

**COMPARATIVE ANALYSIS OF ENVIRONMENTAL IMPACT ASSESSMENT COMPLIANCE BY
TWO DEVELOPERS IN THE NORTHERN CAPE PROVINCE, SOUTH AFRICA**

by

MAHLATSE JUDDY SHUBANE

submitted in partial fulfilment of the requirements
for the degree of

MASTER OF SCIENCE

in the subject of

ENVIRONMENTAL MANAGEMENT

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: DR K. RAMACHELA

JUNE 2015

DECLARATION OF ORIGINALITY

Student Number: 49127403

I declare that the study on the “*Comparative Analysis of Environmental Impact Assessment (EIA) compliance by two Photovoltaic developers in the Northern Cape Province, South Africa*” is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

.....
SIGNATURE

Mr M J Shubane

.....
DATE

ACKNOWLEDGEMENTS

- Many thanks go to my supervisor Dr K. Ramachela for a thorough reading through the work and offering technical and insightful advice.
- My appreciation goes to my field assistants, Jafta Kapunda, Rennie Mishe and Mr Ghumba who assisted me with administering questionnaires.
- I also want to express my deepest thanks and gratitude to my family. This includes my beloved wife Adoration Rirhandzu Shubane. They have been so patient and supportive throughout my studies. They gave support during difficult and frustrating times.
- I also wish to extend my sincere gratitude to Cynthia Ngwane from Agricultural Research Council (ARC) for assistance and the support with statistical analysis and Cecily van der Berg from Department of Environmental Affairs for assistance with the maps.
- Thanks to everyone who contributed towards this project, without your ideas and inputs this could not have been achieved. Finally, thanks to God almighty for the power, strength and patience He provided.

ABSTRACT

The study was undertaken to investigate the following: limiting factors faced by the developers in complying with the EIA conditions and to determine whether the various developers comply with the conditions. The study was undertaken by use of questionnaires, site visits, meetings, photographs, group interviews. Trained fields assistants were also used to administer the questionnaires in order to collect data.

Data from two sites were collected between 2012 and 2014 and were intentionally collected in order to provide information regarding the implementation of mitigation measures. The collected data was subjected to SAS (statistical software). Chi-square test for independence was performed in order to compare the differences (Snedecor & Cocharen, 1978) between the two sites.

Based on the results of the study, it is therefore recommended that competent authorities should consider drafting and supplying follow-up guidelines and these guidelines should also apply to all the relevant role players involved.

Key Terms:

Environmental Impact Assessment (EIA), Integrated Environmental Management (IEM), EIA follow-up, Environmental Management Programme (EMPr), Environmental Compliance Monitoring, Overall Impact Assessment, Risk Screening, Environmental Auditing, Environmental Authorisation and National Environmental Management Act

ACRONYMS AND ABBREVIATIONS

EIA	Environmental Impact Assessment
IEM	Integrated Environmental Management
EMPr	Environmental Management Programme
NEMA	National Environmental Management Act (Act No 108 of 1998)
UNEP	United Nations Environment Programme
IEA	Institute of Environmental Assessment
EA	Environmental Authorisation
IAIA	International Association for Impact Assessment
USEPA	United States Environmental Protection Agency
WCED	World Commission on Environment and Development
ISO	International Standards Organisation (14001)
EMS	Environmental Management System
IGAE	Intergovernmental Agreement on the Environment
ECA	Environment Conservation Act (Act No. 73 of 1989)
RSA	Republic of South Africa
DEAT	Department of Environmental Affairs and Tourism

DEA Department of Environmental Affairs

TABLE OF CONTENTS

	PAGE
DECLARATION.....	i
ACKNOWLEDGEMENTS.....	ii
ABSTRACT.....	iii
ACRONYMS AND ABBREVIATIONS.....	v
CONTENTS.....	vi
LIST OF FIGURES.....	xi
LIST OF TABLES.....	xii
LIST OF PHOTOGRAPHS.....	xiii
LIST OF APPENDICES.....	xiv

CHAPTER ONE: INTRODUCTION

1. 1.	Introduction and Background.....	1
1.1.1.	Statement of the Research Problem.....	6
1.1.2.	The need for the research.....	9
1.2.	Research Questions.....	10
1.3.	Aims and objectives.....	10
1.3.1.	Main objectives.....	10
1.3.2.	Specific objectives.....	10
1.4.	Thesis outline.....	11

CHAPTER TWO: LITERATURE REVIEW

2.1.	Introduction.....	12
2.2.	Origin of EIA in South Africa.....	18
2.2.1.	The EIA process as implemented in South Africa.....	18
2.2.1.1.	Basic Assessment Process.....	21
2.2.1.2.	Scoping EIA Process.....	21
2.2.2.	Screening.....	22
2.2.3.	Scoping.....	23

2.2.4. Impact assessment and mitigation.....	24
2.2.5. Reporting.....	24
2.2.6. Review.....	24
2.2.7. Decision.....	25
2.2.8. Implementation.....	25
2.3. Environmental legislation in South Africa.....	26
2.3.1. The Constitution of South Africa, Act 108 of 1996.....	26
2.3.2. The Environmental Conservation Act, Act 73 of 1989 (ECA).....	28
2.3.3. The EIA regulations published in terms of the ECA of 1989.....	28
2.3.4. National Environmental Management Act, Act 107 of 1998.....	29
2.3.5. EIA regulations published in terms of the NEMA.....	29
2.3.6. Implications of the change in EIA regulations for this study.....	31
2.4. EIA compliance.....	32
2.4.1. Defining EIA compliance.....	32
2.5. EIA follow-up.....	33
2.5.1. Types of EIA follow-up.....	34
 CHAPTER THREE: METHODOLOGY THE STUDY	
3.1. Study area.....	37

3.1.1.	Climate and rainfall.....	38
3.1.2.	Vegetation.....	40
3.1.3.	Projects description.....	42
3.1.4.	Study approach.....	47
3.1.4.1.	Questionnaires.....	48
3.1.4.2.	Meetings.....	48
3.1.4.3.	Photographs.....	49
3.1.4.4.	Site visits.....	51
3.1.5.	Data processing and analysis.....	52

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1.	Introduction.....	53
4.2.	Participants survey.....	53
4.3.	Projects impacts on the environment.....	62
4.4.	The impacts of the construction activities and mitigation measures.....	64
4.5.	Socio-Economic impacts of the projects.....	69
4.5.1.	Ecological impacts.....	71
4.5.2.	Project skills requirements.....	74
4.5.3.	Forms of interactions with the local communities.....	75
4.5.4.	Conclusion.....	77

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1.	Conclusions.....	78
5.1.1.	Environmental Compliance by the developers for both project A and B.....	78
5.1.2.	Effectiveness of mitigation measures.....	78
5.1.3.	Limiting factors faced by the developers.....	79
5.2.	Recommendations.....	79
5.2.1.	Compliance and the environmental impacts.....	79
5.2.2.	Roles and responsibilities.....	80
5.2.3.	Gather follow-up data during the construction and operational phase of the projects.....	80
5.2.4.	Encourage environmental awareness training	81
	References.....	82

LIST OF FIGURES

Figure 1(a): The 2010 EIA flow of process in South Africa (adapted from DEA 2010)

Figure 1(b): The 2010 EIA flow of process in South Africa (adapted from DEA 2010)

Figure 2: Map of South Africa indicating the District and Local Municipalities of the study areas in the Northern Cape Province

Figure 3: Average monthly rainfall from 1982-2012

Figure 4: Northern Cape Province maximum temperature

Figure 5: Northern Cape Province minimum temperature

Figure 6: Map of South Africa showing Northern Cape Province vegetation types

Figure 7: Gender of Respondents by Age Class (N=96)

Figure 8: Gender of Respondents by Age Class (N=107)

Figure 9: Perceived environmental impacts of the solar panels harvesting project at project A and project B. A survey was carried out using questionnaires on the project A and project B communities

Figure 10: Perceived environmental impact of the solar panels harvesting project at project A and project B. A survey was carried out using questionnaires on the project A and project B communities

Figure 11: Form of interactions with the communities used by the developers during construction and operational phase of the projects

LIST OF TABLES

- Table 1: Indicating the 50 MW PV facility components and number of components
- Table 2: Showing recommended mitigation measures in the EIA reports
- Table 3: Summary of EIA impacts and mitigation measures in terms of ecological perspectives
- Table 4: Summary of EIA impacts and mitigation measures regarding socio-economic perspectives
- Table 5: Comparative analysis of permanent and short term labourers for project A and B
- Table 6: Comparative analysis of skilled and unskilled labourers for project A and B
- Table 7: Analysis of workers in relation to age groups and gender for project A
- Table 8: Analysis of workers in relation to age groups and gender for project B

LIST OF PHOTOGRAPHS

- Photograph 1: Indicates vegetation regrowth under the solar panels
- Photograph 2: Showing the ecological corridor linkages which provide significant migration for animals.
- Photograph 3: Indicating the group discussions with members of the community and local leaders
- Photograph 4: Showing solid waste on site which was temporarily stored with a plan to dispose it in a licensed permanent secured disposal area
- Photograph 5: Showing bird flappers along the power line which connect to the PV facility
- Photograph 6: The transformer constructed during the study which depicts water which will contain oil if leaks occur
- Photograph 7: Indicating the road leading to the construction area prior to the commencement of site clearance
- Photograph 8: Showing construction after site clearance in order to commence with construction activities

LIST OF APPENDICES

Appendix 1: Ethics clearance (Ref Nr_2013_CAES_100)

Appendix 2: Community Property Association consents

Appendix 3: Company consents

Appendix 4: Questionnaire

CHAPTER ONE: INTRODUCTION

1.1. Introduction and Background

Environmental Impact Assessment can be defined as a planning or decision-making tool that allows the various impacts of a proposed project and its alternatives to be assessed prior to a consent decision being taken (Ortolano & Shepherd, 1995). From the results of the assessment of the proposed projects and the alternatives, management measures to minimise negative and optimise positive impacts are developed. The overall aim is to prevent substantial detrimental effects to the environment (Aucamp, 2009).

The decision to do an EIA is often based on lists that describe the activities that need an EIA and the level needed. Sensitive environment where an EIA must always be done for every new project are often listed for example in the regulations for the proper administration of special nature reserves, natural parks and world heritage sites published by the South African Government National Environmental Management Act, Act No. 107 of 1998, (Aucamp, 2009).

Environmental Impact Assessment

In South Africa, EIA practice became mandatory in 1997 with the promulgation of the EIA regulations under the Environment Conservation Act 73 of 1989 (RSA 1989; RSA 1997). Worldwide the concept of EIA has been around for decades, but its use only really burgeoned after the United States made EIAs mandatory for federal agency projects in terms of their seminal National Environmental Policy Act of 1969 (Ortolano & Shepherd, 1995).

Since then, EIA has become increasingly used by many countries to promote good environmental decision making and to encourage sustainable environment, Sadler, (1996).

Increasingly, non-governmental organizations such as development banks and aid agencies are also requiring that EIAs be undertaken for projects that they fund. This has had the result that even in countries where EIA is not a legislative requirement; it is often carried out to satisfy the requirements of funding agencies (Ortolano & Shepherd, 1995). The use of the EIA process as sustainability tool has also been emphasized by inclusion of EIA processes in many principles of the World Summit on Sustainable Development in Rio de Janeiro in 1992 and Johannesburg in 2002 (Fuller, 2005).

In South Africa the absence of a general environmental policy, poor public interaction and a lack of responsibility by competent authorities contributed to non-compliance to the development and implementation of environmental evaluation procedures (Sowman, *et al.* 1995; Duthie, 2001).

The United Nations Environment Programme (“UNEP”) has described the EIA as an examination, analysis, and assessment of planned activities with a view to ensuring environmentally sound and sustainable development. The Canadian Environmental Research Council offers insight into how EIA is carried out professionally. It defines EIA as a process that attempts to identify and predict the impacts of human activities on the biophysical environment and on human health and well-being. Furthermore, it also interprets and communicates information about those impacts, and investigates and proposes means for their management (Ross & Thompson, 2002).

EIA follow-up has been identified as an important principle of best practice in EIA (IAIA & IEA, 1999). EIA follow-up is generally regarded as consisting of the activities of monitoring, evaluation, management and communication (Arts *et al.* 2001). This is clearly due to the fact that while EIA provides decision-makers with information on the potential environmental consequences of the proposed projects; follow-up provides feedback on the actual impacts of projects (Marshall *et al.* 2005).

Projects are not usually implemented as planned and unexpected impacts may occur during implementation. Non-compliance with the consent conditions or failure to apply the recommended mitigation measures may also indicate non-compliance. EIA follow-up offers the opportunity to assess these issues and to implement corrective measures where necessary (United States Environmental Protection Agency (US EPA), 1992; Arts & Nooteboom, 1999). EIA follow-up also offers an ideal opportunity to learn from experience and to apply the lessons learned to future EIAs and EIA related decisions (Dipper *et al.* 1998; Arts *et al.* 2001).

UNEP, (2002) pointed out that without this feedback from follow-up, EIA can remain essentially an exercise in prediction and faces the danger of becoming little more than an administrative process (Marshall *et al.* 2005). One of the cornerstones of sustainable development is sound environmental management. However, balancing the needs of current generations without compromising the environment for future generations is far from simple (UNEP, 2002). A number of environmental decision-making instruments have been developed in an attempt to ensure that development is sustainable.

Weaver *et al.* (2008) stated that “sustainability or sustainable development is a notoriously ‘fuzzy’ concept that arguably has different meanings at different levels of application and in different context”. Addressing this, in 1987 the Brundtland Commission provided definition for sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development (WCED), 1987)).

Very little work has been done on compliance in South Africa despite recommendations to do so (Weaver, 2003). The efficacy of the EIA process can only be assessed through the follow-up of projects subjected to an EIA (Ortolano & Shepherd, 1995). Unfortunately, the EIA process however often only ends at the consent decision stage and seldom proceeds through to the project implementation and operation stages (Tomlinson & Atkinson, 1987a; Sadler, 1988, Culhane, 1993; Petts & Eduljee, 1994; Glasson, 1999; Arts *et al.* 2001; Hullet & Diab, 2002; Morrison-Saunders & Arts, 2004).

EIA is essentially a predictive process that attempts to identify and assess the potential environmental impacts of a proposed development before a consent decision is made (UNEP, 2002).

Additionally, the lack of EIA follow-up means that the opportunity to monitor and control a project during its implementation is lost (US EPA, 1992; Arts & Nooteboom, 1999; Dasgupta *et al.* 2000). Most environmental impacts arising from a project occur during the implementation and operational stages and follow-up is essential in ensuring that these impacts are kept within acceptable limits.

Impacts that were not anticipated by the environmental impact assessment studies may also occur and follow-up offers the chance to identify and manage these unexpected impacts (Morrison-Saunders, 1996; Arts & Nooteboom, 1999).

As a result of on-going evaluation of the EIA process by the relevant national and provincial government departments, the government initiated a programme to review and modify the EIA regulations in terms of the National Environmental Management Act (NEMA): Second Amendment Act of August 2003 (Sandham & Pretorius, 2008). In the amendment of section 24, this Act makes particular reference to a number of issues (including provision for independent review of Environmental Impact Reports (EIRs), and these changes were duly incorporated into the new regulations implemented on 3 July 2006 Government Notice Number R. 385 of 2006; Sandham & Pretorius, (2008)].

South African IEM guidelines identify compliance monitoring, environmental monitoring, and environmental auditing as vital components of the EIA implementation stage (Heydenrych & Laassen, 1998); Rossouw & Wiseman (2004). According to Hill (2000), the lack of regulations on EIA follow-up constitutes a retrograde step for environmental management in South Africa. Similar scenarios have been reported in Asian EIA practice where lack of attention and commitment to follow-up as a serious shortcoming (Lohani *et al.* (1997); Shah *et al.*, (2010)).

In the field of mitigation and monitoring, Cubitt & Diab (2001) pointed out that often EIA places greatest emphasis on the stages leading up to the Record of Decision, with little concern for the monitoring and auditing of impacts. Record of Decision

refers to the written decision made by the regulatory environmental authorities in terms of Section 22 of the Environment Conservation Act (RSA 1989) allowing a project to proceed. Katzchner (2001) concurs with this opinion as follows: “Much focus to date, in response to legislation, has been on the project specific EIA and focus thus has been up to and no further than the decision on a project”. In the opinion of Barker & Hill (2000), “in South Africa, EMPs are not always properly implemented during construction phase of the projects”.

Very few EIA processes continue past the consent decision stage (Culhane, 1993; Petts & Eduljee, 1994; Glasson, 1999; Arts *et al*, 2001; Morrison-Saunders & Arts, 2004) and South Africa has been no exception (Wood 1999; Duthie 2001; Hulett & Diab 2002; Weaver 2003; Sandham *et al.*, (2013)). Lack of resources especially personnel and budget is the reasons for lack of follow-up in South Africa. The South African EIA legislation does not provide guidance as to what should happen post-decision, while pre-decision guidance is available.

The South African authorities usually attend only to queries during construction and post-decision (W Rikhotso, personal communication, January 7, 2015). This means that negative impacts can continue to occur if the public does not report to the competent authorities and other relevant stakeholders.

1.1.1. Statement of the research problem

The absence or lack of EIA follow-up seems to be a worldwide problem (Wood, 1994; Arts, 1998; Glasson *et al.*, 1999 and Baker & Dobos, 2001). Current thinking on EIA follow-up has been well documented by a number of authors, for example

Arts (1998), Arts *et al.* (2000), Baker & Dobos (2001) & Morrison-Saunders *et al.* (2001). Morris & Therivel (2001), mentioned lack of monitoring is a serious deficiency in the current practice.

