An assessment of cumulative effects in Strategic Environmental Assessment: a critical review of South African practice

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature:

Date:

ABSTRACT

There is a general consensus that EIA is limited in its scope. The main concern in this regard is that EIA generally fails to handle cumulative impacts effectively, due to its focus on individual projects. Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions. The evaluation of cumulative effects generally focuses on potential pervasive, regional environmental problems.

Due to its strong focus on sustainable development, Strategic Environmental Assessment (SEA), by definition, should address cumulative effects. EIAs in South Africa traditionally only considered the "footprint" or area covered by each project component. However, in recent years the cumulative nature of environmental impacts of human actions has increasingly become a visible concern to the South African public, which has led to the need to infuse cumulative effects concepts into environmental assessments.

In theory, a SEA is aimed at improving the way in which cumulative effects are dealt with in environmental assessments. This raises the question of whether past and present South African SEA approaches have effectively addressed the issue of cumulative effects.

This thesis provides a critical reappraisal of recent experience in SEA with particular reference to its application in South Africa. It is in this context, of the opportunities and constraints of current SEA application, that this study attempts to determine how best to infuse cumulative effects methodology and philosophy into the emerging South African SEA process.

This study evaluates three SEA case studies undertaken in South African, in order to assess how effectively cumulative effects are addressed within the current South African SEA process. The analysis focuses on both innovative approaches used in each study, as well as the limitations and deficiencies of each approach.

A generic framework was developed in order to provide broad guidelines for practitioners and reviewers. These guidelines focus on how best to infuse cumulative effects philosophy and methodology into the current SEA process.

It is envisaged that this methodology will enhance the current SEA process, in order to ensure that environmental issues are placed on the same level as economic and social considerations in future decision making, to achieve sustainable development.

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GLOSSARY/ABBREVIATIONS

Cape Action Plan for the Environment (CAPE) A Project undertaken by the Council for Scientific and Industrial Research (CSIR), to develop a long term conservation strategy for the protection of the Cape Floral Kingdom's biodiversity.

Cape Floral Kingdom (CFK) The Fynbos Biome.

Cost-benefit analysis (CBA) An objective, careful, explicit analysis of the costs and benefits of a proposal within a structured framework (DEA, 1992).

Cumulative Effects Assessment (CEA) An assessment of the impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Department of Environmental Affairs (DEA) The National Government Environmental Department prior to the 1994 elections.

Department of Environmental Affairs and Tourism (DEAT) The National Government Environmental Department, as renamed and restructured after the 1994 elections.

Environmental Assessment (EA) The process of collecting, organizing, analysing, interpreting and communicating data that is relevant to some decision (DEA, 1992).

Environmental Impact Assessment (EIA) "A detailed study of the environmental consequences of a proposed course of action. An environment assessment or evaluation is a study of the environmental effects of a decision, project, undertaking or activity. It is most often used within an Integrated Environmental Management (IEM) planning process, as a decision support tool to compare different options" (DEAT, 1998).

Environmental Management Programme Report (EMPR) Environmental reporting required for mining activities.

Integrated Environmental Management (IEM) "A philosophy which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process in order to achieve a desirable balance between conservation and development" (DEA, 1992).

Interested and affected parties (I&APs) "Individuals and groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, workforce, customers and consumers, environmental interest groups, and the general public" (DEAT, 1998).

Limits of acceptable change (LAC) The levels beyond which a further exacerbation of a given impact becomes unacceptable (CSIR, 1997).

Policies, plans and programmes (PPPs)

Plan " A purposeful, forward-looking strategy or design, often with coordinated priorities, options and measures that elaborate and implement policy' (CSIR, 1997).

Policy "A general course of action or proposed overall direction that is being pursued and which guides ongoing decision-making" (CSIR, 1997).

Programme "A coherent, organized agenda or schedule of commitments, proposal instruments and/or activities that elaborate and implement policy" (CSIR, 1997).

Scoping "A procedure for narrowing the scope of an assessment and ensuring that the assessment remains focused on the truly significant issues or impacts" (DEA, 1992).

State of the Environment Report (SoER) A National State of the Environment report produced by DEAT in February 2000.

Strategic Environmental Assessment (SEA) There is no universal definition for SEA, however, it is referred to in the White Paper on Environmental Management Policy for South Africa (1998) as "a process to assess the environmental implications of a proposed strategic decision, policy, plan, programme, piece of legislation or major plan." A notable problem with this definition is that it could imply that SEA is separate from the policy, plan and programme formulation process. Furthermore, this definition focuses on the impacts of the environment on development. However, the principle of evaluating the opportunities that the environment offers to development and the constraints that it imposes; should be included in the definition of SEA. In the SEA guidelines, SEA is defined as a process of integrating the concept of sustainability into strategic decision-making.

Terms of Reference (ToR) List of tasks and requirements to be met by the specialists undertaking specialist studies.

Valued ecosystem component (VEC) Any part of the environment that is considered important by the proponent, public, scientists or government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.

World Wildlife Fund of South Africa (WWF-SA)

CHAPTER 1 INTRODUCTION

This chapter provides an introduction and background to the research problem, the aims and objectives of this study and a brief description of the research strategy. The methods used are then described, as well as a brief summary of the rationale for the case study selection. The final section of this chapter provides an outline of the report structure.

1.1 BACKGROUND

Environmental Impact Assessments (EIAs) have traditionally focussed primarily on examining the environmental effects of a single development. Each individual development, considered on its own, may produce impacts that are considered insignificant. However, when the effects of this single development are combined with the effects of other present (or past) developments, these apparently insignificant small impacts become cumulatively significant. This has led in recent years to the trend, particularly in North American countries, of expanding the scope and scale of the analysis so that the effects of multiple activities can be examined on a larger set of environmental components.

Evidence is increasing that the most devastating environmental effects may result not from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time. In recent years there has been a growing realisation that the process of evaluating and minimizing the negative environmental impacts of individual developments, which are unobjectionable in themselves, do not adequately take into account the accumulative nature of some effects (Court, Wright & Guthrie, 1994). This has led to the development of procedures, known as Cumulative Effects Assessment (CEA), for evaluating the consequences, sources and pathways of cumulative impacts of multiple activities (CSIR, 1997). CEA is the process of systematically analysing and assessing cumulative environmental change.

The evaluation of cumulative effects focuses on impacts on the natural and social environments that take place so frequently in time, or so densely in space that the combined effects of individual impacts cannot be assimilated. The assessment of cumulative effects has received a great deal of attention in developed countries. In South Africa, the cumulative nature of many environmental impacts of developments has increasingly become a visible concern to the public. Some decision makers and land use managers are becoming concerned about these multiple, small environmental changes, which are largely unregulated, but have struggled to operationalize these concerns. Due to the growing global concern of the cumulative environmental effects of human activities, and the recognition that there is a lack in competencies within South Africa to evaluate cumulative effects, there is a need to develop methodologies and guidelines to ensure that cumulative effects are addressed through the current Integrated Environmental Management (IEM) process.

CEA is essential for effectively managing the consequences of human activities on the environment. The purpose of CEA is to ensure that the full range of consequences of actions be considered. Without incorporating cumulative effects into environmental management and planning, it will be impossible to move towards sustainable development. To a large extent the goal of CEA is to include environmental considerations into the planning process as early as possible to improve decisions (Council on Environmental Quality, 1997).

1.2 THE RESEARCH PROBLEM

There is a general consensus that EIA is limited in its scope. The main concern in this regard is that EIA generally fails to handle cumulative impacts effectively, due to its focus on individual projects. Secondly, many development activities that are not presented as discrete projects, are not subjected to EIA, even though they may entail wider ranging environmental impacts than individual development projects. Almost 90% of all EIAs do not proceed beyond the screening phase.

Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions. The evaluation of cumulative effects generally focuses on potential pervasive, regional environmental problems. Due to its strong focus on sustainable development, Strategic Environmental Assessments (SEAs), by definition, should address cumulative effects. EIAs in South Africa traditionally only considered the "footprint" or area covered by each project component. However, in recent years the cumulative nature of environmental impacts of human actions has increasingly become a visible concern to the South African public, which has led to the need to infuse cumulative effects concepts into environmental assessments.

SEA is becoming a widely used approach for integrating environmental issues into the formulation of policies, plans and programmes in order to achieve sustainable development. SEA initially arose out of the limitations of EIA. Where EIA is undertaken after a development proposal is submitted, SEA involves the investigation of alternative land uses prior to development proposals being submitted. EIA focuses on the impact of development on the environment. However, within an SEA process, the opportunities and constraints of the environment for development are assessed. Unlike EIA, SEA is not project or site-specific, but rather addresses the needs of a particular region or sector at a strategic level.

In theory, a SEA is aimed at improving the way in which cumulative effects are dealt with in environmental assessments. This raises the question of whether past and present South African SEA approaches have effectively addressed the issue of cumulative effects within each study.

Reviewers and integrators of EIAs, or SEAs, require an overview of what exactly CEA should entail and how best cumulative effects can be addressed within the formal South African IEM structures, in order to ensure that cumulative effects are addressed with current and future South African practice.

1.3 AIMS AND OBJECTIVES OF THIS STUDY

This thesis provides a critical reappraisal of recent experience in SEA with particular reference to its application in South Africa. It is in the context of the opportunities and constraints of current SEA application, that this study attempts to determine how best to infuse cumulative effects methodology and philosophy into the emerging South African SEA process.

Therefore, the aims of this research study were to:

- determine to what extent past South African SEA studies have been able to address cumulative effects.; and
- provide guidelines for the integration of CEA into the current South African SEA process.

In order to achieve these aims, the study was guided by the following six operational objectives:

1. provision of a broad overview of current international experience and trends in assessing cumulative effects as part of SEA processes;
2. provision of a brief overview of current South African practice, placing SEA within the IEM framework;
3. development of a set of criteria, using the key parameters and principles for assessing cumulative effects, against which case studies could be evaluated;
4. evaluation of three South African SEA case studies, in order to judge how effectively cumulative effects have been addressed within this process;
5. compilation of "lessons learnt" for each case study that may inform future applications; and
6. development of a generic framework to guide practitioners and reviewers in the assessment of cumulative effects, and to infuse this philosophy into the current SEA process.

1.4 RESEARCH STRATEGY

The research strategy was based on the analysis of qualitative SEA case study data using an inductive approach towards developing an understanding of the incorporation of IEM/SEA principles in different case studies. With this research approach, the data was used to derive an explanation of the relationship between EIA/CEA and SEA in an attempt to validate the theoretical principles, which underlie these approaches (Hamel, Durfour & Fortin, 1993).

Figure 1 provides a diagrammatic representation of the research approach used in this study.

A broad literature review was undertaken in order to obtain an overview of current EIA, CEA and SEA practice, both internationally and locally. This information was then used to develop evaluation criteria, and a scoring system against which the specific case studies could be evaluated.

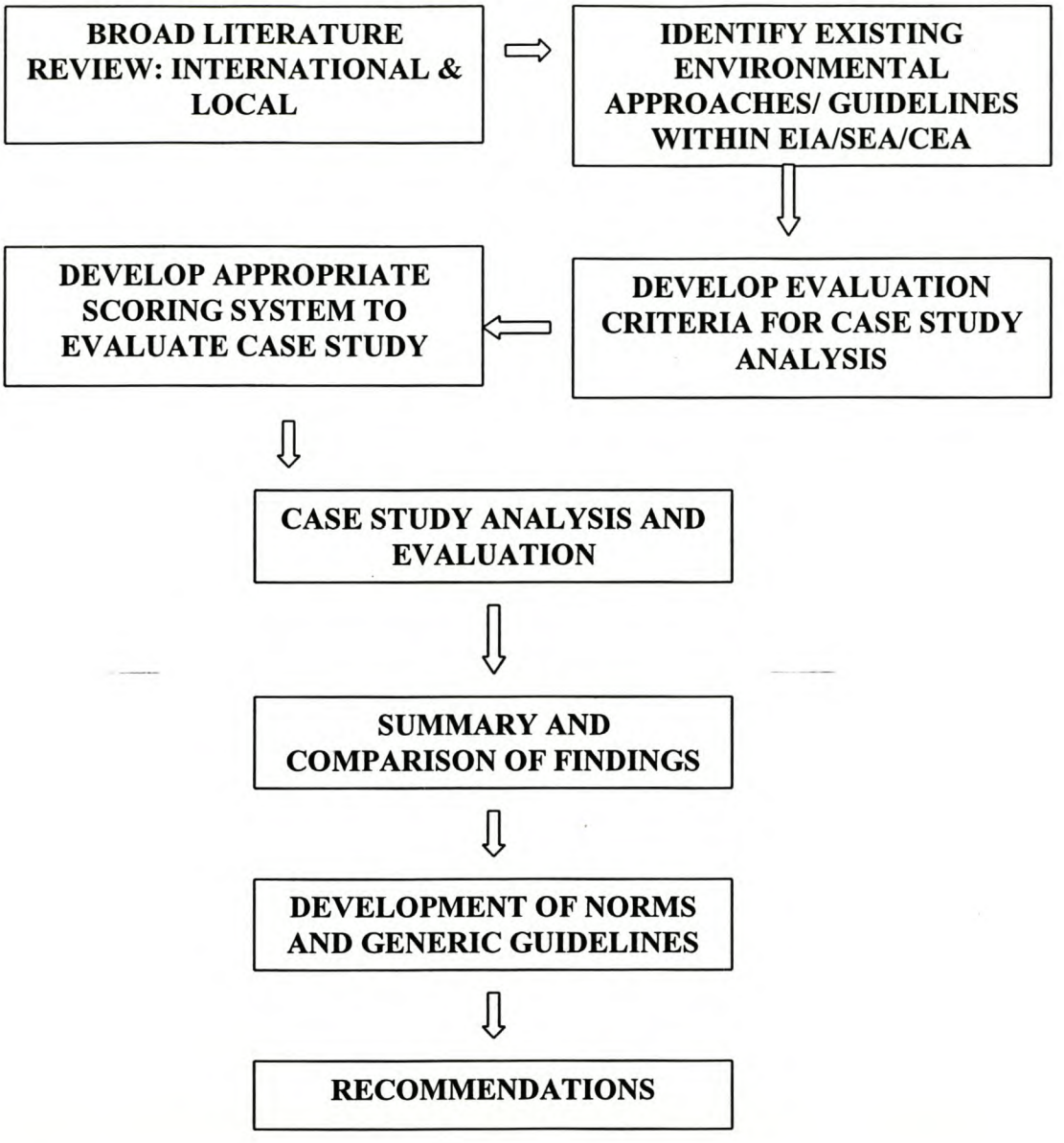

Figure 1 Research Design

Three South African studies were then analysed, focussing on:

- the identification of the degree to which the assessment of cumulative effects were incorporated into SEA studies;
- the identification of the state of CEA and SEA within South Africa; and
- the development of a practical process within the SEA system, which facilitates the effective and efficient assessment of cumulative effects within the SEA process.

Using the key principles and characteristics of CEA identified during the broad literature review, a generic framework for assessing cumulative effects was developed. This framework was based on the four key phases of EIAs, namely scoping, describing the environment, determining environmental consequences and proposed monitoring and mitigation measures.

The criteria were developed in the form of key questions to be addressed during each phase of the environmental assessment. These key questions incorporate the key parameters required for addressing cumulative effects, as identified in the literature review.

A qualitative case study analysis was undertaken by evaluating the case studies according to these key criteria in order to determine to what extent cumulative effects had been addressed within each study. From these results, norms and guidelines for future applications could be developed.

1.5 METHODS AND CASE STUDY SELECTION

A broad literature review was undertaken in order to evaluate the current and potential processes for assessing cumulative effects, as well as current and potential processes for undertaking SEA. This was followed by an exploratory strategy of enquiry via the case study method. The case study approach derives from the social sciences and is an investigative approach that uses qualitative data to derive theory or to provide explanation.

This qualitative research methodology structures the textual data in order to analytically evaluate the validity of the text through a process of data reduction, whereby categories were used to classify and group segments of textual data. The display of data, which were reduced in this way, was designed to aid the perception of patterns, relationships and common sequences within and between categories, thereby enabling explanations derived from the generalizations (Strauss & Corbin, 1990).

For the purposes of this study, three case studies were chosen, namely:
1. Cape Action Plan for the Environment (CAPE) Project (CSIR 2000a);
2. A Strategic Environmental Assessment for Sasol-Secunda (CSIR 2000b);
3. Durban South Strategic Environmental Assessment (CSIR 1999).

The Council for Scientific and Industrial Research (CSIR) has undertaken numerous SEAs since 1996. However, the choice of these specific studies aimed at providing a range of different types of SEAs to enable effective comparison and evaluation of the scope, techniques and procedures used within the respective studies. Each study represents a different type of SEA, both in terms of the geographic location (region) of the study area, as well as in terms client and therefore the type of SEA undertaken.

- The CAPE project, although not specifically undertaken as an SEA, provides an innovative example of a SEA approach to a regional study at a biome-scale, namely; the Cape Floral Kingdom., with a specific focus on the conservation sector.
- The Sasol–Secunda SEA represents a sectoral approach to the SEA process, with the client (Sasol) requiring a sectoral study (focused on Industry Sector) in order to determine what the potential development options are for this region (Highveld-Mpumalanga); and

- the Durban South Basin study represents a SEA undertaken for a specific region (KwaZulu- Natal) with the purpose of informing government decision-making on future planning options for the basin.

The approaches and methodologies applied in each case study differ considerably and therefore provided excellent scope for comparison. The effectiveness or success of each study differs from been rated (according to public perceptions of the process) as highly successful (CAPE) to less successful (Durban South SEA). This provided an excellent opportunity to identify both shortcomings and strengths of the SEA process, with the specific reference to cumulative effects.

1.6 THE REPORT STRUCTURE

The report consists of five chapters. The first chapter provides an introduction and overview of the research problem, study aims and objectives, the research strategy and data particulars.

Chapter 2 provides a theoretical overview of the EIA and SEA processes. After a brief introduction and description of EIA, the historical development of the EIA process is briefly outlined. Then the implementation of EIA within the South African context is described, before the limitations and weaknesses of the EIA process are discussed. A brief overview of SEA is given, followed by an analysis of the international trends in SEA. The focus is then placed on SEA within the South African context.

Chapter 3 provides an overview of CEA, briefly describing what cumulative effects are, a historical overview of CEA development and guidelines for integrating CEA in environmental assessments. A summary of the key challenges still hindering the effective assessment of cumulative effects are then discussed in the final section of this chapter.

Chapter 4 focuses on the integration of CEA into the SEA process, dealing specifically with current South African practice. A review of the appropriateness of addressing cumulative effects within the SEA process is followed by an evaluation of South African practice using a case study analysis. A comparison and summary of the key findings is provided and recommendations for possible best practice guidelines are made to ensure that cumulative effects are infused into the South African SEA process.

The final chapter provides a summary of the key findings of this report and a brief evaluation of this study's original aims and objectives, and then concludes with further research recommendations.

CHAPTER 2 ENVIRONMENTAL IMPACT ASSESSMENT AND STRATEGIC ENVIRONMENTAL ASSESSMENT: AN OVERVIEW

This chapter provides a theoretical overview of the EIA and SEA processes, within the broader context of international development and applications, and then focusing on the local South African context. The EIA process is described in terms of its historical development internationally and then more specifically within the South African IEM process. The section on EIA concludes with a summary of the limitations and weaknesses of existing EIA processes. The rest of this chapter then focuses on the SEA process, as a possible solution to the problems experienced in current EIA practice. The SEA process and rationale is defined and discussed, followed by a summary of international trends in this field, before finally sketching the South African SEA approach as a means of improving our existing IEM process.

2.1 INTERNATIONAL DEVELOPMENT OF EIA

The 1960s heralded the emergence of EIA, due to the growing awareness of the adverse and complex impacts of development on the surrounding environment. People recognized the need to understand and deal with these impacts to avoid serious environmental devastation. The procedure adopted was environmental impact assessment. EIA was first introduced in the United States of America in 1969 through the National Environmental Protection Act (NEPA). Since then, over 100 countries in the world have established formal national EIA systems. During this time, EIA has evolved into a comprehensive and versatile instrument for development planning and resource management, and the practical contribution that it can make to informed decision-making is widely acknowledged. It's inclusion in Principle 17 of the Rio Declaration on Environment and Development offers a good example (Canter, 1996).

The purpose of EIA is to ensure that environmental considerations are taken into account in decision-making about development proposals. The initial rationale for developing the EIA process was to redress the historical problem of environmental considerations being ignored or neglected in relation to political or economic considerations (Erikson 1994). The two key elements of EIA relevant to planning and decision-making are the informational element, i.e. the scientific techniques and methodologies used to generate information on significant environmental impacts of development actions and their consequences, and the influence element, i.e. the processes and procedures employed to ensure consideration of the information in decision-making (Horberry, 1989). Therefore, the end result of an EIA process is that the most appropriate decision is made in terms of maximizing positive and minimizing adverse environmental effects (Biswas & Geping, 1987).

