the greatest proportion of indigenous species and habitat types. Apart from the wetlands, the biological significance of flora is low. Thus, special attention needs to be given to the wetlands when considering future land-use. The removal of the highly invasive alien species will have to become a priority, in order to ensure that the wetland flora is not affected.

I&APs agree that botanically, the importance of the CA is limited, and that alien vegetation should be removed. I&APs supporting the conservation of the wetlands feel that wetlands have value for flood prevention, and educational potential. They are also aesthetically pleasing.

(b) Fauna

A high avifaunal diversity exists in the wetlands. Although the population of certain bird species has declined since 1960 as a consequence of habitat modification, the area does support a number of species whose numbers are declining in the southwestern Cape due to the depletion of wetland habitats. For example, the population of White Pelican in the southwestern Cape is small (approximately 650) and these birds use the Liesbeeck Lake as a feeding site, making this part of the CA biologically significant. Also, the palaeartic migratory waders such as the Curlew Sandpiper and Little Stint and Ruff utilize the Raapenberg wetlands during September and October each year. Thus, regionally, these wetlands are important stopover points for bird movements between the southern wetlands of Rondevlei, Zeekoeivlei and Zandevlei and the northern wetlands of Paarden Island vleis and Rietvleis. The survival of the birds frequenting the CA is dependent on the survival of wetlands.

There has not been an official survey conducted on the amphibian, reptile, fish and mammal life in the CA. Mammals that have been seen in the area include the Cape clawless otter, water mongoose, Cape grey mongoose and the endemic Cape dune molerat. In order for informed land-use decisions to take place with regards to the conservation status of the fauna, an indepth survey would be beneficial.

I&APs identify the CA as being important for avifauna which is dependent on the wetlands.

4.2.7. Summary of the Bio-Physical Factors

The constraints generated by the physical factors with respect to future land-use seem to be centred largely around the suitability of the land for construction purposes. And overall, hydrology, namely flooding is the overriding factor that constrains land-use in this area.

By assessing the biological significance of the flora and fauna, the conservation status is revealed. Generally, the CA exhibits no constraints in relation to conserving flora and fauna which may impede development. However, clearly the wetlands of the area are biologically significant from a floral and faunal point of view.

I&APs also support the conservation of wetlands. Hence, future land-use would have to consider this factor.

4.3 Infrastructure

In light of future developments in the CA, the examination of infrastructure is necessary in order to determine the carrying capacity of stormwater, telephone lines, transport and water carrying services.

4.3.1. Current Infrastructure

Currently, there appears to be a lack of infrastructure to support additional development. This is especially true with regards to water carrying infrastructure which would have to be expanded. Telephone lines, electricity, refuse removal and gas services would have to be provided as well. The installation of phone lines will have to be done in a visually attractive manner. The planning of stormwater and sewerage works will need special attention.

4.3.2. Accessibility

Road infrastructure and flyover intersections create barriers to pedestrian traffic. Thus, accessibility to the CA is problematic at the moment. Future land-use proposals would have to address the problem of accessibility.

I&APs also claim that accessibility of the area via better roads is needed if the site is to become a Greenbelt. Also, the east-west movement on site is restricted due to inadequate roads, and needs to be improved.

4.3.3. Summary of Infrastructure

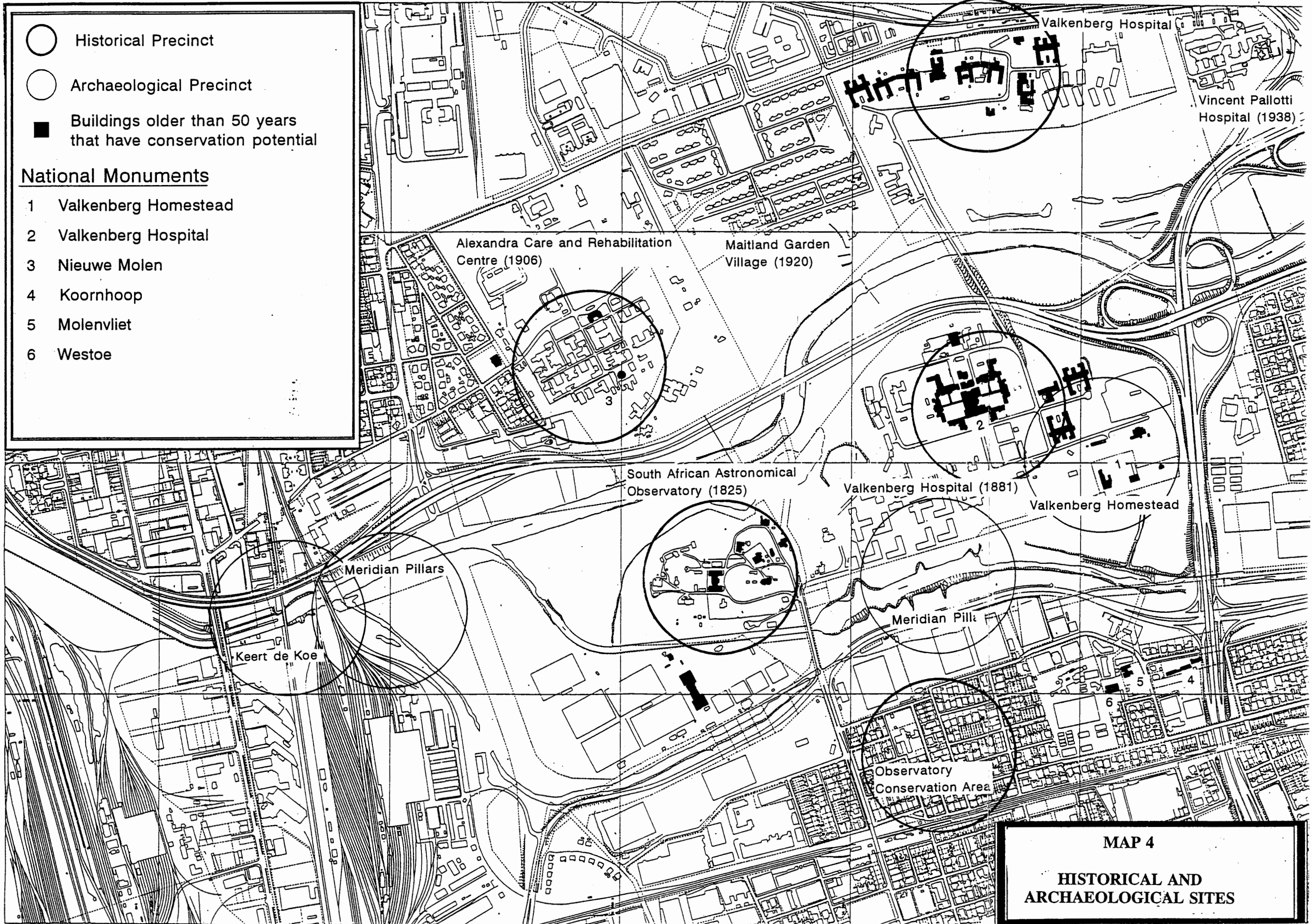
The biggest concern with the inadequacies and expansion of infrastructural services is cost, which will ultimately be borne by the developer, or by the taxpayer if the land is owned and developed by the state or the local authority. Areas needing special attention are the planning of stormwater and sewerage infrastructure, as well as accessibility to the area. To summarize, the inadequate infrastructural services does need to be considered in relation to future land-use. However, engineering solutions may be sought.

4.4 The Socio-Economic Environment

4.4.1. Historical Significance

In terms of South African history, the significance of the CA is noteworthy. In the year 1652, the arrival of Jan van Riebeeck marked the first permanent European settlement at the Cape. The Salt River vlei and the Liesbeeck River geographically represent the area where van Riebeeck and his people settled with the establishment of Free Burgher farms. In addition to the European settlement, people have been living in the southern part of Africa for approximately two million years. Therefore, it is expected that there are thousands of archaeological sites the will contain some relics of this habitation (Baseline Document, 1994).

As a result of this history, there are specific buildings and sites of archaeological and historical importance on the study site. Declared National Monuments include the Valkenberg Homestead, the main administrative buildings of the Valkenberg Hospital, the Nieuwe Molen and the main building in the SAAO (see Map 4). It should be noted that permission from the National Monuments Council is required to demolish any building older than 50 years, and, there are many buildings falling into this category within the study site.



- Historical Precinct
- Archaeological Precinct
- Buildings older than 50 years that have conservation potential

National Monuments

- 1 Valkenberg Homestead
- 2 Valkenberg Hospital
- 3 Nieuwe Molen
- 4 Koornhoop
- 5 Molenvliet
- 6 Westoe

MAP 4
HISTORICAL AND
ARCHAEOLOGICAL SITES

Smuts (1986) supports the idea of urban conservation stating that the conservation of prehistoric, historic and contemporary cultural elements contributes to the quality of life established in urban environments. From an educational point of view, the preservation of the historical sites in the area is also important. Furthermore, since the site exhibits historic buildings, archaeological sites, and the relics of natural features such as the rivers and the grasslands, a detailed archaeological study would have to take place prior to any development to prevent contravention of the National Monuments Act No. 28 of 1969, as amended.

The I&APs support the historical significance of the area. Some comments include that the area is rich in 'buried' history, the buildings are architecturally pleasing and should be preserved and that the maintenance of the buildings with historic value in the CA is needed to give people a sense of culture and history.

Overall the historical significance of the area should be addressed, thus making this a factor to be considered in future land-use.

