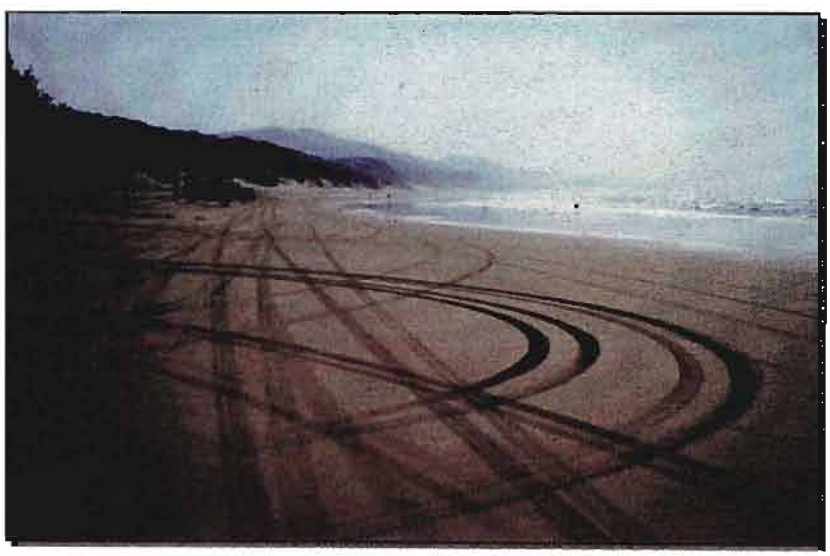
A LEGISLATIVE AND BIOPHYSICAL ASSESSMENT OF THE REGULATION OF OFF-ROAD VEHICLES ON SOUTH AFRICAN BEACHES



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ABSTRACT

The legislative management of Off-Road Vehicles (ORVs) on beaches has evolved over a period of time in response to a range of influences and changing circumstances within the various social, institutional, economic and biophysical systems.

The impact of ORVs on beaches in South Africa is multifaceted and when viewed holistically incorporates the interaction between the biophysical, social, economic and institutional environments. This Study focuses only on the legislative and biophysical environments associated with the impact of ORVs on beaches.

Sustainable coastal development draws attention to the "process" character of sustainable development that needs to be worked towards over time in an iterative manner. It highlights the need to take into account the current reality of prevailing circumstances, the uncertainty of the future, limited understanding of coastal ecosystems and communities, and the complex interactions between and within the human and non human components of the environment. An understanding of the ecological integrity and effective governance dimensions (being the focus of Study), although only two of the five dimensions of sustainable coastal development, contributes towards an understanding of the sustainability of the impact of ORVs on beaches within the South African context.

The legislative environment is investigated from the management perspective of the national Department of Environmental Affairs and Tourism. This Study determines whether effective governance is being achieved through the ongoing management of the impact of ORVs on South African beaches. The institutional management at a national level has resulted in the conditional banning of ORVs from beaches, which has resulted in promoting the ecological integrity of beaches, therefore contributing towards sustainable coastal development.

The physical system is investigated where appropriate in terms of the biophysical parameters within which ORVs are managed on beaches within the inter-tidal zone as per the ORV General Policy (1994). In order to understand the biophysical system within which ORVs are managed, the existing literature and research concerning the impact of ORVs on beaches is reviewed, including existing literature on beach geomorphology and beach biota. A Case Study

Area was selected for an experimental investigation to determine the biophysical impact of ORVs on sandy beaches. The experiment was conducted at Leven Point, north of Cape Vidal situated on the KwaZulu-Natal north coast within the St Lucia Marine Reserve.

The ORV General Policy (1994) has been superseded by the ORV Regulations (2001), which do not however, specify the biophysical delineation of the management of ORVs on beaches. This Study has included recommendations applicable to the management of ORVs on beaches in South Africa in terms of the ORV Regulations (2001). These recommendations advocate the conservation of the dynamic biophysical environment of the inter-tidal zone on beaches, and the need to take a sustainable coastal development approach to applications for Recreational Use Areas (RUAs) in terms of the ORV Regulations (dated 21 December 2001).

PREFACE

The work described in this dissertation forms part of a coursework MSc programme, and was carried out in the School of Life and Environmental Sciences, University of Natal, Durban, from January 2000 to December 2002, under the supervision of Professor G. Garland.

This study represents original work by the author and has not been submitted in any form, in part or in whole, to any other University. Where use has been made of the work of others, it has been duly acknowledged in the text.

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Jennifer Davey

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Prof. G. Garland

LIST OF ABBREVIATIONS

ECA:	Environmental Conservation Act, Act 73 of 1989
DEAT:	National Department of Environmental Affairs and Tourism
CALM:	Department of Conservation and Land Management of Western Australia
CWC:	Californian Wilderness Coalition
g:	Grams - measurement of mass of sand samples
GSLWP:	Greater St Lucia Wetland Park
HWM:	High water mark
KZN:	KwaZulu-Natal
KZNNCS:	KwaZulu-Natal Nature Conservation Services (now known as KZN Wildlife)
LWM:	Low-water mark
mm^3:	millimetres cubed
NCAU:	Natal Coast Anglers Union
NEMA:	National Environmental Management Act, 107 of 1998
ORV:	Off-Road vehicle
SASAA:	South Africa Shore Angling Association

SEACAM:	Secretariat for Eastern African Coastal Area Management
4WD:	Four Wheel Drive vehicle or 4x4 or Off Road Vehicle
4x4:	Off Road Vehicle, or Four Wheel Drive vehicle

LIST OF DEFINITIONS

Backshore: The Area on beach where organic material is deposited by the tides above the mean high water mark where the organic material is broken down by fungi and bacteria. It is an important nesting and roosting site for coastal seabirds as well as nesting sites for turtles. (SEACAM, 1999).

Beach: The unconsolidated sediment forming the unvegetated edge of the shoreline of the sea or an estuary that extends from the low-water mark landwards to higher features of the coast such as dunes, cliffs or vegetated soil.

Biophysical: The flora, fauna and geomorphological aspects that make up the biophysical component of the environment.

Coastal protected area: An area situated wholly or partially within the coastal zone that has been legally designated as a protected area for the purposes of conserving any aspect of the environment (Government Gazette No. 22960; 21/12/2001).

Coastal zone: An area adjacent to the sea characterised by coastal landforms, and includes beaches, dunes, estuaries, coastal lakes, coastal wetlands, land submerged by the waters of the sea, or of any estuary, coastal lake or coastal wetlands, boat-launching sites, proclaimed harbours and recreational use areas (Government Gazette No. 22960; 21/12/2001).

Compaction: The application of forces to a soil mass which results in an increase in density and strength (Webb, 1982).

Dune: A mound or ridge of loose wind-blown material, usually sand, whether covered by vegetation or not. (Government Gazette No. 22960; 21/12/2001)

Estuary: A partially or fully enclosed body of water which is open to the sea permanently or periodically, and in which the water level rises and falls as a result of the action of the tides whenever it is open to the sea. (Government Gazette No. 22960; 21/12/2001)

High water mark: The highest line reached by the waters of the sea or of an estuary during either spring tides or ordinary storms occurring during the most stormy period of the year, excluding exceptional or abnormal floods. (Government Gazette No. 22960; 21/12/2001)

Impact: The influence caused by an external factor on the environment, such as an Off-Road Vehicle's impact on the beach.

Inter-tidal zone: The area between the High water mark and the Low water mark. Beaches can be divided into two zones, comprising the backshore and inter-tidal zone. The inter-tidal zone plays an important role in filtering large quantities of sea-water and breaking down organic components through the action of bacteria in the sand. (SEACAM, 1999).

Littoral active zone: Comprised of beaches, dunes and sand bars in the surf zone and river estuary mouths, and are intrinsically linked by a continuous exchange of sand. (SEACAM, 1999).

Low-water mark: The lowest line to which the waters of the sea or of an estuary recede during periods of ordinary spring tides. (Government Gazette No. 22960; 21/12/2001)

Marine Reserve: An area situated within the coastal zone that has been designated as a protected area for the purposes of conserving the marine environment.

Median: The middle observation in a set of observations that have been ranked in magnitude.

Off-road vehicle: A vehicle that can be driven away from a road, that is usually a 4x4 vehicle, and for the purposes of this Study, is capable of being driven on sandy beaches.

Permeability: Refers to the rate of flow or drainage of water through sand (Brown and McLachlan, 1990).

Recreational use area: An area designated as such by the Director-General under regulation 5 (of the ORV Regulations). (Government Gazette No. 22960; 21/12/2001)

Statistics: Refers to the ways of organising, summarising and describing quantifiable data, and methods of drawing inferences and generalising upon them (Folwer, Cohen and Jarvis, 1999).

Sustainable coastal development: is defined as the process through which current and future generations realise their human potential, whilst maintaining diverse, healthy and productive coastal ecosystems, and minimising harm to other life-forms. It is not only about coastal ecology or economics, and includes the social, cultural and governance dimensions as well. (Glavovic, 2000).

Use: in relation to a vehicle includes driving, operating or being conveyed by, that vehicle. (Government Gazette No. 22960; 21/12/2001)

Vehicle: Any motorised conveyance that is designed to transport one or more persons on land and includes a trailer. (Government Gazette No. 22960; 21/12/2001)

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1 INTRODUCTION

1.1 Overview

This Study investigates the legislative and biophysical controls aimed at minimising the environmental impacts of ORVs on beaches in South Africa, and the contribution of these two elements to sustainable coastal development. It considers the changes in policy and legislation that govern the management of ORVs on beaches, and assesses the evolutionary progression of these successive changes.

A more in-depth focus is taken on the ORV General Policy (1994) due to its pivotal role in the institutional management of ORVs on beaches. A Conceptual Model of the ORV General Policy (1994) has been developed and compared to Cooper's (1996) Soil Conservation Policy Conceptual Model. Cooper's (1996) Conceptual Model on Soil Conservation Policy is described and a comparative analysis is undertaken with the ORV General Policy (1994) Conceptual Model, devised to explain the interacting elements of the events that followed the promulgation of the ORV General Policy (1994). Whereas Cooper's (1996) Soil Conservation Policy Conceptual Model identified that the key component was the perceptual element of the soil conservation policy environment, the ORV General Policy (1994) Conceptual Policy Model highlights the key component to be the institutional element. This is evident from the key role played by the national Department of Environmental Affairs and Tourism in instituting the management of ORVs on beaches in South Africa.

A specific landmark is the promulgation of the ORV Regulations on 21st December 2001, which came into effect on 20th January 2002. This Study therefore approaches the investigation by considering at the policy and legislation events that led up to the promulgation of the ORV Regulations, and the related events that have since followed. The changes in legislation have resulted in the general prohibition on the recreational use of vehicles in the coastal zone, and the provision of procedures for approving the use of vehicles in the coastal zone under specific circumstances.

Minister of Environmental Affairs and Tourism, Mr Vali Moosa's statements made at the beginning of Environmental Week, 4 to 8 June 2001, reflect the changing legislative environment. Minister Vali Moosa's stated: "We must act before it is too late to protect our environment." (Natal Witness, 5 June 2001), and was reported to say in his interview with the *Natal Witness* that the people of South Africa needed to change their attitude (Natal Witness, 5 June 2001). In his budget speech to Parliament Minister Moosa emphasised that the country's guiding principle must be sustainable development and sustainable use of natural resources. He proceeded to announce the publication of draft regulations aimed at prohibiting the driving of ORVs and other private vehicles on beaches (Natal Witness, 5 June 2001).

Sustainable coastal development draws attention to the "process" character of sustainable development that needs to be worked towards over time in an iterative manner. It highlights the need to take into account the current reality of prevailing circumstances, the uncertainty of the future, limited understanding of coastal ecosystems and communities, and the complex interactions between and within the human and non human components of the environment. An understanding of the ecological integrity and effective governance dimensions (being the focus of Study), although only two of the five dimensions of sustainable coastal development, contributes towards an understanding of the sustainability of the impact of ORVs on beaches within the South African context.

This Study determines whether effective governance is being achieved through the ongoing management of the impact of ORVs on South African beaches. The institutional management at a national level has resulted in the conditional banning of ORVs from beaches which has resulted in promoting the ecological integrity of beaches, therefore contributing towards sustainable coastal development.

This Study looks in greater depth at the biophysical system of ORV management and how existing research on the biophysical impact of ORVs has dictated the physical boundaries of ORV management. It includes a case study experiment conducted north of Cape Vidal at Leven Point during July of 2001. Leven Point is located within the Greater St Lucia Wetland Park and the St Lucia Marine Reserve. Refer to Figure 3 of

the Map showing the location of Cape Vidal and Leven Point. The purpose of the experiment was to determine the biophysical impact of ORVs on the beach between the high water mark and low water mark (inter-tidal zone). The physical boundary determined by the General Policy (1994) restricted ORVs on beaches to the area between the high water mark and low water mark. The experimental design, statistical results and interpretation thereof are detailed further in this Study.

Informal interviews and visual observation of the general use of ORVs on the beach at Cape Vidal was undertaken in May 2002 to assess the impact of the regulated use of ORVs on beaches at Cape Vidal. In order to provide a comparison, visual observations of the post-ORV Regulation impact at Cape Vidal were made in July 2001.

This Study therefore investigates the biophysical impact of ORVs on beaches as controlled by policy and legislation, and the actual biophysical impact of ORVs on beaches as determined by the case study experiment. The findings of the experiment are evaluated within the context of existing literature and research.

Recommendations are made that are relevant to the implementation of the ORV Regulations (dated 21 December 2001) in the determination of biophysical boundaries within which ORVs should be managed.

1.2 Research Questions, Aims and Objectives

The research questions effectively provide a framework of reference for this Study, and lead to the presentation of the overall aim, specific aims, and specific objectives.

The research questions are listed below:

1. What legislative changes have taken place to regulate the management of ORVs on beaches in South Africa?
2. Is there national and international research concerning the impact of ORVs within the inter-tidal zone on sandy beaches, and is the research applicable to the experiment conducted at Leven Point?

3. Are there biophysical impacts, such as the impact on the sand particle size distribution, density of the beach sand, and presence and distribution of ghost crabs, caused by an ORV at Leven Point on the beach between the high and low water mark (inter-tidal zone)?
4. Are the KZN Wildlife management staff at Cape Vidal able to provide information on the management of ORVs on the beach at Cape Vidal?
5. What will a visual assessment of the impact of ORVs on the beach before, and after the promulgation of the ORV Regulations at Cape Vidal illustrate?
6. Can recommendations be made based on the findings of the literature search, experimental investigation, informal interviews and visual observations, that will inform the future management and contribute to the physical delineation of ORVs on beaches in South Africa?"

The six research questions listed above lead to the overall study aim, which is:
"To undertake a legislative and biophysical assessment of the Regulation of ORVs on South African beaches".

The specific aims of each of the research questions are:

1. To determine whether there is a clear evolutionary progression in which successive acts seek to minimise the weaknesses of previous efforts, and whether the legal framework of environmental management has contributed to the progression in ORV management on beaches, and thus to sustainable coastal development.
2. To assess the existing research for its applicability to the Study and experiment at Cape Vidal in particular.
3. To determine whether there are any biophysical impacts caused by an ORV on the sand particle size distribution, density of the beach sand, and presence and distribution of ghost crabs within the experimental area.
4. To conduct informal interviews with appropriate management staff of the KZN Wildlife Cape Vidal Camp in order to source information on the biophysical impact of ORVs on the beach at Cape Vidal.
5. To determine whether there is an observable difference in the impact on the beach caused by ORVs before and after the promulgation of the ORV Regulations.

6. To prepare appropriate recommendations that will contribute the future management of ORVs on South African beaches.

The specific objectives that must be met to satisfy the overall aim of the research are:

1. To review and assess the changes in the legislative environment concerning the regulation of ORVs on beaches in South Africa.
2. To evaluate the findings of the experimental research within the context of the existing literature.
3. To assess the biophysical impact of an ORV on the inter-tidal zone of sandy beaches at Leven Point, located north of Cape Vidal within the St Lucia Marine Reserve.
4. To undertake informal interviews with key staff of KZN Wildlife at Cape Vidal (as the Case Study Area).
5. To undertake a visual assessment of the impact of the pre- and post-promulgation of the ORV Regulations at Cape Vidal.
6. To prepare recommendations within the context of the existing literature, the research findings, informal interviews, and visual observations in order to contribute towards the biophysical delineation within which ORVs should be managed on beaches in South Africa.

1.3 Thesis Structure

The research questions, aims and objectives discussed in section 1.2 above provide the framework for this Study.

Chapter Two contains the theoretical context of the Study, and looks at sustainable development theory, Coopers (1996) Conceptual Soil Conservation Policy Model, the literature findings on the biophysical impacts of ORVs on beaches, and overseas information on the management of ORVs.

Chapter Three contains the methodology followed to investigate the legislative management of ORVs on beaches and the literature search. It details the methodology and design of the field experiment at Leven Point, Cape Vidal and the statistical application and hypothesis formulation of the experimental results. Chapter Three

addresses the methodology applied for the selection of the most appropriate type of interview. This chapter describes the methodology applied for the visual observations and the preparation of recommendations.

Chapter Four includes the results of the methodology, these being the legislative management of ORVs on beaches in South Africa, the environmental legal framework, the findings from the beach survey at Leven Point, the findings from the informal interviews, and the findings of the visual observations.

Chapter Five undertakes a discussion of the interpretation of the results described in Chapter Four. It includes an assessment of the institutional and biophysical components of sustainable coastal development, the evolutionary progression in the legislative management of ORVs on beaches, and provides a comparative analysis of Cooper's (1996) Conceptual Soil Conservation Policy Model with the ORV General Policy (1994) Conceptual Model. Chapter Five looks at the evaluation of the median particle sand size, and discusses the findings of the statistical analysis of the sand densities. This chapter discusses the findings of the ghost crab populations, and the findings from the informal interviews and visual observations.

Chapter Six identifies the shortfalls of the investigation.

Chapter Seven draws various conclusions concerning the legislative management of ORVs on beaches in South Africa, and addresses the shortfalls in existing research. This chapter draws conclusions on the findings of the field experiment at Leven Point within the context of the existing literature. It includes conclusions drawn from the interviews and the visual observations.

Chapter Eight provides recommendations specific to the biophysical delineation of ORV access on beaches in South Africa, and identifies these recommendations as being applicable to the identification of Recreational Use Areas (RUAs) in terms of the ORV Regulations which came into effect on 20 January 2002.

Chapter Nine provides a final summary, drawing together the overall findings of the Study, which serves in effect to reach the stated aim of the Study "to undertake a legislative and biophysical assessment of the Regulation of ORVs on South African beaches".

2 THEORETICAL CONTEXT OF STUDY

2.1 Sustainable Development Theory

2.1.1 Defining Sustainable Development

Since the early 1960s people have become aware that the earth's environment is deteriorating rapidly and that a state of environmental crisis which cannot be sustained is approaching rapidly. Sustainable development is a concept that emerged from debates of the 1980s which focused on environment and development in a way which was not mutually exclusive (Oelofse, 1998).

The term sustainable development has been defined in many different ways. The most commonly accepted definition is that given by the World Commission on Environment and Development, commonly known as the Bruntland Report or Our Common Future (WCED, 1987) - Sustainable development is defined as *development that meets the needs of present generations without compromising the ability of future generations to meet their own needs.* The World Conservation Union (IUCN), the United Nations Environmental Programme (UNEP) and the World Wide Fund for nature (WWF) define sustainable development as *improving the quality of life while living within the carrying capacity of supporting ecosystems* (IUCN, UNEP, WWF, 1991). In both "World Conservation Strategy (IUCN, 1980) and "Our Common Future (Bruntland, 1987), sustainable development is identified as a realistic means of maximising human benefit without significant environmental costs, and without threatening economic growth. This definition focuses on the ability of the natural resource base to cope with development, strongly suggesting that there are limits that need to be considered in the natural environment, if environmental degradation as a result of poor development practices is to be prevented (Oelofse, 1998).

O'Riordan *et al.* (2000) are of the opinion that ever since the 1992 Earth Summit at Rio de Janeiro, the concept of sustainable development has supposed to guide the future pattern of economies, societies and environmental well-being. They are of the opinion that the notion of sustainability as a process of transition towards a more caring future for people and the planet while enterprise flourishes has gained topicality over the

years. Their paper looks at how a concept designed to be universal yet culturally distinctive, can be incorporated into patterns of socio-economic change while providing its own distinctive stimulus to the characteristics of that change (and provides a South African perspective, which is explored further in section 2.1.4).

Sustainable development is a broad term, which is general and vague, and it is often criticised because it means different things to different people. However it is useful as it provides a framework that can be applied at different scales, global, national, regional or local, and in different contexts and different places. It conveys an approach to development which aims at finding solutions to all current and future social, economic and environmental problems (e.g. poverty, disease, pollution, loss of biodiversity, employment). If a society accepts sustainability as a goal then it must develop economically and socially in a way which minimises the impacts of its activities, the costs of which are borne by future generations, and in instances where costs and impacts are unavoidable, then compensation must be made to future generations (Kerry-Turner, 1995).

2.1.2 The Four Components of Sustainable Development

According to Oelofse (1998) there are four key components that need to be considered when working towards sustainable development. These are futurity, ecological integrity, social justice and public participation as detailed further below.

Futurity refers to the stock of both natural and human capital that should be passed on to future generations. Sustainable development is therefore future oriented in that it aims to ensure that future generations are at least as well off as people living now. This is known as intergenerational equity, in other words fairness between generations. The resource base should not be exploited or the earth's life support systems damaged to the extent that future generations cannot support their needs or have access to a reasonable quality of life. The precautionary principle is applied in decision making in an attempt to reduce the impact that people have on the environment. The precautionary principle says that if the impacts or implications

of actions are unknown, then the activity should not be carried out, or at least it should proceed with caution.

Ecological integrity refers to the healthy functioning of natural systems. This component of the definition of sustainable development refers to the notion that if we are to enhance the quality of life of all people on the planet, then we need to look after the ecological life support systems of the earth. However, these systems are known as the global commons as they do not belong to anyone in particular and so are open to be used freely and with little control. International treaties and agreements, regulate how countries and corporations can utilise these important global sinks, but they continue to absorb vast amounts of waste which extend beyond their carrying capacity or ability to process these wastes. Smaller scale ecological systems also need to be able to sustain themselves, both for the healthy functioning of the planet as a whole, and in terms of the local functions they perform. Maintaining biodiversity and reducing the impact of pollution on ecosystems are probably the two most important environmental considerations at regional and global level.

Social justice refers to meeting the needs of present generations, particularly those that are marginalised and impoverished, through wise development and planning. However, development that ignores the broader context of the environmental well-being will not improve the quality of life of people in the long term. The difficulty in applying principles of social justice is that they imply a redistribution of resources. However, principles of social justice can be used to determine how the most vulnerable members of society can be compensated for the problems they experience.

Public participation is seen as critical in achieving sustainable development. A broad range of stakeholders needs to be involved in decisions regarding areas or regions that they have an interest in. Participation refers to the active involvement of well informed people, who are enabled and empowered to play a role in environmental decision-making. Local Agenda 21 is an internationally recognised

programme which aims at developing partnerships between different stakeholders so as to aim toward sustainable development at the local authority level.

2.1.3 The Sustainability Agenda

By the 1990s the normative theory of sustainable development was accepted as the overarching framework for environmental management (O'Riordan, *et al.*, 2000). This sustainability agenda recognises the importance of maintaining ecological systems while developing and enhancing social capital, involving people in decision-making, addressing issues of social justice, and ensuring that decisions taken are economically viable and sustainable (O'Riordan, *et al.*, 2000). Even with its theoretical focus on ecological and social issues, the formation of policy and legislation and technical approaches to environmental management was and continues to be shaped by science, with an emphasis on the green agenda (Scott *et al.*, 2001).

The World Commission on Environment and Development (WCED, 1987) and the Rio Earth Summit in 1992 placed the environment on the global agenda. The pre-Rio debate was about putting green issues on the global agenda, and the Rio Conference linked environment and development (Munnik, 2001). The Rio+10 Summit in Johannesburg focussed the international communities attention on environmental issues, with poverty and the environment being the main issue under discussion (Munnik, 2001).

The World Summit on Sustainable Development (WSSD) met from 26 August – 4 September 2002, at the Sandton Convention Centre in Johannesburg, South Africa. The WSSD's goal, according to UN General Assembly (UNGA) Resolution 55/199, was to hold a ten-year review of the 1992 UN Conference on Environment and Development (UNCED) at the Summit level to reinvigorate global commitment to sustainable development. The WSSD also negotiated and adopted two main documents: the Plan of Implementation and the Johannesburg Declaration on Sustainable Development. The negotiations began with two days of informal consultations on 24-25 August, and continued over the course of the WSSD. Major areas of disagreement included: time-bound targets for sanitation, renewable energy, energy subsidies, chemicals and health, natural resource degradation, biodiversity loss and fish stocks; Rio Principles 7

(common but differentiated responsibilities) and 15 (precautionary approach); governance; trade, finance and globalisation; the Kyoto Protocol; and health and human rights. (Earth Negotiations Bulletin, 2002).

The Plan of Implementation is designed as a framework for action to implement the commitments originally agreed at UNCED and includes eleven chapters: an introduction; poverty eradication; consumption and production; the natural resource base; health; Small Island Developing States (SIDS); Africa; other regional initiatives; means of implementation; and institutional framework. The Johannesburg Declaration outlines the path taken from UNCED to the WSSD, highlights present challenges, expresses a commitment to sustainable development, underscores the importance of multilateralism and emphasises the need for implementation. (Earth Negotiations Bulletin, 2002).

2.1.4 The South African Perspective

According to O'Riordan *et al.* (2000) there is a serious attempt to replace the once popular phrase, "sustainable development" with a new northern-driven word, "sustainability". In principle, this is a good idea, because sustainable development has passed its shelf-life. Sustainability becomes less of an objective and more of a pathway, or a transition, to a state where nature and humanity have come to terms with themselves in a demonstration of mutual respect and forgiveness.

Sustainability is a very broadly based policy arena: its success lies in capturing economically and democratically redistributive processes and placing them in ecological and social frames of empowerment and mutual respect.

Patterns of governance at national, provincial and local levels are changing towards greater democratic accountability and integrated development (O'Riordan *et al.*, 2000).