2.2 EIA DEVELOPMENT IN SOUTH AFRICA

This section provides an overview of EIA development within the local context, highlighting how South Africa differs in principle from the international EIA process. The historical milestones of the EIA development in South Africa are briefly outlined, followed by a discussion of the implementation of EIA within the South African context.

2.2.1 The local context

South Africa is a less developed country, and as such, environmental evaluation procedures of the developed westernised world required some adaptation in order for them to be effectively implemented in the South African context.

Experience in the developed countries that have been practicing environmental management for well over thirty years, has shown that environmental assessments are all too often simply reactive, negative and costly and often delay development. This experience proves that a carefully structured and regulated procedure is required to ensure an effective and efficient process.

The integration of environmental concerns into public policy depends on an open system of government, a wide disclosure of information and informed citizens. South Africa has historically lacked these elements of governance and additional problems such as the lack of scientific data, inadequate administrative structures and lack of trained personnel all hamper the process.

Furthermore, environmental assessment places great emphasis on long-term, inter-generational ecological criteria, aesthetic considerations and scientific/ educational interests. This is a stumbling block in the process in lesser-developed countries as often these countries are faced with " bread and butter" issues of survival, with pressing present needs for food, housing and sanitation. The country's priorities are basically those of economic growth and development. As a result, the environmental concerns are not foremost in the political agenda and the process is hampered by a lack of political will to back environmental assessments and legislation. Taking these factors into consideration, there was a need to deviate from the western industrialized countries' environmental procedures, in order to formulate an approach that encouraged decision-makers to compromise, with an emphasis on identifying options and facilitating choices between options, rather than only focusing on the negative impacts of a development.

There has recently been an important shift in the environmental debate in South Africa, from the so-called "green" (biophysical) concerns to "brown" (basic needs) concerns. It is within the context of these broad paradigm shifts that EIA has been introduced in South Africa. EIA is a process having the ultimate objective of providing decision-makers with an identification of the likely environmental consequences of their actions. In this context however, the term environment must be seen in its broadest sense, as encompassing the natural, social and economic environments. An EIA is just one of a number of sustainable development tools (Audouin & Rossouw, 1998) embedded within the framework for environmental management in South Africa as provided by the IEM procedure.

2.2.2 Historical milestones

In 1984, the Council for the Environment established a committee to recommend a national strategy to ensure the integration of environmental concerns into development actions. After an extensive period of research and consultation, a constructive process of guiding and documenting development decisions was recommended. The procedure was initially devised by the Council for the

Environment (1989) and subsequently revised by the Department of Environmental Affairs (DEA, 1992). Although IEM was not legally required for many years it was commonly accepted and applied by industry and practitioners and has received international acclaim (Audouin & Rossouw, 1998).

IEM is defined as " a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process, in order to achieve a desirable balance between conservation and development" (DEA, 1992). This procedure is designed to ensure that the environmental consequences of development proposals are understood and adequately considered within the planning process. The term environment is used in its broad sense, encompassing biophysical and socio-economic components.

A very significant step for formalizing EIA in South Africa was the promulgation of *The EIA Regulations: Implementation of sections 21, 22 and 26 of the Environment Conservation Act,* in April 1998. This legislation facilitates the integration of environmental management with development activities.

In 1998, the National Environmental Management Act (NEMA) 107 was also promulgated. This policy, which is the national government's overarching framework policy, sets out the vision, principles and strategic goals and objectives and regulatory approaches that government will use for environmental management in South Africa. NEMA is aimed at developing a spirit of cooperative governance to ensure integration between the different departments of governments in terms of sustainable environmental management. However, despite the strengths of this legislation, there are still numerous deficiencies in terms of integration of environmental concerns across the different public and private sectors. This legislation still tends to be project based, and few strategic issues are adequately addressed. The EIA Regulations still focus on activities rather than on the receiving environment and provide no reference to scale of impact assessments, and the linkages with other significant legislation, such as the development and planning legislation remain inadequate.

In response to these deficiencies a guideline document on *Strategic Environmental Assessment for South Africa* was published by Department of Environmental Affairs and Tourism (DEAT), in February 2000. This procedure aims to provide a proactive management instrument in order to ensure the integration of environmental issues into the formulation of all plans and programmes. It is envisaged that the development of the SEA process will provide a basis for the integration of social, economic and biophysical concerns in order to achieve development sustainability, as advocated in the IEM procedure.

2.2.3 Implementation in South Africa

The purpose of IEM is to resolve or mitigate any negative impacts and to enhance positive aspects of development proposals. It is used to guide the development process by providing a positive interactive approach to gathering and analyzing data; and then, presenting the findings in a way that can be easily understood by non-specialists. It thus serves to refine and improve proposed policies, programmes and projects through a series of procedures, which are linked to the development process (Fuggle & Rabie, 1994).

The procedures aim to:

- stimulate creative thinking in the planning and initial design stage;
- provide a systematic approach to the evaluation of proposals;
- formalise the approval process in the decision-making stage; and
- ensure that monitoring and desirable modifications take place in the implementation stage.

The basic principles, which underpin IEM are:

- a broad understanding of the term "environment";
- informed decision-making;
- accountability for decisions and for the information on which they are based;
- an open and participatory approach to the planning of proposals; and
- proactive and positive planning.

This is therefore a multidisciplinary field, integrating contributions from professionals involved in all disciplines relevant to the planning of the development proposal. Due consideration is also given to alternative options for the development, including where appropriate, the "no-go" option. This process also facilitates accountability for decisions taken, by ensuring that a record of decision and the rationale behind it is available to the public on request. Public participation is encouraged, by involving all interested and affected parties (I&APs) during the scoping stage; and active participation of affected groups in the planning stage (Fuggle & Rabie, 1994).

As the flow diagram showing the major steps in the South African IEM procedure given in Figure 2.1 indicates, IEM consists of three main stages in the development of any proposal:

1. the development and assessment of the proposal;
2. the decision making stage; and
3. the implementation stage.

It is important to note from Figure 2.1 that the procedure allows for three possible routes at the assessment phase. These range from "no formal assessment" to "impact assessment". This ensures that unnecessary expense is not incurred for the sake of doing an EIA. A second important point is that stakeholder consultation is recognized as a key component of the procedure. Consultation with various I&APs and specialists in the scoping phase results in a series of issues being identified, which, in turn, provide the framework for the specialist investigation. The third point worth noting is the presence of a series of feedback loops, which mean that an iterative process is followed. A final point is that in the South African IEM procedure, the EIA is simply one element in an ongoing process. Many people make the mistake of confusing EIA with IEM simply because the EIA component receives most public attention. It is becoming increasingly important to link EIA into effective internationally recognized Environmental Management Systems such as ISO 14000. Then at a policy and regional level, tools such as SEA and CEA replace EIA in the IEM process (Fuggle & Rabie, 1994).

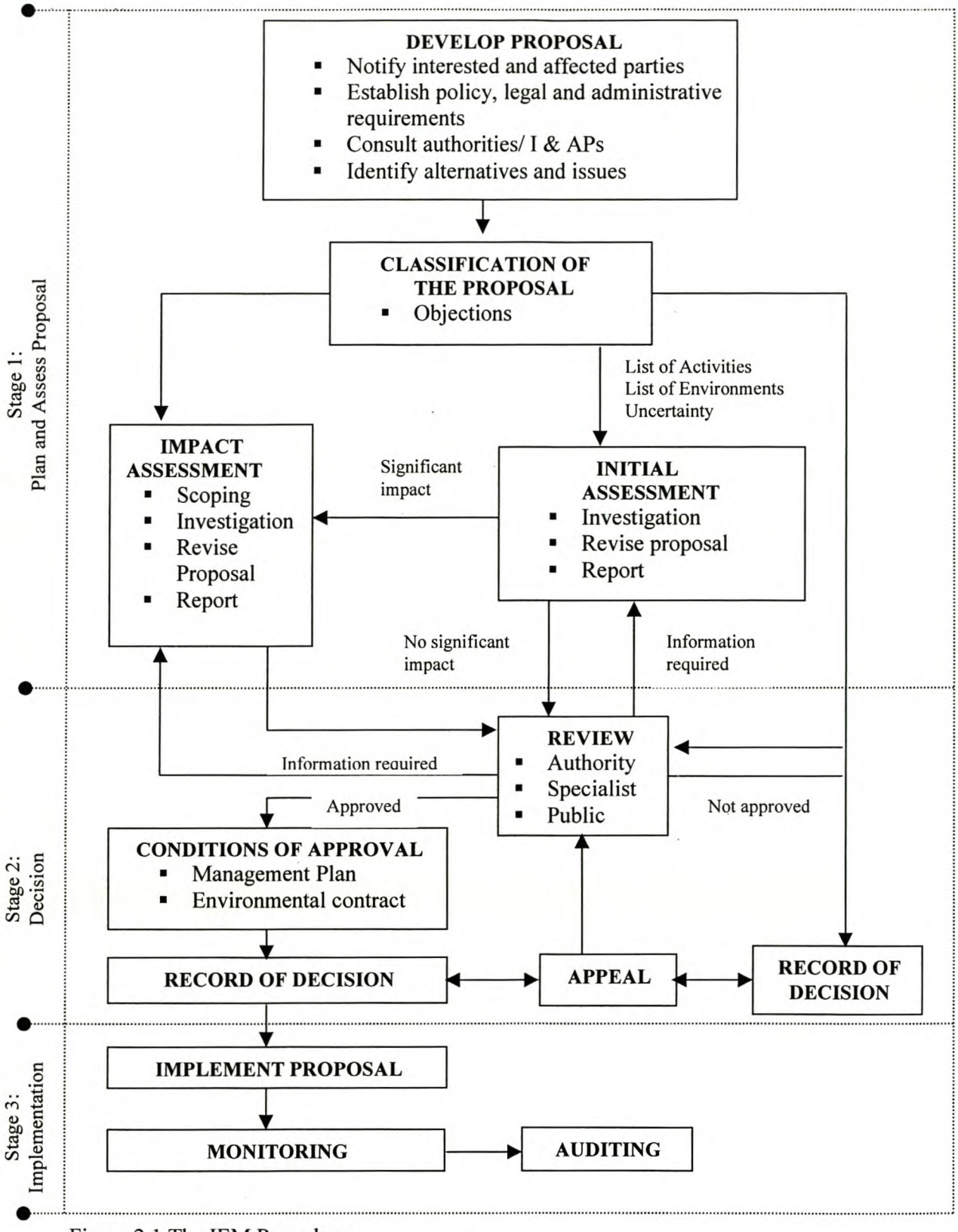

Figure 2.1 The IEM Procedure
(Source: Department of Environmental Affairs (DEA) 1992: 10)

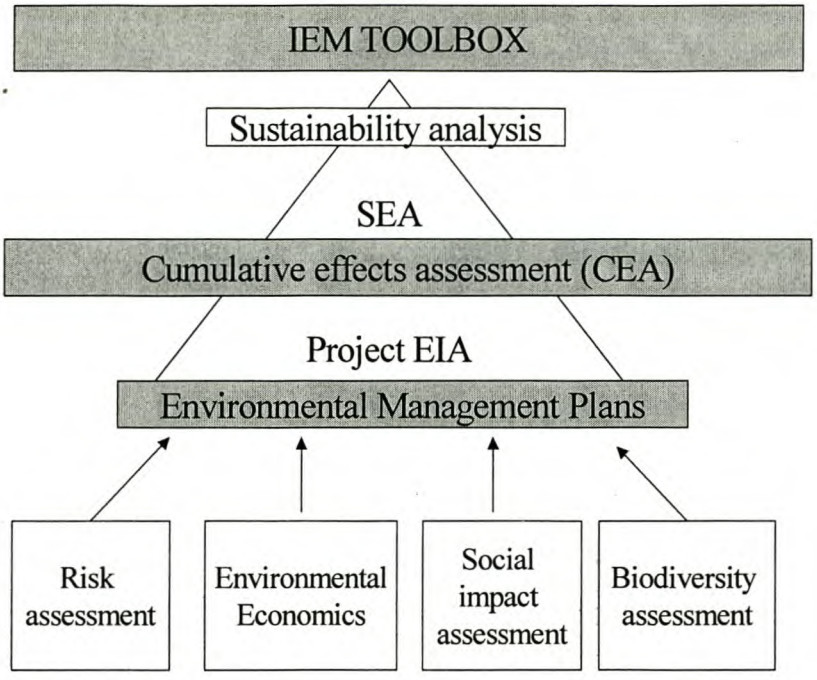

Figure 2.2 The IEM Toolbox

As Figure 2.2 indicates, there are various 'tools' that are used as part of the IEM procedure, such as EIAs, Environment Management Plans, and some of the emerging tools include methodologies to assess cumulative effects, risk assessment and economic environmental evaluation techniques and methodologies for implementing SEAs. The "toolbox" shows a how these "tools" fit into the IEM "toolbox".

2.3 THE LIMITATIONS AND WEAKNESSES OF EIA

Sadler (1995, 1996) states that some of the key limitations of the EIA process include:

- its inconsistent application to development proposals, with many sectors and classes of activity omitted;
- its operation as a "stand alone" process, poorly related to the project cycle and approval process; and
- its inability to address cumulative effects or risk factors.

EIAs are constrained by analytical and administrative shortcomings that impede its ability to analyse and assess cumulative environmental change. Temporal and spatial factors are usually not adequately considered in EIAs. Temporal boundaries are commonly characterised by short time frames, usually determined by a project's life cycle with primary emphasis on the implementation phase. Spatial boundaries are typically confined to local scales, usually delineated by project or jurisdictional perimeters. The limited spatial and temporal dimensions generally narrow impact analysis to considerations of single perturbations, simple cause-effect relationships, first order impacts, immediate effects, and an individual site.

This limited scope overlooks environmental change involving multiple perturbations, complex causation, higher-order impacts, interacting processes, time lags and extended spatial boundaries. The site-specific focus of EIA tends to disregard the long term processes and lags, and cross-boundary movements, which are characteristics of many cumulative effects. It also overlooks the additive or interactive effects among environmental changes originating from two or more individual projects. Further, a project focus tends to disregard environmental change induced by higher levels of decision-making, which are frequently the driving forces behind individual projects (Spaling & Smit, 1993).

Administrative limitations relate to EIAs reactionary approach and project level focus. An EIA process is usually triggered after a decision has been made to initiate a development activity. The inertia of this initial decision restricts the ability of EIA to influence an activity's original justification and design, and pre-empts a proactive or anticipatory approach. SEA presents a promising means of addressing some of these issues.

2.4 SEA: THE SOLUTION?

In the light of these shortcomings of EIA, the SEA process offers numerous possibilities to overcome the project specific barriers created by EIA. The following section therefore focuses on the SEA process. The nature and definition of SEA are briefly discussed followed by the rationale for the application of SEA. The application of SEA is then discussed, firstly within the international context, and then finally focusing more specifically focusing on the South African approach, which differs somewhat from international applications.

2.4.1 Nature and definition of SEA

SEA responds to what the World Commission on the Environment and Development (WCED) (the so-called Brundtland Commission) called the "chief institutional challenge" of the 1990s, namely considering "the ecological dimensions of policy at the same time as economic and other dimensions" (WCED, 1987).

There is no internationally agreed definition for SEA. The term encompasses a range of types and contexts of decision-making. However, in general, SEA is understood to be a process for identifying and addressing the environmental consequences (and associated social and economic effects) of proposed and existing policies, plans and programmes (PPPs), and other similar pre-project level initiatives with spatial regional development consequences.

SEAs therefore differ from:

- EIAs of large-scale projects because these are site-specific and normally only focus on one activity, and are therefore not strategic as they proceed policy proposals;
- "integrated" PPP-making, which incorporates environmental issues in the PPP-making process but does not involve the stages of a formal environmental assessment process, in particular an appraisal of alternatives based on environmental objectives and criteria;

- environmental audits or "state of the environment" reports (SoER) which do not predict the future environmental impacts resulting from the application of a PPP;
- many "environmental appraisals", environmental strategies or cost-benefit analyses (CBA): those which do not predict the likely future effects of a PPP, do not consider a range of environmental components, and/or do not result in a written report; and
- various integrated management plans which deal with the environmental impacts of a specific biotope (e.g. coast, heathland), but do not specifically inform decision-making on alternative planning and development options that could result in sounder environmental outcomes.

Sadler (1997) describes SEA as a decision-aiding rather than decision-making process, referring to SEA as a "tool for forward planning" to be flexibly applied at various stages of policy-making. Using this broad perspective, SEA encompasses assessments of both broad policy initiatives and more concrete programmes and plans with physical and spatial references. According to Dalal-Clayton and Sadler (1998), the interrelationship between PPPs is frequently idealised as a hierarchial or tiered process of decision-making. In reality, however, policy-making does not necessarily follow a logical sequence of discrete, technical steps. Rather, it is a more complex, iterative process in which the range of choice is gradually narrowed and most options are foreclosed by the project phase. This fact has a critical bearing on practical applications of SEA.

The difference between PPPs in practice is not very clear and often misunderstood and inappropriately applied. However, there is a hierarchy or tiering that can be used to make a distinction between PPPs. The hierarchy follows the sequence:

Policy ⟹ Plan ⟹ Programme ⟹ Project

What is important is that each of these components often set the structure for the lower component (i.e. policy influences the plan which in turn influences the structure of the programme which determines the project's outcome).

2.4.2 Rationale for the application of SEA

Although widely promoted, SEA is still an emerging process that aims to integrate environmental considerations into laws, policies, plans and programmes. To date, formal provision and guidelines for undertaking SEA are confined largely to industrialized countries (e.g. Australia, the Netherlands, Canada, New Zealand, the United States of America and the United Kingdom).

According to Dalal-Clayton & Sadler (1998), the rationale for SEA of policies, plans and programmes falls into three main categories: strengthening project EIA; addressing cumulative and large-scale effects; and advancing the sustainability agenda.

2.4.2.1 SEA in strengthening EIA

EIA practice is constrained by certain weaknesses and limitations. These include structural weaknesses centred on the relatively late stage at which EIA is usually applied in decision- making. By this point, high-order questions of whether, where and what type of development should take place have been decided on, often with little or no environmental analysis. Project-by-project EIA is also an ineffective means of examining these issues. The use of SEA or an equivalent approach to incorporate environmental considerations and alternatives directly into PPPs is far preferable. This approach can also help to streamline the EIA process, making EIAs more consequential and reducing the time and effort involved in their preparation. For developing countries, SEA may yield significant other benefits, like screening out certain kinds of development at policy level and reducing the need for many project-level EIAs and thus relieving pressure where institutional and/or skills capacity is normally limited.

2.4.2.2 SEA for addressing cumulative and large scale effects

Recently, considerable efforts have been made to extend EIA-based frameworks to encompass certain types of cumulative effects. These deal reasonably well with the ancillary impacts of large-scale projects (e.g. dams, transport infrastructure) and the incremental effects of numerous, small-scale actions of a similar type (e.g. road realignment and improvement). However, more pervasive cumulative effects and large-scale environmental change (which are the end result of multiple actions and stresses that cut across policy and ecological boundaries) can be addressed best by SEA of PPPs.

2.4.2.3 SEA to advance the sustainability agenda

When applied systematically, SEA can become a vector for the transition from conventional to a sustainability approach to planning and decision-making, as called for by the Brundtland Commission (WCED, 1987) and Agenda 21 (UNCED, 1992). Conventionally, the emphasis has been on tackling the environmental symptoms or effects of development in the "downstream" part of the decision cycle. By contrast, the sustainability approach focuses on the sources or causes of environmental deterioration, which lie in the "upstream' part of the decision cycle, in the economic, fiscal and trade policies that guide the overall course of development.
SEA provides a means of incorporating environmental objectives and considerations into economic decisions.

2.4.3 International trends in SEA application

Internationally, the debate on the development and practical application of SEA has been growing over the past decade. There is also a growing body of literature on SEA concepts, processes and applications. The current situation regarding SEA has been likened to the early years of EIA. This section provides the context of international SEA applications and then provides some examples of industrial countries that have made a significant contribution to SEA applications internationally.

2.4.3.1 The context of applications

Then, as now, reservations existed about delays, duplication and appropriate methodologies. EIA experience has shown the benefits of improved decision-making at the project level. Experience has also shown that EIA cannot guarantee environmental standards and resource sustainability. SEA is shifting attention to this neglected area. SEA basically addresses two areas of need. Firstly, SEA counteracts some of the limitations of the project EIA, and secondly, promotes sustainable development.

Current SEA processes vary considerably. They may be formal or informal, comprehensive or limited in scope, be closely linked with or be unrelated to either policy or planning instruments. In general, three broad approaches to SEA have been adopted to date (Sadler & Verheem, 1996):

- it has been introduced as a relatively distinct, separate process – typically as an extension of EIA;
- it has been established as a two-tier system (e.g. in the Netherlands) with formal SEAs required for specific sectoral plans and programmes and an environmental 'test" applied to strategic policies; or
- it has been incorporated into more integrated forms of environmental policy appraisal (e.g. in the United Kingdom) and regional and land use planning (e.g. in Sweden).