4.4.2. Economic Activity In and Around the CA

(a) Economic Development

Economic land-uses in the CA are dominated by the service industry. Namely, Valkenberg Hospital, Alexandra Home Care and Rehabilitation Centre and Vincent Pallotti Hospital. SAAO is a research facility and the Peninsula Golf Driving Range and the River club on the Liesbeeck Sportgrounds represent the recreational/sport facilities on site. Judging by the present land-uses, the CA per se does not necessarily promote economic development. However, the economic activity in the vicinity of the CA indicate that further development of this nature may be appropriate. In terms of land-use, this puts pressure on the area for economic development, which would ultimately compete with maintaining the natural quality of the land. In short, the surrounding area of the Confluence promotes and actually creates an opportunity for economic development. However, due to the location, the land in the CA ranges from moderately to very expensive. This limits land acquisition owing to the

fact that large amounts of capital will be needed. This consequently influences who can financially afford to purchase the land.

(b) Job Creation

Job creation is one of the most pressing issues in the new South Africa. And, since the CA offers an opportunity for economic development the issue of job creation in this area is raised. Currently, the area surrounding the C-BR has the highest concentration of employment opportunities in Metropolitan Cape Town. The average job population ratio for Metropolitan Cape Town is one job for every three residents. The average for the area surrounding C-BR climbs to three jobs for each resident. This can be attributed to the high concentration of manufacturing businesses in the area. Other activities in the area include printing and publishing, electronic equipment, food manufacturing, retailing, furniture and wood processing, warehousing, wholesaling and distribution. Since the job population ratio in this area currently exceeds the average for Cape Town, job creation is not a crucial factor to consider for future land-use.

There is mixed opinion from the I&APs as to whether this area is suitable for economic expansion through job creation. Some however have married the idea of conservation and economic prosperity by claiming that labour intensive jobs will be created by maintaining open space, and through tourism and recreation.

4.4.3. Recreational Activity in the CA

Sporting facilities are the main recreational land-use found in, and around the CA. The Liesbeeck Sportsgrounds are the major sporting facility in the CA. These sportsgrounds are used mainly as a golf driving range. The western periphery of the CA has a high concentration of sports facilities. These include Hartleyvale (which is used as a hockey field and soccer stadium), Malta Park Sportsgrounds, the Bowls Club and the Observatory Swimming Pool. To the south of the area, two golf courses are represented in Rondebosch and Mowbray, as well as the Peninsula Golf Driving Range in the east. Currently, the CA

contains 5.3% of the Cape Metropolitan Area (CMA) population and 23.3% of the sports facilities. The facility to people ratio is 1:5, an average well above the rest of the CMA.

The CA also has birdwatching facilities at various sites (i.e. Raapenberg North). In addition to birdwatching, the Liesbeeck and Black Rivers are occasionally used for recreational fishing. Walking paths (for people to walk their dog) are also found in the CA.

Future land-use is not particularly affected by the recreational facilities in the CA. Special attention should be given to the wetlands in order to ensure that the birdlife is not affected.

I&APs feel that the Liesbeeck Sportgrounds offer an ideal opportunity for community recreational activities. They also feel that present facilities in the area are underused and the question of accessibility must be addressed.

The recreational use of the land does not pose a major constraint to future land-use. Implications are however made for further development of recreational facilities. It has been argued that the area could be transformed into a major sporting centre in preparation for the 2004 Olympic Games.

4.4.4. Security

Security in the area will affect the type of land-use possibilities in terms of human safety. Theft from cars and housebreaking are the most common crimes within, and around the CA. A few reported incidents of mugging and robbery have taken place near the Observatory Bridge and pedestrian berm. This however is not a common occurrence. Statistically, crime in this area is not high in relation to the rest of Cape Town.

I&APs perceive the CA as a place where security is a concern. People have been attacked in the CA. Other I&APs state that increased public use may improve security and that a lack of management causes security problems.

Although a slight constraint to land-use, the lack of security can be mitigated. Thus, this is not a significant factor to consider in land-use decision making.

4.4.5. Summary of Socio-Economic Factors

Clearly, the historical significance of the is an important factor to consider for future land-use decisions. The buildings of historical significance must be preserved in light of their importance.

4.5 Land-Use Policies, Plans, Development Proposals and Controls Affecting Future Land-Use

4.5.1. Land Use: Policies and Plans

For land-use planning to be comprehensive, and systematic, it should proceed from the level of national goals, to regional and local considerations (Westman, 1985). Also, IEM requires the examination of plans and policies. Structure plans lay down guidelines for future development (Fuggle and Rabie, 1992). Assessing the various plans and policies pertaining to Cape Town reveals two main thrusts. These arise from the 'Greening of the City: Open Space and Recreation Plan for Cape Town', and the Interim Metropolitan Development Framework (IMDF).

(a) IMDF

The IMDF is a recent document having been produced in December 1993. One of the main needs identified from the IMDF is an increase of medium-to-low cost housing, and the densification of such existing areas. More specifically, the periphery of the CA is noted as being well suited for this purpose. The IMDF also recognizes the importance of Metropolitan Open Space Systems (MOSS), in order to contain urban sprawl.

In order to address the housing shortage in Cape Town, the I&APs see several possibilities arising within the CA. Some see re-locating the Valkenberg Hospital and using this area for

housing. They are also of the opinion that housing is needed close to the CBD and that the CA is ideal. If densification is to take place, then this area is perfect. Also low cost housing in the Confluence could take place, without disturbing the natural environment. In relation to the open space, I&APs have varied opinions. Some claim that Metropolitan Open Space System (MOSS) has value regionally and locally, and that the CA should be used for MOSS, and not purely for conservation.

(b) Greening the City

This plan aims at making a more visible and accessible open space system in the city. It is based on the concept that the whole city must be seen as a recreation resource, comprising a wide range of leisure opportunities. The concept of linkages and creating corridors of open space are central to the whole plan. One of the thrusts of this document is to maximise the recreational potential of river corridors and the vlei areas. Within the CA, this document foresees the following developments (City Engineers Department, 1982):

- The Liesbeeck River/Lake - water related linear park.

This consist of a parkland around the Liesbeeck Lake with hides, an interpretive centre linked to a nature trail and an island refuge for birds. This proposal was given a high priority;

- Black River Parkland - riverside parkland.

Envisaged in this area are picnic and braaivleis spots, with riverside walks. The Vincent Pallotti Wetland and the Raapenberg Bird Sanctuary feature prominently in this proposal. This proposal was allotted a low priority;

- Enhancement of Major Arterial Routes and Approach Routes.

The bold landscaping of the N2 freeway, Liesbeeck Parkway and the Black River Parkway would include tree belts, earthmounds etc. This project was given a low to medium priority;

- Coast to Coast Greenway Trail.

This is the central idea of the Greening Plan. The Black River, Raapenberg Bird Sanctuary and the Pallotti Wetlands form a portion of this proposed greenway. This proposal was given a low priority and,

- Neighbourhoods.

The CA falls within the Greening Plan for the Mowbray area which proposes the planting of trees around schools, leased sports fields and along streets.

The structure plans also enforce the need to conserve historically and aesthetically significant buildings and elements.

I&APs strongly support the idea of open space as a land-use in the CA. Some of the comments are that the area was historically an open space and should therefore be retained as such. Also, people in urban environments have a need for a therapeutic environment. Further, open space is important for local residents in an increasingly dense environment. In relation to land-use compatibility, the I&APs state that the peaceful environment offered by the open space is compatible with the hospitals currently located in the CA.

4.5.2. Land-Use Development and Controls

This is investigated in order to assess land-use compatibilities. Westman (1985) states that an accurate prediction of impacts on a site cannot be made without knowledge of the other proposed projects for the area, and the intensity of direct and indirect stresses they will impose on the site. Also, in order for cumulative impacts on the land to be assessed, plans for the future development of the area need to be looked at (Westman, 1985).

(a) Current Land-Uses

The majority of the area is utilized for institutional use, while residential and commercial use are present but not dominant. Of great importance is the ambience of open space which is

highlighted due to the proximity of the to Cape Town, and the density of the surrounding built up area.

(b) Current Developments

Currently, the UCT Courtyard development is taking place (see Map 1). Others which are likely to occur are the Gateway Park Development. These developments have an effect on future land-use in terms of compatibility.

4.5.3. Zoning

The zoning of the area must be considered as it affects land-use. The zoning scheme is flexible, allowing for land-use changes on condition that the correct procedures are followed, the proposal meets with public agreement, and is not detrimental to the environment. Changing a zoning scheme could prove to be expensive as zoning imposes development rights which if changed, may require compensation. The costs and benefits of changing the zoning scheme will have to be weighed when considering future land-use.

The appropriateness of the current zoning scheme is questioned by some I&APs. While some I&APs agree that the zoning scheme is appropriate and should be maintained, there are others who find that the current zoning scheme is “disastrous”. Furthermore, some claim that the scheme is not effective and too easily subverted. This however does not ultimately affect the decisions taken for future land-use.

4.5.4. Summary of Land-Use Policies, Plans Development Proposals and Controls

The policy and plans affecting Cape Town have a profound influence on the future land-use of the area. In addition to addressing need, these structure plans are one method that planning uses to improve the quality of life of the community (the main goal of land-use planning) and thus needs to be taken into consideration. To conclude this section, the present and future development plans for this area is a factor to be considered in order to ensure compatibility with future land-use.

4.6 Factors of Overall Significance for Land Use in the CA

From the initial evaluation, a few factors arise as being important considerations to land-use. The following is a summary of the key constraining factors to land-use.

Hydrology arises as a key constraining factor to land-use with regards to flooding. Flood control in the CA is possible by means of engineering solutions (see Section 5.6). These solutions however are temporary, costly and offer no insurance that flood events will not occur. Furthermore, there are various factors that affect urban river management which influence flooding and thus make it difficult to control. The following chapter expands on the problems with urban river management. Briefly, these difficulties are the lack of co-ordination in the catchment for holistic river management, the difficulty with predicting flood levels, and the uncertainty associated with global warming and sea level rise.

The conservation of the wetlands must be considered for ecological, biological and educational reasons. Thus, this factor is a constraint for future land-use.

