CAPE METROPOLITAN COUNCIL
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IBHUNGA LOLAWULO LWENQILA YEKAPA

STRUCTURE PLAN FOR MINING

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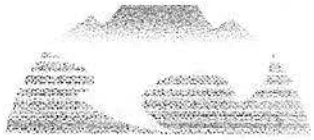
PLANNING, ENVIRONMENT & HOUSING DIRECTORATE

SPATIAL PLANNING

STRUCTURE PLAN
FOR
MINING

in the
Cape Metropolitan Area and portions of
West Coast and Winelands areas

prepared for



Cape Metropolitan Council

and the

Metropolitan Local Councils

Winelands District Council

West Coast District Council

prepared by

DUXBURYS

TOWN AND REGIONAL PLANNERS • PROFESSIONAL LAND SURVEYORS

in association with

COASTEC
coastal and environmental consultants

COMMON GROUND CONSULTING

MJ MOUNTAIN & PARTNERS
engineering geological and geotechnical consultants

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Cover: Alpha Stone and Readymix

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ACRONYMS AND ABBREVIATIONS

CBO	Community-based Organisation
CMA	Cape Metropolitan Area
CMC	Cape Metropolitan Council
CMR	Cape Metropolitan Region
DA	Department of Agriculture
DECAS	Department of Environmental and Cultural Affairs and Sport
DME	Department of Mineral and Energy Affairs
ECA	Environmental Conservation Act
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EMPR	Environmental Management Programme Report
I&AP's	Interested and Affected Parties
IEM	Integrated Environmental Management
LUPO	Land Use Planning Ordinance
MLC	Metropolitan Local Council
MOSS	Metropolitan Open Space System
MSDF	Metropolitan Spatial Development Framework
NRA	Natural Resource Accounting
PIGO	Problems, Issues, Goals and Objectives
SEA	Strategic Environmental Assessment
SOE	State of Environment
WCPDA	Western Cape Planning and Development Act
WDC	Winelands District Council
UNCED	United Nations Conference on Environment and Development

1. EXECUTIVE SUMMARY

The Cape Metropolitan Council (CMC) in consultation with the local authorities in the study area has appointed consultants to prepare a Structure Plan for Mining in the Cape Metropolitan Area (CMA) and adjoining West Coast and Winelands areas.

The primary aim of this study is to assist local authorities with decision-making regarding applications for land-use changes for mining. In addition, management guidelines (to support this function) are provided.

The Structure Plan has followed a conventional planning process of technical studies, a scoping (public participation) process leading to goals and objectives, which in turn have informed the policy and management proposals. A steering committee that includes representatives from local authorities, provincial and government departments and consultants is overseeing the progress of the project.

The CMC first appointed consultants in April 1998 to prepare a Structure Plan for Sand Mining only. The process for that plan had progressed some way before Council then decided to expand the study to look at all minerals in the same study area. For this reason there was a certain amount of what might appear to be repetition in the public participation processes.

A Problems, Issues, Goals and Objectives for Sand Mining report was produced in April 1999. Apart from encapsulating the issues raised by Interested and Affected Parties, the report also included detailed reports related to the sand resource by Geologists and Environmentalists. An overview of the information from that study has been included in this report (and its Annexures). Readers requiring more detailed information (particularly relating to the geology specialist report on sand, and the public participation) should however refer to the Sand Mining document.

Legislative provisions concerning mining are briefly studied. There are existing statutory mechanisms in place to deal with mining. There are however problems at the levels of co-ordination between the various authorities, as well as in monitoring and enforcing compliance with the relevant legislation. Stakeholders have also pointed out that the involvement of local communities (employment, participation in decision-making, etc.) is not yet adequately addressed.

Spatial and land-use planning in the study area is represented by numerous planning frameworks and structure plans. Approved overarching planning is still represented by the Urban Structure Plans or Guide Plan (approved in terms of the Physical Planning Act in 1981 and 1988). It has been the intention that these be replaced by the Metropolitan Spatial Development Framework (MSDF) when approved by the Provincial Government. It is, however, more likely that the MSDF will be incorporated into the Spatial Framework of the Unicity's Integrated Development Plan (IDP). The provisions made for mining in the above Plans or Framework are explored.

The primary source for the geological investigation was existing data on the geology and the occurrence of mineral resources in the study area. Using mainly aerial photo interpretation, this has been refined to allow for a more detailed map (at a scale of 1:10 000) of the mineral resources to be compiled. This is available in a digital format, and forms part of the CMC's Geographic Information Systems (GIS) database.

Only known mineral resources are reported on in the existing literature. Extrapolations have however been made to indicate areas favourable for the possible mining of minerals. The most important construction minerals present in the area are:

- Stone (coarse aggregate); gravel; building sand (fine aggregate); and dimension (building) stone.

The most important industrial minerals found in the area are, in order of decreasing importance:

- Kaolin; silica (glass) sand; brick clay; ball clay; and phosphate.

Small occurrences of manganese, copper, tin, tungsten, gold and silver have been mined in the area in the past. It is however unlikely that the large-scale exploitation of these minerals will ever occur.

The mineral resources of the study area have also been interpreted and classified in accordance with a number of criteria, in order to assist decision-making. The following criteria were used:

- Geological conditions
- The potential economic resource (i.e. the type of mineral or rock)
- The economic importance of the resource over time
- The usual method used for excavation (i.e. short-term impacts), and
- The physical end result of mining (i.e. long-term impacts)

The classification information is included in the digital mineral resources map attributes. Economic importance is a particularly relevant criteria when considering the alternative use of land where a mineral may be present. A table to provide recommendations in this regard is provided.

The aim of the botanical/environmental input is to provide an overview of the general ecology and conservation status of the study area, to rate the various ecosystems and vegetation formations on the basis of conservation importance, and to develop management guidelines (where impacts on the environment are anticipated).

The study included literature and site surveys. Information on vegetation within the Cape Metropolitan Area was adapted from the recently-completed CMC Environmental Significance Mapping study.

For the first time ever maps showing the comparison of the original, versus the remaining natural vegetation in the area have been produced. A very low 21.9% of the original vegetation (with only 16.2% being of good quality) remains. It is concluded that the Cape Lowlands vegetation (this covers the entire study area) is one of the most threatened and under-conserved regions in South Africa. Sand Plain Fynbos, for example, which occurs along the West Coast and adjacent inland plains, is critically threatened, and can be regarded as a Red Data vegetation type.

The botanical study has enabled recommendations to be made regarding vegetation types that should not be disturbed, as well as regarding the impact mining would have on the remaining vegetation in the study area.

A key is provided for determining site rarity and conservation importance. This key can be applied to the consideration of land for mining or any other land-use.

Existing information and mapping of agricultural potential and intensity is provided as one of the "layers" that must influence decision-making regarding mining.

An overview is provided of the input received from the Interested and Affected Parties (I & AP's). A list of relevant problems and issues that should be addressed in this study is based upon this input. Comments from the planning team are included as "editorial" input where necessary, in order to focus the process on the terms of reference for this study. Finally, a set of concise goals and objectives for the study are formulated.

The proposals and recommendations of this Structure Plan include various land-use policy recommendations. These include clearly definable (from a spatial perspective) policies, such as the delineation of areas where mining (or in fact any land-use other than conservation) should not be permitted, as well as areas where high priority mineral resources occur and where mining should consequently be given precedence until the resources are exhausted.

Decision-making regarding mining in areas other than those highlighted above is facilitated by a set of guidelines supported by tables, and the digital GIS-based databases compiled for this study.

Whilst this Structure Plan provides a strategic overview of environmental considerations, the recommendation is nevertheless made that site-specific Environmental Impact Assessments (EIA) be required for all land-use applications for mining. EIA should be carried out in terms of Integrated Environmental Management (IEM) procedures. The need for such studies is underlined by the fact that the current legal requirements for mining applications (e.g. the permitting system in terms of the Mineral Act) are not fully in accordance with IEM procedures. The exceptionally high bio-diversity of individual sites and areas in the study area further re-inforces this need.

The digital databases (showing for example the minerals, vegetation and other data and attributes in map form) can be viewed on the CD that has been compiled for this project, or on request at the GIS section of the Spatial Planning Department of the CMC. A copy of a free viewer program is included on the CD. Site-specific views (or maps) can be generated, as the minerals and vegetation maps have been prepared at a scale of 1:10 000.

A set of management guidelines related to mining are included, dealing with the mitigation of potential impacts that mining and its related activities could have on the natural environment.

Finally various general recommendations are made, including the urgent need to achieve integration of the processes for applying for, and approving requests to mine. Recommendations for other necessary studies are also made.

The report consists of two parts: Volume 1 (the main text), and Volume 2 consisting of the Annexures. Volume 2 is a very bulky document with many fold-out colour plans, lists of data, etc. For this reason the distribution of Volume 2 is being limited. Queries regarding the Annexures should be addressed to the Spatial Planning Department of the CMC.

2. INTRODUCTION

2.1 Background

The Cape Metropolitan Council (CMC) in consultation with the local authorities in the study area has appointed consultants to prepare a Structure Plan for Mining in the Cape Metropolitan Area (CMA) and adjoining West Coast and Winelands areas (**Figure 1**). The team consists of :

- DUXBURYS: Town Planners and project co-ordinators
- M. J. Mountain and Partners: Geological and geotechnical consultants
- Coastec: Environmental consultants
- Common Ground Consulting: Public participation facilitation

This report sets out the results of the various specialist studies and public participation processes conducted for this project, as well as the findings, recommendations and proposals of this Structure Plan.

Prior to the decision to prepare a Structure Plan for **Mining**, a similar initiative to prepare a Structure Plan for **Sand Mining** only had been underway since April 1998. Part-way through the process for that Plan, Council decided to broaden the scope of the investigations to include the consideration of all the minerals in the study area.

The Sand Mining project had progressed to the stage that a comprehensive geological survey of the sand resource has been completed, as well as an overview of the environmental sensitivity of the main areas suitable for sand mining. A draft Problems, Issues, Goals and Objectives (PIGO) report had also been prepared and has been made available for scrutiny by stakeholders. The local authorities in the study area are able to use this report to provide interim assistance with decision-making (in line with the aims of the project, which are similar to that outlined in Section 2.2 below). Finally, a report providing comments by the planning team on issues raised by stakeholders in response to the Sand Mining PIGO report has been prepared and distributed.

The two mining studies share a number of common issues, as well as a considerable amount of base data. This report provides an overview of all the available data, but **does not however repeat all the information contained in the draft Sand Mining reports**. Copies of the latter are available on request.

2.2 The Study Area

The study area has been defined by the CMC on the basis of purely practical considerations and not on any detailed or scientific study. Topography (particularly mountain ranges, which influence transportation costs) and distance from the CMR are some of the criteria considered. The study area stretches westwards from the Hottentots Holland – Franschhoek – Drakenstein – Elandskloof mountain chains, and southwards from an east-west line just to the north of the towns of Darling and Riebeeck Kasteel, to the Atlantic and False Bay coasts respectively (**Figure 1**). This is the same area studied for the Sand Mining Structure Plan project.

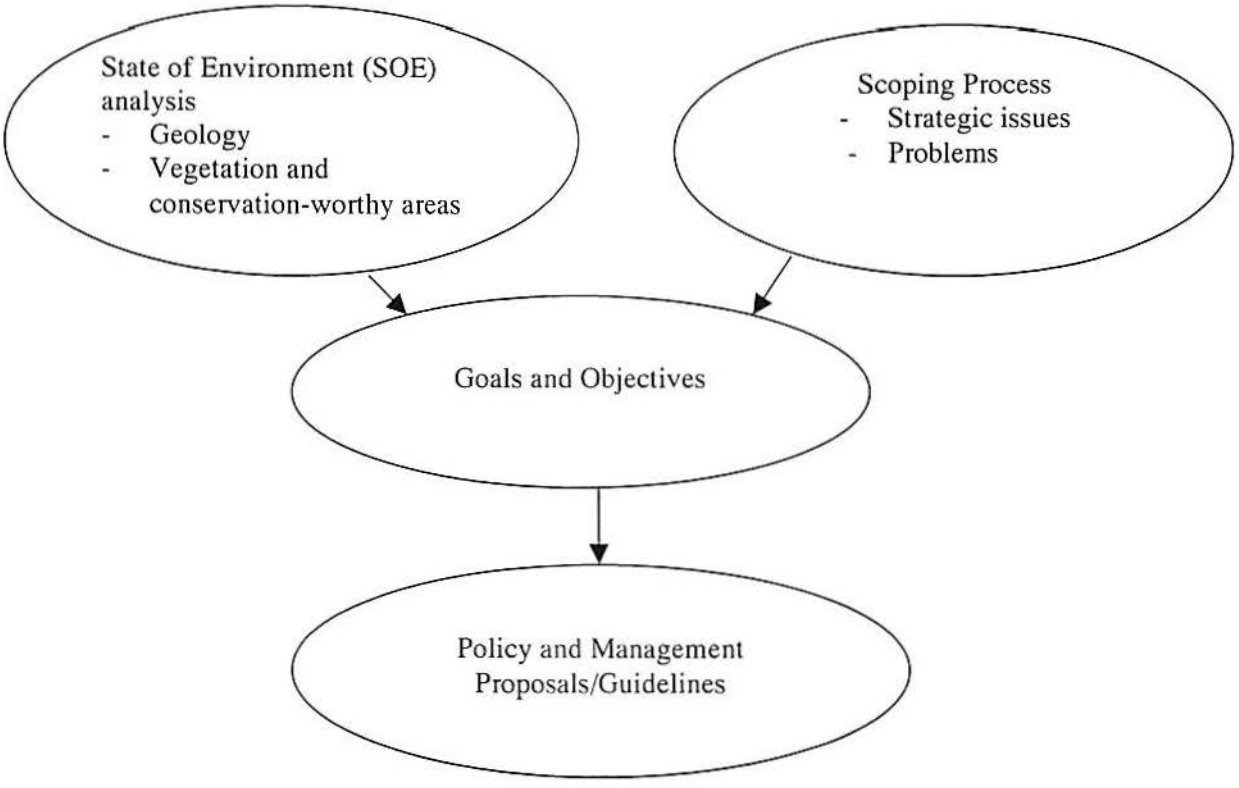
2.3 The Aim of the Structure Plan

The Structure Plan for Mining is being prepared in terms of current land-use legislation, namely the Land Use Planning Ordinance (Ord. No. 15 of 1985 - LUPO), or the Western Cape Planning and Development Act No. 7 of 1999, which will replace LUPO. As such the primary thrust of the Structure Plan is the appropriate use of land, keeping in mind the overall goal of improving the quality of life of the inhabitants of the area under consideration. The Structure Plan can be used as a tool to assist in assessing the merits of applications for mining and other related land-uses in terms of current land-use legislation (as noted above).