Recently, there has been growing recognition of the importance of integrating environmental assessments with other policy and planning instruments. Attention is primarily focused on understanding SEA as a concept, on its scope and range of application as an environmental assessment tool that can strengthen the principles of environmental assessment and extend these principles to policies, plans and programmes. Understanding the application of SEA in practical case studies helps to collect the necessary empirical evidence and test scientific findings and assumptions. Translation of this learning into appropriate regulations and institutional mechanisms can then be seen as a follow-up step.

SEA is also related to the consideration of cumulative effects. It is seen as providing a context and rationale within which to address cumulative effects. Recent studies developed as part of the Australian review process (Court, Wright & Guthrie, 1994) highlight the advantages of this relationship between SEA and the assessment of cumulative effects. However, there is still a lack of practical examples where this synergism is achieved and demonstrated with adequate methodologies and empirical examples.

2.4.3.2 Examples of application

Democracy and openness in terms of the economic and political structures in place strongly influence the rate at which SEA systems are being implemented. The environmental assessment of policy options and planning strategies requires a high degree of openness and flexibility. Therefore, it is obvious that in those countries with well-established democratic structures, SEA is evolving more rapidly.

Canada, the United States of America, the Netherlands, the United Kingdom, Denmark, Sweden, Norway, Finland, Germany, France, New Zealand and Australia have all already made significant contributions to institutional and procedural approaches to SEA. Formal SEA regulations and guidelines have been established in a limited number of countries. (New Zealand, the Netherlands, the United States of America, the United Kingdom, Australia and Canada). International organization such as the World Bank and European Union, have also made significant contributions to this field.

Most countries relate SEA to sustainability goals, on the grounds that SEA may assist the decision-making process by influencing the design of more sustainable policies and strategies. In some cases, sustainability remains implicit background policy (such as in the United States of America and the United Kingdom). In other cases sustainability issues are used as benchmarks against which objectives and criteria in SEA can be measured (e.g. Canada and the Netherlands), or as a strong policy that helps shape new forms of decision-making in support of sustainable development (e.g. Australia, New Zealand) (Dalal-Clayton & Sadler, 1998).

2.4.4 The South African approach to SEA

When examining the development of SEA, it must be noted that SEA experience also varies according to the country's context. South Africa is of particular interest here, as we have taken a somewhat different approach, placing the emphasis on "assessing the effects of the environment on development needs and opportunities." This section provides an overview of the evolution of SEA within the South African context and describes the key principles underlying the South African SEA process.

2.4.4.1 Conceptual evolution and aims of SEA

In South Africa there is widespread interest among academics, professionals, civil servants and politicians about the need for SEAs, its applicability and possible legislative contexts. Although SEAs have only recently been undertaken in South Africa, we are in a good position to learn from international experience.

An innovative approach to SEA is being followed in South Africa. This is of particular interest because, in practice, South Africa is a unique amalgam of developed and developing economies and societies. It can draw on and adapt lessons from industrial countries readily, but must also have regard to their portability and use in settings that are comparable to those in many developing countries (Dalal-Clayton & Sadler, 1998).

In South Africa, EIA is a well-established tool for decision-making procedures for IEM (DEA, 1992) and regulations for EIA have evolved over a number of years. However, the deficiencies of EIA have resulted in changing perceptions of what is required in terms of an environmental assessment. This has lead to the emergence of SEA (Wiseman, 1997). The emphasis is on "assessing the effect of the environment on development needs and opportunities," with a strong focus on assessing cumulative impacts. How EIA and the evolving SEA process in South Africa compare conceptually is shown in Table 2.1 below.

Table 2.1 A conceptual comparison of EIA and SEA in South Africa

EIA	**SEA**
Is reactive to a development proposal.	Is pro-active and informs development proposals.
Addresses a specific project.	Assesses the effect of the environment on development needs.
Has a well-defined beginning and end.	Is a continuous process aimed at providing information at the right time.
Assesses direct impacts and benefits.	Assesses cumulative impacts and identifies implications and issues for sustainable development.
Focuses on the mitigation of impacts.	Focuses on maintaining a chosen level of environmental quality.
Has a narrow perspective and a high level of detail.	Has a wide perspective and a low level of detail to provide a vision and overall framework.
Focuses on project-specific impacts.	Creates a framework against which impacts and benefits can be measured.

Source: CSIR 1996: 8

The SEA process in South Africa has not been adopted by national policy-making institutions or for policy-making processes yet, but it is applied at the plan and programme levels of the project cycle. The aim is to establish an achievable and measurable set of minimum requirements, recognizing that SEA comprises a mix of a project-level focus and more strategic thinking.

2.4.4.2 The principles and process of application

Fundamental to the approach towards SEA implementation, is flexibility and relevance to the project cycle. The overall goal of SEA is to ensure that environmental issues are incorporated into the planning and programme development process as early as possible. Several SEAs have recently been undertaken in South Africa, which prompted the CSIR to identify guidelines for SEA. The approach followed was to identify principles for South African SEA, based on international approaches as well as local experience.

The following ten principles (DEAT & CSIR, 2000) advocate that SEA:

1. is driven by the concept of sustainability;
2. identifies the opportunities and constraints that the environment places on development of plans and programmes;
3. sets criteria for levels of environmental quality or limits of acceptable change;
4. is a flexible process which is adaptable to the planning and sectoral cycle;
5. is part of a strategic process, which begins with the conceptualisation of the plan or programme;
6. is part of a tiered approach to environmental assessment and management;
7. has its scope defined within the wider context of environmental processes;
8. is a participative process;

9. is set within the context of alternative scenarios; and
10. recognizes the principles of precaution and continuous improvement.

The CSIR has designed a process (see Figure 2.3) to implement these principles in various stages, namely:

- an initiation stage to determine the SEA approach required for the particular region;
- a scoping stage to identify the key strategic issues of the region;
- a stage for the assessment of strategic issues;
- the reporting and review stage and various linkages to later stages of the project cycle in terms of monitoring and adaptation.

SEA methods are evolving rapidly, but a clear framework of best practice methods has still not yet emerged. At the moment, SEA is primarily progressing through individual case studies. These, in turn, are leading to a greater understanding of possible SEA methods. Once these have become more accepted and widespread, more SEA regulations and guidelines are likely to be established.

SEA is also related to the consideration of cumulative effects, as it is seen as providing a context and rationale within which to address cumulative effects. The following chapter provides an overview of CEA.

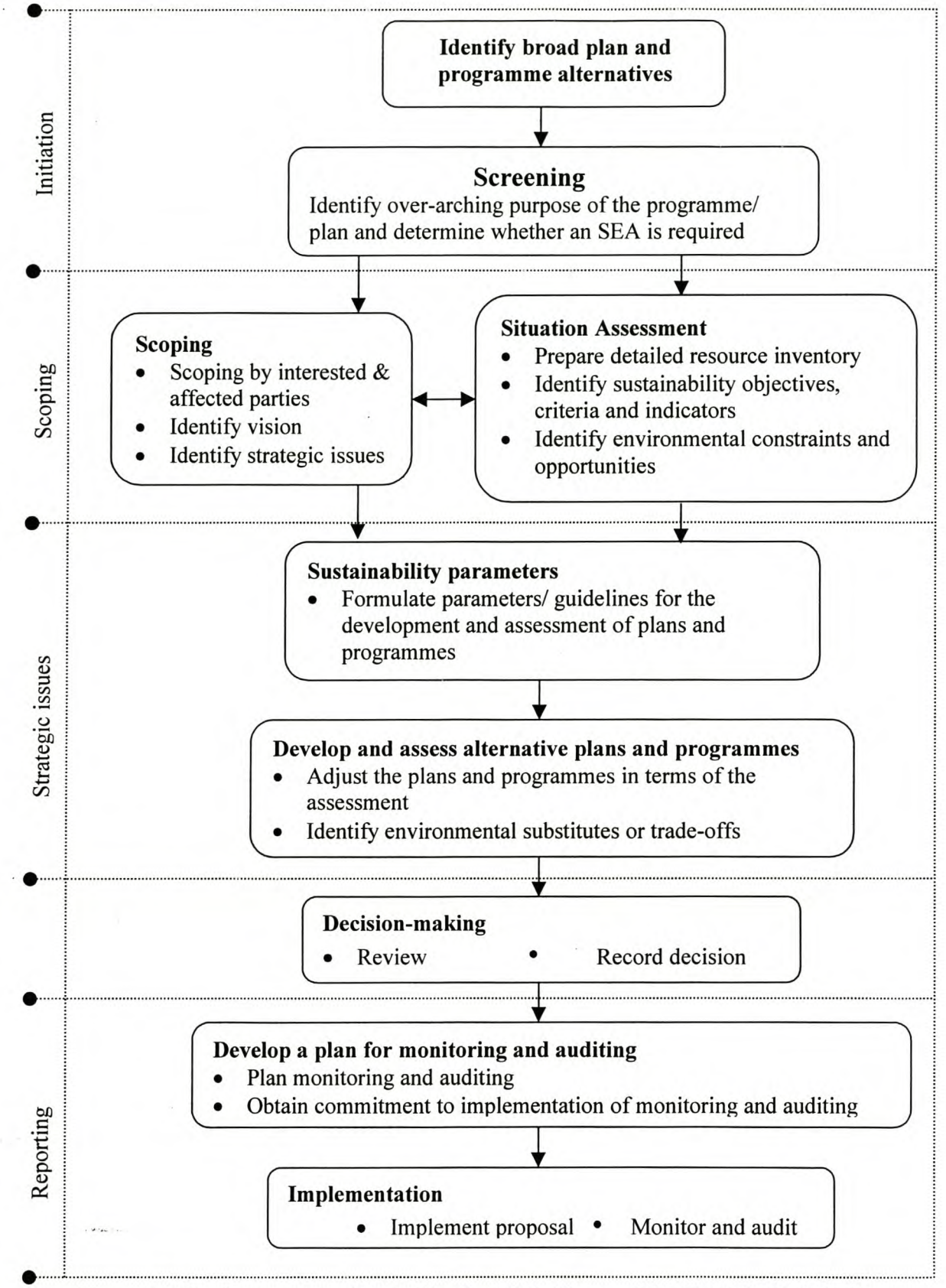

Figure 2.3 The SEA process designed by the CSIR (Source: DEAT & CSIR 2000:18)

CHAPTER 3 AN OVERVIEW OF CUMULATIVE EFFECTS ASSESSMENT

This chapter focuses on CEA as an approach to ensure that the cumulative impacts of developments are taken into consideration within the environmental assessment process. Firstly, the concept of cumulative effects is discussed, followed by an explanation of the need for CEA. The historical development of CEA is then described followed by an outline of possible guidelines for integrating cumulative effects into current environmental assessment processes. This outline provides a framework within which CEA can be applied to improve current environmental assessment practice. There are, however, still key challenges that are currently hampering the effective application of CEA and these are briefly discussed in the final section of this chapter.

3.1 THE CONCEPT OF CUMULATIVE EFFECTS

A backdrop for the discussion of cumulative effects is provided in this section, with a definition of cumulative effects and a list of key principles associated with CEA. This is followed by a description of the main concepts pertaining to cumulative effects, in terms of the sources and manifestations of cumulative effects and the typology of cumulative effects.

3.1.1 Definition of cumulative effects

According to the Council on Environmental Quality (1997), cumulative effects occur when:

- Impacts on the environment take place so frequently in time or so densely in space that the effects of individual impacts cannot be assimilated; or
- the impacts of one activity combine with those of another in a synergistic manner.

Effects can interact, combine and compound over time and space such that the overall effect often exceeds the simple sum of previous effects. Individually, these impacts may not be qualitatively different from environmental effects associated with single-project developments, but collectively they may result in changes to the environment that would not otherwise have occurred. Cumulative effects may also prevail for many years beyond the life of the action that caused the effects (Spaling & Smit, 1993; Court, Wright & Guthrie, 1994; Council on Environmental Quality, 1997). Cumulative impacts are generally defined as the total effect on the environment of a series of developments taking place within a specific region over a particular period of time.

Table 3.1 provides a summary of the main principles of cumulative effects. Although no universally accepted framework for CEA exists, these general guidelines have gained acceptance as principles. These principles have differentiated CEA from traditional project-specific EIA. The principles can be divided into various classification classes; namely; firstly determining the cause of the impacts and the effects of the impacts, which in turn will enable one to determine the spatial and temporal scope of the impacts. Having then determined the cause-effects relationship,

and the spatial-temporal scope of the effects, one will then be able to analyse the impacts.

Table 3.1 A summary of the main principles of cumulative effects

Classification type	Principle
Spatial scope	▪ Cumulative effects on a given resource, ecosystem and human community are rarely aligned with political or administrative boundaries.
Temporal scope	▪ Cumulative effects may last for many years beyond the life of the action that caused the effects.
Cause	▪ Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.
Cause	▪ Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
Effect	▪ Cumulative effects are the total effect, including both direct and indirect effects on a given resource, ecosystem and human community of all actions taken.
Analysis	▪ Cumulative effects need to be analysed in terms of the specific resource, ecosystem and human community being affected.
Analysis	▪ It is not practical to analyse the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.
Analysis	▪ Each affected resource, ecosystem and human community must be analysed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

(Source: Council of Environmental Quality, 1997: 12)

3.1.2 Sources and manifestations of cumulative effects

Cumulative environmental changes are characterised by broad, often undefined spatial, temporal and media dimensions. Changes occur over time scales much longer than forecasts and assessments normally utilised in planning and policy decisions. Spatial changes transcend the fixed boundaries of local sites to include regional and even global scales. Where the intensity of development remains low, the impacts can be assimilated by the environment overtime, and cumulative effects do not become a significant issue. However, when development reaches a high level of intensity, the impacts cannot be assimilated rapidly enough by the environment to prevent an incremental build-up of these impacts over time (Eccles *et al.*, 1994).

This temporal and spatial accumulation gradually alters the structure and functioning of environmental systems, and subsequently affects human activities. In addition to expanded temporal and spatial dimensions, cumulative environmental changes are also characterised by an activity dimension. Environmental change often results from human activities, which feature a multiplicity of small, independent decisions by numerous individuals. Each decision may result in an increment of environmental change that is individually insignificant but, repeated over time and dispersed over space may accumulate and contribute to significant environmental change. These dimensions over time, space and activity define the essence of cumulative environmental change and serve to distinguish its various types (Spaling & Smit, 1993).

3.1.3 Typology of cumulative effects

The various scenarios for cumulative effects are provided in Table 3.2. In simple terms, cumulative effects may arise from single or multiple actions and may result in additive or interactive effects. Interactive effects may be either countervailing - where the net adverse effect is less than the sum of the individual effects - or synergistic - where the net adverse cumulative effect is greater than the sum of the individual effects (Council on Environmental Quality, 1997). Table 3.3 highlights the actions and processes that lead to cumulative effects.

Table 3.2 Types and characteristics of cumulative effects*

Type	Characteristic	Example
Time crowding	Frequent and repetitive effects.	Forest harvesting rate exceeds regrowth.
Time lags	Delayed effects.	Bioaccumulation of mercury.
Space crowding	High spatial density of effects.	Pollution discharge into stream from non-point sources.
Cross-boundary	Effects occur away from the source.	Atmospheric pollution and acid rain.
Fragmentation	Change in landscape pattern.	Fragmentation of indigenous habitats.
Compounding effects.	Effects arising from multiple sources or pathways.	Synergism among pesticides.
Indirect effects	Secondary effects.	Developments following construction of new highway.
Triggers and thresholds	Fundamental changes in system functioning and structure.	Climatic change.

*(adapted from the Council on Environmental Quality, 1997)

According to Spaling and Smit (1993) there is consensus among researchers that cumulative effects can be characterised according to the following attributes:

- *Temporal accumulation*: This occurs when the interval between perturbations is less than the time required for an environmental system to recover from each perturbation.

The rate of temporal accumulation may be continuous, periodic, or irregular and occur over short or long time frames;

- *Spatial accumulation*: This is analogous to temporal accumulation and results where spatial proximity between perturbations is smaller than the distance required to remove or disperse each perturbation. Spatial accumulation may be characterised by scale (local, regional or global), density (clustered or scattered) and configuration (point, linear or areal);
- *Human activities*: The nature of human-induced activities or perturbations, which also affect the accumulation of environmental change, provided the perturbations are sufficiently linked in time and space. Activities may vary by number, type and magnitude.

Table 3.3 Basic actions and processes that lead to cumulative effects*

	ADDITIVE PROCESS	INTERACTIVE PROCESS
SINGLE ACTION	*Slowly dissipative*: Repeated "additive" effects from a single proposed project. (e.g. the impacts associated with small scale sugar cane production)	*Multiplicative* Stressors from a single source that interact with the receiving environment to have an "interactive" net effect. (e.g. development of the English Channel tunnel which stimulated major rail expansion in south-east England)
MULTIPLE ACTIONS	*Multiple impacts*: Effects arising from multiple sources that may affect environmental resources additively.	*Synergistic relationships*: Effects arising from multiple sources that affect environmental resources in an interactive fashion. (e.g. sulphur dioxide emissions which lead to acid rain)

*(adapted from Council on Environmental Quality, 1997; Contant & Wiggins, 1993)

These attributes of time, space and activity are not mutually exclusive but rather highly interdependent. Their interaction generates the complexity inherent in cumulative environmental change. These attributes underlie methodological approaches to analysing and assessing cumulative effects (Spaling & Smit, 1993).

3.2 THE NEED FOR CEA

Evidence is increasing that the most devastating environmental effects may result not from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time. In recent years there has been a growing realisation that the process of evaluating and minimizing the negative environmental impacts of individual developments, which are unobjectionable in themselves, does not adequately take into account the accumulative nature of some effects (Court, Wright & Guthrie, 1994). This has led to the development of procedures, known as Cumulative Effects Assessment (CEA), for evaluating the consequences, sources and pathways of cumulative impacts of multiple activities (CSIR, 1997). CEA is the process of systematically analysing and assessing cumulative environmental change.

CEA is essential to effectively manage the consequences of human activities on the environment. The purpose of CEA is to ensure that the full range of consequences of actions be considered. Without incorporating cumulative effects into environmental

management and planning, it will be impossible to move towards sustainable development. To a large extent the goal of CEA is to include environmental considerations into the planning process as early as possible to improve decision-making (Council on Environmental Quality, 1997). The practice of CEA is complex because of the need to consider multiple sources of change, alternate pathways of accumulation, and temporally and spatially variable effects (Spaling, 1994; Smit & Spaling, 1995).

There is an increasing need for decision-makers to look at their projects in the context of other developments in the community or region (i.e. analysing the cumulative effects). Direct effects continue to be important, in part because they are more certain. Nevertheless, the importance of local, regional and global environmental change has resulted in efforts to undertake and improve the analysis of cumulative effects. CEA attempts to overcome the limitations inherent in the *tyranny of small decisions* (Odum, 1982) and the *tragedy of the commons* (Hardin, 1968). CEA reflects an assessment philosophy, by encompassing not only the consequences of actions, but also the causes, as well as possible management policies. CEA must thus contend with the difficulty of balancing social needs and environmental constraints with an incomplete knowledge base (Stakhiv, 1988). The study of possible cumulative effects is necessary in order to determine whether or not changes have already been set in motion that are detrimental to the long-term health of the environment and the people who rely on it. In addition, such studies would help to assess the severity of the changes expected, possible policy responses to manage or avoid an impact, and the effect of additional industrial developments.

3.3 HISTORICAL DEVELOPMENT OF CEA

The history and emergence of CEA internationally is not clear from the available literature. What is clear though, according to Duinker (1994) is the expansion of EIA to include:

- social, economic and cultural considerations;
- not just discrete projects, but also programmes (e.g. regional forestry programmes), plans and policies;
- not just single projects, but concurrent projects in an area, or similar projects occurring sequentially in an area.

These factors inherently suggest the assessment of cumulative effects. Although cumulative environmental change and its consequences are readily apparent, it has only been widely recognised over the last two decades (Table 3.4). Its recognition can be largely attributed to the scientific basis and institutional context of EIA. Views differ as to whether this development is an evolutionary maturation of EIA or a reaction to the shortcomings of EIA theory and practice. The emergence of CEA in both Canada and the United States has paralleled a broadening of the scope and role of EIA. EIA processes in these countries have included explicit provisions for the assessment of cumulative effects. The inclusion of these provisions into a revised EIA process is indicative of a perspective that views environmental assessment as an overarching framework in which CEA is considered a subset of EIA (Spaling & Smit, 1993).

Table 3.4 Overview of the evolution of Environmental Impact Assessment*

1970's	• Environmental Assessment introduced. • First EIA's focused exclusively on biophysical aspects. • Initial research in cumulative effects scenarios.
1980's	• Social assessments, economic analysis and risk analysis included in the EIA process. • Initial efforts to address cumulative effects in EIA.
1990's	• Sustainability principles receive attention. • SEA emerges as a tool for addressing environmental issues in policies and plans. • International recognition that environmental assessment has to be expanded to include cumulative effects.