The fact that the CA is within the 'Smokeless Zone' will put a constraint on some land-uses, and therefore is another important factor to consider with regard to future land-use.

The historical significance of the CA must remain intact. Some buildings will have to be given special consideration when planning for land-use in the study site.

Finally, policies and plans, zoning, current land-uses and proposed developments all must be taken into account when considering future land-use options for the area.

Of these final factors to consider, hydrology is identified as the key constraining factor to land-use. Flooding potential of the land is a basic problem that cannot easily be overcome. It is not easily mitigated or negotiated. Although some control of this factor is possible, it is not feasible in light of the costs associated with engineering solutions and the

unpredictability of floodlines. Conservation of the wetlands, historical significance and the plans and policies are factors that need attention after the hydrology has been considered.

Both the Liesbeeck and the Black River are urban rivers which have been significantly altered from their natural state. This makes it increasingly difficult to control flooding. The following chapter will assess the many problems associated with urban river management and thus re-enforce the significance of flooding as a constraining factor with paramount importance in relation to land-use.

CHAPTER FIVE

CHAPTER FIVE

PROBLEMS WITH URBAN RIVER MANAGEMENT

5.1 Introduction

Rivers are dynamic systems which respond in a balanced way to natural ranges of environmental variability (Luger and Davies, 1992). In a natural state, rivers can serve both an ecological and anthropogenic function. Ecologically, they are a natural, self-cleansing system with intricate food webs of micro-organisms, plants and animals (Luger and Davies, 1992). For humans, they are a vital source of water, aesthetically pleasing and can also aid in dealing with our wastes in limited quantities.

The Liesbeeck and Black Rivers are an example of two urban rivers which have been subjected to considerable modification and consequently have ceased many of the ecological functions associated with rivers. These rivers have been subjected to re-routing, canalization, and floodplain reclamation in an attempt to control flooding.

Flooding has been identified as the key constraining factor to land-use in the CA. This chapter highlights the problems of urban river management, with particular reference to the study area, and in doing so re-enforces hydrology as a key constraining factor to land-use. To begin with, flooding in urban areas has been exacerbated by modifications to the river system. Misguided attitudes and perceptions of the river and its surrounding environment have served to underestimate the power of rivers and discount their ecological function. Secondly, rivers are integrated dynamic systems which need to be managed holistically. Catchment management needs to be co-ordinated amongst all the local authorities. Thirdly, South African law fails to control the human activities which impinge negatively on rivers. Another problem associated with river management, is the difficulty associated with predicting floodlines accurately. And finally, the consequences of global warming also need to be addressed for future planning purposes.

5.2 Modifications to the River System

Historically, river banks were viewed as strategic areas for human settlement. In 1652, Jan van Riebeeck described the CA as an area where fishing, and hunting activities took place. The grasslands found alongside the Liesbeeck were viewed as land with the potential to cultivate. Settler development started in the study area with the establishment of Free Burgher farms along the banks of the Liesbeeck River system during the late 1650's. In an undeveloped environment, these settlements near the river were not problematic. Development on the floodplain in today's urbanized environment proves to be difficult with regards to flooding (Luger, *pers. comm.*)

Today, despite flood hazards, the aesthetic attributes of rivers encourage construction in floodprone areas. For example, there are many properties abutting the Liesbeeck River. And, residents have altered the course of the river, and in some instances have engineered the banks to gain more land (Luger and Davies, 1992). This interferes with the natural flow regime of the Liesbeeck, and hinders any attempt at managing the river.

Rivers have been modified to fit human needs. More specifically, an attempt has been made to mitigate against flooding. This humanist attitude is pointed out by Fuggle and Rabie (1992) stating that all water use, including that for purely environmental conservation purposes can only be justified if it is to serve human beings according to the Roman 'adage cum igitur hominum causa omne uis constitutum sit'. The canalization of the Liesbeeck River began in the 1940's in order to manage the flooding (Luger and Davies, 1992).

Canalization and channelization have occurred extensively in both the Liesbeeck and Black River systems. This engineering solution to controlling the floods, has had profound effects on the natural function of both the rivers. Canalization and straightening of meanders destroys the beauty, recreational and ecological value of rivers. In addition, canalization may alleviate flood risk along one section of river, but may pose high risk in sections downstream. Hence, structures previously built in flood free zones may become subjected to floods (Luger, *pers. comm.*).

Also, canalization increases the velocity of the water in the rivers hence scouring the river beds which in turn increases the sediment load deposited downstream where the velocity decreases. In the Black River this is a problem which consequently requires the dredging of the river twice a year. Canalization seems to be short term solution to a long term problem. This is especially true since river catchments in urban areas are constantly changing, hence requiring a more comprehensive approach to controlling the floods.

Luger and Davies (1992) attribute this river modification to a lack of education, coupled with bad planning. Furthermore, a lack of understanding of the ecological, and economic value of river systems has promoted planning and development on riparian land which takes little cognizance of the implications of these actions. This lack of understanding, has resulted in superfluous building close to the river, and on the floodplain, which has had profound implications on river management.

5.3 Catchment Management

5.3.1. Activities in the Catchment Affecting River Management

Stormwater run-off, sedimentation and erosion arising from the catchment all contribute to the quality and quantity of water in the river. Flooding is directly influenced by the activities occurring the catchment area.

As urbanization continues, the hardening of the catchment increases the probability of floods, and is a threat to the stability of the river. Flood regimes are altered as the land is transformed from its natural, vegetated state, to a hard, paved surface, thereby preventing infiltration and promoting run-off (Alexander, 1993). This has an exacerbatory effect on flood peaks and promotes flooding downstream.

In relation to the CA, the Black River catchment anticipates further urbanization (Baseline Document, 1994). Consequently, the flood regime experienced in this area will be increased. Floodplain and river management clearly cannot occur in isolated patches, rather, the river channel must be viewed as a functioning, interlinking whole.

Erosion in the catchment promotes sedimentation of the river. This has an effect on the aquatic life and on the flow of the river. In relation to the study area, the Black River receives a high sediment input from the Vygekraal River, which drains the sandy Cape Flats (Baseline Document, 1994). This lowers the channel velocities of the Black River, thereby promoting flooding. Furthermore, the silting up of the river favours the growth of waterplants such as *Potamogeton pectinatus*. Hence the Black River is severely affected by the activities in the upper catchment.

5.3.2. Administrative Difficulties

Holistic catchment management is difficult to achieve when there are multiple authorities involved in the management of a river. This is especially true of the Black River, which passes through many municipalities. A lack of co-ordination amongst these municipalities becomes problematic, as the management of the Black River lies in the jurisdiction of the municipality it passes through. The Elsieskraal, a tributary of the Black River for example, was canalized against the advice of Cape Town City Council (CCC) in order to control flooding in the municipality of Goodwood (Baseline Document, 1994). To alleviate flooding downstream of Goodwood, the CCC was forced to further canalize the Elsieskraal to where it meets the Vygekraal. This lack of co-operation between municipalities degrades the natural function of the river, and increases flooding downstream.

In addition, there is a great need to consolidate river management within a municipality under one administrative unit. At present, in the Cape Town Metropolitan Area, there is great fragmentation with regards to the control of catchments within a municipality. For example, the Department of Roads, Forests, Parks and Gardens, Stormwater and Sewerage and Town Planning are all involved in the management of the river in one respect or another. These departments proceed to manage the river with little co-operation between them, thereby impeding integrated, holistic control of catchments.

Therefore, fragmentation between departments should be addressed, and co-operation and understanding encouraged. In New South Wales for example, the prime responsibility for

local planning and land management rests with local government. However, because integration of engineering and planning factors is a complex process and requires the input of specialised technical knowledge, local government is assisted by federal government authorities. Using the example of New South Wales, flood management is co-ordinated between several local departments, but assistance is also given from the federal government.

Johannesburg also recognizes the problems of several different authorities managing sections of the river. Accordingly, they have formed the Co-ordinating Committee for Community Open Space (COCCOS). This group was formed in 1977 and has the following objectives:

- (a) to deal with stormwater management and problems of stormwater runoff;
- (b) to conserve river courses;
- (c) to develop recreational and educational potential of rivers.

COCCOS is an umbrella organization which has local authorities as members.

Clearly, co-ordination between municipalities, and within municipalities, is a key factor in promoting integrated holistic management of the Black River. To facilitate this holistic, integrated approach to management, legal support is necessary.

5.4 Inadequacies in the Legal Framework Governing River Management

The South African legal framework fails to govern many of the activities which negatively impinge on the natural functioning of rivers. Present legal provisions do not adequately prohibit development in flood prone areas, or activities in the catchment which may result in the degradation of the system.

Stormwater runoff has a profound influence on the river flow and thus on flooding. The Water Act 54 of 1956 categorizes urban stormwater as 'private' water. Hence, the rights and responsibility of use and disposal of private water rest with the owner of the land on which the water is found. This becomes problematic as the relationship between stormwater runoff

and river flow or floods is not addressed in this act (Wiseman and Sowman, 1991), leaving the onus on the owner of the land to regulate stormwater disposal.

The Cape Province however does attempt to address stormwater management principles through the Municipal Ordinance 20 of 1974, the former Divisional Council Ordinance 18 of 1976 and the Land Use Planning Ordinance 15 of 1985 (Wiseman and Sowman, 1991). The Municipal Ordinance 20 of 1974 grants local authorities in the Cape the power to “drain stormwater.. into any natural watercourse and to pay compensation to any person suffering damage in consequence” . This ordinance also fails to address the possible effects of stormwater on river hydrology.