If there is no follow-up to the pre-decision EIA phase, then there is no means of telling if the environmental consequences of a project are as anticipated or even within acceptable limits (Marshall *et al.* 2005). In effect there is no learning from experience and the chance to advance the knowledge base for future EIAs is lost (McCallum, 1987; Bisset & Tomlinson, 1988; Duinker, 1989; Dipper *et al.* 1998; Arts *et al.* 2001).

Hence, debate on EIA follow-up is viewed not as an isolated event but as part of an on-going process of IEM, with the overarching goal of achieving sustainable development (Arts, 1998; Wood & Coppel, 1999; Bhekhechi & Mercier, 2002).

At present, EIA follow-up is not a mandatory step in most EIA procedures, although environmental legislation has been passed in Netherlands, New Zealand, Hong Kong, Canada and parts of Australia and the United States (Arts, 1998; Wood & Coppel, 1999; Bhekhechi & Mercier, 2002). EIA in South Africa is required by law and is a mandatory requirement by developers (NEMA, 107 of 1998).

An investigation into the status of EIA follow-up in South Africa revealed that whilst all environmental practitioners were aware of the importance of follow-up, their understanding of what it entailed differed from the widely accepted international practices (Hullet & Diab, 2002). For example, few recognised the need to engage interested and affected parties (I&APs) and most believed follow-up to be the

implementation of an Environmental Management Programme (EMPr) during the construction phase (Hullet & Diab, 2002). Barriers to effective EIA follow-up were mentioned such as lack of enforcement (Hullet & Diab, 2002).

As far as implementation is concerned, De Wit (2001) argues that “South Africa, despite a well-developed environmental legislative context, does not have the capacity or the institutions to implement EIA regulations”. De Wit (2001) further argues that “trade-off models do not receive the explicit attention they deserve in environmental assessments in South Africa”. Economic trade-offs is an important part of conservation and management planning. Decisions as to which areas to conserve involve trading off biodiversity values against the opportunity costs of conservation. These opportunity costs are the benefits of the best alternative use of the land or water required for conservation (Fuggle & Rabie, 2009). The generation of energy from solar is perceived to have little impacts on the natural environment (Fluri, 2009).

The overall rationale for undertaking this study was that EIA follow-up and compliance is an essential, but ignored as part of the EIA process. In other words, lack of EIA follow-up means that there opens up a gap to see whether a project during its implementation has been controlled effectively. Most environmental impacts arising from a project occur during the implementation and operational stages and therefore, follow-up is essential in ensuring that these impacts are kept within acceptable limits.

Impacts that were not anticipated by the environmental impact assessment studies may also occur and follow-up offers the chance to identify and manage these unexpected impacts (Morrison-Saunders, 1996; Arts & Nooteboom, 1999). This study attempted to address this lack of follow-up in South Africa.

1.1.2. The need for the research

In the EIA field, much attention is paid to the process leading up to the granting of environmental authorisation (EA). However, after the competent authorities have granted the decision, whether the mitigation measures prescribed in the EIA reports were properly implemented at the field or not are not known. This study therefore seeks to contribute to the following:

- Monitoring and Auditing of the environmental impacts post decision;
- The implementation of EMPs in practice;
- Knowledge that will assist the developers to minimise the negative environmental impacts that occur during construction;
- Generation of knowledge of the public in terms of non-compliance by the developers;
- Improvement in decision making skills by communities in order to address the social issues associated with the selected projects;
- Competence in future environmental management and the knowledge that would help developers to understand when it is best to apply the stipulated mitigation measures;
- Knowledge will be used by the developers and competent authorities to best attempt to implement the EA conditions; and

- Capacity for other future developers to understand the implementation of the conditions correctly during the pre-construction, construction and operational phase of any project and to best apply good mitigation measures stipulated in EMPs.

1.2. Research Questions

Three critical research questions to be addressed in this study are:

- (i) What are the levels of understanding of the developers with regard to complying with the EA conditions?
- (ii) What is the effectiveness of mitigation measures as prescribed in the EA, EIA reports and EMPs?
- (iii) What improvement options can be explored to the present EIA compliance for it to be sustainable?

1.3. Aims and objectives

1.3.1. Major objectives

To assess whether the developers comply with the EIA, and analyse impacts of non-compliance.

1.3.2. Specific objectives

- To determine whether the developers comply with the conditions through auditing the EIA reports;
- To assess the effectiveness of mitigation measures as prescribed in the EA, EIA reports and EMPs; and

- To identify and analyse constraints experienced by developers in achieving environmental compliance in the field.

1.4. Thesis outline

The thesis is divided into five chapters. Chapter one deals with the introduction and background of the study. Chapter two covers literature review on the EIA compliance. Chapter three describes the study area and the methodology of the study. Chapter four discusses the data and the results of the study. Chapter five presents the conclusion and recommendations of the study in order to deal with the associated impacts appropriately.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Stopping the EIA process after the EIA consent decision has been issued can be regarded as incomplete process. A follow-up process is not considered as part of EIA process (Sadler, 1996; Dipper *et al.* 1998; George, 2000). The subject of this study is therefore to do a pilot follow-up process to assess and hopefully address the lack of follow-up process in South Africa.

It is widely acknowledged that EIA plays an important role in the assessment of possible environmental impacts of proposed developments, as well as in the consideration and evaluation of alternatives and the identification of mitigatory measures. However, there is often no monitoring or post-auditing to ensure that the mitigation measures or the conditions and recommendations of the EIA are put into practice (Hullet & Diab, 2002). George (2000) recommended that an environmental management system, for example International Standards Organisation (ISO) 14001, be instigated to avoid negative impacts during the operation of projects. He further highlighted that such a structured approach could place clear responsibilities on the stakeholders involved. However, the costs involved in implementing monitoring practices can be high, and although development assistance can initially provide funding, national governments will ultimately need to become more actively involved. He also stated that in situations where inadequate funds are available for a comprehensive monitoring programme, resources should be targeted towards those impacts identified as being most significant.

In South Africa, the IEM guidelines identify compliance monitoring, environmental monitoring and environmental auditing as vital components of the EIA implementation stage (Heydenrych & Claassen, 1998).

Du Preez *et al.* (1997) observed that there was limited reference and guidance to steps for mitigation of impacts during the post-decision stage of a project. In his evaluation of the strengths and weaknesses of the South African EIA system, Woods (1999) identified a principal weakness with regard to impact monitoring and EIA system monitoring. Furthermore, Shippey (1997); Lu & Yuan (2010) commented that the majority of environmental protection measures for projects in South Africa lack legal enforceability.

The waste management sector has adopted an approach to follow-up which is in keeping with the accepted understanding of EIA follow-up according to the views of Arts (1998) & Arts *et al.* (2000).

Benefits of introducing an Environmental Management System (“EMS”) include potential financial savings due to reduced operational costs and avoidance of remedial costs, and improved relationships with the local community (Marshall *et al.* 2001).

Marshall *et al.* (2001), in an account of the attempt by the Scottish energy industry to integrate the EIA process into an EMS structure, argued strongly that the EIA process requires a management structure within which to implement recommendations and that an EMS can easily be adapted to incorporate EIA

recommendations. In principle, both EMS and EIA are aimed at minimising environmental impacts and are therefore compatible.

The challenge according to Marshall *et al.* (2001) is to integrate individual project requirements into a broader management framework without losing the flexibility required in the EIA process. An EMP is suggested as a suitable interface between the EIA and EMS.

A number of mechanisms have been formulated in this sector to enforce environmental compliance (Barker & Hill, 2000). These are the bonus-penalty system or the “carrot and stick” method, which consists of different bonuses and penalties awarded to the developer in order to encourage environmental compliance.

According to Goldblatt (1978); Linder (2003), South Africa is unequivocally classified as a bio-diverse country. The country is ranked as the third most biologically diverse in the world, containing between 250 000 and 1000 000 of both fauna and flora species, many of which occur nowhere else in the world. For plants alone, some 18 000 vascular plant species occur in the country, of which 80% are endemic.

Brownlie & Wynberg (2001) pointed out that animal life is equally varied, both in terms of numbers and species. South Africa hosts an estimated 5.8% of the world's total of mammal species; 8% of bird species; 4.6% of the world's described insect species (World Conservation Monitoring Centre, 1992). In terms of the number of endemic mammal, bird, reptile and amphibian species, South Africa is the 24th richest country in the world, and the 5th richest in Africa (World Conservation Monitoring Centre, 1992).

EIA is being used globally, either as a planning or management tool in order to minimise the harmful consequences of development. Its emphasis is on prevention and it is hence an example of the precautionary principle (Glasson, 1995); Kolhoff *et al.*, (2012). Ensuring environmental protection and management is the primary goal of EIA (Bailey, 1997; Morrison-Saunders & Bailey, 1999); Morrison-Saunders & Bailey (2003). The role and scope of EIA are expanding continuously, although its application, practice and procedures vary from country to country (Glasson *et al.* 1994); Simpson (2001).

Saddler (1998); Sullivan-Sealey & Cushion (2009) identified areas for the overall evaluation of the effectiveness of EIA and these include: defect monitoring and impact auditing.

The importance and benefits of monitoring and auditing in the EIA process has been repeatedly highlighted in a wide range of literature (Arts, 1998; Arts & Nooteboom, 1999; Arts *et al.* 2001; Bisset and Tomlinson, 1988; Canter, 1993; Glasson, 1995; Glasson *et al.* 1999). In 1986, a special committee of the National Research Council of the USA identified monitoring as the single action that could most improve impact assessment (Fairweather, 1989).

According to McCallum (1987), EIA cannot be expected to endure in society without the introduction of impact monitoring. Although monitoring and auditing are two important components of the EIA process, their implementation in the EIA process is being neglected globally.

However, Carpenter (1997) noted that the issue of monitoring and auditing in EIA is becoming more prominent. The annual conference of the International Association for Impact Assessment (IAIA'00) held in Hong Kong in 2000 specifically focused on various issues of monitoring and auditing in EIA and suggested future directions for good practice. EIA is reported to be mostly concerned with the prediction and identification of impacts at a pre-decision level focusing only on the steps before and up to the planning decision but ignoring post development follow-up activities, such as monitoring and auditing (Arts *et al.* 2001; Glasson, 1995; Petts & Eduljee, 1993). As a result, EIA is failing to maximize its potential for continuous improvement (Wood, 1999).

Moreover, it would seem that the procedural emphasis of EIA upon the pre-decision analysis keeps it distant from its goal, i.e., environmental protection. In a major study on international EIA effectiveness by Sadler (1996); Vanderhaegen & Muro (2005), it was found that there was a lack or poor performance of follow-up activities in EIA. This is considered to be a major weakness of EIA globally (Arts *et al.* 2001; Bisset & Tomlinson, 1988; Buckley, 1989a; Dipper *et al.*, 1998; Glasson *et al.* 1999; Ortolano & Shepherd, 1995; Sadler, 1996; Wood, 2003).

In Australia, the Intergovernmental Agreement on the Environment (IGAE, 1992) set out a schedule for EIA, recognizing and acknowledging the need for national participation in all facets of EIA and accepting the role of EIA in post-development environmental monitoring and management. This agreement forms a basis for EIA to become one of the most important and useful tools for environmental management in Australia.

However, in the Australian EIA system, monitoring and auditing remain the weakest areas, requiring the attention of policy makers and EIA practitioners. As noted by Harvey (1998); Harvey & Clarke (2012) in most of the EIA jurisdictions in Australia, EIA is being used as a planning tool rather than an environmental management tool.

Therefore, monitoring and auditing programmes are not strictly considered within most of the EIA processes in Australia; alternatively, they tend to be requirements of the planning approval of the project. Although Australia is one of the major EIA jurisdictions of the world, very little research has so far been conducted on EIA follow-up in Australia (Ahammed & Nixon, 2006). Similarly South Africa is also noted to lack research initiatives to address this issue.

Environmental Impact Assessment in South Australia was formally introduced under the provisions of the Planning Act 1982 which was repealed and replaced by the Development Act 1993. Many of the development proposals approved under the SA Planning Act 1982 have subsequently been built, and sufficient time has lapsed for monitoring regimes to potentially be established.

Therefore, there was a need to investigate the role of monitoring and auditing in the South Australian EIA process under this Act. No such study has yet been conducted. Ahammed & Nixon, (2006) attempted to look at how the environmental impact monitoring process was incorporated within South Australian development projects that required an EIA under the Planning Act 1982, and established the need for further research under the new legislative provisions at both federal and state levels. Thus contribution to increased understanding of the Australian situation would be significant for much wider application including South Africa.

2.2. Origin of EIA in South Africa

2.2.1. The EIA process as implemented in South Africa

Environmental Impact Assessment (EIA) in South Africa became mandatory in 1997 with the promulgation of the EIA regulations under the Environment Conservation Act 73 of 1989. Prior to this, some voluntary EIAs were conducted under the IEM framework (Weaver 2003). The IEM procedure never became mandatory, but its principles of holism, consultation and integration remain important concepts for environmental policy in South Africa (Hamann *et al.* 2000).

In particular, there was a requirement for comprehensive scoping and emphasis on extensive public participation. Some notable differences in the early years of South African EIA from international best practice were the virtual absence of time-frames and the lack of follow-up after authorisation (Sandham *et al.* 2013).

Due to the requirement for all projects to undergo such comprehensive scoping and extensive public participation, the usual result was a drawn-out and expensive administrative procedure. In these cases the content of the scoping report was extended to include more information than usually envisaged for a scoping report, but less than that for a formal full environmental impact report as required by the EIA regulations (Sandham *et al.* 2013).

The EIA process in South Africa as set out in the 1997 EIA regulations conformed fairly well to the generic EIA process as shown in Figure 1(a) and 1(b)). There was however a few unique adaptations and these are highlighted in figure 1 (a) and 1(b).

BASIC ASSESSMENT

LN 1 & 3

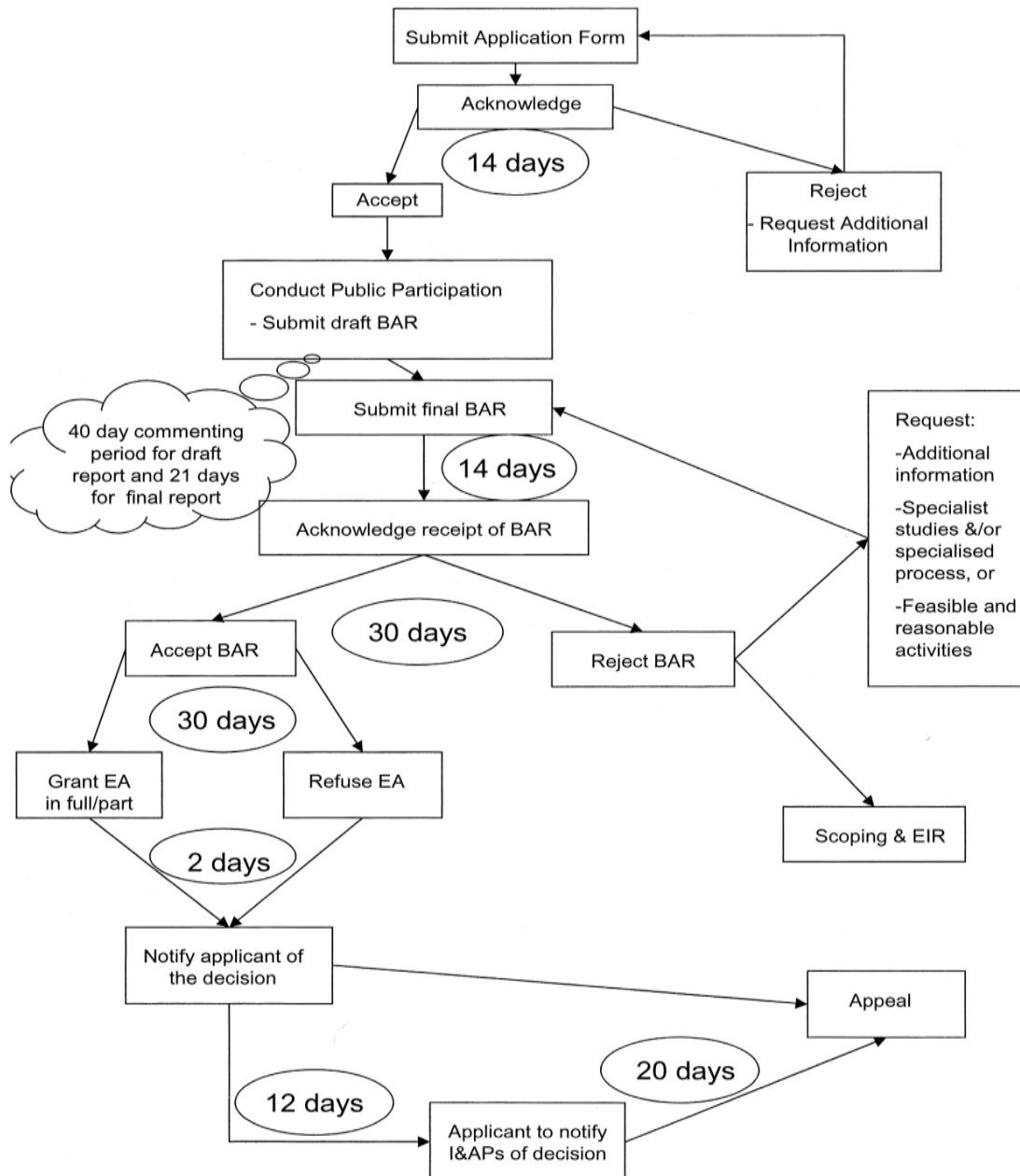


Figure 1(a) The 2010 EIA flow of process in South Africa (adapted from DEA 2010)