For South Africa, this issue of protecting natural life support processes that are collectively owned but invisible to the day to day life chances of the poor and the marginalised, is difficult. We are talking here of two sets of life-saving support systems, namely the bio-physical functions that provide fertility and absorb waste, and

the socio-cultural norms that maintain the strength and stability of communities. Damage to the first creates *criticality,* the progressive incapacity to sustain life as we know it. Break up of the second leads to *vulnerability,* or the sequential incapacity of societies to cope with their threats. To combine criticality and vulnerability into a degrading and debilitating coupled relationship leads to fundamental non-sustainability. This is because the perverse interactions of criticality and vulnerability progressively undermine self-generating capacities for correction and survival. (O'Riordan *et al.*, 2000).

2.1.5 Sustainable Development in South Africa

Sustainable development or sustainability provides the broad overarching theoretical framework for environmental management in South Africa. However, there is no certainty about what sustainability means. Environmental management can be approached from a weak or strong sustainability perspective. Weak sustainability provides a technical and scientific approach to environmental management. It maintains the status quo and promotes the use of science and technology to solve environmental problems (Turner, 1993). Strong sustainability provides a far more radical approach to environmental management. It questions how underlying forces, such as the structures of society, have resulted in the environmental crisis. It challenges the mainstream green agenda and seeks to address issues of social and environmental justice so as to ensure sustainability. Research into sustainability in South Africa mirrors both of these approaches.

2.1.6 Strong and Weak Sustainability

According to Rees (1999) traditional environmental economists favour a weak sustainability criterion in which the aggregate stock of manufactured and natural capital must be held constant (Nordhaus, 1992; Pearce *et al.* 1989, 1990; Pezzey, 1989). By this criterion it is of little consequence if natural capital assets are depleted provided that part of the returns are invested in creating an equivalent value of manufactured capital. Weak sustainability is favoured explicitly by most economists and implicitly by most development planners (Rees, 1999).

Ecological economists generally regard natural and manufactured capital to be complements rather than substitutes and also believe there are many essential life-support services for which there is little possibility that technology could find an adequate substitute (Rees, 1999). The ecologically minded therefore support a strong sustainability criterion in which both renewable natural capital and manufactured capital must be held intact separately (Constanza and Daly 1992, Daly 1990, Rees 1990, Victor *et al.* 1994). This more risk-averse version of the constant capital stocks criterion can be stated as follows: "each generation should inherit an adequate per capita stock of both manufactured and self-producing natural assets no less than the stock of such assets inherited by the previous generation." (Rees, 1999).

2.1.7 The Spectrum of Sustainable Development

A variety of different perspectives have been used to approach the concept of sustainable development (Pezzey, 1992; Turner, 1993). According to Gibbs *et al.* (1998) a spectrum of perspectives can be identified ranging from a technocentric "very weak sustainability" position through to an ecocentric position of "very strong sustainability" (see the Table below). This spectrum from weak(er) to strong(er) versions of sustainability is important because the way in which sustainable development is defined and operationalised crucially shapes how the economy and the environment are integrated. Advocates of weak sustainability approaches assume that there is a very high degree of substitutability between human capital and natural capital (Pearce *et al.*, 1994). In these approaches environmental concerns assume a higher priority in economic policy, but there is no specification of the environmental quality to be achieved (Gibbs *et al.*, 1998). The emphasis will effectively be on raising environmental efficiency, that is, reducing the environmental impact of each unit of economic activity and addressing individual parts of the economy, such as forms or sectors, without an holistic approach to the environment (Gibbs *et al.*, 1998).

Strong versions of sustainability, however, take issue with the assumption of almost infinite substitutability of resources and specify minimum levels of environmental quality to be achieved prior to consideration of other goals (Turner, 1993). Strong versions of sustainable development begin from a presumption that society cannot simply let economic activity result in a continual decline in the quality and functions of

the environment, even though it may be beneficial in other ways (Daly and Cobb, 1989; Jacobs and Stott, 1992).

Table 1: The spectrum of sustainable development (source from Turner, 1993)

Version	**Features**
Very weak sustainability	Overall stock of capital assets remains stable over time, complete substitution between human and natural capital. Essential link between willingness to pay and sustainable development.
Weak sustainability	Limits set on natural capital usage. Some natural capital is critical, that is, non-substitutable. Related to the precautionary principal or safe minimum standards. Trade-offs still possible. Not all ecosystem functions and services can be adequately valued economically. Uncertainty means whatever the social benefits foregone losses of critical capital are not possible.
Strong sustainability	Not all ecosystem functions and services can be adequately valued economically. Uncertainty means whatever the social benefits foregone losses of critical natural capital are not possible.
Very strong sustainability	Steady-state economic system based on thermodynamic limits and constraints. Matter and energy throughput should be minimised.

Rees (1999) is of the opinion that environmental assessment, pollution control and environmental standards legislation, growth management strategies, and similar measures are steps in the right direction and can produce positive local effects. However, Rees (1999) states that they remain largely reactive, are often plagued by problems of inter-jurisdictional co-ordination, and are frequently undermined by indifferent implementation and lax enforcement, and have not significantly changed fundamentally unsustainable environment-economy relationships. Global change has accelerated with the expansion of energy and material throughput and the expansion of the ecological footprint of the human economy throughout the world. This suggests

that sustainable development is a new kind of development that requires a transformation of both human-to-nature and people-to-people relationships on the local to global scales. Rees (1999) states that there is more to be gained from changing behaviour and values that there is from technological fixes, and presents a minimal set of 'necessary conditions' for sustainability which stress the need to reconcile the ecological, cultural and economic dimensions of human well-being.

2.1.8 Necessary Conditions for Global Sustainability

According to Rees (1999) ecological stability requires that:

- Consumption by the economy of the products and services of nature be compatible with rates of production of the ecosphere.
- The production of wastes by the economy remain within the assimilative capacity of the ecosphere.
- Economic activity protect the essential life-support functions of the ecosphere, and preserve the biodiversity and resilience of the earth's ecological systems.

According to Rees (1999) geo-political security requires that:

- Society satisfies basic standards of material equity and social justice.
- Governance mechanisms are in place to enable an informed citizenry to have an effective participatory role in decision-making.
- People share a positive sense of community cohesion (local and global) and a sense of collective responsibility for the future.

The challenge of sustainability for the developed world is how to reduce our ecological footprints while satisfying the economic aspirations and socio-cultural needs of society (Rees, 1999).

2.1.9 Sustainable Coastal Development

The principles for coastal management contained in the "White Paper for Sustainable Coastal Development in South Africa" (April 2000) are listed in section 4.2.5.

In his book entitled: "Our Coast, Out Future: A New Approach to Coastal Management in South Africa" (December 2000) Glavovic breaks the phrase "sustainable coastal development" down into its component parts.

"Coast" is a qualifier – it is the context within which sustainable development is described by Glavovic (2000). The term coast is used to describe the place where land, air and sea meet: it is made up of the land that is affected by being near to the sea and the sea that is affected by being near to the land. Ultimately, however, promoting sustainable development is a global quest, with the coastal system forming just one part of the global environment that is affected by the actions taken at local, regional, national and international levels. (Glavovic, 2000).

"Sustainable" simply means enduring or long-lasting. It should not be taken to mean "stationary" or "status quo" – it is not merely about maintaining a particular set of conditions in perpetuity. Rather, in this context, the term sustainable draws attention to the timeframe of decision-making. It explicitly implies a longer timeframe than our immediate interests might otherwise dictate – it conveys the importance of thinking ahead to the legacy we leave for future generations. Linked with the word development, sustainable implies prudent use, long-term thinking and stewardship. (Glavovic, 2000)

"Development" can be narrowly defined as a process of advancement, growth or maturation. In this narrowest of senses, the term development seems to conflict with the notion of sustainability narrowly defined as long-lasting, rendering the phrase sustainable development a contradiction at best. But understood more broadly, the term development encompasses that which is central to meeting basic needs and improving the quality of life – it is fundamentally concerned with realising human potential. Development in this broader sense involves an economic dimension, including reducing poverty and promoting investment, employment and wealth creation, and a social dimension, including education, community relations and empowerment. Development in this sense is concerned with the fundamental human right to life, and the entitlement to achieve one's potential and live in dignity. The term development should therefore not be taken to simply mean "growth" – both the

qualitative and the quantitative economic and social dimensions are fundamental to the broader notion of development. Rampant or uncontrolled growth is often self-defeating. Development therefore has to do with meeting basic human needs and fostering human well-being; it should not be confused with simple greed and uncontrolled desires or wants. It is essentially the process of realising human potential. (Glavovic, 2000).

In the same way that the harmonies achieved in a choir cannot be produced by individual singers in isolation, the phrase sustainable development means more than either of these words on their own – i.e., the whole is greater than the sum of the parts. Returning to the coastal setting, coastal ecosystems provide the foundation for coastal development. To be sustainable, the nature and scale of coastal development initiatives must not exceed the capacity of coastal ecosystems to support human activities. (Glavovic, 2000).

"Sustainable coastal development" can thus be defined as the process through which current and future generations realise their human potential, whilst maintaining diverse, healthy and productive coastal ecosystems, and minimising harm to other life-forms. Sustainable coastal development is thus not only about coastal ecology or economics, it includes the social, cultural and governance dimensions as well. (Glavovic, 2000).

The next section looks at the dimensions of sustainable development identified by Glavovic (2000) in more detail.

2.1.9.1 Dimensions of Sustainable Development

The pursuit of sustainable development can be described as the process of simultaneously promoting ecological integrity, public co-operation, cultural vitality, economic prosperity and effective governance. These five fundamental dimensions of sustainable development:

- **Ecological integrity and natural capital**: Human existence is dependent upon the healthy functioning of the earth's essential ecological processes and life-support systems that provide the air we breathe, the water we drink and food we eat. The ecological integrity of the earth's ecosystems therefore needs to be

maintained. We need to learn to live off the "income" generated by natural capital, which includes the planet's air, water, land and biodiversity. Using up our natural capital might yield short-term benefits to some individuals, but it is ultimately an unsustainable development path for humanity. Maintaining the ecological integrity of coastal ecosystems thus lays the foundation for building a sustainable coastal society.

- **Public co-operation and social capital:** The term **social capital** describes the norms and networks of trust and reciprocity that foster **public or civic co-operation**. Virtues such as social trust tend to be self-reinforcing; whereas distrust tends to spiral down on itself, making public co-operation extremely difficult to achieve. Active participation in social institutions (such as churches and charity organisations) promotes public co-operation and is a precondition for both social and economic development. Continued efforts are therefore needed to build social capital to promote sustainable coastal development.

- **Cultural vitality and ethical capital:** The interests of people from many different backgrounds need to be reconciled in the pursuit of sustainable development. The deep-rooted set of values and beliefs that people draw upon in determining how they should behave and how they should resolve conflict can be thought of as **ethical capital**. Ethics, like culture, are not static – they evolve over time. Building ethical capital fosters, among other things, respect for the values, beliefs and practices of others. The ability of work together in a multicultural setting can be described as **cultural vitality.** A society characterised by cultural vitality, is well positioned to address the contradictions of poverty and affluence, to resolve the interests of current and future generations as well as build harmony between nature and humanity.

- **Economic prosperity and human, manufactured and financial capital:** Three interconnected forms of capital – human, manufactured and financial capital – lay the foundation for achieving **economic prosperity. Human capital** is rooted in the knowledge, skills, health and ability of individuals to work productively. **Manufactured capital** includes the basic infrastructure (such as transportation,

shelter, water, energy and communications), technology and other means of production that are the "tools" for economic activity. **Financial capital** includes the financial resources available to people, including savings, credit supplies and regular remittances such as pensions. Building up these stocks of capital is central to overcoming extreme deprivation and enabling people to live dignified lives and realise their potential. Prosperity does not necessarily imply just having more. A healthy, meaningful, productive and enriched life can be the result of living simply and wanting less in the way of material possessions. Current measures of economic progress, such as Gross Domestic Product, underestimate the value contributed by coastal ecosystem goods and services. For example, an oil spill can perversely end up being counted as an "economic benefit" because vast amounts of money are spent on cleaning up oil-damaged beaches, when the real social cost of such a disaster barely gets taken into account.

The challenge is to create an economy in which surpluses and technical knowledge are generated on a self-reliant and sustained basis. It requires that the modes of economic production and technology are designed to maintain ecological integrity whilst promoting economic and social development. It requires an economic system that ensures that costs and benefits are defined in their broadest social sense, and that social costs are internalised and not imposed on society at large, especially not on the marginalised, weak and vulnerable sectors of society. Economic prosperity is about meeting basic needs and improving the quality of human life – it is about the right to a healthy and productive life in harmony with other people and nature.

- **Effective governance and political and institutional capital:** Two forms of capital are central to building **effective governance** institutions. **Political capital** can be thought of as "political will" – the ability to pursue the common good rather than narrow or special interests. Political capital is built up by visionary leaders who are committed to promoting sustainable development. **Institutional capital** is rooted in the organisational character that determines the responsiveness and effectiveness of governance institutions, which include government agencies, the private sector and civil society oganisations. Together, these institutions construct

the "rules of the game" in society – they shape politics and are shaped by history. They are also the instruments for achieving desired outcomes in the public arena. Creating and maintaining effective governance institutions requires more than simply accumulating technical, financial and human resources. The morale and motivation of staff, together with how well people work together towards common objectives, profoundly affect how well governance institutions are able to perform.

Thus visionary leadership and an institutional culture that fosters learning, collaboration and self-improvement are central to building effective coastal governance institutions. This also requires political mechanisms that promote effective and meaningful public participation in decision-making; as well as openness, transparency and accountability in decision-making, with effective participation by major stakeholders, including groups such as women, indigenous peoples and the youth. It includes administrative mechanism that creates meaningful opportunities for public involvement, is flexible and has the capacity for learning and self-correction. It also includes legal mechanisms that are capable of ensuring that fairness and justice are accessible to all.

The concept of sustainable development thus draws attention to three critical considerations that are central to coastal management:

Firstly, the concept of sustainable coastal development draws attention to the complex, interconnections between the ecological, social, cultural, economic and governance dimensions of the coastal system, and to their interdependence. It draws attention to the fact that the coastal system is made up of natural and human components. In revealing the "systems" character of the coast, the concept of sustainable coastal development highlights the need for systems thinking in coastal management. It also draws attention to the challenge of making decisions under conditions of uncertainty and makes explicit the linkage between science and public policy. Achieving sustainable coastal development therefore necessitates an integrated process of decision-making and ongoing management. It explicitly recognises that we are living in a complex, dynamic and finite world, about which we have imperfect knowledge. But this should not cause us to postpone action, provided our actions promote human development, in its social,

cultural, economic and governance dimensions, and maintain the ecological integrity of coastal ecosystems.

Secondly, it draws attention to the importance of promoting equity amongst individuals of this generation, as well as between current and future generations. It also focuses attention on the need to promote harmonious relationships between humans and other species. It highlights the interconnections between ecological integrity, basic needs and human rights, as well as the relationship between population growth, wealth and poverty. Central to the concept of sustainable coastal development is the need to adopt proactive and anticipatory measures to promote human well-being, whilst retaining options for the future.

Thirdly, it draws attention to the "process" character of sustainable development – it is an ideal that needs to be worked towards over time in an iterative manner. It highlights the need to take into account the current reality of prevailing circumstances, the uncertainty of the future, our limited understanding of coastal ecosystems and communities, and the complex interactions between and within the human and non human components of the environment.

Sustainable coastal development is essentially concerned with realising human potential through coastal development that meets basic needs and respects human rights within biophysical constraints. Thus, it involves maintaining the integrity of coastal ecosystems so that both current and future generations can realise their potential and live in dignity.

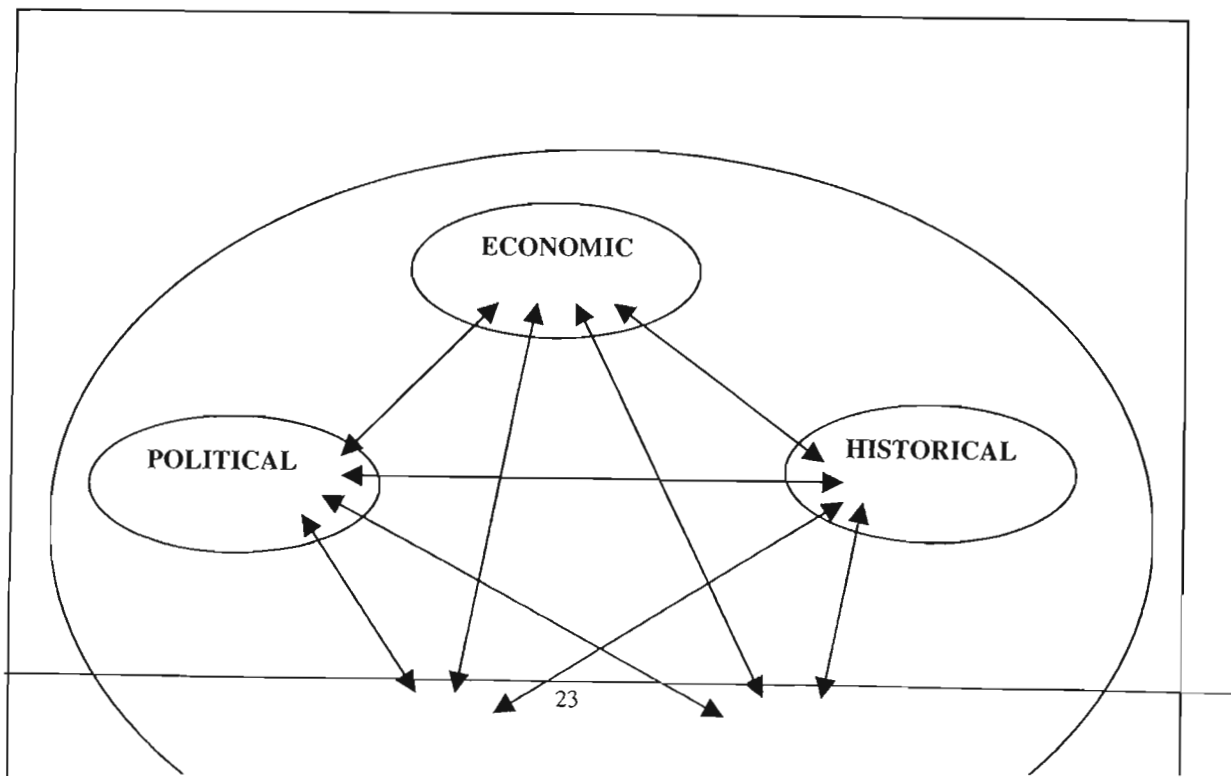
2.2 Cooper's (1996) Conceptual Model on Soil Conservation Policy

Reference is made to Cooper's (1996) conceptual policy model as described in her work entitled: "Soil conservation Policy in South Africa, 1910 – 1992: The 'Human Dimension'."

The purpose of incorporating Cooper's (1996) Conceptual Policy is to provide a conceptual model against which the ORV General Policy (1994) Conceptual Model (as described in section 5.2.1) will be compared.

Cooper (1996) evaluated the adequacy of South African soil conservation as indicated by four key legislative enactments formulated specifically to address soil erosion, using key elements of the World Soils Policy as a baseline. Cooper (1996) undertook a SWOT (Strengths, Weakness, Opportunities and Threats) analysis of the four key legislative enactments. The analysis of the four key acts revealed a clear evolutionary progression in which successive acts sought to build upon successes and minimise the weaknesses of previous efforts. The analysis revealed marked temporal variability in the extent to which each element was addressed and explored the multi-environmental constraints, identified as political, social, historical, economic and perceptual, on attainment of all goals.

Cooper's (1996) assessment permitted the compilation of what she termed the South African Policy Environment Model, which took the form of a working hypothesis. Five environments are featured in the model - the economic, political, historical, physical and perceptual environments, which individually and collectively shaped the South African policy environment represented in the Study. The analysis of each act was depicted in the form of a schematic matrix depicting the extent to which each act complied with the World Soils Policy objectives aimed at the sustainable utilisation of soil. The schematic matrix depicts the numerous variables identified in this analysis to be significant in shaping the contemporary South African policy environment, as included below in Figure 1.



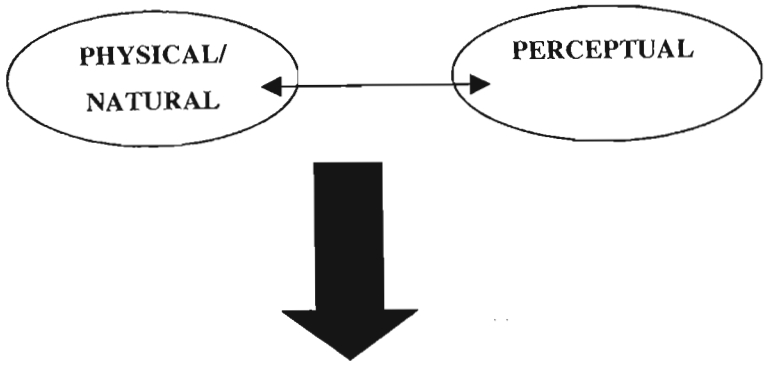


Figure 1: Cooper's (1996) conceptual model (as summarised) depicting the complexity of human interactions operative within the soil conservation policy environment.

Note as part of the diagram: The factors pertinent to each component identified in Cooper's (1996) study that significantly influenced the relative non-success of South African soil conservation policy, formulation, implementation, administration and enforcement, have not been included in the schematic diagram above, but included in the text below. Refer to Figure 7.1 in Cooper (1996).

Historical developments (both spatial and temporal) in the context of land use and degradation were shown to have contributed to the contemporary extent of soil erosion (Cooper, 1996). The economic environment posed a number of constraints to attaining conservation goals, as did the complexity of dynamics represented within the political environment, and the physical environment (Cooper, 1996). Cooper (1996) identified that it was the perceptual environment and the variables operative within this system that had been overlooked, and which are of importance to the ultimate success of soil conservation policy.

Cooper's (1996) hypothesis was tested using responses from a questionnaire survey. Cooper (1996) found that in spite of the apparent effort by the South African government to address soil conservation, contemporary opinion according to documentary evidence suggested that the policies formulated failed to attain soil conservation goals and reduce the extent and rate of land degradation. Cooper (1996) concluded that the ineffectiveness of policy could be ascribed to the following: lack of importance ascribed to soil; national level control; non-uniformity in application of law; inadequacies in the implementation of policy; paucity of

information on real nature and extent of problem; and, perceptions in an uninformed environment. The study submitted that key player's perceptions underpin and ultimately give rise to the relative effectiveness of soil conservation strategies.

The study identified a number of factors that operate within five dynamically interactive environments, namely the political, historical, perceptual and natural environments, considered influential in shaping the temporal and spatial variation in the policy environment represented in the study. The study identified from the examination of the multidimensionality of soil erosion, that soil erosion is also a problem of accountability; focus; priorities and government commitment; situational incompatibility; misinformed perceptions; and, timing.

Cooper (1996) submitted that lack of recognition of these inter-and intra-environment dynamics could account for the relative inefficacy of soil conservation policy to promote the sustained adoption of conservation practice. Such factors would have been overlooked due to the neglect of the 'human dimension' of the problem in South Africa in the period under review.

Cooper (1996) concluded that only be recognising the multidimensionality of the soil conservation policy environment and its components, can the past inefficacies be overcome. In order for South Africa to meet its challenges concerning the conservation and sustained utilisation of soil, the priority of policy developers must be the expedient adoption of a multi- and interdisciplinary approach to agricultural resource management, with particular emphasis on its 'human dimension'.

Cooper's (1996) conceptual model as depicted in Figure 1 above, contains the elements of the political, economic, physical, historical, and perceptual environment that comprise the model and which contributed to the soil conservation policy environment. These elements are indicated in the model, the details of which have been included below, as taken from Cooper (1996):

"POLITICAL ENVIRONMENT

- Pre-set/determined objectives/agendas of politicians and policy makers
- Ideology and culture – apartheid versus agriculture –

- a) different priority and aspirations
- b) differences in motivation and commitment
- c) justification for expropriation questionable
- d) prescribed extent of ministerial authority

- Resistance to change
- Lack of political will
- Agriculture and landuse policies -
  - a) land tenure
  - b) separate development
  - c) betterment
- Pass laws – mobility of labourers
- Extent of ministerial authority
- Party politics – importance of winning votes
- Interagency and interdepartmental co-operation and co-ordination
- Preferential treatment policies and mechanisms
- Conferment of land rights" (Cooper; 1996; Figure 7)

"PHYSICAL/NATURAL ENVIRONMENT

- Scientists norms – what is the real extent of the problem?
- Land ownership
  - a) no security of tenure
  - b) communal systems
- Demographics
- Fragmentation – land use
- Droughts/floods/disease – subdued enthusiasm for conservation
- Differentiation between geologic and accelerated (natural or anthropogenic) erosion
- Utilisation of marginal lands (inherently fragile, vulnerable and char. by steep slopes)
- Uneconomic viability of plots
- No provision for off-site consequences of soil erosion" (Cooper; 1996; Figure 7)

"ECONOMIC ENVIRONMENT

- Insufficient allocation of State funds :
  - a) to promote soil conservation nationwide

- b) to support efforts of NGOs and statutory agencies

- Resource Constraints of :
  - a) NGOs
  - b) farmers
  - c) government Departments
  - d) state
- Migratory labour system – conflicting goals of the
  - a) department of Mines
  - b) department of Agriculture
- Agricultural dualism reflecting :
  - a) overemphasis economic production/commercial agriculture (increasing production levels)
  - b) neglect of subsistence agriculture/small-scale farming operations
- Profitability factor – soil conservation – in presence of alternative investment options
- Costs of implementing preferential treatment policies – drain on available resources for soil conservation." (Cooper; 1996; Figure 7)

"HISTORICAL ENVIRONMENT

- Colonial conquests for land – ignored geographical and political boundaries
- Colonial landuse practices :
  - a) cleared indigenous vegetation and trees and ploughed land
  - b) continuous cropping methods, mechanisation and irrigation
- Exceeding carrying capacity thresholds (relates to landuse policies of the past and present)
- Failure to manage landuse in entire catchments (relates to preferential policies)
- Inherited state of environment – with/without anthropogenic interference
- Agricultural policies – shaped structure of economy :
  - a) optimum resource use
  - b) betterment
  - c) separate development/rehabilitation
- Agricultural dualism" (Cooper; 1996; Figure 7)

"PERCEPTUAL ENVIRONMENT

- Uniqueness of individuals frame of reference/formation of attitudes, opinions and perceptions of :
  - a) judiciary
  - b) decision-maker
  - c) policy formulator
  - d) general public
  - e) government officials/ministers
  - g) farmers
- "Felt" needs – discrepancy in perception of – overexploitation of resources environmental perception and interpretation of reality determined by number of perceptual filters
- Risk perception – uncertainty and probability (consequences of inadequate data and scientific consensus)
- Intergenerational criterion :
  - a) time horizons
  - b) social relevance
- Perceived suitability of conservation approach :
  - a) curative
  - b) corrective
  - c) proactive
  - d) prevention
- Uneven popularity of issue :
  - f) consensus, awareness

- Discontent regarding extent of ministerial authority :
  - a) perception = dictatorial
  - b) opposition to "imposed obligations"
- Question of "who is to blame for soil erosion?" – cause speculative:
  - a) natural or anthropogenic?
  - b) state – imposition of economic pressures?
  - c) farmer – bad landuse practices?
- Inadequacy of educational efforts and focus" (Cooper; 1996; Figure 7)

"SOIL CONSERVATION POLICY ENVIRONMENT

Shaped and characterised by:

- Management of soil resources – failure of State to prioritise
- Approach to environmental resource management – general lack of commitment to coordinated and holistic management
- National level control:
  - a) microlevel applicability questionable; remotely relevant to farmers
  - b) poor co-ordination/co-operation different ministerial levels; conflicting priorities of government hierarchies
  - c) Implementation "top-down" approach – perceived paternalistic/dictatorial approach e.g. with regard to expropriation of land allocation of subsidies and enforcement of legislative controls
- Divergent perceptions of soil erosion – shaped by lack of scientific consensus/uncertainty, risk perception, intergenerational criterion and
- Reinforced by classical conditioning and social learning
- Inherent legacy of pre-Union land use and agricultural policies
- Contemporary :
  - a) systems of land tenure
  - b) preferential treatment white commercial agriculture
  - c) inadequacies in support mechanisms, structures, programmes, infrastructures, personnel, incentives and enforcement provided for in legislation
- Inadequate information baseline to inform policy decisions
- Conflicting interests :
  - a) state
  - b) agriculture
  - c) industry
- Preferential legislative provision for soil erosion control.
- Problematic communicability of legislation – multi – lingual population
- Legislation focus :
  - a) correction versus prevention
  - b) forestry versus soil conservation
- Institutional structures :
  - a) changing portfolios
  - b) inadequate representation from farming community

- c) question of conflicting priorities
- d) failure to address individual needs at microlevel

- Inadequate legislative enforcement :
  - a) non-reporting of contraventions
- b) policy of persuasion versus prosecution" (Cooper; 1996; Figure 7)

The above subsections have been referenced from Cooper's (1996) Model as depicted in the Soil Conservation Policy Model (Figure 7 of Cooper, 1996).