The Land Use Planning Ordinance 15 of 1985 attempts to address the problems associated with increasing urbanisation in the river catchment by means of recommendations in the “Blue Book” which contains technical guidelines for developers and local authorities (Wiseman, *pers.comm.*). Among other things, the Blue Book advocates forward planning in relation to stormwater management by recommending the preparation of master drainage plans for a river and for the design of catchment area stormwater management systems (Wiseman, 1990). The implementation of these guidelines is often overlooked as responsibility for enforcing these guidelines is not clearly defined. As previously discussed, there are very few local authorities who have jurisdiction over an entire river catchment. Also, local authorities may fail to ensure that design principles in the guidelines have been properly adhered to.

The law is not stringent in relation to development on flood prone areas. In 1975, Section 169A of the Water Act specified that limitations should be placed on what activities could be undertaken in areas below the 1:50 year flood line (Alexander, 1993). In 1978, the act was amended and the designated floodline reduced to 1:20 years (Alexander, 1993), symbolizing a regression in the legal power to control development in flood prone areas.

Section 169A is intended to alert the relevant authority to the danger of flooding by requiring that the 1:20 year floodline be shown on the relevant township layout plan (Alexander, 1993). In the Cape Province, the Cape Provincial Administration (CPA) requires the

inclusion of the 1:50 year floodline on the layout plan of proposals for the rezoning or subdivision of land (Wiseman and Sowman, 1991). These floodlines should be determined by a professional engineer or a land surveyor but are often intuitively drawn in. However, the local authority within the Cape Province is not obliged to adhere to the CPA policy (Wiseman and Sowman, 1991). In addition, a local authority has the right to permit development to take place on vulnerable land if an approved structure plan exists for the area.

In relation to the CA, the law fails to adequately control stormwater from the catchment. The Black River and its tributaries drain a considerable area of the Cape Flats. The Liesbeeck River drains Claremont, Newlands, Rondebosch, Mowbray and Observatory. Expanding urban developments increase the amount of stormwater flowing into both the Black and Liesbeeck Rivers. However, since the Black River catchment area is less developed it is more susceptible to any future hardening of the catchment than the Liesbeeck area. Without legal provisions to abate the increase in runoff, there is a higher risk for flooding downstream. Thus, the implementation of environmental performance standards is warranted.

5.5 Difficulties Associated with Predicting Floodlines

The prediction of floodlines is dependent on many factors. The availability and reliability of flood data over a long period is required to feed into catchment modelling techniques. Further, Alexander (1993) points to other factors related to catchment characteristics and rainfall which determine the severity of a flood. These are:

- (a) Rainfall characteristics
- (b) Fixed catchment characteristics
- (c) Catchment processes
- (d) Antecedent moisture status

Rainfall characteristics

The magnitude and frequency of the flood are determined by the following rainfall characteristics; depth, area, duration and movement of storm rainfall (Alexander, 1993).

Fixed catchment characteristics

These characteristics include the size of the catchment and its slope, drainage system density, vegetative cover, and the direction of the catchment slope relative to the direction of movement of the severe rainfall producing systems.

Catchment processes

Catchment process which contribute directly to the flood peak include the potential infiltration rate, pondage and channel storage. The potential infiltration rate is directly related to the permeability and moisture content of the soil and it determines proportion of the rainfall that is available to generate runoff. The unevenness of the ground determines the proportion of surface runoff that gets trapped in pools which is the pondage. The proportion of the runoff that is necessary for the safe passage of the flood through the system is the channel storage.

Antecedent moisture status

The antecedent moisture status is the state of "wetness" of the catchment prior to the commencement of the rain. This determines the proportion of the rainfall that contributes to the flood peak since a drier catchment will allow greater infiltration.

The examination of these four characteristics in the catchment need to be completed in order to begin determining floodlines. As urbanization in the catchment continues, and global warming continues, these factors will change. Thus, floodlines are not static.

As there has been a lot of discussion of the flood peak magnitude, a discussion of it is warranted. The flood peak of a river or tributary is when the water overtops the banks. If a flood does not overtop the river bank in one particular area of the river, it can still pose a

threat to the lower catchment. Flood peaks in a river system are dangerously unpredictable as they may happen all at once, thus increasing the level of the flood downstream.

In the Black River system, the CA is affected by the flood peaks which occur upstream. If the flood peaks occur all at once, the severity of the flood could be much higher than originally determined. Thus, when predicting floodlines, flood peaks in the whole river system must be determined and this is very difficult task (Luger, *pers. comm.*).

5.6 The Greenhouse Effect

Since 1856, global mean temperatures have risen approximately 0.5 degrees centigrade (Hughes and Brundit, 1992). Although controversial, there is a likelihood that the observed global warming is due to an accumulation of the 'greenhouse gases' in the atmosphere. It is predicted that the greenhouse effect and the consequent global warming will have an effect on both the sea level and on weather patterns. This paper does not intend to argue as to whether or not global warming is actually occurring. Instead it serves to point out that the uncertainty regarding the effects of global warming add to the difficulty of making accurate prediction of floodlines.

In South Africa, model predictions of rainfall patterns suggest that there will be changes in weather regimes which will ultimately affect flooding regimes. Rainfall characteristics will change thereby introducing a higher degree of uncertainty to the predicted floodlines. Hewitson (*pers. comm.*) anticipates a greater frequency in storms. Also, as a result of a warmer atmosphere, global sea-level rise of up to 1 metre within the next century is expected (Hughes et al, 1993). And, South African tide-gauge records show that over the last 40 years, sea-level rise in South Africa is consistent with the world estimates. Hughes et al. (1993) have assessed the possible impacts of sea level rise on the Diep River/Rietvlei system in Cape Town. Their findings suggest that the channel banks and mouth area of an inlet are vulnerable to sea-level rise and that flooding events may be increased. The proximity of the Diep River System to the Salt River system suggests that similar events will be experienced in the CA due to its proximity to the Atlantic Ocean.

Presently, the CA is affected by the spring tides which force water back up the Salt River system into the Black and Liesbeeck Rivers (Baseline Document, 1994). This causes flooding in the lower Liesbeeck River which is further exacerbated if rainfall simultaneously occurs. With the increase in storm frequency, this flooding is likely to occur more often. Also, the slow but continuous rise in sea level will influence the approach to management of a river system due its unpredictability.

5.7 Management Strategies

There are many management strategies available for reducing flood risks of a river. Alexander (1993) outlines these options which include the do nothing option, moving residents to higher ground, building flood damage mitigation works, installing passive flood warning systems and/or active flood warning systems, and developing a community river watch system. Some of these are applicable to the CA while others are not relevant.

The do nothing option has minimal cost, and there is no technology required for its implementation. Moving residents to higher ground is not relevant within the study site as there are no residential areas in immediate danger of flooding.

The building of structural measures represents the hard engineering solution to the flooding problem. The purpose of structural measures is to reduce flood peaks (flood control dams), or protects areas from inundation (flood levees), or reduce flood levels (canalization). The reduction of flood levels would be most relevant to the CA in order to allow the land to be utilized for development needing construction. Thus land-uses such as residential or commercial could proceed with less hazard to floods and flood damage. The major disadvantage to the implementation of structural measures is the high cost. Also, these structural devices to control floods instill a false sense of security as the possibility of exceeding the design flood may occur (Alexander, 1993). Furthermore, the larger the flood, the less effective the flood protection measures. The difficulty of predicting accurate floodlines, could negate the advantages of implementing structural measures.

Passive flood warning systems, active warning systems and river watch systems are methods used in reducing the danger of flood in areas where structural damage and loss of life are probable. Because the flood prone area within the CA is mostly open space, these methods require no in-depth exploration at present.

Thus, the flooding in the CA could be controlled or reduced by means of the engineering solutions discussed. This would allow for structures to be built within the present 1:50 year floodline thereby increasing the potential land-uses in the CA. However, there are several disadvantages to the implementation of these structural measures. The high financial cost of using these methods, is a key constraining factor in light of the present situation in South Africa, where meeting the basic needs of the population (shelter, jobs and food) are priorities. Furthermore, these structures by no means guarantee safety from floods. Experience in the USA and elsewhere show that flood plain development is usually intensified after protection is provided (Alexander, 1993). This consequently increases the property vulnerable to flood damage as flood mitigation works cannot be economically designed to provide protection against all conceivable flood magnitudes (Alexander, 1993). The probability of floods exceeding the predicted return time is shown in Appendix 3. The do nothing option is no longer available to the CA as the river systems have already been degraded to the point where management is essential. An integrated, holistic management strategy is needed for the CA.

5.8 Discussion

There are many variables which affect urban river management thus making it a difficult task. To summarize, the modification of the Black and Liesbeeck Rivers has served to discount their inherent value, resulting in a degraded system. Development close to the banks have resulted in piecemeal solutions to flooding such as canalization and channelization, which has exacerbated the flooding problems in some areas. The absence of integrated catchment management is another problem which undermines the goal of flood control in the Black and Liesbeeck River. River systems must be managed with a view of them as a whole, interlinking system. The lack of legal backing in preventing development in flood prone areas and integrated stormwater management is yet another barrier to

overcome in urban river management. Without appropriate legal mechanisms to enforce integrated river management, it is difficult to get co-operation from both developers and local authorities. Even with a change in attitude, proper management and appropriate legal backing, the factors which influence floodlines are not static thus rendering them somewhat insignificant over time. The possibility of global warming increases this notion of unpredictability.

Clearly, land-use proposals in the CA must address the problem of flooding first as it is difficult to mitigate against, or control the flooding of the river, and engineering solutions are too expensive. The proposed widening of the Black River represents a temporary solution to an everchanging problem. Further, aside from changing the dynamics of the river, this widening will have other grave consequences for the Raapenberg Bird Sanctuary. Land-use proposals must include 'worst-case scenarios' in order to be prudent against flooding and the consequences of flooding (see Chapter 5).

The following chapter will undertake an examination of the possible land-uses in the in light of hydrology being the key constraining factor to land-use. Attention is given to the land-uses below the 1:50 year floodline. Thereafter, a brief overview for land-uses in the remainder of the CA is assessed.