Secondly, in the process of conducting the necessary surveys and studies for this project (as well as through the inputs received from I&AP's), certain problems and issues related to the impacts that mining could have on the environment have been identified. Recommendations on suitable measures for addressing and mitigating these are made where feasible. These will include guidelines which address aspects of the management as well as of the rehabilitation of mines. The guidelines can assist in formulating conditions that can be attached to approvals in terms of the above legislation. The emphasis in terms of management issues is on potential impacts on the environment, and does not deal with operational and other technical aspects of mining. In addition, recommendations that would be relevant to authorities other than the CMC and the MLC's (such as Government Departments and legislators) are also made.

2.4 The Planning Process

The process for the project is based upon a logical series of steps, which can be illustrated as follows:



Interim reports have been produced at various key stages of the process, to provide the primary means of informing and soliciting meaningful feedback from I&AP's.

A technical steering committee has overseen the progress of the project. This committee included representatives from the following bodies:

- Cape Nature Conservation,
- CMC Environmental Management,
- CMC Spatial Planning,
- The Botanical Society,
- The Consultants (as listed above),
- The Council for Geoscience,
- The local authorities in the planning area,
- Department of Agriculture: Resource Conservation,
- Department of Minerals and Energy,
- Provincial Administration: Western Cape,
- West Coast District Council, and
- Winelands District Council.

This committee met on a regular basis in order to review and monitor progress.

2.5 The Scope of the Project

The extent and nature of the work to be carried out for this project was determined by the CMC in consultation with the local authorities in the study area. These decisions were informed by the identified need for a product as described above, as well as normal constraints on time and other resources. Apart from the town planning and land-use-related input, specialist input included studies by geology/soil specialists, public participation facilitators, and environmentalist/botanists.

The geological input provides information on the location, extent and quality of the available mineral resources, as well as a prioritisation of the deposits. Because of the extent of the study area, the geological work is based on the interpretation of available literature and reports, with improved detail being achieved by means of aerial photo interpretation. This work reports on what is known and cannot comment on resources that have yet to be found because of being buried. Extrapolations have, however, been made from existing data to indicate areas where there is a significant probability that the exploitation of mineral resources may still take place.

The environmental input provides (amongst others) an indication of the botanical and conservation status and importance of the study area (with emphasis on those portions of the study area where exploitable mineral deposits occur, or are expected to occur).

To aid decision-making, the following products have been generated:

- Maps indicating not only the location of the most important known mineral deposits but also giving an indication of the relative importance (i.e. a prioritisation) of the deposits. Prioritisation is based upon a number of criteria, including the estimated economic importance, quantities and qualities of deposits, and the impacts known methods of mining will have on the potential post-mining use of the areas to be mined.

- Maps showing the relative conservation importance of the natural vegetation in areas that could be mined.

- Maps showing the relative importance of agricultural land in the study area in terms of agricultural potential and the intensity of agricultural use (i.e. agricultural infrastructure investment).

- Apart from the agricultural potential, the above mapping has mostly been compiled at a scale of 1:10 000. The scale of the printed maps that accompany this report is however such that the precise position of individual sites relative to the mapped information is difficult to determine accurately. As the final digital maps have been captured by the GIS section of the CMC Spatial Planning Department, accurate hard copy enlargements of the mapping relative to sites in

question can be produced by that section. This will enable decision-makers to assess individual sites that are the subject of land-use applications on the basis of the above mapping (together with the tables or matrices referred to below). To further aid decision-making, overlays of the above maps could be produced where feasible. The above are also available on compact disk and on the internet for independent use by those that are appropriately equipped.

- The above maps are supported by this report which includes tables and policy recommendations to guide decision-making, because multiple criteria need to be considered. Within the broad priority categories there will also inevitably be finer detail variations and, where possible, these are described, or at least alluded to. Environmental sensitivity for a specific site is also a characteristic that often occurs in too fine detail to be mapped at the scale of the entire study area. This aspect is therefore also described in the report text.

- Finally, the report includes recommendations regarding:

  - management guidelines for the operation and the rehabilitation of mines, principally related to where the natural environment may be impacted,

  - issues that should be addressed in Environmental Impact Assessments that will be required as part of applications for land-use permission to mine,

  - possible improvements in the legislative and/or public administrative environments where problems or issues have been identified, and

  - land-use policy guidelines.

3. LEGISLATIVE PROVISIONS FOR MINING

3.1 International Trends

A brief research of examples of legislation affecting surface mining in the United States of America, Australia and New Zealand reveals that generally very comprehensive control of such activities is provided for in these countries. Particularly noticeable are the strong control over the environmental impacts associated with mining operations and the establishment of substantial measures to enforce compliance with environmental management plans (which include comprehensive post-mining rehabilitation measures).

It is also noticeable that, although the economic importance of mining is recognised, this is not given precedence over environmental concerns. These countries generally place the control of environment issues in the hands of a strong public agency with considerable executive power. This is a particularly noticeable departure from the local situation, where control over environmental concerns is vested with many different bodies, authorities and Government Departments. Mining is also excluded from the control of the conservation body that currently oversees environmental impact assessment activities.

3.2 National and Provincial Legislation

The intention in this section is to provide only an overview of relevant legislation. It is not a goal of this Structure Plan to provide an in-depth analysis of the legislation affecting mining.

3.2.1 Relevant Legislation

There are various Acts of Parliament which currently make provision for, or seek to exercise a certain amount of control over, or affect mining. The following is some of the relevant legislation:

The Water Act, No. 54 of 1956

The Precious Stones Act, No. 73 of 1964

The Strategic Mineral Resource Development Act, No. 88 of 1964

The Mine Health and Safety Act, No. 29 of 1996

The Mining Titles Registration Act, No. 16 of 1967

The Mining Rights Act, No. 20 of 1967

The Mineral Laws Supplementary Act, No. 10 of 1975

The Conservation of Agricultural Resources Act, No. 43 of 1983

Environment Conservation Act (ECA), No. 73 of 1989

The Minerals Act, No. 50 of 1991

The Physical Planning Act, No. 125 of 1991

The National Environmental Management Act (NEMA), No. 107 of 1998.

The above Acts should be read in conjunction with the various regulations brought out in terms thereof, as well as the various amendment Acts.

Although the Development Facilitation Act (Act No. 67 of 1995 - DFA) has not been adopted in the Western Cape, the "General Principles for Land Development" of the DFA apply nationally, and also inform the local Planning and Development Act. Apart from the principle of the optimum utilisation of resources, the DFA does not specifically impact on Mining.

At the Provincial level, the following Ordinances (among others) are relevant when considering mining:

The Cape Nature and Environmental Conservation Ordinance (Ordinance 19 of 1974), and:

The Land Use Planning Ordinance (Ordinance 15 of 1985 – LUPO).

The last-mentioned Ordinance is expected to be replaced by the Western Cape Planning and Development Act No 7 of 1999 (WCPDA). There are also various regulations brought out in terms of the Provincial legislation.

3.2.2 Administration of Relevant Legislation

- The **Department of Minerals and Energy** (DME) is responsible for the implementation of the **Minerals Act**, Act no. 50 of 1991. The Act regulates, *inter alia*, the prospecting for and the optimal exploitation of minerals, as well as the utilisation and rehabilitation of the surface of land during and after prospecting and mining operations.

  The Minerals Act provides for the issuing of permits for mining. Applicants who wish to mine must apply to the DME and must provide the following information:

  - Proof of the legal right of the applicant to the mineral deposit.
  - Particulars of the manner in which the applicant intends to prospect and rehabilitate the disturbances of the surface.
  - Particulars of the applicant's ability to carry out the above.
  - The manner and scale of the intended mining operation.
  - The presence or availability of the mineral at the subject site.

  Applicants for a permit to mine are also required to submit an Environmental Management Programme (EMP). An EMP is supposed to be preceded by a process where the nature and dynamics of the pre-prospecting or pre- mining environment are investigated, where the impacts of such an activity on the environment are investigated, and the nature, extent and significance of such impacts are quantified and assessed. The process is also supposed to include full I&AP involvement. The process as prescribed is substantially similar to the requirements for an Environmental Impact Assessment (EIA) in terms of the Environmental Conservation Act in terms of principles, and technical and functional nature. The primary difference is that of the relevant controlling authority. Mining EMP's are administered by DME, which does not have as its primary function the protection of the environment (as is the case with DECAS).

  In processing applications for mining permits, the DME contacts various other authorities for comment or input. These can include the:

  - Department of Agriculture
  - Department of Water Affairs and Forestry

- Western Cape Nature Conservation Board
- Relevant local authority (Municipality or District Council)

I&AP's representing some of the local authorities have reported the sentiment that their comments are not always taken into account by DME in the issuing of mining permits.

- The **Department of Environmental and Cultural Affairs and Sport (DECAS)** is responsible for the administration of the **Environmental Conservation Act (ECA)**, No 73 of 1989. **The Environmental Impact Management unit** of DECAS is currently the delegated authority responsible for implementing the regulations brought out in terms of this Act for the carrying out of Scoping and/or Environmental Impact Assessment (EIA) Reports for various listed activities.

  Included in Regulation R1183 brought out on 5 September 1997 in terms of Section 21 of the ECA, is a list of activities identified by the Minister "that may have a detrimental effect on the environment". These include changes of land-use from **agricultural** use, **undetermined** use, or land used for nature conservation or zoned open space to **any other use**. The majority of current and potential mining operations in the study area fall into these categories. The regulations provide for a detailed process (including a scoping process and possibly an environmental impact assessment) that must be followed in consultation with the Environmental Impact Management Unit (DECAS).

  Although the intention to identify mining as a separate activity in terms of Section 21 of the Act was already published in the Government Gazette of 4 May 1994, mining was excluded from the provisions of the ECA due to concerns that there would be duplication of environmental management requirements (i.e. in terms both the ECA and the Minerals Act). A decision regarding the identification of mining and mining related activities in terms of the ECA is being held in abeyance until bilateral discussions between DECAS and the Department of Minerals and Energy have been finalised. As at the date of this report, it is understood that these discussions have not yet been completed.

  Compliance with these environmental regulations is separate to, and apart from, any other statutory requirements that may be applicable (such as applying for a mining permit, and for the correct zoning or land-use consent or departure). There are, however, negotiations currently under way regarding the administrative coordination of the requirements for applications in terms of LUPO and the Environmental Conservation Act. The goal is to rationalise the statutory development conditions and requirements to which a developer, including the developer of a mine, is subject in terms of both the Act and the Ordinance.

- The **Conservation of Agricultural Resources** Act, No 43 of 1983 provides, *inter alia,* for the regulation of the utilisation of agricultural resources. The goals of this Act include the promotion of the conservation of soil, water resources, and vegetation, as well as the combating of weeds and invader plants. The **Department of Agriculture** (DA) or a Conservation Advisory Board administers this Act.

  When applications to the DME for mining permits are referred to the DA, this latter Department usually provides recommendations regarding the surface area of land that may be opened for mining before the rehabilitation thereof must take place. The DA is also able to make input regarding the need for and the scope of an EIA, as well as regarding the determination of the depth to which mining should take place.

The monitoring of mining operations is conducted by extension officers of the DA for their areas of jurisdiction. It is reported, however, that this monitoring does not take place at present on a regular basis.

A provision of the Act that impacts upon the right to mine is that a permit from the DA is required before **any natural veld may be disturbed or utilised for any other use**. Applications for such a permit are evaluated on the basis of various criteria such as slopes, the rarity of the flora, the agricultural potential of the soils, and the viability of satisfactory rehabilitation, etc.

- The **Department of Regional and Land Affairs** is responsible for the implementation of the **Physical Planning Act**, No 125 of 1991. Among other provisions, this Act provides for the preparation of Regional and Urban Structure Plans. These Structure Plans were previously known as Guide Plans, and are not to be confused with Structure Plans provided for in the Land Use Planning Ordinance (LUPO), No. 85 of 1985 (the present Mining Structure Plan is of the latter category). The Physical Planning Act places a prohibition on land-uses that are not consistent with an approved (or duly amended) Structure Plan. Structure Plans prepared in terms of LUPO do not give or take away any rights to land, but provide only a guideline for authorities concerned with approving developments and changes in land-use.

  It is relevant to note that, in terms of Section 27(2) of the Act, **mining activities** are **excluded** from the provisions of this legislation.

3.3 Local Authorities and Zoning Scheme Regulations

Zoning Scheme regulations are currently prepared or adopted by the local authorities in the study area in terms of LUPO (similar provisions for "land-use management" are made in the WCPDA). The regulations are concerned with controlling or managing the uses permitted on land. The zoning schemes include a listing of the various zoning categories, in addition to sets of regulations attached to each zoning category. In terms of LUPO (as well as the provisions of the WCPDA), no land may be utilised in a way or manner that is contrary to the zoning thereof, nor to the provisions of the relevant regulations.

The various local authorities in the study area make use of zoning scheme regulations that are mostly based upon the "standard" set of regulations prepared by the Provincial Administration in terms of LUPO. The West Coast and Winelands District Councils use the standard regulations prepared in terms of Section 8 of LUPO. The other local authorities use their own schemes that are adapted to suit local circumstances.

In this study area, only the Winelands and West Coast District Councils provide for a separate zone category ("Industry III") for mining. The other municipalities generally treat mining as a departure (this is usually a temporary permission, subject to a fixed time period), or as a conditional or consent use over and above the existing zoning of the property concerned. The officials of the two District Councils prefer, however, to also make use of the departure approach, as opposed to allocating new zonings to mines. This is due to the finite time period usually attached to the active life of a mine. In addition, the granting of rights for a limited time period provides an opportunity to review the operation and its impacts before allowing the activity to continue.

3.4 Concluding Observations

From the above, it is clear that there are already a number of legal mechanisms governing and affecting the decision -making process on whether mining should or should not take place at any given location. These mechanisms include:

- The requirement for a Scoping or an EIA Report in terms of the Environment Conservation Act regulations (although mining is at present excluded from these provisions),
- The requirement in terms of LUPO (soon the WCPDA) for Councils (and in cases of appeals, the Provincial Minister of Planning) to consider the merits of all land-use changes, and
- The requirement for a permit to be obtained from the Department of Agriculture to disturb any natural veld.

These statutory provisions are however not fully integrated with the DME process of issuing a mining permit. I&AP's have suggested in their input to this project that mines in the study area are sometimes established on the basis of a mining permit in terms of the Minerals Act without any of the above additional provisions being complied with. It is possible that this situation is partly due to an apparent lack of consensus among the various authorities concerned regarding a common vision or goal for mining, as well as the appropriate treatment or use of land where mineral deposits are located. This is being addressed at present by a "**Mining Environmental Forum**". This group meets every second month, and consists of representatives of DME, the CMC, DECAS, DWAF, Department of Agriculture, District Councils, the Botanical Society, WC Nature Conservation Board, etc. This Structure Plan should also provide an information basis for negotiating such consensus.