2.3 Literature Findings on Biophysical Effects of ORVs on Beaches

2.3.1 Introduction

The beach can be divided into two zones, the foreshore or inter-tidal zone and the backshore or berm (Zamemba *et al.*, 1979). The inter-tidal zone is defined as that part of the beach between the spring low water mark and the spring high water mark, while the berm is defined as that part of the beach between the spring high water mark and the dune margin (van der Merwe, 1988). The latter, often narrow, part of the beach is the site of heavy vehicle impact throughout the year (Zamemba *et al.*, 1979). Impacts on the berm were more clear-cut than on the inter-tidal beach face (Godfrey *et al.*, 1978). The berm is very heavily impacted, being a relatively flat surface covered only by the highest tides. It is here that drift accumulates, sea birds nest, and new dunes form if the beach is accreting (Godfrey *et al.*, 1978; Leatherman and Godfrey, 1979).

2.3.2 Beach Geomorphology

2.3.2.1 Introduction

Beaches adapt their shape very rapidly to changes in wave energy and dissipate this energy in minor adjustments of the position of each sand grain (Pethick, 1984). The beach is therefore able to maintain itself in a dynamic equilibrium with its environment due to the inherent mobility of its sediments (Pethick, 1984). Beaches are essentially energy sinks acting as a buffer between waves and the coast, a buffer which must dissipate energy without suffering any net change itself (Pethick, 1984).

The beach is not only characterised by wave-driven sand transport but also by aeolian (wind) transport in the backshore and dunes (Brown and McLachlan, 1990). Most beaches are backed by dunes and interact with them in terms of sediment budgets by either supplying or receiving sand (Brown and McLachlan, 1990). The sandy beach is therefore an extremely dynamic environment where sand, water and air are always in motion.

2.3.2.2 Sand

Sand originates mainly from erosion of the land and is transported to the sea by rivers. Beaches may also receive sand from biogenic sources in the sea such as from animal skeletons. The two main types of beach material are therefore quartz (or silica) sands of terrestrial origin and carbonate sands of marine origin. Other materials that may contribute to beach sands include heavy minerals, basalt (volcanic) and feldspar. (Brown and McLachlan, 1990).

The most important feature of sand particles is their size. Particle size is generally classified according to the Wentworth scale, in phi units. The particle diameter for sand according to the Wentworth size scale is indicated below (Brown and McLachlan, 1990):

Generic name	**Wentworth size scale range (∅)**	**Particle size (mm)**
Very coarse	0 to -1	1.0 to 2.0
Coarse	1 to 0	0.50 to 1.0
Medium	2 to 1	0.25 to 0.50
Fine	3 to 2	0.125 to 0.25
Very fine	4 to 3	0.0625 to 0.125

Fine sands, although holding more water than coarse sands, have lower permeabilities due to their smaller pore sizes (Brown and McLachlan, 1990). Permeability refers to the rate of flow or drainage of water through sand (Brown and McLachlan, 1990).

The penetrability of sand is of utmost importance to the macrofauna of sandy beaches as all species must be able to burrow into the substratum (Brown and McLachlan, 1990). Penetrability of the sand is related to particle size and porosity, but is also dependent on other factors (Brown and McLachlan, 1990). Resistance to penetration increases rapidly with depth below the surface of the sand, while it fell with increasing angle from the vertical according to Brown and Trueman's study (Brown and Trueman: in Brown and McLachlan, 1990).

According to Webb (1982) one of the most important and long-lasting effects of off-road vehicle use is the compaction caused by the force of rolling wheels, and compaction affects all soils in a different manner. Soils most susceptible to density increases are loamy sands or very coarse soils with a wide range of particle sizes.

2.3.2.3 Waves

In the context of sandy beaches, surface gravity waves are of primary concern, although internal and tidal waves may also be important. Surface gravity waves and the secondary currents they induce constitute the driving forces behind most processes occurring on open sandy beaches. (Brown and McLachlan, 1990).

Cornish (1898) suggested an hypothesis that briefly states that the higher onshore velocities and shorter durations will move both large and small particles in the onshore direction but that the lower offshore velocities will return only the finer material seawards (Pethick, 1990). Since the offshore velocities are of longer durations however there will be a net offshore movement of this fine material, that is, it will move further offshore than onshore during one wave period (Pethick, 1990). This hypothesis is known as *the null-point* hypothesis (Pethick, 1990). According to Pethick (1990) despite the internal coherence of this hypothesis and despite innumerable attempts to verify it using field and experimental data it has so far remained only a hypothesis, and attempts to construct theoretical beach profiles using the null-point have failed.

2.3.2.4 Sand Movement

Water movement results in shear stress on the seabed which may move sand off the bed into the water, where it can be transported. The coarsest sands occur around the break point and they generally become finer offshore and onshore, corresponding to the distribution of current velocities (Brown and McLachlan, 1990).

As shear stress on the bed increases with a shoaling wave, a point is reached where drag on sand particles becomes sufficient to rock them back and forth. Closer inshore this movement is accentuated (Brown and McLachlan, 1990).

Sand can be transported in two modes – as bed load and as suspended load. Bed load is defined as that part of the total volume of material moving closer to the bed and not much above ripple height. Suspended load is that part transported above the bed. Coarser material is mainly carried as bed load. This transport may be in a longshore, as well as in an on-offshore direction. (Brown and McLachlan, 1990).

2.3.2.5 Interaction Between Beach Slope, Waves and Particle Size

The steeper the waves and beach, the greater the tendency for accretion. If a beach consists of very coarse material, such as pebbles, uprunning swashes tend to drain into the beach face thereby eliminating backwash. Sand or pebbles carried are thus carried up the beach but not back again, resulting in a steep beach. Fine sand beaches stay waterlogged because of their low permeability, so that swash is followed by a full backwash, which flattens the beach by removing sand suspended by the swash. Thus the coarser the sand, the steeper the beach face for a given regime of wave action. (Brown and McLachlan, 1990).

Beach slope is therefore not merely a function of particle size, but is a relationship between beach slope, sand particle and wave action (Brown and McLachlan, 1990).

2.3.2.6 Water Filtration by the Sand

Large volumes of sea-water are filtered by the inter-tidal and sub-tidal sand bodies of beaches (Brown and McLachlan, 1990). In the inter-tidal zone this occurs by swash flushing of unsaturated sand and in the sub-tidal by wave pumping, that is by the pressure changes associated with wave crests and troughs (Brown and McLachlan, 1990).

Most input occurs on the upper beach around high tide. This water drains into the sand in a series of pulses, each corresponding to a swash. Water seeps out of the beach slowly by gravity drainage, mostly below the mean tide level. The volume of water filtered increases with coarser sands and steeper beaches. Fine-grained beaches

filter smaller volumes but the water has a greater resistance time in this sediment than in coarser beaches (Brown and McLachlan, 1990).

2.3.2.7 Geomorphic Effects of Off-Road Vehicles on Beaches

The damage caused by off-road vehicles on the non-vegetated beach-face was studied at Cape Cod (Leatherman and Long, 1977) and at Fire Island (Anders and Leatherman, 1981) by the University of Massachusetts, Amherst. In areas affected by wind it was found that ORV tracks resulted in larger and higher velocity turbulent eddies near the surface, which would increase sand transport. Vehicular tracks generally resulted in accretion on the beach backshore. The vehicle tracks can act as sediment traps when a carpet of sand is being blown over the surface by the wind (Leatherman and Long, 1977; Wilcock and Carter, 1975). On the foreshore, ORV tracks accelerate beach erosion (Anders and Leatherman, 1981). It was found that twice as much suspended sediment was present in the backwash of impacted sites as compared to adjacent unimpacted sites (Anders and Leatherman, 1981). During a three-year experimentation period, it was found that the sediment of the impacted sites was approximately 25% more mobile than the control sites. Vehicular passage also breaks the salt crust, when present, and this can initiate aeolian transport of sand (Leatherman and Long, 1977; Leatherman and Godfrey, 1979; Schneier, 1987). With an offshore wind, this sand can be blown towards the ocean and lost to the longshore current system. Direct displacement experiments showed that ORV traffic compacts beach sand at depth, but loosens the surface of the beach, thus rendering it more susceptible to aeolian and/or swash activity (Anders and Leatherman, 1981). The first few passes along the beach through a track displace the most sand, and each succeeding pass results in less sediment movement (Anders and Leatherman, 1981).

Schoeman[1] found that compaction is reduced by ORV tracks. According to Schoeman ORVs do not compact the sand, they loosen it and this pattern is apparently true both for the inter-tidal and supra-littoral zones. This means that the sediment becomes more easily available for wind and water transport, thereby influencing sand

[1] Personal communication, 6 June 2001

particle size distribution patterns across beaches, which is likely to be reflected in beach gradients and biotic communities.

The study conducted by (a group of students at the University of Natal, Durban) Almond, Diederichs and Lebohang (undated; unpublished) found that: "The passage of vehicles over the sand surface causes the sand below the surface to become compacted. The surface of the sand is not compacted by these vehicles, and the density here may, in fact, be decreased by the horizontal forces exerted by the wheels of the vehicles." Their study did not extend to beach erosion, however. One hypothesis was based on the likelihood of the churning action of wheels causing the smaller particles to be made available for wind erosion. Their investigation on the variance of sand particle size showed no significant difference between the driven and undriven areas of the Umlalazi Beach, KwaZulu-Natal. Their conclusions were the following: "It has been stipulated in the past that surface sand that has been disturbed by vehicles is likely to be affected by wind erosion. Our study conclusively shows no significant effect of this kind."

Some profiles exhibited beach erosion following heavy traffic (Leatherman and Long, 1977). Over a three-year period, it was shown that beach profiles on impacted sites are more variable that the profile on unimpacted sites (Anders and Leatherman, 1981). Although it can be reasoned that ORV – induced changes to the beach are unimportant, particularly when compared to storm-generated beach erosion, Leatherman and Long (1977) came to the tentative conclusion that smaller scale modifications of the beach profile by vehicles can possible be significant on an incremental basis. Recreation pressures increase the mobility of sand both within and between the beach and dune systems, and render the coast more liable to storm erosion (Carter, 1975; Leatherman and Long, 1977; Anders and Leatherman, 1981).

It is important to compare natural rates of change in the volume and topography of beaches with those which may be induced by ORV traffic when evaluating the environmental effects of ORVs on beach systems (Niedoroda, 1975). In systems where large natural changes take place, ORV traffic is not expected to have

significant effects on the system. Three estimates are needed to determine how significant or insignificant this traffic can be.

These are:

1. An estimate of the long term loss or gain of sand in any of the beach systems;
2. An estimate of the total annual change in the volume of the beach prism in both accreting and eroding systems; and,
3. An estimate of the maximum change which may be introduced by recreational vehicle traffic (Niedoroda, 1975).

At Cape Cod it was determined that 20,2 cubic metes of sand per linear meter of beach face were lost from eroding beaches each year (Zeigler cited in Niedoroda, 1975). Although it is more difficult to estimate the total amount of sand which is gained on accreting beaches, because the sand can be moved to deposits offshore or accumulate as sand dunes, a reasonable estimation of net gains is in order of 10-20 cubic metres per linear meter (Niedoroda, 1975). According to Niedoroda (1975) close to 150 cubic meters of sand per meter of beach front are exchanged between the onshore beach prism (beach face sand bar) and the offshore beach prism (surf zone sand bar) over an annual cycle, whether the beach is accreting or eroding. Compared with the estimates of annual loss or gain from a beach, it can be seen that an order of magnitude more sand oscillates between the offshore and beach prisms than is gained or lost from these zones. Therefore the annual onshore-offshore movement of sand is of greater importance in this Study than whether the beach is eroding or accreting (Niedoroda, 1975.)

The third estimate required involved the amount of sand, which can be transported by off-road vehicles driving on the beaches. Assuming that off-road vehicles drive along the steep portions of the active beach face, it should take approximately 10000 vehicle passages along a given profile to transport 150 cubic meters per meter of beach front down the beach face (Niedoroda, 1975). Anders and Leatherman (1987) found that the principal factors controlling the seaward displacement of sand are slope, sand compaction and number of vehicles passes in the same track. Their data suggested that the level of off-road vehicle use in the National Seashore at Fire Island could be contributing to the overall erosion rate by delivering large quantities of sand to the

swash zone (max. of 199 300m³/y). The downslope of sand can be reduced by an order of magnitude if proper management principles are applied (Anders and Leatherman, 1987).

The main factors controlling the seaward displacement of sand are slope, sand compaction and number of vehicle passes in the same track (van der Merwe, 1988).

2.3.3 Beach Biota

2.3.3.1 Introduction

Sandy coastlines are dynamic environments where physical habitat structure is determined by the basic elements of sand and water (Brown and McLachlan, 1990). Sandy beaches are devoid of living aquatic macrophytes and their flora consists of benthic microalgae and phytoplankton, both components often dominated by diatoms (Brown and McLachlan, 1990). Most invertebrate phyla are presented on sandy beaches, either as interstitial forms or as members of the macrofauna, or both (Brown and McLachlan, 1990).

Many of the adaptations which distinguish sandy-beach animals from those of other marine habitats result from instability of the substratum coupled with heavy wave action. Therefore burrowing behaviour displayed by animals inhabiting all types of soft substrata is both rapid and powerful on high energy beaches to ensure that the animal is not to be swept away by incoming waves and swash. (Brown and McLachlan, 1990). As an adaptation, typical sandy beach animals have developed tidal rhythms of migration which maximise food resources and possibly attenuation of predation (Brown and McLachlan, 1990).

Rhythms of activity are associated with the tidal ebb and flow. The danger of desiccation is not an over-riding concern as the animals can retreat below the surface of the substratum or even below the water table (Brown and McLachlan, 1990). Inter-tidal filter-feeders cannot feed while the tide is out. Macrofaunal arthropods and molluscs tend to leave the substratum and to show excursions up and down the slope

with the tides, particularly on exposed beaches showing a moderate tidal range (Brown and McLachlan, 1990).

2.3.3.2 Effects of Off-road Vehicles on Beach Flora

Driftlines often contain a large quantity of organic matter, which is quickly broken down by fungi and bacteria, thereby releasing nutrients into the sand and eventually back to the sea (Godfrey *et al.*, 1978; Leatherman and Godfrey, 1979; Zamemba *et al.*, 1979; Divisional Council of Dias, 1983; Brokensha, 1984; Schneier, 1987). The drift zone also contains fragments and seeds of dune plants and is, therefore, a significant site for new dune development on open sand (Godfrey *et al.*, 1978; Zamemba *et al.*, 1979; Divisional Council of Dias, 1983; Brokensha, 1984; Schneier, 1987). It was found that only a few vehicle passes could break up the concentrated organic deposit and destroy the regenerating plants above and just below the sand surface (Godfrey *et al.*, 1978; Leatherman and Godfrey, 1979; Godfrey and Godfrey, 1980). Vehicle traffic also crushes and kills seedlings of annuals and the young plants of perennials (Leatherman and Godfrey, 1979). The integrity of the driftline is therefore destroyed by off-road vehicle traffic as material is scattered about on the beach, and vehicle impact also decreases the rate of decay of organic material (Brokensha, 1984).

The shearing and compressional effects of vehicle passage extend to a depth of 20cm, and the sheer stress of the turning wheels disintegrate the drift and break the plant rhizomes (Leatherman and Godfrey, 1979).

It is clear that off-road vehicle traffic can cause significant geomorphic damage. On the back beach (shorewards of storm driftline) of accreting shores, vegetated mounds that are sometimes randomly scattered about the back beach deposits and sometimes arranged in semi-continuous lines form the origin of developing coastal sand dunes. These vegetated mounds (embryo dunes) are often formed by seed germination and not rhizome growth (Niedoroda, 1975). Off-road vehicle traffic flattens the mounds and destroys the seedlings, thus eliminating the frail processes required for the development of substantial back beach and sand dunes (van der Merwe, 1988).

2.3.3.3 Effects of Off-road Vehicles on Beach Fauna

Attempts to determine whether off-road vehicle traffic had an impact on meiofauna populations, interstitial algae or bacteria in the inter-tidal zone were unsuccessful as the high variability within the sample areas masked any correlation with vehicle damage (Godfrey *et al.*, 1978; Leatherman and Godfrey, 1979). On the driftline the bacterial counts were high, 1000 more numerous than in bare sand nearby (Godfrey, 1980) but were markedly reduced where vehicles pulverised organic deposits (Godfrey *et al.*, 1978; Leatherman and Godfrey, 1979; Godfrey and Godfrey, 1980).

The inter-tidal zone, the area between the high and low water marks, is fairly resistant to the impact of ORVs, although the soft sand close to the driftline is easily compacted, crushing small animals on and below the sand surface (http://www environment.gov.za/sacoast).

The least sensitive part of the beach is the lower inter-tidal zone, which has to be resilient to pounding waves. Here the sand is hard enough for driving, although animals feeding on stranded material, such as ghost crabs, plough snails, isopods and insects are still vulnerable to being crushed. (http://www environment.gov.za/sacoast).

2.3.3.3.1 Ghost Crabs

Ghost crabs (genus Ocypode) are amongst the most abundant and conspicuous of macroscopic invertebrates inhabiting the sandy beaches of the east-coast of South Africa (Jackson, Smale and Berry, 1991).

Crab abundance fluctuates seasonally, with a maximum of over 5000 per kilometre of beach (Jackson, Smale and Berry, 1991). The drop in winter figures is probably due to a decline in activity similar to that seen in *O. quadrata* on the east coast of the USA, where crabs remain confined to their burrows for 3 months during winter (Haley, 1972).

According to Berry (1976), there are three species of ghost crab on the east coast of Southern Africa and although all three can be found on the same beach, they occupy different levels on it, probably associated with differences in feeding habits and

degrees of tolerance of desiccation. The most abundant is *Ocypode ryderi,* the adults of which are usually pinkish-white and can be distinguished from the other two species by the presence of dark mauve pigmentation on the leg joints. *O. ryderi* lives highest on the beach, near the spring high tide level and scavenges for dead animals and edible seaweed amongst the debris of the strandline. Living slightly lower on the beach is *Ocypode madagascariensis,* the rarest East Coast species. It is extremely similar to *O. ryderi* in general appearance but it usually a more orange colour and lacks mauve pigmentation to the leg joints. It also feeds on stranded material but in the mid beach region. The third species is called *Ocypode ceratophthalma* and the adults, which are usually greenish, are unmistakable due to the presence of a conspicuous projection from the end of each eye, the function of which is unknown. This species lives lowest on the beach and is usually most abundant where flat rocks or sand flats are exposed at low tide on which it can scavenge.

According to Berry (1976), all ghost crabs are semi-terrestrial, but while they may live on land they must still return to the sea to breed. They have anatomical and behavioural adaptations that enable them to withstand the harsh environmental conditions of beaches such as daily fluctuations in sand temperature of between 20°C to well in excess of 60°C. Between the bases of the last two pairs of legs are tufts of water-absorbent hairs and while a crab briefly enters the sea or even just sits on damp sand, these tufts draw up water into its gill chambers which must always be kept moist. All species excavate burrows 1-1,5m deep in which they lie up during the heat of the day and where the moist atmosphere slows down evaporation from their gill chambers. They may even plug the entrance to their burrow with sand if evaporation is too rapid. Using the same strategy, they avoid dying of cold on winter nights when the temperature in their burrows remains several degrees higher than the air and sand temperature outside. Conditions on the beach are usually most favourable for them at night and they are largely nocturnal. However they do emerge during the day if it is cool and they are not disturbed by humans (Berry, 1976).

As the high water level is continually changing with the spring-tide/neap-tide cycle it is necessary for ghost crabs to constantly dig new burrows at the appropriate level on the beach. Furthermore, the timing of their daily activities such as resting, feeding and burrowing is closely synchronised with the timing of the tidal ebb and flow (Berry, 1976).

Ghost crabs are eaten by many species of fish and also by birds such as gulls and even terrestrial predators such as genets. Because of their abundance – there are usually about 1500-3000 crabs per kilometre of beach – they play an important role in the coastal ecology of Natal. As omnivorous scavengers they present one of the main pathways by which the energy contained in stranded organic matter is channelled back to the food web of the adjacent sea and into the terrestrial foodweb (Berry, 1976).

In a study looking at the impacts of off-road vehicles on beach macrofauna on the Cape Lookout National Seashore (North Carolina) it was found that neither mole crabs (*Emerita talpoida)* nor *Donax variabilis* were damaged (Wolcott and Wolcott, 1984). During the day ghost crabs (*Ocypode quadrata)* were completely protected by burrows as shallow as five centimetres in both wet compacted sand and soft unpacked sand, but could be killed in large numbers while feeding on the foreshore at night (Wolcott and Wolcott, 1984; Bouwer, 1986). Crabs often congregate in large numbers on the wet sand near the waters edge, particularly at night, which increases their vulnerability to vehicles driving on the lower shore (Boon *et al.*, 1999). As ghost crabs have good sight and move rapidly, they can generally avoid being crushed during the day (Bouwer, 1986). At night, however, they have no effective escape response, as they usually respond to headlamps by 'freezing' or running towards the source of light and then often run under the wheels (Bouwer, 1986). Another problem is the ruts formed by vehicles. Many off-road vehicle drivers follow ruts mad by previous vehicles to facilitate their driving, thereby crushing the ghost crabs that have come to feed on the previously crushed crabs (Bouwer, 1986). The crabs are cannibalistic and will feed on conspecifics (animals of the same species) that have been crushed by passing vehicles, thus placing them in the path of the next vehicle using the same tyre tracks (Boon *et al.*, 1999).

Predicted population mortalities calculated from observed kills of ghost crabs per vehicle-km ranged 14-98% (Wolcott and Wolcott, 1984).

On northern Natal beaches, in the sanctuary area of the St. Lucia Marine Reserve, where vehicle utilisation is minimal, countless thousands of ghost crabs can be seen both day and night (Brokensha, 1984). On beaches where vehicle utilisation is practised they are far less common and in some cases absent (Leggett, 1975; Steiner and Leatherman, 1979; Brokensha, 1984). In a study to determine the human recreational impacts on ghost crabs (*Ocypode quadrata fab.*) Steiner and Leatherman (1981) found the mean density of crabs per 0,1 ha plots to be 10 on an undisturbed beach, 19 on a pedestrian impacted beach, 1 on a light off-road vehicle and pedestrian-impacted beach and 0,3 on a heavy off-road vehicle impacted beach. They suggested that off-road vehicles could be adversely affecting the crabs directly by crushing or burying them or indirectly by interfering with their reproductive cycle or altering their environment. It was thought that vehicular disturbance resulted in fewer crabs and no reproduction at all, with new inhabitants migrating from undisturbed areas. On sections of the beach used by ORVs ghost crab densities were lower and the sizes of their holes were significantly smaller than on unimpacted beaches. This indicates that most ghost crabs do not live long enough to develop into larger crabs (Leggett, 1975). Wolcott and Wolcott (1984) and Bouwer (1986) suggested that off-road vehicles be banned from the foreshore between dusk and dawn in heavily used areas to protect the ghost crabs.

Some preliminary experiments conducted by Bouwer (1986) on the effects of beach vehicles on ghost crab populations in the St Lucia Marine Reserve confirmed that more crabs are killed at night than during the day (Boon *et al.*, 1999). Bouwer (1986) found that the average number of crabs killed by a single passing vehicle was 2,9 crabs per kilometre at night and 0,6 crabs per kilometre during the day. The total mortality of crabs by beach vehicles will obviously depend on the number of vehicles that use the beach, the density of crabs on the beach and whether the vehicles used the beach by day or night (Boon *et al.*, 1999).

The Oceanographic Research Institute (ORI) has conducted extensive research on ghost crabs, first in the 1970's (Jackson *et al.*, 1991) and more recently in the early 1990s (Robertson, 1995). In view of its relative inaccessibility, Long Beach (Stanger, KwaZulu-Natal North Coast) was selected as a "control" site during the latter period for comparison with sites that were exploited or exposed to high human activity (Boon *et al.*, 1999).