CHAPTER SIX

CHAPTER SIX

LAND-USE PROPOSALS FOR THE CA

6.1 Introduction

This chapter suggests land-uses for the CA in light of the key constraining factors. The hydrology of the CA emerges as the single most hazardous and thus constraining factor to future land-use. Thus the flood prone area is highlighted and concentrated on.

The flooding propensity of the land is the guiding factor which determines what land-use activities may be appropriate in these high risk areas and sets the stage as to what should take place around it. Suggestions for land-use outside the floodprone area are made in terms of compatibility to land-uses in the floodprone area.

6.2 Open Space as a Land-Use Option in the Flood Prone

6.2.1. Description of the Flood Prone Area

The flood prone area is shown in Map 3. The majority of this land is owned by the CCC, while Transnet owns the Liesbeeck Sportsgrounds which lies within the 1:5 year floodline. In the flood prone area the land is zoned mainly for Community Facilities Use and Public Open Space. Important natural features within the flood prone area include the Raapenberg Bird Sanctuary, the Palloti wetland, Rosenfontein wetland and the Varsvlei wetland. Areas that are above the 1:50 floodline are the Valkenberg Property, Maitland Gardens and the SAAO.

6.2.2. Rationale for Proposing Open Space

The problems of managing an urban river are outlined in Chapter 5. From this, it is concluded that the flooding of rivers is difficult to predict and control. The consequences of

flooding without prudent forward planning and setting in place mechanisms for controlling inappropriate land-use activities are far reaching.

Past experience demonstrates that flood losses can be grouped into several categories (Alexander, 1993). The following are a list of flood losses that could be relevant to the CA:

- loss of human life;
- destruction of built structures;
- disruption of services (water supply, electricity supply, sewage disposal, transportation networks);
- temporary or permanent damage to the environment due to erosion on the floodplain, erosion of river banks and the deposition of sediment;
- psychological stress suffered by those who have experienced flood loss, or who are exposed to potential flood loss;
- permanent or temporary loss of income by those directly or indirectly affected by flood damage;
- decreased value of property;
- costs of emergency rescue actions and temporary reinstatement of access and services, and
- costs to the community and taxpayers of flood damage relief schemes.

The amount of flood damage that can be expected is pivotal to the following three factors:

- losses in areas where there are no protection measures;
- losses in areas where local structural protection has been provided, and
- losses in areas downstream of major flood control works.

Clearly, there is a large element of risk involved in allowing development in or near the flood plain. And, different structures or developments on a floodplain have a different risk of failure when exposed to a particular flood event (Alexander, 1993). These risks according to Alexander (1993) are difficult to calculate hence the need to specify flood exceedance probabilities (floodlines) when specifying limits to development. The determination of an acceptable level of risk is a policy decision, not an engineering calculation. In the Cape Province, the designated flood line limiting development is the 1:50 year floodline (Wiseman

and Sowman, 1991). And, although this policy exists, local authorities need not adhere to it if a structure plan for the area already exists.

Future decisions regarding land-use options in the should respect this designated floodline which limits development below the 1:50 year floodline. The Council of the Environment (1988) recognizes that one of the functions of open space is to protect inhabitants from human-caused 'natural disasters' such as floods. This Council also supports the exclusion of development below the 1:50 year floodline. Boddington (1988) argues that as a general principle, sites which are inherently unsuitable for development (wetlands and river floodplains) should be set aside and managed as natural areas. While a principal reason for having open space in the case of the CA is for safety from flooding, there are other useful and valid reasons for having this open space. Boddington and Wall (1988) and Kruger (1987) point out several other justifications for open space in an urban environment.

Other Benefits Derived from Open Space

(a) Buffer Zones

Urban open space provides a buffer zone along major arterial routes and separates residential and industrial areas. In the CA, the open space serves this purpose well considering the 3 major roads which surround it. Open space attenuates the noise created by the surrounding automobile traffic which is problematic in the CA. Also, open space facilitates the absorption of dust and provides a visual relief from the surrounding built form. In doing so, open space promotes mental and physical well-being for nearby residents, makes the urban form more tolerable and improves the health of nearby residents.

By restricting development within the flood prone area, the wetlands may be protected. From a humanistic point of view, this allows flood peaks to be absorbed thereby reducing flood peaks downstream. Furthermore, wetlands filter out and settle sediments and nutrients from the river water thereby reducing the need for dredging. This is especially significant for the Black River which requires dredging semi-annually. Also, wetlands are a place where aquatic flora and fauna flourish providing interest for urban city dwellers. Traditionally, wetlands were viewed as breeding grounds for mosquitoes and subsequently filled ensuing

their destruction. Wetlands have disappeared at an alarming rate in the Western Cape. Open space in the CA would allow the retention of these wetlands.

(b) Ecological Reasons

Open space can exist beyond human needs, but for purely ecological reasons. It may preserve representative portions of remnant indigenous flora as found in the wetlands in the and thus allow continued survival of basic genetic material which protects the ecosystem from catastrophic decline. The continued survival of genetic material adds to the health of an ecosystem. McHarg (1967) describes a healthy ecosystem as being complex, diverse, stable, having a high number of species and low entropy. This is accomplished by safeguarding the ecological systems in urban open space (Council for the Environment, 1988) by ensuring the following:

- i) Affording protection to plants and animals. In the CA this would mean the protection of the avifauna and the indigenous flora found in the wetlands;
- ii) Affording protection to topographical features of ecological, scenic and recreational importance, especially those which are easily disturbed or destroyed by development. In the CA this would be the rivers and wetlands;
- iii) Including the systematic eradication of alien vegetation. This is an area which needs attention in the CA in order to promote the proliferation of indigenous flora, and
- iv) Providing for interconnection of open space through corridor spaces to facilitate fauna and flora migration. According to the Theory of Island Biogeography (MacArthur & Wilson, 1967), a green corridor in an urban setting would facilitate the 'rescue effect' which allows species from one reserve to re-habitate another close reserve in the case of a catastrophe. The designation of open space in the CA would allow for the Coast to Coast Greenway which would connect Table Bay in the north and False Bay in the south.

(c) Recreational Purposes

Open space can also cater for recreational needs. Presently, the houses a golf driving range the Raapenburg Bird Sanctuary and a walking trail. In the vicinity of the CA are a number of

sporting facilities, hence the CA does not demonstrate a need for sporting fields or arenas specifically. Further development could include playgrounds, an upgraded walking trail, picnic areas and water-based recreation (Boddington, 1985). This contributes to the general state of health and enjoyment of surrounding neighbourhoods, as well as to the general Metropolitan population by providing city dwellers with recreational opportunities.

(d) Educational Usage

Catering for educational needs is yet another justification to support the proposal that the area below 1:50 year floodline be used as open space. Playing fields provide places for school sports which promotes health and teamwork. The wetlands, and bird sanctuary allows for biological education. By simply having open space accessible to the public, citizens are educated about the value of open space. The Council of the Environment (1988) confirms that open space is a vast outdoor educational resource on the doorstep of the majority of the population and educational institutions.

Smuts (1986) states that environmental education must have the ultimate purpose of developing spiritual and intellectual appreciation for the environment. By creating open space in an urban environment, and promoting its various uses, a better knowledge and appreciation of the environment is achieved.

I&APs supporting the idea of the CA for educational purposes state that children could be educated about the history of the CA. Also, at a Metropolitan level, the CA provides an opportunity for environmental education in the city. Locally, schools from surrounding areas could use the CA as an outside classroom and school research projects. Some I&APs state that the CA presents an opportunity for educational institutions to be built.

(e) Aesthetic Reasons

Open space is useful for purely aesthetic reasons as well. It may preserve scenically beautiful sites, vistas and skylines. Site visits to the CA reveal a dramatic view of Table Mountain and Devil's Peak. Open space preserves the view for surrounding neighbourhoods and sets a mood for a recreational or relaxing atmosphere. Generally it gives visual relief

from the monotonous urban surrounds thereby contributing to the mental and psychological well-being of urban dwellers. The residential areas in and around the CA could benefit greatly from the open space as the surrounding area is primarily industrial and residential. Furthermore, as the CA is located at such a strategic point in relation to tourists arriving from the airport, the open space is a visually attractive land-use from a tourism point of view.

6.3 Environmentally Appropriate Activities for the Open Space Zone

Open space encompasses a variety of possible activities. Initially, it was thought that specific activity types would be proposed for each floodline depending on the environmental conditions within each floodline. For example, walking trails in the 1:5 area, picnic areas within the 1:20 year floodline and sports field within the 1:50 year floodline. However, the activities considered appropriate for the floodplain could withstand periodic inundation as no fixed structures are needed. Consequently, the activities proposed refer to the area below the 1:50 year floodlines as a whole.

6.3.1. Walking Trails

Walking trails create an opportunity for surrounding residents to appreciate nature in the city. Currently, the CA has a trail which is utilized primarily by the local population as a dog walking trail. The walking trail could be upgraded by incorporating the Raapenberg Bird Sanctuary and the historical buildings into the walk. The birdlife serves to enhance the natural quality of the environment while the historical buildings add an element of richness and education. Smuts (1986) supports the ideas of walking trails in an urban environment claiming that continuous open spaces are suited to hiking trails which have definite ecological and recreational advantages, and serve to enhance the urban landscape. Her statement is supported with the example of the Braamfontein Spruit Trail which, since its inauguration, has encouraged the development of green areas along urban streams and rivers for recreational use for the public. A walking trail in the CA would increase pedestrian traffic thereby alleviating the security concerns expressed by the I&APS.