4. SPATIAL PLANNING BACKGROUND

4.1 Introduction

Numerous Structure Plans and Spatial Development Frameworks have been prepared, are in preparation, or are being revised for various portions of the study area. Such plans that have been prepared in terms the Land Use Planning Ordinance (LUPO) are relatively flexible, in that they do not give or take away rights to land. A review of the hundreds of planning initiatives in the study area would consequently prove a fruitless exercise. Instead, the recommendation is made that the findings of this Structure Plan should inform the other spatial planning frameworks in the study area, where applicable.

Statutory plans affecting the area are, at present, represented by the Urban Structure Plans (as discussed above). These were formerly known as Guide Plans, prepared and approved in terms of the Physical Planning Act, No. 88 of 1967. Relevant to the study area is the Cape Metropolitan Area Urban Structure Plan (1988): "Volume 1: Peninsula" and "Volume 3: Hottentots Holland Basin", as well as the 1981 "Atlantis and Environs Urban Structure Plan". The Draft Metropolitan Spatial Development Framework (MSDF – see **Figure 2**) has been advertised for public comment with a view to approval in terms of LUPO. The intention has been to withdraw the Urban Structure Plans, either in total (Peninsula and Hottentots Holland plans), or in part (the portion of the Atlantis and Environs Plan that falls within the Cape Metropolitan Area), once the "Statutory MSDF" is approved. It is, however, more likely that the MSDF will be incorporated into the Spatial Framework of the Unicity's Integrated Development Plan (IDP). It is also likely that an Integrated Spatial Plan will be approved by the Unicity as a Sectoral Plan in terms of the Western Cape Planning and Development Act. The Urban Structure Plans (Guide Plans) will, however, still need to be withdrawn.

Until such time as the Urban Structure Plans are withdrawn, they will remain legally applicable. In terms of Section 27 of the Physical Planning Act (no. 125 of 1991) no approval for a rezoning, departure, subdivision, or any other application, may be given that is not consistent with the Regional and Urban Structure Plans. This implies that an amendment of the Urban Structure Plan is required before, or together with, a decision regarding an application for a change of land-use, if such application is not consistent with the Structure Plan. This underlines the point made in Section 3.2.2 that Structure Plans prepared in terms of LUPO do not have the status of the Urban or Regional Structure Plans prepared in terms of the Physical Planning Act.

4.2 Provisions for Mining: Urban Structure Plans

- Volume 1: Peninsula

  This Urban Structure Plan has a designation for mining on its map, namely "Minerals and Construction Materials". Section 2.4 indicates that the following areas are designated for the exploitation of minerals and construction materials:

  a) The Tygerberg area (stone) – excluding buffer zone;

  b) The silica (glass sand) deposits in the Philippi Horticulture Area;

  c) Open-cast mining in the sand dunes in the Philippi Area, provided that mining is not lower than the general surface level of the surrounding area;

  d) Kaolin in the Noordhoek area;

  e) Exploitation and processing in any area covered in the Structure Plan provided that it is consistent with the general guidelines of the Structure Plan, accompanied by a motivation stating that the operation will have minimum impact on the environment, will not have conflict with other land-uses, and the operation will not create air pollution problems in residential areas;

f) The areas indicated for exploitation, along with the buffer areas, may also be used for nature conservation and agricultural purposes to the extent that they are consistent with exploitation activities.

The Urban Structure Plan also notes that the former Department of Planning and the Environment has indicated the following areas where a construction material industry may be established in the future:

a) The Tygerberg area (stone)

b) The Eerste River/Faure areas (stone)

c) The Paarl area (stone and clay)

d) The Koelenhof/Bottelary area (clay)

e) The Fisantekraal area (clay)

f) The Klipheuwel area (clay)

g) The West Coast (stone, sand and clay)

h) The Gordon's Bay area (clay)

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  Two areas are noted in this Plan for mineral extraction, namely southwest of Sir Lowry's Pass, and an area in the vicinity of the Broadlands Industrial area.

4.3 Provisions for mining: MSDF

The Draft MSDF Technical Report (a more comprehensive report that will not be legally approved as part of the advertised Draft Statutory MSDF) includes the following recommendations with regard to mineral deposits:

"While the extraction of mineral deposits is largely controlled by the Department of Minerals and Energy (DME), it is important that mineral planning, which can have significant land-use implications, be fully integrated as an element in the overall development framework for the Cape Metropolitan Region. The optimal utilisation of mineral resources is explicitly required under the Minerals Act, 1991. This is unlikely to be achieved unless there is close co-operation between land-use planners and the DME."

Policy 45 Areas with mineral deposits of economic value, where not already covered by urban development, should generally be safeguarded from urban development. This is subject to the desirability and viability of mineral extraction. In this regard, where appropriate the DME should be consulted as final arbitrators in terms of the Mineral Act, 1991.

The Draft Statutory MSDF includes the following policies relevant to mining:

4.3.1 Integrated Environmental Management procedures, or similar methodologies as required by the Environmental Conservation Act, should form part of development proposals for any environmental and economic resources.

4.3.2 All Local Authorities should ensure that compatible strategies are pursued when dealing with mineral or extractive material resources/rights, and existing and future land-use development or conservation requirements for the area.

4.3.3 In the section of the Statutory MSDF report dealing with the delineation of the Metropolitan Open Space System (MOSS), it is noted that "Disused mineral works and quarries" can be

included among large open areas that can contribute to the MOSS system. The Philippi Horticultural Area, which covers a deposit of high-grade silica-glass sand, is included in the MOSS as an urban agricultural area. The sand deposit is however not mentioned in this section.

4.3.4 The MSDF includes a draft "Urban Edge" line beyond which urban development should not be permitted (**Figure 2**). The draft Edge line is being refined by means of more detailed local studies that are currently under way. One of the goals of the Urban Edge is to "make (the) best use of our natural resources". Although not explicitly stated, these would include mineral resources. This is underlined by the inclusion of the following in the "Edge Demarcation Criteria" in the MSDF Technical Report:

"Economic mineral deposits as referred to in Section 6.0 may be used to assist delineation of the edge where appropriate."

4.4 Discussion

The area demarcated for "Mineral Extraction" (Tygerberg Hills area) in the 1988 Urban Structure Plan will be afforded a certain measure of "protection" from urban development in the new MSDF Statutory Plan as it falls outside the draft Urban Edge.

In a similar way the MSDF Urban Edge around the Philippi Horticultural area should continue some measure of the Urban Structure Plan protection of the silica sand deposit in that area from urban development. A weakness of the Statutory MSDF (in terms of protecting these silica deposits) is that the deposits are not **specifically** referred to. The 1988 Urban Structure Plan includes a specific reference to the fact that the designation of the Philippi Horticultural area should not be "an obstacle to the future exploitation of the high-grade glass sand deposits". The concern is that the designation of the Philippi Horticultural area as part of the MOSS in the MSDF may lead to conflict between further exploitation of the sand and environmental concerns with which the MOSS is normally associated.

4. PUBLIC PARTICIPATION

5.1 Methodology

The planning process for this project is being supported by public participation with respect to the following steps:

- Scoping
- Review of Issues, Goals and Objectives;
- Review of draft proposals and management guidelines

The communications, reports and summaries associated with the pubic participation process add up to a considerable volume of documents. These are included in the previous reports, particularly the Problems, Issues, Goals and Objectives (PIGO) reports for the Sand Mining as well as the Mining Structure Plans. In order to reduce the bulk of the documentation accompanying this report these documents are referred to only in summary form. Copies of these reports can be obtained on request.

- **Interested and Affected Parties**

The wide geographic scope of the study area, and the relatively specialist nature of the subject matter of this project makes it necessary that the major part of the public participation process focuses on a limited set of stakeholders. These include:

- Councillors from relevant authorities (CMC and Sub-structures);
- Relevant Local Government Officials (CMC and Sub-structures);
- Building Industry members;
- Mining concerns;
- Relevant National and Provincial Government Departments;
- Community organisations in affected areas; and
- Environmental NGO's.

In addition, information has been disseminated and appeals for involvement have been put out to the general public.

- **Public Participation Strategy**

Key determinants of the public participation strategy for the planning process are:

- The extensive geographic scope of the area under investigation;
- A very specific group of I&AP's;
- The relative ease of communicating in writing with the relevant I&AP's;
- The need to inform the general public about the process and to provide opportunities for involvement; and
- The highly strategic nature of the exercise.

Because of the above, the public participation strategy consists of three major elements, namely:

- Written and media communication;
- Selected consultations with key stakeholders; and
- Possible public meetings (should the demand exist).

Consultants Common Ground Consulting were appointed to formulate and implement the above strategy.

5.2 Process Overview

5.2.1 Introduction

As noted above, this project started as a Structure Plan for Sand Mining. After that study had made some progress, the decision was taken to broaden the scope to include the consideration of all minerals in the study area. This implies that the public participation process had to "re-started". The following is an overview of the various actions taken with regard to the sand mining and the mining Structure Plan projects. This section is a summary only. More details and information is included in the previous PIGO reports.

5.2.2 Sand Mining Structure Plan

- Initial steps and Correspondence

The steps taken to initiate communication with stakeholders, as well as the various responses and communications received are set out in the Sand Mining, as well as the Mining, PIGO reports.

- Draft Sand Mining Problems, Issues, Goals and Objectives (PIGO) Report

A draft PIGO report for **sand** mining was prepared in April 1999. An accessible summary of the report was distributed to all I&AP's, and copies of the full report were also distributed to the local authorities in the study area, as well as to I&AP's who requested copies. Responses to the report were received from the following parties:

1. Blaauwberg Municipality,
2. The Botanical Society,
3. Cape Nature Conservation,
4. Department of Agriculture, Resource Conservation,
5. The Environmental Management Department, Cape Metropolitan Council,
6. The Environmental Planning Branch: Planning and Economic Development, Cape Town Municipality,
7. Helderberg Municipality,
8. Olympic Sand cc (a 48 page document), and
9. Paarl Municipality.

- Memorandum of responses to comments on PIGO Report

Some of the local authorities in the study area had indicated at an earlier stage that the combining of the sand and other mineral mining studies was potentially delaying their access to information that could assist their decision-making regarding mining (particularly sand mining) rezoning applications. For this reason, a memorandum of responses to the above comments was prepared in February 2000 and forwarded to all parties who had copies of the sand mining PIGO report. The mapping and other information regarding the sand resource in the PIGO report, as well as the "response to comments" report is intended to assist in this regard. A copy of this memorandum is also obtainable on request.

5.2.3 Mining Structure Plan

- Database

  The database of I&AP's was further expanded in conjunction with input from various members of the steering committee for the project. The full list is included as Annexure A to this report.

- Actions taken by the CMC

  In addition to the process undertaken by the consultants for this project, the CMC has taken the following steps:

  - The co-operation of the local authorities in the study area, in terms of Section 4 (1) (b) of the Land Use Planning Ordinance has been secured.

  - Notices were distributed to various departments and bodies as requested by the Provincial Administration: Western Cape in terms of Section 4 (4) of the Ordinance. Responses were received from the following:

    - Franschhoek Municipality
    - South Peninsula Municipality
    - Paarl Municipality
    - West Coast District Council
    - Winelands District Council

    Copies of the above correspondence are available on request.

- Discussion/Background Information Document

  A short, accessible document was prepared in three languages, giving the background to, and reasons for the study. A brief description of how the project was to be tackled was included, as well as a questionnaire for I&AP's to complete and return. In total, 856 documents were distributed.

- Responses to Questionnaires

  Fifty-four responses were received in reply to the mailings. Consultants Common Ground Consulting prepared a summary of the responses received to the questionnaire.

- Interviews with Selected Stakeholders

  Eight respondents to the survey indicated a desire to meet the planning team. Each of these respondents was telephoned, and most requested to be kept informed of the progress of the study, or to keep the option open of a meeting at a later stage in the process.

  A meeting was subsequently held with a representative of the Aggregate and Sand Producer's Association (ASPASA). The results of this meeting are included in the "Problems and Issues" section below.

- Draft Mining Problems, Issues, Goals and Objectives (PIGO) Report

  A draft PIGO report for **mining** (i.e. all minerals, not just sand) was prepared in July 1999. Because the specialist studies (geology and plantlife/conservation) had not been completed at the time of the preparation of that report, an important component thereof was a report-back on the responses to the questionnaires distributed with the "Background Information Document" document (as discussed in the preceding section). The reactions to the questions asked, as well as various written and verbal responses received from I&AP's were used to prepare a list of problems and issues that should be addressed in this study.

  Further goals of the mining PIGO report were to solicit a reaction to, and obtain approval for the proposed method for classifying the mineral deposits in the study area. Approval was also sought for a set of proposed goals and objectives for the Structure Plan.

  Because the specialist studies had not been completed at the time of the preparation of the report, the mining PIGO report was distributed only to the members of the Steering Committee. Written responses were received from the following:

  - Cape Nature Conservation,
  - The Environmental Management Department, CMC, and
  - The Spatial Planning Department, CMC.

  As the responses revolved around a few technical details, they are not reproduced in this report. Copies of the responses can, however, be obtained from the last-mentioned Department. Where necessary, this report incorporates the issues raised.

- Draft Structure Plan for Mining report

  "Accessible" and full versions of the draft Structure Plan for Mining report (dated May 2000) were distributed to I&AP's for comment. These comments were summarised in a report dated August 2000, and have been utilised to prepare this final draft report.

  This report includes data from the Sand Mining study, as well as the work that was done on all the minerals in the study area. Not all the detailed information from the Sand Mining study can, however, be included in this report. Copies of the relevant Sand Mining studies are available on request.

6. GEOLOGICAL ASSESSMENT

6.1 Introduction

The study area (and the Western Cape) is not well endowed with high-value mineral resources. Those that are known to be present are predominantly suitable for use in the construction industry (sand, gravel, stone, clay, etc.). Industrial minerals found in the study area are mainly silica sand (for glass manufacturing) and kaolin (used for paper products, and as an inert filler in certain industrial processes). The deposits of these two industrial minerals occurring in the study area are however known to be the best of their kind in South Africa.

Previously available work with regard to the mineral resources on the study area had not indicated the extent and the relative importance of the deposits except on very broad scale (± 1:50 000 or smaller). To promote effective decision-making regarding land-uses however, such information should be available at a more detailed scale. This geological investigation has consequently been conducted at a larger scale of 1:10 000, and has also attempted to classify or prioritise the mineral deposits in the study area.

The database created for this investigation allows for digital map overlays or combinations of the mapping of various criteria such as mineral deposits and environmental sensitivity to be generated. This is a pre-requisite for informed land-use decision-making.

The full report by engineering geological and geotechnical consultants M.J. Mountain and Partners is included with this report as Annexure B. This report includes various Appendices and Annexes. The latter are mostly various separate reports that formed the basic sources of data for the investigation (including the detailed sand resource report by M.J.Mountain and Partners). These reports are bulky and include various colour plans of different sizes, and are consequently not included with the copies of this report reproduced for general distribution. Copies of these reports can be viewed at the Spatial Planning Department of the CMC.