*(adapted from Sadler, 1996; CSIR, 1996:1)

The earliest and most common attempt to assess cumulative effects involved grouping numerous probable development activities together and analysing their collective impact on the environment. These studies typically employed either an analysis of several projects combined into a scenario of expected development in a geographic area (*regional assessment*) or an assessment of an entire program of related or similar activities (*programmatic assessments*). This type of assessment dates back to the mid 1970's (Contant & Wiggins, 1993). Another attempt at analysing cumulative effects was the use of *suitability studies* to determine appropriate areas for development. Rather than forecasting and analysing the impacts of individual projects on the environment, suitability analysis examine the characteristics of a region and identify areas that are appropriate for or sensitive to different types of development. As a result, cumulative impacts are addressed in the context of the natural system's ability to withstand development pressure. To determine suitability ratings, overlay maps were created, and the resultant composite map identified whether an area was suitable or unsuitable for a particular type of land use (Contant & Wiggins, 1993). This methodology, known as 'the sieve technique', was available in the early 1970's and is described by McHarg (1971).

3.4 GUIDELINES FOR INTEGRATING CEA INTO ENVIRONMENTAL ASSESSMENTS

Although no standard methods exist for addressing cumulative impacts, an area of priority in the environmental arena in the United States has been the need for methodological approaches and reductions in institutional barriers related to the analysis of cumulative impacts (Canter, 1997). Most efforts to incorporate CEA into EIA have focussed on "considering the proposed action in relation to surrounding projects; appropriately defining the base-line conditions; and addressing combined impacts from the proposed action and surrounding activities on environmental media, natural resources and socio-economic systems" (Canter & Sadler, 1997:12).

One practical way to develop or select a CEA methodology is to consider an outline prepared by Davies (1992), which contains the following steps:

1. Define the boundaries of project related effects.
2. Identify pathways through which the anticipated environmental effects of a project are expected to occur.
3. Identify relevant past and existing projects and activities, their impacts on the environment of the proposed project(s) and pathways through which those impacts occur.
4. Identify future projects and activities and their potential linkages via impact pathways to the proposed project(s).
5. Identify valued ecosystem components (VECs) that exist within the zone of influence of the proposed project(s).
6. Through linked pathways, assess the possible interactions among environmental effects of the proposed projects(s) and the environmental effects of past, present and future projects.
7. Determine the likelihood and significance of cumulative effects of the proposed project(s) on the VECs.
8. Identify appropriate mitigation and monitoring measures.

A logical and systematic approach to achieving this has been the incorporation of CEA principles (as given in Table 3.1) and steps into the EIA process, highlighted in Table 3.5. This table depicts how various CEA steps can be integrated into the existing EIA components, namely; scoping, the description of the affected environment, determining the environmental consequences and the mitigation of environmental consequences.

Table 3.5 CEA steps integrated in the components of the EIA process*

EIA Components	CEA Steps
Scoping	1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals. 2. Establish the geographic scope for the analysis. 3. Establish the time frame for the analysis. 4. Identify other actions affecting the resources, ecosystems and human communities of concern.
Describing the affected environment	5. Characterise the resources, ecosystems and human communities identified in the scoping in terms of their response to changes and capacity to withstand stresses. 6. Characterise the stresses affecting these resources, ecosystems and human communities and their relation to regulatory thresholds. 7. Develop a baseline condition for the resources, ecosystems and human communities.
Determining the environmental consequences	8. Identify the most important cause-and-effect relationships between human activities and resources, ecosystems and human communities. 9. Determine the magnitude and significance of cumulative effects.
Mitigation of environmental consequences	10. Modify or add alternatives to avoid, minimise, or mitigate significant cumulative effects. 11. Monitor the cumulative effects of the selected alternative and adapt management.

*(adapted from Canter & Sadler, 1997)

These steps provide a useful guide for EIA practitioners, to be modified according to individual situations and circumstances.

3.5 CHALLENGES IN UNDERTAKING CEA

Environmental effects, both direct and cumulative, are best considered in terms of loss of environmental function. The identification of environmental function depends to a large extent upon the complete understanding of: (1) how the environment developed in the past, and (2) how the environment functions today. Before cumulative effects can be properly addressed, it is necessary to have a firm understanding of how the various components of the environmental system are linked together and how this system operates (Gartner, Hilditch & Hubbard, 1994).

CEA is a relatively new technology. There are therefore a number of limitations to using a cumulative effects approach (Spaling, 1994; Damman, Cressman & Sadar, 1995; Canter, 1996). Some of these are:

- limited development of appropriate methodologies;
- lack of documentation on impacts from past development activity with which to extrapolate future scenarios;
- a meager knowledge base on cause and effect relationships;
- a limited understanding of how key linkages and interactions operate within ecosystems;
- comprehensive monitoring programmes have usually not been undertaken to close information gaps;
- uncertainty with respect to the determination of "acceptable limits" for environmental change; and
- uncertainty regarding the scope of CEA.

A proper assessment of cumulative environmental effects requires a sound database of the existing environment, an acceptable management plan for how resources and land within natural boundaries should be managed over time, and an indication of which criteria are used in that geographic context to measure carrying capacity of the ecosystem (i.e. the limits of sustainability). The responsibility and mandate for such overall resource management and land use planning rarely rests with individual project proponents (Sears & Yu, 1994).

Analysis of cumulative impacts is typically an inexact science. Under the best of circumstances, the analysis of environmental impacts can be a formidable problem. When the impacts of other past, present and future activities are uncertain or unknown, analysis of cumulative impacts may be very difficult. Often such analysis is beyond state-of-the-art. Evaluating cumulative impacts when there is uncertainty in data can further complicate the analysis of cumulative impacts. Quantitative assessment of cumulative impacts is technically challenging. These problems largely result from uncertainty and lack of quantitative data on the impacts from past, present and reasonably foreseeable future activities. However, qualitative analysis can provide decision-makers with equally useful information. This approach involves quantitative analysis of present direct impacts with a qualitative analysis of past and future impacts (Eccleston, 1993).

According to Rennick (1994) some of the key challenges or issues to be addressed when undertaking a CEA approach are:

- How should the spatial boundaries be determined?
- What indicators and targets should be measured and how should they be measured?
- Are the measured cumulative environmental effects significant?
- Who should be involved in the implementation of the monitoring system?

The assessment of cumulative environmental change is essential to support the paradigm of sustainable development. There are a myriad of complex interactions and processes in the natural, social and economic environments, which must be considered when evaluating cumulative impacts.

There is a critical need to define and analyse the link between CEA, SEA and EIA and other planning tools. Based on the preceding discussion, it is felt that CEA should not be developed as a "stand-alone" product. It is argued that a CEA perspective should be incorporated into project specific EIAs. It is desirable because project EIAs can then be placed into a broader environmental management perspective (Lawrence, 1994). Sadler & Verheem (1996) maintain that the scope of SEA is more appropriate to the time and space scales at which cumulative effects are expressed. CEA approaches should therefore be integrated into both SEA and EIA. However, where possible SEA should form the first level of environmental assessment, in order to provide a strategic view of development on a regional scale, as this scale is more appropriate for assessing cumulative effects. Any issues identified at this level could then be taken forward in a more detailed EIA level of study. This should serve to strengthen the IEM process and make the environmental management toolkit more adaptable and flexible.

The following chapter focuses on possible methodologies to integrate the assessment of cumulative effects into SEA and an assessment of current South African SEA case studies.

CHAPTER 4 INTEGRATING CUMULATIVE EFFECTS PHILOSOPHY INTO STRATEGIC ENVIRONMENTAL ASSESSMENT: AN EVALUATION OF CURRENT PRACTICE

This chapter focuses on the appropriateness of addressing cumulative effects in SEA and then provides an evaluation of South African practice. A comparative summary of the findings of the case study analysis is then provided. The final section of this chapter focuses on recommended guidelines for best practice for integrating cumulative effects into the current South African SEA process. This section demonstrates how the evaluation criteria, developed and applied earlier in this chapter, can be infused into the South African SEA process in order to ensure that cumulative effects are adequately addressed within the SEA process.

4.1 THE APPROPRIATENESS OF ADDRESSING CUMULATIVE EFFECTS IN SEA

In response to the shortcomings of EIA, the scientific basis and institutional context of EIA has shifted internationally to incorporate considerations of cumulative effects.

- Analytical shifts include expanding spatial boundaries apparent in regional approaches to environmental assessment, extension of existing EIA methodologies for cumulative effects analysis, and monitoring of cumulative effects.
- Administrative shifts include the flexible application of EIA to projects, programmes and policies, and regulatory actions and organisational reforms that explicitly recognise cumulative effects.

These shifts and expansion of EIA have been adopted in countries like the United States and Canada (Peterson *et al.*, 1987; Droiun & Leblanc, 1994). Views differ as to whether these shifts or adaptations in EIA are sufficient to analyse and assess cumulative effects. One perception is that these adaptations represent the maturing of EIA into an overarching environmental assessment framework. This framework may require occasional scientific or institutional adjustments, but the conceptual and methodological basis, are considered to have developed sufficiently to address cumulative effects. One such conceptual framework, described by Canter & Sadler (1997), consists of three steps, namely:

1. delineating potential sources of cumulative change;
2. identifying the pathways of possible change (direct, indirect, nonlinear or synergistic processes); and
3. classification of resultant cumulative changes.

According to this perspective CEA will not radically alter the environmental assessment process. CEA is environmental assessment - only better, more comprehensive, more effective - and is therefore an exciting step forward in the evolution of environmental assessment (Bronson, Sear & Paterson., 1991). Another perspective regards the adaptations to EIA as insufficient to overcome the shortcomings that impede the assessment of cumulative effects. This perspective differentiates between EIA and CEA, considering the latter as a form of planning. CEA is seen as the dominant framework or tool to select the optimal path from among possible future growth scenarios. EIA is still considered a part of this framework, but

is relegated to its traditional role of generating information for specific project decisions (Spaling & Smit, 1993). Sadler (1996) states that SEA can facilitate the analysis of cumulative effects. Where policies, plans and programmes lead to projects and activities, SEA permits an early, overall look at their potential relationships and effects. Compared to EIA, the scope of SEA is more appropriate to the time and space scales at which cumulative effects are expressed. The various aspects that characterise CEA are compared with EIA and SEA in Table 4.1 below.

Table 4.1 A Comparison of SEA, CEA and EIA*

Aspects	**EIA**	**CEA**	**SEA**
Purpose	Project evaluation.	Management of pervasive environmental problems.	Process for evaluating policies, plans or programmes.
Sources/ Initiation	Individual projects with high potential for adverse environmental impacts.	Multiple projects and/or activities.	Multiple projects and/or activities.
Temporal perspective	Short to medium term. Continuous dispersion over time. Proposed activity.	Medium to long term. Discontinuous dispersion over time. Past, present and future activities.	Medium to long term. Provides ongoing and long term principles and guidelines for development and planning.
Spatial perspective	Site-specific. Focus on direct impacts. Continuous dispersion over time.	Broad spatial patterns. Wide geographic area. Discontinuous dispersion over time (e.g. time lags).	Applied to sectors of industry or to regions.
Significance interpretations	Significance of individual effects interpreted.	Significance of multiple activities interpreted. Expectation that combined impacts may be significant.	Provides interpretation of potential strategic impacts and benefits, including an assessment of their significance.
Links to planning	Poorly related to the project cycle. Only project level planning.	Facilitates scenario planning.	Provides information on environmental issues to the design and planning stage. Explicit links to comprehensive environmental objectives. Program and policy level planning.
Relationship to decision-making	Reactive. Facilitates informed decision-making by providing analysis of the impacts of the specific proposal.	Proactive; anticipates future activities and predicts likely effects.	Provides guidelines for detailed planning and decision-making in later stages of the project cycle.
Ongoing management	Monitoring and management of major, direct impacts	Management of predicted effects.	Establishment of Strategic Environmental Management Plan for follow-up, implementation and monitoring.

*(adapted from Lawrence, 1994; Sadler, 1996; Sadler and Verheem, 1996)

An important issue in SEAs is cumulative effects, and the fact that SEAs may provide better mechanisms for examining such effects than project impact studies. The key to the incorporation of CEA within SEA is the identification and prediction (qualitative or quantitative) of cumulative effects.

4.2 AN EVALUATION OF SOUTH AFRICAN PRACTICE

This section focuses on the specific case study methodology used to evaluate the three South African case study examples. An explanation of the development and application of the evaluation criteria is provided along with a description of the scoring system applied.

4.2.1 The evaluation approach

The practice of CEA and SEA is relatively new; therefore, value can be gained from the review of case studies. In depth reviews of appropriate examples can be a useful starting point to develop a framework of how best to integrate CEA into SEA. Kreske (1996) stated that the absence of regulations and guidelines as to how to plan and conduct a CEA, is perhaps one of the most significant barriers to efficient and effective CEA studies.

The effectiveness of EIA and SEA as an instrument of sustainable development is largely determined by the successfulness of addressing cumulative issues related to the projects, and plans or programmes. CEA can direct its response and shape the outcomes of these projects, plans or programmes and thereby influence the ultimate project decisions. To achieve the study aims, evaluation criteria in the form of research questions have been formulated (see Section 4.2.2) in order to interrogate both the construct elements of the conceptual CEA framework and the relationships that exist between SEA and EIA. These questions serve as the case study points of origin and represent the descriptive catalyst for the analytical phase of the enquiry i.e. they are designed to begin the process of "operationalizing" the conceptual research framework (Miles & Huberman, 1994).

4.2.2 Evaluation criteria for case study analysis

In 1997, a Cumulative Effects Assessment Working Group was established by the Canadian Environmental Assessment Agency. The objective of this working group was to formulate an approach for assessing cumulative effects, as required by Canadian law. This working group developed a set of criteria for assessing cumulative effects. These criteria could then be used as a checklist to determine if a CEA study has been properly conducted or to guide practitioners when carrying out a CEA study. These criteria are thus analogous to delineating an approximate state-of-practice for CEA. The eight listed criteria below could be used in developing generic guidelines for planning and conducting CEAs:

1. **STUDY AREA EXTENT:** The study area must be large enough to allow the assessment of VECs or strategic resources that may be affected by the development. This may result in an area that is considerably larger than the project's 'footprint' and each VEC may have a different study area.

2. **ALL POSSIBLE ACTIONS CONSIDERED:** Other actions that have occurred, exist or may yet occur which may also affect those same VECs have been identified. Future actions that are approved within the study area must be considered and officially announced and reasonably foreseeable actions should be considered if they may affect those VECs and there is enough information about them to assess their effects.
3. **RECOGNITION OF ACTION'S POTENTIAL INCREMENTAL NATURE:** The incremental additive effects of the proposed project and other actions on the VECs are assessed.
4. **THRESHOLD VALUES AND TOTAL IMPACTS IDENTIFIED:** These total effects are compared with threshold policies, if available, and the implications of the VECs are assessed.
5. **APPROPRIATENESS OF ANALYTICAL METHODS USED:** The analysis of these effects uses quantitative techniques, if available, based on best available data. This should be enhanced by qualitative discussion based on best professional judgement.
6. **PROPER MITIGATION RECOMMENDATIONS:** Mitigation, monitoring and effects management should be recommended. These measures may be required at a regional scale (possibly with other stakeholders) to address broader concerns of effects on VECs.
7. **RESIDUAL EFFECTS STATED:** The significance of residual effects is clearly stated and defended.

However, it is now recognised that CEA is not a stand-alone tool that can be applied separately to EIA or SEA, but is rather an approach that needs to be incorporated within SEA, which is not project-specific, to ensure that these studies are in fact based on the SEA principles as provided in the recently published guidelines (DEAT & CSIR, 2000). Therefore, this study develops criteria to evaluate various case studies to determine if cumulative effects philosophy and methodologies have been effectively integrated into current South African SEA practice.

For the purposes of this study, the criteria (as listed above) developed previously by the Cumulative Effects Assessment Working Group (1997) and Canter & Sadler (1997) were adapted slightly to enable easy integration into the current South African processes. The EIA process (scoping, project description, determining environmental consequences, and the mitigation of environmental consequences) provides the framework for the development of evaluation criteria (i.e. key criteria have been assigned to the different stages of the process). These criteria were developed within the EIA process framework to ensure easy integration into the existing IEM process. The criteria are presented as key questions, to be addressed in each phase, with the key elements of each criterion shown in bold in Table 4.2. The bold text of each criterion highlights the key element of each criterion. It is these elements that are used as a yardstick or measurement parameter, in order to determine the effectiveness of each case study. The four components/phases of EIA process, namely: scoping, describing the environment determining the affected environment and mitigation and monitoring, can be assessed by evaluating the effectiveness of each component of the EIA process using these specific yardsticks. This in turn will enable the EIA practitioner or reviewer to determine at which phase in the process is the CEA component at its weakest, or where more attention to cumulative effects is required within the EIA process.

Table 4.2 Evaluation criteria to assess the integration of CEA into South African SEAs*

Criteria for efficient scoping
1. Were **cumulative effects** mentioned or discussed?
2. Were **spatial boundaries** sufficient to consider cumulative effects?
3. Was the **time frame** long enough to allow detection of possible cumulative effects?
Criteria for effective baseline description
4. Were all **actions/activities individually or cumulatively** affecting the resource identified?
5a. Were the effects of **past, present and foreseeable future** actions considered?
5b. Were actions **analysed?**
Criteria for determining environmental consequences
6. Were all possible **aspects of the action/activity** considered?
7a. Were all **possible impacts/ effects/ stresses** on the resource identified or characterised?
7b. Were all **potentially affected resources** considered?
7c. Were **individually minor effects or multiple actions over time** considered?
7d. Were the **effects quantified**?
7e. Were **delayed or secondary effects** assessed?
7f. Were possible **effects away from the source** identified?
7g. Were **additive or synergistic effects** evaluated?
8. Was the **environmental threshold, pollution climate or baseline conditions** fully understood or established?
9. Was there a focus on **resource sustainability?**
10. Were **tools** used to evaluate CE's (e.g. Carrying capacity, ecosystem analysis)
11. Was **fragmentation of habitats** a consideration?
Criteria for mitigation and monitoring
12. In mitigation recommendations, were **alternatives recommended** to mitigate cumulative effects specifically
13. Were possible **cumulative effects monitored** or included in a management plan?

*(adapted from Canter & Sadler, 1997)

These criteria could then be used as a checklist against which each case study could be evaluated to determine how effectively cumulative effects were addressed within the study.

4.2.3 The rating system applied

The Canadian Environmental Assessment Agency - Cumulative Effects Assessment Working Group's (1997) used a descriptive value judgement rating system to evaluate to use of CEA in Canadian case studies. A basic scoring system was developed in order to provide an indication of how effectively each criterion was addressed within the individual case studies. This scoring system, quantified from 1-5, is described in Table 4.3.

Table 4.3 Description and rating of the scoring system applied

Score	Rating	Description
1	**Unacceptable**	Shows no understanding of the issue and has paid no attention to the issue at hand.
2	**Poor**	Shows a poor understanding of the issues at hand and provides inadequate attention and detail to address the issue.
3	**Acceptable**	Provides detail to deal with the issues in an acceptable – if not somewhat general-manner.
4	**Good**	Demonstrates an above average understanding of the issues at hand and these were dealt with in an acceptable manner.
5	**Excellent**	Demonstrates an excellent understanding of the issues and comprehensive inclusion of this factor in the case study.

This system provides a useful basis for comparison between case studies. The 20 criteria in Table 4.2 were evaluated for each case study using the scoring system of 1-5, as shown above. The sum of the total scores per case study therefore indicates how effectively or comprehensively each case study addressed the criteria. If, for example, a case study scored 5 (excellent) for all 20 criteria, the total would be 100 (5 x 20). The total scores can therefore be represented as a percentage value, that indicate to what extent cumulative effects had been addressed. The cumulative scores were then classified according to the statistical quintile principal, to provide the qualitative rating and value judgement displayed in the following table.

Table 4.4 Qualitative norms of adequacy/efficiency assigned to quintile score classes

Cumulative score (%)	Qualitative rating	Description
<20	**Unacceptable**	Shows no understanding of the issue and has paid no attention to the issue at hand.
21-40	**Poor**	Demonstrates a poor understanding of the issues at hand and provides inadequate attention and detail to address the issue.
41-60	**Acceptable**	Provides detail to deal with the issue in an acceptable – if not somewhat general manner.
61-80	**Good**	Demonstrates an above average understanding of the issues at hand, issues were dealt with in an acceptable manner.
81-100	**Excellent**	Demonstrates an excellent understanding of the issue and comprehensive inclusion of this factor in the case study.

It is envisaged that this rating system could be applied as a simple check by practitioners (project managers, specialists or integrative writers) and reviewers to determine how effectively cumulative effects have been incorporated into any SEA/ EIA study.

4.3 CASE STUDY ANALYSIS

This section focuses on three South African case studies. For each study, the objectives of the study, the outcomes and products, innovative approaches used in the study and limitations of the study, are provided. All the detailed analyses for the three case studies are to be found in Appendix A.

The three selected case studies are:

1. Cape Action Plan for the Environment (CAPE) Project (CSIR 2000a) (detail in Appendix A-1).
2. A Strategic Environmental Assessment for Sasol-Secunda (CSIR 2000b) (detail in Appendix A-2).
3. Durban South Strategic Environmental Assessment (CSIR 1999) (detail in Appendix A-3).