6.3.2. Water Sports

Presently, the water quality of the Black River is too poor for recreational activities besides fishing. In Pietersburg (Northern Transvaal) many streams were transformed from polluted eyesores to attractive natural assets with good recreation opportunities. (Smuts, 1986). These streams were revived with the assistance of the general public who cleaned up the solid waste and aided with the eradication of alien vegetation. In the CA, the Friends of the Liesbeeck attempt to clear away the litter around the river. The Black River needs more than a general clean up of litter and alien vegetation. Special attention needs to be given to the improvement of the water quality. In doing so, the Black River would cater for water-based recreation. Some thoughts on the potential recreational uses include swimming, canoeing and paddle boat rentals.

6.3.3. Sports Field, Picnic Grounds and Market Gardening

Other possibilities for the open space zone are derived from the Greening Plan. Projects directly affecting the CA in this plan include a water related linear park Around the Liesbeeck Lake with hides, and interpretive centre linked to a nature trail and an island refuge for birds. Also envisaged in the Greening Plan was the Black River Parkland which incorporated picnic and braaivleis spots and riverside walks. Sports fields, along with a playground for children are other suitable activities which could take place in the CA. The planting of a medicine garden was suggested by an I&AP. This suggestion could be extended to include market gardening in the open space zone. However a thorough investigation into the fertility of soils in the floodprone area needs to be undertaken.

6.3.4. The CA as a Multiple-Use Park

By incorporating several types of open space into the , various levels of parks are created which cater for a variety of needs, both in a local and metropolitan context. An open space classification system is documented by Bannon (1976).

Neighbourhood parks: This park is normally the focal point in neighbourhood. It is within walking distance and caters for all the children's activities. By providing a playground with slides, swings and jungle gyms, children from the nearby Maitland Gardens would be able to enjoy this type of a park.

Community parks: These parks serve several neighbourhoods and cater for family recreation. Various sports fields are provided, as well as opportunities for passive recreation. By using the open space for sports fields, picnic areas and a walking trail, the communities of Observatory, Salt River and Woodstock would also enjoy the benefits of open space.

Metropolitan parks: These parks are mostly resource oriented and provide opportunities for boating, swimming, picnicking, and camping. If a reserve oriented facility is not available, a regional sports complex can fulfil the same role. If the water quality is improved the Black River could offer opportunities for paddle boating, and swimming. Thus this open space would serve a metropolitan recreational need.

Wayside parks: Stopover areas which are provided along major arterial routes. The would be a classic example of this type of a park considering its proximity to Settlers Way. It would provide a pleasant stopover for quick picnics or tea in the Rosedale Country Coffee Shop.

Special Activity Area: Included in this category are golf courses, municipal pools and indoor recreational centres. Golf courses require large tracts of land and are often developed along rivers, while pools and recreation centres can be located near shopping centres to strengthen the focal point already created by the shopping centres. The open space in the CA would fulfil the requirements of this park as it presently hosts a golf driving range.

By implementing several usages or types of parks within the open space, the CA succeeds in catering to a variety of neighbourhood, community and metropolitan recreational needs.

6.4 Open Space: Issues Needing Attention:

The current state of the would not be acceptable for many of the open space activities suggested. The following are some suggestions which would improve the aesthetic appearance of the CA making it appropriate for recreation, education, and conservation.

1) Eradication of alien vegetation:

This would enhance the CA from an ecological perspective. If colonization of indigenous flora is promoted, this area could act as a corridor for the movement and survival of plants in an urban setting hence promoting the 'rescue effect'.

2) Plant trees:

The planting of indigenous trees would serve many purposes. Strategic planning and planting of trees could serve as a wind barrier in some areas. Trees also improve soil conditions, urban hydrology, increase the quantity and diversity of urban wildlife, reduce extremes in micro-climates and reduce air pollution (Kruger, 1988). These functions are relevant to the CA. Finally, trees will increase the aesthetic appeal of the study site.

3) Clean up the litter:

Site visits reveal that there is a litter problem within the flood prone area which detracts from the aesthetic appeal of the site. Although 'Friends of the Liesbeeck' attempt to solve this litter problem, extensive cleaning will have to take place in order to make the area more suited to open space and recreation.

4) Improve water quality:

Since the water quality at present does not allow for water contact sports, this will have to be improved. This task may prove more difficult than the other suggestions, but will have to be done even over a longer period of time. Improving the water quality will simultaneously alleviate the unpleasant odours that are present around the river.

6.5 Attitudes of I&APs to Open Space

In relation to having open space as a land use in the CA I&APs have several encouraging comments. The following are derived from Table 14 in the Baseline Document (1994):

- the CA was historically an open space and should therefore be retained as such;
- people in urban environments have a need for therapeutic environments;
- CA is important for local residents in an increasingly dense surrounding environment;
- is an important visual open space;
- southern suburbs are already fully developed and open spaces are therefore needed;
- Cape Town has too little open and recreational space, and
- Vincent Pallotti Hospital requires a peaceful environment.

I&APs also view the open space in the CA as having Metropolitan, as well as local significance. They state that there is a need for a green lung in Cape Town, and the Coast to Coast greenway is an important concept. Furthermore, they feel that there are few greenbelts in Cape Town.

The positive input from I&APs in regards to opens space in the CA points to a need and a want for this land-use proposal. Furthermore it fulfils the requirement of assessing the communities needs from I&AP input advocated by IEM.

The Council for the Environment (1988) recognizes the importance of the timely provision of adequate natural open space as a vital element within the built environment. It further states that without the provision of adequate natural areas the environmental and living quality of our cities will rapidly deteriorate. The creation of open space in the CA is in keeping with the Councils suggestions. Also, by planning open space in the floodprone area first, then addressing the surrounding area in terms of other land-uses that are compatible to open space, the idea of SLOAP (space left over after planning) is abolished. This form of planning detracts from the meaningful functional, physical and visual integration of open space into the overall urban structure.

6.6 Compatible Land-Uses in the Confluence Periphery

Given that the area below the 1:50 year floodline would be open space, land-uses in the surrounding area should pay attention to compatibility. The four land-uses that will be discussed include residential, commercial, industrial and special use. These categories are derived from the Floodplain Development Manual for the New South Wales Government (1986).

6.6.1. Residential

Residential development refers to houses, duplexes, flats, units and homes for the aged (New South Wales Government, 1986). Given that the population in the greater Cape Town area is predicted to increase by 60% by the year 2000 (Boddington, 1985), there will be a need for residential development. In addition, this increased population will be young, poor and poorly educated, requiring shelter and other basic survival needs. Hence, the development of low-cost housing is a desirable option, in order to accommodate the requirements of the projected increase in population. Further, the development of low-cost housing near the CBD would aid in deterring urban sprawl, and allow for the low income population to reside closer to the city centre rather than the outskirts of the city. Hence, the provision of low-cost housing would serve to aid in alleviating the inconveniences and inefficiencies inherent to the South African city.

Currently, there is single dwelling residential zoning on the land owned by CCC and presently occupied by the Golf Driving Range. The majority of this land falls into the flood prone area and therefore the development of this piece of land for residential purposes would not be wise. Residential use would be ideal in parts of the Valkenberg area. Site visits have shown that there are areas within the Valkenberg property that are under used and run down. However, this land is owned by the Department of Community Development, and the land in this area would have to be acquired which could prove to be expensive. In addition, there are some I&APs who see the relocation of the Valkenberg and the Alexandra Rehabilitation Hospital as preferred options in order to accommodate alternative land-uses in the future.

The inclusion of housing in the would be consistent with the needs of the nation, and the region in the new South Africa. Furthermore, the IMDF also advocates the provision of housing as a major thrust for the Cape Town area. "At a time when South African cities are under so much pressure to provide improved facilities for those least able to afford to pay for them, the conflict between 'natural areas' and 'development' in urban areas needs to be investigated (Council of the Environment, 1988, p.6). The CA offers a unique opportunity to bring these two conflicting needs together. Open space would be complementary to a residential area by providing recreational facilities. Residential development could also increase pedestrian traffic in the area thereby improving the security of the area.

I&APs agree that housing is a feasible land-use in the CA. They state that housing is needed close to the CBD and that the CA would offers potential for low-cost housing without disturbing the natural environment. Furthermore, if Valkenberg Hospital is relocated the area could be used for housing.

6.6.2. Industrial Use

Industrial use refers to all industrial related activities including factories, engineering workshops, garages, warehouses and the like (New South Wales Government, 1986). Industrial use in the should be limited for several reasons. To begin with there is currently no zoning for industry in the CA. Secondly, since the CA exists in the 'Smokeless Zone', great care will have to be taken to ensure that present air pollution readings are not increased. Finally, industrial use is less compatible with open space than other land-use possibilities (i.e. residential) at it would detract from the ambience of the open space.

I&APs have no direct comment in relation to the establishing of industry in the area. They do however state that air pollution in the must be controlled.

6.6.3. Commercial Use

Commercial use refers to shops, offices hotels and motels (New South Wales Government, 1986). Presently, there are two small parcels of land in the CA zoned General Business and General Business. General Commercial land is located on the western edge of the study site adjacent to the Black River Parkway. As this area is quite heavily developed at present, it would not be problematic to keep this area for commercial use. The General Business Area presently houses the Rosedale Country Coffee Shop. A site visit reveals that this land-use is very compatible with the open space.

Further commercial development which could be suggested for the area includes hot dog vendors and perhaps a small tuck shop in the open space area. This small commercial venture would serve to create jobs, service the public while visiting the open space, and improve security without detracting from the character of the open space.

I&APs have no comments in relation to commercial land-use in the CA.

6.6.4. Special Use

This type of use includes hospitals, schools, public halls, churches, police and fire stations, telephone exchanges, electricity sub-stations, water and sewerage works (New South Wales Government, 1986).

Currently the CA has the Valkenberg Hospital, Vincent Pallotti Hospital, and Alexandra Care and Rehabilitation Centre as special usages. Further special usages which may be required in light of other development include the various infrastructural elements mentioned.