6.2 Aims and Scope of the Geological Study

The primary product of the investigation is a GIS (Geographic Information System) – based map of the spatial distribution and extent of the actual and potential mineral resources in the study area at a scale of 1:10 000. In addition, an overview of the actual and potential quantities and qualities of the mineral resources is provided. Finally, classification of the mineral resources based on the digital mapping is provided in order to assist with decision-making, as well as the highlighting of sensitive or priority portions of the study area.

6.3 Methodology

Because of the extensive area being studied, the brief for this project determined that fieldwork be limited, and that existing data form the main source for the geological study. The primary source is a report on "The Geology and Mineral Resources of the Greater Cape Town Region" (Hill *et al.*, 1992). Other sources (including the geological report for the Sand Mining Structure Plan project) are listed in the full geological report.

A limitation of all consulted sources is that only mineral occurrences known to the author(s) are reported. Information on undiscovered resources (should these exist) is not available. Nevertheless, extrapolations have been made from the existing data to indicate areas favourable for the possible mining of minerals.

The mapping of the mineral resources was carried out by means of aerial photo interpretation. This technique is used to improve the accuracy of the existing mapping of the boundaries of areas at a larger scale (I: 10 000) than has previously been attempted.

A system of mapping units (i.e. areas of relatively homogeneous geology and mineral resources) was used for this project. These mapping units denote the various types of areas

that were mapped, such as potentially exploitable mineral resources of various types, as well as non-exploitable geological formations.

All the potential mineral resources of the study area have also been classified in terms of a number of pre-determined criteria (see Section 6.6 below).

6.4 General Geology of the Project Area

Because existing geological maps and information are very complex and difficult for the layman to read and understand, a simplified mapping of the major geological formations has been prepared.

The geological succession in the study area is derived from the 1:250 000 geological map of the Western Cape (Geological Survey, 1990). The general geology is summarised in the geological report (Annexure B). The table in that Annexure also highlights the relationship between the mineral resources found in the area and the geological formations. The distribution of the major geological formations is shown in **Figure 3**, which is a simplified version of the above map, digitally reduced. Hill *et al.* (1992) also provides a concise summary of the general geology.

6.5 Mineral Resources

A full description of the mineral resources found in the study area (including estimated quantities) is set out in the geology report (Appendix A of Annexure B). The following is a concise extract from that report, and does not cover the minerals in detail.

The most important construction minerals present in the area are:

- Stone (coarse aggregate);
- gravel;
- building sand (fine aggregate); and
- dimension (building) stone.

The most important industrial minerals found in the area are, in order of decreasing importance:

- Kaolin;
- silica (glass) sand;
- brick clay;
- ball clay; and
- phosphate.

Small occurrences of manganese, copper, tin, tungsten, gold and silver have been mined in the area in the past. It is however unlikely that the large-scale exploitation of these minerals will ever occur.

The spatial locations of the mineral resources at a scale of 1: 10 000 has been prepared as a digital map. Because a map of the entire study area at this scale would result in a very large print, a reduced version thereof is included with this report (see **Figure 4**). The digital information regarding the mineral deposits (as well as the vegetation and other information assembled for this project) can be provided on a CD, accompanied by a free viewer. This information can be obtained from the CMC Spatial Planning Department.

As building sand is the most prominent mineral mined in the study area (in terms if quantity), further information regarding this mineral is provided below.

6.5.1 Building Sand

The geological mapping and assessment of the sand resources investigation formed part of a holistic study undertaken for the Sand Mining project. Previous work conducted by other bodies had not indicated the areal extent, quality, and thickness of the various sand resources except in very broad terms and at a coarse scale (1:250 000). This geological investigation has mapped at a more detailed scale (1:10 000) and assessed the sand resources in greater detail within the project area. The full report of the geological survey of the sand resource (including tables of estimated quantities of available sand) is included as *Annexure 2* of Appendix A of Annexure B to this report, and is available from the offices of the CMC. This section covers a brief summary of that report.

- **Findings**

  In summary, the following types of sand are present:

  Colluvial sands of limited extent and thickness (generally <2m) that, within these deposits, form high quality natural concrete sands in limited areas.

  Aeolian sands that cover large tracts of the project area and which are generally suitable as a medium to low quality sand only after beneficiation, but are usable as plaster or mortar sand, and fill.

  Alluvial sands are found in most river and stream courses. Generally these are only suitable as fill, but deposits of better-quality natural building sand may occur in places. Beneficiation could improve the quality of some of the deposits.

The mapping exercise has revealed that the quantities of the sand resource available are considerably more than was expected or previously (see the tables of quantities in the Annexure referred to above). This is particularly so in the Paardeberg area, where slightly more than ten times the amount of high quality concrete sand calculated by Van der Merwe (1996) is estimated to occur. It is important when considering these figures however to take into account that these reflect **gross** quantities of existing sand. Factors that may prevent the exploitation of the deposits (such as high intensity or investment agriculture, nature reserves or conservation areas, etc) were not included in the survey.

Areas where sand occurs in deposits generally too thin to be exploited without permanent damage to the land have however been mapped. These are areas where permission to mine should not be granted unless the deposit is fully proven as being both exploitable as well as capable of being adequately rehabilitated.

6.6 Water Tables and Sand Mining

Water tables occur as permanent or seasonal features. The latter can include tables "perched" or trapped on relatively impermeable layers of harder material. High levels of seasonal tables are obviously associated with rainfall patterns. Permanent underground water bodies (aquifers) provide a source of water for irrigation and urban use. Temporary water tables frequently cause flooding, and can prevent the use of land for any productive purpose other than as a seasonable water feature or wetland. Reclamation can be achieved by filling to above the level of flooding.

- Colluvial sand areas

Reducing the thickness of colluvial sand above temporary water reservoirs (by means of mining) leads to erosion and sheet-flow. Subject to further investigation, it is recommended that at least 500mm of sand be left above the maximum water table height to permit satisfactory mine rehabilitation.

- Aeolion sand areas

The permanent aquifers found in aeolion sand areas can be reduced in storage size through evaporation if mining takes place to a level too close to the water table. Mining below the water table also requires specialised (and expensive) equipment. Figures 4 and 5 in Annexure 2 (of the geology report) indicate the water levels of the two most important areas for the extraction of water: the Cape Flats aquifer, and the Atlantis aquifer. It would appear from the water-table levels that the dunes above the general ground level can be removed (by mining) without materially affecting the aquifers. Mining of inter-dune sheets could however have negative impacts on the aquifer. These facts will need to be checked by means of site-specific hydrological studies should mining be considered in these areas.

- Alluvial sand areas

Seasonal fluctuations in river sand water tables will significantly affect the availability of exploitable sand. Again detailed studies are necessary before mining permission should be considered.

6.7 Classification of the Mineral Resources

The classification or ranking of the known mineral resources in the study area was undertaken to guide decision-making regarding land-use issues, and not to provide a definitive guide to the importance of the resources (the various types of minerals found have not, for instance been rated against each other). The method does, however, give decision-makers an indication of the relative importance of various deposits of any particular mineral under consideration.

The methodology employed was proposed in the draft Problems, Issues, Goals and Objectives report for this project. The classification process was based on the refined mapping of the mineral resources (at a scale of 1:10 000), divided into "mapping units" or "polygons". Each mapping unit indicates an area of relatively homogeneous geology, including mineral resources. The qualitative criteria utilised are the following:

- Geological conditions
- The potential economic resource (i.e. the type of mineral or rock)
- The economic importance of the resource over time
- The usual method used for excavation (i.e. short-term impacts), and
- The physical end-result of mining (i.e. the long-term impact of mining)

Regarding the economic importance criteria, no consideration has been given to the relative cost of mining the resource to society at large (i.e. full cost accounting). Such a study is outside the brief of this project. Even assessing the viability of exploiting a resource in the future is a complex task. Consequently a simplified approach has been adopted, viz. that the use of economic resources will continue in much the same style as over the last number of years. In addition, the assumption is made that deposits furthest from population centers will be exploited only after all nearer available resources are exhausted.

The above criteria can be combined to generate various scenarios indicative of the extent of rehabilitation required to make mined-out areas suitable for agricultural and/or urban development (see Section 5.1.5 in Annexure B).

Finally, those criteria that can be subdivided into a number of sub-classifications have been allocated relative ratings (see Table 1 below, which is based on more detailed information in Annexure B).

TABLE 1

RELATIVE RATINGS ASSIGNED TO GEOLOGICAL CLASSIFICATION CATEGORIES

MAJOR CLASSIFICATION	SUB-DIVISION	RATING
Economic importance over time: (rating based on the probability that the deposit will be exploited in the near future)	Of immediate economic importance	Extremely high
	Of definite near-future economic importance	Very high
	Of potential near-future economic importance	Moderate
	Of potential far-future economic importance	Low
	Of no known economic importance at present	Extremely low
Usual excavation method: (rating based on the anticipated effect on the environment during mining)	Pit	Moderate
	Quarry	Very high
	Mine	High
	Adit	Low
End-result of mining: (rating based on the anticipated extent of rehabilitation required)	Shallow excavation above water table	Low
	Shallow excavation to below water table	Moderate
	Deep excavation above water table	Very high
	Deep excavation to below table	Extremely high
	Underground mine	Extremely high
	Adit	Very low

6.8 Mapping of the Mineral Resources

The general mapping of the mineral resources (location and spatial extent) has been discussed above (see also **Figure 4**). A further series of digital maps has been produced to illustrate the classification of the mineral deposits, as noted in the previous section. The illustrative prints (Figures 4 to 18 in Annexure B) cover such a large study area (about 7 000 km²) that detail is unfortunately lost. This mapping is consequently best utilised by making use of the digital database compiled for this project. Individual sites can be highlighted and a range of information can be extracted. Geological information that can be extracted and viewed includes:

- The occurrence (or absence) of a particular mineral
- The relative importance of the deposit, in accordance with the scheme of classification discussed above
- The excavation method (should the deposit be, or become economically viable)
- The occurrence of deposits, overprinted to show where exploitation will intersect the water table

Various other criteria or information (such as the vegetation or agricultural data) can be juxtaposed or combined with the geological information by using the digital database.

This digital minerals mapping is a key product of this study, and provides an important tool for land-use planning and decision-making.

6.9 Conclusions

It has been possible to classify the mineral resources of the project area in a digital format. This information can be used to demarcate areas where mining should be given different levels of priority.

The digital map that accompanies this report shows that most geological formations in the project area have some potential economic value, but the great majority is of low potential. The few that do contain resources of significant importance can be identified from the digital map.

The conclusion was reached in the geological study that the primary criteria governing land-use decisions should be the presence of economically viable economic mineral resources and the feasibility of successfully rehabilitating the areas from which these resources have been extracted.

7. PLANT LIFE AND GENERAL ENVIRONMENT

7.1 Introduction

The aim of the environmental input for this study is:

- To provide an overview of the general ecology and conservation status of the study area, focussing on the natural plant life (species and vegetation), particularly in relationship to the different soil and habitat types.
- To rate the various ecosystems and vegetation formations on the basis of conservation importance.
- To develop management guidelines concerning mining and the natural environment.

The results of the study have provided a valuable perspective on the remaining vegetation of the study area, particularly with regard to the conservation importance and sensitivity thereof. This permits certain recommendations to be made regarding the desirability of mining. The value of this database and conservation rating and mapping, however, goes way beyond the needs of this particular study. This information has never before been available at this scale and to this extent, and consequently can inform decisions regarding all potential land-uses in the study area. The revision of existing, and the preparation of new, spatial planning frameworks within the area should consequently be guided by this information.

The full report by the environmental consultants (Coastec) is included with this report as Annexure C. The following is a concise summary of the findings of the study.

7.2 Methodology

The approach for the environmental study included the following components:

- A literature survey of pertinent published and unpublished information was conducted.
- The original vegetation of the study area was determined by using present correlations between geology/soils and vegetation (and in some cases rainfall), using available digital geological mapping (see previous section).
- Information was collected on the natural vegetation remnants in the study area. For the area defined as the Cape Metropolitan Area (CMA - i.e. the area of jurisdiction of the CMC), use was made of the data captured for the recent (1999) CMC Environmental Significance study. This information had to be further refined in order to arrive at vegetation categories compatible with the data for the rest of the study area. At the time of completion of the study, information for the Cape Peninsula and the West Coast lowlands between Bokbaai and Yzerfontein was unavailable.
- In total, 177 sites containing natural vegetation were selected for study, based on the following criteria:
  - On, or in close proximity to, high probability mining sites,
  - Mined-out, or severely damaged sites (from a natural vegetation perspective),
  - Sites with a low probability for mining, included for comparative purposes, and
  - Where any additional species lists of relevance were available.

On the basis of a number of selection criteria, 65 of the above sites were subsequently selected for inter-site comparative study.

- Habitat rarity was established for each site, based on the percentage of vegetation remaining in any particular category.
- Red Data (i.e. rare or endangered) species were recorded for each site.
- A plant species similarity analysis was conducted. Internationally recognised statistical methods were applied to this analysis.
- The medicinal and other value of plants from the study area was ascertained.
- A subjective evaluation of the "usefulness" of natural veld from a tourism perspective was determined.
- A categorisation of the relative conservation status and importance of the vegetation in the study area was undertaken.
- Management guideline proposals were developed, based upon currently accepted management principles for mining and natural veld management.
- Finally, a contextual synthesis was undertaken, based on the information obtained above. This allowed the importance/rarity of the resident plantlife and ecosystems in areas regarded as important for mining to be determined, particularly with regard to conservation importance.

7.3 Results and Analysis

- **Figure 5** shows the "original" extent of the natural vegetation in the study area. The area is part of the region known as the Western Cape lowlands (i.e. the mountain areas, and hence mountain vegetation types fall outside the study area). The region originally supported extensive stands of three major vegetation types: Dune Thicket, Sand Plain Fynbos, and West Coast Renosterveld. The map indicates the sub-types of these categories, as well as the location of the major transitions between Dune Thicket and Sand Plain Fynbos.

  A practical system for the easy definition of vegetation categories is proposed for use in mining and planning processes in the study area. The method is based on the overall vegetation type and the underlying geology. The abbreviations proposed are used throughout the botanical study. The terminology is explained in Table 2.

  Comments on the Peninsula lowland vegetation were derived from personal observations and the literature survey. The same applies to the West Coast lowlands in the north-west of the study area. The river vegetation remnants have been excluded from the analysis due to an absence of "original" river vegetation.