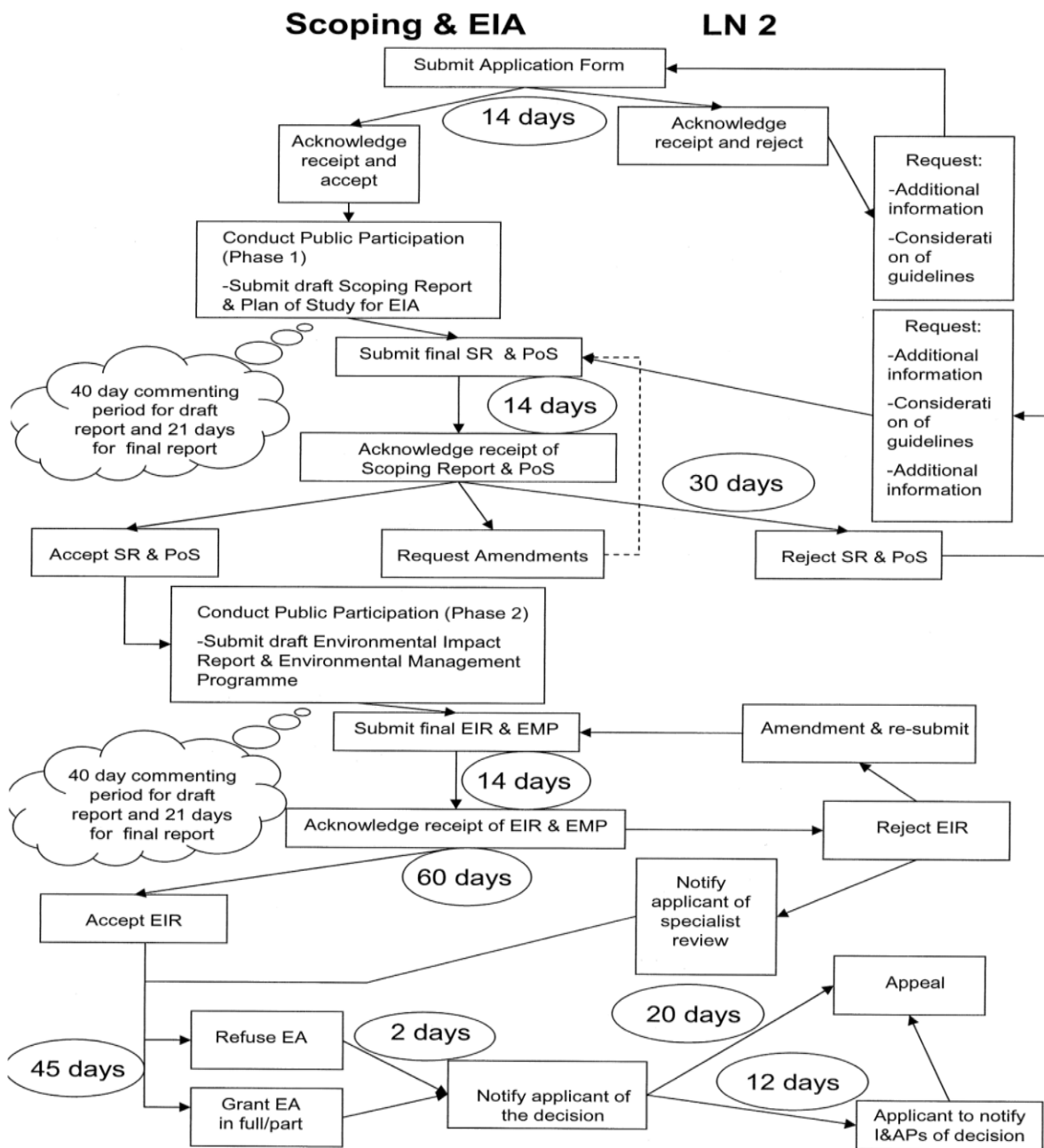


Figure 1(b). The 2010 EIA flow of process in South Africa (adapted from DEA 2010)

2.2.1.1. Basic Assessment process

In terms of Basic Assessment process, the applicant must submit an application form to the competent authority and the competent authority must within fourteen (14) days acknowledge receipt of the application form. As part of the Basic Assessment process public participation must also be undertaken with the potential interested and affected parties. A forty (40) days commenting period must be allowed on draft Basic Assessment report and twenty one (21) days on final Basic Assessment report.

Once the applicant submitted final Basic Assessment report, the competent authority must within fourteen (14) days acknowledge receipt of the final Basic Assessment report. In addition, the competent authority must within thirty (30) days accept the final Basic Assessment report. Thereafter, the competent authority must within thirty (30) days to finalise the project and two (2) days to issue the decision to the applicant.

The applicant has twelve (12) days to notify potential interested and affected parties of the decision. Ultimately, the regulation caters twenty (20) days for appeal to be lodged.

2.2.1.2. Scoping EIA process

In terms of Scoping EIA process, the applicant must submit an application form to the competent authority and the competent authority must within fourteen (14) days acknowledge receipt of the application form. As part of the Scoping process public

participation must also be undertaken with the potential interested and affected parties. A forty (40) days commenting period must be allowed on draft Scoping report.

Once the applicant submitted final Scoping report, the competent authority must within fourteen (14) days acknowledge receipt of the final Scoping report. In addition, the competent authority must within thirty (30) days accept the final Scoping report so that the applicant can move the next EIA phase. In terms of this process second round of Public Participation must also be undertaken with the potential interested and affected parties. A forty (40) days commenting period must be allowed on draft EIA report.

Once the applicant submitted final EIA report, the competent authority must within sixty (60) days to accept the EIA report and forty five (45) days to draft the decision. Thereafter, the competent authority has two (2) days to issue the decision to the applicant.

The applicant has twelve (12) days to notify potential interested and affected parties of the decision. Ultimately, the regulation caters Twenty (20) days for appeal to be lodged.

2.2.2. Screening

Screening is usually intended to act as a preliminary decision-making process. When applied in terms of the EIA procedure, screening is used to determine whether assessment is necessary and if so, at what level (DEAT 2002). Screening in South

Africa is guided both by legislation and by the discretion of the regulatory authorities. A list of activities that require environmental assessment has been published as part of the EIA regulations which act as a primary screening process. Pre-application meetings between the regulatory authorities, the project proponents and/or their environmental consultants to discuss issues also sometimes takes place and can act as screening sessions (Wood 1999).

2.2.3. Scoping

The South African EIA guidelines define scoping as “the process of identifying the significant issues, alternatives and decision points which should be addressed by a particular EIR, and may include a preliminary assessment of potential impacts” (DEAT, 1998). As with the generic EIA process, public participation forms an important part of the scoping process (DEAT 2002). Although this conception of scoping is in line with the generic EIA process, it is at this step of the South African EIA process that a key difference from the generic process is evident in practice.

For the 1997 EIA regulations allowed for a project to be approved, turned down or subjected to further studies (EIA proper) at the scoping stage. This provision for a consent decision to be taken at the scoping stage is an unusual practice and had the result that most applications stopped after scoping and were never subjected to a full EIA (Duthie 2001; Weaver 2003). The scoping process instead functioned as a “mini-EIA”, with proponents and consultants combining the steps of scoping and impact assessment in the hopes of obtaining a consent decision as quickly as possible.

2.2.4. Impact assessment and mitigation

As explained above, impact assessment and mitigation in the South African EIA process is often combined with that of scoping. However, in the case where applications were subjected to the traditional route of scoping and then EIA, then impact assessment and mitigation involves an assessment of the issues identified during the scoping stage (ECA 1997; UNEP 2002). This assessment includes consideration of impact avoidance, minimization and mitigation measures.

2.2.5. Reporting

During this stage the results of the scoping and/or EIA are recorded, along with any public comments. Although contents that are required in the various reports are outlined in the 1997 EIA regulations and the subsequent guideline document (DEAT, 1998), the quality of reporting is still often poor (Wood C 1999; DEAT 2004c; Kruger & Chapman 2005).

2.2.6. Review

During the review process, the relevant authority determines, *inter alia*, whether there is sufficient information on which to base a sound decision (Fuggle & Rabie, 1999) and whether the necessary legal and procedural requirements have been met (DEAT, 1998). Review may also include specialist and public review of the environmental reports (DEAT, 1998).

2.2.7. Decision

After review, and provided that further information is not required, the relevant authority may make one of two decisions, namely to authorize the project (with or without conditions) or to deny authorization section 9(1) of ECA. A Record of Decision is then issued stating the nature and location of the activity, contact details of the applicant and environmental consultant, validity period of the authorization, conditions of authorization (if applicable), key factors for the decision and means of appeal (DEAT, 1998).

2.2.8. Implementation

This stage involves the implementation and management of the project and is one of the most neglected steps in the EIA process in South Africa (Wood C, 1999; Weaver, 2003). Neither the 1997 EIA regulations in terms of ECA nor the related guidelines (DEAT, 1998) make any mention regarding the implementation of the approved project, so guidance is somewhat lacking. Authorities may attempt to guide implementation through means of the conditions of authorization and/or by requiring the proponent to submit an environmental management plan (EMPr). However, as little EIA follow-up appears to have been done, the effectiveness of these conditions of authorization and the EMPs is largely unknown. It is here that this study hopes to make a valuable contribution.

It is clear that the South African EIA process is in general agreement with the generic EIA framework, although it does have its own unique features. In particular the fact that a consent decision can be made at the scoping stage and the lack of a specified

follow-up process should be noted. Both of these issues have been addressed in the 2010 EIA regulations and their effectiveness must still be realized.

2.3. Environmental Legislation in South Africa

There are many Acts in South Africa that have some bearing on environmental management and only the ones that have direct relevance for the study are discussed.

2.3.1. The constitution of South Africa, Act 108 of 1996

The overarching piece of legislation that affects all others in South Africa is the Constitution of South Africa. Two issues are of prime relevance for environmental management in the Constitution and therefore for this study. The first of these is the enshrinement of the right of all persons to an environment that is not harmful to their health as a basic human right. Section 24 of the Constitution of South Africa reads:

“Everyone has the right –

to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.

In other words, all persons in South Africa are entitled to have the environment protected and managed in such a way that it does not impact detrimentally on their – or future generations’ – health and well-being. While this basic right may be more concerned with human well-being than actual environmental health, the two are related and this section places a duty on not only the Government of South Africa, but also on each and every person in South Africa, to manage the environment appropriately.

This section of the Constitution has also led to the enactment of several key pieces of environmental legislation such as the National Environmental Management Act 107 of 1998 (hereinafter referred to as NEMA) and its related Acts.

The second issue of importance relating to environmental management and the Constitution is the provision for the administration of environmental matters. Environmental management is a concurrent responsibility of provincial and national Government although local government is also expected to promote a safe and healthy environment within its financial and administrative capabilities. Co-operation between these three spheres of Government is therefore important and this co-operative governance has important implications with regards to enforcement of environmental violations in that the various spheres of government are strongly discouraged from taking each other to court (Hamann *et al*, 2000).

2.3.2. The Environment Conservation Act 73 of 1989 (ECA)

Despite much of ECA already having been repealed by Section 50 of NEMA, 1998, ECA remains important for the purpose, as it is the primary Act that guided the 1997 EIA process and it provides an essential background to the evolution of the EIA process in South Africa with regards to the new 2006 EIA regulations.

ECA essentially provided the legislative framework on which the South African EIA process could be based. This was accomplished by making provision for the identification of activities that could have significant detrimental effects on the environment in terms of Section 21 of ECA, 1989; requiring that such activities be assessed for their environmental impact and authorized before they could commence in terms of Section 22 of ECA, 1989 and by allowing the promulgation of regulations regarding environmental impact reports in terms of Section 26 of ECA, 1989. Although ECA provided for an EIA process; it was not until 1997 – with the gazetting of the EIA regulations– that effect was given to this provision.

2.3.3. EIA regulations published in terms of the ECA of 1989

On the 5th of November 1997, listed activities i.e. those that were deemed to have potentially significant detrimental impacts on the environment as well as the regulations governing the preparation, submission and assessment of the environmental impact assessments were published in Government Gazette No.18261, Notices R.1182 and No. R. 1183. Fairly minor amendments to these regulations were published on 17 October 1997 (GN R.1355); 27 March 1998 (GN R.448) and 10 May 2002 (GN R. 670 and No. R. 672).

2.3.4. National Environmental Management Act 107 of 1998

The National Environmental Management Act (NEMA) gives effect to the constitutional right of the citizens of South Africa to have the environment protected and also provides for co-operative governance and the control of activities that may have a detrimental impact on the environment (Constitution of South Africa, section 24, 1998). It is the intention of NEMA and its similar environmental management Acts to provide an overarching framework for sustainable environmental management within South Africa. NEMA has a strong focus on sustainable development and sets out a number of principles that all organs of state undertaking activities that might significantly affect the environment must adhere to Section 2 of NEMA, 1998. These include placing people and their needs at the forefront of environmental management; ensuring that development is economically, socially and environmentally sustainable and ensuring that sustainable development considers all relevant factors.

2.3.5. EIA regulations published in terms of the NEMA of 1998

On 21 April 2006 EIA Regulations was promulgated in terms of chapter of 5 of NEMA (GN. No. R. 385, R. 386 and R. 387 in Government Gazette No. 28753 of 21 April 2006 refer), replacing the regulations promulgated in terms of ECA and introduces the new provisions regarding EIAs. The NEMA Regulations came into effect on 03 July 2006 (GN. R. 612, R. 613, R. 614, R. 615 and R. 616 in Government Gazette No. 28938 of 23 June 2006 refer). These regulations are based largely on the previous ones, with key changes being as follows:

- Applications follow either a basic assessment route (for smaller projects) or a

traditional scoping-EIA route (for more complex projects).

- The roles and responsibilities for the various role-players have been refined. For example time-frames for processing applications have been introduced and the concept of independence regarding environmental consultants has been clarified.
- A threshold approach has been taken in respect of some of the listed activities.
- Provision has been made for enforcement and more post-authorization management mechanisms such as transfers and withdrawals of authorizations.

On 18 June 2010 EIA Regulations were promulgated in terms of chapter of 5 of NEMA (GN. No. R. 543, R. 544, R. 545 and R. 546 in Government Gazette No. 33306 of 18 June 2010 refer), replacing the regulations promulgated in terms of NEMA of 1998 (i.e. 2006 regulations) and introduces the new provisions regarding EIAs in terms of NEMA (2010 Regulations). The NEMA 2010 Regulations came into effect on 02 August 2010.

These regulations are based largely on the previous ones, with key changes being as follows:

- Applications follow either a basic assessment route (for smaller projects) which involves both Government Notice. No. R. 544 and R. 546 (R. 546 refers to geographical areas) or a traditional scoping-EIA route (for more complex projects).

- The roles and responsibilities for the various role-players have been refined. For example time-frames for processing applications have been amended.
- A threshold approach has been amended in respect of some of the listed activities.

2.3.6. Implications of the change in EIA regulations for this study

The follow-up work undertaken for this study was carried out while both the 1997 and 2006 EIA regulations were not in effect and the study-did not focus on listed activities identified in terms of the 1997 and 2006 regulations. Therefore, this study focused on listed activities in terms of 2010 regulations.

The change in the regulations (from those under ECA 1997 and NEMA 2006 to those under NEMA 2010) has meant that some of the activities listed in terms of the old EIA regulations are no longer applicable and a number of new activities have been added under the new EIA regulations. The overall implication of this change in legislation for this study is not expected to be great and indeed there are some positive benefits, namely:

- The under-lying principles of follow-up remain the same for both the old and the new regulations as the basic intention of the EIA process has not changed. The principles of the follow-up process presented here are equally valid for both sets of regulations.
- Many of the previous listed activities have been included in the list of activities for the new regulations (ECA 1997 & NEMA 2006) and the information gathered during this study's follow-up exercise will still be valid for

these same listed activities. New activities can easily be included in the follow-up process by using the same methods as used for this study. The information gathered for this study is therefore still relevant for - and can be readily applied in terms of the new EIA regulations.

2.4. EIA Compliance

Section 2.2 provided an over view of the EIA processes, both in general and South Africa. This section focuses on what takes place after the EIA process has been finalised.

2.4.1. Defining EIA Compliance

Zaelke *et al.* (2005) described compliance as ‘an indivisible part of the rule of law’ and further stated that *“without the rule of law and compliance to promote social stability and legal certainty, firms are less willing to make the investments and to assume the risks that form the basis of market economy development. This lack of investment, in turn, can slow economic growth and deprive governments of resources needed to invest in education, social safety nets and sound environmental management, all of which are critical for sustainable development”*.

According to Kotze & Paterson (2009), if one considers compliance at domestic level, 20 percent of the regulated population will automatically comply with any regulation, 5 percent will attempt to evade it, and the remaining 75 percent will comply as long as they think that 5 percent will be caught and punished. In the simplest of terms, an effective environmental regime requires the government to provide incentives for those who want to comply and sanctions for those who do not.

2.5. EIA follow-up

According to Arts *et al.* (2001), EIA follow-up refers to the activities undertaken during the post-decision stages of the process to monitor, evaluate, manage and communicate the environmental outcomes that occur in order to provide for some follow-up to the environmental impact statement and these includes the following:

- “*ex post* evaluation” which has been used by Arts *et al.* (2001) to refer to evaluations that take place after a principal EIA consent decision; and also by Sadler (1996) & UNEP (2002) to refer to a policy level (as opposed to project level) evaluation of a system.
- “Auditing”, this is often used to refer to post EIA decision activities particularly those that provide an objective comparison of observations to pre-set standards (Arts & Nooteboom 1999; Sampson & Visser 2004). However, the term may also be used to refer to the review process of the EIR (Canter 1985; Tomlinson & Atkinson 1987a; Damall *et al.*, (2009)) and more commonly to the verification of predicted environmental impacts with actual ones (Bisset 1980; Bird & Therival, 1996; Wood, 1999; Hui, 2000).
- “Post auditing” (Culhane 1993; Dipper *et al.* 1998) or “post development auditing” (Wood G 1999) may also be used to refer to the verification of predicted environmental impacts with actual ones.