The South African Astronomical Observatory (SAAO) is another special use in the CA. If access to the public was improved this land-use would be quite compatible with the open space of the CA. Since the SAAO is one of the oldest scientific institutions in South Africa,

it would serve to enrich the historical flavour of the area and thus enhance the educational potential.

In relation to special use, some I&APs state that the location of the Valkenberg Hospital is questionable. If the hospital is relocated, the land could be used as a venue for an educational centre for the local community.

6.7 Summary of Land-Use Proposals

The idea of multi-functional use is a key concept when looking at land-uses in the CA. Open space should be the designated land-use for the areas below the 1:50 year floodline. Within this open space many types of recreation could take place thus serving to enhance not only the surrounding area but the metropole in general.

Other land-uses in the CA should be judged in relation to their compatibility with open space and of course taking I&AP comment into consideration.

Since the majority of the land outside the floodlines is presently occupied, the relocation of Valkenberg hospital is desirable so as to make room for alternate land-uses. The land-uses that would be compatible in this area would be residential. The provision of low-cost housing would be consistent with the IMDF and some of the I&APs opinions.

Industrial land-use should be discouraged, as it does not serve well with open space, while small commercial ventures could enhance the open space environment.

6.8 Practical Considerations

The main land-use proposal for the CA in light of the key constraining factor of hydrology is open space. Residential and some commercial use are also favoured. However, there are practical considerations which may impinge on the optimal land-uses suggested.

Ownership and zoning are two considerations which may impede the proposed land-uses. For example, the Liesbeeck Sportsgrounds are owned by Transnet. This land would have to be acquired from Transnet in order to use it as open space. This could prove to be expensive if the land has to be purchased.

Areas within the Valkenberg property have been identified as ideal for residential purposes and perhaps educational institutions. Currently, the land is occupied and the issue of ownership and purchase arises once again.

CHAPTER SEVEN

CHAPTER SEVEN

CONCLUSIONS & RECOMMENDATIONS

7.1 Conclusions: A Fulfilment of Aims and Objectives

The primary objective of this study was to synthesize and evaluate the environmental factors influencing land-use planning in the CA. By adhering to the principles underpinning the IEM procedure this environmental evaluation was undertaken. An investigation of the physical, biological, social, economic, cultural, and historical environment was completed in order to gain insight into factors that would constrain land-use in the CA. In keeping with the IEM procedure, I&APs were consulted with a view to gaining an understanding of their needs and incorporating public concerns into the decision making process.

An evaluation of the environmental components was done by assessing whether or not the factor could be easily mitigated. In light of this evaluation, hydrology was identified as the key constraining factor to land-use, thus fulfilling the objective of identifying the key constraining factor to land-use.

Another objective of this dissertation was to integrate the IEM and land-use planning procedures in order to provide a greater understanding of the key constraining factors associated with the CA to an ongoing planning process. By using the IEM procedure to evaluate environmental components, the following land-use considerations have been addressed:

- (a) The use or uses to which land can (or should) be put;
- (b) The interaction between multiple-uses of the same piece of land, and the cumulative interaction of these with the environment, and
- (c) The juxtaposition and spatial interaction with land use(s) on adjacent and nearby pieces of land. The investigation of these factors reveal that hydrology is the key constraining factor to land-use in the CA.

Having incorporated IEM into the land-use planning process, environmentally sound land-use options have been proposed before any development proposal actually takes place.

The recommendations that follow are given in light of hydrology being the key constraining factor to land-use. Metropolitan and local need are also addressed.

7.2 Recommendations

7.2.1. Open Space

The area below the 1:50 year floodline should be designated as open space. Although hard engineering solutions such as canalization are possible, these solutions are too expensive, destroy the ecology of the river and are short term. The unpredictability associated with designated floodlines warrants a more prudent approach to flood management.

The designation of this land for open space has advantages aside from offering human safety. It offers both local and metropolitan residents an area for recreation and environmental education. Aesthetically, the area is made more appealing for the surrounding neighbourhoods as well as passers by on the highway. This is especially significant for tourists arriving from the airport, as the N2 highway passes the .

Ecologically, the area fulfils many functions. Presently, there are a number of bird species that frequent the wetland in the area as well as indigenous reed sand grasses that should be protected. Furthermore, if the alien species were removed from this area, it could facilitate the 'rescue effect' for indigenous flora and fauna.

In terms of recreation, this open space has the potential to cater to a variety of recreational needs. The types of recreational usage that could be promoted in this area would serve a much broader population than just the local neighbourhoods. Appropriate recreational planning, could transform the CA into an open space utilized by the Metropolitan area.

Educationally, the open space area would serve to promote an appreciation for nature. Furthermore, the ecological processes of nature, and the birdlife in the wetlands would serve well for day trips by schools.

Finally, the creation of open space adds to the quality of life for residents in an urban setting. This is especially true since the area around the CA is very dense.

By having open space in the CA, many issues raised by the I&APs could be resolved. Needing some form of maintenance, open space creates job opportunities. Also, if small commercial ventures are undertaken within the open space, other jobs could also be created. By designating this area as open space and managing it as such, security problems raised by the I&APs could be attenuated. Also, river management would become a priority in order to keep the area aesthetically pleasing. Water quality would have to be improved as well as terrestrial pollution abated.

The management of the open space, as well as the funding of it are issues that will have to be properly addressed. Some ideas suggested by I&APs for the management of this space include the 'user pays' principle. Others suggest that local communities should have the responsibility to manage open space. Also, a few restaurants in the CA could generate the revenue needed to manage the area as open space.

The location of various activities within the open space would need proper planning. A multi-disciplinary team would be most appropriate in order to ensure that the ecological processes of the area are not undermined. Landscapers would be to make the area aesthetically pleasing.

7.2.2. Compatible Land-uses

The designation of open space in the centre of the study site guides the the remainder of land-use options in the CA. Currently, the majority of the land outside the 1:50 year floodline is already developed, thus leaving little available land for other land-uses. There relocation of the Valkenberg hospital is a desired option for many of the I&APs. If

relocation occurred the land would be opened up for many other land-use options. At present, there is a considerable part of Valkenberg which is under-utilized. The buildings stand empty and are run down. If this area was available, residential, commercial and industrial uses could be considered.

(a) Residential

Firstly, the residential option proves to be the most desirable for many reasons. In light of the need for housing both regionally and nationally, low cost housing would be suited to this area. Some I&APs agree that this area is suited for housing due to its closeness to the CBD. This would put residents close to the work area. Furthermore, residential use is compatible with the open space. The two uses compliment each other as residents will have access to open space and recreation and the residential neighbourhood could potentially offer more security in terms of more people being present.

If residential use were to take place, noise barriers would have to be constructed in order to ensure less psychological stress. Noise barriers may have to be constructed in areas where the ambience of the open space is destroyed by highway traffic noises.

(b) Commercial

Commercial use is not needed as much as housing. Thus, it should not be considered as a major land-use option except for in smaller parcels of the CA. The vicinity of the Rosenfontein tearoom is already zoned general business and could benefit from the addition of other small businesses. This could be an art gallery or perhaps another restaurant. commercial use could also take place in the area zoned commercial next to the Black River Parkway.

(c) Industrial

Industrial use should be discouraged in the CA for many reasons. The main reason being the incompatibility of industrial usage with open space. Also, any industrial use in the CA would have to consider the 'Smokeless Zone' which the CA rests in. Moreover, there is currently no industrial zoning at present.

These suggestions are made based on the information gathered from the baseline document. However there are key issues outstanding which will influence the land-use options for the . These issues include the outcome of the C-BR study. Whether or not Valkenberg is fixed in its present location is also another issue to be resolved. Pivotal to the open space working well is the co-operation of the present landowners. SAAO would have to be approached in order to ensure that improved public access occurs.

Also, the outcome of the catchment modelling may bring about new information on the behaviour of floods and could potentially alter the floodlines as they are presently designated. In relation to the river, the proposed river widening may change the whole look of the CA in the vicinity of the Raapenberg Bird Sanctuary. The Raapenberg Bird Sanctuary may have to be relocated consequently which could have implications for the layout of the open space.

A thorough geotechnical survey would have to take place in order to determine bearing capacities of the soils for construction purposes. This will determine the height of buildings which will have implications for the number of people housed in a residential area. Since low cost housing advocates a high density of people living in one place, bearing capacities may influence this. An analysis of soil fertility would also be helpful. This could have implications for small market gardening ventures which may serve to create some jobs and perhaps educate. The toxicity of the soil should also be tested in the Liesbeeck Sportsgrounds area.

Aside from the issue of the various types of development that could occur, or leaving the area as open space, the issue of river management needs to be urgently addressed. There are many aspects that could improve urban river management. The following are a few suggestions.

Aside from the hard core engineering solutions such as canalization and detention dams, there are other proactive methods of urban river management. These include a change in the way rivers are viewed both by the public and local authorities. This will prevent the

modifications which have served to degrade them. Most importantly, improved catchment management is needed. One umbrella organization is needed to handle issues such as erosion, canalization, and stormwater runoff. This will help to alleviate the disjunct river management which had Goodwood Municipality canalize the Elsieskraal River despite the objections of the CCC. Examples may be taken both from Johannesburg's COCCOS and the New South Wales government.

Areas which need attention are the outcome of the C-BR study which will influence land-use in the CA. Further recommendations for the CA include a complete IEM for any future development proposals.

7.3. Areas of Further Study

The following areas need attention with regard to future land-use in the CA:

- a thorough investigation of the bearing capacities of the soil;
- an investigation into the fertility of the soil in order to assess agricultural potential, and
- methods for improving accessibility to the CA.

Finally, it is recommended that any future development proposal in the CA undergo a thorough IEM.

Having suggested a multi-use open space near a high density, low-income area would set a precedent of South African cities. Socio-economically disadvantaged people would have direct access to environmental education and recreation facilities. This would be in keeping with the changes that are needed in the post-Apartheid era.