4.3.1 Cape Action Plan for the Environment (CAPE) Project

The Cape Floral Kingdom (CFK) is a global biodiversity asset, the smallest of the six floral kingdoms in the world and the only one located entirely within one country. The Cape Action Plan for the Environment (CAPE) is a project developed in partnership with the Global Environmental Facility (GEF) to secure the future of the CFK.

4.3.1.1 Objectives of the study

This initiative was funded by the Global Environmental Facility and coordinated by World Wide Fund for Nature South Africa (WWF-SA) in partnership with government, communities and the private sector.

Its aim was to develop a Strategy and Action Plan to protect the biodiversity in one of Earth's richest but severely threatened biological regions, the CFK and its associated marine and coastal environments. Major threats include loss of habitat due to land transformation for agricultural purposes, rapid and insensitive urban development, the overexploitation of marine resources and wild flowers, and the spread of alien species. Underlying causes include lack of capacity and poor coordination between bodies responsible for management of natural resources, lack of awareness of the importance of biodiversity and a short term focus of meeting present needs. The project was therefore aimed at integrating socio-economic and biodiversity concerns with an emphasis on building partnerships via an extensive and thorough consultative process, in order to conserve the biodiversity of the region through the development of key projects to promote sound management practices and sustainable utilisation of the region's unique biodiversity.

4.3.1.2 Outcomes and products

There were various outcomes or products. Firstly, a Situation Assessment was undertaken to analyse the threats and opportunities for the region. This phase produced results from three separate study modules, namely:

i) the terrestrial environment;
ii) the marine, estuarine and freshwater environments; and

iii) the legal, socio-economic and institutional aspects.

A strategic plan was then developed based on the Situation Assessment. This stage involved extensive public participation, to ensure ownership of the resultant Strategy and Action Plan by key stakeholders in the process. The Strategy comprised of three components: conserving biodiversity, promoting sustainable use and strengthening institutions. Specific objectives of the Strategy included:

- The need to establish an effective reserve network, enhance off-reserve conservation and support bioregional planning;
- the need to develop methods to ensure sustainable yields, promote compliance with laws, integrate biodiversity concerns into catchment management and promote sustainable nature-based tourism; and
- the need to strengthen institutions, policies and laws, enhance co-operative governance and community participation, and support continued research.

The components were then integrated into a comprehensive, multifaceted Action Plan consisting of key projects identified to meet the specific objectives stated above. These projects clearly identified priorities for funding and implementation.

4.3.1.3 Innovative approaches used in the SEA

This programme focused on building partnerships between executing agencies, non-governmental organizations, research institutes and the private sector.

This resulted in a high level of buy-in from a wide range of stakeholders and this commitment is aimed at ensuring the long-term sustainability of the project. The CAPE strategy is aligned with the priorities of the South African government. The key executing agencies that will be responsible for implementation have drawn up an agreement (Memorandum of Understanding) to ensure effective coordination of the programme, and a lead agent, namely Western Cape Nature Conservation Board was identified early in the process.

Participation in the CAPE process was structured to allow different degrees and levels of involvement by different groups, depending on their preference and on the roles that they would play in implementation. A wide range of public involvement tools were used at various stages in the process and for different groups, according to need.

The public involvement activities engaged the "public", key stakeholders and authorities at four different "layers". The broadest layer was the wider public, particularly those resident in the CFK area, whom the public involvement programme aimed to inform via general media releases. The next layer was the interested parties who were part of the project database. The public involvement programme aimed to inform as well as to receive input from this group.

The next layer was the implementing agencies with whom the public involvement programme and the project management team interacted closely through the establishment of focus groups. The final level was represented by those, particularly implementing agencies, who influenced the project as members of the team and /or through the governance role that they played on the Steering and Technical committees.

One of the key philosophies of the approach to Module 3 (addressing the socio-economic, institutional, legal aspects) of the CAPE Project was to involve the stakeholders who are potential implementing agents as closely as possible. The initial structures through which implementing agents became involved in the project governance were the CAPE Steering and Technical Committees.

As the project moved towards the development of the Implementation Programme it became critical to have a stronger link with the key implementing agents. This led to the establishment of a working group. The primary role of the CAPE Working Group was to guide the CAPE technical team in the development of an implementation programme. The working group included representatives from conservation authorities, national and provincial government, non-governmental organisations and research institutions. Members of the working group assisted in the preliminary selection of the projects that make up the implementation programme. The working group also made recommendations on the prioritisation of these projects.

The other major focus was on providing inputs on long-term management structures for implementation of CAPE, and on the development of a Memorandum of Understanding.

4.3.1.4 Limitations of the study

This case study report consisted of the three modules mentioned above. The findings and recommendations from the three technical reports were integrated into the Strategy and Action Plan for Implementation. However, the integration of these different study components often proved problematic. This can be largely attributed to the lack of detailed terms of reference (TOR) for the project as a whole, as well as for the specific specialist studies undertaken. No standardised approach was used, in terms of methodologies, and presentation of results. Consequently differing standards of research and data presentation are apparent in the different reports, which often made it difficult for the project team to integrate all the findings into a comprehensive final report. This emphasises the importance of the TORs in a study of this magnitude. It is vital that basic requirement are clearly stated, such as the expected outputs of the study, the most appropriate methodology to be used, and the format required for the end product. This enables the integrative team to work more effectively and ensures that all the components (socio-economic and biophysical) of such a study are effectively addressed without an imbalance of detail or bias due to a lack of sufficient information for any of the components. The final report heavily emphasised the biological, institutional and legal components with less emphasis on the socio-economic component, largely due to insufficient information available from the socio-economic study.

4.3.2 A Strategic Environmental Assessment (SEA) for Sasol-Secunda

Sasol's mining and industrial operations in Secunda on the Mpumalanga highveld are both complex and massive in scale. The complexity and scale have important environmental implications. Given the scale of the operations, impacts on the environment are potentially severe and the complexity of the operations could result in complex environmental effects, or cumulative effects. During the last decade or so, Sasol has begun to conduct environmental assessments of the proposed developments.

These assessments have taken the form of EIAs for industrial activities and Environmental Management Programme Reports (EMPRs) for mining activities.

4.3.2.1 Objectives of the study

While these EIA and EMPR requirements have contributed in many ways to environmental management, they have also had the effect of adding complexity. The concept of sustainable development is emerging as a pressing requirement for this area in order to ensure the sustainability of strategic resources in the region. Sasol-Secunda's activities and actions play a vital role in this region. Therefore, Sasol has identified the need to assess all possible future development options, in order to determine what future development the area and strategic resources of the area would be able to sustain.

In essence the SEA has been conducted as a series of discrete steps illustrated in Figure 4.1. The **environmental profile** refers to those environmental issues relevant to the area and appropriate to Sasol's development thinking. The environmental profile can include any impacts whatsoever that relate to Sasol's activities but in this case there are six impacts deemed most likely to constrain or provide opportunities for future Sasol developments.

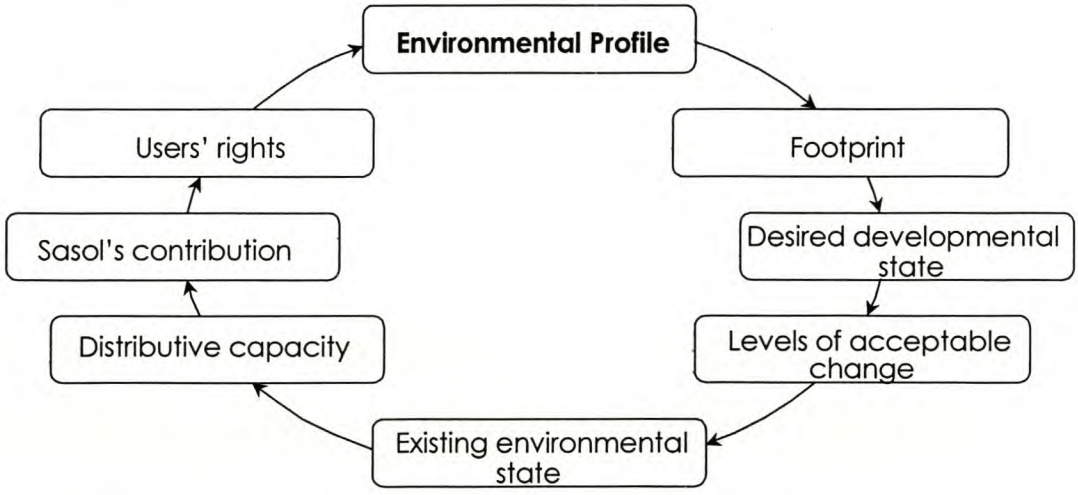

Figure 4.1 Schematic illustration of the overall philosophy of the Sasol-Secunda SEA (Source: CSIR, 2000b: 5)

An immediate problem in executing the SEA has been to determine the geographical extent or scope of the study.
If SEA is a process of determining how the existing state of the environment impacts on development it is obviously important to define the extent of the environment being assessed. Thus an early part of the SEA process has been the defining of a **footprint** for each of the strategic impacts. The footprint in turn has been defined by determining Sasol's sphere of influence in each of the impacts identified.

Once the footprint had been defined it became necessary to determine the **desired developmental state**. The importance of this step has been to define the development

thinking and planning within each of the impact footprints. The development thinking in turn provides an indication of likely changes in environmental pressures into the future. Once the desired developmental state had been identified the process moved on to one of the most important components of the SEA, namely defining the **levels of acceptable change**. The importance of this step lies in the fact that constraints to, or opportunities for, future development are largely governed by the defined levels of acceptable change. The variables used in defining the levels of acceptable change could then be used to describe the current or **existing environmental state.** The state of each of the impacts has been described in this step. The difference between the levels of acceptable change and the existing state of the environment provides an estimate of what has been termed **distributive capacity**.

Distributive capacity refers to the degree to which the environment can withstand further impact without significant deterioration and can be both positive (where the existing state is within the levels of acceptable change) and negative (where the existing state exceeds the levels of acceptable change).

The final two steps in the process relate to the possible use of, or responsibility for, the distributive capacity.

That, in turn, requires an understanding of the degree to which Sasol contributes to the existing environmental state (*viz* **Sasol's contribution**), and an understanding of how distributive capacity may be allocated for use, or how responsibility for a negative distributive capacity may be assigned. This, the final component of the SEA, has been termed **users' rights**.

4.3.2.2 Outcomes and products

As indicated previously, an important difference between EIA and SEA lies in the detail of the assessment. Whereas in EIA a focused and detailed assessment is required, in SEA several key indicators are sought that can provide a framework rather than a comprehensive assessment of every issue considered. In the Sasol SEA the requirement of several key indicators has been translated into the identification of so-called 'strategic' impacts. By 'strategic' is meant those impacts likely to have a bearing on decision-making or, put differently, those impacts likely to constrain or provide opportunities for future development.

In identifying strategic impacts two almost contradictory requirements had to be met. The first of these was to ensure that the impacts were of relevance to the *environment* in which Sasol operates rather than to Sasol itself. The second requirement was to ensure that the impacts were *relevant* to Sasol and its Secunda activities.

In order to achieve this, people who had worked in the area and who had experience in environmental assessment for Sasol (either EMPR or EIA) were brought together for a workshop. The group was then given an opportunity to raise and list every impact they deemed significant. The following impacts were deemed those most likely to govern future developments by Sasol in the Secunda area over a 5-20 year period:

- human health;
- water resource protection;

- resource use;
- macro-economics;
- socio-economics; and
- biodiversity and land potential.

A specialist study was undertaken for each strategic resource. The results of each study were then integrated into a Final Report.

4.3.2.3 Innovative approaches used in the SEA

The project management team and client held an initial scoping workshop in order to determine and prioritise what issues needed to be addressed and required further specialist studies or inputs. This involved identifying what environmental and social and economic resources where of main concern for this study. The group also developed a very well structured methodology, in the form of a sequence of tasks that needed to be followed in each resource study, namely: develop project footprint; determine existing state; determine the desired state for the area; determine limits of acceptable change (LAC); determine distributive capacity; and then finally attempt to interpret this information in terms of users' rights. This approach was a very innovative conceptual approach in terms of addressing cumulative effects.

The emphasis placed on first determining the state (or vision) for the area and then focusing on what the limits of acceptable change (benchmark for monitoring environmental change) are for each strategic resource, provided an excellent framework for the assessment of cumulative effects.

4.3.2.4 Limitations of the study

The Sasol SEA process was marred by the refusal of other key stakeholders (such as Eskom) to be involved in the process, as they viewed the process as an internal Sasol project that had no bearing on them nor possible future benefits for their organisation. This raises an important issue when dealing with sectoral studies, the inclusion of all key roleplayers in the area is vital in order to gain a realistic idea of the levels of impacts on key strategic resources. Some aspects of the study were hindered by the lack of available data or expert understanding, which hampered the assessment of cumulative effects. This is a general constraint in most cumulative effect assessments. This can be addressed by clearly stating the limitations and information gaps within the study and putting monitoring mechanisms in place to obtain data and knowledge for future reference, as was suggested in this study.

4.3.3 Durban South SEA

In the Durban South Basin, apartheid planning policy intertwined residential areas with heavy industry, an international airport and port infrastructure with little or no regard for safety or quality of life of people in the Durban South Basin. The policy created an inequitable situation, particularly for residents who were forced to suffer the negative environmental impacts associated with the generation of wealth for the region. This has caused extreme dissatisfaction on the part of many residents with regard to current living conditions. As a result, community action has and will

continue to place severe constraints on future industrial development in the Durban South Basin unless the situation is effectively resolved.

4.3.3.1 Objectives of the study

The need for the study was motivated by local communities in the Durban South Basin who, since the advent of democracy, have been mobilising around environmental issues. The South Central Local Council and the Durban Metropolitan Council accepted their responsibility to resolve the conflict between industrial and local community needs that had been created by apartheid planning. They undertook this SEA as an integral part of their Local Agenda 21 programme.

The Durban South Basin SEA was tasked with finding a way of addressing the problems associated with planning and management in the Durban South Basin. The SEA brief identified four objectives to address this situation.

The objectives of the study were to:

1. produce a baseline assessment of the Durban South Basin identifying opportunities and constraints for future development;
2. identify key strategic development criteria for current and future development;
3. evaluate various types of future development in terms of their sustainability; and
4. develop a policy planning framework for sustainable development to guide management and planning in the Durban South Basin.

In terms of this brief, five development options were assessed. They were the Existing Situation, the Mixed Use Option (combining housing and light industry), the Petrochemical option, the Second Port Option and the Combined Second Port and Petrochemical Option.

4.3.3.2 Outcomes and products

The project brief divided the SEA into four distinct phases in order to meet the objectives outlined above. Phase 1 was the study design phase and outlined the process that the SEA would follow. Phase 2 was a baseline environmental assessment of conditions in the Durban South Basin. From the baseline environmental assessment and in conjunction with key stakeholders, major areas of environmental concern were identified against which development and management options could be assessed (Strategic Development Criteria).

These criteria were carried forward into Phase 3. This phase addressed the first two objectives of the brief. Phase 3 produced alternative development scenarios for the Durban South Basin. These scenarios were based on real plans for expansion of industry and port as well as community desires for light industry and commercial development. The scenarios were then tested against the Strategic Development Criteria, which were identified in Phase 2. Phase 3 also developed an environmental planning and management framework for each of the development options and identified detailed responsibilities and management issues. Phase 3 addressed the third objective as well as providing the basis for forming a policy planning framework

which is the fourth objective of the SEA brief. Phase 4, as the final phase of the SEA process, brought together the findings and recommendations of the previous three phases and moulded them into a general policy planning framework for the Durban South Basin – thus fulfilling the fourth objective. The Final Integrated Report is the product of Phase 4.

The study recommended resolutions that the Durban Metropolitan Council, the South Central Local Council and the South Local Council should accept, in order to promote sustainable development in the Durban South Basin and the Durban Metropolitan Area.

- Recommended Resolution 1 was that the future development of the Durban South Basin should be industrial.
- Recommended Resolution 2 was that the local authorities promote industrial developments in the Durban South Basin and build on developments such as the proposed port development, petrochemical expansion and associated downstream light industry and commerce. This should be undertaken within a pro-active planning and environmental management framework in order to ensure that regional benefits are maximised and that local costs to the biophysical, economic and social environments are minimised.
- Recommended Resolution 3 was that, in support of the policy, the relevant local authorities should commit themselves to implementing the strategic plan recommended in the SEA. This requires that they:
    - Establish dedicated institutional structures and project teams to address planning and management issues;
    - Prepare a development plan for the Durban South Basin in accordance with the recommendations of the SEA and the local Integrated Development Plans; and
    - Implement those projects and actions that have been identified by the SEA as requiring priority attention, particularly infrastructural improvements and the need to reduce air pollution.

4.3.3.3 Innovative approaches used in the SEA

Three sets of Guiding Principles have been identified through the SEA process, which address the issue of sustainability at global, regional and local levels. These include:

1. Principles of Sustainability as outlined in Agenda 21 and interpreted for the Durban South Basin which must overarch all development. In terms of the South African context these indicate a need for environmentally sustainable economic development.
2. Durban Metropolitan Development Principles, which have been developed from the Durban Metropolitan Council's strategic vision for their future. These tend to focus on the needs of the Durban Metropolitan Area.
3. Community development objectives that were established by the South Durban Community Environmental Alliance. These focus on the requirements of the communities in the Durban South Basin.

The use of principles developed at all three levels show where there is correlation and where decisions will have to be made to make the best trade-off situations, and therefore provided a useful basis against which the development options could be assessed.

4.3.3.4 Limitations of the study

The conceptual approach to the project was sound, however, many aspects of the project were problematic. The following issues have been identified in this review as the main deficiencies of the study:

- Lack of a common vision established at the outset of the process. This is perhaps one of the most important steps within the SEA process, as it enables the study team to get input from all stakeholders involved in the process, in order to establish common ground for conflicting I&APs. Incongruity existed between the client (Durban South Municipality), the I&APs and the project team's perceptions of the expected outcomes and products. This should have been addressed at the outset of the project during the visioning process, in order to ensure that a common understanding existed before the study commenced. The lack of clarity on outputs and products resulted in "shifting of the goalposts" which was both costly and time-consuming.
- In the case of this study, the two opposing stakeholders (industry and community) were incompatible and this visioning process at the scoping stage would have identified the need for conflict resolution early on in the process.
- Conflict resolution was required prior to the main study, as the public participation process became a propaganda tool used by the I&APs to disrupt and stall the process.
- This emphasises the importance of the public participation process within a SEA process. This process should form the backbone of the study, ensuring stakeholder buy-in and support required for an effective study. Lack of stakeholder commitment to the process results in the emergence of a disruptive influence, which leads to a costly and time-consuming public participation process, which often still does not achieve stakeholder buy-in.
- The media is a very influential tool, which if harnessed correctly, could be a useful means of information distribution. The media should be seen as a stakeholder in the process, and structured and consistent media liaison must occur throughout the project in order to maintain open channels of communication.
- In terms of the specialist reports, the need for detailed TORs should be emphasised. These TORs should clearly state what is required, explicitly mentioning the need to address cumulative effects issues, and stating what the end product should provide.
- The link between air quality and health issues within the basin was never established, due to practical constraints of budget and jurisdiction (health issues fall under the Department of Health and could therefore not be assessed within the scope of this study.) This was perhaps the main issue in terms of cumulative effects and therefore was a fatal flaw in the assessment of cumulative effects within this study.
- These practical constraints emphasise the importance of identifying and securing buy-in from all appropriate stakeholder groups before commencing with the study. Institutional barriers and lack of political will is one of the main obstacles within the SEA process at present, and appropriate mechanisms need to be established to deal with these issues in order to enhance the effectiveness of future SEA processes.

- Internal management issues also detracted from the ultimate effectiveness of this study. The Project Management changed hands three times during this project. The project manager provides the overall guidance of the process, both externally with client interactions and internally with the project team. It is his job to understand the changing dynamics of the process and provide relevant updated information and briefs to the project team, in order to ensure that it maintains the correct focus throughout.
  Therefore, this position requires continuity and consistence, in order to maintain client confidence and provide the direction and guidance required by the project team.
- The specialist studies should have been externally reviewed at an early stage before integration into the final report. This reviewer should focus on the robustness of the methodology used and ensure the reliability and validity of the data used and findings of the study.

4.4 COMPARITIVE SUMMARY OF THE CASE STUDY FINDINGS

Table 4.5 indicates the scores awarded per case study (see Appendix A for detailed case study evaluations), in order to obtain the sum total for each case study evaluated. This score enables one to determine how effective each case study was in terms of addressing cumulative effects (see Table 4.4).

The Sasol-Secunda case study has been rated at 77%, indicating that it can be seen as a good example of how cumulative effects can be addressed within an SEA approach.

The CAPE project was rated as 76%, again demonstrating some useful and effective methodologies and approaches for assessing cumulative effects at a regional level of focus.