Reference is made to the EIA Scoping Report prepared by Boon *et al.*, 1999): "ORI investigated the effects of beach traffic on ghost crab abundance during two surveys at Sodwana Bay. Counts of ghost crab burrows were made on three stretches of beach north of Sodwana Bay, exposed to varying levels of beach traffic. Area A (closest to Sodwana Bay) was heavily used by beach traffic, only 25 vehicles per day were permitted in Area B and Area C was only open to official vehicles and traffic was therefore very light. During the first survey, when crab populations consisted predominantly of small crabs, which had newly settled on the beaches, burrow numbers were different in the three areas, but the differences were not statistically significant. During the second survey, however, when more large crabs were present, there was a significant difference in burrow numbers at the three sites. Area A had an average of 180 burrows per kilometre, Area B an average of 320 burrows per kilometre and Area C and average of 440 burrows per kilometre. This suggests that beach vehicles may cause a reduction in the abundance of ghost crabs. However, it is not known whether the crab numbers are reduced by direct mortality or by the migration of crabs to more suitable beaches. This work also indicated that juvenile crabs will settle on beaches that may not prove to be suitable for their continued existence.

Ninety eight percent of the ghost crabs at Long Beach are the Pink Ghost Crab (*Ocypode ryderi).* This species is the most common species in KZN and is generally associated with steep, coarse-grained beaches such as that at Long Beach. The two other species of ghost crabs found on the KZN coast, the Madagascan Ghost Crab (*Ocypode madagascariensis)* and the Green Ghost Crab (*Ocypode ceratophthalmus)* are also found on Long Beach, but in very low numbers. Although the Pink Ghost Crab was also the most common species at Kosi Bay, the other two species were

much more abundant at Long Beach as the Kosi beaches are flatter and have a finer sand grain size, conditions which are preferred by these two species.

For the ORI research, crab abundance was assessed by counting the number of crab burrows in 10-m wide stretches of beach, starting at the dune vegetation and ending at the water's edge. The average number of crab burrows per kilometre on Long Beach during the sampling period (September 1992 to December 1994) was 4 871 (range 2 067 – 8 917). This is lower than the average numbers of crabs recorded on two stretches of beach in the Kosi Bay area over the same period of time [6 448 (range 975 – 22 024) and 7 155 (range 3 713 – 14 283)], but higher than the crab counts on a beach on the Durban beachfront exposed to a high level of pedestrian activity [2 792 (range 203 – 8 000)]. (Boon *et al.*, 1999).

Many more large crabs (>30mm carapace width) were found at Long Beach than at Kosi Bay, probably on account of the harvesting of crabs by local people at Kosi Bay. Thus, although ghost crabs were more abundant at Kosi Bay than at Long Beach, they were on average larger at the latter site. As a result, the average biomass (total dry weight of organisms in a given area or volume) of crabs per kilometre of beach was higher at Long Beach (3 548kg) than at either of the two Kosi Bay beaches (1 748 and 2 789kg respectively). Most of the crabs on the Durban beachfront beach were small and the average biomass was only 265kg per kilometre. The high biomass of crabs at Long Beach indicates that, at the time of sampling, the crabs were not heavily exploited and that the population was, on the whole, relatively undisturbed."

The unpublished findings of a study undertaken at Umlalazi Beach, KwaZulu-Natal by a group of students and looked at the effects of ORVs on the beach. The study undertaken by Almond, Diederichs and Lebohang (undated) investigated the density of beach sand, particle size and crab hole density at a number of points on either side of a fence, that formed the boundary between the driven side and undriven side of the beach. The Report concluded that ORVs have an effect on the sand and macrofauna of the beach. The investigation on the number and location of crab holes found that they appeared to be located away from areas of disturbance from

the passage of ORVs. The report found that: "The passage of vehicles over the sand surface causes the sand below the surface to become compacted... This effect may cause the death or migration of the macro-fauna dwelling in the sand."

2.3.3.3.2 Nesting Birds

In South Africa the White fronted Plover *Charadrius marginatus* is mainly confined to the sea shore, where on the east coast it occurs at average densities of about one bird per kilometre. These Plovers feed in the upper part of the intertidal zone, in the drift line and in the back-shore area. In KwaZulu-Natal the main breeding season s in July and August and the nest is usually situated near the high water mark. This species is not a prolific breeder and on average it takes five two-egg clutches to successfully raise one chick. The low breeding success is mainly due to heavy nest predation, but ORVs may crush eggs or kill the precocial young birds, which take refuge in tire tracks. Disturbing birds at the nest may also lead to breeding failure when exposed eggs overheat and the developing embryos die. (Boon *et al.*, 1999).

The Mozambique Nightjar *Caprimulgus fossii* is a widespread African species, which reaches the southernmost limit of its range at about the latitude of Durban, where its range is undoubtedly fragmented by habitat destruction. Significantly this species is reported to occur on the Zimbali Estate (reported by Nichols, as cited in Boon *et al.*, 1999).

In addition to the above mentioned species, Blacksmith Plovers *Vanellus armatus* do on occasion breed in the dune scrub in the vicinity of the mouth of the Tongaat Estuary (W. Robertson cited in Boon *et al.*), while other waterbirds, e.g. Water Dikkops *Burhins vermiculatus,* may also do so (Boon *et al.*, 1999).

It was found that birds can acclimate to vehicles passing very close to their nests, but they flush when persons or dogs approach (Blodget, 1978; Godfrey *et al.*, 1978; Godfrey and Godfrey, 1980). The danger in disturbing nesting birds so that they leave the nest is that the unprotected eggs can easily overheat and the developing chicks then die. When nesting colonies are protected by fences, and drivers obey the rules, the impact of ORVs on birds can be minimal, especially where the beach is

wide. On narrow beaches where there are nesting sites there will be direct confrontation between vehicles and birds. Once the chicks hatch there are new problems, the precocial nestlings begin running out of the colony, and on the approach of a vehicle they try to hide in tyre tracks (Godfrey and Godfrey, 1980). Disruption of feeding plovers and sandpipers by vehicles are minimal, but vehicles can be a constant menace to resting flocks at high tide (Blodget, 1978).

On beaches in the Eastern Cape, Oystercatchers, *Haematopus moquini,* often nest on or just above the high driftline and on beaches where there are no extensive mobile sand dunes the Whitefronted Plover, *Charadrius marginatus,* also breeds on the driftline (Schneier, 1987). According to Rabie (1980) and the Divisional Council of Dias (1983), off-road vehicles have a negative effect on breeding and feeding Oystercatchers and Whitefronted Plovers and in South West Africa the rare Damara Tern, *Sterna balanaearum.* On the Tongaland beaches, northern Natal, off-road vehicles have a significant effect on bird life, especially Sandpiper juveniles which suffer heavy mortality when they hide in vehicle tracks and are killed when beach drivers use the same tracks and run them over (Brokensha, 1984).

If nesting colonies are protected by fences and drivers obey the rules, the impact of ORVs on birds can be minimal (van der Merwe, 1988). Birds that do not breed in colonies can be very severely affected by ORV traffic (van der Merwe, 1988).

2.3.3.3.3 Sea Turtles

Two species of sea turtle nest on the beaches of Tongaland; the loggerhead, *Caretta caretta,* and the leatherback, *Dermochelys coriacea,* both listed in the Red Data Book as threatened species (Brokensha, 1984). Between October and February these turtles beach at night to lay their eggs on the high beaches and between December and March the hatchlings make their way to sea. It is during these times that they are interfered with man (Brokensha, 1984). The tyre ruts are also capable of trapping these turtle hatchlings which steer a course for the sea immediately after hatching, thus making them even more susceptible to predation that they already are, or making them unable to reach the sea before drying out (Schneier, 1987).

In addition, the deep tracks left by the vehicle act as an impassable barrier to turtles migrating up and down the beach (http://www environment.gov.za/sacoast). For example, on the northern coast of KwaZulu-Natal, loggerhead and leatherback turtles lay their eggs in the soft sand just behind the driftline, and after hatching the young must make their way down the beach to the sea. Turtle hatchlings that fall into the tracks may become trapped on the beach, leaving them exposed to predation and dehydration. (http://www environment.gov.za/sacoast).

2.3.3.3.4 Marine Resources

Because vehicles enable people to travel long distances along the beach and also allow them to carry heavy loads, they inevitably increase the exploitation of marine animals e.g. fish, crayfish and abalone (Rabie, 1980).

The investigation conducted by van der Merwe and van der Merwe (1991) on the effects of off-road vehicles on four inter-tidal macrofaunal species (the gastropod *Bullia rhodostoma*, the bivalves *Donax serra* and *Donax sordidus*, the benthic mysid *Gastrosaccus psammodytes*, and the supralittoral isopod, *Tylos capensis*) on an exposed sandy beach at the Sundays River, found that: "Inter-tidal species, with the exception of *G. psammodytes*, showed a high tolerance for vehicular traffic. The apparent vulnerability of *G. psammodytes* might have been a consequence of the experimental procedures used. The supralittoral species *T. capensis* was highly susceptible to vehicle impacting, the amount of damage sustained increasing as a function of the number of vehicle passes. This is caused by deep tracks ploughed by vehicles in the less compact sand above the drift line.

Van der Merwe and van der Merwe (1991) concluded that: "The amount of damage ORVs inflict on the inter-tidal macrofauna of exposed sandy beaches under normal conditions is small (0-5%). However, at upper levels of the beach the effect of impacting is considerable, with as few as 17 passes damaging 10% of the supra-littoral fauna. The tendency for drivers using this area to follow the same tracks accentuates this."

2.4 Overseas Information of Relevance to Study

2.4.1 Western Australia

The Department of Conservation and Land Management (CALM) of Western Australia permits public access to most areas they manage. While on CALM managed lands, all vehicles must be licensed under the Road Traffic Act and must comply with the regulations of this act. CALM may authorise the use of vehicles registered under the Control of Vehicles (Off Road Areas) Act in specific areas, but not on public roads. These areas are established specifically for the operation of trail and trial bikes, dune buggies and other recreational vehicles.
(http://www.calm.wa.gov.au/tourism/4wd_policy.html)

All vehicles are required to stay on established roads or tracks. Vehicles may only be used off a public road or track (e.g. a beach) if an area has been designated for such use. In the case of national parks and conservation parks, the designation of roads is conferred through the preparation of a management plan, which involves extensive public participation. The Department will permit people with disabilities to use motorised vehicles off-road to enable them to access a particular area or event. This is provided that the vehicle is registered under the relevant traffic act or off-road areas act, holds a current driving licence, and access of the area will not significantly impact on the natural environment and/or the use and enjoyment of other visitors.

Restrictions on vehicle and other forms of access are imposed so that the public's recreational needs can be satisfied while native flora and fauna and landscape values are protected. Uncontrolled recreational use, including off-road vehicle driving, has in the past severely damaged the environment. The increase in people results in the increase in greater risk of vegetation loss, soil compaction and erosion, localised changes to surface run-off, vandalism to cultural features and wildfire, and social problems created from litter and excessive noise.

CALM advocates the adherence to the Australian National Four Wheel Drive (4WD) Council's Four-Wheel-Driver's Code of Ethics, which state that:

1. "Keep to the laws and regulations for 4WD vehicles.

2. Keep to constructed vehicle tracks. Do not drive "off-road" except in permitted areas.
3. Keep the environment clean. Carry your own rubbish home.
4. Obey restrictions on the use of public lands. Respect national parks and other conservation areas.
5. Obtain permission before driving on private land. Leave livestock alone and gates as found.
6. Keep your vehicle mechanically sound.
7. Take adequate water, food, fuel and spares on trips. In remote areas, travel with another vehicle.
8. Respect our wildlife. Stop and look, but never disturb or chase animals.
9. Respect other recreationists rights to peace and solitude in the bush.
10. Obey all fire restrictions. Extinguish your fire before leaving. Don't let your exhaust fumes emit sparks. Please note that on some CALM-managed lands there is a "no camp fires" policy.
11. Help in bushfire emergencies and search and rescue, if you are properly equipped and able.
12. Join a 4WD club and support 4WD touring as a responsible and legitimate recreational activity." (http://www.calm.wa.gov.au/tourism/4wd_policy.html)

Although this website does not specifically identify the management of ORVs on beaches in Western Australia, it provides useful information on the general management of ORVs within conservation areas, and the reasons why such regulation is necessary. The code of practice for four wheel driving illustrates the responsibility or "duty of care" of ORV drivers to help protect Western Australia's flora, fauna and natural landscapes for future generations. Here, the theme of sustainable coastal development is evident.

2.4.2 *California, United States of America*

The Californian Wilderness Coalition's (CWC) report (http://www.calwild.org) identifies that Off-road vehicles leave a unique mark on the landscape, leaving tracks that are visible for generations and often permanent impacts. The CWC report identifies that when irresponsibly used, or improperly managed, ORVs cause damage to sensitive soils, degrade critical wildlife habitat, trespass on private property and shatter the quiet of the great outdoors. Their report states that irresponsible off-road vehicle use poses special problems for law enforcement.

The Algodones Dunes are considered to be California's off-roading mecca, which is suffering from out-of-control off-road vehicle use that has become dangerous from public safety viewpoint. At Lake Tahoe Basin, the Forest Service, have reported that off-road vehicle users have created new, unauthorised routes, creating erosion and sedimentation that may further diminish the clarity of California's most famous lake. Numerous other examples are cited.

CWC presented a plan for creating a more balanced and fair off-road vehicle policy in California, which if implemented will for example, minimise damage to California's landscapes, and reduce conflicts between motorised recreationists and other public land users. (Reference is made to the Executive Summary from the website http:// www.calwild.org)

The Plan includes three elements: federal reform, state legislative reform, and state administrative reform.

Federal Reform

Federal reform is aimed at designating and mapping legal riding routes, and specifies that an environmental impact analysis should be completed prior to the designation. The federal reform component states that to comply with current laws and alleviate the damage caused by off-road vehicles to public lands, federal land managers should:

Designate and map legal riding routes

The Plan states that all vehicle routes on federal land should be subject to environmental impact analysis.

Determine where use is appropriate

Motor vehicle use should be allowed only on those routes where the appropriate land management agency has documented that vehicle use will not cause adverse environmental impacts, and that impacts to the environment and other recreationists will be minimised. Thresholds for unacceptable impacts must be established prior to beginning analysis.

Monitor the effects

The use of motorized vehicles should be allowed only in those areas where federal land managers are able to actively monitor the effects of motorised vehicles on the landscape. If monitoring determines that thresholds established for unacceptable impacts are reached in an area or trail, the area or trail must be closed until the impact is reduced to an acceptable level.

Protect undesignated wilderness

Across the state, wilderness-quality lands are being degraded by motorised vehicles. These areas should be declared off-limits to motorised vehicles.

Enforce the law

Some federal land managers are failing to prevent motorised vehicles from entering wilderness and other closed areas. Land managers should make trespass and closure violations a higher priority. Further, Congress should appropriate additional funds to assist land managers in enforcing federal laws and regulations.

State Reform

In 1971, California enacted the Chappie-Z'Berg Off-Highway Motor Vehicle Act (OHV Act), which created the State of California's off-road vehicle program. In the past three decades, this program has allocated over half a billion dollars to support off-road vehicle use on state, federal, and private land throughout California.

The OHV Act, as amended, found that "The indiscriminate and uncontrolled use of those vehicles may have a deleterious impact on the environment, wildlife habitats, native wildlife, and native flora," and that "Effectively managed areas and adequate facilities for the use of off-highway vehicles and conservation and enforcement are essential for ecologically balanced recreation."

Without active involvement, the state runs the risk of being held responsible for the shortcomings of off-road vehicle management, while remaining unrecognised for the benefits of its grants program. The following legislative reform will help to bring balance to the state's off road vehicle program, by ensuring that state funding is used to repair damaged areas, prevent future damage, and mitigate the effects of off-road recreation. State legislators should require:

Increased funding for conservation and law enforcement

The state's off-road vehicle act urges California to control the impacts caused by the "indiscriminate and uncontrolled use" on the environment, wildlife habitats, native wildlife, and native flora". This means that funding is needed to effectively enforce closed areas, protect soils and watershed, carry out monitoring and remediation work, and keep riders on designated routes. Current funding is not adequate to fulfil these needs, and additional funding should be authorised.

Mitigation funding and non-motorised buffers

Off-road vehicles can cause extensive harm to the natural environment and wildlife habitat. Funding for mitigation of off-road vehicle damage is needed to ensure that critical habitat areas are protected. This mitigation may be responsible at the site of the off-road vehicle use, or may be more appropriate elsewhere.

Uniform soil and habitat standards

Currently the state is utilising highly technical soil protection standards that are difficult for non-geologists to apply. These standards should be updated and applied uniformly.

Polluter pays

Registration fees for off-road vehicles should be linked to emissions levels (higher emissions equals higher fees). This will create a positive incentive to reduce emissions from off-road vehicles.

Reducing off-road vehicle-related crimes

Currently, fines for riding a motor vehicle into closed areas are too low to effectively discourage use. Fines for vehicle trespass into closed areas should be dramatically increased to create a real deterrent to illegal riding.

Off Road Vehicle Grants Program

Through its off-road vehicle grants program (which provides millions of dollars each year to support the acquisition, development, and operations of off-road vehicle facilities and areas on federally managed lands), the state is in a unique position to positively influence off –road vehicle management on public lands. In the past, grants have been used by federal agencies to supplant federal funds. Grants should supplement, not replace, federal appropriations, and should not be used as a surrogate for federal funding to carry out land management responsibilities. In order for the program to adequately mitigate the effects of off-road recreation and prevent excessive off-road vehicle-related damage, the state should adopt the following principles with regard to its off-road vehicle grants program:

Comply with the law

The top priority of the grants program should be to monitor and repair existing resource damage, prevent future damage, and ensure compliance with state and federal laws and regulations. Grants should not be given to districts that cannot ensure compliance with federal and state laws and regulations, except to bring those areas into compliance with the law.

Protect Sensitive areas

Grants to support projects that could adversely impact on jeopardise the ecological integrity or social values of wild areas or rivers should be eliminated.

Prevent future damage

Acquisition and development of new off-road vehicle areas and trails should cease until all lands within the program are in full compliance with all applicable state and federal laws, regulations, and policies, and current resource damage is adequately addressed.

Respect other land users

Grants should not be used to fund projects that create or expand conflicts with non-motorised recreationists. Projects submitted for grant awards should assure that residents and private property owners adjacent to the proposed project area are protected from noise, trespass, and property damage.

Do no harm

The state should not fund off-road vehicle activities in areas where off-road vehicle used has been shown to cause unacceptable environmental damage, where off-road vehicle use will lead to damage of sensitive lands, or where off-road vehicle use will lead to an increase in illegal riding or conflicts with other recreationists. In addition, the state should not fund areas that cannot demonstrate compliance with all federal and state laws and policies. Through the enactment of the above reforms, California can head off an environmental disaster in the making. The report states: "Our fragile heritage is at risk, and immediate action is needed to ensure it is maintained, intact, for the benefit of future generations."

The "duty of care" principle is advocated by the CWC in their Plan for creating a balanced and fair off-road vehicle policy in California.

2.4.3 World Heritage Site: Fraser Island, Australia

Fraser Island attained its World Heritage Listing in December 1992 in recognition of the island's exceptional sand dune systems, its rainforests on sand and its pristine freshwater lakes (http://www.ea.gov.au/heritage).

Fraser Island is the tenth World Heritage listed site in Australia, joining the ranks of the Great Barrier Reef, the Wet Tropics of Queensland, Uluru National Park (formerly

Ayers Rock) and Lord Howe Island. The listing recognises Fraser Island combination of environments as having outstanding universal value and its protection for future generations as a global responsibility. The responsibility of protecting Fraser for future generations, however, belongs to all visitors in respecting the island' environments. There is an Environmental Code that states that no litter may be left; driving over dunes is not permitted; and that when driving and walking vehicles must be kept to the existing tracks. "To the 4WD enthusiasts, it is the ultimate off-road experience. To everyone who visits Fraser – it is the largest sand island in the world and one of Australia's World Heritage sites" (http://www.ea.gov.au/heritage).

3 METHODOLOGY

3.1 The Legislative Management of ORV Use On Beaches

3.1.1 Introduction

The first objective (from Chapter 1) is the investigation of the changes in the legislative environment concerning the regulation of Off-Road Vehicles on beaches in South Africa. The events leading up to the promulgation of the ORV Regulations, and the events that have followed need to be assessed to determine whether there is a causal chain or logic in which these events have occurred. This Study takes into account the legal framework of environmental management in South Africa. The environmental legal framework that regulates the management of ORV use on beaches is included under section 4.2.

The legislative management of ORV use on beaches is assessed by reviewing the information prepared on the "Background to the General Policy" as recorded by Mr Schneier (2000) of the National Department of Environmental Affairs and Tourism (DEAT). This information provides the framework of the ORV General Policy (1994) Model.

Cooper's (1996) conceptual model as described in section 2.2 above, contains the elements of the political, economic, physical, historical, and perceptual environment that comprise the model and which contributed to the Soil Conservation Policy Environment. Cooper's (1996) Model is compared to the ORV General Policy (1994) Model in section 5.2.1 of this Study.

3.2 Literature Search

The second objective (from Chapter 1) is a literature search of the existing national and international research on the impact of ORVs on the inter-tidal zone of sandy beaches. The findings of the experimental research are evaluated in the context of existing literature.

The literature search is focused on the impact of ORVs on beaches within the inter-tidal zone. This is the biophysical delineation for ORV use on beaches as determined by the General Policy (1994) and further detailed under section 4.1.2.2. The research referenced includes information on sandy beach geomorphology, beach biota, and a review on the impact of ORVs within the inter-tidal zone on sandy beaches. The findings of the literature search on the biophysical impacts of ORVs on beaches are detailed under section 2.3 of this Study.

The literature search included an assessment of overseas information pertinent to ORVs on beaches, and reference is made to areas in Australia and the US in section 2.4 of this Study.

3.3 Beach Survey Methodology

3.3.1 Introduction

The third objective of this Study (from Chapter 1) is the assessment of the biophysical impact of an ORV on the inter-tidal zone of sandy beaches, as investigated at Leven Point, located north of Cape Vidal within the St Lucia Marine Reserve. The objective of the experiment is to determine the biophysical impact of an ORV on the beach between the high and low water mark (inter-tidal zone), with a focus on the sand particle size distribution, sand density, and presence and distribution of ghost crabs. The findings of the experimental research conducted at Leven Point regarding the impact of an ORV on the sand density within the inter-tidal zone are to be evaluated in the context of the findings of the literature search (see second research question).

3.3.2 General Difficulties with Field Experiments of Beaches

According to Dr Schoeman of the University of Port Elizabeth (Personal communication, 6 June 2001), the physical and biological descriptors of beaches are highly variable over small spatial and temporal scales. Things change dramatically on beaches over short time frames and from one place to the next (even if the two sites are within meters of each other). This causes severe difficulty in detecting differences

between beaches, i.e. because there is so much variability within beaches variability between beaches becomes insignificant.

Dr Shoeman is of the opinion that even if differences between two beaches could be detected (one impacted by ORVs and another not), one could never ascribe those differences to the presence of ORVs, because some other attribute of the beach (measured or unmeasured) might be causing the differences. Beach animals are strongly affected by physical characteristics of beaches (for example: differences in sand particle size, differences in surf zone conditions, proximity of estuary mouth, etc.).

An understanding of the difficulties with experimental surveys of beaches is necessary in the design of the experiment, and to interpret the findings of the experiment.

3.3.3 Design of Experiment

The General Policy (1994) states under section 4.1.2.2 that: "Vehicle traffic must, as far as possible, be restricted to the "wet sand" portion of the beach, between the low and high water marks. Vehicle access may therefore be prohibited for a specified period preceding and following high tide. Vehicles may be permitted on the beach above the high-water mark if this portion of the beach is not ecologically sensitive to vehicle traffic. Such areas must be identified and clearly demarcated."

The design of the experiment was based on assessing the impact of an ORV on a beach where no ORVs are permitted to drive on a regular basis, in order to provide a "clean slate" for assessment of the potential impact of an ORV, within the inter-tidal zone specifically.

To determine the potential impact of an ORV on this "clean slate" the design of the experiment was focussed on the collection of sand samples at the sand surface and at a depth of 20cm, before and after an ORV made a certain number of passes. The experiment includes the calculation of the Median Sand Particle Size and the density of each sand sample.

The experiment was planned to take place during the Spring Low Tide, to ensure that access could be gained to the experiment site from Cape Vidal along the beach, and to facilitate the experiment within the lower inter-tidal zone.

The difficulties in designing such an experiment are inherent when taking into account the dynamic variability that occurs within a beach, and the influence of the seasonal variations over time.

3.3.4 Identification of an Appropriate Beach to Survey

Permission was sought to conduct the experiment at Cape Vidal, a KZN Wildlife controlled area. Permission was granted by the head of Scientific services Dr Martin Brooks.

Following discussion with Mr Drikus Gissing the Marine Officer of KZN Wildlife at Cape Vidal, it was decided that the most suitable area to conduct the experiment was at Leven Point, situated 22km north of Cape Vidal (refer to Figure 3). At the time of the experiment, Leven Point formed the boundary between where ORVs were permitted to drive and where they were not permitted to drive on the beach north of Leven Point, unless the ORVs were KZN Wildlife vehicles.

The experimental area was therefore chosen as being the stretch of inter-tidal beach located about five metres north of the Leven Point signboard.

Reference is made to the photographs of Day One (Appendix 1) and Day Two (Appendix 2) that illustrate the location of the experiment at Leven Point.

3.3.5 Experimental Methodology

The experiment was conducted on 21 and 22 July 2001 during a spring low tide at Leven Point, between the high water mark and the low water mark. Mr Gissing provided assistance with transport to the site and by driving his ORV through the demarcated area to conduct the experiment.

According to the Tide Chart for 2001 issued by KwaZulu-Natal Nature Conservation Services (now known as KZN Wildlife), the Spring low tide was on 21st July 2001 at 10:13am, and on the 22nd July 2001 it was at 10:55am.

3.3.5.1 Day One

The sand sample collecting experiment was started at 8:44am and was finished at 9:42am on Day One, during Spring Low Tide. The weather conditions were difficult for purposes of conducting the experiment with intermittent rain and a very strong wind.

A section of beach was selected and three points measured at an interval of three metres apart. A metal cylinder of known volume was used to collect sand samples at each of these three points prior to the ORV passing over the demarcated section. Sand samples were collected at the surface and at a depth of 20cm. The sand samples were collected immediately adjacent to the previous sample, and the 20cm depth sample was collected immediately below the surface sample.