GLOSSARY

GLOSSARY

baseline information: the totality of all relevant information prior to the process of submitting it to a critical analysis and evaluation.

biophysical: a category that includes both biological component (e.g. fauna and flora) and physical components (e.g. climate, hydrology and topography).

canalization: the concrete lining of the banks and the bed of the river.

chain referral: a system whereby identified I&APs nominate unidentified I&APs.

channelization: the extension of a river by the creation of an earth channel

conservation: protection from destructive influences. A term applied in general to the positive work of maintenance, enhancement and wise management, of reducing the rate of consumptions to avoid irrevocable depletion, in order to benefit posterity (i.e. the conservation of nature or historical buildings)

development: any form of land-use change (i.e. infrastructural change); or the act of causing growth, expansion, realization of what had formerly been potential.

environment: the biophysical and socio-economic elements.

eutrophic: "well nourished", with an excess of plant nutrients.

greenway: a continuous system of open spaces consisting of large parks, all the way through to components such as tree lined roads which act as linking corridors.

Integrated Environmental Management (IEM): a philosophy that prescribes a code of practice for ensuring that environmental considerations are integrated into all stages of the development process to achieve a desirable balance between conservation and development.

Interested and Affected Parties (I&APs): individuals or groups concerned with an activity and its consequences.

interfluvium: the area of land between two rivers.

inversion: an increase of atmospheric temperature with height.

land-use planning: the demarcation of land for specific uses, usually (but not necessarily) over an extensive area, based on environmental, social and economic criteria, which takes into account present and possible future needs.

local authority: a municipality or a division, or any other local authority established by law.

metropolitan: refers to the Greater Cape Town agglomeration of municipalities and other local authorities.

Metropolitan Open Space System (MOSS): a linked and integrated system of open spaces within a city.

open space: this refers to land that has not been built on, (i.e. vleis, wetlands, river, mountains, street verges and other undeveloped and vacant land).

palaeartic: the region that includes Europe and northern Asia, together with Africa north of the Sahara.

Peninsula Mountain Chain: the spine of mountains extending from Cape Town to Cape Point.

planning: a method for outlining or defining goals and ways of achieving them, or the drawing-up and implementation of a plan or land-use plan.

retention dam: a constructed facility to accommodate excess or flood water.

rezoning: the alteration of a zoning scheme in order to effect a change of zoning in relation to a particular piece of land.

Smokeless Zone: the area extending from Groote Schuur Hospital along the N2 freeway to the Black River Parkway, along the Parkway to central Cape Town through Camps Bay. This area has stricter air pollution standards than the rest of the city.

South African Railway Commuter Corporation (SARCC): This came into existence in 1989, when SATS was divided, and a State corporation was established. It controls the railway networks (lines around the stations) in all South African cities.

state land: this refers to the land owned by the State, and maintained for use by the general public.

structure plan: planning documents that stem from the Land Use Planning Ordinance No. 15 of 1985 (LUPO). LUPO defines the general purpose of these plans as follows: "To lay down guidelines for the future spatial development of an area in such a way as will most effectively promote the general welfare of the community concerned". Structure plans are not legally binding.

trace metal: a metal that occurs at a concentration of less than 1000 ppm in the earth's crust.

Transnet: Transnet came into existence in 1989, when SATS was divided. It is a private company, with the State being the largest shareholder. It controls the goods section of the former SATS property, and portions of land in-and-around railway stations in South Africa. The company administers a number of associated bodies, i.e. Propnet, Spoornet, and Portnet.

urban sprawl: the continuous outward growth of urban areas. This results in the non-urban surroundings being slowly converted to urban areas, often resulting in the loss of important agricultural land.

waders: long-legged birds that wade in shallow waters.

zone: land set apart by a zoning scheme for a particular zoning, irrespective of whether it comprises one or more land units or part of a land unit.

zoning: a category of directions setting out the purpose for which land may be used and the land-use restrictions applicable in respect of the said category of directions, as determined by the relevant "Zoning Scheme".

zoning schemes: control mechanisms of lanuse in particualr area, consisting of scheme regulations and a register with or without a zoning map.

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APPENDIX ONE

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APPENDIX TWO



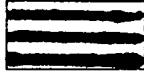
Malmesbury Shale Outcrop



Fill, Reclaimed Land



Greywacke and Quartzitic sandstone

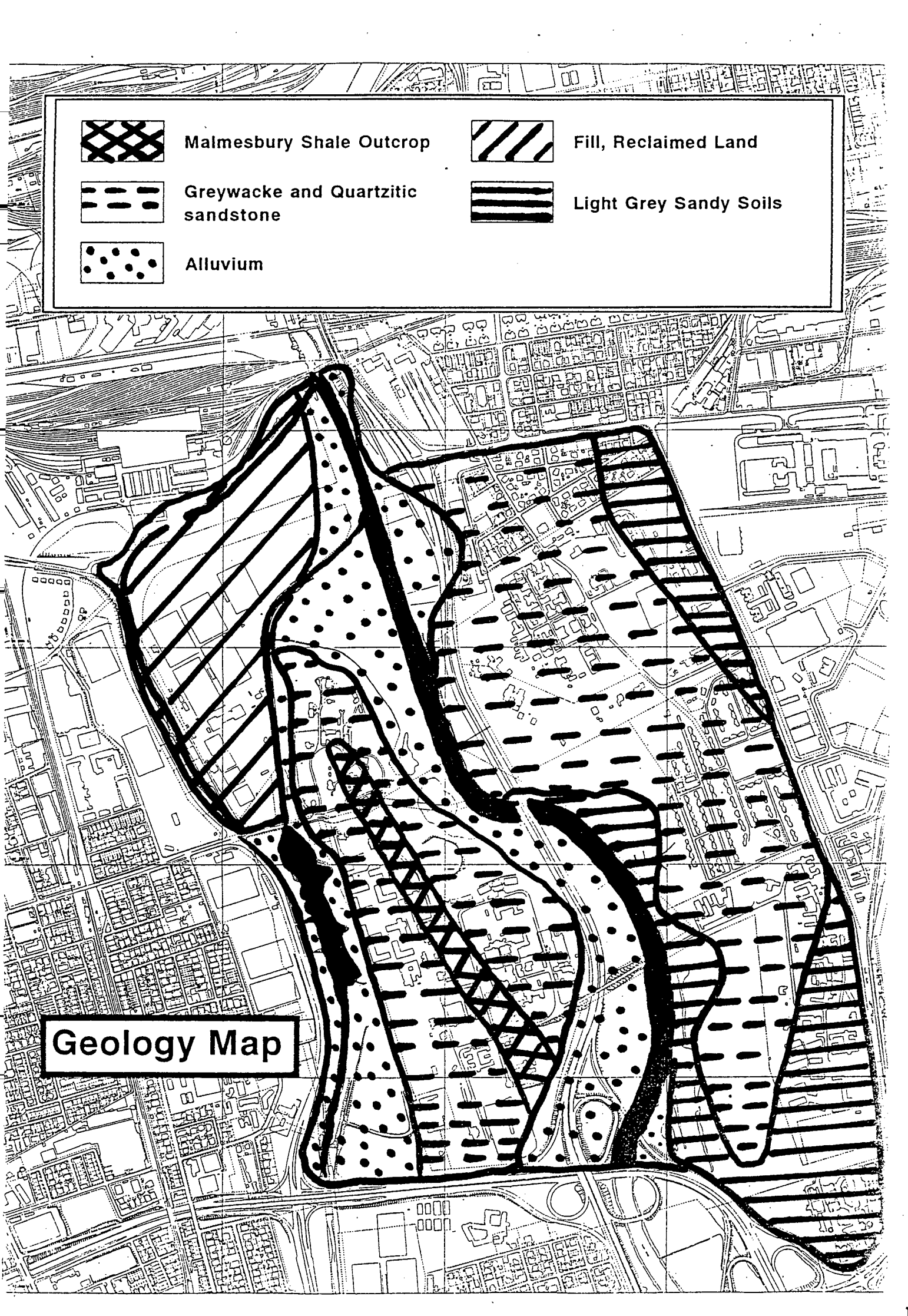


Light Grey Sandy Soils



Alluvium

Geology Map



APPENDIX THREE

EXCEEDANCE PROBABILITIES

Return period T in years for given design life L and permissible exceedance probability r .								
r	$L = 1$	2	5	10	20	25	50	100
99 %	0	1,1	1,7	2,7	4,9	6	11,4	22,2
95 %	1,1	1,3	2,2	3,9	7,2	8,9	17,2	33,9
90 %	1,1	1,5	2,7	4,9	9,2	11,4	22,2	43,9
75 %	1,3	2	4,1	7,7	14,9	18,6	36,6	72,6
50 %	2	3,4	7,7	14,9	29,4	36,6	72,6	145
33 %	3	5,5	12,9	25,2	49,9	62,1	124	247
25 %	4	7,5	17,9	35,3	70	87,3	174	348
20 %	5	9,5	22,9	45,3	90,1	113	225	449
10 %	10	19,5	48	95,4	190	238	475	950
5 %	20	39,5	98	195	390	488	975	1950
2 %	50	99	248	495	990	1238	2476	4951
1 %	100	200	498	995	1990	2488	4977	9953

Table 8.1 Percentage probability r that an event of given return period T will be exceeded at least once during the design life L years.									
T	$L = 1$	2	5	10	15	20	25	50	100
10	10	19	41	65	79	88	93	99,5	99,9
20	5	10	23	40	54	64	72	92	99,4
50	2	4	10	18	26	33	40	64	87
100	1	2	5	10	14	18	22	40	63
200	0.5	1	2	5	7	10	12	22	39
500	0.2	0.4	1	2	3	4	5	10	18
1000	0.1	0.2	1.5	1.2	1.5	2	2	5	10