Arts & Nooteboom (1999) and Morrison-Saunders *et al.* (2003) pointed out that “EIA follow-up” as a concept in this regard seems to gain most attention and it is the most favourite concept for this research.

According to Arts *et al.* 2001 the term monitoring means acquiring and saving of environmental data continuously, for instance collection of data on the compliance status of a project which is already approved by the competent authority. Monitoring sometimes includes some form of evaluation of the collected information (Petts & Eduljee, 1994); Ross *et al.*, (2001); or evaluation may take place independently (Duinker, 1989). Making decision and improvising and implementing solutions to the various issues arising out of monitoring and evaluation activities can be termed management (Arts *et al.* 2001).

He further refers to communication as the process of exchanging of information gained from the EIA follow-up process to the interested and affected parties and the general public.

2.5.1. Types of follow-up

There are a number of types of follow-up that can take place. However, the most commonly identified type is compliance verification which is verifying if the strategy/project is performing as required and assessing its effects. Assessing effects means measuring the impact of a project on the environment. (Canter 1985; Tomlinson & Atkinson 1987; Sadler 1988, 1996; Arts & Nooteboom 1999; George 2000). These types of follow-ups are briefly defined below.

a) Environmental Auditing

The term “environmental auditing” is a convenient label generally used to describe a variety of activities. In the private sector it refers to an internal audit, for example, to assure corporate executives and investors that all relevant regulatory requirements are being satisfied (Quevedo, 1995); Moudon & Lee (2003).

According to Kesan (2000), self-auditing serves as a signal of sound and environmentally responsible internal management, collects favourable publicity, attracts corporate investors, reduces insurance premiums, and by enabling early detection of any problems it may allow firms to find less expensive solutions to fix them. Immunity laws prevent states from enacting penalties that are appropriate to the seriousness of the violation, as they are required to do under federal law (USEPA, 2000).

Evans *et al.* (2011), found that participation in ISO 14001, a voluntary certification program that sets standards for environmental management systems adopted by firms, improved compliance with Clean Air Act regulations in Mexico.

Environmental self-auditing has a positive effect on compliance. However, audit privilege laws reduce incentives for compliance while audit immunity laws are found to have no effect on compliance (McKay, 2003).

Stafford (2006), found experimental evidence that stated that with weaker commitment to environmental protection and/or limited institutional capacity to implement stringent environmental regulations was more likely to adopt audit privilege laws.

It is noted that the environmental conditions stipulated by the competent authority are not adhered to in most cases, therefore the developers turned to ignore the environmental conditions during life cycle of the project (McKay *et al.* 2003).

b) Compliance monitoring

Compliance monitoring has been termed a regulatory cycle, which is undertaken in order to assess compliance with the prescribed legal requirements and permitting conditions (Kotze & Paterson, 2009). According to Kotze & Paterson (2009) monitoring can occur on-site and can also take place off-site in the form of compliance reports and audit reports.

CHAPTER THREE: METHODOLOGY OF THE STUDY

3.1. Study Area

The data was collected on two sites that is Project **A** and Project **B** in the Northern Cape Province, South Africa. The first study area Project **A** is situated within Frances Baard District Municipality and the second study area, Project **B** is situated within ZF Mgcawu District Municipality formerly known as Siyanda. Both projects are for the construction of Photovoltaic facilities. PV cells converted solar radiation directly into electricity. When photons of sunlight strike the cell, electrons are knocked free from silicon atoms and are drawn off by a grid of metal conductors, yielding a flow of direct current (Bouamane & Jones, 2012).

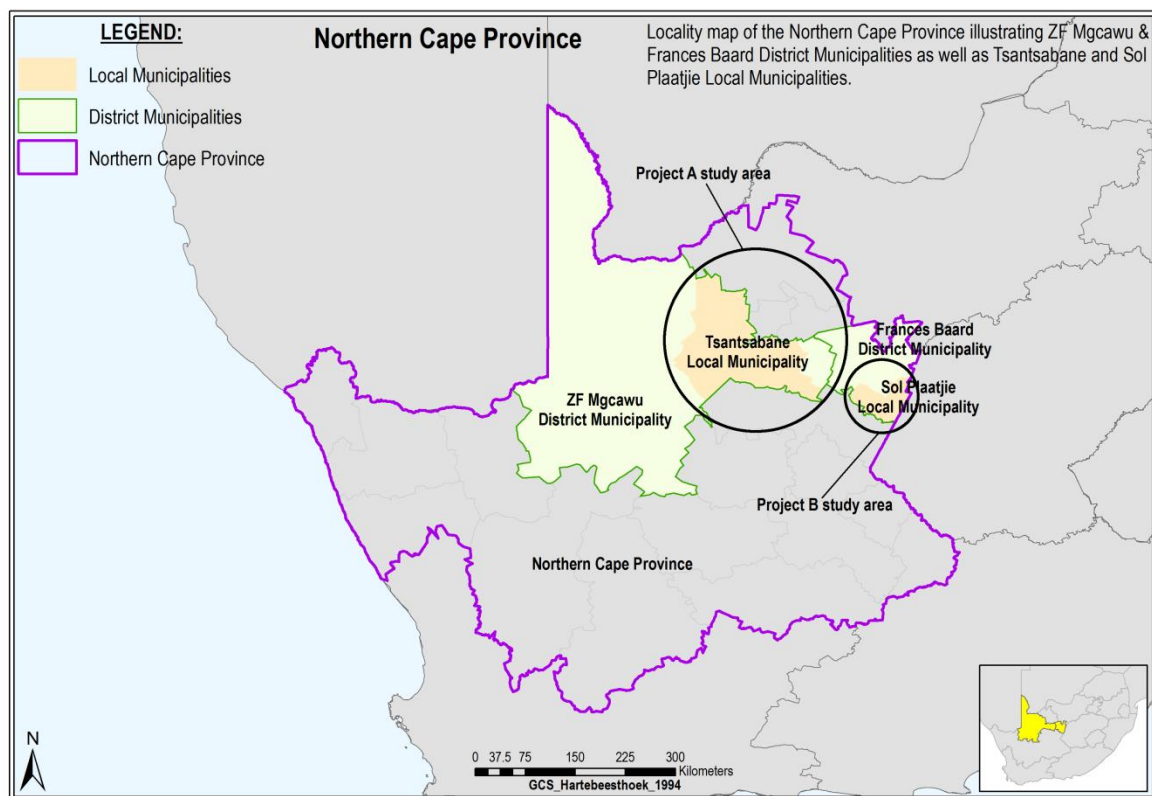


Figure 2: Map of South Africa indicating the District and Local Municipalities of the study areas in the Northern Cape Province

Source: Department of Environmental Affairs (DEA), 2014.

3.1.1. Climate and rainfall

The average summer midday temperature in the study area is 32 °C in January and 17°C in June. The region experiences its coldest temperatures during July when average evening temperature is 0°C. The study area receives its rainfall predominantly during summer months and receives approximately 241mm of rain per year. March is the month in which the highest rainfall is received, 57mm, whilst on average in July no rainfall is received (SA Explorer 2012).

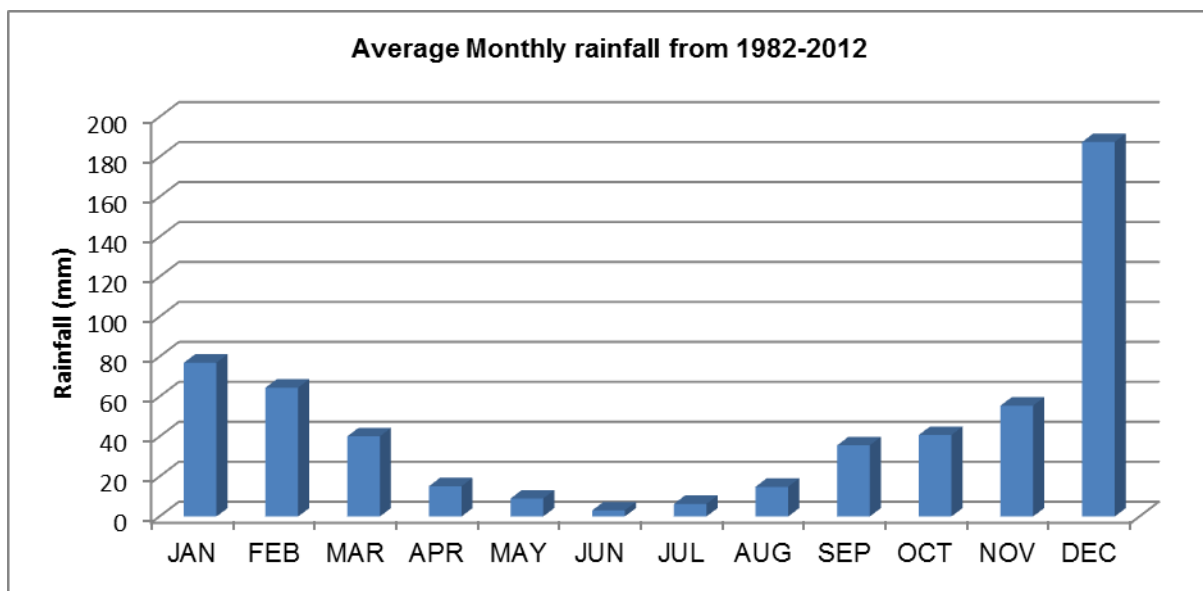


Figure 3: Average monthly rainfall from 1982-2012 (Sourced from SAWS, 2014)

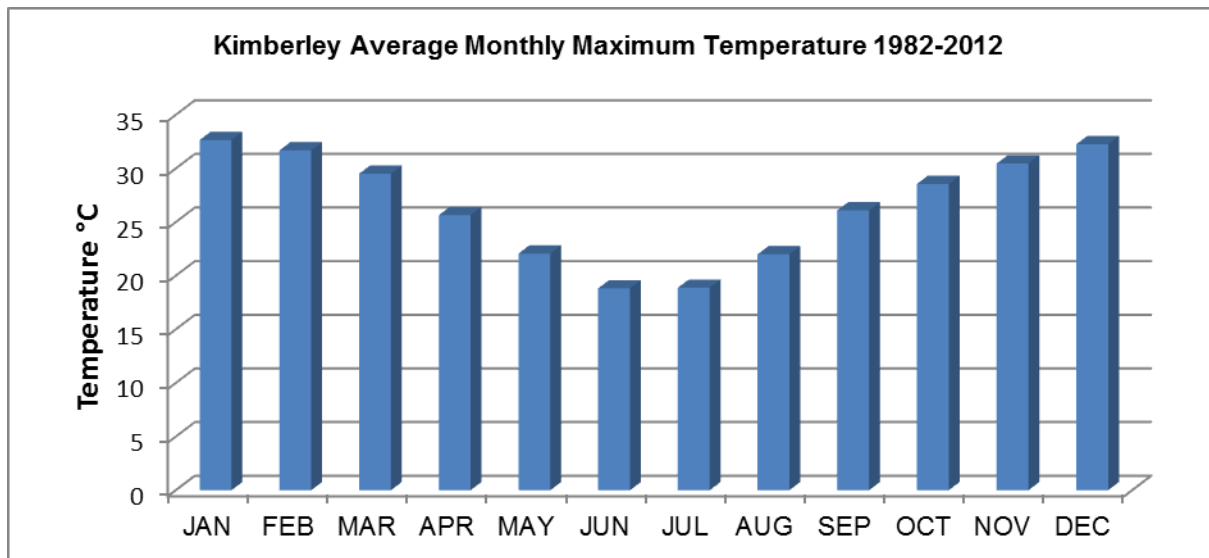


Figure 4: Northern Cape Province maximum average temperature (Sourced from SAWS, 2014)

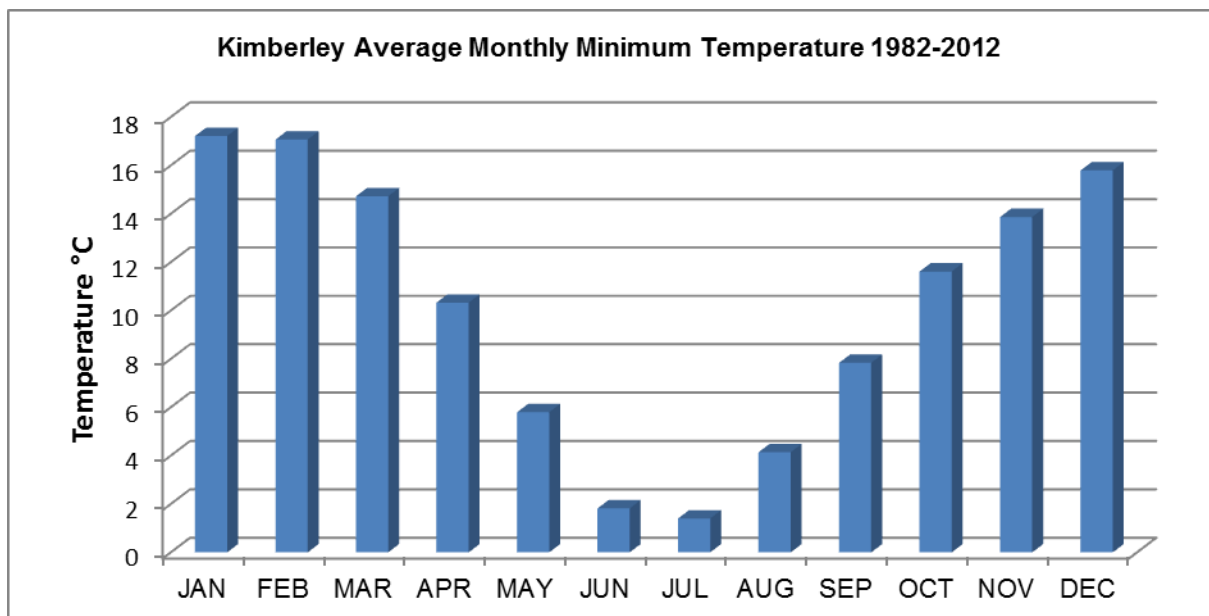


Figure 5: Northern Cape Province minimum average monthly temperature (Sourced from SAWS, 2014)

3.1.2. Vegetation

The study area falls within the Savanna biome of South Africa. Within this biome the study area falls within the following vegetation types; Kuruman Mountain Bushveld; Olifantshoek Plains Thornveld; and Postmansburg Thornveld. The study area also contains one azonal vegetation type namely the Southern Kalahari Salt Pans (Figure 4).

The topography of the Kuruman Mountain Bushveld) can best be described as: “Rolling hills with generally gentle to moderate slopes and hills pediment areas with an open shrubveld with *Lebeckia macrantha* prominent in places” (Mucina & Rutherford, 2006). In terms of vegetation structure it consists of a well-developed grass layer. The vegetation type contains five biogeographic important taxa: *Lebeckia macrantha*, *Justicia puberula*, *Tarchonanthus obovatus*, *Euphorbia wilmaniae*, *Digitaria polyphylla* and *Sutera griquensis*. The only endemic taxon to this vegetation type is *Euphorbia planiceps*. The conservation value of the vegetation type is not threatened and the target amount for conservation was set at 16%. The vegetation type is not conserved in any statutory conservation areas. Some parts are heavily utilised for grazing but very little of the vegetation type is transformed (Mucina & Rutherford, 2006). The Olifantshoek Plains Thornveld occurs mainly on plains.

The vegetation structure is described as an open tree and shrub layer with a sparse grass layer. Biogeographically important taxa include *Acacia luederitzii* var. *luederitzii*, *Lebeckia macrantha*, *Hermannia burchellii*, *Justicia puberula*, *Putterlickia saxatilis*, *Tarchonanthus obovatus*, *Antheophora argentea* and *Sutera griquensis*.

The only endemic species to the vegetation type is *Amphiglossa tecta*. The conservation status of the vegetation type is least threatened and the target for conservation has been set as 16%. Only 0.3 % of this vegetation type is statutorily conserved in the Witsand Nature Reserve. Transformation has only occurred in 1% of the vegetation type (Mucina & Rutherford, 2006).

The landscape of the Postmansburg thornveld is best described as: “Flats surrounded by mountains”. The vegetation structure is shrubby thornveld which consists of a dense shrub layer and a patchy grass layer. Shrubs of the Postmansburg thornveld generally are low and have a karroid affinity. Biogeographically important taxa include *Euphorbia bergii* and *Digitaria polyphylla* (Mucina & Rutherford, 2006).

The conservation status of the vegetation type is least threatened and the target for conservation has been set as 16%. The vegetation type is not conserved in statutory conservation areas but very little has been transformed (Mucina & Rutherford, 2006). The Southern Kalahari Salt Pans are best described as: “low grasslands on pan bottoms”. The dominant genus in the Southern Kalahari Salt pan is *Sporobolus* and it occurs with a mixture of dwarf shrubs. The dwarf shrubland is dominated by *Lycium* and / or *Rhigozum*. This dwarf shrubland usually forms the outer belt of the salt-pan zonation systems.

The conservation status of the vegetation type is least threatened and the target for conservation has been set as 24%. The vegetation type is conserved within the Kgalagadi Transfrontier Park (8%) (Mucina & Rutherford, 2006).