TABLE 2. VEGETATION SUB-CATEGORIES USED IN THE STUDY

Vegetation type	Vegetation category and substrate
Dune Thicket (DT)	Dc DT on calcareous sands Dl DT on shallow sands over limestone or on limestone
Sand Plain Fynbos (SPF)	Si SPF on inland, non-marine-derived acid sands (older, non-aeolian colluvium) Sm SPF on marine-derived acid sands (aeolian) Sq SPF on inland, non-marine-derived acid sands (recent, non-aeolian colluvium)
Dune Thicket / Sand Plain Fynbos transition	DS DT/SPF on slightly calcareous to slightly acidic/neutral sands
West Coast Renosterveld (WCR)	Wsh WCR on shale Wg WCR on granite
Mountain Fynbos (MF)	Msh MF on shale (Mshm, > 800 mm rainfall per annum) (Mshk, on koppies) Mg MF on granite (Mgm, > 800 mm rainfall per annum) (Mgk, on koppies) Mf MF on sandstone (peripheral to our area of interest)

- **Figure 6** shows all the remnant vegetation in the study area, regardless of quality. Further maps in the full botanical report (Annexure C) show the remnants of the various major vegetation categories. The percentages of the original extent remaining are shown in Table 2 of that report. A total of 21.9% of the original area of natural vegetation remains, with only 16.2% of good quality. Dune Thicket and Dune Thicket/Sand Plain Fynbos Transition both have large areas still remaining, although the former is poorly represented on the Cape Flats, the site of greatest urbanisation. Vegetation categories showing the most decline are West Coast Renosterveld on shale (1.6% remaining), Sand Plain Fynbos on Quartenary inland acid sands (1.7% remaining), Sand Plain Fynbos on inland, non-marine derived acid sands (3.91%), and West Coast Renosterveld on granite (10.4%).

- Species data are shown in Appendix 1 of Annexure C. Total species for the study area number 2 417 or 26.9% of the Cape Floral Kingdom (CFK). This implies that more than a quarter of the CFK is found in an area that is less than 5% of the area covered by that Kingdom. This illustrates the exceptional richness of the lowland flora found in the study area.

- 175 Red Data species were encountered in the study area, being 12.4% of the total for the CFK. This is a high proportion, compared to other areas.

- Figures 9 to 11 in the botanical report (Annexure C) show the results of an inter-site analysis of 65 sites in the study area. The analysis underlines the strong role of substrate (soils) in determining plant species and therefore vegetation categories. It is clear that, with the exception of Dune Thicket, there are generally low similarities between individual sites, indicating the high diversity in vegetation experienced across the whole study area.

- A preliminary list of medicinal plants occurring in the area is included in Appendix 2 of Annexure C. A number of important medicinal plants are found in the area, adding to the conservation-worthiness of the vegetation remnants. Results from certain studies indicate that there may be a high reliance on indigenous plants in rural parts of the study area.

- Appendix 3 in Annexure C lists the sites in the study area which have conservation status, or which have been considered as having conservation importance.

From a conservation viewpoint, the Western Cape lowlands form one of the most threatened and under-conserved regions in South Africa. Table 3 shows the degree of loss of lowland vegetation. On the Cape Flats alone less than 1% of the original extent of the Sand Plain Fynbos is left, with 50% remaining elsewhere on the lowlands. Much of the latter is severely impacted by acacia infestation and frequent burning. As this vegetation type is restricted to the West Coast sand plains, the regional and national significance of this category is extremely high. This, coupled with the fact that this system harbours a high number of Red Data species, makes it in effect a Red Data vegetation type.

TABLE 3. LOSS OF LOWLAND VEGETATION IN THE WESTERN CAPE, AND ITS CONSERVATION STATUS

VEGETATION TYPE	GEOLOGY	% LOST OR TRANSFORMED	% LOST IN WEST COAST COASTAL AND INLAND PLAIN	CONSERVATION STATUS (% OF ORIGINAL EXTENT)
Sand types				
Dune Thicket	Calcareous sand, calcretes and limestones	25	64	14.49
Sand Plain Fynbos	Acid sand	50	50	1.05
Non sand types				
West Coast Renosterveld	Shale and granite	97	97	1.76
Mountain Fynbos	Sandstone and quartzite	11	not present	26.14

Dune Thicket fares better than Sand Plain Fynbos, and also has a greater conservation status. However, because this type is confined to a narrow strip along the coast, any form of coastal development or mining is likely to reduce this vegetation type substantially.

7.4 Conclusions and Recommendations

7.4.1 Plantlife

Eleven major sub-regions were determined in the study area. Four of these support either or both major sand-dependant vegetation types, namely Dune Thicket and Sand Plain Fynbos, as well as a transition between the two.

The vegetation types are directly governed by soils. Two chief sand types are present: calcareous (supporting Dune Thicket), and acid (Sand Plain Fynbos). West Coast Renosterveld, however, occurs almost exclusively on granite and shale.

The study area displays a species richness previously unknown. Total plant species for 177 sites, for example, amount to one quarter of the total species found in the CFK. Red Data species found at these sites represent 10% of the total CFK.

Each of the above sites displays a unique species complement or "botanical fingerprint".

7.4.2 Conservation

If the International Union for the Conservation of Nature (IUCN) recommended minimum reserve size of 10% for any particular vegetation type is accepted, then only Dune Thicket (including some Dune Thicket/Sand Plain Fynbos transition) has adequate conservation status in the study area. Existing conservation areas are shown in **Figure 7**.

An indication of the significance of the impact that mining is likely to have on the various vegetation types is given in Table 4. If a *quantitative* approach is taken (i.e. with no consideration for the conservation of biodiversity across the study area), then it is the Sand Plain Fynbos of the Cape Flats and inland plain which would be likely to suffer most if mining were to take place. If, however, a *qualitative* approach is adopted (i.e. the conservation of the range in biodiversity across the area), then the significance of mining impacts is far higher. All vegetation categories (with the exception of the Dune Thicket West Coast types) are then likely to suffer high impacts. The inland types are particularly vulnerable because of the scarcity of the natural vegetation and the fact that the sand resource of this region is highly sought after for building purposes (particularly for concrete).

A comparison of **Figures 5** and **6** highlights the reality of how little of the original natural vegetation remains in the study area.

The creation of a Cape West Coast Biosphere reserve between the West Coast National Park and the proposed Blaauwberg Conservation Area would enhance conservation endeavours in the west of the study area. The Reserve would, however, cater chiefly for the West Coast sand-dependent types, and to a certain extent, to West Coast Renosterveld on the granite Darling Hills.

TABLE 4. LIKELY SIGNIFICANCE OF MINING ON REMAINING NATURAL VEGETATION IN THE STUDY AREA

SUB-REGION	Vegetation category (Table 1)	Present conservation status	Potential conservation status	Confidence for future conservation	Likely significance of mining impact: *quantitative*	Likely significance of mining impact: *qualitative*
Cape Peninsula Lowlands	Dc/Dl	MODERATE	GOOD	HIGH	HIGH	VERY HIGH
	Sm	POOR	GOOD	HIGH	HIGH	VERY HIGH
	Wsh	GOOD	VERY GOOD	VERY GOOD	HIGH	VERY HIGH
Cape Flats	Dc	MODERATE	GOOD	MODERATE	HIGH	VERY HIGH
	Dl	MODERATE	MODERATE	MODERATE	HIGH	VERY HIGH
	Sm	POOR	POOR	POOR	VERY HIGH	VERY HIGH
	Wsh	POOR	MODERATE	MODERATE	VERY HIGH	VERY HIGH
Tygerberg & environs	Wsh	GOOD	GOOD	GOOD	HIGH	VERY HIGH
Bottelary Hills & environs	Wg	POOR TO MODERATE	MODERATE	MODERATE	VERY HIGH	VERY HIGH
	Mgk	POOR TO MODERATE	MODERATE	MODERATE	VERY HIGH	VERY HIGH
Schapenberg	Wg	POOR	MODERATE	MODERATE	VERY HIGH	VERY HIGH
	Mgm	POOR	MODERATE	MODERATE	VERY HIGH	VERY HIGH
Paardeberg & environs/ Paarl Mountain	Wg	MODERATE	GOOD	MODERATE	VERY HIGH	VERY HIGH
	Mgk	MODERATE TO GOOD	VERY GOOD	MODERATE	HIGH	VERY HIGH
West Coast Dunes Zone 1	Dc/Dl	GOOD	VERY GOOD	MODERATE	MODERATE	MODERATE TO HIGH
West Coast Dunes Zone 2	Dc/Dl	GOOD	VERY GOOD	MODERATE	MODERATE	MODERATE TO HIGH
	DS	GOOD	GOOD	MODERATE	MODERATE	MODERATE TO HIGH
West Coast Acid Sands Zone 1	Sm	POOR	GOOD	MODERATE	HIGH	HIGH TO VERY HIGH
Inland plain (marine origin)	Sm	POOR	MODERATE	POOR	VERY HIGH	VERY HIGH
Inland plain (non-marine origin)	Si/Sq	POOR	POOR	POOR	VERY HIGH	VERY HIGH
	Wsh	POOR	MODERATE	MODERATE	VERY HIGH	VERY HIGH
	Wg	POOR	MODERATE	MODERATE	VERY HIGH	VERY HIGH
	Mshm/Mshk	POOR TO MODERATE	MODERATE	MODERATE	VERY HIGH	VERY HIGH
Darling Hills & environs	Wg	POOR	MODERATE	MODERATE	MODERATE TO HIGH	HIGH TO VERY HIGH
Mountain shale/granite slopes on edge of study area	Mshm/Mgm	MODERATE TO GOOD	GOOD TO VERY GOOD	GOOD	MODERATE TO HIGH	HIGH TO VERY HIGH

Dc/Dl = Dune Thicket; Sm, Si, Sq = Sand Plain Fynbos; DS = DT/SPF transition; Wsh/Wg = West Coast Renosterveld on shale or granite; Mshm/Mshk/Mgm/Mgk = Mountain Fynbos on shale or granite; m = mountains, k = koppies

CPL = Cape Peninsula Lowlands; CF = Cape Flats; TB = Tygerberg & environs; BH = Bottelary Hills & environs; SB = Schapenberg; PB = Paardeberg & environs; PM = Paarl Mountain; WC = West Coast; I = inland; DH = Darling Hills; D = Dunes; A = Acid sands; S = Shale; Z = zone. No categories have been provided for mountain slopes. **The vegetation sub-regions may be seen in the Arc Explorer Project on the Mining Structure Plan CD-ROM.**

With reference to the natural vegetation in the study area, the following recommendations with regard to conservation are made:

Approach to mining in each sub-region:

- Cape Peninsula: no major mining activities, therefore no immediate threats to plantlife through this practice. Kaolin mining occurs on the lowlands fringe and should be carefully monitored. Future mining, particularly where development will proceed, might be a consideration and should be avoided.

- Cape Flats: Dune Thicket being severely impacted at Macassar and in the Philippi area. Sand Plain Fynbos not being mined. Although less than 1% remains in the sub-region, most is found in areas not likely to be mined, for example Kenilworth Racecourse. Mining emphasis should be shifted from the Cape Flats to the West Coast.

- West Coast: no major mining activities, although leveling of dunes occurring for development. Blaauwberg North is a classic example, where most of the sand deposits are being permanently sterilised by housing. Prospects for mining should be investigated as a land-use, particularly where development is under way.

- Inland coastal plain: the best quality concrete sand is found in this sub-region, particularly in the Malmesbury-Paardeberg-Klipheuwel area. Local impacts have been substantial, although much of the mining is on land already farmed and therefore devoid of natural vegetation. Mining in areas still supporting natural vegetation should be avoided, particularly on the non-marine derived acid sand (chiefly Si and Sq)

- Bottelary Hills, Schapenberg, Darling Hills, Tygerberg and environs: the natural veld on the koppies and flats of these areas should be avoided. Koppie clusters have their own distinctive flora and play a crucial role in conservation of the Western Cape lowland flora.

- Berg River valley: virtually the whole valley has been transformed by farming and alien vegetation, with mining taking place locally. This valley is one of the rarer habitats in the study area due to the presence of ancient river terraces and a high water table. Mining is not viewed as a priority use in this sub-region and should be discontinued, given the sensitive nature of the river system and the presence of ancient river terraces.

7.4.3 Conservation Importance

Table 6 in the chapter on proposals and recommendations for this Structure Plan (Section 10) provides a key for determining the conservation importance of vegetation categories and sub-categories in the study area. The approach is based primarily on substrate, and in some cases rainfall. This key (and the practical utilisation thereof) is further explored in Section 10.

The recommendation is made that mining (or any other land-use) should not disturb the following vegetation sub-types:

- Sand Plain Fynbos on inland, non-marine derived sands (Si)
- Sand Plain Fynbos on Quartenary acid sands (Sq)
- West Coast Renosterveld on shale (Wsh)
- West Coast Renosterveld on granite (Wg)
- Small remnants of Mountain Fynbos on shale and granite (Msh/Mg).

Caution should also be exercised with: Dune Thicket on shallow sands over limestone (or on limestone), and Sand Plain Fynbos on marine-derived acid sands

The location and spatial extent of the above vegetation is illustrated in **Figures 8.1** to **8.3**.

8. AGRICULTURE

8.1 Introduction

The agricultural value of an area that may be considered for mining is one of the many factors that should be taken into account in assessing whether mining is the optimum land-use option.

8.2 Agricultural Potential

Figure 9 gives an indication of areas of high and medium agricultural potential for either annual or perennial crops. The information is based on maps produced by the Institute of Soil, Climate, and Water, and is supplied by the CMC GIS section. The potential ratings are based on available maps of geology and soils. The boundaries must be regarded as general, to be checked against site-specific data, because soil types can vary considerably within short distances.

Areas classified as of medium, medium-low, and low potential are not indicated on **Figure 9**. These soils do not necessarily exclude agriculture from these areas because farming viability is commonly linked more strongly to the availability of water and services.

8.3 Agricultural Intensity

The CMC GIS database also has mapping of agricultural intensity, which refers to the capital investment or agriculturally-related development of land. These factors frequently influence the market value of land more than soils. The mapping has been done at a generalised level as part of the preparation for the MSDF.

8.4 Conclusion

The above information is utilised as one of the data "layers" for this project.

Those needing guidance regarding applications to mine at specific sites can access more detailed mapping from the CMC GIS Section.

9. PROBLEMS AND ISSUES, GOALS AND OBJECTIVES

9.1 Problems and Issues

The primary purpose of the first stage of the public participation process was to identify the various problems and issues that should be addressed in this study.

The various I&AP's (ranging from the public and officials, to experts) have raised an extremely wide range of issues. A Structure Plan prepared in terms of current land-use planning legislation can, however, serve as a tool only for addressing problems and issues that are within the ambit of that legislation. Issues that fall outside the sphere of this plan (and the Ordinance) can only be highlighted for further attention or study, or be incorporated in the general recommendations.

The communications, reports and summaries associated with the pubic participation process add up to a considerable volume of documents. These are included in the previous reports, particularly the PIGO report for the Mining Structure Plan. In order to reduce the bulk of the documentation accompanying this report these documents are referred to only in summary form. **An analysis of the various problems and issues raised by the stakeholders is set out in the PIGO report.** The issues and problems have been categorised in the PIGO report under the following headings:

- Issues relating to the public interest
- Land-use Issues
- Issues related to the environment
- Issues relating to mining itself

The problems and issues raised have informed the formulation of the project goals and objectives, and have also influenced the proposals and recommendations of this Structure Plan.