The Durban South Basin Case Study was rated at 60%. This case study is an 'acceptable' example of how to address cumulative effects, however this study could have dealt with the cumulative effects issues in a more effective way, had the practitioners focused on the specific criteria required to address cumulative effects. The study was also perceived by the public, as being an unsuccessful project. This evaluation has shown that these perceptions stem mainly from the fact that pressing cumulative effects issues, such as health and air quality, were not adequately addressed within the scope of this study.

Table 4.5 A summary of the case study ratings as evaluated according to the criteria set out in Tables 4.3 and 4.4

Criteria	CAPE Project	Sasol Secunda SEA	Durban South SEA
1.	3	4	3
2.	5	5	3
3.	5	5	4
4.	4	4	4
5a.	4	4	4
5b.	4	3	3
6.	4	4	4
7a.	4	3	3
7b.	4	4	3
7c.	4	3	2
7d.	3	4	3
7e.	3	3	2
7f.	3	4	2
7g.	3	3	2
8.	3	5	3
9.	5	5	3
10.	3	4	2
11.	5	4	3
12.	4	3	4
13.	3	3	4
TOTAL	**76**	**77**	**60**
Qualitative rating	**Good**	**Good**	**Acceptable**

The case studies provide some innovative thinking and useful conceptual approaches that can be used to ensure that cumulative effects are adequately assessed in future SEAs. However, all three studies could have been further enhanced if the project team had explicitly focused on the assessment of cumulative effects. Therefore, first aim of this study has been accomplished by determining to what extent past South African SEA studies have been able to address cumulative effects.

4.5 RECOMMENDED GUIDELINES FOR BEST PRACTICE

In order to enhance future SEA studies undertaken in South Africa and improve the assessment of cumulative effects within these studies, CEA guidelines need to be infused into the current SEA process (as shown in Figure 2.3). Therefore, the following section addresses the second aim of this study; namely:

- to provide guidelines for the integration of CEA into the current South African SEA process.

4.5.1 Overview of the amended SEA process

The Canadian Cumulative Effects Assessment Working Group (1999) has recently produced a Practitioners Guide to Assessing Cumulative Effects. This guideline document revised the original criteria developed by the Canadian Working Group in 1997, discussed earlier in Section 4.2.2. The Practitioners Guide provides generic guidelines to assist practitioners in the assessment of cumulative effects. The guidelines are based on the original criteria developed to assist practitioners in the assessment of cumulative effects. For the purposes of this study, these Canadian guidelines have been adapted and applied to the evaluation criteria used in this study, to provide South African practitioners and reviewers with similar generic guidelines for the evaluation of cumulative effects within South African SEA process.

This section uses the original SEA process, as depicted in Chapter 2, Figure 2.3, in order to demonstrate how the generic Canadian Guidelines can be adapted and infused into the South African SEA process (see Figure 4.2) to enhance the SEA process. Figure 4.2 provide a diagrammatic representation of how the evaluation criteria used in this study (provided in Table 4.2), can be integrated into the current South African SEA process.

The evaluation criteria provide a useful starting point from which a SEA project team can develop the project framework and detailed terms of reference for each specialist study.

The 13 evaluation criteria should be infused into various stages of the current SEA process (Figure 4.2) as follows:

- **criteria 1-3** should be integrated in the **scoping stage** of the SEA process;
- **criteria 4 & 5** should be dealt within in the **scoping stage**, and more specifically within the **Situation Assessment**;
- **criteria 6–9** address the **strategic issues**, specifically with regards to the **determination of sustainability parameters** for the project;
- whilst **criteria 10 & 11** should be helpful in **developing and assessing alternatives plans and programmes** for the project; and
- **criteria 12-13** should then be infused within the **reporting stage** of the SEA process to ensure that cumulative effects are adequately addressed in the development of a **monitoring and auditing plan and during project implementation.**

The following sections provide recommended best practice guidelines for each of the 13 evaluation criteria. Each criterion, numbered in brackets, is addressed sequentially under the appropriate stage of the SEA process.

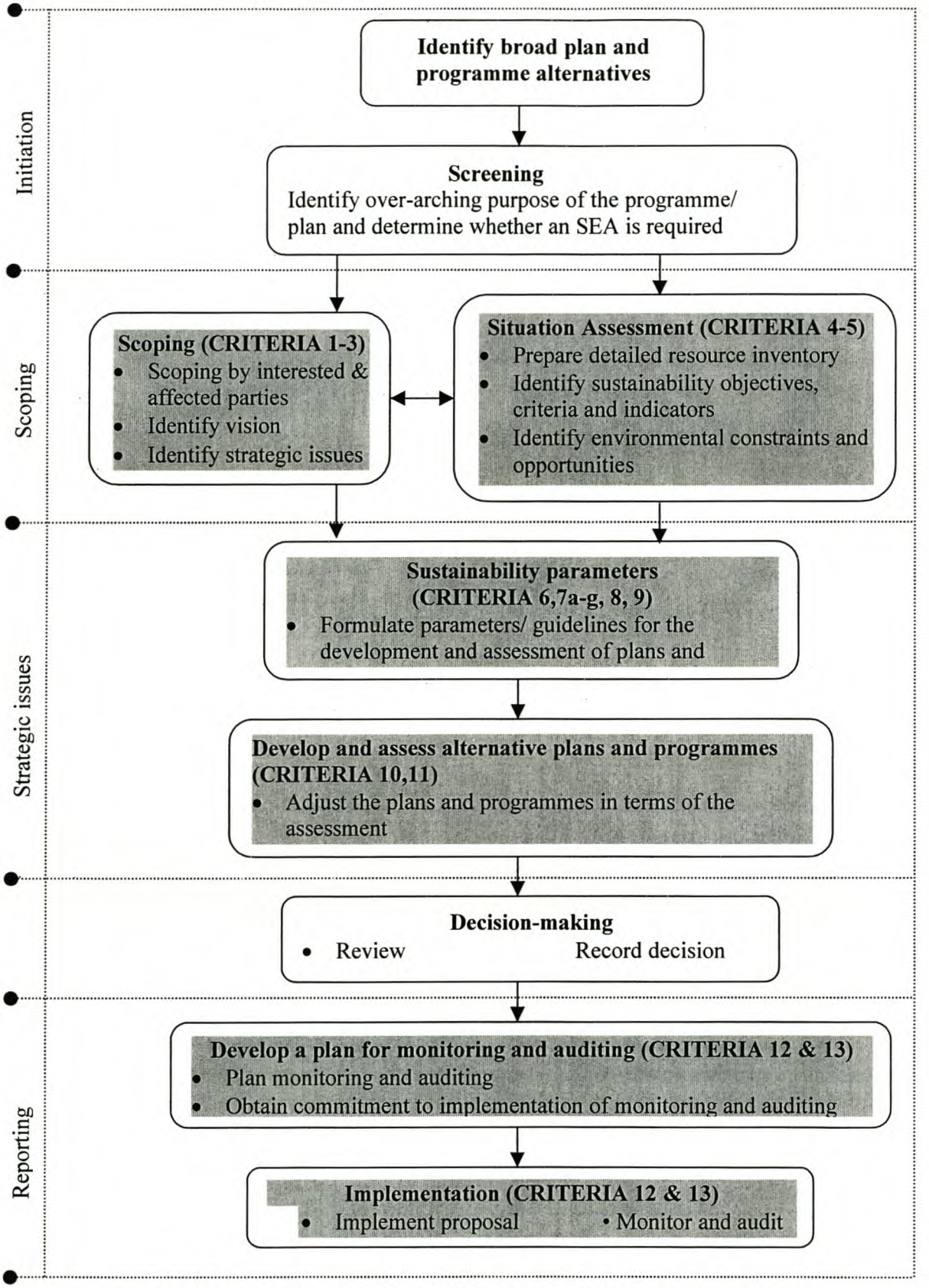

Figure 4.2 The SEA process with the highlighted stages indicating the integration of cumulative effects evaluation criteria

4.5.1.1 Guidelines for efficient scoping

Scoping is a well-established first step in good EIA/SEA practice, and is essential in establishing the assessment's terms of reference. When assessing the larger regional nature and complexity of cumulative effects, scoping must be very strictly applied to avoid assessing more than is necessary. Scoping should include the following tasks: issue identification, selections of valued ecosystem components (valuable resources), setting of boundaries, identification of other actions and initial identification of potential impacts and effects.

The following best practice guidelines should enhance the current SEA scoping process to ensure that cumulative effect issues are identified upfront. Figure 4.3 indicates where criteria 1-3 and criteria 4 & 5 should be integrated into the existing SEA scoping process. This will ensure that all possible cumulative effects issues are identified and that the scope of the project, spatial and temporal, will adequately address these issues.

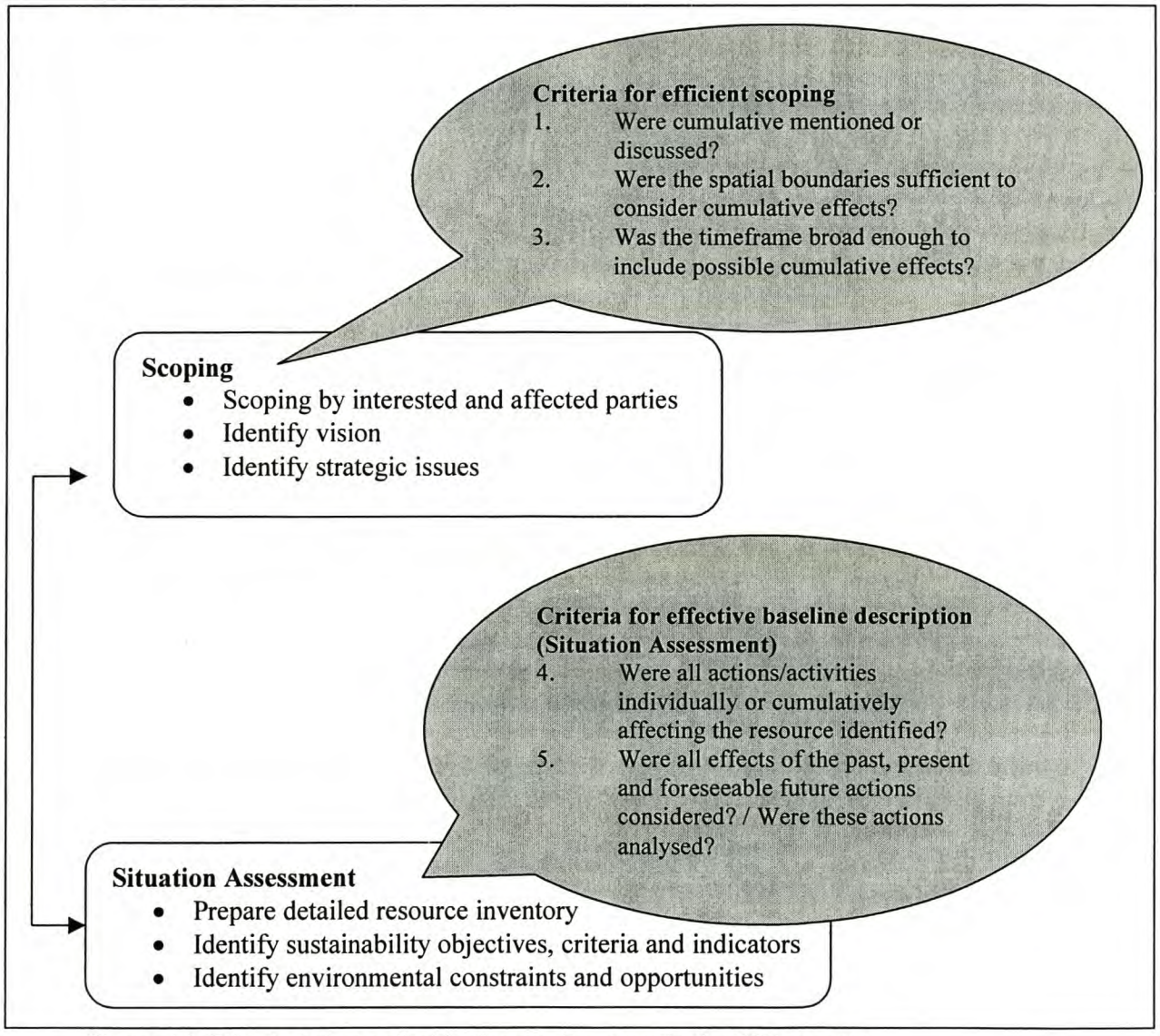

Figure 4.3 Criteria to be applied in the scoping stage in the SEA process

Specific recommended guidelines for addressing each criterion shown in brackets are as follows:

(1) Were **cumulative effects** mentioned or discussed?

- Identify of cumulative effects within the case study region explicitly.
- Place these effects in the context of the specific scope or nature of the study.

(2) Were **spatial boundaries** sufficient to consider cumulative effects?

The challenge facing the practitioner in establishing appropriate boundaries is in finding the balance between practical constraints such as budget, time and available data, and the need to adequately address complex environmental interactions, that could extend for considerable distances and well into the future.
The following generic guidelines may be used to assist in setting spatial boundaries:

- Establish a local study area (footprint of client's project area), in which obvious effects, which can be mitigated, will occur.
- Establish a regional study area where there could be possible interactions with other actions. Consider the interests of all stakeholders in the area.
- Consider the use of several separate boundaries for each valuable environmental component identified, and then combine these into the broad regional boundary (e.g. the Sasol case study).
- Expand boundaries sufficiently to address cause-effect relationships between actions and valuable resource components.
- Characterise the abundance and distribution of the valued resource component (e.g. a rare species) at a local regional scale and ensure the boundaries take this into account. This is particularly helpful in terms of biodiversity and health and social assessments, which often grapple with the less tangible, poorly defined secondary effects.
- Determine if any geographical constraints may limit cumulative effects within a relatively confined area near the action. (i.e. water quality restricted to catchment level, or prevailing winds influence air emissions and the extent of the airshed).
- Characterise the nature of pathways that describe the cause-effect relationships to establish a "line-of function". For example, the event chain: effluent from a pulp mill→contaminants in the river→tainted fish→impact on human consumption and wildlife.
- Set the boundaries at the point at which cumulative effects become insignificant. Defined as effects that occur within acceptable levels or within guideline standards.
- Involve specialists in the boundary demarcation.

(3) Was the **time frame** broad enough to include possible cumulative effects?

The establishment of temporal boundaries requires the practitioner to consider "how far back in time" and "how far ahead in the future " should planning extend in order to determine the scope of the assessment. This involves a comparison of incremental changes over time, using historical records to establish an environmental baseline and then the consideration of what reasonably foreseeable actions are likely to occur in the future.

The boundary in the past ideally should begin before the effects associated with the specific actions under review were present.

The following points may determine past temporal boundaries:

- when impacts associated with the action first occurred;
- existing conditions;
- the time at which certain land designations were made (land zonations);
- the point in time at which effects similar to those of concern first occurred; or
- a past point in time representative of desired regional land use conditions or pre-disturbance conditions (the historical baseline), especially if the assessment includes determining to what degree later actions will have affected the environment.

The future time limit would typically end when pre-development conditions become re-established or when the effects are likely to become insignificant. The following points are useful for consideration when determining future temporal boundaries:

- end of operational life of a project;
- after project abandonment and reclamation;
- after the recovery of valued resources to pre-disturbance conditions; or
- when effects return within limits of acceptable change.

The analysis of past and future activities will often only involve a qualitative analysis due to the lack of descriptive information, or if data is available on future activities, modelling scenarios can produce the possible future trends and impacts. However, there will be increasing uncertainty associated with these predictions.

4.5.1.2 Guidelines for determining the Situation Assessment

The South African SEA Guidelines (DEAT & CSIR, 2000) propose that certain tasks be undertaken in order to compile a Situation Assessment. The tasks include the preparation of a resource inventory, the identification of sustainability objectives, criteria and indicators and the identification of environmental opportunities and constraints. Figure 4.3 illustrates where the cumulative effects evaluation criteria 4 & 5 should be integrated into these tasks so as to enhance this process.

At this stage in the process, it is important to note the difference between actions and activities. Human actions often cause a disturbance to the environment. These actions include projects and activities. Projects are usually some form of physical work that is planned, constructed and operated. Activities may be part of a project, or not associated with any particular project but arise over time due to an ongoing human presence in the area. For example, a mine development with a resource access road is an example of a project, whilst public traffic, hiking and hunting along the access road is considered to be an activity.

(4) Were **all possible actions/ activities** affecting the resource identified?

All actions need to be identified that have caused or may cause effects and may interact with effects caused by the action under review. Actions could be organised by categories in recognition of the similar types of effects that they might cause. Useful categories in which to classify activities include:

- economic sector: commercial, mining, manufacturing, tourism etc;
- industrial sector: power generation, heavy industry, light industry;
- landuse types: sport and recreation, forestry, conservation, agriculture; and
- infrastructure: road, rail, water, air.

(5a) Were **past, present and foreseeable future** actions considered?

These actions can be identified using the spatial and temporal boundaries established earlier in the scoping process. Table 4.6 provides a summary of the spatial and temporal criteria and how these criteria can be applied to assessing past, present and future actions.

Table 4.6 Useful spatial and temporal criteria for assessing past, present and future actions.

Spatial criteria	Temporal Criteria
Location within project area: actions that occur within the specific project area that may affect the valued resources. (i.e. when undertaking a specific sectoral study- the actions or activities associated with directly with that sector)	*Past*: actions that are abandoned but still may cause effects of concern
Actions outside the regional study area if they are likely to interact with other actions occurring within the defined and ultimately impact on the valued resource components (this is an important aspect in terms of the addressing indirect secondary effects such as those associated with the social and economic aspects of the study)	*Existing:* currently active actions *Future:* Actions that may still occur

(5b) Were these actions **analysed**?

The following factors will determine what the most appropriate tool for analysis will be.

- types of impacts;
- types of effects and disturbances potentially caused;
- types of valued natural resources affected;
- quality and extent of baseline data available;
- level of expertise available; and
- resources available (capacity, time and budget) available.

Key questions to ask when assessing effects, include:

- What are the main resources that are likely to be affected by the action?
- What parameters/ indicators are best used to measure the effects on the resource?
- What determines the resource's present condition?
- What effect does the action's interaction with other actions have on the resource?

- What is the probability of occurrence, probable magnitude and probable duration of the effects?
- How much further effect can the strategic resource sustain before the changes become irreversible? This requires limits of acceptable change or threshold values to be established.
- What degree of certainty can be attached to the estimates of occurrence and the predicted magnitudes of the effects?

4.5.1.3 Guidelines for the analysis of strategic issues

Having determined the key issues and compiled a situation assessment in the scoping process, the SEA guidelines then advocate the formulation of sustainability parameters and the development of alternative plans and programmes as key tasks for assessing the strategic issues identified during scoping. Figure 4.4 illustrates which evaluation criteria should be incorporated into key tasks of this phase to ensure that the key cumulative impacts identified are assessed at this stage in the SEA process.

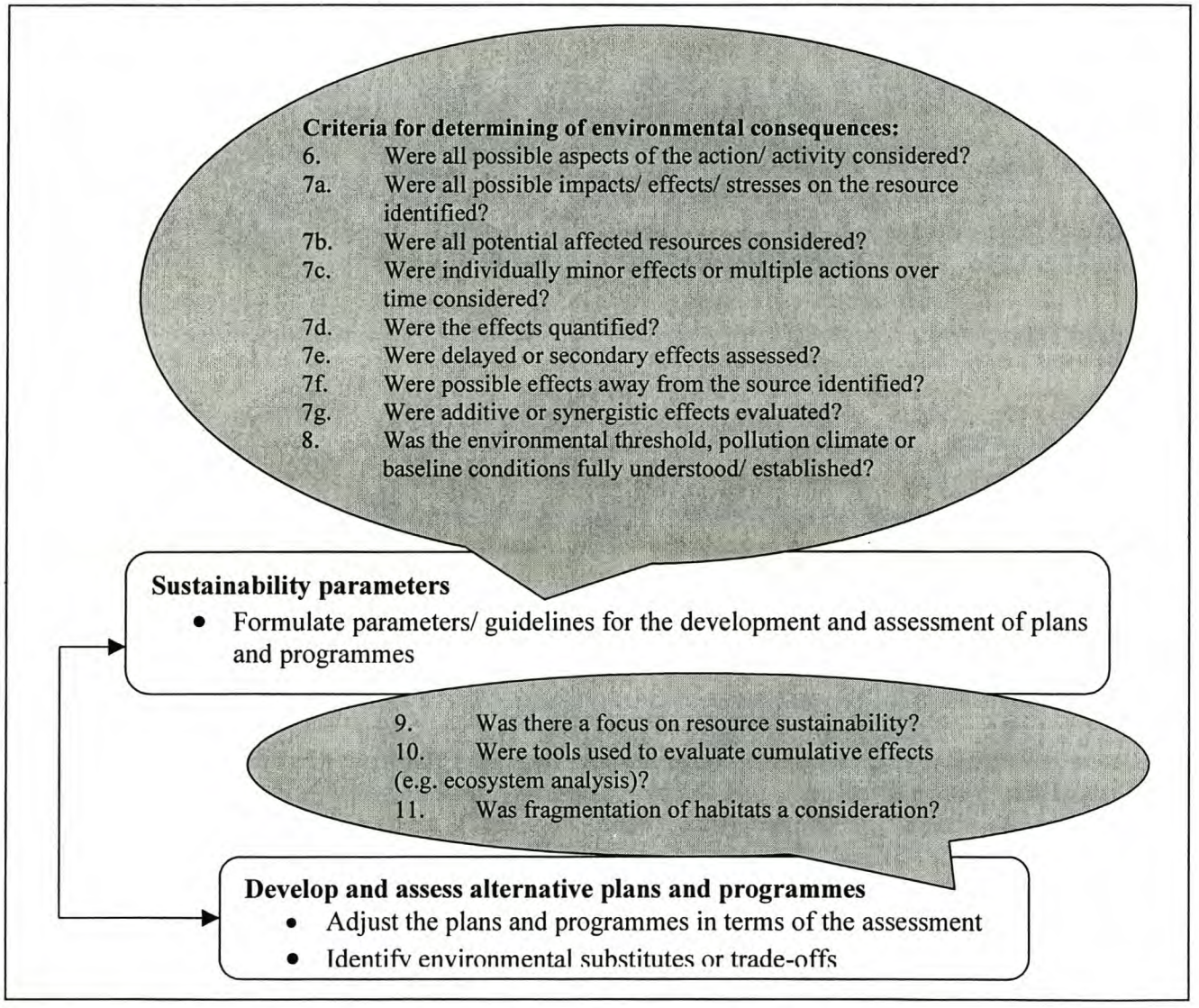

Figure 4.4 Criteria for the analysis of strategic issues in the SEA process

Specific recommended guidelines for addressing each criterion shown in brackets are as follows:

(6) Were all possible **aspects of the action** considered?