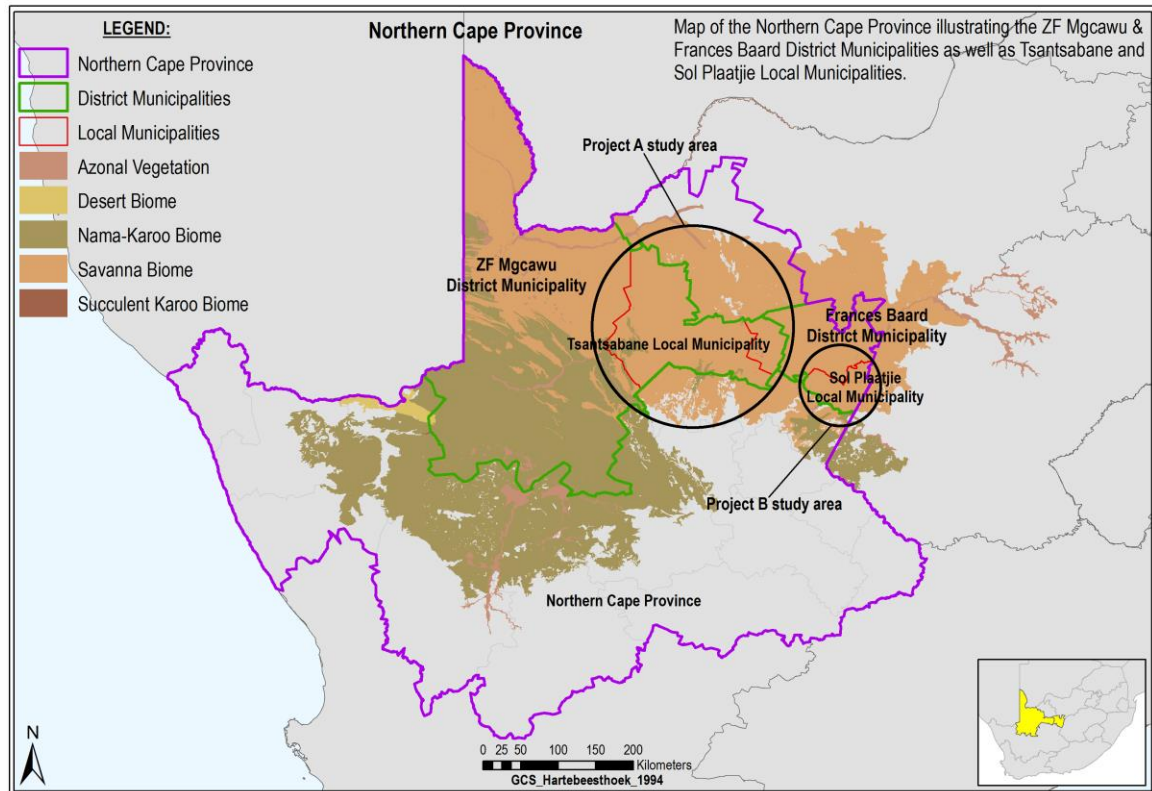


Figure 6: Map of South Africa showing Northern Cape Province vegetation types

Source: Department of Environmental Affairs (DEA), 2014.

3.1.3. Projects description

South Africa has a huge potential to generate power from renewable sources. The South African government has identified wind and solar as potential energy sources. The Northern Cape has been identified as a potential site for solar energy generation. Two solar energy projects have been initiated in the Northern Cape. The generation of energy from solar is perceived to have little impacts on the natural environment (Fluri, 2009).

Description of Project A

The owner of the project identified Photovoltaic (PV) facility as a key project to contribute with job creation and electricity demands within the region. The project is a response to the Department of Energy bid invitations for renewable energy projects to generate electricity to feed into the National grid, which is in line with the Integrated Resource Plan for electricity.

This project created a short term job opportunities for the neighbouring community during the construction phase of the development and few permanent jobs (skilled labourers).

The 50 MW PV facility consist of the following components:

PV module (244 000 modules); 12 200 PV panels; Support structures to mount the photovoltaic panels. The maximum height of structure was 4 m high from the ground level and the panels is north facing slope; PV module dimensions of 1956 x 992 x 50 mm; 12 200 PV structures; 22 and 44 kV internal underground reticulation cables; 37 inverters; Inverter power have a capacity of 667 kilowatts (KW); On-site switching station; A new overhead 132 kV power line of approximately 5.8 km. The power line were connected between Manganore-Silverstream 132 kV power line which traverses portion 4 of Farm Groenwater 453, and remainder and farm 455; Internal access road is 6 m wide and 3.5 km long; Biozone wastewater treatment of a capacity of 730 m³ per annum; and a storeroom, workshop, administration office and ablution facilities.

The maximum output capacity of the implemented PV facility was 50 Megawatts (MW).

The total area of the constructed PV was 117 ha.

The project established adjacent to the of Kuruman Mountain bushveld, Olifantshoek Plains Thornveld, Postmasburg Thornveld and Southern Kalahari Salt Pan vegetation types.

50 MW PV Facility Components	Number of Components
PV Modules	244 000 modules
PV Panels	12 200
Maximum Height of the structure from the ground level	4 m high
PV module dimensions	1956 x 992 x 50 mm
Internal underground reticulation cables	22 and 44 kV
Inverters	37
Inverter power capacity	kilowatts (KW)

Table 1: Indicating the 50 MW PV facility components and number of components

Description of Project B

The owner of the project identified a 75 MW PV facility as a key project to contribute with job creation and electricity demands within the region. The implemented project was a response to the Department of Energy bid invitations for renewable energy projects to generate electricity to feed into the National grid, which is in line with the Integrated Resource Plan for electricity. The implemented project comprises of 18 300 panels occupying an area of approximately 174 hectares. An additional 20 hectares will comprise of associated infrastructure and constituted a total lay down footprint of 194 hectares.

The site falls within the boundaries of the Tsantsabane Local Municipality and in the greater Siyanda District Municipality. The electricity transformers contain oil which if it leaks could cause water and soil contamination. Noise occurred from the construction machineries and wastes were generated during the construction activities.



Photograph taken by: Mahlatse Shubane

Photograph 1: Indicates vegetation regrowth under the solar panels.

During construction phase vegetation and fauna habitats were destroyed, however the following mitigation measures were recommended in order to mitigate the anticipated impacts in the EIA report (see the table below):

Table 2: Showing mitigation measures recommended in the EIA reports

Mitigation Measures
<ul style="list-style-type: none">• Clearly mark and stay clear of buffer zones and corridors where applicable according to the ecological sensitivity findings;• Keep area of disturbance as small as possible;• Rehabilitate area after construction phase to original status;• Keep vegetation disturbance area as small as possible; and• Conflict over income and leadership within the local communities as well as the loss of income and employment after decommissioning

3.1.4. Study Approach

The study was undertaken by use of questionnaires, site visits, meetings, photographs and group interviews. Trained field assistants were also used to administer the questionnaires in order to collect data.

The approach focused on whether the developers on both project A and B complied with the stipulated conditions (such as working areas and access roads clearly demarcated; working hours restricted between 08h00 and 17h00; no work activities on holidays and Sundays and selective brush vegetation clearing) in the Environmental Authorisations, EIA reports and EMPs based on socio-economic and ecological factors.

The compliance monitoring and follow-up cannot be able to note every aspects of environmental importance. Follow-up process needs to concentrate on the most important environmental aspects that would add value to the measurable environmental aspects.

In this instance, this study was done by checking if the prescribed conditions (See table 3 & 4) of the environmental conditions of the projects were complied with or not. Most developments in South Africa are approved based on certain conditions to be adhered to. Therefore, the study was designed to record whether the stipulated mitigation measures were applied or not. The methods and tools utilised in the collection of EIA compliance data for this study are discussed below.

3.1.4.1. Questionnaires

The questionnaires were designed in order to record perceptions of various stakeholders on whether the developers complied with the conditions and mitigation measures as described in the EIA Reports. Both socio-economic and ecological impacts mitigation measures were assessed against the compliance assessment.

3.1.4.2. Meetings

Meetings with the members of the community of both projects A and B, and local leadership for both project A and B were held and data was collected through both group discussions (see photograph 3).



Photograph taken by: Jafta Kapunda

Photograph 2: Indicating the group discussions with members of the community and local leaders.

3.1.4.3. Photographs

Photographs were taken to illustrate compliance or lack of compliance. This was useful in capturing interview exercises conducted in several sites that were visited on the same day. In addition, most of wastes generated on sites were rubble, wood material, food stuff (for example soft drink bottles and tins. Wood wastes were perceived as fire hazard whereas plastics blown away by would have negative impacts on livestock.



Photograph taken by: Mahlatse Shubane

Photograph 3: Showing solid waste on site which was temporarily stored with a plan to dispose it in a licensed permanent secured disposal area.

The aspects of follow-up focused on compliance monitoring and needs to provide a detailed proof of compliance is the capturing and filing of records such as photographs. If the stipulated mitigation measures are not adhered to soil without grass cover would result in soil erosion through water taking away top soil and top soil are prone to wind erosion. Wind erosion other than causing loss of soil also affects respiratory wellbeing of the local communities and dust falls on their properties. Eventually there will be loss of plant biodiversity which will affect animals' biodiversity at large scale.

3.1.4.4. Site visits

Site visits were conducted and each development selected was visited by the researcher and the two field assistants. Thorough observations were made during the site visit in order to see the complete impact of the development and compliance was checked on site in relation to the conditions/or mitigation measures of the environmental authorisations.

The field assistants visited the sites without the researcher. Some of the site visits were conducted and was carried out without the contractor and the local environmental officer. This was done in order to ensure that the contractor through the advice from the environmental officer did not do some clean-up before the researcher and his two field assistants arrive on sites.

3.1.5. Data processing and analysis

Two Photovoltaic (PV) facilities in the Northern Cape Province were selected in order to analyse whether the developers complied with the EIA conditions. As such, these projects were differentiated as Project **A** and **B**.

The data were processed and analysed using SAS (statistical software). The data were prepared in Microsoft Excel and imported to SAS for processing and analysis. Chi-Square test for independence was performed in order to compare the differences (Snedecor & Cochran, 1978) between the two projects (Project **A** and **B**). This test summarises the data in terms of frequencies and percentages either as a frequency of 1:1 ratio or a combined Row by Column (RxC) contingency table. The p-values of the chi-square tests were indicated in the results and discussions and where if the p-value was found to be less than 0.05, the result was viewed as significant (StatSoft Inc., 2007; Dunn & Clarke, 1987; Clewer & Scarisbrick, 2006; Ferguson, 1987; Zar, 1998; Dunn & Clarke, 2009).

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Introduction

The following chapter presents the results of the participants survey, environmental impacts, impacts caused by construction activities and their mitigation measures, socio-economic impacts and an ecological impacts on both project A and B. Participant's survey was designed to collect information on the number of male and female participants as well as their age differences. The environmental impacts caused by construction activities, socio-economic impacts and an ecological impacts were designed to gather information during construction and operational phases of the projects in order to establish whether the developers complied with the stipulated conditions in the EA, and to assess the effectiveness of mitigation measures mentioned in the EA, EIA reports and EMPs. The information gathered and most of the respondents indicated that both the developers complied with stipulated conditions.

4.2. Participants Survey

Project A

A total number of 96 respondents were interviewed of which 61% were male and 39% were female.

The age of the participants ranged from 17 to over 60 years with an average of 35 years. Most of the respondents were 21 to 25 years and constituted 39%, followed by persons between 17 to 20 years, constituting 32%. Respondents younger than 20

years constituted 3%, while respondents between 50 and 60 years and beyond 60 years constituted 26% respectively.

There were more female (45%) respondents in the age of 17 to 20 years as opposed to male respondents in the same age group. However, there were more male (41%) in the age of 21 to 25 years compared to 17% of females in the same age group (See figure 7).

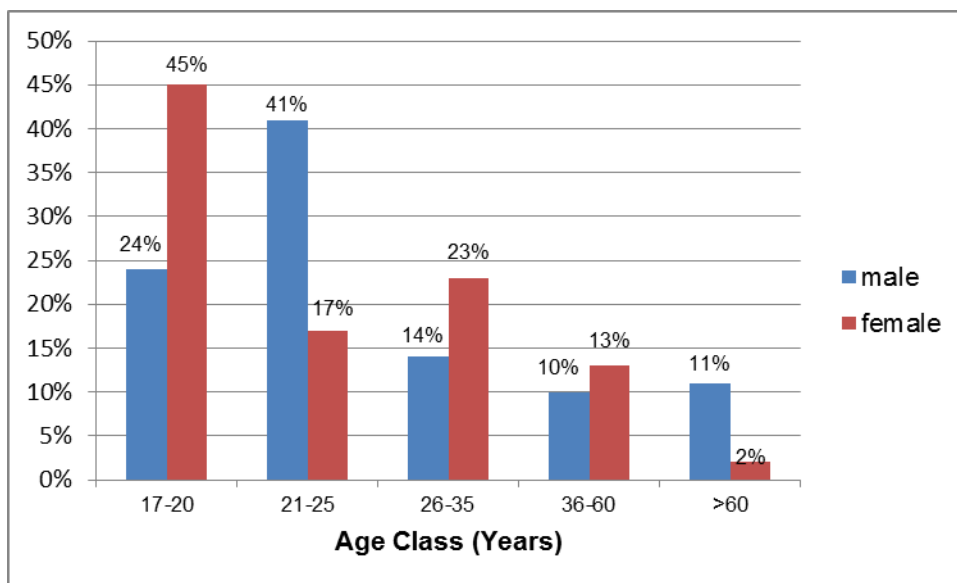


Figure 7: Gender of Respondents by Age Class (N=96)

Project B

A total number of 107 respondents were interviewed of which 55% were male and 45% were female.

The age of the participants ranged from 15 to over 60 years with an average of 35 years. Most of the respondents were 31 to 35 years and constituted 41%, followed by persons between 20 to 30 years, constituting 37%. Respondents younger than 20 years constituted 2%, while respondents between 50 and 60 years and beyond 60 years constituted 20%.

There were more male (41%) respondents in the age of 20 to 30 years as opposed to female respondents in the same age group. Equally, there were more female (47%) in the age of 31 to 35 years compared to 12% of males in the same age group (See figure 8).

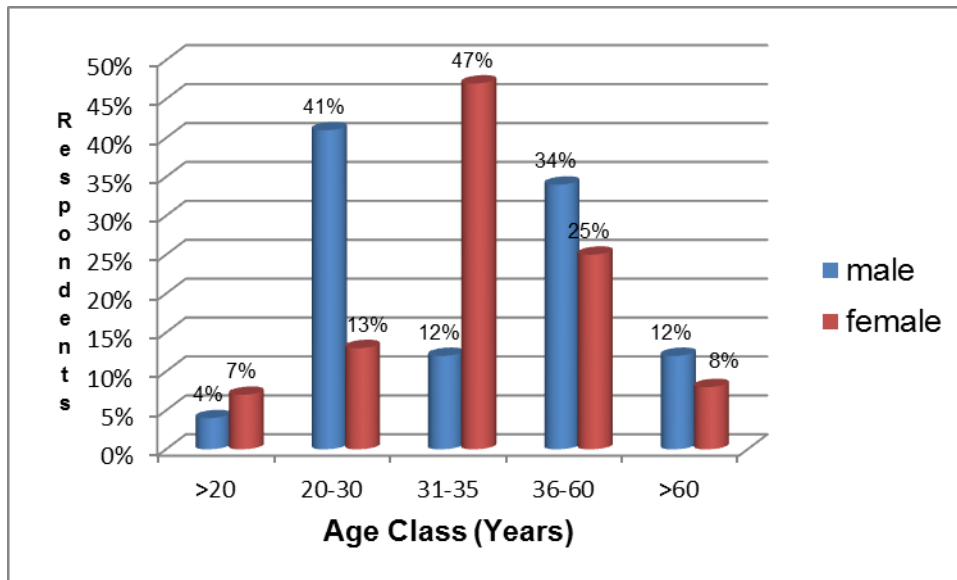


Figure 8: Gender of Respondents by Age Class (N=107)

The majority of the respondents indicated that noise followed by air pollution were the most observed impacts during construction of both projects (see figure 10 below). However, the developers applied the most recommended and appropriate mitigation measures in order to reduce the above mentioned environmental impacts. These mitigation measures included working hours from 08h00 to 17h00 were applied and there were no construction activities on Sundays and holidays; drip trays were used on generators and machinery in order to contain oil leaks; working areas were clearly demarcated; on a weekly basis (three times a week) waste water were used to suppress dust impacts and oil tanks were constructed on bunded areas.

Table 3 indicated that in terms of ecological perspective dust emanating from construction, soil disturbance, loss of habitat, ground water and soil impact by oil should leaks occur from the electric transformers, construction workers increase risk of veldfires, cement, lubricant and fuel spillages and land disturbance were the most anticipated impacts. However, mitigation measures such as straw bales and sprinkler system should be applied, keep top soil separate, reinstate soil after construction, rehabilitate after construction, transformers must be constructed on bunded area, no open fires are allowed, but only on designated areas, ensure adequate fire fighting equipment is present at all times, drip trays must be used under construction vehicles and machineries, no fuel to be stored on site and vegetation underneath the reflector must not be cleared.

In addition, the status during study follow-up showed that construction vehicle were used in order to suppress dust, top soil were separated and land was re-surfaced with topsoil, the area used for construction activities were rehabilitated by using locally indigenous vegetation, all transformers were constructed on bunded area (See photograph 6), no fires observed by local communities, fire extinguishers and fire beaters were present on site, firebreaks were established around the facility site, drip trays were observed under construction vehicles and machineries and no fuel were stored on site. These were the indications that the developers adhered to the stipulated EIA conditions.

In terms of socio-economic perspective noise during construction, influx of construction workers, increase in crime rates and theft and damage to infrastructure were the most anticipated impacts. Though, mitigation measures such as activities

were carried out between 8.00 AM and 5 PM when children were at school studying, local skilled and semi-skilled workers should be employed and an independent security company should be contracted.

In addition, the status during study follow-up showed that the respondents during the survey mentioned that construction activities were limited between 8.00 AM and 5 PM and it was also observed by the researcher as well as field assistants, approximately 870 Local people were employed and security officers were present all the time of the visits in order to protect the facility and the local communities mentioned that there were no theft encountered. These were the indications that the developers adhered to the stipulated EIA conditions.