The ORV passed over the demarcated section once and sand samples were taken at the surface and at a depth of 20cm. The ORV was driven in the demarcated section and made ten passes in the same tracks. Sand samples were taken at the surface and at a depth of 20cm at the three points. Following an additional 20 passes in the same tracks sand samples were collected at the three points at the surface and at a depth of 20cm. All the sand samples were placed in a plastic packet, sealed and labelled.

The locations of the samples on the top of the primary dune were marked for the collection of samples on Day Two.

3.3.5.2 Day Two

The sample collecting experiment was started at 10:49am and was finished at 11:55am on Day Two, during the Spring Low Tide. The weather conditions were more conducive to conducting the experiment, as it was partly cloudy.

The experiment was conducted at the same site the next day within the lower inter-tidal zone, and repeated to replicate the activities undertaken the previous day. The same three transects from the previous day were demarcated to delineate the areas for the collection of the sand samples. Sand samples were collected as per the methodology described for Day One.

3.3.5.3 Ghost Crabs

The number of ghost crabs burrows located within a 40m² area from the high water mark to the low water mark adjacent (and north) to the experimental site within Leven Point was counted on Day Two. The weather conditions on Day One did not enable the burrows to be identified due to the wind blown sand and rain obscuring the burrows.

3.3.6 Laboratory Analysis of Sand Samples

The median particle size of the sand samples was determined using the methodology described below.

The samples of sand collected during the experiment were placed on the uppermost member of a column of sieves mounted on a sieve shaker. The sieves are vibrated for a set period of time, after which material retained on each sieve was retrieved and weighed. The samples were dried in an oven before the sieving process.

The total mass in grams was recorded for each sample. The mass in grams retained at each mesh size was recorded. The sieve sizes are: 2mm; 1mm; 0.5mm; 0.5mm; 0.125mm; 0.053mm; and <0.053mm.

In order to determine the median particle size of the sand samples, the mass (g) retained at each mesh size of the sieve was divided by the quantity sieved, to calculate the percent of the total of the sand sample at each mesh size. This "percent of the total" is subtracted from 100% to determine the "percentage finer than" total. These "percentage finer than" values were then plotted on log-normal graph paper, and the

value at the 50% value was read off the graph. These values are recorded as the Mean Particle Sizes for each sand sample. The graphs to determine the Median Particle Sizes are attached at Appendix 5.

3.3.7 Sand Sample Density

In order to determine the Density of each sand sample the Volume of the cylindrical ring used to collect the sand sample was calculated using the following formula:

- Volume = $\prod D^2/4$ x H (i.e. $\prod 50mm^2/4$ x 50mm) = $98.175cm^3$

Therefore the cylindrical ring that was used to collect the sand samples on both days has a volume of $98.175cm^3$.

The Density of each sample was determined using the following formula:

- Density = Mass / Volume

The total mass (grams) of each sand sample was weighed in the laboratory. The total mass was used in the calculation of the density of the sand sample.

3.3.8 Statistical Methodology

3.3.8.1 Application of statistics to experiment conducted at Cape Vidal

The statistical procedure followed to analyse the density data collected at the case study area is described below:

Step 1: Formulate H_0

The Null Hypothesis has been formulated taking into consideration the objectives of the investigation, as the following:

H0: There is no significant difference between beach sand densities along the section of beach under investigation.

Step 2: Formulate an alternative hypothesis H_1

The Alternative Hypothesis has been formulated as:

H1: There is a significant difference between the beach sand densities along the section of beach under investigation.

Step 3: Decide upon a rejection level or significance level

The level of significance is set at 0.05 or 5%. The two-tailed test is selected at the 5% level of rejection as it provides a higher threshold of significance than a one-tailed test. (Folwer, Cohen and Jarvis, 1998).

Step 4: Select and carry out an appropriate statistical test

The non-parametric Mann-Whitney U-test is applied to the data, as the sample sizes of the sand densities collected in the experiment are relatively small and the purpose of the experiment is to test whether the densities (derived data) of the two samples are different.

Step 5: Assess the calculated value for the Mann-Whitney U-test in terms of the Null Hypothesis

The calculated values for U have been compared to the statistical tabled values, and assessed for their significance, and whether H0 can be accepted or rejected. Refer to section 6.4 below for the application of the Mann-Whitney U-Test, to the sand densities collected at Leven Point during July 2001.

3.4 Personal communication and interviews

3.4.1 Introduction

The fourth objective is to undertake informal interviews with key staff of KZN Wildlife at Cape Vidal (as the Case Study Area), and the DEAT official in Cape Town, responsible for the management of ORVs.

3.4.2 Theoretical Context

Qualitative information through the process of conducting informal interviews was obtained for the purposes of investigating the impact of ORVs on the beach at Cape

Vidal, the Case Study area. In addition, the Official from DEAT who has been directly involved in the management of ORVs for a number of years was interviewed.

The type of interview conducted is considered to be what is termed "intensive", rather than what is termed "extensive". According to Sayer (1992; pg 242) the distinction between the two from a superficial level can be considered to be "nothing more than a question of scale or 'depth versus breadth'." However, the two types of design ask different sorts of questions, use different techniques and methods and define their boundaries and objects differently (Sayer, 1992). In intensive research the primary questions concern how some causal process works out in a particular case or limited number of cases (Sayer, 1992). Extensive research is concerned with discovering some of the common properties and general patterns of a population as a whole (Sayer, 1992).

In this Study, the intensive interview approach was selected to determine the causal process of the management of ORVs before and after the promulgation of the ORV Regulations at the Case Study area - the KZN Wildlife Camp at Cape Vidal.

In intensive research, the types of groups studied are causal groups and the type of account produced is the casual explanation of the production of certain objects or events, though not necessarily representative ones (Sayer, 1992). The types of questions asked are for example, "How does a process work in a particular case or number of cases? What produces a certain change? What did the agents actually do?" (Sayer, 1992; pg 243). The type of methods used for intensive research includes the study of individual agents in their causal contexts and interactive interviews (Sayer, 1992). The limitations in intensive research are that "actual concrete patterns and contingent relations are unlikely to be 'representative', 'average' or 'generalisable' (Sayer, 1992). Necessary relations discovered will exist wherever their relata are present, e.g. causal powers of objects are generalisable to other contexts as they are necessary features of these objects" (Sayer, 1992; pg 243).

The individual people directly responsible for the management of ORVs at Cape Vidal (the Case Study area), being the Camp Manager and the Marine Control Officer, were interviewed.

The two types of research design work with different conceptions of groups (Sayer, 1992). Extensive research focuses on groups whose members share similar (formal) attributes but which need not actually connect or interact with another, and individual members are only of interest in so far as they represent the populations as a whole (Sayer, 1992). "Intensive research focuses mainly (though not exclusively) on groups whose members may be either similar or different but which actually relate to each other structurally or causally. Specifically, identifiable individuals are of interest in terms of their properties and their mode of connection to others." (Sayer, 1992; pg 244).

The Camp Manager and the Marine Control Officer at Cape Vidal are employed by KZN Wildlife and are both responsible for the management of ORVs on the beach at Cape Vidal.

In intensive studies the individuals need not be typical and they may be selected one by one as the research proceeds and as an understanding of the membership of a causal group is built up (Sayer, 1992; pg 244). With a less formal, less standardised and more interactive kind of interview the researcher has a better chance of learning from the respondents what the different significance of circumstances is for them (Sayer, 1992; pg 245). The disadvantages of intensive studies are that the results are not "representative" of the population as a whole (Sayer, 1992).

The interviews were conducted in an informal manner, where the questions asked and their sequence and wording is not worked out beforehand. According to Eyles and Smith (1988; pg 7;) "... the interviewer tries to tailor the wording of the questions to each particular individual and ask the questions in an order appropriate for the interviewee. The aims are to ensure that the questions have the same meanings for all respondents and to engage in 'conversation' to set the respondent at ease." With informal interviewing it is not assumed that appropriate question phrasing and style of

answer are known in advance (Eyles and Smith; 1988). These emerge as the interview progresses in the process of interaction between the researcher and respondent (Eyles and Smith; 1988). There is usually a checklist of topics to be covered by all respondents.

According to Robertson (1998; pg 384), there are several different types of questionnaire with variations arising primarily from different types of question and the method of administering the questionnaire to the respondents. As described by Gant (1994) the face-to-face interview can vary greatly in content and style, from asking questions that demand specific short answers to ones that are very informal conversations. The style varies according to the characteristics of the respondents, the research topic and the environment in which the meeting takes place (Gant, 1994; pg 385).

The interviews at Cape Vidal (and with the DEAT official) varied from asking questions to holding an informal conversation, as was deemed appropriate to facilitate the time constraints of the two individuals.

3.4.3 Background: Informal Interviews

In order to obtain information on the impact of ORVs on beaches, an informal interview was held with Mr Shawn Schneier of DEAT in Cape Town on 19 December 2000.

The Case Study research at Cape Vidal, the KZN Wildlife managed conservation area, included interviews with the KZN Wildlife Camp Manager, Mr Ron Joubert, and the KZN Wildlife Marine Officer, Mr Drikus Gissing during the week-end of the beach experiment (20th to 22nd July 2001). In addition, a follow up visit to Cape Vidal was conducted from 10th to 12th May 2002 in order to determine the impact that the ORV Regulations (promulgated on 21st January 2002) has had on the activities at Cape Vidal.

The purpose of the July 2001 interviews was to source local knowledge on the use of ORVs on the beach at Cape Vidal and the general impacts associated therewith, such as

the management by KZN Wildlife of users, observations of impacts on ghost crabs, and opinions on the driving between the high water mark and low water mark.

The purpose of the May 2002 interviews was to determine what impacts the general banning of ORVs from the beaches has had at Cape Vidal. Other observations were made regarding the general management of access to the beach, attendance figures at the Camp, general impressions, etc.

The interviews were informal and based on a checklist of issues in order to source information. This semi-structured approach was aimed at a select group of people (KZN Wildlife officials employed at the Cape Vidal Camp) causally related.

The qualitative research was therefore "intensive" focusing "... mainly (though not exclusively) on groups whose members may be either similar or different but which actually relate to each other structurally or causally. Specifically, identifiable individuals are of interest in terms of their properties and their mode of connection to others." (Sayer, 1992; pg 244)

3.4.4 Informal Interviews

3.4.4.1 DEAT: Mr Shawn Schneier

A general interview was held with Mr Schneier on 19 December 2000 in Cape Town to understand the role of the Department of Environmental Affairs and Tourism (DEAT) with regard to the use of ORVs on beaches. The informal interviews are detailed further in section 4.4.

3.4.4.2 Cape Vidal KZN Wildlife Camp Manager: Mr Ron Joubert

An interview was held with Mr Joubert on 22 July 2001. The following questions were asked in the form of an informal interview, as further detailed under section 4.4.2:

- Is there compliance with local bylaws at Cape Vidal?
- Are permits issued by KZN Wildlife?

- What are the general perceptions associated with the public driving ORVs on the beach at Cape Vidal?

3.4.4.3 Cape Vidal KZN Wildlife Marine Conservation Officer: Mr Drikus Gissing

An interview was held with Mr Gissing on 21 July 2001. The following questions were asked in the form of an informal interview, as further detailed under section 4.4.2:

- Is there compliance with local bylaws at Cape Vidal (permits)?
- Are there seasonal variations in use of ORVs on the beach at Cape Vidal?
- What is the average number of vehicles on the beach a day?
- What is the impact on fauna caused by ORVs?
- Is driving permitted on the beach at night?
- What are the general perceptions associated with the public driving ORVs on the beach at Cape Vidal?

3.5 Methodology for Visual Observations at Cape Vidal

3.5.1 Introduction

The fifth objective is to conduct a visual assessment of the impact of the promulgation of the ORV Regulations at Cape Vidal (post December 2000). This is to be compared to the impact of the use of ORVs at Cape Vidal prior to the promulgation of the ORV Regulations (prior to December 2000).

3.5.2 Prior to ORV Regulations (July 2001)

Visual observations were made and photographed (where possible) at the entrance to the beach and on the beach at Cape Vidal, of the access control of ORVs entering the beach and the presence and location of ORVs on the beach.

3.5.3 Following ORV Regulations (May 2002)

Visual observations were made and photographed at the same places where photographs were taken in July 2001, at the entrance to the beach and on the beach at Cape Vidal.

3.6 Methodology for Recommendations

The sixth objective of is the preparation of recommendations within the context of the findings of the existing literature, legislative management, research findings, informal interviews, and visual observations. The objective of the recommendations is to contribute towards the physical delineation within which ORVs should be managed on beaches in South Africa.

4 RESULTS

4.1 The Legislative Management of ORV Use On Beaches

4.1.1 Introduction

This Study investigates the legislative controls aimed at minimising the environmental impacts of ORVs on beaches in South Africa. It investigates the changes in policy and legislation that govern the management of ORVs on beaches, and assesses the evolutionary progression of these successive changes. These findings are discussed in section 5.2.

4.1.2 General Policy: Control of Vehicles in the Coastal Zone

4.1.2.1 Background to General Policy

Schneier (2000)[2] is referenced with respect to the background to the preparation of the General Policy: "The issue of off-road vehicle (ORV) use along the coast was first addressed at a national level in 1984. Due to the problems arising from ORV use the then Minister of Environmental Affairs and Tourism requested the former Council for the Environment to investigate this matter and make pertinent recommendations. The Council in turn tasked its Committee for Coastal and Marine Systems with the investigation.

The first draft report considered by the Committee recommended a ban on all recreational use of vehicles on all beaches. However, this recommendation was strongly opposed by the then Natal Parks Board. The Board and its successor the KwaZulu-Natal Nature Conservation Service derived considerable income from issuing permits for off-road vehicle use on beaches under its jurisdiction.

In 1986 the Committee produced a final report entitled "A Policy for controlling Off-road Vehicles in the Coastal Zone of the Republic of South Africa". The report found

[2] The Department of Environmental Affairs and Tourism's information prepared by Mr S. Schneier (2000) as Ministerial advice regarding the use of ORVs is referenced for much of this section.

that all coastal ecosystems, with the exception of certain inter-tidal beaches, are sensitive to vehicle traffic. The report also found that irresponsible ORV use threatens the safety of other beach users. The report recommended prohibiting vehicles from ecologically sensitive areas and bathing beaches. Beaches where ORV use could be accommodated were to be identified by the provincial conservation authorities in consultation with local authorities. A permit system was recommended to regulate ORV use in these areas.

The findings of the above report provided a basis for a departmental document entitled "A Policy and Guidelines for the Control of Vehicles on and adjacent to Beaches". The Minister referred this document to the Administrators of the Cape and Natal in 1989. The Minister requested the Administrators to implement the policy and guidelines in their respective provinces.

The Minister's request had no statutory basis and could be applied at the discretion of the provincial and local authorities. It was decided to use section 2 of the newly drafted Environment Conservation Act (No. 73 of 1989) to provide such a statutory basis. Section 2 empowered the Minister to "determine the general policy" with respect to the protection of the environment."

According to Schneier (2000), the Policy was motivated by several concerns.
These included the findings that ORV use:

- was detrimentally affecting ecologically sensitive coastal areas;
- posed a threat to the safety of people engaged in various recreational activities and generally diminished the enjoyment derived from such activities; and
- was controlled at the discretion of the local or provincial authority concerned, and in some coastal areas no controls existed.

There was therefore a need to establish a uniform national policy for controlling ORV use in the interest of environmental protection, human safety and the enjoyment derived from coastal recreation. All three factors are important in

promoting coastal tourism that contributes significantly to the economies of villages and towns on the South African coast.

A proposed policy concerning the use of vehicles in the coastal zone was published in the Government Gazette of 21 January 1994 for comment. The Department of Environmental Affairs and Tourism sent copies of the proposed policy to all coastal local authorities, angling clubs, manufacturers of four-wheel drive vehicles and four-wheel drive clubs. Comments received reflected overwhelming support for the proposed policy. Only a few organisations and individuals were not in favour of the policy. The policy was revised in the light of the comments received before being published as the General Policy in the Government Gazette. (Schneier, 2000)

4.1.2.2 General Policy: Control of Vehicles in the Coastal Zone

National legislation for controlling off-road vehicles on the coast existed in the form of a national policy, titled *General Policy in terms of the Environment Conservation Act (No. 73 of 1989): Control of Vehicles in the Coastal Zone* (hereafter referred to as the Policy). The Policy was promulgated in the Government Gazette on 29 April 1994.

The General Policy made provision for the coast to be zoned to make provision for areas where vehicles are excluded (based on environmental or recreational considerations) or permitted subject to the conditions of a permit (sections 2.1 and 2.2). The use of vehicles in the coastal zone was only permitted on demarcated beaches (sections 2.2 and 3.2), excluding existing roads. The general policy determined which coastal areas were to be closed to vehicles (section 3.1); it identified beach areas where controlled access by vehicles were allowed (section 3.2); and, it provided control measures which were applicable to vehicles in demarcated coastal areas (section 3.3). The General Policy (1994) states under section 3.3.5[3] that "Vehicle traffic must, as far as possible, be restricted to the "wet sand" portion of the beach, between the low and high water marks. Vehicle access may therefore be

[3] This particular control provides the parameter of this Study for the assessment of the biophysical impact of ORV 's on beaches within the inter-tidal zone.

prohibited for a specified period preceding and following high tide. Vehicles may be permitted on the beach above the high-water mark if this portion of the beach is not ecologically sensitive to vehicle traffic. Such areas must be identified and clearly demarcated."

Schneier (2000) identified that there were significant shortcomings in the Policy's implementation.

The Policy legally bound all organs of State whose powers or duties influenced the impact of ORVs on the coastal environment. However, the Policy was not directly applicable to the behaviour of the off-road vehicle user, nor could it be used to penalise illegal ORV use. According to Schneier (2000), other legislation was required to give effect to the policy.

4.1.2.3 DEAT Promotion of General Policy

In order to promote the Policy's implementation, a letter was sent to all coastal local authorities following the Policy's promulgation in 1994. This letter explained the procedure followed in drafting the ORV Policy, highlighted the Policy's salient features, spelled out its legal implications and identified the steps which needed to be taken to implement the Policy. DEAT highlighted that the Policy required local authorities to consult the provincial conservation authorities in order to identify ecologically sensitive areas. The provincial conservation authorities were requested to render assistance in this regard. They were also requested to render assistance with respect to law enforcement.

The Department was involved in various cases in order to ensure the Policy's implementation in specific coastal areas. Members of the public, including local residents and holidaymakers, brought various cases to the Department's attention.

In order to promote environmental awareness among off-road vehicle users on the coast, the Department of Environmental Affairs and Tourism (Schneier, 2000) published an illustrated pamphlet entitled "Off-road vehicles and coastal conservation". This pamphlet was published soon after the Policy's promulgation and

widely distributed. It has been replaced by an updated version entitled "Off-road vehicles and caring for our coast".

4.1.2.4 DEAT Survey of compliance with the ORV Policy

The National Department of Environmental Affairs and Tourism (DEAT) undertook a survey in 1998 of compliance with the ORV policy. A detailed questionnaire was sent to coastal local authorities in July 1998. Its purpose was to determine the extent to which local authorities were complying with the Policy.

According to the Report prepared by Schneier (2000), "The following salient points emerged from an analysis of the responses:

1. Nine local authorities had closed all their beaches to ORVs. George's beaches were closed due to physical inaccessibility. One additional local authority, namely Velddrif, permitted access for traditional fishing only and not general recreation.
2. Four local authorities contravened the Policy's requirement that a permit system be introduced to regulate ORV use in demarcated areas. Of these Knysna and Kenton-on-Sea restricted ORV use to boat launching sites only.
3. Regarding the Policy's requirement that recreational areas be closed to ORVs, in many instances "non-compliance" is due to ski boat launching sites in these areas. Examples are at Plettenberg Bay, Knysna and Durban (South Local Council). Eight local authorities contravened this requirement and one complied partially with it.
4. Two local authorities, namely Stanger and Pennington, had not consulted their provincial conservation authority to determine which areas were ecologically sensitive.
5. Two protected areas remained open to ORVs, contravening the Policy. One is a provincial nature reserve falling within the West Coast District Council's area of jurisdiction. The other is at Pennington.
6. Nine local authorities had not consulted the local community with respect to allowing ORV access to beaches, as required by the Policy.

7. Four local authorities had not promulgated regulations to implement the Policy in their area of jurisdiction.
8. Six local authorities admitted that their enforcement of regulations was inadequate, principally due to inadequate manpower resources.
9. Of the local authorities, which had closed their beaches, only Cape Town indicated that they were enforcing this closure in terms of regulations. George's beaches were inaccessible. Several authorities had either not promulgated regulations to enforce the closure or were not enforcing such regulations.
10. Sixteen local authorities were not complying with at least one of the Policy's key requirements.
11. Assuming their responses were accurate, four local authorities were complying with all the Policy's requirements. Of these, Cape Town and George had closed beaches and the West Coast Peninsula and Margate had instituted permit systems.
12. Seven local authorities' responses were totally "invalid" and seventeen responses were partially invalid. This indicates that actual non-compliance with the Policy was higher than openly admitted. For example, it is known (although not evident from the questionnaire responses) that Hermanus Municipality and the Overberg District Council were not complying with certain requirements of the Policy.

The overall conclusion drawn from this analysis is that the implementation of the Policy by local authorities was unsatisfactory and intervention by provincial government was necessary to rectify this."

Mr Schneier[4] reported that: "The prevalence of ORV use on our coast is clearly evident from the responses to the questionnaire sent to coastal local authorities in 1998. According to the responses received, only nine local authorities have closed all their beaches to ORVs. Many others have ignored key requirements of the Policy such as the requirement that bathing beaches be closed to ORVs. The reason given is that the use of ORVs on these beaches is "historical" and pre-dates the legislation.

[4] Draft Report submitted to the Minister of Environmental Affairs and Tourism (September 2000).

Responses to the questionnaire also indicated that some local authorities were issuing large numbers of permits annually to members of the public to enable them to drive on the beach. For example, the West Coast District Council issued 2500 permits, the Overberg District Council 4500 permits and the Western District Council between 3500 and 4000. Two of these local authorities charged R120 and R75 per permit, indicating that a significant amount of revenue was derived from issuing permits.

Contrary to one of the Policy's requirements, the recreational use of ORVs is also permitted in many protected areas. According to the KwaZulu-Natal Nature Conservation Service (KZNNCS), this use is a major generator of tourism revenue. Beach permits issued by the KZNNCS currently generate approximately two million Rand per annum. The holiday resort at Cape Vidal, largely dependent on ORV users, is one of the KZNNCS resorts' top five revenue earners."

Schneier (2000) reported that: "Apart from the environmental degradation and disturbance to beach users associated with the irresponsible use of off-road vehicles in the coastal zone, serious and fatal injuries have also occurred. Vehicles in the coastal zone are presently controlled at the discretion of the local authority concerned, and in some coastal areas no controls exist. The purpose of the proclamation was to establish a uniform national policy in the interest of the environment, human safety and the enjoyment derived from recreation in the coastal zone."

4.1.2.5 Provincial Enforcement of the General Policy

According to Schneier (2000) the provinces were responsible for implementing the Policy in areas that fell under their direct jurisdiction, such as provincial nature reserves on the coast and, in KwaZulu-Natal, marine reserves and sanctuaries. The provincial environmental authorities were also responsible for ensuring that local authorities complied with the Policy. The various coastal provinces' efforts, concerning both compliance with the ORV General Policy in areas under their control, and areas under the control of local authorities, as referenced from Schneier (2000) are discussed below.

The Northern Cape Province

The Northern Cape's coastline is remote, has no large towns or holiday resorts and much of it is closed to the public due to mining activities. The impact of mining on the coastal environment is likely to have far exceeded the impacts associated with the recreational use of ORVs. The province's Department of Agriculture, Land Affairs, Conservation and Environment had not received any complaints concerning ORV use on the coast. However, it is likely that abuses outside mining areas occurred. No inspections of this coastline were carried out to monitor ORV use and the degree of compliance with the Policy.

The Western Cape Province

Promoting compliance by local authorities

The national Department requested the State Attorney in 1996 to obtain a court order to compel the Overberg Regional Services Council to implement the Policy. Following the amendment of the Environment Conservation Act in 1996, the Director-General requested the Western Cape government to institute the court action on its behalf. The Western Cape government acceded to this request.

Further requests by the provincial government to the Municipality to implement the Policy went unheeded. To prevent further environmental damage to the area the Western Cape government resolved in 1999 to erect a barrier to prevent access and to resort to law enforcement. These steps, taken in terms of section 31A of the Environment Conservation Act prevented further ORV access to the area.

Following repeated requests by the Department and the Western Cape government, the South Cape District Council agreed to consult the public in respect of the use of ORVs on the sea-shore between Boggoms Bay and Dana Bay. The Western Province's Director-General had on two occasions acceded to the national Department's requests to emphasise to the Council the Policy's requirements regarding public participation.

The Control of ORVs in Protected Areas

Regarding protected areas under the Province's control, compliance with the Policy was good in some instances and poor in others. All protected areas should have been closed to ORVs. ORVs were permitted on the beach adjacent to the Walker Bay Nature Reserve, subject to the issue of a permit. ORV access to the nature reserve at Waenhuiskrans was not controlled in terms of the Policy's requirements regarding the introduction of a permit system. However, the largest coastal nature reserves, namely De Hoop and Goukamma, were closed to ORVs.

The Eastern Cape Province

Promoting compliance by local authorities

The Eastern Cape Province's Department of Economic Affairs, Environment and Tourism were responsible for ensuring compliance with the Policy in the province. The national Department's two attempts to secure the provinces co-operation in ensuring compliance with the Policy were largely unsuccessful. The areas concerned were the coastal strip between Hamburg and Birha and the coast adjacent to the Van Stadens River mouth. The former section of coast included areas under the jurisdiction of local authorities and the province. The latter area fell within the Western District Council's area of jurisdiction.

Representatives of the provincial Department served on two working groups convened by the Amatola and Western District Regional Services Councils. The objective of the working groups was to zone their coastlines for ORV use in terms of the Policy. The provincial Department did not play a leadership role in convening the working groups, nor did it convene a working group to zone the Transkei coast for ORV use.

The Control of ORVs in Protected Areas

Several nature reserves and State Forests on the coast fell under the province's direct control. These protected areas were not closed to ORVs in terms of the Policy. Access control to these areas was inadequate and law enforcement within them was virtually non-existent.