The following information may be useful in determining the aspects of the action:

- Location and physical size (area covered, volume of throughput, spatial distribution of components).
- Components of the action (different activities) and supporting infrastructure.
- Expected life period of activities and phasing involved (project life cycle).
- Seasonal variations in activities.
- Number of employees (permanent/ temporary).
- Frequency of use (for intermittent activities).
- Transportation routes and modes of transport.
- Types of processes used (e.g. open pit mining, craft bleaching etc..).

(7a) Were all **possible impacts/ effects/ stresses** on the resource identified or characterised?

This criterion could be used by both the specialist and the reviewer to validate the results of the previous criteria (4, 5a & 5b). If all actions and aspects of these actions have been considered, then all possible impacts/effects should be easily identifiable, using the end results from these previous tasks (Criteria 5a, 5b & 6). The specialist should demonstrate the impact pathways, clearly showing how the action impacts on the affected resource. The development of cause-effect pathways is a useful methodology to use for this task.

(7b) Were all **potentially affected resources** considered?

This criterion is used validate to the initial identification of strategic resources during the scoping phase of the study. It should enable the specialist and the reviewer to confirm if the initial list was comprehensive. Should subsequent information and analysis reveal any additional potentially affected resources, these must then be included in the assessment.

(7c) Were **individually minor effects or multiple actions over time** considered?

In order to determine if individually minor effects are the cause of long term cumulative effects, it is useful to determine if there is spatial or temporal overlap in actions or activities within the study area. The following questions could be helpful in understanding the nature of overlap between activities.

- Do actions rarely or never occur at the same time. Do actions rarely or never interact with or result in other actions i.e. weak cumulative effects interaction?
- Do actions sometimes occur at the same time as other actions and do these actions impact on other actions i.e. moderate cumulative effects interaction?
- Do actions often occur at the same time, and do these actions have a strong link to one another i.e. strong cumulative effects interaction?

(7d) Were the **effects quantified**?

Various methods are available, but quantitative analysis tools are largely restricted to numerical modeling for the air and water environment. Other environments such as biodiversity assessment and social assessments will need to make use of more qualitative assessment techniques in the absence of quantitative techniques. Geographical Information System (GIS) can play an important role in most assessments by enabling the specialist to undertake a spatial analysis in order to determine the extent of the impact and quantify the physical properties of the actions (lengths of road, area cleared) and changes to the landscape (loss of habitat).

The determination of the significance of the cumulative effect is probably the most important and challenging step in this process. The following questions can guide the specialist through a basic line of inquiry, eventually leading to a significance conclusion:

- Is there an increase in the action's direct effect in combination with the effect of the other actions?
- Is the resulting effect unacceptable?
- Is the effect permanent i.e. the concept of reversibility?
- If the effect is not permanent, how long before recovery from the effect?

(7e) Were **delayed or secondary effects** assessed?

The SEA process is aimed at integrating both the socio-economic and biophysical components of the study. Delayed or secondary effects often refer to socio-economic effects (such as health issues, noise pollution, increased risk etc...). Therefore this criterion is useful in focusing the specialist on the more pervasive effects of the study. This criterion will often determine what mechanisms are required to mitigate and monitor these effects.

(7f) Were possible **effects away from the source** identified?

This criterion is used to test the validity of the spatial boundary established in criterion 2, as well as substantiate the findings of 7a (identify possible impacts and effects). These validation mechanisms add robustness to the process and ensure that the process undergoes a critical evaluation where the justification of previous steps is required.

(7g) Were **additive or synergistic effects** evaluated?

This criterion builds on the outcomes of criteria 5a (identify past, present and future actions/ activities), 5b (analysis of actions), 6(consideration of all possible aspects of the action) and 7b (individually minor effects over time). This criterion requires the outcomes of the previous criteria to be critically analysed and critical pathways and linkages to be identified or order to evaluate the additive or synergistic effects.

(8) Was the **environmental threshold, pollution climate or baseline conditions** fully understood or established?

The total effects must be compared to thresholds or limits of acceptable change or to existing standards and guidelines, in order to assess the implications of the effects on the affected resource. The guidelines for the determination of significance (under 7d) are also relevant to this criterion. The following questions provide useful guidance:

- Are quantitative thresholds available for any of the affected resources, or are any qualitative thresholds, standards or guidelines available?
- If indicators are proposed, can the derived values be used to determine if the effects will be reversible or irreversible?

(9) Was there a focus on **resource sustainability?**

This is a general question to ensure that the specialist and project team constantly maintain the main focus of the SEA process, which is to ensure resource sustainability.

(10) Were **tools** used to evaluate cumulative effects (e.g. carrying capacity, ecosystem analysis)

Criterion 7d deals with the quantification of effects. What this specific criterion aims to achieve, is to highlight specific methodologies used in the study to assess cumulative effects. This will enable the specialists and project team to identify innovative approaches or new methodologies used to assess cumulative effects. It is important that this knowledge is shared with the wider environmental assessment community. The International Association for Impact Assessment is a useful platform for knowledge sharing. It is vital that new methodologies and approaches are presented and discussed in order to improve the effectiveness of assessing cumulative effects.

(11) Was **fragmentation of habitats** a consideration?

The following questions provide a useful starting point:

- Are any of the resources locally or regionally rare or scarce? Are there any environmentally sensitive areas that might be disturbed?
- With or without local significant effects, could the action contribute to regional " nibbling" loss of habitat (terrestrial or aquatic). Could these losses in turn affect other resources that reside in or pass through the study area?

4.5.1.4 Guidelines for reporting on mitigation and monitoring

Having completed the assessment of strategic issues, it is then important to develop a plan for implementation, monitoring and auditing. The following tasks are prescribed by the SEA guidelines (DEAT & CSIR, 2000); namely: the preparation of an implementation strategy, the development of a monitoring and auditing plan and then the subsequent implementation of the implementation strategy and monitoring plan. Figure 4.5 illustrates where the evaluation criteria 12 & 13 should be integrated into this final phase of the SEA process.

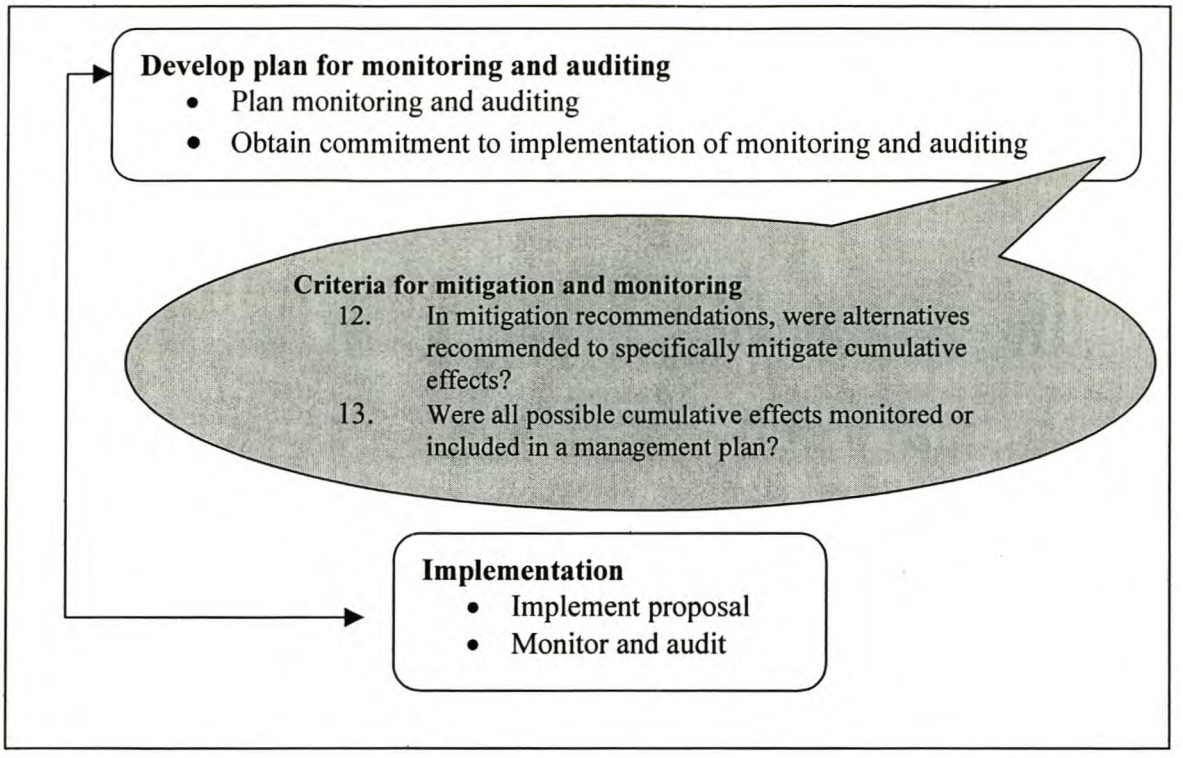

Figure 4.5 Criteria for monitoring, auditing and the implementation stage of the SEA process

The specific recommended guidelines for addressing each criterion shown in brackets are as follows:

(12) In mitigation recommendations, were **alternatives recommended** to mitigate cumulative effects?

The mitigation of local effects is often the best way to reduce cumulative effects in the long term. It is important that mitigation measures are implemented wherever possible to reduce potential impacts. Innovative options (e.g. pollution trading/ compensation/ rehabilitation of disturbed areas etc...) are also available for the mitigation of cumulative effects, as the mitigation is not just focused on a specific activity. Several jurisdictions and stakeholders will usually fall within a regional assessment area. The co-operation of these interests groups is often required to ensure that mitigation measures are successful. Therefore recommendations should include the creation of a strong regional co-ordinating body or steering committee that can monitor and review the implementation of suggested mitigation measures.

It is very important that the residual effect (remaining impact after mitigation) is clearly stated or defined (i.e. the effectiveness of the recommended mitigation measures must be stipulated). Then the significance of the residual effect must be determined.

(13) Were possible **cumulative effects monitored** or included in a management plan?

It is useful to determine what follow–up actions have been established or recommended in the form of environmental management measures in order to monitor and continuously reassess the effectiveness of the mitigation measures and identify potential the long term effects. A monitoring or management plan is essential for studies where there is some uncertainty as to the environmental effects of future actions or there is some uncertainty as to the effectiveness of the mitigation measures.

CHAPTER 5 CONCLUSIONS

This chapter provides a summary of the key findings of this report as well as a brief evaluation of this study's original aims and objectives in order to determine how effectively these aims were addressed. The final section focuses on future research recommendations to provide an indication on how this work can be taken forward.

5.1 EVALUATION OF THE STUDY

The aims of this research study were as follows:

- determine to what extent past South African SEA studies have been able to address cumulative effects; and
- provide guidelines for the integration of CEA into the current South African SEA process.

Three case studies were evaluated to determine to what extent cumulative effects have been addressed in past and current SEA practice. The results of this evaluation showed that two of the three studies (CAPE project and Sasol-Secunda SEA) provided a good assessment of cumulative effects within the SEA process, whilst the other case study (Durban South SEA) provided an adequate assessment of cumulative effects. This evaluation shows that currently cumulative effects are inherently addressed in most studies. The case studies provided some innovative thinking and useful conceptual approaches for assessing cumulative effects. However, all three studies could have been further enhanced if the project team had explicitly focused on the assessment of cumulative effects. Therefore, to enhance the current practice of SEA in South Africa, the second aim of this project was:

- to provide guidelines for the integration of CEA into the current SEA process.

The subsequent section of the of report therefore focused on the current SEA process and how to improve upon this by integrating cumulative effects evaluation criteria into specific phases of the SEA process. This study advocates an enhanced SEA process by infusing various best practice recommendations for assessing cumulative effects into each phase of the existing SEA process. This ensures that the overall process maintains its focus and consistency, whilst still maintaining the flexibility required in the SEA process.

5.2 RECOMMENDATIONS FOR FURTHER RESEARCH

There are still a number of scientific challenges underlying cumulative effects identification, prediction and evaluation. Firstly, for many environments the scientific understanding of the pathways by which impacts are manifested are extremely limited. Moreover, impacts that extend beyond the thresholds of media in natural systems, and the processes for the transfer of impacts are even more poorly understood. These issues still pose as a stumbling block in attempting to analyse cumulative effects, and therefore require further research and consideration. This fundamental research requires understanding the impact pathways and thresholds and should form part of the objectives of specialist studies.

Another major issue for further consideration and research relates to the institutional coordination, and statutory legitimacy of the assessment of cumulative effects.

At present, there is no legislation that specifically requires such an assessment, although it is inherent in NEMA and the SEA guidelines in order to ensure sustainable development. Since the advent of democracy in 1994, a large quantity of environmental legislation has been passed. Therefore, it is not advisable to attempt to create a new Act or piece of legislation specifically focused on cumulative effects. CEA should rather be integrated into existing legislation and processes, such as the SEA process, in order to enhance current practice and add robustness to the South African SEA process. The evaluation criteria could provide a useful framework to use as a basis for the development of the initial SEA process, as guidelines for project team for the development of terms of reference for specialists and finally as a common point of reference for reviewers.

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APPENDIX A

Table A-1 Ratings and comments on the Cape Action Plan for the Environment (CAPE) case study

Criteria	Rating	Comments
SCOPING		
1.	3	▪ Cumulative effects were not explicitly mentioned in the study. ▪ However, the broad focus of the study created the appropriate boundaries and timeframes for cumulative effects to be inherently addressed as part of the process. ▪ Project & specialist TORs made no specific reference to the consideration of cumulative effects.
2.	5	▪ The Fynbos biome automatically demarcates the natural spatial boundary ▪ Biological boundary very appropriate for determining impacts on the resource
3.	5	▪ 20 year vision developed as part of the strategy – this is a very appropriate timeframe for assessing short and long term cumulative effects. ▪ 5 year action and implementation plan provided good basis for monitoring and mitigation of cumulative effects.
DESCRIBING THE PROJECT		
4.	4	▪ Initially a situation assessment was completed by specialists, incorporating all three components of the biome, namely the terrestrial, aquatic (freshwater and marine), and institutional, financial, socio-economic and legal components of the biome. ▪ These components ensured that the biophysical, social and economic processes were all considered in terms of their impact and influence on the conservation of biodiversity in this region. ▪ The Situation Assessment looked at all possible threats and opportunities in the biome from existing activities within the biome ▪ The activities were grouped in three main overarching themes, namely; conserving biodiversity, promoting sustainable use and strengthening institutions.
5a.	4	▪ The study focused mainly on present actions, through the Situation Assessment, and future actions and activities, in the from of the strategy development, long-term vision and 5 year Action and Implementation Plan. ▪ However, past activities were not directly mentioned or studied, although experts involved in specialist studies all had a good understanding of how past activities such a apartheid planning influenced present settlement patterns and development.
5b..	4	▪ Technical studies were completed for all three components of the study, these reports identified and analysed all the key threats and opportunities for their specific study component. ▪ These reports provided detailed analysis for component of the study. ▪ The biological analysis was done using a GIS system, known as C-Plan. This system identified broad habitat units to determine the level of impact on different areas within the biome and determine which areas are most sensitive to future development. ▪ Likewise both the aquatic and social-economic studies applied appropriate methodologies to analysis the current extent of impact on these resources and what the future requirements were in order to maintain biodiversity in the region.

DETERMINING ENVIRONMENTAL CONSEQUENCES		
6.	4	▪ The public participation process adopted an innovative, tiered approach, to encourage appropriate participation at various levels throughout the project duration. At this stage of the project, specific focus groups provided input into specific studies, an overarching Technical Committee and a Working Group provided guidance for the project team. This also provided key stakeholders with the opportunity to provide input into the process, in order to ensure that all important activities and aspects of activities that influence the conservation sector were identified and appropriately addressed in the study.
7a.	4	▪ The situation assessment integrated the inputs from all three components of this study into a final integrated report that listed and prioritised all the key opportunities and constraints for conservation of biodiversity in the fynbos biome. ▪ The threats identified all possible present and future impacts or stresses on the system that could impact negatively on the biodiversity of the region. The opportunities likewise identified effects or impacts that could have a positive influence on the system.
7b.	4	▪ The broad scope of the project and the natural biological demarcation of the spatial boundary provided the appropriate backdrop for the specialist to look at all activities and all the resources that affected or played a role in specific ecosystem functioning or processes within the biome and determine all potentially affected resources in the areas. ▪ The very nature of the project, with the ultimate goal of ensuring the long-term conservation of biodiversity, encouraged a strong biological focus. Therefore the socio-economic aspects of the study were often given less attention. ▪ Political complexities in terms of working across political/ provincial boundaries (Eastern/ Western Cape) respectively, created difficulties in terms of the socio-economic studies. ▪ In many instances specialists are still grappling with the complexities associated of social-economic interactions and impacts, making these sectors more difficult to assess.
7c.	4	▪ A SEA by its very nature focuses on the more strategic level issues rather than specific local actions or impacts. ▪ During the strategising stage of the project process all issues identified were prioritised in terms of their importance. ▪ Numerous local minor effects and actions, such as the spread of alien species over time, or impact of local overharvesting of resources were given high priority due to their overall impact on the entire fynbos biome and the implications of these local actions or minor effects on future biodiversity conservation. ▪ The C-Plan system specially looks at specific small scale effects or continuous multiple actions (such as new developments) and assesses what the overall impacts of all these actions will be for the bioregion.
7d.	3	▪ The biological/ terrestrial components of this study the effects were very well quantified at a broad scale using the GIS system of broad habitat units to determine which areas were more sensitive or vulnerable to effects. ▪ Resource economics proved to be a useful tool to quantify the impacts of alien invasives in terms of the loss of water quality & quantity and the estimated cost of this loss to society ▪ The marine study also provided estimated financial losses in terms of potential future job losses and quota reductions as the result of predicted marine stock crashes. ▪ The social-economic studies, hampered by a lack of understanding of all the cause-effects pathways, could only provide very general assessments of the socio-economic situation rather than been able to provide accurate quantification of the effects on these sectors.