Table 3: Summary of EIA Impacts and mitigation measures in terms of ecological perspectives

Type of impact	Description of impact	Mitigation measures for possible impacts	Status during follow-up
Ecological impact	Dust emanating from construction activities	<ul style="list-style-type: none"> • Straw bales and sprinkler system should be applied 	<ul style="list-style-type: none"> • Construction vehicles were used to spray water in order to suppress dust
	Soil disturbance	<ul style="list-style-type: none"> • Keep top soil separate • Reinststate soil after construction 	<ul style="list-style-type: none"> • It was observed that top soil were separated during construction and the top soil

			were reinstated
	Habitat loss	<ul style="list-style-type: none"> • Rehabilitate after construction 	<ul style="list-style-type: none"> • The area used for construction activities were rehabilitated by using locally indigenous vegetation
	Ground water and soil impact should oil leakages occur from the electric transformers	<ul style="list-style-type: none"> • Transformers must be constructed on bunded area 	<ul style="list-style-type: none"> • All transformers were constructed on bunded area (See photograph 6)
	Construction workers increase risk of veldfires	<ul style="list-style-type: none"> • No open fires are allowed, but only on designated areas • Ensure adequate fire fighting equipment is present at all times 	<ul style="list-style-type: none"> • No fires observed by local communities • Fire extinguishers and fire beaters were present on site • Firebreaks were established around the facility site.
	Cement, lubricant and fuel spillages	<ul style="list-style-type: none"> • Drip trays must be used under construction vehicles and 	<ul style="list-style-type: none"> • Drip trays were observed under construction vehicles and

		<p>machineries</p> <ul style="list-style-type: none"> No fuel to be stored on site Controlled handling and storage of hazardous waste 	<p>machineries</p> <ul style="list-style-type: none"> No fuel was stored on site.
	Land disturbance	<ul style="list-style-type: none"> Vegetation underneath the reflector must not be cleared 	Vegetation was observed underneath the reflectors (See photograph 4)

Table 4: Summary of EIA Impacts and mitigation measures regarding socio-economic perspectives

Type of impact	Description of impact	Mitigation measures for possible impacts	Status during follow-up
Socio-economic impact	Noise during construction	<ul style="list-style-type: none"> Work done between 8.00 AM and 5 PM when children were at school and workers at work 	<ul style="list-style-type: none"> The respondents during the survey mentioned that construction activities were limited between 8.00 AM and 5 PM
	Influx of construction workers, Increase crime rates and competition	<ul style="list-style-type: none"> A local skilled and semi-skilled workers should be employed 	<ul style="list-style-type: none"> Approximately 870 Local people were employed
	Theft and damage	<ul style="list-style-type: none"> An 	<ul style="list-style-type: none"> Security officers

	to infrastructure	independent security company should be contracted	were present all the time of the visits in order to protect the facility and the local communities mentioned that there were no theft encountered
--	-------------------	---	---

For socio-economic impact it is important to analyse various sectors of the community. For instance, gender, age, literacy level as impact of the project varies to different sectors of the community.

Based on education levels, more local people with no formal education were involved in the survey than those with primary levels. Among the community leaders, 60% were of the view that the projects helped the community through temporary jobs.

The study revealed that local community members between the ages of 17-20 and 21-25 years were more involved in these projects than those below 20 years and above 60 years. The results revealed that younger persons were preoccupied with other livelihood activities.

As information was gathered from questionnaire survey there were 30 permanent jobs created during the operational phase and 470 short term job opportunities during pre-construction and construction for project A (see table 5). In Project A there were 35 males and 20 females employed which were over 25 years of age and 140 males and 65 females employed between the age of 30 and 35 years. In

addition, the age of the workers over 40 years were 230 males and 10 females. The survey showed that there were more males employed as opposed to females' workers. It was thought that more males were employed than females because females spent most of their time handling the household affairs such as cleaning, cooking and looking after their children (see table 8).

For Project B, it was observed that there were 36 permanent jobs created during the operational phase and 399 short term job opportunities during pre-construction and construction for project B (see table 5). There were 20 males and 15 females employed which were over 25 years of age and 105 males and 70 females employed between the age of 30 and 35 years. In addition, the age of the workers over 40 years were 155 males and 70 females.

The survey showed that there were more males employed as opposed to females' workers. It was thought that more males were employed than females because females spent most of their time handling the household affairs such as cleaning, washing clothes, cooking and looking after their children (see table 8).

Similarly, in Project A there were 30 skilled workers employed as compared to 470 unskilled workers whilst in Project B there were 36 skilled workers and 399 unskilled workers (see table 6). The unskilled workers mostly were employed during pre-construction and construction phase of the projects. In addition, both projects required a high level of skilled workers and local communities were not highly skilled. As such, most skilled workers were outside communities' including foreigners as compared to South African citizens or local residents.



Photograph taken by: Mahlatse Shubane

Photograph 4: Showing bird flappers along the power line which connect to the PV facility

4.3. Projects impacts on the environment

At Project A most respondents (97%) said the project had no impact on the soil, fauna and flora and other areas of cultural, historical, archaeological or scientific value while 3% of the respondents said that the project could benefit the environment through rehabilitation of the site after construction. There were no environmental accidents occurred during construction of the projects and there were no public objections/complaints with regard to the projects.

However, 51% of the respondents said that Project B had no beneficial impact on the environment, whilst 33% of the respondents thought the project could benefit the environment through rehabilitation of the site after construction. Hundred percent (100%) of the respondents mentioned that project B had no beneficial impact to the environment. There was statistically no significant difference between project A and project B respondents ($P=0.061$) with regard to the benefit to the environment (see figure 9).

Noise and dust pollution were the only impacts identified and noise was the major environmental impact. However, dust and the noise were only present during construction and not after the completion of the construction activities for both project A and project B. Lack of environmental knowledge from the project B community as compared to project A was a major factor that the majority of the respondents (51% from project A and 97% from project B) indicated that the project had no environmental benefit. A chi-square test) results showed that there was statistically (a significant difference on the responses between the respondents in project A and project B ($P<0.001$) on the environmental impacts (see figure 9).

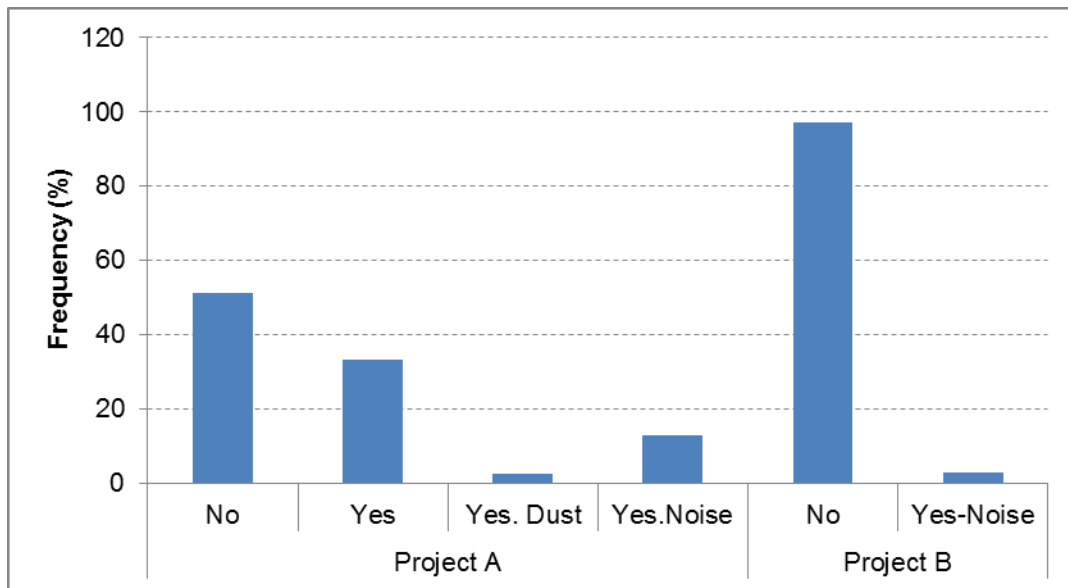


Figure 9: Results from the questionnaire survey indicating views of respondents' environmental impact of the solar panels harvesting project at project A and project B. A survey was carried out using questionnaires on the project A and project B communities.

4.4. The impacts of the construction activities and mitigation measures

Noise was identified as the major environmental impact during construction for project A (16% of the respondents) and project B (6% of the respondents). Dust emanating from the construction activities was also identified as a major pollution for both project A (23%) and project B (15%) (See figure 11). The solid wastes were temporarily stored on site and were collected three times per week in order to dispose wastes at a registered or authorised disposal site 15 km away (See photo 3).

Questionnaire survey was used to gather information related to the waste disposal. The workers mentioned that solids wastes at the temporary storage did not contribute negative health impacts to the employees. For example, the solid wastes at the disposal did not cause a lot of environmental damage as the site is well controlled by the qualified waste specialist.

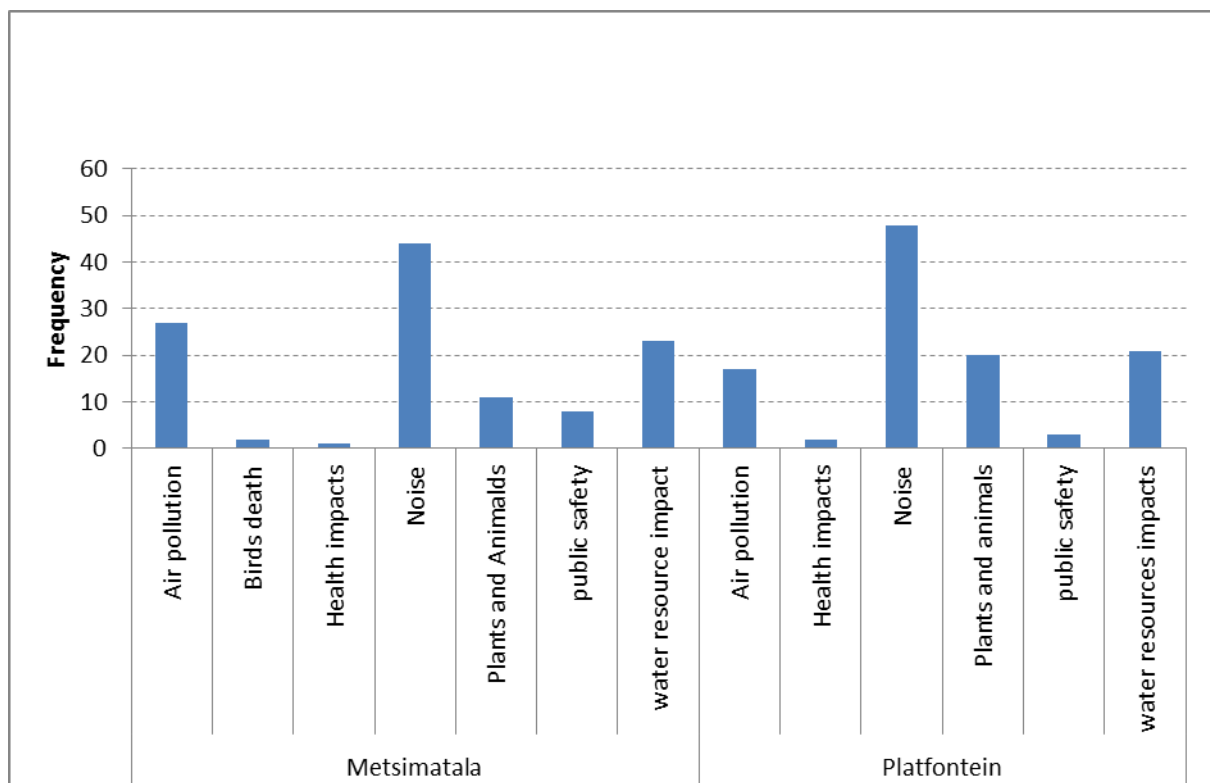


Figure 10: Results from the questionnaire survey indicating views of respondents on environmental impact of the solar panels harvesting project at project A and project B.

In both projects A & B the respondents, 0, 86% from Project A and 1,8% (see figure 10) from Project B were of the view that both developers had not succeeded in implementing the intended health mitigation measures for both projects.

Water resources were also identified to be impacted by the construction activities; while there is no water pollution issues that could be readily identified for both project A (20%) and project B (19%) (See figure 10). It was thought that the use of water from the same sources by the communities could have caused this perceived water resources impact. In the Northern Cape Province of South Africa water is a scarce resource and so the use of large volumes of water at the construction could have resulted in most respondents perceiving that the project could impact on their water resources. The results showed statistically significant difference between project A and project B communities perceptions on project impact on water availability and quality ($P < 0.001$) (Figure 10 above).

The solar panels were constructed on a 117 ha for project A and 174 ha for project B of lands which obviously had an impact on the plants, due to land clearing and also on the fauna that depend on those plants. For instance, if the vegetation grows and become dry under the solar panels fire might be caused and this will also have financial implications to the developers. There was a condition in the EIA which stated that natural vegetation must be restored after construction and this condition was adhered to since the regrowth of indigenous vegetation under the solar panels were observed during the study (see photo 1).

Eighty nine percent (89%) of the respondents at project A said that the drip trays were used for all the machinery and generators during construction, whilst 79% of the respondents perceived that the drip trays were used for all the machinery and generators during construction. Drip trays are tools which were placed under the construction vehicles during construction when the vehicles were not in use. Drip

trays were used to collect and hold fuel should leakage occurs. There was statistically no significant difference between project A and project B ($P=0.045$) with regard to effectiveness of applied mitigation measures, such as the use of generators on site.

It was observed that the drip trays were always placed under the construction vehicles, generators and other machineries in order to contain any fuel leakages.

The results showed that 48% of the respondents in project A said that construction occurred between 8am to 5pm from Monday to Friday in order to mitigate noise environmental impacts. This was perceived to be the most successful measures since the neighbouring communities would be resting at home after 5pm. For instance, school learners wanted to study and the workers to rest after work and after 5pm. In project B, 52% of the respondents said that construction occurred between 8am to 5pm from Monday to Friday and this mitigation measure was applied for the same reason as for project A.

The electrical transformers contain oil which may pollute if it leaks. However, all the electric transformers were constructed on bunded area filled with water in order to contain oil if leakages occurred (See photograph 5 below).



Photograph taken by: Mahlatse Shubane

Photograph 5: The transformer constructed during the study which depicts water which will contain oil if leaks occur.

Bunded area was recommended by the EIA reports that it should be constructed for the transformers and the transformers constructed on bunded area on site in order to contain any spills during the operational phase of the projects were reported (see Photograph 5 above).

Fifty nine percent (59%) of the respondents said that drinkable and waste water were identified as the most used mitigation measures to ease dust impacts for project A, whilst 78% of the respondents for project B said that waste water was used to suppress dust impacts (for instance waste water were sprayed onto the affected dust areas using a hose pipe). Project A produced more dust than project B and the results showed statistically a significant difference between the dust environmental impacts occurred at project A and project B ($P < 0.001$) on the respondents.

4.5. Socio-economic impacts of the projects

Local-skilled, semi-skilled and skilled workers were employment during the construction and operational phase of the project. There were 500 workers during construction and there were 310 workers currently employed mainly for electronics and only 25 workers for project A during operational phase and for project B there were 435 workers during construction and only 30 workers for the operational phase of the project.

It was perceived that the number of local workers employed on both projects contributed to the secondary social impacts such as better nutrition and education for the local communities. The researcher observed that during end of the month when the workers got paid and the workers went to town in order to buy groceries and learners school uniform. The project also assisted in skills development and infrastructure development within the local communities. Even the local businesses were improved mostly during construction phase because there were many local people selling food to the workers.

Table 5: Comparative analysis of permanent and short term labourers for project A and project B

Project name	Type contract	Pre-construction	Construction	Implementation
Project A	Permanent			30
	Short term	160	310	
Project B	Permanent			36
	Short term	126	273	

Table 6: Comparative analysis of skilled and unskilled labourers for project A and project B

Project A		Project B	
Skilled labour	unskilled labour	skilled labour	unskilled labour
30	470	35	400

Table 7: Analysis of workers employed in relation to age groups and gender for project A

Age Groups	Gender	
	Male	Female
≥25 Years	35	20
30-35 Years	140	65
Over 40 Years	230	10

Table 8: Analysis of workers employed in relation to age groups and gender for project B.

Age Groups	Gender	
	Male	Female
≥25 Years	20	15
30-35 Years	105	70
Over 40 Years	155	70

Social impact is that both positive and negative impacts occurred as a consequence of the implemented developments (Project A and B). Negative impacts were low whilst positive impact remains high for both projects. When considered in terms of benefit to the local community through job creation, equity and empowerment, social impacts can be considered highly positive since 500 workers were employed for project A and 435 workers for project B were also employed during construction phase. The developer ensured that the affected community fully understood complexities of the development and an honest and clear channel of communication between the developer and the community leaders were established through meetings (see figure 11). Based on the survey records of communication to date, this has been achieved by the developer.

This was to establish whether the developers complied with the stipulated EIA conditions of their respective projects.

4.5.1. Ecological Impacts

Ecological corridor linkages provided significant migration surfaces for insects, fauna and flora, improving the chance of survival in disturbed or transformed areas. These corridors further perform a significant role for dispersal and gene flow by avoiding isolation of ecological units. Ecological corridors rendered ineffective where no gene flow had occurred naturally in the past and can act as reservoirs for pathogens and introduced species. Ecological corridors further vary in effectiveness depending on the species which are intended to use it and therefore an appropriate width needs to be sought to adequately provide for the intended species.



Photograph taken by: Mahlatse Shubane

Photograph 6: Showing the ecological corridor linkages which provide significant migration for animals.



Photograph taken by: Mahlatse Shubane

Photograph 7: Indicating the road adjacent and leading to the construction and construction prior to site clearance took place



Photograph taken by: Mahlatse Shubane

Photograph 8: The construction site after site clearance in order to commence with construction activities

The status of natural vegetation was medium to low on the PV facility sites. There appeared to be no loss of any particular unique ecosystem or sensitive species for the selected sites. Vegetation was however largely remained at the facility, as this was not being cleared underneath the PV panels.