9.2 Goals and Objectives

9.2.1 Introduction

The interested and affected parties have submitted an extensive list of proposals for goals and objectives forming in the study area. These are summarized in the PIGO report. In this process the stakeholders have raised a number of significant issues. Many of these issues, although important, are perhaps not entirely suited for formulating realistic, achievable goals for this project, particularly given the statutory origin of this Structure Plan. It is vital however that these issues remain in debate, and should not be ignored. For this reason the planning team has submitted the following comments on certain of these issues:

9.2.2 Control over mining

Many of the suggested goals relate to increased **control** over mining, and the use of, or the functioning of the free market economic mechanism. Given the existing statutory provisions (particularly as encompassed in the Minerals Act) and the rights set out in the Constitution (particularly related to property rights and freedom of trade, etc.) some of these desired goals are not viable, and are unlikely to be supported by all stakeholders.

This Structure Plan is being prepared in terms of the Land Use Planning Ordinance (Ordinance No. 15 of 1985 - LUPO), or the Planning and Development Act (when, and if, this replaces LUPO). It is consequently only in the provisions of this legislation that certain controls (additional to those already legislated for) can be introduced.

The following controls related to mining can be exercised in terms of LUPO:

- Permission to change the use of land from any other use to that of mining (even if only temporarily), and
- Conditions that can be attached to the above, in terms of Section 42.

Permission to use land for mining can be withheld subject to various requirements such as for instance permits or permissions in terms of other legislation, environmental impact assessments, etc.

Conditions that can be attached to the granting of zoning permission can relate to a wide range of aspects covering for instance:

- management practices
- the implementation of impact-mitigating measures
- rehabilitation measures
- contributions to cover external costs
- responsibilities
- monitoring and reporting

Officials report a number of problems at local authority level concerning control over mining. These include:

- Insufficient manpower to monitor land-uses as well as mining operations on a regular basis. Usually inspections are conducted only in response to complaints.
- Officials have no jurisdiction beyond that provided for by the ordinances and by-laws applicable to their particular local authority. If inspections reveal that there are problems related to the activities or areas of jurisdiction of other Departments, these can only be reported to the relevant officials, but cannot be acted upon.
- Not all local authorities have compiled a zoning scheme map and register that confirms the zoning of all land in their areas of jurisdiction. In certain cases this leads to disputes regarding the legality of mining operations in terms of land-use permission.
- Not all zoning schemes provide specifically for mining, and the relevant officials are consequently not always fully equipped to deal with this activity.
- There appears to be a lack of co-ordination between the local authorities and the various Departments concerned with implementing legislation affecting mining. Although the mining permit from the DME states that the requirements of the local authority (particularly those related to zoning) must also be complied with, frequently the local authority becomes aware of a mine that is operating with such a permit only after mining operations have started. If the DME does ask the local authority for comment on a permit application, the time period allowed for comment is usually insufficient for advertising the application locally and then obtaining the Council's approval of the official's report on the matter.

9.2.3 Environmentally Sustainable Mining

- Introduction

  At a global scale we are experiencing a rapid shift from a "cowboy" economy (where there is always a new frontier to explore and exploit), to a "spaceman" economy, where it is being realised that the earth has limited and finite resources. Dr Barry Sadler of the UK Institute for Environmental Assessment has noted that the current scales and rates of eco-change that man is causing represent a liquidation of the natural capital of the planet. Paul B Vitta of UNESCO (Nairobi) notes that the estimated 1998 global consumption of resources has risen to US$ 24 trillion. This represents twice the 1975 rate of consumption, and six times the 1950 rate.

  Paul Vitta believes that there are essentially only two strategy options available to combat the ever-increasing ecological damage resulting from current rates of world consumption of resources; namely, to

  - reduce consumption, or

  - increase efficiency in the use of resources.

  It is unlikely that much progress can be expected with consumption reduction, particularly given the general thrust of world-wide poverty relief policies (it is a fact that consumption of resources increases rapidly with increased affluence).

  It is consequently in the areas of technology and increasing efficiencies that solutions will have to be sought. Because minerals are used mainly in the construction industry, a reduction in consumption can be achieved by increasing the adoption of alternative approaches to construction. These include alternative technologies and building and construction methods, as well as methods of re-using materials. As it is obvious that the use of non-renewable materials cannot be sustained forever, this shift in thinking will become inevitable as natural material costs rise to exorbitant levels. To avoid irreparable damage to the environment, it is, however, necessary to encourage and promote this trend before it becomes enforced by circumstance.

  There is considerable pioneering work being done with regard to alternative technologies for the construction of shelter. These include the use of more traditional materials, and the use of renewable building materials that can be farmed (such as timber, thatch and straw, etc.). Unfortunately there appears to be less effort being invested in research on alternative methods for other construction work for which minerals are extensively used, such as civil engineering works and larger buildings.

- Sustainability

  The goal of "*sustainability*" is claimed for most current development initiatives, to the extent that the word tends to become a hollow catchword, devoid of real meaning. The concept does, however, have particular relevance when considering the issue of mining. It is therefore useful to explore the concept from a broader perspective before considering its relevance to this project.

  Environmental sustainability or even sustainable development is defined in a number of ways, according to the viewpoints of the author or authority concerned.

  Extraneous and peripheral issues are, however, frequently introduced. These can confuse the issue. To retain perspective it is necessary to examine the basic meaning of sustainability. Essentially a sustainable process or activity must be one which can be continued on an indefinite basis, without a net loss of resources (i.e. input must equal output, and *vice versa*). Given this definition, mining, in its narrowest sense, clearly cannot be a sustainable activity. Mineral resources are finite, and, once mined, are never returned

to their original, natural location and state. Once the resources are fully exploited, the mining activity must cease, and can never be re-started.

It is suggested by a stakeholder in the sand mining industry that mining is in fact a sustainable activity, by arguing that:

a) Mineral exploitation can be **economically sustainable** by means of government collecting a "resource rent" tax from the mining industry, and then investing this in other kinds of economic activities which can replace the employment and incomes of the resource-based industries once the resources are exhausted.

b) Minerals such as aggregate rock and sand **are not consumed**, but are converted into permanent things of greater and lasting value to human society.

c) Sand mining allows for sequential land-use, and therefore allows for **biological sustainability**.

d) Perspective can be given to the sustainability of resource exploitation by viewing it from the context of "sustainable development" (particularly as defined in the White Paper on Environmental Management Policy for South Africa). Implicit in this perspective is the use of natural resource accounting (NRA or "full cost accounting") which takes into account the use and depreciation of "natural capital" in addition to the conventional economic indicators.

The following points are relevant when considering the above (the numbering refers to the above points):

a) This form of "sustainability" cannot be guaranteed, because it relies totally upon a deliberate and concerted effort by a government (and governments in the longer term) to undertake successfully a complex and contentious task (that of collecting a resource rent tax and ensuring that the proceeds are invested to sustain income and employment). Collecting such a rent is likely to be unpopular with current players in the industry and is therefore likely to be difficult to implement in a democratic political environment. A less democratic government cannot, on the other hand, be relied upon to deliver on the appropriate investment of the tax proceeds.

b) The assumption that structures made from sand, rock and stone have a long-term benefit is problematic. Technological changes can render such structures obsolete in time. In addition, such objects are known to have a limited economic life span. Economics also dictates that sand and stone are seldom recycled when such structures are demolished.

c) The case for biological sustainability on the basis that sand-mining areas can be rehabilitated is predicated on a number of assumptions. The following reservations are recorded regarding this claim:

- Post-mining use for most other land uses requires the careful implementation of pre-determined mining depths, as well as appropriate rehabilitation measures. If this is **not** done, the land can be **permanently sterilised** for any uses other than, for example, a wetland or a barren piece of open space.

- Even though certain indigenous plant species can be encouraged to establish themselves in rehabilitated mined areas, the current scientific opinion is that it is impossible to recreate the **original** plant community present before mining. An original eco-system is based on site-specific environmental factors that evolved and changed over thousands of years, and this scenario can never be recreated.

d) Natural Resource Accounting (NRA) would represent a useful tool for developing appropriate and equitable environmental policy. However, only **when** and **if** the South African government decides to draw up a set of such accounts parallel with the national economic accounts will the parameters and norms be in place for similar exercises at more local levels of economic activity. It is impossible to conduct a NRA exercise for a localised, sectoral study such as this project without such a national framework being in place: i.e. in a "vacuum".

It is to be hoped that the adoption of NRA will eventually be realised because it is one of the principles of the White Paper on an Environmental Management Policy that decision-making on environmental policy should ideally be based upon full cost accounting. Only when the principles of the White Paper are followed through by the adoption of appropriate legislation can we expect to see some start to implementing these concepts. In the interim, the White Paper represents only policy, not statutory requirements.

- International Commitments

The 1992 Earth Summit held in Rio has led to various commitments on behalf of participating countries (including South Africa). These include Agenda 21, which is an action plan and blueprint for sustainable development. Agenda 21 is one of the five documents adopted by more than 178 governments at the United Nations Conference on Environment and Development (UNCED) in Rio.

The text of Agenda 21 carries a strong moral obligation to ensure the implementation of the various agreements. South Africa's role as one of the global partners in sustainable development was reaffirmed at the Earth Summit +5 called in June 1997 in New York.

Chapter 10 of Agenda 21 has, as its broad objective, the facilitation of the allocation of land to uses that provide the greatest sustainable benefits, and the promotion of the transition to a sustainable and integrated management of land resources. True commitment to these principles would have significant impact on all mining activities. To date there has however been a disappointing lack of such commitment on behalf of the international community.

It is also significant in considering the issue of mining that South Africa is a signatory to the International Convention on Bio-diversity. South Africa is the third most biologically diverse country in the world and the only country in the world with an entire plant kingdom within its borders (the Cape Floral Kingdom). Having ratified the convention on bio-diversity, South Africa has an international obligation to protect the bio-diversity of a floristic region that is globally irreplaceable. This obligation is particularly significant given the juxtapositioning of occurrences of exploitable mineral resources and significant remnants of this floral kingdom in the study area.

9.2.4 Balance between Economic and Environmental Considerations

A significant issue related to mining is the need to find a balance between economic and environmental considerations. Minerals are recognised as vital resources for building purposes, as well as other industrial applications. The exploitation of mineral resources is consequently an essential component of economic development. The Western Cape, however, also enjoys a rich heritage in terms of its natural environment that is not only of importance from an ecological perspective, but is also a source of significant revenue from tourism, and even potentially from the renewable exploitation of assets such as plant life.

The White Paper on Environmental Management (May 1998) suggests that a **reasonable balance** between economic and environmental should be found. Given an unlimited scope for this study, it may have been possible to arrive at economically justified proposals for achieving such a balance. To achieve this, models incorporating the monetary value of the natural environment, as well as the natural resources would have to be constructed. All externalities and costs to society would also need to be considered and quantified. This would be an undertaking of very considerable magnitude, complexity and cost. This has not been possible given the scope of this project. Achieving a reasonable balance will therefore in this case have to be based on more qualitative methodologies. Final decisions regarding a reasonable balance will ultimately need to be taken by the political decision-makers.

9.2.5 Urban Development

The current limits of urban development of the CMA and the surrounding towns in the study area are illustrated in **Figure 1**. For the purposes of this study it is assumed that the areas designated as developed are not available for the exploitation of minerals.

Current initiatives to delineate an Urban Edge line for the CMA are intended to assist in implementing the policy of defining the limits of growth of the urban area. The thrust of current policy is oriented to limiting the outward sprawl of the CMA. The draft Urban Edge lines, however, nevertheless give an indication of the remaining primary longer-term directions of growth of the metropolitan area. Such growth is constrained by the physical limitations of the sea to the west and the south, the mountains to the south and the east, and the valuable fertile agricultural lands located generally to the east and northeast of the current CMA. The areas to the north and to a certain extent the northeast of the CMA are not constrained by these physical factors. Consequently the "new north" (immediate West Coast), and the Kraaifontein - Durbanville axes constitute the primary directions of future urban growth.

Current policy aims to concentrate and densify development within the limits of the Urban Edge. Once infill development has taken place in the Cape Flats/Metro South-east areas (such as Delft, Mfuleni, Khayelitsha and Airport areas), it is expected that development to the north will accelerate. Rapid growth is in fact already being experienced along these northern growth axes.

As important as the new growth on the periphery of the CMA may be, it is nevertheless important to keep in mind that Central Business Districts of cities are known to retain a strong demand for construction minerals over time due to the dynamic nature of these areas. Constant re-development and infrastructure changes and improvements ensure that the demand for building materials remains high.

The growth trends of the CMA are relevant to the priority given to mineral deposits related to the construction industry located in the area, as well as the potential for urban development to sterilise mineral deposits before they are exploited. With regard to construction minerals, the importance of deposits located to the north of the CMA will increase with time, relative to those located towards the southern half of the CMA.

9.2.6. Benefits to Local Communities

The existing legislation covering mining (see Section 3 above) does not at present appear to give practical execution to the concerns raised by many of the I&AP's regarding increasing the benefit of mining operations to local communities. Many of these concerns are receiving increased attention (the Government White Paper on a Minerals and Mining Policy, for example, espouses the inclusion of those previously excluded from the mining industry). These policies do, however, imply some interference in the free market mechanism and consequently could prove problematic to implement in practice.

9.3 Proposed Goals

The goals proposed for this Structure Plan are based on what is attainable in terms of the exercising of the powers vested in authorities in terms of LUPO (or its replacement). Related to land-use permission, the goals are:

- "To provide a framework to assist decision-making with regard to the desirability and sustainability of mining at particular localities".

- "To provide recommendations regarding the extent and quality of information and documentation that should be required to accompany applications for mining in terms of LUPO".

Regarding conditions that can be attached to mining approvals in terms of Section 42 of LUPO, the following goal is proposed:

- "To provide guidelines concerned with the management of mining activities to assist in the optimum exploitation of the resource whilst minimising negative impacts associated therewith".

10. PROPOSALS AND RECOMMENDATIONS

10.1 Land-use Policy Recommendations

10.1.1 Introduction

The policy recommendations made in this section are in pursuit of the Structure Plan goal: "To assist decision-making with regard to the desirability and sustainability of mining at particular localities". The recommendations refer generally to proposed new mines, but are also relevant for extensions to existing mines.

The DME has participated on the steering committee, and should make use of the information and guidelines of this Structure Plan in the process of considering permit applications for mining in terms of the Minerals Act. This Structure Plan is, however, prepared in terms of the Land Use Planning Ordinance (or the new Planning and Development Act), and consequently has as its main function guidance for the relevant authorities regarding land-use decisions as far as they relate to mining in their areas of jurisdiction.

The studies conducted for this project have permitted certain clear policy recommendations to be made, as well as to be expressed spatially (i.e. mapped). There is also, however, a vast range of possible actions that cannot be given such clear-cut guidance (particularly at the scale of the whole study area). Recommendations are made also as to how such cases should be handled.

The preceding Chapters of this report provide detailed guidelines on how the digital GIS-based information on the study area can be accessed on a site-specific basis. Most of the mapping has been done to a scale of 1:10 000, which allows for a close-up perspective of any particular site or area that may be under consideration.