7e	3	▪ The socio-economic issues are generally considered to be the delayed or secondary effects in terms of this study ▪ The study therefore did attempt to assess delayed or secondary effects. However, as previously mentioned the socio-economic issues were generally not easy to assess and quantify. ▪ The study also considered all possible sectors impacting on the conservation sector, many of the sectors did in fact no have direct effects on the conservation sectors but rather indirectly affected the conservation of biodiversity. (e.g. National policies and legislation which indirectly influenced activities in the conservation sector.)
7f.	3	▪ The delimitation of the spatial boundary was very effective, in terms of enabling the specialist to consider the resource footprint in entirety and thereby ensuring that all effects, including those away from the source could be identified. ▪ The project had a strong focus on ecosystem functioning (looking at the ecosystem as a whole) and this approach proved to be a very effective approach to identify all effects both at the source and source away from the source of impact.
7g.	3	▪ The specialist studies tended to assess such effects inherently within their studies. Such as the freshwater specialist study looked at the effects of sedimentation, agricultural run-off and other upstream developments which affects the water quality downstream eventually impacts negatively on the estuaries, altering fish breeding habitats and ultimately affecting the fish population. ▪ The terrestrial study also had a strong focus of the loss of habitat and the long term additive effects that this would have in terms of maintaining ecosystem functions and processes. ▪ Cumulative effects are generally borne form additive or synergistic effects and all studies should therefore place a strong focus on this issue in order to ensure that they have a firm understanding of how cumulative effects impact on the area and what the implications are in terms of long term monitoring and mitigation. Although this study did inherently address this issue, the study would have benefited greatly by explicitly identifying cumulative impacts that require large term monitoring and mitigation.
8.	3	▪ For the biological studies, the ecosystem interactions are generally well understood and various biological targets have been established. For the purposes of this study, areas with a high number of red data book species and species endemism were the areas identified as priority areas requiring conservation measures. ▪ However, again due to the complexities in assessing cause-effect pathways within the social environment, it proved more difficult to address these within the social studies.
9.	5	▪ The CAPE project's main purpose was to develop a long term conservation strategy for the Cape Floristic Kingdom. Therefore, the main focus of this study was to ensure that all activities and actions that influence this resource are carried out in a sustainable manner in order to ensure that the resource is conserved. One of the specific themes for the development of core projects was that of sustainable resource utilisation. This included projects on the need for further research to determine sustainable levels of wildflower harvesting, projects to address the current overexploitation of marine resources through improved enforcement, the creation of marine protected areas and educational and awareness projects. The sustainable utilisation of catchments was also developed as a core project, identifying the need for integrated catchments management to ensure that catchments are managed in a sustainable manner.
10.	3	▪ No methodology was used with the specific aim of assessing cumulative effects, however, numerous tools used in this study have potential to assess cumulative effects. ▪ C-Plan is a GIS System that is used specifically for conservation and bioregional planning. This model uses broad habitat units in order to classify different areas and various criteria can be entered into the system in order to determine which areas are suitable for development

		and which areas are sensitive or vulnerable and should not be developed. This system could be a very useful way to display the spatial effects of cumulative effects within an area. ▪ Resource economics was another tool used in this study to determine long term or cumulative effects, with specific reference to the potential spread of alien plants and the potential impact this would have on the regions water resources. ▪ The focus on ecosystem functioning and processes is a useful approach to assessing cumulative effects, as it involves developing a good understanding of the cause-effect pathways within a system.
11.	5	▪ The biological study focused mainly on the issue of habitat fragmentation and the implications of this on the sustainability of biodiversity within this region. ▪ One of the main themes for the development of high priority projects, was that of on/off-reserve conservation in order to mitigate the impacts of habitat fragmentation. Two key projects that were developed under this theme were projects aimed at securing land and funding to create 3 mega-reserves in different habitats in the regions and then the second project linked to this project, was the creation of mega-corridors between these reserves in order to maintain ecological processes that are necessary to maintain ecosystem functioning. These projects are aimed at enhancing present conservation measures and mitigating the possible negative effects of present habitat fragmentation.
MITIGATION OF ENVIRONMENTAL CONSEQUENCES		
12.	4.	▪ The structure of the CAPE process provided the project team and key roleplayers with the opportunity to assess various alternative future development scenarios. The results from the situation assessment were used to inform the development of the strategy. The strategy developed an overall vision, and this vision was then broken down into various goals, which would need to be met in order to ensure the realisation of the vision for this region. These goals were then broken down further into specific short term objectives that need to be met in order to ensure that the goals are achieved. These specific objectives were then prioritised and the strategically high priority objectives were developed into key projects that require funding and need to be implemented within the next five years in order to achieve the long term vision for this area. If these short term and medium term goals are met then most of the negative impacts threatening the success of this project will have been minimised or managed to within acceptable limits of change. ▪ The Steering Committee and Working Group roles continue after the completion of the CAPE project in order to ensure continuity and ensure that the project actions are effectively implemented on the ground. These committees will also have the responsibility of monitoring and evaluating the success of the proposed actions. Annual review meetings will enable the stakeholders to assess the success of the initial targets and goals and if necessary to alter these goals and targets to ensure that through a process of continual improvement and adaptive management the ultimate vision of CAPE is met.
13.	3	▪ No management plan or specific cumulative effects monitoring system has been put in place for this study. However, the five-year Action Plan will be implemented and many of the projects, which form part of this action plan, do have a monitoring component. ▪ The development of recommended indicators for monitoring, against which the steering committee could monitor success of the projects would further have enhanced this project.

Table A-2 Rating and comments on the Sasol-Secunda SEA case study

Criteria	Rating	Comments
SCOPING		
1.	4	▪ Cumulative effects were mentioned in the Final integrated report as an issue that needed to be addressed in order to secure future sustainability for Sasol and the surrounding environment. ▪ Specialists were required to draw up their own Terms of Reference (TORS) and most specialists did include a sentence on the need to identify and consider cumulative or additional impacts. ▪ However, some specialist studies did not address this issue directly.
2.	5	▪ This study made use of a very innovative approach in terms of defining the spatial boundaries. ▪ Six strategic impacts were identified during the scoping process, for each of these impacts an individual footprint area was defined. ▪ This methodology is well aligned to the cumulative effects methodology that recommends that all regional valued ecosystem components (strategic impacts) are identified and then appropriate individual boundaries are defined for each impacts sphere of influence.
3.	5	▪ This study was not evaluating a specific proposed new development. It was a study to determine possible future development options, therefore the timeframe had to be flexible in terms of possible future activities. ▪ The study made use of a 5-20 year period, in which existing and future desired state were examined. ▪ The timeframe was most appropriate, as this enables the project team to identify both short term and potential long term cumulative effects in this region.
DESCRIBING THE PROJECT		
4.	4	▪ The study approach was a very useful approach in terms of ensuring that all possible actions/ activities affecting the resources were identified. By determining the appropriate footprint per strategic impact, each specialist was then able to carry out a comprehensive analysis of what activities were occurring within the specified footprint area, and thereby identify what activities/ actions were impacting on what resources and then determine the extent of the impact. ▪ Data availability plays an important role in this task and Sasol's activities are well documented in various EIAs/EMPRs undertaken prior to this study. The availability of this data made this task easier for the specialists. ▪ The scoping workshop, which involved team members and specialists of previous EIA studies and key stakeholders from the area ensured that all the potential activities/ actions of concern were listed and then prioritised in terms of their importance for the purposes of the SEA study. ▪ Eskom, who are key stakeholders in the area, refused to participate in the process. Their input would have added much value at this stage of the SEA process.
5a.	4	▪ This was well done in most specialist studies, largely due to the availability of fairly good monitoring data for the area, especially in terms of the water quality/ quantity. This enabled specialists to evaluate past and present activities. ▪ Future activities were evaluated based on the determination of the desired state and information provided by the client on possible future proposals.

		▪ Therefore past, present and future activities were adequately considered in this report.
5b.	3	▪ The availability of monitoring data for all sectors, in many instances (social, health and biodiversity studies) hampered the indepth analysis of particular actions. ▪ Most of the specialist studies looked at all the land use activities within their footprint areas. In that way the potential impacts for each user could be identified. However, this was mainly qualitative in nature, ie. the type of nature of the impact rather than the quantitative effect. ▪ In some instances, the availability of environmental data was lacking, e.g. there was little data available on soil quality, which made it difficult to determine the impact of certain actions on biodiversity ▪ In some instances there is a general lack of understanding of complex cause-effect pathways and specific ecosystem functioning which also hampered indepth analysis of these issues (e.g. biodiversity studies and soil acidification, and result loss of agricultural productivity).
DETERMINING ENVIRONMENTAL CONSEQUENCES		
6.	4	▪ In terms of the Sasol activities, all aspects of their activities were well understood, largely due to available data from previous EIAs previously undertaken or from inputs and information from the client. ▪ As this SEA was undertaken specifically for Sasol-Secunda, relatively little focus was placed on the other activities, other than to determine the nature and extent of the impact that other actions or activities. Therefore, specialist studies did not go into detail of the specific aspects of these activities
7a.	3	▪ All the specific impact footprints were integrated to form the overall Sasol footprint (i.e. shows the extent of Sasol's sphere of influence in the area). Through the integration of all the specialist studies most impacts/ effects or stresses were identified. ▪ However, in certain areas such as the biodiversity study and the social economic study, the lack of knowledge as to how various impact pathways function and what the ultimate impact will be is difficult to determine. This results on a lack of detail in terms of the significance of the impact and what mechanisms play a role in the impact. ▪ This stage also depended heavily on information supplied by the client and other stakeholders within the footprint. Unfortunately not all stakeholders were keen to be involved as the study was seen as a Sasol SEA.
7b.	4	▪ The scoping workshop held at the start of the SEA process ensured that all possible issues and impacts were identified at the outset of the project, this enabled the specialists to determine what resources were likely to be affected by which impacts. ▪ The level of detail for each study was determined by the availability of data.
7c.	3	▪ Very little focus was placed on minor effects in this study, as the study only concentrated on the main strategic impacts identified at the start of the project. However, the early determination and definition of each strategic resource's Limit of Acceptable Change (LAC) and the subsequent determination of the existing state enabled the project team to define the opportunities and constraints of the surrounding environment. These were expressed in terms of the negative or positive distributive capacity of each resource. By establishing a clear understanding of what the system could sustain any minor effects would be mitigated and controlled through the establishment of limits of acceptable change and ongoing monitoring of the level of change for each affected resource. ▪ In terms of the health study, the specialist team look firstly at the end result of the impact (i.e. diseases) and then worked back from this point to determine to what extent and which emissions were adding to the ultimate impact. This is a useful approach to follow to ensure

		that minor effects or multiple actions are taken into consideration.
7d.	4	▪ This depended heavily on information supplied by the client or other stakeholders and the availability of monitoring data. In terms of the water resource studies this was very well done, with specific reference to water demand, water quality, groundwater quality and decant. ▪ In terms of the biodiversity and land potential study and the social economic study, all the land use activities within their footprint areas were considered. In that way, the potential impacts and effects for each user could be identified. However, this was mainly qualitative in nature, i.e. the nature of the impact rather than the quantitative effect.
7e	3	▪ Delayed effects were assessed in the water resource study in terms of the ground water decant. This was expected to occur in approximately 2017, due to current mining conditions and management options. ▪ In terms of the social economic and health study, much of the focus of these studies is on secondary or delayed effects resulting from the influx of jobseekers and the subsequent increase in unemployment and poverty and the resultant secondary effects such as increased disease (HIV/ AIDs), crime etc… ▪ The phasing of the specialist studies is an important issue when it comes to the determination of secondary effects. It would perhaps have been more beneficial to run the biodiversity and social studies after the completion of the water studies and health studies. As the results from these studies would have provided the specialists with the necessary data required to identify and quantify secondary or delayed effects stemming from water quality or health issues.
7f.	4	▪ By using the individual footprint areas for each strategic impact and obtaining input from the client and other stakeholders in the area, the specialists were able to identify all effects within the area, including those away from the source. This was particularly well done in the health studies in terms of determining the effects of emissions and within the water studies in terms of downstream impacts of water quality and quantity.
7g.	3	▪ Additive and synergistic effects were well addressed in the water studies and health studies, however in the other studies these effects were poorly addressed. This is largely due to a lack of expert understanding of impact pathways of how some of the more complex impact pathways interact. The availability of data also played an important role in determining the extent to which these effects were evaluated.
8.	5	▪ This study devotes an entire chapter to the determination and definition of the Limits of Acceptable Change (LAC) for each identified resource ▪ The introductory section of the integrated report emphasized the importance of this step within the SEA process. ▪ The project team viewed the determination of LACs as the main method to determine the environmental constraints and opportunities of this area. This approach shows that the project team were continuously considering cumulative effects.
9.	5	▪ The study approach was very focused on resource sustainability. This was achieved by firstly establishing the environmental profile of Sasol's impacts and then determining what the desired state was, after which limits of acceptable change were defined for each strategic resource. Then the distributive capacity of these resources was determined. Through the comparison of the existing state and the available distributive capacity, opportunities and constraints were identified. This determined which resources were being unsustainably utilised and which resources were still within or under the limits of acceptable change. The study team then focussed their attention on best these resources should be managed and distributed in future, in order to ensure the sustainable utilisation of the resource. (users rights).

10.	4	▪ The overall approach of the study is a useful approach or tool for evaluating cumulative effects. The concept of first defining individual impact footprints and then combining all the individual footprints into one large footprint to indicate Sasol's sphere's of influence or environmental profile is a useful approach to determine overall the cumulative impact of a sector or region. ▪ This study provides a good example of how water quality & air quality modelling can be used to assess the impact of different emissions and the interactions between emissions. ▪ In terms of the ground water studies; the reserve concept and the resource quality objectives (RQO) allows for an assessment of carrying capacity of the resource, to ensure the maintenance or protection of the ecological reserve. ▪ The social and biodiversity studies did not use any specific methodology to assess cumulative effects.
11.	4	▪ This criterion formed the basis of the biodiversity and land potential specialist study, ensuring that cumulative effects were considered implicitly throughout this study. This study also makes recommendations for the establishment and maintenance of corridors between wetlands and other threatened habitats in order to ensure the long term maintenance of these systems.
MITIGATION OF ENVIRONMENTAL CONSEQUENCES		
12.	3	▪ This SEA was not conducted with a specific development in mind, therefore there was little focus on alternatives and necessary mitigation. However, most of the specialist studies did provide broad recommendations for the long term management of the resources and the establishment of the LACs for each resource should act as a measure against which future impacts can be monitored and controlled.
13.	3	▪ Every specialist study undertaken included a section on recommended monitoring mechanisms in order to obtain more detail and measure future impacts, and gain a better understanding of longer term impacts. However, there were no intentional monitoring mechanisms set in place to specifically monitor cumulative effects.

Table A-3 Ratings and comments of the Durban South SEA case study

Criteria	Rating	Comments
SCOPING		
1.	3	▪ It is clearly stated in the introductory section of the Final Integrative Report that: "the impact of Durban South Basin are complex and cumulative. This results in a composition of sometimes relatively minor impacts which when added together, detract significantly from the quality of life of the residents in the area" (CSIR, 1999, pp iv). Therefore cumulative effects were identified as an issue that requires attention at the outset of this study. ▪ A criticism of the report is that the health issue was raised during scoping as one of the main cumulative effects issues in the basin yet was not incorporated in this study (due to budget constraints and the client (Durban Metropolitan Council not having the jurisdiction to investigate the health issue as this issue falls under the Dept. of Health). This practical constraint resulted in a fatal flaw in the SEA process from the outset.
2.	3	▪ It was recognised from the beginning of the project that a flexible approach would be required in terms of defining the Study Area. ▪ Initially a hard line was drawn around the main areas of heavy and industry as well as the communities perceived as being the most impacted by environmental problems in the Durban South Basin. ▪ As the study progressed, this area of impact proved to be too limiting and the approach adopted was to consider the importance of all areas that were influenced by or had influence on activities in the Durban South Basin. This provided the appropriate scope for cumulative effects to be assessed. ▪ However, the social study limited its analysis to the initial hard line boundary whilst the economic study extended its analysis to a regional focus, this created an imbalance between these two components in this study and resulted in the recommendations of the Final Integrative Report having a very strong economic focus.
3.	4	▪ The timeframes used in this study were generally sufficient to ensure the adequate assessment of cumulative effects as the project did consider past and present activities and placed on strong focus on possible future trends and activities within the basin.
DESCRIBING THE PROJECT		
4.	4	▪ Numerous workshops and public meetings with all the relevant stakeholders in the area (government, industry and community) were held during the scoping stage of this project. At this stage all possible activities and actions that were potentially resulting in environmental problems were identified and the study on baseline conditions and existing state of the Durban South Basin identified all possible activities and actions occurring within the basin, including social, biophysical and economic activities and resources.
5a.	3	▪ The study approach was based on the the consideration of present conditions and potential future development options. ▪ The first phase of the study focused on assessing the existing environmental conditions and baseline conditions for the Durban South Basin. Then five different future development options were identified, compared and evaluated in order to determine what development potential existed within the basin. ▪ Not much focus was placed on past activities other than to mention that previous planning had resulted in the current environmental problems been experienced within the basin, due to the settlement of local communities alongside heavy industry and the incompatibility of these two sectors.

		▪ The impact of past apartheid planning actions is an important issue, as it created the current atmosphere of animosity and distrust prevalent in the local communities. The community distrust and dissatisfaction hindered the public participation process. This social issue should have been recognised and addressed via conflict resolution at an early stage in the process., as it is a major barrier to the ultimate success of this process.
5b.	3	▪ Specialist studies were undertaken for most of the actions occurring in the Basin, which were identified as having potential impact on the environment of Durban South Basin. ▪ However, little attention was given to the social community health issues.
DETERMINING ENVIRONMENTAL CONSEQUENCES		
6.	4	▪ This was determined by the availability of data in most instances, and generally little data was available on the specific aspects of all activities. ▪ The study was also focused at a macro level and therefore did not required detailed studies on each specific activity. The study tended to focus only on the strategic issues rather than local issues which involved specific aspects of activities.
7a.	3	▪ The failure to analyse impacts on health is a serious flaw in the study.
7b.	3	▪ The air quality issue was the most important issue in terms of cumulative effects in this study. The specialist air study only analysed three pollutants affecting air quality in the region and this was met with severe criticism from the public as other potential sources of pollution (such as vehicle emissions, light industry, VOCs etc.) were not considered.
7c.	2	▪ The study identifies that the impacts in the Durban South Basin are: "complex and cumulative. This results in a composition of sometimes relatively minor impacts which when added together, detract significantly from the quality of life of the residents in the area" (CSIR, 1999, pp iv). However, despite this recognition of the additive impacts of minor effects, the SEA fails to analysis any minor effects such as small scale air emission (vehicles, light industry). ▪ The study also fails to determine what the limits of acceptable change are for each strategic resource within the area, and this therefore makes it difficult to determine if the evaluation of only the strategic impacts identified in the study is adequate. As it is often the minor or multiple effects over time that add to the larger impacts and result in the exceedance of the limits of acceptable change.
7d.	3	▪ Most of the strategic effects identified were adequately quantified in the specialist reports, however, in terms of the air study, the air modelling produced incorrect data at one stage in the project which was subsequently rectified, however, this created an atmosphere of distrust and animosity in the process. ▪ This stresses the importance of scientific rigour in the quantification of impacts and the need to all studies to be externally reviewed to ensure robustness and test the validity of the findings before making the results available. Incorrect results can seriously undermine the future process.
7e	2	▪ Once again delayed or secondary effects mainly refer to social-economic and health issues. ▪ The study did undertake a social perceptions survey to assess peoples perceptions of the different issues, however, this study was only carried out within the immediate vicinity of the Durban South Basin, whilst the economic study was done on a regional basis. As this area is of regional importance as it does impact on communities outside of the basin and the lack of they input reduced the validity of the social assessment, and results in an imbalance with a bias towards the economics of the study.

		▪ Health issues, which are probably the main issue in terms of secondary effects of environmental impacts within the basin, were not addressed at all within the study.
7f.	2	▪ The biophysical and economic issues were well addressed in this regard, however effects away from the source, in terms on effects on the local communities in the area (social issues) were given no attention (this refers to the assessment of brown issues such as noise, odour, visibility, quality of life, sense of place).
7g.	2	▪ Due to a lack of methodologies available to assess these impacts, these effects were not adequately addressed at all, especially in terms of correlation between air quality and health issues within the region.
8.	3	▪ A separate study of the baseline conditions of the Basin was undertaken in Phase 2. These conditions were well addressed and understood. ▪ In terms of the air study the figures obtained from the modelling process were compared to the current South African Air Quality Guidelines, whilst the community felt that these guidelines were not adequate and that the air quality should use the World Health Organisation's Guidelines in order to ensure that the air quality standards which the basin would not have a negative future impact on health (*viz.* the precautionary principle). ▪ This raises the issues of perceptions and the importance of having established a common vision among all stakeholders in terms of what environmental quality would be acceptable in the Basin. A common vision was not established for this study.
9.	3	▪ The study was aimed at determining what the most feasible future development scenario would be for the Durban south Basin, in terms of securing the long term sustainability of the area and the wider region. The study compared and evaluated the biophysical, social and economic implications of the various development options in order to determine which of the options was the most sustainable. However, as mentioned previously the Final Integrative Report was strongly focused on the economic and biophysical aspects, whilst the social aspects were underplayed and the final recommendation was that local communities would need to be relocated. ▪ This highlights the difficulties of undertaking a regional SEA, as the various sectors are often incompatible and lead to a conflict of interest, which is difficult to address fairly and equitably for all parties concerned. In such instances it is easy for the emotional local issues to become embroiled with the larger strategic issues thereby confusing the process and often obstructing the purpose of the SEA.
10.	2	▪ Few tools were effectively utilised to specifically to evaluate cumulative effects. ▪ Air modelling was used however, only a small range of pollutants were considered, therefore the study was not entirely successful in determining the overall potential cumulative effects.
11.	3	▪ Due to the fact that the study area is already disturbed land, which is either occupied by industry or housing settlements, habitat fragmentation was not an important issue in this study.
MITIGATION OF ENVIRONMENTAL CONSEQUENCES		
12.	4	▪ The Final Integration Report evaluates and compares the potential impacts of each future development option. The two options that are favoured in the study provided mitigation mechanisms that will improve future air quality in the Basin, due to the installations of improved, cleaner technologies.
13.	4	▪ The Final Report also provided recommendations for future management of the area, in terms of developing an environmental management framework and specific air quality monitoring systems and integrated waste management within the region to reduce environmental impacts within the region