During construction phase vegetation was cleared for the purpose of the establishment of the respective projects. The respondents and the researcher perceived that this contributed to loss in biological diversity through habitat destruction. In addition, during the study several site visits before construction activities commenced and operational phase were undertaken. It was observed that the site clearance activities cleared most of the indigenous vegetation cover on sites (see photograph 7 & 8). However, it was observed that there was indigenous vegetation growing underneath the solar panels (see photograph 1). This indicated that the developer complied with one of condition recommended in the EIA report, which is to rehabilitate the construction sites after construction activities have been completed (see table 1). Also dust emanated from the construction and operational activities impacted on the neighbouring communities.

4.5.2. Projects skills requirements

The projects were highly technical and so required highly skilled labour which was not present in the local community (see table 5). So both local and external people were employed to work on the projects. The local people were employed mainly as general workers due to lack of the skills required. Although, the respondents for both projects perceived that 56% of the employers for Project A and 66% for Project B were both local and outside communities, the reality was that most of the outside

communities were highly skilled labourers and local communities were mostly unskilled labourers.

4.5.3. Forms of interactions with the local communities

The developer interacted with the community and 37% of the respondents at project A indicated that the meeting and site notices were used, whilst 73% of the respondents from project B said that the meetings were the most form of interaction with the community.

The survey showed that the majority of the community members at project B were illiterate. The project information on the study was advertised on the local newspapers and site notices were placed at the conspicuous places for the community members to read. However, the project B community members only heard about the meetings instead of reading the newspapers and site notices. It was thought that since 73% of the respondents from project B community members said that meetings was the most form of interactions between the community and the developers, illiteracy was the most contributing factor to their responses. The results showed statistically a significant difference between the respondents in project A and project B communities in terms of interaction by the developers for both Project A and Project B ($P < 0.001$) (Figure 11).

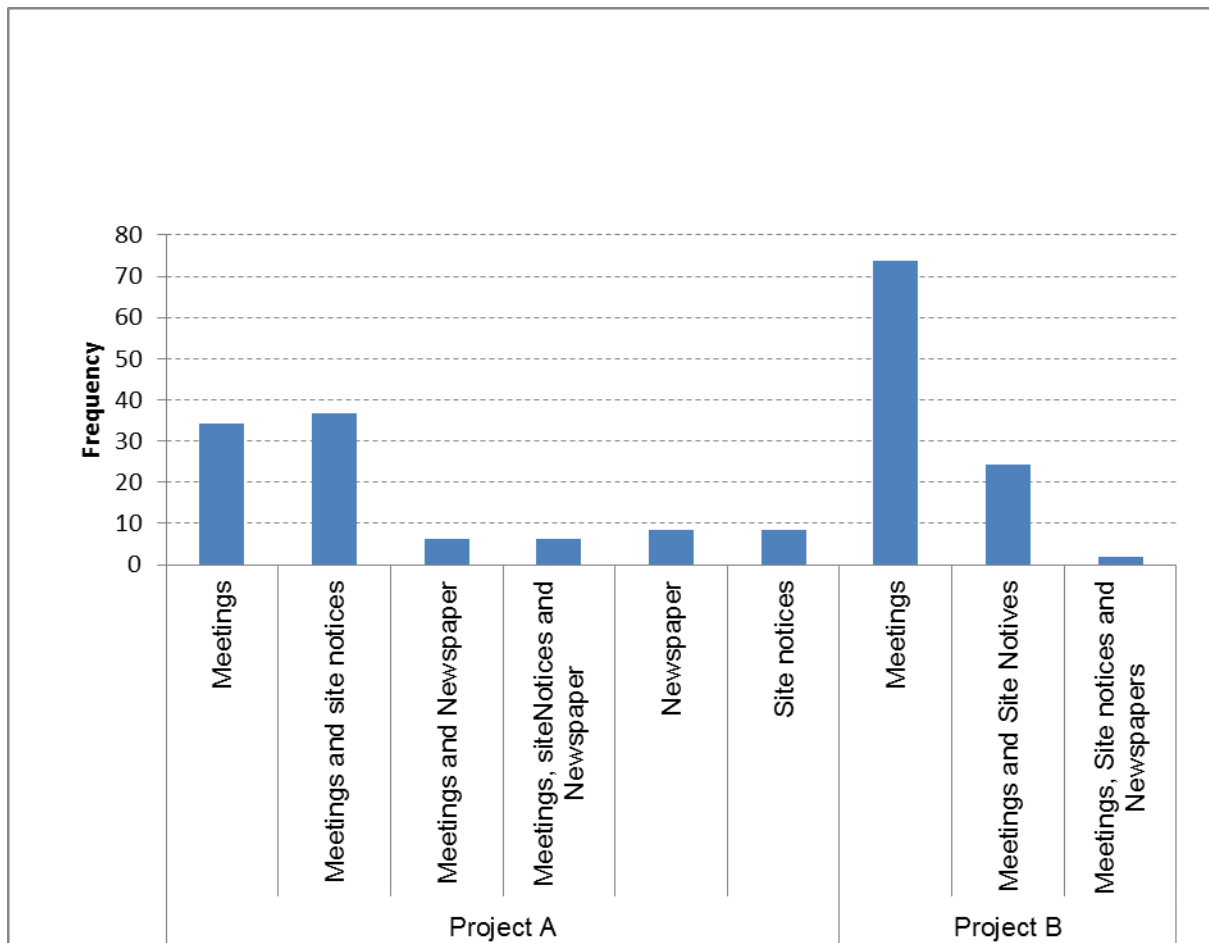


Figure 11: Different Forms of interactions with the communities used by the developers during construction and operational phase of the projects.

The study also focused on whether environmental impacts such as air pollution, noise, water resources and plants and animals were mitigated according to the intended mitigation measures. The study therefore succeeded in revealing different types of impacts. Evans *et al.* (2011) also highlighted that environmental audit theoretically needs to reveal the magnitude and nature of environmental harm associated with the proposed activities. And as such, the study revealed that environmental compliance legislation can be instrumental when it comes to identifying the environmental impacts and their appropriate mitigation measures. For instance, noise was the most identified as the most environmental impacts, however

mitigation measure such restricting working hours between 8am and 5pm was implemented.

4.5.4. Conclusion

This chapter focused on the results of the participant's survey, environmental impacts, impacts caused by construction activities and their mitigation measures, socio-economic impacts and ecological impacts on both project A and B. It is evident that female participants (45%) with the age ranging from 17 to 20 years were the dominant participants, whilst male participants (41%) with the age ranging from 21 to 25 years dominated in project A (see figure 7).

In addition, male participants (41%) with age ranging from 20 to 30 years were the majority of the participants, whereas female participants (47%) with the age ranging between 31 to 35 years were the most participants in project B (see figure 8).

Furthermore, it is clear that the study revealed that noise followed by air pollution were the most dominant impacts during construction of both projects (see figure 10). The results showed that generally, most of the recommended mitigation measures were implemented well by the developers.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

The study was conducted to determine the following: whether the developers complied with the EIA conditions; assess the effectiveness of mitigation measures as prescribed in the EA, EIA reports and EMPs; and to identify the limiting factors faced by the developers in order to comply with the EIA conditions.

5.1. Conclusions

5.1.1. Environmental compliance by the developers for both project A and B

The study reveals that both developers complied with the stipulated EIA conditions. Most of the respondents for project A (97%) and project B (100%) said that the projects had no significant impact on the environment. However, dust and noise were reported to have been present during construction phase only and were acceptable since working hours were restricted between 8am and 5pm and construction vehicles were used to spray water in order to suppress dust in order to mitigate the abovementioned impacts.

5.1.2. Effectiveness of mitigation measures

Perception among the respondents was that noise and dust emanating from construction activities was identified as the major environmental impacts. All the respondents for project A (89%) and project B (79%) said that drip trays were applied for all machinery and generators on all sites. The study showed that 48% of the respondents in project A said that construction occurred within the stipulated

hours of the day (between 8am and 5pm). The study indicated that the electric transformers which contain oil were constructed on bunded area.

In addition, the study indicated that 59% of the respondents said that drinkable and waste water were used to mitigate dust impacts for project A, whilst 78% of the respondents for project B reported that only waste water was used to suppress dust. These results showed that in project B the developer complied with EIA conditions compared to project A in terms of using waste water in order to mitigate dust impacts. Therefore, the developer in project A showed that more environmental awareness must be implemented on site in order to educate the workers about the importance of using portable water in order to suppress dust.

5.1.3. Limiting factors faced by the developers

The study showed that both projects required highly skilled labourers which were not present from the local communities. So a lot of the highly skilled outsiders' workers were hired than the unskilled local workers due to the fact that there was a shortage of skilled labourers within the local communities.

5.2. Recommendations

5.2.1. Compliance and the environmental impacts

The study found that compliance monitoring and follow-up processes were both useful. However, in Project A drinkable water was used to suppress dust impacts. It is also recommended that impacts monitoring be maintained in the future to provide a check on the accuracy of the effects (or impacts) predicted.

5.2.2. Roles and responsibilities

In terms of Section 24 of Constitution of the Republic of South Africa everyone has the right and responsibility to protect the environment. So according to US EPA 1992 and Morrison-Saunders *et al*, 2001 public pressure and involvement can be a very useful tool for inducing applicants to fulfil their environmental responsibilities and thus far it is recommended that ways in which to involve the public in follow-up be maintained through the life cycle of the projects. The neighbouring communities did not influence because most of the community members were interested in getting jobs rather than playing their environmental roles.

5.2.3. Gather follow-up data during the construction and operational phases of the projects

Most environmental impacts occur during construction phase, so more visits should be encouraged and undertaken at this stage and even during operational phase as well. The follow-up need to be undertaken in order to determine plant species diversity and to determine whether there are continued environmental impacts and benefits in the long run. In addition, in order to ensure the long-term sustainability of the follow-up programme, several staff members should be involved in follow-up and training of new staff should be on-going. This helps to ensure continuity, is safer in the field, allows on-the-job training and helps to reduce favouritism when judging the degree of impacts. George (2000c) also supports the follow-up of a project in this stage, although for a different reason. He highlighted that a post-implementation visit is useful to determine if the developer has been accurately reporting on operational impacts.

5.2.4. Encourage environmental awareness training

Environmental awareness can improve the environmental management throughout the lifecycle of the projects. Providing environmental training to the facility staff including contractors will improve environmental management.

It is also recommended that National Government should come up with standardised follow-up requirements, so that it can be filtered down to Provincial Government level.

It is also noted that both projects improved the socio-economic interests of the local communities such as short term job opportunities were created.

REFERENCES

Ahammed, A. K. M. R & Nixon, B. M. (2006). Environmental impact monitoring in the EIA process of South Australia.

Arts, J. (1998). *EIA Follow-up. On the Role of Ex-Post Evaluation in Environmental Impact Assessment*. Groningen: GeoPress.

Arts, J. & Morrison-Saunders, A. (2004). Theoretical perspectives on EIA and Follow-up, in Morrison-Saunders, A & Arts, J (editors), *Assessing Impact: Handbook of EIA and SEA Follow-up*, Earthscan: London, pp 22-41.

Arts, J. & Nooteboom, S. (1999). Environmental Impact Assessment Monitoring and Auditing, in Petts, J (editor), *Handbook of Environmental Impact Assessment* (Volume 1), Blackwell Science: Oxford, pp 229-251.

Arts, J. Caldwell, P. & Morrison-Saunders, A. (2001). Environmental impact assessment follow-up: good practice and future directions – findings from a workshop at the IAIA 2000 conference. *Impact Assessment and Project Appraisal*, 19(3), pp 175-185.

Aucamp, P. J (2009). Environmental Impact Assessment: *A practical guide for the discerning practitioner* (Van Schaik Publishers, Pretoria).

Bailey, J. (1997). Environmental impact assessment and management: an underexplored relationship. *Environmental Management* 2(3): 317-327.

Baker, J. & Dobos, R. (2001). Environmental assessment follow-up: A framework for environment Canada. In *Proceedings of Follow-up Workshop* held at IAIA '01 Conference, Cartagena, Columbia.

Barker, G. & Hill, R. (2000). Partnerships in the Construction Industry – The Practical Implementation of Environmental Management Plans. In proceedings IAIA-SA Conference. 30 September 2000, Stellenbosch.

Bekhechi, M.A. & Mercier, J.R (2002). The legal and regulatory framework for environmental impact assessments: study of selected countries in sub-Saharan Africa.

Bird, A & Therivel, R. (1996), "Post-auditing of environmental impact statements using data held in public registers of environmental information", *Project Appraisal*, 11(2), pages 105-116.

Bisset, R. (1980). "Problems and issues in the implementation of EIA audits" *Environmental Impact Assessment Review*, 1(4), pages 379-396.

Bisset, R. & Tomlinson, R. (1988). "Monitoring and auditing of impacts", in P Wathern (editor), *Environmental Impact Assessment: Theory and Practice* (Unwin Hyman, London) pages 117-127.

Bouamane, L. & Jones, G. (2012). "Power from Sunshine": A Business History of Solar Energy.

Brownlie, S. & Wynberg, R. (2001). The integration of biodiversity into national environmental assessment procedures: National Case Studies, South Africa.

Buckley, R. (1989)a: Precision in environmental impact prediction: first national environmental audit, Australia. Canberra7 Centre for Resource and Environmental Studies, Australian National University.

Canter, L. W. (1985), "Impact prediction auditing", *The Environmental Professional*, 7, pages 255-264.

Clewer, A. G. and Scarisbrick, D. H., 2006. Practical Statistics and Experimental Design for Plant and Crop Science. John Wiley and Sons, New York.

Cubitt, J. & Diab, R. (2001): EIA follow-up: Current Status and Recommendations, in proceedings IAIA-SA Conference, 6-8 October 2001, Nelspruit.

Culhane, P. (1993). Post-EIS auditing: a first step to making rational environmental assessment a reality. *The Environmental Professional*, 15, pp 66-75.

Damall, N. Seol, I. & Sarkis, J. (2009). Perceived stakeholder influences and organisations' use of environmental audits.

Dasgupta, S. Hettige, H. & Wheeler, D. (2000). What improves environmental compliance? Evidence from Mexican industry. *Journal of Environmental Economics and Management*, 39, 39-66.

De Wit, M. (2001). Trade-offs and EIA in South Africa: An Unhappy marriage? In proceedings IAIA-SA Conference, 6-8 October 2001, Nelspruit.

Dipper, B. Jones, C. & Wood, C. (1998). Monitoring and post-auditing in environmental impact assessment: a review. *Journal of Environmental Planning and Management*, 41(6), pp 731-748.

Dunn, O.J. and Clarke, V. A., (1987). Applied Statistics: Analysis of variance and Regression. (2nd Edition). John Wiley and Sons, New York.

Dunn, O.J. and Clarke, V. A., (2009). Basic statistics: A primer for the biomedical sciences.

Duinker, P. (1989). "Ecological effects monitoring in environmental impact assessment: what can it accomplish?" *Environmental Management*, 13, pages 797-805.

Du Preez, J. Haynes, M. & Paton, A. (1997). Practical implementation of Integrated Environmental Management in South Africa. The approach adopted by Umgeni Water, in proceedings IAIA-SA Conference, 1997.

Duthie, A. G. (2001). A review of provincial environmental impact assessment administrative capacity in South Africa. *Impact Assessment and Project Appraisal*, 19(3), pp 215-222.

Evans, M. F. Liu L. & Stafford S. L. (2011). Do environmental audits improve long-term compliance? Evidence from manufacturing facilities in Michigan. Springer Science & Business Media, LLC 2011, pp 280-302.

Fairweather, P. (1989). Where is the science in EIA?, 20(5):141 –4.

Ferguson, G. A., 1987. Statistical Analysis in Psychology and Education. (5th Ed.) McGraw Hill International Editions. Auckland.

Fluri, T.P., 2009. The potential of concentrating solar power in South Africa.

Fuggle, R. F. & Rabie M. A. (1999), *Environmental management in South Africa* (Juta, Cape Town).

Fuggle, R. F. & Rabie, M. A. (2009), *Environmental management in South Africa* (Juta, Cape Town).

Fuller, K. (2005). “Environmental Impact Assessment”, in J Brady (editor), *Environmental Management in Organizations, the IEMA handbook* (Earthscan, London) pages pp186–199.

George, C. (2000). Environmental monitoring, management and auditing.

Glasson, J. (1995)a: Environmental impact assessment: the next steps? Built Environ; 20(4):277– 9.

Glasson, J. Therivel, R. & Chadwick, A. Introduction to environmental impact assessment. London7 UCL Press; 1994.

Glasson, J. (1999). The first 10 years of the UK EIA system: strengths, weaknesses, opportunities and threats. *Planning Practice & Research*, 14(3), pp 363-375.

Goldblatt, P. (1978). An analysis of the flora of southern Africa: its characteristics, relationships and origins. *Annals of the Missouri Botanical Garden* **65**: 369.

Hamann, L., L. Booth & T O’Riordan (2000), “South African environmental policy on the move”, *South African Geographical Journal*, 82(2), pages 11-22.

Harvey, N. (1998). Environmental impact assessment: procedures, practice and prospects in Australia. Melbourne7 Oxford University Press.

Harvey, N. & Clarke, B. (2012). Environmental impact assessment in practice in Australia. Harvey, N. (1998). Environmental impact assessment: procedures, practice and prospects in Australia. Melbourne7 Oxford University Press.

Heydenrych, P. & Claassen, P. (1998) A national strategy for integrated environmental management in South Africa. *Discussion Document*. Directorate Environmental Impact Management, Department of Environmental Affairs and Tourism, Pretoria.

Hill, R. (2000). Integrated environmental management systems in the implementation of projects. *South African Journal of Science*, **96**, 50–54.