KwaZulu-Natal

Promoting compliance by local authorities

The provincial Department of Agriculture and Environmental Affairs was responsible for ensuring that local authorities complied with the Policy. According to Ms Allen of the Department, they had not received complaints from members of the public concerning ORV use on the coast. Ms Allen was under the impression that the Policy had been repealed by NEMA and was no longer in force. She added that even if it had not been repealed, her Department would not be able to monitor or enforce its implementation by local authorities due to their other commitments, particularly the administration of the environmental impact assessment regulations promulgated under the Environment Conservation Act (73 of 1989).

The KwaZulu-Natal Nature Conservation Service had received many written complaints from members of the public concerning ORV use in local authority areas of jurisdiction. The KwaZulu-Natal Nature Conservation Service's (KZNNCS) standard response was to state that the control of ORVs on beaches was a local authority matter in terms of the Sea-shore Act and that the complainants' concerns should be raised with the local authority concerned.

The Control of ORVs in Protected Areas

The use of ORVs on certain beaches under the former Natal Parks Board's control preceded the Policy and was well established when the Policy was promulgated. It therefore seemed inconceivable that the former Natal Parks Board could have approved of the Policy's requirement that protected areas be closed to ORVs. However, the Parks Board had expressed their satisfaction in writing with the content of the draft Policy. This draft included the requirement that protected areas be closed to ORVs. The day the Policy was promulgated the Board's Chief Conservator: Coast contacted Mr Schneier and informed him that the Board had overlooked the wording of this requirement of the Policy.

Although the Board and its successor, the KZNNCS, did not totally exclude ORVs from protected areas, these areas were zoned as required by section 2.1 of the Policy. For example, two sections of coastline falling within the St Lucia Marine Reserve and

the Maputaland Marine Reserve, 25 km and 45 km in length respectively, were designated as vehicle free wilderness areas. Within these two reserves 79 km were accessed by ORVs subject to the issue of a permit. The Policy's requirement that protected areas be closed was therefore being partially complied with. The Policy's requirements concerning the introduction of a permit system to regulate ORV use in demarcated areas was being fully complied with.

4.1.2.6 DEAT Evaluation of the General Policy

4.1.2.6.1 Shortcomings of the General Policy

According to Schneier (2000) the ORV General Policy sought to facilitate the controlled use of ORVs in a manner that was ecologically and socially responsible. If the Policy had been correctly implemented, ORVs would have only been permitted in areas which were not ecologically sensitive and where the enjoyment and safety of other beach users were not compromised. ORV use in these areas would have been regulated in terms of a permit system.

Schneier (2000) reported that efforts to implement the Policy since it was promulgated indicated that it had several inherent shortcomings. DEAT (Schneier; 2000) identified that the following shortcomings of the Policy should be addressed if the recreational use of ORVs on the coast are allowed to continue:

1. "The Policy does not require a management plan to be approved by a competent environmental authority before a beach or section of coastline is opened for controlled ORV use. Such a management plan should be based, *inter alia,* on an assessment of ecological, recreational and public safety factors.
2. The Policy must be applied by different local authorities individually and does not require regional issues, such as habitat requirements for specific bird or animal species, to be taken into account.
3. The Policy depends on the introduction of a permit system to ensure that ORVs are adequately controlled in demarcated areas. However, this requirement is too vague. While some permits stipulate detailed requirements with which the ORV user must comply (e.g. permit issued by KwaZulu-Natal Nature Conservation

Service), other permits are nothing more than a receipt indicating payment to a local authority."

In order to verify certain findings of the evaluation, Mr Schneier of the Coastal Management Sub-Directorate carried out an inspection of sections of the Eastern Cape and KwaZulu-Natal coastlines during the week of 31 July to 4 August 2000. Officials of the Eastern Cape Province's Department of Economic Affairs, Environment and Tourism and the KwaZulu-Natal Nature Conservation Service accompanied Mr Schneier during this inspection.

4.1.2.6.2 Evaluation Report Containing Three Scenarios

On the basis of the evaluation and the inspection conducted in August 2000, three scenarios and their implications were presented by Mr Schneier to the Minister of Environmental Affairs and Tourism. These three scenarios are described below and are referenced from Schneier (2000):

"Scenario 1: Retain the existing Policy

The evaluation indicated that shortcomings existed in respect of the Policy's content, its implementation by the relevant authorities, the legal arrangements for implementing it and the enforcement of regulations which gave it effect in specific areas.

With a few exceptions, the control of ORV use on the coast ranged from inadequate to totally unacceptable. Maintaining the existing Policy was not likely to improve the situation."

Scenario 2: Ban off-road vehicle use

"A ban would apply to the private or recreational off-road use of vehicles on the coast. Beaches are more resilient to ORV use than other coastal features such as dunes and salt marshes. The ban would therefore need to be applied in a defined coastal area encompassing various coastal features, as is the case with the existing Policy. Consideration would need to be given to whether a ban should also apply to the launching of boats, currently widespread. On some beaches,

ORV use is limited to the launching of boats only. If a ban was to be imposed, consideration should be given to exempting a limited number of demarcated sites for launching purposes only." (Schneier, 2000)

Implications

According to Schneier (2000): "Due to the prevalence of ORV use on the coast, there is little doubt that a ban would provoke considerable opposition, although many people are also likely to support it. Opposition would be particularly vociferous from the organised angling community and, to a lesser extent, from the motor industry. This is already evident from letters written to you in response to your proposed ban. Many local authorities and the KZNNCS will also oppose a ban. The other provincial conservation authorities are unlikely to strongly oppose a ban as they derive little or no revenue from issuing permits. Only the conservation authorities that have statutory boards can directly plough the income derived from issuing permits into managing the areas concerned. Although the Western Cape recently established such a board, it currently derives little revenue from issuing beach permits.

According to the KZNNCS, imposing a ban would detrimentally affect tourism in their coastal protected areas. Extended sections of coastline within their protected areas would become inaccessible. Providing alternative road access to remote beaches through dune forest would have more detrimental environmental impacts than allowing access along the beach. The KZNNCS would be unable to derive revenue from the use of these inaccessible areas. Many anglers would no longer spend their holidays at KZNNCS resorts if not permitted to use ORVs on the beach. Overcrowding of anglers would probably result on beaches close to the established camps.

It should be emphasised that the KZNNCS has not attempted to evaluate the potential benefits to tourism if a ban were imposed. It is likely that the imposition of a ban would make resorts such as Sodwana and Cape Vidal more attractive to hikers and other more nature orientated tourists. However, the

numbers of such eco-tourists are likely to be less than the current numbers of ORV users, particularly in the short term.

A ban will prove ineffective unless it is strictly enforced. With the exception of the beaches controlled by the KZNNCS, law enforcement on beaches is presently virtually non-existent. This applies both in respect of areas that are closed to ORVs, and in respect of controlled use areas. Penalties imposed on transgressors are also inadequate, varying from verbal warnings to fines of as little as R100 and never exceeding R500. Such penalties are insufficient to deter transgressors when the chances of being apprehended are very slight. Such penalties are also inadequate to deter transgressors able to afford vehicles worth several hundred thousand Rand."

Scenario 3: Allow ORV use under strictly controlled conditions

According to Schneier (2000), "The Policy's implementation along the coast is generally inadequate and its objectives have therefore not been met, with a few exceptions. However, the KZNNCS has demonstrated that it is possible to achieve the Policy's objectives if adequate control measures are applied. This scenario systematically addresses the shortcomings of the Policy and its implementation.

1. Promulgate new legislation

New legislation, probably in the form of national regulations, is required. This will eliminate the clumsy legal arrangements whereby various statutes and regulations give legal effect to the Policy. National regulations will establish a procedure for allowing strictly controlled ORV recreational use in demarcated areas, and prohibit ORV use outside such areas. The regulations will need to allocate administrative responsibilities to local, provincial and national spheres of government. The regulations will also provide for severe penalties, including the confiscation of ORVs, to deter transgressors.

Regulations will need to provide for a period of grace during which existing legal arrangements will continue to apply. Permits for driving vehicles on

beaches, issued in terms of existing legal arrangements, will also remain valid during this period.

2. Establish adequate institutional arrangements

The provincial environmental authorities are, with a few exceptions, not ensuring that local authorities comply with the existing Policy. It would be an onerous task for these authorities to address the numerous inadequacies regarding current compliance with the Policy. The regulations proposed above would place the onus on local and provincial authorities to ensure that an adequate management system is in place before an area is opened for controlled ORV use.

3. Zone the coast

The provincial conservation authorities will need to zone the coast at a broad regional scale into areas that must be closed to ORVs, and areas where the controlled use of ORVs may be considered. This zoning process will be guided by an assessment of ecological factors, such as habitat and breeding requirements of turtles and certain bird species. A major shortcoming of the existing Policy's implementation concerns its requirement for ecologically sensitive areas, including bird-nesting areas, to be closed to ORVs. Only one local authority has closed its beaches to ORVs during the African black oystercatcher breeding season specifically. This bird nests close to the high water mark. Research has shown that its breeding success is detrimentally affected by vehicle traffic.

4. Strictly control ORV use in demarcated areas

After completion of the zoning process, local authorities either individually or jointly with their neighbouring local authorities, could apply to the relevant provincial environmental authority for a management plan to be approved in respect of demarcated areas. A management plan would need to be compiled in terms of the requirements of the national regulations. A management plan would need to include:

a. an assessment of ecological, recreational and public safety factors;

b. detailed and adequate control measures; and

c. financial arrangements to ensure that the management plan is effectively implemented and enforced.

The regulations should also empower the responsible provincial MEC and the Minister of Environmental Affairs and Tourism to revoke the validity of a management plan if it is inadequately implemented. This would effectively close the area concerned to ORVs."

4.1.2.6.3 Recommendations of Evaluation Report

Schneier (2000) recommended to the Minister of Environmental Affairs and Tourism that: "The KZNNCS has demonstrated that it is possible to control the recreational use of ORVs in a socially and environmentally responsible manner. This use can generate funds to advance conservation and management objectives. It was therefore recommended that Scenario 3 be adopted in respect of controlling the recreational use of ORVs on the coast. This submission has found that the current arrangements for controlling the recreational use of ORVs on our coast are seriously flawed. Should you not approve of Scenario 3, it is recommended that Scenario 2 be adopted. If Scenario 2 is adopted, consideration will need to be given to the question of permitting the limited use of ORVs for boat launching only."

4.1.2.6.4 Evaluation Report to Minister Vali Moosa, September 2000

According to Mr Schneier a meeting was held with the Minister in the beginning of September 2000 to discuss the evaluation report on the use of ORVs on beaches in South Africa. This initial ministerial advice was requested by the Minister of Environmental Affairs and Tourism to determine the status quo of ORV use on beaches in South Africa. Mr Schneier stated that Minister of Environmental Affairs and Tourism, Minister Vali Moosa required a ban on recreational vehicles on beaches, and that exceptions might be made for boat launching, subject to ecological and public safety factors, and handicapped persons.

The Minister asked Mr Schneier of DEAT to prepare the necessary legislation to prohibit ORVs from beaches. Mr Schneier stated (email dated 23 October 2000) that: "It is likely that a ban will be vigorously opposed and it might not materialise. Whether it materialises or not there remains a need for managers to know what impacts vehicles have on inter-tidal fauna. If a ban is imposed angling associations and others will continue to make representations to this and future governments to reverse the ban."

4.1.3 Legal Opinion Regarding Draft Regulations (May 2001)

According to Mr Schneier of DEAT (23 May 2001): "The advertising of the draft regulations (completed in January) for public comment was delayed by a legal opinion which advised that it was necessary to follow a complex procedure before the regulations could be promulgated. Additional legal advice was obtained which indicated that it is unnecessary to follow the complex procedure previously recommended."

The draft regulations propose a general ban on the off-road use of vehicles on the coast for recreational purposes. These draft regulations proposed that the regulations provide for the use of vehicles in demarcated areas for boat launching only, subject to environmental impact assessments. The draft regulations recommended that handicapped persons not be exempted from the requirements imposed by the regulations. In order to address the problem of inadequate law enforcement, the draft regulations provide for severe penalties.

The draft regulations were sent to the Director-General's office on 22 May 2001. Mr Schneier[5] stated that: "The Minister will probably make some announcement during his budget speech in Parliament on 29 May 2001 concerning the advertising of the regulations for comment."

[5] Personal communication, 23/10/2000

4.1.4 Draft ORV Regulations

The draft ORV Regulations were gazetted on 29 May 2001, in Government Notice 1401 of 2001. Reference is made to the background information contained in the website[6] advertising the Regulations for public comment: "The purpose of the proposed regulations is to provide national legislation in the interest of the environment and human safety and the enjoyment derived from coastal recreation. All three factors are important in promoting coastal tourism, which contributes significantly to the economies of villages and towns on the South Africa coast.

The Constitution requires government to protect the environment. The National Environmental Management Act (No. 107 of 1998) further requires government to give specific attention to sensitive and highly dynamic coastal ecosystems. The Regulations therefore reflect the obligations imposed on government by the Constitution and sub-ordinate legislation. The Regulations help ensure that our coast remains a valuable national asset, which is managed in the long-term public interest.

The government is also required to promote the participation of all interested and affected parties in environmental governance. Decisions taken by government must take into account the interests, needs and values of all interested and affected parties, who are therefore urged to use this opportunity to comment on the proposed regulations."

The deadline for public comment on the draft Regulations was initially the 29th June 2001, but was extended due to the large response from the public. The draft Regulations proposed a general ban on the use of vehicles on the coast for recreational purposes.

Minister of Environmental Affairs and Tourism, Mr Vali Moosa's statements made at the beginning of Environmental Week, 4 to 8 June 2001 reflect the changing legislative environment: "We must act before it is too late to protect our environment." (Natal Witness, 5 June 2001), and was reported to say in his interview with the *Natal Witness*

[6] http://www.environment.gov.za/sacoasat

that the people of South Africa needed to change their attitude (Natal Witness, 5 June 2001). In his budget speech to Parliament Minister Moosa emphasised that the country's guiding principle must be sustainable development and sustainable use of natural resources. He announced the publication of draft regulations aimed at prohibiting the driving of ORVs and other private vehicles on beaches (Natal Witness, 5 June 2001).

4.1.5 Regulations in Terms of the National Environmental Management Act, 1998: Control of Vehicles in the Coastal Zone

Regulations (No. 1399 of 2001) for the control of vehicles in the coastal zone were gazetted on 21st December 2001 in terms of Section 44 of the National Environmental Management Act (No. 107 of 1998), and became effective on 20 January 2002.

The website news article entitled, "Government gets tough with new environment laws – Cabinet approves much debated ban on 4x4s..." is referenced. It states: "Welcoming the uncompromising stance supported by Cabinet, Moosa said: "The use of vehicles for recreational purposes on the coast is increasing. This use is increasingly damaging coastal ecosystems and historical sites, and diminishing the quality of the recreational experience of the general public. This diminishes the value of the coast, a vitally important national asset."

The preamble to the ORV Regulations is referenced: "To provide for a general prohibition on the recreational use of vehicles in the coastal zone, to provide procedures for approving the use of vehicles in the coastal zone under specific circumstances, to provide measures for the enforcement of these regulations and to prescribe penalties in respect of contravention." (Government Gazette No. 22960; 21/12/2001)

These regulations provide for a general prohibition on the recreational use of vehicles in the coastal zone, detail permissible uses, provide for demarcation of limited Recreational Use Areas and the application for permits to use vehicles in the coastal zone, and stipulate measures for the enforcement of the Regulations and penalties in respect of contraventions. Transitional provisions were made with respect to boat

launching sites (18 months), and 11 months grace was provided for existing scientific research, non-recreational activities approved in terms of the Marine Living Resources Act (No. 18 of 1998), tour-operated tourism activities and access to private property.

The "Ulwandle" KwaZulu-Natal's Coastal Management Newsletter (Summer 2002) reported, that "Those caught driving an off-road recreational vehicle across a South African beach on or after January 20, 2002 will be dealt with strictly, including having their 4x4 seized and confiscated, says the Department of Environmental Affairs and Tourism (DEAT). Applicants for permits will be required to follow environmental impact assessment procedures."

4.1.6 Legal Case Following the Promulgation of the Regulations

The South African Shore Angling Association (SASAA) and the Oyster Bay Ratepayers Association contended that the Minister of Environmental Affairs, Minister Vali Moosa had "over-stepped his authority, which was exclusive to the Minister of Transport, by approving a ban which involved vehicles" (Natal Mercury, 26 April 2002). The Advocates on behalf of the applicants, applied that the ORV regulations were *ultra vires* the National Environmental Management Act, Act 107 of 1998. (Goldberg and Victor Inc., 6 February 2002). The SASAA argued that it would be impossible to host competitions at certain beaches as these were only accessible by vehicle, and that the Sea-Shore Act that regulates the use of the sea-shore does not make provision for the Minister of Environmental Affairs and Tourism to make regulations that govern the use of the sea-shore.

The Department of Environmental Affairs and Tourism's (DEAT) counter-argument on coastal marine preservation included that the recreational use of off-road vehicles on the coastline had increased dramatically over the past three decades, and that in the absence of regulations that controlled vehicle access to the coastline, this was damaging to the ecologically sensitive coastal areas and also posed a threat to the safety of bathers. DEAT argued that provision could be made for recreational areas where regular access could be made for vehicles, but only with a permit, under strict control and after an environmental impact study had been conducted by local authorities (Natal Mercury, 26 April 2002).

The case was heard by the High Court of Port Elizabeth, and the final ruling was given on 25 April 2002. Judge Andre Erasmus of the High Court dismissed the applications and stated that the new regulations did make provision for vehicular access under special circumstances. Judge Erasmus stated that Minister Vali Moosa had not acted arbitrarily in enforcing the beach ban, and therefore did not act unreasonably as contended by the applicants (Natal Mercury, 26 April 2002). Judge Erasmus noted that the Seashore Act did not explicitly exclude the powers of other ministers from making regulations regarding the use of the seashore by members of the public.

4.1.7 KZN Wildlife Policy for Greater St Lucia Wetland Park

KZN Wildlife is in the process of developing guidelines or principles for assessing applications for recreational vehicle use areas in the coastal zone of KwaZulu-Natal (as at the end of May 2002). The purpose of these principles are to prevent an *ad hoc* approach to the ORV Regulations, such as the implementation of Recreational Use Areas, and the risk of compromising biodiversity and development potential of the coast. The principles address ecological (related to key biodiversity and biophysical considerations), social (visitor-related), and management and economic limitations.

The newspaper report dated 17 November 2002 referenced in Table 2 (no. 24) entitled: "Proposal may ease 4x4 beach tensions" states that the latest study for Recreational Use Areas in the Greater St Lucia Wetland Park has identified a 4.5km stretch of beach at St Lucia and 4km at Sodwana and Mapelane. There is a restriction on vehicle numbers with a limit of 15 at Mapelane. The article mentions that the ban will remain at Cape Vidal. The article quotes Andrew Zaloumis, the Chief Executive of the Greater St Lucia Wetland Park Authority that: "Its been important to look at beach usage holistically so it examines zonation, beach driving, boat launching, scientific research and management. The final report, along with public comment, will go to the department with decision- taking by the Director-General."

4.1.8 Natal Coast Anglers Union

The Natal Coast Anglers Union (NCAU) is the representative body in KwaZulu-Natal for competitive shore anglers, a number of which represent South Africa at international level. The NCAU has a Beach Vehicle Code of Conduct that embodies the rules and regulations published by KZN Wildlife (Fendt, 27 March 2002). The Code of Conduct includes an undertaking by the applicant to abide by the rules and regulations pertaining to the access to beaches and driving on beaches as issued by the KZN Wildlife and other Local Authorities. The Code of Conduct stipulates driving only between the low and high water marks wherever possible; no driving on sand dunes or areas of vegetation; taking of special precautions when driving in areas used by bathers; travelling at a safe speed that will not endanger the safety of other beach users; using legal and authorised access routes to the beach for the purposes of Shore Angling; and, removing litter and cleaning at the place of fishing.

The NCAU are in the process of communicating with the KZN Wildlife Greater St Lucia Wetland Park: Marine Conservation Manager concerning the various proposals to declare recreational use areas (in terms of the ORV Regulations) for the conservation areas of the coast under KZN Wildlife's jurisdiction. The NCAU are concerned that access to their existing fishing areas has been reduced by up to 60%, and are arguing that the intention of new regulations is to limit vehicle numbers and not impose resource extraction limitations. (NCAU; 10 January 2002)

4.1.9 Summary of Chronological Events

The issue of off-road vehicle (ORV) use along the coast was first addressed at a national level in 1984.

Minister of Environmental Affairs and Tourism requested the former Council for the Environment to investigate this matter and make pertinent recommendations. The Council in turn tasked its Committee for Coastal and Marine Systems with the investigation.

The first draft report considered by the Committee recommended a ban on all recreational use of vehicles on all beaches. However, this recommendation was strongly opposed by the then Natal Parks Board.

In 1986 the Committee produced a final report entitled "A Policy for controlling Off-road Vehicles in the Coastal Zone of the Republic of South Africa". The report found that all coastal ecosystems, with the exception of certain inter-tidal beaches, are sensitive to vehicle traffic. The report also found that irresponsible ORV use threatens the safety of other beach users. The report recommended prohibiting vehicles from ecologically sensitive areas and bathing beaches. Beaches where ORV use could be accommodated were to be identified by the provincial conservation authorities in consultation with local authorities. A permit system was recommended to regulate ORV use in these areas.

The findings of the above report provided a basis for a departmental document entitled "A Policy and Guidelines for the Control of Vehicles on and adjacent to Beaches". The Minister referred this document to the Administrators of the Cape and Natal in 1989. The Minister requested the Administrators to implement the policy and guidelines in their respective provinces.
The Minister's request had no statutory basis and could be applied at the discretion of the provincial and local authorities. It was decided to use section 2 of the newly drafted Environment Conservation Act (No. 73 of 1989) to provide such a statutory basis. Section 2 empowered the Minister to "determine the general policy" with respect to the protection of the environment."

A proposed policy concerning the use of vehicles in the coastal zone was published in the Government Gazette of 21 January 1994 for comment. The Department of Environmental Affairs and Tourism sent copies of the proposed policy to all coastal local authorities, angling clubs, manufacturers of four-wheel drive vehicles and four-wheel drive clubs. Comments received reflected overwhelming support for the proposed policy. Only a few organisations and individuals were not in favour of the policy. The policy was revised in the light of the comments received before being published as general policy in the Government Gazette.

National legislation for controlling off-road vehicles on the coast existed in the form of a national policy, titled *General Policy in terms of the Environment Conservation Act (No. 73 of 1989): Control of Vehicles in the Coastal Zone* (hereafter referred to as the Policy). The Policy was promulgated in the Government Gazette on 29 April 1994. The General Policy made provision for the coast to be zoned to make provision for areas where vehicles are excluded (based on environmental or recreational considerations) or permitted subject to the conditions of a permit.

In order to promote the Policy's implementation, DEAT sent a letter to all coastal local authorities following the Policy's promulgation in 1994.

In order to promote environmental awareness among off-road vehicle users on the coast, the Department of Environmental Affairs and Tourism published an illustrated pamphlet entitled "Off-road vehicles and coastal conservation". This pamphlet was published soon after the Policy's promulgation and widely distributed. It has been replaced by an updated version entitled "Off-road vehicles and caring for our coast".

The Department was involved in various cases in order to ensure the Policy's implementation in specific coastal areas.

The National Department of Environmental Affairs and Tourism (DEAT) undertook a survey in 1998 of compliance with the ORV policy.

The overall conclusion drawn from this analysis was that the implementation of the Policy by local authorities was unsatisfactory and intervention by provincial government was necessary to rectify this. Schneier (2000) reported that: "Apart from the environmental degradation and disturbance to beach users associated with the irresponsible use of off-road vehicles in the coastal zone, serious and fatal injuries have also occurred. Vehicles in the coastal zone are presently controlled at the discretion of the local authority concerned, and in some coastal areas no controls exist. The purpose of the proclamation was to establish a uniform national policy in the interest of the

environment, human safety and the enjoyment derived from recreation in the coastal zone."

Contrary to one of the Policy's requirements, the recreational use of ORVs was also permitted in many protected areas. Although the Natal Parks Board and its successor, the KZNNCS, did not totally exclude ORVs from protected areas, these areas were zoned as required by section 2.1 of the Policy. For example, two sections of coastline falling within the St Lucia Marine Reserve and the Maputaland Marine Reserve, 25 km and 45 km in length respectively, were designated as vehicle free wilderness areas. Within these two reserves 79 km could be accessed by ORVs subject to the issue of a permit. The Policy's requirement that protected areas be closed was therefore being partially complied with. The Policy's requirements concerning the introduction of a permit system to regulate ORV use in demarcated areas was being fully complied with.

Schneier (2000) reported that efforts to implement the Policy since it was promulgated indicate that it had several inherent shortcomings. The Policy legally bound all organs of State whose powers or duties influenced the impact of ORVs on the coastal environment. However, the Policy was not directly applicable to the behaviour of the off-road vehicle user, nor could it be used to penalise illegal ORV use. According to Schneier (2000), other legislation was required to give effect to the policy.

According to Mr Schneier a meeting with the Minister in the beginning of September 2000 was held to discuss the Evaluation Report prepared by Mr Schneier on the use of ORVs on beaches in South Africa, following Mr Schneier's visit and assessment conducted at the beginning of August 2000. This Ministerial advice was requested by the Minister of Environmental Affairs and Tourism to determine the status quo of ORV use on beaches in South Africa.

The Minister asked Mr Schneier to prepare the necessary legislation to prohibit ORVs from beaches. The draft regulations proposed a general ban on the off-road use of vehicles on the coast for recreational purposes and were sent to the Director-General's office on 22 May 2001. The Draft Regulations were announced in the Minister's budget speech on 29 May 2001. The deadline for public comment was

initially the 29th June 2001, but was extended due to the large response from the public.

The ORV Regulations were promulgated on 21 December 2002 and gave affect to the total banning of ORV from beaches for recreational purposes. The ORV Regulations came into effect on 20 January 2002.

The South African Shore Angling Association (SASAA) and the Oyster Bay Ratepayers Association contended that the Minister of Environmental Affairs and Tourism, Minister Vali Moosa had "over-stepped his authority, which was exclusive to the Minister of Transport, by approving a ban which involved vehicles" (Natal Mercury, 26 April 2002), and took the Minister to court, arguing that the ORV Regulations were *ultra vires* NEMA.