In summary, the digital mapping is available on request from the CMC Spatial Planning GIS Section, or can be viewed on the CD-ROM disc accompanying this report, or viewed on the Internet at **http://www.cmc.gov.za/peh/spatial/projects.html**. The digital data includes a copy of ArcExplorer, which allows the data to be viewed. Physical aspects that have been mapped include agricultural potential, vegetation, and geology/mineral resources (including the relative classification of the mineral deposits and vegetation remnants).

This digital mapping forms the core content of this Structure Plan, because it allows for decisions to be supported by quality, detailed information that has not been available at this scale or in this format before. As such, the information (particularly the environmental information) can be a valuable tool for planning and decision-making on a wide range of issues, and for various land-uses other than just mining.

10.1.2 General Spatial Policies

The mapping of the various physical characteristics of the study area has permitted certain areas to be highlighted where explicit policy recommendations can be made. This technique has also allowed for such policies to be mapped. The general recommendations are that:

- Mining should **not** be permitted:
  - In areas of high rarity and conservation importance (**Figure 7,** and **high conservation priority areas** only in **Figures 8.1** to **8.3** - as determined in the GIS data-base, and also explained in Table 4).
  - In areas of high agricultural potential (**Figure 9**). An exception to this is sand mining, which can be permitted on the basis of the principle of sequential land-use. An important caveat in this case is that sufficient measures be

implemented to stock-pile and return top-soil (particularly to an adequate depth – say 500mm - above impermeable clay layers). In addition, the depth of mining should not exceed a minimum level above the water table (say ±500mm).

- In areas protected by legislation, such as National Parks, rivers and wetlands, World Heritage sites, etc.

The environmental/botanical information and mapping collected and executed for this study have never before been available at such a scale and covering such a large area. This has allowed a totally new perspective to be gained regarding habitat rarity and conservation importance in the study area. For this reason, it is important to note that the areas highlighted as being of high conservation importance in **Figures 7** and **8.1** to **8.3** are not only unsuitable for mining, but should in fact not be utilised for **any land-use** other than conservation purposes.

- Mining should be given **priority**, and urbanisation should **not** be permitted in the areas indicated in **Figure 10** (High Priority Mineral Deposits) until the applicable mineral resource is exploited and depleted.

When the Cape Metropolitan Area: Peninsula Urban Structure Plan (1988) is withdrawn (as is intended when the Statutory MSDF is approved), the demarcation or indication of the areas for mineral extraction, and for the Philippi Horticultural area (which also provides protection for the high-grade glass sand in that area) will fall away. The statutory MSDF does not provide for such **specific** protection of high priority mineral deposits. It is vital that a means of providing statutory protection for these areas be devised and implemented.

With certain minerals (particularly sand), post-mining use of the land that is mined for other purposes (apart from the conservation of the original vegetation) is entirely feasible. This is, however, provided that mining does not take place below the general level of the surrounding area, or below the water table level (unless a water feature/body is specifically desired or planned end-use), and that adequate rehabilitation measures are implemented. Spatial planning can therefore indicate such areas as suitable for **later phases** of **urban** land-uses, provided that adequate protection of the resource is noted. Agriculture as a land-use need not permanently sterilise underlying mineral deposits, so this land-use designation can be provided for on the areas highlighted in **Figure 10**.

- In cases where high priority mineral deposits occur underneath areas identified as being of conservation priority, decision-making must be guided by the relative conservation priority rating of the site in accordance with Table 6. This table illustrates conservation priority from a regional perspective (i.e. the whole study area). The information in Table 6 is also included in the GIS versions of Figures 8.1 to 8.3. **Areas with a "very high" or "extremely high" conservation importance rating should not be mined irrespective of the importance of the mineral deposit.**

10.1.3 Assessment of Site-specific Cases

Between the two extremes of zones where clear recommendations can be made on where mining should not be permitted and where mining should take precedence as a land-use, there lies a considerable range where the desirability of mining should be assessed on a case-by-case basis. This can be as a result of the relative rankings of the criteria being considered being somewhere on a mid-point of a scale, and not at an extreme. Also, there are frequently site-specific variations in data or location details that are not always apparent at the scale of the entire study area.

Decision-making will, in such cases, need to involve the:

- determination of more detailed and site-specific information,

- consideration of a number of often conflicting criteria, and
- exercising of judgement.

The primary tool for the above is an Environmental Impact Assessment (EIA), in accordance with Integrated Environmental Management (IEM) principles and procedures which should be carried out for each and every application for a land-use permission to mine. This recommendation is expanded upon in Section 10.2 below.

Guidelines are provided below for the first two of the above points. With regard to the last point above, it is relevant to note that although recommendations can be framed by using the information and recommendations of this plan, final judgement calls will have to be made by the political decision-makers (Councillors or Ministers). Although the latter are the formal representatives of the electorate, the contributions of the local I&AP's should also not be ignored.

The following general recommendations are made:

- Mining should **not be permitted** (unless mitigating measures that would satisfactorily reduce the impacts are introduced and fully implemented):
  - In areas where sensitive **hydrology** (water tables, drainage systems, aquifers, catchment areas, etc.) could be negatively impacted.
  - Where **visual impact** would be high, particularly from the perspective of scenic routes and other tourist-oriented destinations, and residential areas.
  - Close to **residential development** (buffer zones should be provided)
  - Where other unacceptable **negative impacts** (particularly cumulative and environmental impacts) could occur. An example of a cumulative impact not related to the natural environment is the impact that mines have on roads infrastructure.
- Table 5 provides a guideline for considering development proposals from the perspective of the economic **importance of mineral resources**:

TABLE 5: RELATIONSHIP BETWEEN POTENTIAL OF MINERAL RESOURCES AND GEOLOGICALLY-BASED RECOMMENDATIONS FOR DEVELOPMENT

NATURE OF RESOURCES	RECOMMENDATIONS FOR DEVELOPMENT
Areas currently being mined ("mined")	No other development possible until resource worked out
Areas of major potential resource ("maj")	No other development to be permitted until resource worked out
Areas of moderate potential resource ("mod")	Other development permitted after geological investigation has proved no resource present that is potentially viable at current market values.
Areas of minimal potential resource ("min")	Other development permitted without restriction unless interested and affected parties can prove, by further geological investigation, the presence of a resource that is potentially economically viable at current market rates
Areas of no potential resource ("nil")	No restriction on development from a geological standpoint

NOTE: The abbreviated terms used in the digital database are shown in parentheses.

- With regard to determining the rarity and **conservation importance** of vegetation categories in an area, the mapped information must be read together with the key set out in Table 6, as well as the recommendations set out in the Botanical Section (see Section 7).

TABLE 6: KEY FOR DETERMINING SITE RARITY AND CONSERVATION IMPORTANCE FOR MINING AND OTHER LAND-USES

					Vegetation Category	Rarity	Conservation Importance
1. Sand	1.1	Calcareous	1.1.1	Deep sands	Dc	Abundant	Moderate
			1.1.2	Shallow sand / Limestone	Dl	Occasional	Very high
	1.2	Mildly calcareous To acidic, or neutral	1.2.1	Deep sands	DS	Fairly abundant	High
	1.3	Acid	1.3.1	Deep sands (aeolian, marine origin)	Sm	Fairly abundant	High
			1.3.2	Deep sands (non-aeolian, inland origin, chiefly colluvium)	Si	Extremely rare	Extremely high
			1.3.3	Shallow to deep Sands (recent, Locally derived Colluvium)	Sq	Extremely rare	Extremely high
2. Clays and loams	2.1	Shale	2.1.1	Moderate rainfall	Wsh	Rare	Very high
			2.1.2	high rainfall	Msh Msh	Occasional Extremely rare	Very high Extremely high
	2.2	Granite	2.2.1	Moderate rainfall	Wg	Occasional	Very high
			2.2.2	high rainfall	Mg Mg	Occasional Extremely rare	Very high Extremely high

Vegetation categories: as per Table 2.

The likely significance or impact of mining on the natural vegetation remaining in the study area can be ascertained by referring to Table 4 in Section 7.

10.1.4 Conclusion

The recommendations are based on a regional perspective derived from the area-wide data collected for this study. In the final analysis, decision-makers will need to decide on a case-by-case basis whether other information arising out of an EIA can justify decisions that are not consistent with these broad recommendations.

In a similar vein, impact mitigation measures, if properly implemented, can in certain cases also justify deciding against these general recommendations. Factors to consider in such cases include the likelihood of such measures being implemented, and measures to enhance compliance that are put in place (such as for instance financial levies or guarantees).

10.2 Decision-making support policies

The second goal of this Structure Plan is as follows: "To provide recommendations regarding the extent and quality of information and documentation that should be required to accompany applications for mining in terms of LUPO".

The most robust methodology currently available for ensuring that sufficient and quality information is provided by applicants is the IEM process as developed and promoted by the Department of Environment Affairs. The IEM guideline documents issued by that Department note the following:

"Integrated Environmental Management (IEM) is designed to ensure that the environmental consequences of development proposals are understood and adequately considered in the planning process. The term 'environmental' is used in its broad sense, encompassing biophysical and socio-economic components. The purpose of IEM is to resolve or mitigate any negative impacts and to enhance positive aspects of development proposals"

It is recommended that IEM procedures be followed in all cases when applications for rezoning or departures for mining in terms of current land-use planning legislation are submitted to the relevant authorities.

Ideally, the authority responsible for overseeing IEM for other listed land-uses in terms of the Environmental Conservation Act (currently the Environmental Impact Unit of DECAS) should also oversee mining IEM processes.

This recommendation is regarded as particularly important given the following considerations:

- Mining is currently excluded from the requirements for an EIA (or a permit for an exemption, or for a Scoping report) as set out in the regulations brought out in terms of the Environmental Conservation Act No. 73 of 1989
- Although there are similarities between the mining EMPR's and EIA's, the permitting process for mining in terms of in the Minerals Act currently does not always **in practice** appear to comply with the full definition and spirit of IEM as noted above. Areas where problems are observed include (see Problems and Issues report for this study): insufficient input from environmental specialists who can understand the environmental context of sites, insufficient participation on behalf of all interested and affected parties (particularly local communities), and poor monitoring of the implementation of mitigating measures and rehabilitation plans. Most importantly, mining EMPR's are also currently approved by DME and not an independent authority concerned with environmental protection and conservation. This amounts to self-policing, which is not a sound principle.
- The studies conducted for this project have highlighted that the rarity and conservation importance of most of the portions of the study area where mineral deposits are found is high. In addition, as a result of the exceptionally high biological diversity of individual sites (i.e. there are usually vast differences in the ecology of different sites – even small sites relatively close together), it is vital that site-specific EIA's be carried out to provide sufficient information for decision-making.

10.3 Management Guidelines

The recommendations contained in this section are in support of the final Structure Plan goal: "To provide guidelines concerned with the management of mining activities to assist in the optimum exploitation of the resource whilst minimising negative impacts associated therewith."

Recommendations for management guidelines are included in the report by the environmental consultants (See Annexure C). The following is a summary of these guidelines:

10.3.1 Conservation planning and management

- Management of conservation and mining should operate within the context of regional and local planning frameworks.
- A multiple management model should be employed (mining, agricultural land, natural areas, other uses)
- The Cape West Coast Biosphere Reserve and similar approaches should form a cornerstone for planning in the region.

- Management should be consistently applied to a network of protected areas which, in turn, should be proposed to satisfy minimum conservation requirements for the region. In this regard, liaison with the Cape Action Plan for the Environment is essential.

10.3.2 Rehabilitation

- Detailed rehabilitation measures for individual mines cannot be supplied in this study, as these vary considerably depending on site circumstances, mining method, etc.

- Rehabilitation is covered in Chapter VI of the Minerals Act. Appropriate rehabilitation measures should be identified in mining EIA's, as part of the impact mitigatory measures, and included in the mining EMPR.

- The rehabilitation measures included in the mining EMPR, as well as the probability of the measures being implemented must influence the granting of permissions to mine.

- Measures to improve the likelihood of rehabilitation measures being implemented should be introduced. These could include financial levies to cover for example damage to road infrastructure resulting from mining activities, or guarantees to be provided by mining applicants to allow authorities to complete rehabilitation work in the event of the failure of mines to do so.

10.3.3 Buffers

- The interface or buffer between mining and the natural and rural environment of the region should be defined using sound ecological principles, and treated in an environmentally responsible way.

10.3.4 Catchment management initiatives

- Co-ordination with catchment management initiatives is essential.

10.3.5 Sensitive ecosystems

- The integrity of rocky shore, coastal dune, wetland, river, and other sensitive systems in the area should be maintained where possible, through astute use and management.

10.3.6 Sustainable use

- An integrated management plan for how the natural resources of the region can be sustainably utilised, and which takes cognisance of mining operations, should be developed.

10.3.7 Management of mines and mining activities

- Environmental sensitivity

  - Mining should proceed in the least sensitive or ecologically important areas
  - Marginal mining areas (e.g. shallow deposits of potential building sand over clay) should receive special management attention or should be avoided altogether.
  - Land degradation should be guarded against.
  - Sensitivity should be displayed towards the environment, aesthetics and visual impact, to the control of windblown sand, and to rehabilitation appropriate to post-mining use of land.

- Visual
  - The visual impacts associated with mining and with related development should be minimised.
  - Sites should be screened from passers-by, particularly along major tourist routes.
- Alien vegetation control
  - Alien vegetation should be controlled, both in natural areas and on mining sites, particularly during and after rehabilitation.
- Fire
  - Fire should be an important management tool for natural areas within or abutting mine sites.
- Restoration
  - Restoration preferably with locally occurring indigenous species, should be a key component of any mining operation.
- Hydrology
  - Mines above exploitable aquifers should not be used for waste disposal purposes.
  - Mines should avoid sites where rivers, streamlines, wetlands and ground water will be adversely affected.
- Regulation
  - EMPR's should be sound and should include effective EIA's and restoration programmes. Full I&AP involvement is essential throughout.
  - Direct as well as indirect impacts of mining should be considered and mitigated against
  - Mine sites should be managed for effective post-mining use with objective and satisfactory determination of post mining use. Again the involvement of I&AP's in this process is crucial.
  - Prescribed management practices should be monitored and enforced
  - Guidelines and controls should be established for mining operations
  - Mining should comply with the provisions of the Mining and Safety Act no. 29 (1996) as amended by Act 27 of 1997
  - Appropriate measures should be introduced which will ensure that mining does not diminish opportunities for eco-tourism, recreation and sustainable use of natural resources
  - To ensure that EMPR's for individual mines are consistent with the Minerals Act and White Paper
  - All mine sites should require the services of an environmental site officer to ensure regulation of activities on site
- Access Roads
  - The repair of damage to road infrastructure as a result of mining should be the responsibility of the mining permit holder.