Hui, S. (2000). Environmental monitoring and audit: Past, present and future

Hulett, J. & Diab, R. (2002). EIA follow-up in South Africa: current status and recommendations. *Journal of Environmental Assessment Policy and Management*, 4(3), pp 297-309.

IAIA and IAE, International Association of Impact Assessment and Institute of Environmental Assessment, UK (1999). *Principles of Environmental Impact Assessment Best Practice*, [accessed from www.iaia.org/modx/assets/files/principles%20of%20IA_web.pdf on 02 December 2011].

Katzchner, T. (2001). Integrated Environmental Management and the Cape Town Unicity, in proceedings IAIA-SA Conference, 6-8 October 2001, Nelspruit.

Kesan, J. (2000). "Encouraging Firms to Police Themselves: Strategic Prescriptions to Promote Corporate Self-Auditing," 1 *University of Illinois Law Review* 155-184.

Kolhoff, A. J. Runhaar, H. A. C. & Driessen, P. P. J. (2012). The contribution of capacities and context to EIA system performance and effectiveness in developing countries: towards a better understanding.

Kotze, L.J. & Paterson, A.R. (2009). Environmental Compliance and Enforcement in South Africa: Legal Perspectives, Juta Law; Cape Town.

Linder, H. P. (2003). The radiation of the Cape Flora, Southern Africa.

Lohani, B. N. Evans, J. W. Everitt, R. R. Ludwig, H. Carpenter & R. A. Tu Shih-Liang, (1997). Environmental impact assessment for developing countries in Asia, vol. 1. Manila7 Asian Development Bank; 1997.

Lu, W. & Yuan, H. (2010). Exploring critical success factors for waste management in construction projects in China.

Marshall, R. N. Smith & Wright, R. (2001), "A new challenge for industry: integrating EIA within operational EMS", paper presented at IAIA'01 Impact Assessment in the Urban Context Conference, EIA follow-up: Outcomes and Improvements workshop, 26 May-1 June, Cartagena, Colombia.

Marshall, R. Arts, J. & Morrison-Saunders, A. (2005). International principles for best practice EIA follow-up. *Impact Assessment and Project Appraisal*, 23(3), pp 175-181.

McCallum, D. R. (1987). "Follow-up to environmental impact assessment: learning from the Canadian experience", *Environmental Monitoring and Assessment*, 8, pages 199-215.

McKay, S. (2003). Sherrifs and outlaws: In pursuit of effective enforcement, *Town Planning Review*, 74(4), pp. 423-445.

McKay, S. McGreal, W.S. & Berry, J. (2003). Planning enforcement: Lessons for practice and procedure, *Planning Theory & Practice*, 4, pp. 325-344.

Moudon, A.V. & Lee, C. (2003). Walking and bicycling: an evaluation of environmental audit instruments.

Morris, P. & Therivel, R. (2001). *Methods of Environmental Impact Assessment* (London: UCL Press).

Morrison-Saunders, A. & Arts, J. (2004). Introduction to EIA follow-up, in Morrison-Saunders A & Arts J (editors), *Assessing Impact: Handbook of EIA and SEA Follow-up*, Earthscan: London, pp. 1-21.

Morrison-Saunders, A & Bailey, J. (1999) Exploring the EIA/environmental management relationship. *Environ Manage*; 24(3):281–95.

Morrison-Saunders, A & Bailey, J. (2003) Practitioner perspectives on the role of science in environmental impact assessment..

Mucina, L. & Rutherford, M.C. (2006). *The vegetation of South Africa, Lesotho and Swaziland (Eds). Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

Ortolano, L. & Shepherd, A. (1995). "Environmental Impact Assessment", in Vanclay, F & Bronstein, D. A (editors), *Environmental and Social Impact Assessment* (John Wiley & Sons, Chichester) pages 3-30.

Quevedo, E.L. (1995). Environmental audit reports: proceed with caution. *Bio/technology* 13:44–45.

Petts, J. & Eduljee, G. (1994) Integration of monitoring, auditing and environmental assessment: waste facility issues. *Project Appraisal*, 9(4), pp. 231-241.

Rikhotso, W. 2015. Interview with the compliance officer on 15 January 2015. Department of Environmental Affairs.

Ross, W. Green, J. & Croal, P. (2001). Follow-up studies in cumulative effects: Management implications in developing nations.

Rossouw, N. & Wiseman, K. (2004). Learning from the implementation of the environmental public policy instruments after the first ten years of democracy in South Africa.

Ross, W. A. (2002). Environmental Impact Assessment. In: D Thompson (Eds.) *Tools for Environmental Management* (p. 231). Canada: New Society publishers.

RSA, Republic of South Africa (1989), *Environment Conservation Act, No 73 of 1989* (Government Gazette, Cape Town).

RSA, Republic of South Africa (1996), *The Constitution of the Republic of South Africa, Act 108 of 1996* (Government Gazette, Cape Town).

RSA, Republic of South Africa (1997), "The identification under section 21 of activities which may have a substantial detrimental effect on the environment and regulations 200 regarding activities identified under Section 21(1)", *Government Notices No. R 1182 and R1183*, (Government Gazette, Pretoria).

RSA, Republic of South Africa (1998), *National Environmental Management Act, No 107 of 1998* (Government Gazette, Cape Town).

RSA, Republic of South Africa (2006), *Regulations in terms of chapter 5 of the national environmental management act, 1998, Government Notice No. R. 385 and lists of activities and competent authorities identified in terms of sections 24 and 24D, Government Notices No. R. 386 and R. 387* (Government Gazette, Cape Town).

Sadler, B. (1996). Environmental assessment in a changing world: evaluating practice to improve performance. *Final report: International study of the effectiveness of environmental assessment*, Canadian Environmental Agency: Ottawa.

Saddler, B. (1998). Ex-post evaluation of the effectiveness of environmental assessment. In Porter A. L and Fittipaldi J. J (eds.) (1998) *Environmental Methods Review: Retooling Impact Assessment for the New Century*. Atlanta, GA, Army Environmental Policy Institute.

Sampson, I. & Visser, W. (2004). "Introduction", in I Sampson (editor), *The guide to environmental auditing in South Africa* (Butterworths, Durban).

Sandham, L. A & Pretorius, H. M (2008). A review of EIA report quality in the North West province of South Africa. *Environmental Impact Assessment Review*, **28**, 229–240.

Sandham, L. A., van Heerden, A.J., Jones, C.E., Retief, F.P. & Morrison-Saunders, A. (2013) Does enhanced regulation improve EIA report quality? Lessons from South Africa. *Environmental Impact Assessment Review*, **38**: 155-162
<http://dx.doi.org/10.1016/j.eiar.2012.08.001>

SA EXPLORER. (2012). Kimberley climate. [accessed from: www.saexplorer.co.za]
on 13 January 2012.

SAS Institute, Inc. (1999), SAS/STAT User's Guide, Version 9, 1st printing, Volume 2. SAS Institute Inc, SAS Campus Drive, Cary, North Carolina 27513.

Shah, A. Khan, S. Shah, M. H. Razaulkah, K. & Jan, I. U. (2010). Environmental impact assessment of infrastructure development in developing countries.

Shippey, K. (1997). Constructing Successful Environmental Management Plans for Building Sites, in proceedings IAIA-SA Conference, 1997.

Simpson, J. (2001). Developing a review package to assess the quality of environmental assessment reports of local authority structure and local plans in the United Kingdom.

Snedecor G.W & Cochran W.G. (1967). Statistical methods, Sixth Edition, The Iowa State University Press, AMES, IOWA USA. Chapter 4 and 11-12.

Sowman, M., Fuggle, & R., Preston, G., (1995). A review of the evaluation of environmental evaluation procedures in South Africa. *Environmental Impact Assessment Review* 15, 45–67.

Stafford, S. L. (2006). Rational or confused polluters? Evidence from hazardous waste compliance. *Contributions to Economic Analysis and Policy*, 5: Article 21.

StatSoft Inc., 2007. STATISTICA (Data Analysis Software System), Version 8. www.statsoft.com.

Sullivan-Sealey, K. & Cushion, N. (2009). Efforts, resources and costs required for long term environmental management of a resort development: the case of Bakers Bay Golf and Ocean Club, The Bahamas.

Tomlinson P, & Atkinson SF. Environmental audits: a literature review. *Environ Monit Assess* 1987;8:187– 98.

Vanderhaegen, M. & Muro, E. (2005). Contribution of European Spatial data infrastructure to the effectiveness of EIA and Strategic Environmental Assessment.

UNEP, United Nations Environment Programme (2002). *Environmental impact assessment training manual* (United Nations, Nairobi).

US EPA, United States Environmental Protection Agency (1992). *Principles of environmental enforcement*, EPA/300-F-93-001, US EPA: Washington.

Weaver, A. (2003). EIA and sustainable development: key concepts and tools, in Southern African Institute for Environmental Assessment (editor), *Environmental impact assessment in southern Africa* (Southern African Institute for Environmental Assessment, Windhoek) pp 3-10.

Wood, C. & Coppel, L. (1999). An evaluation of the Hong Kong environmental impact assessment system. *Impact Assessment and Project Appraisal*, **17**(1), 21–31.

Wood, C. (1999). Pastiche or postiche? Environmental impact assessment in South Africa. *South African*.

Wood, C. (2002). *Environmental Impact Assessment: a Comparative Review*, Harlow, Prentice Hall, 2nd edition.

Wood, C. M. (2003). Environmental impact assessment: a comparative review. 2nd edition. England7 Pearson Education Limited.

Wood, G. (1999). Post-development auditing of EIA predictive techniques: a spatial analytical approach.

Zaelke, D. Stillwell, M. & Young, O. (2005). What reason Demands: Making Law Work for sustainable development: *Environmental Compliance and Sustainable Development volume 1*.

Zar, J. H., 1998. Biostatistical Analysis (4th Edition). Prentice Hall, Upper Sadle River, New Jersey.

APPENDICES



2013-05-29

Ref. Nr.: 2013/CAES/100

To:
Student: MJ Shubane
Supervisor: Dr K Ramachela
Department of Environmental Sciences
College of Agriculture and Environmental Sciences

Student nr: 49127403

Dear Dr Ramachela and Mr Shubane

Request for Ethical approval for the following research project:

Analysis of Environmental Impact Assessment (EIA) compliance by developers in South Africa

The application for ethical clearance in respect of the above mentioned research has been reviewed by the Research Ethics Review Committee of the College of Agriculture and Environmental Sciences, Unisa. Ethics clearance for the above mentioned project (Ref. Nr.: 2013/CAES/100) is **approved** after careful consideration of all documentation submitted to the CAES Ethics committee.

The researcher is advised to uphold point 3 of the Metsimatala Communal Property Association as well as the IXun & Khwe Communal Property Association permission letter. Approval is also based on permission to gather data from Ample Solar employees as well as Groenwater and Platfontein communities. Acknowledgement of the use and handling of photographic material has been noted.

Please be advised that the committee needs to be informed should any part of the research methodology as outlined in the Ethics application (Ref. Nr.: 2013/CAES/100), change in any way. In this instance a memo should be submitted to the Ethics Committee in which the changes are identified and fully explained.

Kind regards,

Prof E Kempen,
CAES Ethics Review Committee Chair



University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 429 12 429 4150
www.unisa.ac.za

METSIMATALA COMMUNAL PROPERTY ASSOCIATION
P O BOX 1051, POSTMASBURG
8420

OBAIKENG KGORONYANE
CELL:0730889074
EMAIL:kgoronyane@gmail.com

To Whom It May Concern

APPLICATION FOR A CONSENT TO UNDERTAKE A RESEARCH FOR AMPLE SOLAR
HOLDINGS AT GROENWATER IN THE NORTHERN CAPE PROVINCE, SOUTH AFRICA.

This letter serves as to confirm that:

1. Mahlatse Shubane (I.D. number: 7710115633080), a Masters Student at UNISA (Student Number: 49127403) has been granted approval by the Metsimatala Community Property Association Chairperson to conduct a research at the Groenwater development project.
2. The student is also granted a permission to conduct interviews with the community members Groenwater for the purpose of data collection.
3. A copy of the final research documents will be forwarded to the Metsimatala Community Property Association Chairperson for approval.

We hope you find the above in good order.

Yours Faithfully


Signature

29-08-2013
Date

Chairperson :Metsimatala Community Property Association

Die !Xun & Khwe Vereniging vir Gemeenskaplike Eiendom

The !Xun & Khwe Communal Property Association

Privaatsak X 5055
Kimberley
RSA 8300

Reg no: CPA/97/0002(ACT,1996)

tel : (+27) 53 833 7045
☎ : (+27) 53 833 7075
✉ : xukhwex@lafrica.com
🌐 : www.xukhwe.co.za

To Whom It May Concern

APPLICATION FOR A CONSENT TO UNDERTAKE A RESEARCH FOR AMPLE SOLAR HOLDINGS AT PLATFONTEIN IN THE NORTHERN CAPE PROVINCE, SOUTH AFRICA.

This letter serves to confirm that:

1. **Mahlatse Shubane** (I.D. number: **7710115633080**), a Masters Student at UNISA (Student Number: **49127403**) has been granted approval by the The !Xun & Khwe Communal Property Association Chairperson to conduct a research at the Platfontein development project.
2. The student is also granted a permission to conduct interviews with the community members Platfontein for the purpose of data collection.
3. A copy of the final research documents will be forwarded to The !Xun & Khwe Communal Property Association Chairperson for approval.

We hope you find the above in good order.

Yours Faithfully


Signature

29/08/2013
Date

Chairperson : The !Xun & Khwe Communal Property Association



65 Swansway, Heuwelsig 8301
P.O. Box 1058, Kimberly 8300

t: +27 053 861 1514
f: +27 058 861 1516

www.amplesolar.com

To Whom it may concern

APPLICATION FOR A CONSENT TO UNDERTAKE A RESEARCH AT AMPLE SOLAR HOLDINGS PROJECTS AT GROENWATER AND PLATFONTAIN IN THE NORTHERN CAPE PROVINCE, SOUTH AFRICA.

This letter serves as to confirm that:

1. **Mahlatse Shubane** (I.D. number: **7710115633080**), a Masters Student at UNISA (Student Number: **49127403**) has been granted approval by the Project Manager at Ample Solar Pty limited to conduct a research at the Groenwater and Platfontein development projects.
2. The student is also granted a permission to conduct interviews with the community members and Ample Solar employees for the purpose of data collection.
3. A copy of the final research documents will be forwarded to the Ample Solar Project Manager.

We (UNISA, the student and the supervisor) will appreciate your cooperation and support during the tenure of his research.

Yours Faithfully

Signature

04/06/2013
Date

Project Manager: Ample Solar Pty Ltd

Directors: Andrew Kesiamang, Posholi Mapheshoane, Nompilo Dube

I (Mahlatshe Shubane) am a registered student with the University of South Africa (UNISA) studying for the Master of Science: **Environmental Management**. I am carrying out a study on the comparative analysis of environmental impact assessment (EIA) compliance by developers in the Northern Cape Province in South Africa. I would appreciate your input in this study by completing/filling in this questionnaire.

Answer the following questions.

1. Please indicate if the project had an environmental impact on any of the following?

Habitat of endangered flora and fauna or areas of high concentration of biological diversity ☐

Areas of unique cultural, historical, archaeological or scientific value

National park or other protected area ☐

Area subject to erosion, desertification, salinisation or other sort of soil damage ☐

Areas of social interest (e.g. habitats of indigenous or tribal groups) ☐

None of the above ☐

2. Has there any environmental accident at the project? Or the project had any administrative or court proceedings or public complaints due to environmental impacts?

☐

Yes, please specify below

☐

No

3. Will the project have significant actual or potential, beneficial or reverse environmental impacts (air emissions, liquid effluents, wastes, noise, significant resource requirements or adverse social impacts like relocation of human settlement)?

☐

Yes

☐

No

What kind of impacts?

4. Does the construction and operational phase of these developments cause the following environmental impacts?

- 4.1. Noise ☐
- 4.2. Air pollution (dust and other emissions) ☐
- 4.3. Impacts on water resources ☐
- 4.4. Health impacts ☐
- 4.5. Birds death ☐
- 4.6. Plants and animals ☐
- 4.7. Safety of the general public ☐

5. If yes, what is the mitigation measures being applied in order to minimise the negative impacts of the above-mentioned impacts?

Working Hours:

From 08h00 to 17h00 ☐

No work on holidays and Sundays ☐

Bunded storage tanks ☐

Appropriate traffic signs ☐

Working areas and access roads clearly demarcated ☐

Protective clothing used at all times ☐

Selective brush vegetation clearing ☐

No wastewater must be discharged into any storm water ☐

Firm, impermeable & chemical resistant to prevent contamination of ground water ☐

6. Are there generators and machinery used on site include drip trays?

Yes ☐ No ☐

7. Who was employed during the construction of the proposed development?

Local community ☐

Outside community ☐

And were environmental damages during construction such as:

Oil drip ☐

Cement mixing on the floor ☐

Throwing waste in the storm water ☐

Working on holidays and Sundays ☐

Animal killing ☐

Using plants for medicine ☐

8. Does the developer interact with the local community?

Yes ☐

No ☐

9. What form of interaction?

Meetings ☐

Site Notices ☐

Newspaper Advert ☐

10. Are the bird flappers installed along the power line?

Yes ☐

No ☐

11. How is environmental littering before and after the project? (E.g. things like plastics, bottles, papers etc).

Littering scale:

0= No litter ☐

1= Low litter ☐

2= moderate litter ☐

3= Bad litter ☐

4= Severe litter ☐

5= Extreme litter ☐

12. What kind of water was used to ease dust impacts during construction?

Drinkable ☐

Unclean ☐

13. Was sanitation available during construction?

Toilets ☐

Drinking water ☐

14. Male ☐ or Female ☐

15. Any other comments.