The High Court Judge dismissed the application in favour of the Minister, and the ORV Regulations remained in force.

KZN Wildlife have responded to the need to apply the ORV Regulations to their areas of jurisdiction, and are currently preparing principles for assessing applications for recreational vehicle use areas in the coastal zone of KwaZulu-Natal.

The NCAU and SASAA are currently discussing the "Proposed principles for assessing applications for recreational vehicle use areas in the coastal zone of KwaZulu-Natal" with KZN Wildlife, in particular, the areas proposed within the Greater St Lucia Wetland Park.

4.1.10 Newspaper Articles on Events

Table 2 references the newspaper articles attached at Appendix 8 for purposes of providing further clarity on the events that occurred with the management of ORVs on beaches.

The chronological register of the newspaper articles assists in determining whether there is a causal chain or logic in which each these events lead to the "conclusion" or promulgation of the ORV Regulations.

Table 2: Newspaper articles of relevance

NO.	DATE	NEWSPAPER / MAGAZINE	ARTICLE TITLE
1	5 June 2001	The Natal Witness	Minister says protecting the environment starts at home – Changing attitudes.
2	11 June 2002	The Mercury	Law will allow Govt to confiscate equipment. Vehicle beach ban looms.
3	5 July 2001	The Natal Witness	Conservationists hail key step in replenishing fish and bird stocks – Plan to ban wheels from beaches.
4	November 2001	Natures Voice (in North Glen News)	Restricted beach access
5	Mid-December 2001	Umhlanga Globe	4x4 Drivers please note
6	December 2001	Gateway to KwaZulu-Natal	Beach driving is restricted.
7	December 2001	Gateway to KwaZulu-Natal	Restricted beach access.
8	January 2002	Natures Voice (in North Glen News)	Off-road vehicles banned on beaches.
9	19 January 2002	The Natal Witness	Beach ban on 4x4s starts.
10	19 January 2002	The Natal Witness	KZN Wildlife and public concerned over banning of 4x4s
11	25 January 2002	The Natal Witness	New 4x4 laws hit businesses hard.
12	Summer 2002	Uwandle: KwaZulu-Natal's Coastal Management Newsletter	4x4 Beach Ban begins.
13	9 February 2002	The Natal Witness	Axles of evil.
14	24 February 2002	Sunday Tribune	4x4 ban hits poor hardest.
15	March 2002	Getaway	Beach driving ban enforced in KZN parks.
16	3 March 2002	Sunday Tribune	Call for ban to be banished.
17	4 March 2002	The Natal Witness	St Lucia residents protest 4x4 beach ban.
18	24 March 2002	Sunday Tribune	4x4 beach ban: St Lucia Easter plea for relief fails.
19	26 April 2002	Natal Mercury	Court upholds vehicle beach ban.
20	13 June 2002	Natal Witness	Exemption to 4x4 beach ban.

21	July 2002	Gateway to KZN	Reprieve for 4x4s on St Lucia beaches.
22	12 November 2002	Natal Witness	Don't wreck our beaches with your vehicles, Valli Moosa tells drivers. No place for 4x4 'ruffians' here.
23	17 November 2002	Sunday Tribune	Not all 4x4 owners are ruffians
24	17 November 2002	Sunday Tribune	Proposal may ease 4x4 beach tensions
25	19 November 2002	The Natal Witness	Watch out for turtles

4.2 Environmental Legal Framework

4.2.1 The Environmental Conservation Act (No. 73 of 1989)

The *General Policy in terms of the Environmental Conservation Act (No. 73 of 1989): Control of Vehicles in the Coastal Zone* was proclaimed in terms of section 2 of the ECA, and the local authorities were therefore responsible for ensuring that the use of vehicles in the coastal zone within the local authority's area of jurisdiction was controlled in accordance with the proclaimed policy.

The General Policy derives its power from section 3 of the Environment Conservation Act (ECA) that reads as follows:

"**Compliance with policy.** (1) Each Minister, Administrator, local authority and government institution upon which any power has been conferred or to which any duty which may have an influence on the environment has been assigned by or under any law, shall exercise such power and perform such duty in accordance with the policy referred to in section 2."

In terms of Section 3 of the Environment Conservation Act, the Department's Director-General was responsible for ensuring that the Policy was complied with by the relevant national and provincial Ministers, local authorities and government institutions. An amendment of the Act was published in the Government Gazette on 8 August 1996. This transferred the responsibility for

monitoring compliance with policy (promulgated in terms of the Act) by local authorities and government institutions, to a designated provincial authority.

Most beaches outside formally protected areas fell under the jurisdiction of a local authority. The Department's Director-General retained responsibility for ensuring that relevant national Ministers and designated provincial authorities complied with the General Policy promulgated under section 2.

4.2.2 The Sea-shore Act (No. 21 of 1935)

The Sea-shore Act (No. 21 van 1935) could be used to implement the Policy on beaches and on State land situated near the coast.

In terms of Section 10 of the Sea-shore Act, the Minister of Environment Affairs and Tourism "may make regulations, or by notice in the Gazette authorise any local authority, in regard to any portion of the sea-shore and the sea situated within or adjoining the area of jurisdiction of such local authority to make regulations" concerning " the use of the sea-shore" and "the control, generally of the sea-shore and the sea".

The "sea-shore" is defined as "the water and the land between the low-water mark and the high water mark". The "high water mark" is defined as the "highest line reached by the water of the sea during ordinary storms occurring during the most stormy period of the year, excluding abnormal or exceptional floods". As a guideline, the high water mark can be regarded as the line where debris accumulates, i.e. slightly higher than the spring high-water mark. The banks of tidal rivers and tidal lagoons are also part of the sea-shore, in terms of the Act.

In terms of section 10(3)(b), the Minister "may declare any regulation to be applicable to any State-owned land adjoining or situated near the sea-shore..." Such State-owned land "shall be deemed to be a portion of the sea-shore".

The Minister's power to promulgate regulations in terms of section 10 was delegated to the Administrator of Natal on 21 January 1980. The most severe fine that could have

been imposed in respect of a contravention of a provision of section 10, was five hundred rand. In order that regulations act as an effective deterrent, penalties should be periodically revised. The administration of the Sea-shore Act was assigned to the coastal provinces by proclamation in the Government Gazette on 7 April 1995.

4.2.3 The Natal Nature Conservation Ordinance (No. 15 of 1974)

Natal's Nature Conservation Ordinance was never used to promulgate regulations for controlling ORV use above the high water mark. Most of the ordinance's provisions were repealed by the KwaZulu-Natal Nature Conservation Management Act (No 9 of 1997).

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

Section 50 of the National Environmental Management Act, 1998 (NEMA) repealed *inter alia,* sections 2 and 3 of the Environment Conservation Act (ECA). As mentioned above, the General Policy was proclaimed in terms of section 2 of the Environment Conservation Act. Notwithstanding this repeal of sections 2 and 3 of the ECA, NEMA's section 51 states that "anything done or deemed to have been done under a provision repealed by this Act remains valid to the extent that it is consistent with this Act until anything done under this Act overrides it". The General Policy was consistent with principles in Chapter 1 of NEMA and therefore remained valid prior to the promulgation of the ORV Regulations.

The "Regulations in terms of the National Environmental Management Act, 1998: Control of Vehicles in the Coastal Zone" were promulgated on 21st December 2001 by the Minister of Environmental Affairs and Tourism under section 44 of NEMA. These Regulations came into effect on 20 January 2002.

Case No. 63/02 "In the matter between the South African Shore Angling Association and Die Oesterbaai se Belastingbetalersvereniging" as the Applicants and "the Minister of Environmental Affairs and Tourism" as the Respondent, was brought to the High Court of South Africa (South Eastern Cape Local Division) in February 2002. The Applicants brought the application to the court "declaring

the Regulations promulgated and published by the Respondent in Government Gazette No. 22960 and Government Notice No. 1399 published on 21 December 2001 to be declared null and void as being *ultra vires* and/or unconstitutional." (Goldberg and Victor Inc.; 6 February 2002).

Refer to Section 4.1.6 above concerning the details of the case. The case was heard by the High Court of Port Elizabeth, and the final ruling was given on 25 April 2002, in favour of the Respondent and the application was dismissed.

4.2.5 White Paper for Sustainable Coastal Development in South Africa (April 2000)

4.2.5.1 Principles for Coastal Management

The following principles underpin the White Paper (DEAT, April 2002):

- **National asset:** The coast must be retained as a national asset, with public rights to access and benefit from the many opportunities provided by coastal resources.
- **Economic development:** Coastal economic development opportunities must be optimised to meet society's needs and to promote the wellbeing of coastal communities.
- **Social equity:** Coastal management efforts must ensure that all people, including future generations, enjoy the rights of human dignity, equality and freedom.
- **Ecological integrity:** The diversity, health and productivity of coastal ecosystems must be maintained and, where appropriate, rehabilitated.
- **Holism:** The coast must be treated as a distinctive and indivisible system, recognising the interrelationships between coastal users and ecosystems and between the land, sea and air.
- **Risk aversion and precaution:** Coastal management efforts must adopt a risk-averse and precautionary approach under conditions of uncertainty.
- **Accountability and responsibility:** Coastal management is a shared responsibility. All people must be held responsible for the consequences of their actions, including financial responsibility for negative impacts.
- **Duty of care:** All people and organisations must act with due care to avoid negative impacts on the coastal environment and coastal resources.

- **Integration and participation:** A dedicated, co-ordinated and integrated coastal management approach must be developed and conducted in a participatory, inclusive and transparent manner.
- **Co-operative governance:** Partnerships between government, the private sector and civil society must be built in order to ensure co-responsibility for coastal management and to empower stakeholders to participate effectively.

These principles are encompassed within the dimensions of sustainable development as described by Glavovic (2000). Refer to section 2.1.9.1.

4.2.5.2 Goals and Objectives of White Paper (April 2000)

The Policy (DEAT, April 2002) sets out a number of goals and objectives for coastal management. In particular, "Theme B: Our National Asset", and "Goal B1: To ensure that the public has the right of physical access to the sea, and to and along the sea-shore, on a managed basis", is of direct relevance to the management of ORVs on beaches.

4.3 Findings from Beach Survey, Leven Point

4.3.1 Description of Tide and Weather Conditions

The weather conditions on Day One were difficult for purposes of conducting the experiment with intermittent rain and a very strong wind.

The weather conditions on Day Two were more conducive to conducting the experiment, as it was partly cloudy with a light breeze.

Although the experiment was conducted during a Spring Low tide on two consecutive days, the water table was at different levels beneath the sand. On Day One, the water table was at a depth of approximately 25cm from the sand surface. On Day Two the water table was at a depth of approximately 20cm. Within the sample area on both days, the level of the water table was closer to the surface the further north the sand sample was taken, i.e. the level of the water table differed within the sample area on both days.

4.3.2 *Photographs of the Site at Leven Point*

Photographs of the site on both days where the experiment was conducted at Leven Point, are attached at Appendix 1 (Day One), and at Appendix 2 for Day Two.

4.3.3 *Median Particle Size*

The median particle sizes as calculated on the log-normal graph paper are indicated in the attached table at Appendix 6.

The table at Appendix 6 shows a uniform distribution of sand particles at the surface on Day One between 0.320mm and 0.330mm, and at the depth of 20cm, the median sand particle size varies on Day One between 0.325mm and 0.350mm. There is a uniform distribution of sand particles at the surface on Day Two varying between 0.320mm and 0.340mm. At the depth of 20cm, the median sand particle size varies on Day Two between 0.345mm and 0.370mm.

4.3.4 *Density of Sand Sample*

The density of each sand sample is indicated in the table attached at Appendix 6. These values were used to calculate the statistical significance.

4.3.5 *Statistical Results*

A summary of the statistical analysis is given in Table 3 below. The test results from the application of the Mann-Whitney U-Test (as determined using the SPSS Computer software package) are attached at Appendix 7, and an interpretation of the findings is given in section 5.5 in this Study. The Methodology of the statistical analysis is described in section 3.3.8 above.

Table 3: Summary of statistical calculations for Mann-Whitney U Test

TEST NO.	GROUP 1	GROUP 2	CALCULATED *U* VALUE[7]	TABLED[8] *U* VALUE	ACCEPT[9] / REJECT[10] NULL HYPOTHESIS
A.	**DAY ONE**	**DAY TWO**			
A1.	No pass all density data for Day One	No pass all density data for Day Two	9	5	ACCEPT
A2.	All pass density data Day One	All pass density data Day Two	27	99	**REJECT**
A3.	1 pass for surface and 20cm depth for Day One	1 pass for surface and 20cm depth for Day Two	5	5	**REJECT**
A4.	10 passes for surface and 20cm depth for Day One	10 passes for surface and 20cm depth for Day Two	6	5	ACCEPT (Note: that for 1-tailed test significance level at 0.05, table U value is 7. The Null Hypothesis would be rejected for 1 tailed test).
A5.	20 passes for surface and 20cm depth for Day One	20 passes for surface and 20cm depth for Day Two	0	5	**REJECT**
B.	**SURFACE (DAY ONE and 2) NO PASS**	**SURFACE (DAY ONE and 2) AFTER PASSES**			
B1.	Surface no pass for Day One and 2	Surface 1 pass for Day One and 2	14	5	ACCEPT
B2.	Surface no pass for Day and 2	Surface 10 passes for Day One and 2	16	5	ACCEPT
B3	Surface no pass density data for Day One and 2	Surface 20 passes density data for Day One and 2	16	5	ACCEPT
C.	**20cm DEPTH (DAY ONE and 2) NO PASS**	**20cm DEPTH (DAY ONE and 2) AFTER PASSES**			

[7] Calculated U value for Significance level for two-tailed test at 0.05

[8] Tabled U value for Significance level for two-tailed test at 0.05 (Fowler, Cohen and Jarvis; 1998).

[9] Accept Null Hypothesis if calculated U value exceeds the tabled U value.

[10] Reject Null Hypothesis if calculated U value is equal or smaller than the tabled U value.

TEST NO.	GROUP 1	GROUP 2	CALCULATED *U* VALUE[7]	TABLED[8] *U* VALUE	ACCEPT[9] / REJECT[10] NULL HYPOTHESIS
C1.	No pass 20cm depth for Day One and 2	1 pass 20cm depth for Day One and 2	10	5	ACCEPT
C2.	No pass 20 cm depth for Day One and 2	10 passes 20cm depth for Day One and 2	7	5	ACCEPT (Note: for 1-tailed test significance level at 0.05, table U value is 7. The Null Hypothesis would be rejected for 1 tailed test).
C3.	No pass at 20cm depth for Day One and 2	20 passes at 20cm depth for Day One and 2	11	5	ACCEPT
C4.	10 passes at 20cm depth for Day One and 2	20 passes at 20cm depth for Day One and 2	12	5	ACCEPT
D.	**SURFACE (DAY ONE and 2)**	**20cm DEPTH (DAY ONE and 2)**			
D1.	Surface no pass for Day One and 2	20cm depth no pass for Day One and 2	16	5	ACCEPT
D2.	Surface 1 pass for Day One and 2	20cm depth 1 pass for Day One and 2	16.5	5	ACCEPT
D3.	Surface 10 passes for Day One and 2	20cm depth 10 passes for Day One and 2	9	5	ACCEPT
D4.	Surface 20 passes for Day One and 2	20cm depth 20 passes for Day One and Day Two	18	5	ACCEPT
E.	**ALL DENSITY DATA (DAY ONE and 2) NO PASS**	**ALL DENSITY DATA (DAY ONE and 2) AFTER 20 PASSES**			
E1.	No pass density data for Day One and 2 (all surface and 20cm depth)	20 pass density data for Day One and 2 (all surface and 20cm depth)	54	37	ACCEPT
F.	NO PASS DATA	ALL PASS DATA			

TEST NO.	GROUP 1	GROUP 2	CALCULATED *U* VALUE[7]	TABLED[8] *U* VALUE	ACCEPT[9] / REJECT[10] NULL HYPOTHESIS
F1	No pass density data for Day One	All pass density data for Day Two	38	24[11]	ACCEPT
F2	No pass density data for Day Two	All pass density data for Day Two	40	24[12]	ACCEPT

[11] Robertson (1998)

[12] Robertson (1998)

4.3.6 Findings from Assessment of Ghost Crab Burrows

Section 3.3.5.3 above explained why the findings of Day Two were only assessed. There were 10 ghost crab burrows with an average diameter of 1cm that were counted within a 40m² area, and these were concentrated on the upper inter-tidal zone. No ghost crabs were observed. The abundance of ghost crab burrows was therefore assessed to be one burrow per 4m².

4.4 Findings from Informal Interviews

4.4.1 Mr Schneier: DEAT

Mr Schneier reported that the Minister was considering exemptions for handicapped and boat launching. He was of the opinion that there would be large opposition to banning ORVs from beaches and that it would take political courage to enforce a ban. Even if a ban were to be enforced there would be constant lobbies.

At Sodwana, tourism is based on ORVs generating about R2 million a year, and it would be economically disastrous if beaches were closed from a fishing and diving perspective. He stated that the Minister wanted Regulations that would require stricter management of ORVs on beaches, and the preparation of management plans with controls. The principle of the Environmental Impact Assessment Regulations that places the onus on the owner to ensure compliance should be applied to the ORV Regulations.

4.4.2 KZN Wildlife Officials: Cape Vidal

4.4.2.1 Mr Joubert

Mr Joubert stated that there is strict enforcement of the use of ORVs on the beach at Cape Vidal, and that only vehicles with permits are allowed on the beach. ORVs are not permitted to drive on the beaches north of Leven Point. A permit cost R130 per annum, and could be obtained from the office at Cape Vidal. Mr Joubert's perception of the users of ORVs was that the people who generally visited Cape Vidal are

environmentally aware and conscious of the need to adhere to the rules, but that occasionally there were people who did not follow the rules.

4.4.2.2 Mr Gissing

Mr Gissing stated that compliance was not a problem at Cape Vidal, as affluent people visited the site were generally conservationists. He compared Cape Vidal to St Lucia where people have a total disregard for beaches. At Cape Vidal he mentioned that on average only three people are fined a year for driving on the dunes. He also referred to the control of ORVs at Sodwana where there are many more people but where control is maintained at the boat launch site. There is no control at night at Cape Vidal with free access. However, during the turtle-breeding season the beach is closed at night to ORVs from November to Mid-March.

The busiest times of the year are during December and January along the entire stretch of beach where ORVs are permitted. During July and August the ORVs are concentrated opposite the entrance for a 2km stretch for the shad fishing. On a busy day there is an average of fifteen ORVs on the beach. Weekends and public holidays are also busy times.

Mr Gissing was of the opinion that the impact of ORVs on fauna is limited to sea lice below the low water mark, and to ghost crabs. Mr Gissing stated that the aesthetic impact is high. The biggest impact is that caused by ORVs driving above the high water mark where vegetation is destroyed and which takes a long time to grow back. Ghost crabs are either chased away or get killed by ORVs, and in the marine sanctuary there are thousands of crabs compared to where ORVs are permitted to drive. The chicks of plovers get killed or caught in the tracks of ORVs although they breed high up above the high water mark.

Mr Gissing was of the opinion that the people that hike are unhappy with the ORVs on the beaches. The vehicle tracks are limited to a small section about four to five metres wide where the impact is negligible within the inter-tidal zone. The areas of dune vegetation are where access must be prevented for ORVs. Mr Gissing's opinion

was that if the controls were stopped that the ORVs would have an impact on the beach.

4.5 Findings from Visual Observations at Cape Vidal

4.5.1 Prior to ORV Regulations (July 2001)

The photographs attached at Appendix 3 illustrate the presence of ORVs on the beach at Cape Vidal on 21st and 22nd July 2001. The photographs illustrate the recreational use of the beach by people fishing and using their ORVs to gain access to the beach. In additional, the strict enforcement of the permit system is illustrated by the presence of the KZN Wildlife Officers at the entrance to the beach and the signage indicating the rules of access to the beach. The photographs illustrate the visual impact that the tracks and ORVs have on the amenity of the beach. There were very few people walking or sitting on the beach, and the atmosphere was not very peaceful (from a pedestrian's point of view). One of the photographs shows an ORV being driven above (what appears to be) the high-water mark. No KZN Wildlife Officials were present on the beach itself, at the time. There were a number of ORVs on the beach, despite the fact that it was winter and the week-end following the end of the July school holidays.

4.5.2 Following ORV Regulations (May 2002)

A follow up site visit was held at Cape Vidal from 10th to 12th May 2002. Refer to the photographs attached at Appendix 4. Photographs were taken at the same places that were photographed in July 2001. The signage at the entrance to the beach at Cape Vidal has changed to notify that access is prohibited. There were markers on the beach where ORVs are permitted to park once they have launched their boat. No ORVs were being driven around or parked next to recreational fishing activities along the beach. There were many more people walking and sitting on the beach, and the atmosphere was peaceful. There were ORV tracks on the beach but these were restricted to the boat-launching site.

A decrease in the numbers of visitors was visible in the Camp, which is usually very popular. The wild animals that have grown to rely on stealing food from the camps

were noticeably more aggressive, probably as a result of increased competition for scarce resources.

One vehicle entered the beach and drove north for about 1km before stopping and turning around. This ORV belonged to a Tour Operator who was driving visitors around. This phenomenon was not evident prior to the promulgation of the ORV Regulations, as there were numerous opportunities to hire ORVs for driving on the beaches. There was a high presence of KZN Wildlife Officers who walked along the beach where the boats are launched.

5 DISCUSSION OF INTERPRETATION OF RESULTS

5.1 Sustainable Coastal development and the Impact of ORVs on Beaches

The impact of ORVs on beaches in South Africa is multifaceted and when viewed holistically incorporates the interaction between the biophysical, social, economic and institutional environments. This Study focuses only on the legislative and biophysical environments associated with the impact of ORVs on beaches.

Glavovic (2000) identified the five fundamental dimensions to achieve sustainable coastal development as being: ecological integrity and natural capital; public co-operation and social capital; cultural vitality and ethical capital; economic prosperity and human, manufactured and financial capital; and effective governance and political and institutional capital.

An understanding of the ecological integrity and effective governance dimensions (focus of Study) is therefore applicable in considering the impact of ORVs on beaches. Although only two of the five dimensions are investigated, the findings and interpretation thereof contributes towards an understanding of the sustainability of the impact of ORVs on beaches within the South African context.

As Glavovic (2000) identified, the concept of sustainable coastal development draws attention to the challenge of making decisions under conditions of uncertainty and makes explicit the linkage between science and public policy. Achieving sustainable coastal development therefore necessitates an integrated process of decision-making and ongoing management (Glavovic, 2000).

This section includes a comparative analysis of Cooper's (1996) Soil Conservation Policy Model and the ORV General Policy (1994) Conceptual Model. The components discussed and compared in section 5.2.1 are considered to be components that make up sustainable coastal development. This Study assesses the evolutionary progression in legislative events and the biophysical impact of ORVs on the beach. The legislative management of the impact of ORVs on beaches in South Africa therefore illustrates the

link between science (biophysical impacts) and public policy. Effective governance is therefore being achieved through integrated decision-making and ongoing management of the impact of ORVs on South African beaches. The "effective governance" which has resulted in the conditional banning of ORVs from beaches has resulted in promoting the ecological integrity of beaches.

Sustainable coastal development draws attention to the "process" character of sustainable development that needs to be worked towards over time in an iterative manner. It highlights the need to take into account the current reality of prevailing circumstances, the uncertainty of the future, limited understanding of coastal ecosystems and communities, and the complex interactions between and within the human and non human components of the environment.

5.2 Legislative Management of ORV Use on the Beach

5.2.1 A Comparative Analysis of Cooper's (1996) Policy Model for Soil Conservation and the ORV General Policy (1994) Conceptual Model

Cooper (1996) undertook an analysis of the four key legislative enactments formulated specifically to address soil erosion, using key elements of the World Soils Policy as a baseline. The analysis of the four key acts revealed a clear evolutionary progression in which successive acts sought to build upon successes and to minimise the weaknesses of previous efforts. Cooper's (1996) assessment permitted the compilation of what she termed the South African Policy Environment Model. Cooper (1996) identified five environments that are featured in the model, as being the economic, political, historical, physical and perceptual environments, which individually and collectively shaped the South African soil conservation policy environment represented in her study. Refer to Figure 1 in section 2.2 above.

The General Policy: Control of Vehicles in the Coastal Zone (1994) is described in section 4.1.2. above. An evolutionary progression in the successive actions undertaken by DEAT is clear as they attempted to build on the successes and minimise the weaknesses of the General Policy (1994). DEAT were responsible for the promotion of

the General Policy. This was followed by a survey of compliance and an evaluation of the provincial enforcement of the ORV General Policy. Their findings were used to evaluate the effectiveness of ORV General Policy, and to make recommendations to the Minister of Environmental Affairs and Tourism. Throughout this time period when the ORV General Policy was promoted, surveyed for compliance, and evaluated for its effectiveness, a number of key elements are seen to be interacting within the policy environment.

These key elements in the ORV General Policy (1994) environment are identified as the social, biophysical, economic, and institutional environments. Refer to Figure 2 below.