10.6 Other recommendations

- The value and importance of the **data** collected for this project has been emphasised above. **Spatial planning** initiatives in the study area should consequently incorporate or

take cognisance of the data/mapping generated for this project (particularly the botanical/conservation information and mapping).

- The **approval processes** currently required for mining permission (as highlighted in Section 3.4 above) should be **integrated** into a more efficient, comprehensive and logical process.

- Similarly, mechanisms should be investigated to further improve the **co-ordination** between the various **bodies** responsible for the approvals and permits required for mining.

- Local authorities should consider making **special provision** for **mining** in their **zoning scheme** regulations.

- **Further studies** that are necessary include the following:

  - An **integrated management plan** for how the natural resources of the region can be sustainably utilised should be developed by means of a broad-based conservation investigation.

  - An **investigation** should be launched by DME into compliance with **rehabilitation** plans, to be carried out in conjunction with CNC, DECAS and the local authority. Appropriate legal action should be then taken where necessary.

  - The **database** and mapping compiled for the mineral resources should be **updated** periodically with information from new mineral investigations, preferably on an annual basis. If this is not done, the data in this report will soon become obsolete as new prospecting and mining activities are carried out. Decision-making will then suffer. The prime source of the necessary information is DME.

  - As mineral resources are exploited and consumed with time, the consideration of the true cost of mining non-renewable resources to society at large will have to be brought into the decision-making picture. An **economic study** based on the principles of **Full Cost Accounting** will be necessary to gain this perspective. An additional perspective that will have to be included is the economic value of ecological services (e.g. water, medicinal plants, grazing, etc.).

  - It is clear that substantial deposits of **minerals** (mainly sand) occur **north of the boundary** of the study area. An investigation should be made of this area, and policies to reconcile the exploitation of this resource with the proposed Biosphere Reserve will have to be developed.

  - Statutory measures to provide **protection** for identified important mineral deposits (e.g. the silica glass sand deposits in Philippi) should be investigated.

11. CONCLUSION

This Structure Plan has been prepared in terms of the Land Use Planning Ordinance (Ordinance 15 of 1985). The recommendations and findings are consequently specifically oriented towards guiding local or provincial authorities on land-use decisions regarding mining. The information and guidelines in this report do however go beyond this narrow scope. It is consequently hoped that other bodies and authorities involved with mining will find the report useful and will support the proposals.

A comprehensive digital database of, specifically, the mineral resources but also the vegetation/conservation characteristics of the study area has been compiled from the information gathered by the specialist consultants for this study. This database represents an invaluable new resource that should prove invaluable for many purposes other than the specific goals of this plan. First and foremost of these is all forms of spatial and development framework planning in the study area.

For the reasons stated above, this report should be distributed as widely as possible to ensure that the important information is optimally utilised.

Finally, it is hoped that this study will contribute to the eventual establishment of consensus regarding a common vision for all stakeholders in the industry for mining in the area.

12. REFERENCES

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Metropolitan Spatial Development Framework

Figure 2

DRAFT

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Metropolitan nodes
- Activity spine - 100m zone (100du/ha gross)
- Activity corridor - 1km zone (40 - 100du/ha gross)
- Metropolitan Open Space System
- Extent of urban development

NOTE:
This map is conceptual and schematically illustrates the main elements of the MSDF. This map can therefore not be used to identify the delineation of any specific areas.

This plan should be read in conjunction with the report entitled "MSDF STATUTORY PLAN"

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Scale: 1 : 275 000

JUNE 1998

Spatial Planning
G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

MAMRE
ATLANTIS
MELKBOSSTRAND
ROBBEN ISLAND
BLOUBERGSTRAND
MILNERTON
SEA POINT
CAPE TOWN
CAMPS BAY
CLAREMONT
PHILIPPI
HOUT BAY
KOMMETJIE
FISH HOEK
SIMON'S TOWN
CAPE POINT
MUIZENBERG
STRANDFONTEIN
MONWABISI
MACASSAR
STRAND
GORDON'S BAY
STREENBRASMOND
KOGELBAY
BELLVILLE
ELSIES RIVER
PINELANDS
CROSSROADS
PHILIPPI HORTICULTURAL AREA
GRASSY PARK
MITCHELLS PLAIN
PLUMSTEAD
CONSTANTIA

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
GOODWOOD
BOTTELARY HILLS
CAMPS BAY
ATHLONE
HOTTENTOTS HOLLAND MOUNTAINS
BLUE DOWNS
WYNBERG
HELDERBERG
THEEWATERSKL
GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
ZEEKOEI VLEI
HOUT BAY
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Geology

Source: Council for Geoscience

Figure 3.

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

- Bokkeveld
- Cambrian
- Cape Granite Suite
- Klipheuwel
- Langebaan
- Malmesbury Group
- Quaternary
- Springfontyn
- Table Mountain Group
- Witsand

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
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KHAYALITSHA
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HOUT BAY
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Mineral Resources

Figure 4.

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Urban extent
- Study boundary

Mineral Resources

- Ball clay
- Brick clay
- Building sand
- Dimension stone
- Foundry sand
- Glass sand
- Gypsum
- Kaolin
- Lignite
- Limestone
- Metalurgical sand
- Phosphate
- Road gravel
- Road metal
- Salt
- Stone aggregate
- Tin
- Tungsten

DARLING HILLS
RIEBEEK KASTEEL
VOELVLEI DAM
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
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THEEWATERSKLOOF DAM
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GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
ZEEKOEI VLEI
HOUT BAY
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
ELGIN BASIN
STEENBRAS DAM
SIMONS TOWN
SCARBOROUGH

Original extent of natural vegetation

Figure 5.

N

1 : 350 000 @ A3

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary
- Dune Thicket/Sand Plain Fynbos transition - slightly calcareous to acidic/neutral sands (DS)
- Dune Thicket - sands (Dc)
- Dune Thicket - sands over or on limestone (Dl)
- Mountain Fynbos on Sandstone (Mf)
- Mountain Fynbos on Granite - koppies (Mgk)
- Mountain Fynbos on Granite - >800mm rainfall per annum (Mgm)
- Mountain Fynbos on Shale - koppies (Mshk)
- Mountain Fynbos on Shale - >800mm rainfall per annum (Mshm)
- Sand Plain Fynbos - inland, non-marine derived acid sands (older, non-aeolian colluvium, Si)
- Sand Plain Fynbos - marine-derived acid sands (aeolian, Sm)
- Sand Plain Fynbos - non-marine-derived acid sands (recent, non-aeolian colluvium, Sq)
- West Coast Renosterveld on Granite (Wg)
- West Coast Renosterveld on Shale (Wsh)

DARLING HILLS
RIEBEEK KASTEEL
VOELVLEI DAM
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
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KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
MILNERTON
BRACKENFELL
CAPE TOWN
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HELDERBERG
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HOUT BAY
STRANDFONTEIN
MACASSAR
SCHAPENBERG
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH

Extent of remnant vegetation

Figure 6.

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CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Dune Thicket/Sand Plain Fynbos transition - slightly calcareous to acidic/neutral sands (DS)
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- Mountain Fynbos on Granite - koppies (Mgk)
- Mountain Fynbos on Granite - >800mm rainfall per annum (Mgm)
- Mountain Fynbos on inland, non-marine-derived sands (Mi)
- Mountain Fynbos on Shale - >800mm rainfall per annum (Mshm)
- Mountain Fynbos on Sandstone (Ms)
- Mountain Fynbos on Shale - koppies (Mshk)
- Mountain Fynbos on inland non-marine-derived acid sands (older, non-aeolian colluvium, Mq)
- Sand Plain Fynbos - inland, non-marine derived acid sands (older, non-aeolian colluvium, Si)
- Sand Plain Fynbos - non-marine-derived acid sands (recent, non-aeolian colluvium, Sq)
- Sand Plain Fynbos - marine-derived acid sands (aeolian, Sm)
- River vegetation (R)
- West Coast Renosterveld on Granite (Wg)
- West Coast Renosterveld on inland, non-marine-derived sands (Wq)
- West Coast Renosterveld on Shale (Wsh)

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
SIMONSBERG
BOTHASIG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
GOODWOOD
BOTTELARY HILLS
CAMPS BAY
ATHLONE
HOTTENTOTS HOLLAND MOUNTAINS
BLUE DOWNS
WYNBERG
THEEWATERSKLOOF DAM
HELDERBERG
GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
ZEEKOEI VLEI
HOUT BAY
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Conservation Areas

Figure 7.

N

1 : 350 000 @ A3

September 2000

Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

- Cape Peninsula National Park
- Natural Heritage Site
- Natural Heritage Site/National Monument
- Nature Areas within the CMA
- Nature Areas outside the CMA
- West Coast Conservation Areas

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
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DURBANVILLE
TYGERBERG
KRAAIFONTEIN
SIMONSBERG
BOTHASIG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
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HELDERBERG
GRASSY PARK
MITCHELLS PLAIN
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ZEEKOEI VLEI
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MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Conservation Areas

Figure 7.

N

1 : 350 000 @ A3

September 2000

Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

- Cape Peninsula National Park
- Natural Heritage Site
- Natural Heritage Site/National Monument
- Nature Areas within the CMA
- Nature Areas outside the CMA
- West Coast Conservation Areas

DARLING HILLS
RIEBEEK KASTEEL
VOELVLEIDAM
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
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KRAAIFONTEIN
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SIMONSBERG
MILNERTON
BRACKENFELL
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SCHAPENBERG
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI

Distribution of West Coast Renosterveld (Wsh, Wg) and Mountain Fynbos (Msh, Mg) on Granite and Shale (Importance Ratings 1 & 2)

Figure 8.1

N

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September 2000

Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Mountain Fynbos on Granite - koppies (Mgk1)
- Mountain Fynbos on Granite - >800mm rainfall per annum (Mgm1)
- Mountain Fynbos on Granite - >800mm rainfall per annum (Mgm2)
- Mountain Fynbos on Shale - koppies (Mshk1)
- Mountain Fynbos on Shale - >800mm rainfall per annum (Mshm1)
- Mountain Fynbos on Shale - >800mm rainfall per annum (Mshm2)
- West Coast Renosterveld on Granite (Wg1)
- West Coast Renosterveld on Granite (Wg2)
- West Coast Renosterveld on Shale (Wsh1)
- West Coast Renosterveld on Shale (Wsh2)
- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
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BAINSKLOOF MOUNTAINS
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WYNBERG
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HELDERBERG
THEEWATERSKLOOF DAM
GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
ZEEKOEI VLEI
HOUT BAY
STRANDFONTEIN
MACASSAR
SCHAPENBERG
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY

Distribution of Dune Thicket (Dc/Dl) and Dune Thicket/Sand Plain Fynbos (DS) transition remnants.
Importance ratings 1 & 2

Figure 8.2

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary
- Dune Thicket/Sand Plain Fynbos transition - slightly calcareous to slightly acidic/neutral sands (DS1)
- Dune Thicket/Sand Plain Fynbos transition - slightly calcareous to slightly acidic/neutral sands (DS2)
- Dune Thicket - sands (Dc1)
- Dune Thicket - sands (Dc2)
- Dune Thicket - sands over limestone or on limestone (Dl1)
- Dune Thicket - sands over limestone or on limestone (Dl2)

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BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
GOODWOOD
BOTTELARY HILLS
CAMPS BAY
ATHLONE
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WYNBERG
BLUE DOWNS
HELDERBERG
THEEWATERSKLOOF DAM
GRASSY PARK
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HOUT BAY
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
ELGIN BASIN
STEENBRAS DAM
SIMONS TOWN
SCARBOROUGH
KOGELBAY

Distribution of Sand Plain Fynbos (Si, Sm, Sq) Remnants (Importance Ratings 1 & 2)

Figure 8.3

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA YEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary
- Sand Plain Fynbos - non-marine-derived acid sands (older, non-aeolian colluvium, Si1)
- Sand Plain Fynbos - non-marine-derived acid sands (older, non-aeolian colluvium, Si2)
- Sand Plain Fynbos - marine-derived acid sands (aeolian, Sm1)
- Sand Plain Fynbos - marine-derived acid sands (aeolian, Sm2)
- Sand Plain Fynbos - inland, non-marine-derived acid sands (recent, non-aeolian colluvium, Sq1)
- Sand Plain Fynbos - inland, non-marine-derived acid sands (recent, non-aeolian colluvium, Sq2)

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
TYGERBERG
DURBANVILLE
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
GOODWOOD
BOTTELARY HILLS
CAMPS BAY
ATHLONE
HOTTENTOTS HOLLAND MOUNTAINS
BLUE DOWNS
WYNBERG
HELDERBERG
THEEWATERSKLOOF DAM
GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
HOUT BAY
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SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Agricultural Potential

Figure 9.

N

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Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENQILA TEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary

Agricultural Potential

- High Agricultural Potential
- Meduim High Agricultural Potential

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
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BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
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CAPE TOWN
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WYNBERG
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STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

High Priority Mineral Deposits

Figure 10.

N

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September 2000

Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
ISIHLONDA LOLAWULO LWENGILA TEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Metwine.shp
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Waterbodies
- Study boundary
- Mineral deposits of major economic importance

VOELVLEI DAM
DARLING HILLS
RIEBEEK KASTEEL
MAMRE
ATLANTIS
BOKBAAIPUNT
PAARDEBERG
KOEBERG POWER STATION
WELLINGTON
BAINSKLOOF MOUNTAINS
KOEBERG
PAARL MOUNTAIN
PAARL
MELKBOSSTRAND
BLOUBERG
ROBBEN ISLAND
DU TOITSKLOOF MOUNTAINS
BLOUBERGSTRAND
DURBANVILLE
TYGERBERG
KRAAIFONTEIN
BOTHASIG
SIMONSBERG
MILNERTON
BRACKENFELL
CAPE TOWN
BELLVILLE
GOODWOOD
BOTTELARY HILLS
CAMPS BAY
ATHLONE
HOTTENTOTS HOLLAND MOUNTAINS
WYNBERG
BLUE DOWNS
HELDERBERG
THEEWATERSKLOOF DAM
GRASSY PARK
MITCHELLS PLAIN
KHAYALITSHA
HOUT BAY
ZEEKOEI VLEI
SCHAPENBERG
STRANDFONTEIN
MACASSAR
MUIZENBERG
KOMMETJIE
FISH HOEK
GORDON'S BAY
STEENBRAS DAM
ELGIN BASIN
SIMONS TOWN
SCARBOROUGH
KOGELBAY
OLIFANTS BOS BAAI
PRINGLE BAY
CAPE POINT
BETTY'S BAY

Location of Study Area

Figure 1.

N

1 : 350 000 @ A3

September 2000

Spatial Planning G I S

CAPE METROPOLITAN COUNCIL
KAAPSE METROPOLITAANSE RAAD
IBHUNGA LOLAWULO LWENGILA TEKAPA

LEGEND

- Cape Metropolitan Council boundary
- Municipal boundaries
- Winelands District Council boundary
- Class 1 roads
- Class 2 & 3 roads
- Railway lines
- Urban extent
- Waterbodies
- Study boundary