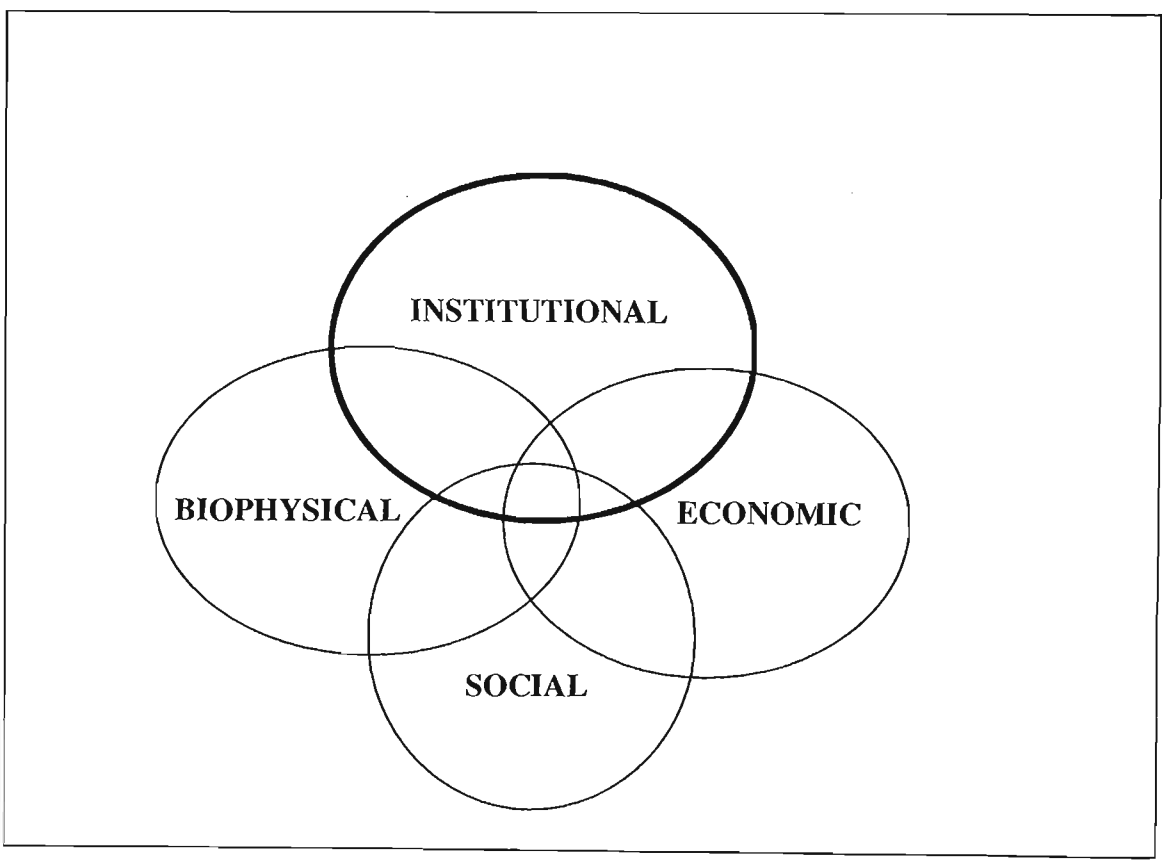


Figure 2: ORV General Policy (1994) Conceptual Model

The historical element is not seen to play a key role, as the driving of ORVs on beaches only recently became a popular recreational activity in the late 1980s. Although Cooper's model included the historical element, in the ORV General Policy (1994) the

historical element is more one of national, provincial and local authority management and control, and is referenced as the institutional element. Cooper (1996) identified the perceptual environment as key in contributing towards shaping the South African Soil Conservation Policy. The perceptual environment is, however, not seen as a key element that shaped the ORV General Policy (1994) environment. It could possibly have played a minor role in the individual's assessment of the biophysical impacts, economic spin-offs, and social recreational value associated with ORVs on beaches. These individuals could have been located within the institutional arena, and their perceptions could have influenced the enforcement or lack thereof, of the General Policy (1994). Therefore, the institutional environment is identified as a key element.

The social element is comprised of the various recreational users of ORVs on beaches that continued to access the beaches with or without permits, depending on whether the local or provincial authority permitted access with or without permits, or whether there was strict enforcement. The lack of enforcement is likely to have been linked to the economic spin-offs associated with the income generated from the tourist activities. The social element is therefore linked to the institutional, biophysical and economic elements.

The biophysical element associated with ORVs on the beaches is linked to the social and institutional elements. The biophysical impacts were effectively the result of the enforcement of the permit system, and the individual user as to whether they or not they restricted their driving to within the inter-tidal zone as stipulated in the ORV General Policy (1994). The biophysical element is also linked to the social environment as recreational users without permits would have been likely to disobey the General Policy's biophysical limits of driving ORVs on the beaches.

The economic element is related to the income received from permits and the spin-offs from tourism and related activities within coastal areas managed by a local authority or provincial authority. The economic element is linked to the institutional element, and social element, and indirectly to the biophysical environment in which the activities take place.

The institutional element is the key element comprising the ORV General Policy (1994) policy environment. The national Department of Environment Affairs and Tourism prepared the ORV General Policy, and surveyed whether the relevant local or provincial authorities were enforcing it. This was followed by an evaluation of the ORV General Policy (1994) and recommendations were made to the Minister. Therefore, although the social, biophysical, and economic elements interacted with the institutional element to varying degrees, it was effectively the institutional element that was key in the General Policy (1994) policy environment.

Cooper (1996) identified that the perceptual environment was the key element in the Soil Conservation Policy environment, and focussed her investigations on determining this.

This Study has undertaken a comparative analysis of Cooper's (1996) Soil Conservation Policy Model and the ORV General Policy (1994) environment, and deduced that that they differ. The ORV General Policy (1994) includes a social element where Cooper's (1996) Model did not, and it highlights that the institutional element was a key contributing factor. Cooper's (1996) Model focussed on the perceptual environment as the key contributing factor. This is seen as a possible sub-component of the institutional element in the ORV General Policy (1994) environment.

5.2.2 *Assessment of Evolutionary Progression in Legislative Events*

The events leading up to the promulgation of the ORV Regulations, and the events that have followed illustrate that there is a clear evolutionary progression in which successive management processes have taken place to minimise the weaknesses of previous attempts to control ORVs on beaches in South Africa.

The successive processes concerning the management of ORVs cannot be viewed in isolation of the promulgation of environmental legislation. The environmental legislation provides the framework for the management of ORVs on beaches, and the effectiveness of this management is concurrent with the effectiveness of the legislation. There are two key pieces of environmental legislation, namely the Environmental

Conservation Act, No. 73 of 1989 (ECA), and the National Environmental Management Act, No. 107 of 1998 (NEMA).

The first significant attempt to manage ORVs on beaches was the promulgation of the "General Policy in terms of the Environmental Conservation Act (No. 73 of 1989): Control of vehicles in the Coastal Zone" in terms of section 2 of the ECA, on 29 April 1994. This General Policy was assessed by DEAT in 1998 for its effectiveness through a questionnaire survey sent to the relevant coastal local authorities. Compliance by the local authorities was reviewed, and the overall conclusion was that the implementation of the Policy by the local authorities was unsatisfactory and that national government intervention was necessary. This was followed up in 2000 by an official of DEAT (Mr Schneier) who conducted an inspection, followed by the submission of a report (proposing the three scenarios) to the Minister of Environmental Affairs and Tourism in September of 2000. The Minister requested DEAT to prepare Regulations to enforce a ban of ORVs from beaches.

Minister Vali Moosa's statement "We must act before it is too late to protect our environment" (Natal Witness, 5 June 2001) made in June 2001 is identified as a key statement within the evolutionary progression of events that culminated in the promulgation of the ORV Regulations. The Draft ORV Regulations were gazetted on 29 June 2001, in terms of section 44 of the National Environmental Management Act, No. 107 of 1998.

The second and most significant event in terms of the management of ORVs on beaches is the promulgation in terms of section 44 of NEMA, of the "Regulations in terms of the National Environmental Management Act, 1998: Control of Vehicles in the Coastal Zone", which was gazetted on 21st December 2001, and which came into effect on 20th January 2002.

5.3 Literature search

5.3.1 Applicability of Literature

The literature review undertaken by van der Merwe (1988) provides a valuable assessment of the international and national literature available on the topic of the impact of ORVs on beaches. The review is however, outdated. There are investigations under way of relevance that are in the process of being conducted at the University of Port Elizabeth (for example) and the Oceanographic Research Institute (ORI) that would serve to further illustrate the impact of ORVs on beaches in South Africa.

The national and international research concerning the impact of ORVs within the inter-tidal zone on sandy beaches is applicable to the experiment conducted at Leven Point, and provides a valuable point of departure. The statistical evaluation as detailed in section 5.5 references relevant research.

The findings from the overseas information as included under section 2.4, highlights that the approach to ORV management should have a focus on "duty of care", a key principle of sustainable coastal development.

5.4 Median Particle Size

The uniform distribution of sand particles on Day One at the surface and at the depth of 20cm, indicate that there is a natural distribution of sand particles within the beach strata with the smaller sand particles located at the surface. This is also evident for the median sand particle distribution found on Day Two at the surface and at the depth of 20cm. The Wentworth Scale (Brown and McLachan, 1990) classifies sand particles with a diameter of between 0.25mm to 0.50mm, as "medium" sand. The size of sand particles determines the permeability of the sand, with fine sands having a lower permeability due to the smaller pore sizes.

The medium sand particles at the experiment area at Leven Point are therefore considered to have a medium permeability, compared to sands that would have a high

permeability made up of very coarse (1.0mm to 2.0 mm) or coarse sands (0.50mm to 1.0mm).

The median sand particle sizes determined for both days showed a very slight difference between the two days. The physical and biological descriptions of beaches are highly variable over small spatial and temporal scales, and this very slight difference cannot be attributed to the passage of the ORV over the same area on Day Two.

5.5 Statistical Evaluation of Sand Sample Densities

Statistical analysis was applied to the results of the sand density samples collected during the experiment to the determination of the biophysical impact caused by an ORV at Leven Point, on the beach between the high and low water mark (inter-tidal zone).

Reference is made to "Table 3: Summary of statistical calculations for Mann-Whitney U Test" in section 4.3.5 above.

5.5.1 TEST A: Densities of Day One Compared to Densities of Day Two

5.5.1.1 TEST A1: No pass all density data for Day One compared to no pass all density data for Day Two

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the two sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm for Day One is not significantly different to the beach sand density at the surface and at a depth of 20cm for Day Two before the ORV made any passes.

The sand samples were collected from south to north along the linear section prior to the ORV making any passes on Day One and again on Day Two. The "no pass" sand samples were collected first within the study area on both days prior to the ORV making any passes.

The lack of a difference between Day One and Day Two reflects the changes made by one tidal cycle within the dynamic inter-tidal zone between the high and low water mark. The beach sand that had been displaced or compacted by the passing of the ORV on Day One was temporary and as soon as the next tidal cycle was experienced, the beach sand was subjected to the dynamic influences of the inter-tidal zone. The section of beach where the experiment was conducted on Day One would have been inundated during the next high tide. The sand densities on Day Two were therefore not significantly different to that of Day One.

Both days of the experiment are considered to be different due to the water table being higher on the second day than on the first day, which is likely to be attributable to the tide on Day Two changing towards high tide. The time of the Spring Low Tide was different on both days and the sand samples were collected at different times on both days.

According to the Tide Chart (KZN Wildlife, 2001) the low tide was at 10:13am on Day One. On Day One the sand samples were collected from 8:44am to 9:42am when the tide was still changing towards the low tide.

Low tide on Day Two was at 10:55am. On Day Two the sand samples were collected from 10:49am to 11:55am, indicating that the tide was changing towards high tide.

The water table appeared to be higher on both days the further north the sand sample was taken within the 20m stretch of beach selected as the study area, influencing the density of the sand at a depth of 20cm. The reason for this is unknown but is likely to be attributed to the beach profile, and reflects the high variability that occurs locally within a beach.

Therefore, although the water table levels were different, and the samples were collected at different times of the day and at different times during the tidal cycle at low tide, the densities of the sand samples on the two consecutive days were not significantly different.

5.5.1.2 TEST A2: All pass density data Day One compared to all pass density data Day Two

The Null Hypothesis is rejected which indicates that the observed differences in the ranks are significant for all the pass density data collected for Day One and all the pass density data collected for Day Two.

These results indicate that the density of the beach sand where the experiment was conducted on Day One can be considered to be significantly different, when compared to the beach sand density of the second day of the experiment, after the ORV made 1 pass, 10 passes and 20 passes.

The sand samples were collected from south to north along the linear section where the ORV made a number of passes. TEST A1 showed that there is no significant difference in the sand densities at the surface and at a depth of 20cm between Day One and Day Two before the ORV made any passes. TEST A2 showed that the sand densities for Day One are significantly different to Day Two after the ORV made a number of passes.

Both days of the experiment are considered to be different due to the fact that the water table was higher on the second day than on the first day, and the water table was higher the further north the sand sample was collected. This made the collection of the sand sample on the second day at the depth of 20cm difficult due to the saturated sand the further north the sand sample was collected. This is also applicable to TEST A1.

The high level of the water table could have influenced the density of the sand samples the further north they were collected after the ORV made the passes, but this was the same for the sand densities before the ORV made any passes. The "control" experiment of TEST A1 showed no significant difference in the sand densities when comparing Day One with Day Two.

The U test result for TEST A2 identifies that there is a significant difference in the sand densities between the two consecutive days. This indicates that the ORV could have influenced the sand densities in some way either at a depth of 20cm or on the

surface to cause the two samples to be significantly different. Alternatively, due to the dynamic nature of the inter-tidal zone and the fact that even as the sand samples were being collected, the beach was undergoing changes, the significant difference is more likely to be attributed to the variability within the beach itself.

The visual evidence of the saturated sand indicates that it was not compacted the further north the sample was taken due to the high level of the water table at a depth of 20cm. This leads to the deduction that the level of the water table is likely to influence the ability of the sand to be compacted at the depth of 20cm after the pass of an ORV.

5.5.1.3 TEST A3: 1 pass for surface and 20cm depth density data for Day One compared to 1 pass for surface and 20cm depth density data for Day Two

The Null Hypothesis is rejected which indicates that the observed differences in the ranks are significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface after 1 pass and at a depth of 20cm for Day One is significantly different at the surface and at a depth of 20cm after the ORV made 1 pass for Day Two.

This correlates with the statistical test results for Test A2 where all pass data for Day One was found to be significantly different to all the pass data for Day Two.
Reference is made to the interpretation for TEST A2.

5.5.1.4 TEST A4: 10 passes for surface and 20cm depth density data for Day One compared to 10 passes for surface and 20cm depth density data for Day Two

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm for Day One after 10 passes of the ORV, is not significantly different to the

beach sand density at the surface and at a depth of 20cm for Day Two, after 20 passes of the ORV.

This result contradicts the findings of TEST A2, TEST A3, and TEST A5. The result of a lack of significant difference between the densities after 10 passes on Day One and Day Two may be due to human error in the collection of the sand samples in adverse weather conditions on Day One, and the collection of saturated sand due to the high water table on Day Two

5.5.1.5 TEST A5: 20 passes for surface and 20cm depth density data for Day One compared to 20 passes for surface and 20cm depth density data for Day Two

The Null Hypothesis is rejected which indicates that the observed differences in the ranks are significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm for Day One after 20 passes of the ORV, is significantly different to the beach sand density at the surface and at a depth of 20cm for Day Two, after 20 passes of the ORV.

Refer to the interpretation for TEST A2.

5.5.2 TEST B: Surface Density

5.5.2.1 TEST B1: Surface no pass density data for Day One and 2 compared to surface 1 pass density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) has not been impacted upon significantly after the ORV made 1 pass. This confers with the literature that states that the surface density is not increased due to a displacement factor. Reference is made to the findings of Anders and Leatherman (1981) that states that: "Direct displacement experiments showed that ORV traffic

compacts beach sand at depth, but loosens the surface of the beach, thus rendering it more susceptible to aeolian and/or swash activity. The first few passes along the beach through a track displace the most sand, and each succeeding pass results in less sediment movement."

5.5.2.2 TEST B2: Surface no pass density data for Day One and 2 compared to surface 10 passes density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) has not been impacted upon significantly after the ORV made 10 passes.

This confers with the literature that states that the surface density is not increased due to the displacement factor. Reference is made to the interpretation for TEST B1 above.

5.5.2.3 TEST B3: Surface no pass data for Day One and 2 compared to surface 20 passes for Day One and 2.

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) has not been impacted upon significantly after the ORV made 20 passes.

This confers with the literature that states that the surface density is not increased due to a displacement factor. Reference is made to the interpretation for TEST B1 above.

5.5.3 TEST C: 20cm Depth (Day One and 2)

5.5.3.1 TEST C1: No pass 20cm depth density data for Day One and 2 compared to 1 pass 20cm depth density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the depth of 20cm (combined for both days) has not been impacted upon significantly after the ORV made 1 pass.

Reference is made to relevant research, which states that: "The shearing and compressional effects of vehicle passage extend to a depth of 20cm..." (Leatherman and Godfrey, 1979). It is unclear exactly where this reference to the "compression effects extending to a depth of 20cm" refers to, either the inter-tidal zone or the backshore.

Reference is made to the findings of Anders and Leatherman (1981) that states that: "Direct displacement experiments showed that ORV traffic compacts beach sand at depth, but loosens the surface of the beach, thus rendering it more susceptible to aeolian and/or swash activity." This statement could infer that compaction of the sand can occur at the backshore where aeolian activity is prevalent, and at the foreshore or inter-tidal zone where there is swash activity.

In addition the high water table on Day Two could have influenced the ability of the sand to become compacted at a depth of 20cm.

5.5.3.2 TEST C2: No pass 20 cm depth density data for Day One and 2 compared to 10 passes 20cm depth density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed difference in the ranks is not significant for the 2 sample data sets. These results indicate that the density of the beach sand at the depth of 20cm (combined for both days) has not been impacted upon significantly after the ORV made 10 passes.

Reference is made to the interpretations in TEST C1 above.

5.5.3.3 TEST C3: No pass density data at 20cm depth for Day One and 2 compared to 20 passes density data at 20cm depth for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the depth of 20cm (combined for both days) has not been impacted upon significantly after the ORV made 20 passes.

Reference is made to the interpretations in TEST C1 above.

5.5.3.4 TEST C4: 10 passes at 20cm depth density data for Day One and 2 compared 20 passes at 20cm depth density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the depth of 20cm (combined for both days) has not been impacted upon significantly after the ORV made 20 passes following on from the 10 passes made by the ORV.

Reference is made to the interpretations in TEST C1 above.

5.5.4 TEST D: Surface Density Compared to 20cm Depth Density

5.5.4.1 TEST D1: Surface no pass density data for Day One and 2 compared to 20cm depth no pass density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density (combined for both days) of the beach sand at the surface is not significantly different to the density at the depth of 20cm, before the ORV made any passes.

The lack of a significant difference between the surface density and at a depth of 20cm infers that the sand within the inter-tidal zone is of a uniform density up to a depth of 20cm. The sand density is dependent on the tidal cycle that causes a fluctuation in the water table that follows the rise and fall of the tide. Reference is made to section 2.3.2.2 concerning Brown and McLachan's (1990) findings that large volumes of sea water are filtered by the inter-tidal and sub-tidal sand bodies of beaches, and that fine-grained beaches filter smaller volumes but the water has a greater resistance time in this sediment than coarser beaches.

In section 5.4 above, the Median Sand Particle Size was classified as "medium" according to the Wentworth Scale (Brown and McLachan, 1990).

Refer to the interpretation of TEST A1 that references the dynamic nature of the inter-tidal zone.

5.5.4.2 TEST D2: Surface 1 pass density data for Day One and 2 compared to 20cm depth 1 pass density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) after 1 pass has not been impacted upon significantly at a depth of 20cm after the ORV made 1 pass.

Reference is made to the interpretation in TEST D1 above.

5.5.4.3 TEST D3: Surface 10 passes density data for Day One and 2 compared to 20cm depth 10 passes density data for Day One and 2

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) after 10 passes has not been impacted upon significantly at a depth of 20cm after the ORV made 10 pass.

Reference is made to the interpretation in TEST D1 above.

5.5.4.4 TEST D4: Surface 20 passes density data for Day One and 2 compared to 20cm depth 20 passes density data for Day One and Day Two

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface (combined for both days) after 20 passes has not been impacted upon significantly at a depth of 20cm after the ORV made 20 passes.

Reference is made to the interpretation in TEST D1 above.

5.5.5 TEST E: Density Data for Surface and 20cm Depth for Day One and Two

5.5.5.1 TEST E1: No pass density data for Day One and 2 (all surface and 20cm depth) compared to 20 pass density data for Day One and 2 (all surface and 20cm depth)

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm (combined for both days) before the ORV made any passes is not significantly different to the sand density after the ORV made 20 passes.

Reference is made to the interpretations in TEST B1 above, where surface densities where compared for both days with the result of no significant difference.

Reference is made to the interpretations in TEST C1 above, where 20cm depth densities where compared for both days with the result of no significant difference. Reference is made to the interpretation in TEST D1 above, where surface and 20cm depth densities where compared for both days with the result of no significant difference.

5.5.6 TEST F: No Pass Data Compared to All Pass Data for Each Day

5.5.6.1 TEST F1: No pass density data for Day One compared to all pass density data for Day One

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm for Day One before the ORV made any passes is not significantly different to the sand density after the ORV made all the passes (1 pass, 10 passes and 20 passes combined).

The sand densities at the surface and at the depth of 20cm before the ORV made any passes do not differ when compared to the combined sand densities at the surface and at the depth of 20cm after the ORV made 1 pass, 10 passes and 20 passes.

The water table on Day One was estimated to be at a depth of approximately 25cm. The level of the water table affected the depth to which the sand could be potentially compacted by the passage of the ORV on Day One. The sand samples collected at the 20cm depth on Day One were slightly more compacted when compared to Day Two, as indicated by the need to use a hammer to force the metal sampling cylinder into the sand at that depth. The level of the water table decreased in depth the further north the sand sample was taken.

The level of the water table affected the depth to which the sand could be potentially compacted by the passage of the ORV on Day One.

5.5.6.2 TEST F2: No pass density data for Day Two compared to all pass density data for Day Two

The Null Hypothesis is accepted which indicates that the observed differences in the ranks are not significant for the 2 sample data sets.

These results indicate that the density of the beach sand at the surface and at a depth of 20cm for Day Two before the ORV made any passes is not significantly different to the sand density after the ORV made all the passes (1 pass, 10 passes and 20 passes combined).

The sand densities at the surface and at the depth of 20cm before the ORV made any passes do not differ when compared to the combined sand densities at the surface and at the depth of 20cm after the ORV made 1 pass, 10 passes and 20 passes.

The water table on Day One was estimated to be at a depth of approximately 20cm. The level of the water table affected the depth to which the sand could be potentially compacted by the passage of the ORV on Day Two. The level of the water table decreased in depth the further north the sand sample was taken.

The level of the water table affected the depth to which the sand could be potentially compacted by the passage of the ORV on Day Two.

5.5.7 Statistics Summary of Findings

The observed differences in the densities at the surface and at a depth of 20cm for Day One and Day Two are considered to be significant as indicated by the rejection of the Null Hypothesis for the following U test:

TEST A2: indicates that there is a significant difference between the sand densities on Day One and Day Two after the ORV made the various passes and attributes this difference to the possible impacts caused by the ORV, and the influence of the high water table on Day Two on the ability of the sand to become compacted.

TEST A3: indicates that there is a significant difference between the sand densities on Day One and Day Two after the ORV made 1 pass and attributes this difference to the possible impacts caused by the ORV, and the influence of the high water table on Day Two.

TEST A5: indicates that there is a significant difference between the sand densities on Day One and Day Two after the ORV made 20 passes and attributes this difference to the possible impacts caused by the ORV, and the influence of the high water table on Day Two.

The remaining Mann-Whitney U Tests for TEST B, TEST C, TEST D, TEST E, and TEST F all indicated that there is no significant difference between the sand densities for the various tests.

5.6 Findings from Ghost Crab Assessment

The beach experiment conducted at Leven Point was conducted during winter. The burrows of the ghost crabs were located on the upper inter-tidal zone and had an average diameter of 1cm. In section 2.3.3.3.1 above, Jackson, Smale and Berry (1991) identified that crab abundance fluctuates seasonally with a drop in winter figures, as identified by Haley (1972).

It is not known whether 10 ghost crab burrows located within a 40m² area is considered to reflect an abundance of ghost crabs. In section 2.3.3.3.1 above reference is made to the findings by Steiner and Leatherman (1981) that the mean density of ghost crabs per 0,1 ha plots were 10 on an undisturbed beach.

5.7 Informal Interviews and Visual observations

The visual observations made at the Case Study Area (Cape Vidal) during July 2001 prior to the promulgation of the ORV regulations, were compared to the observations made during May 2002 (following the promulgation of the ORV Regulations). The observations clearly serve to illustrate the impact that the regulations have had on the beach users.

The observations made during May 2002 showed a marked decline of ORVs on the beach, with ORVs parked in the demarcated area for launching purposes only. The presence of a Tour Operator driving on the beach was observed. These Tour Operators are permitted to drive on the beach as a transitional provision of the ORV Regulations, valid for a period of eighteen months from the date of the promulgation of the Regulations. KZN Wildlife was strictly enforcing the ORV Regulations and the presence of the Officials at the entrance and on the beach confirmed this. The presence of numerous pedestrians on the beach emphasised the lack of ORVs on the beach.

6 INVESTIGATION SHORTFALLS

6.1 Variability of Beaches

The physical and biological descriptions of beaches are highly variable over small spatial and temporal scales. Things change dramatically on beaches over short time frames and from one place to the next, even if the two sites are within meters of each other. This causes difficulty in detecting differences between beaches, i.e. because there is so much variability within a beach, that variability between beaches becomes insignificant.

The variability that occurs within a beach was observed during the collection of the sand samples on each day, and over the two consecutive days. Thus a comparison of sand samples is difficult from the point of view of an identification of an external factor exerting a force or influencing the properties of a sand sample.

The findings of the statistical analysis and the evaluation thereof need to be assessed within the context of the variability that occurs within beaches. Thus, although the statistical results may reflect a significant difference between the densities of sand samples, these differences cannot necessarily be attributed to the influence of the ORV passing over the area sampled.

6.2 Informal Interviews

Mr Joubert (Camp Manager) and Mr Gissing (Marine Conservation Officer), both KZN Wildlife Officials based at Cape Vidal were not available during the second site visit conducted at Cape Vidal from 10 to 12 May 2002. Therefore, emphasis has been placed on the visual observations made at Cape Vidal of the changes evident following the promulgation of the ORV Regulations.

7 CONCLUSIONS

7.1 Legislative Management of ORVs on Beaches in South Africa

The following conclusions are drawn from an assessment of the environmental legislative framework and the effectiveness of the legislative management of ORVs on beaches:

- The environmental legislation provides the framework for the management of ORVs on beaches;
- The effectiveness of this management is concurrent with the effectiveness of the legislation, namely the two key pieces of South African environmental legislation;
- The "General Policy" was promulgated in terms of section 2 of the Environmental Conservation Act (No. 73 of 1989) on 29 April 1994;
- The ORV Regulations were promulgated on 21 December 2001 in terms of section 44 of the National Environmental Management Act, No. 107 of 1998 (NEMA);
- There is a clear evolutionary progression in the successive legislative changes that have resulted in a more effective system of management of ORVs on beaches in South Africa;
- The Minister of Environmental Affairs and Tourism, Minister Vali Moosa, has effectively "acted before it is too late to protect the environment". Minister Vali Moosa advocated the prohibition of ORVs within the coastal zone, and the provision of procedures for approving the use of ORVs in the coastal zone under specific circumstances. This is in line with the principles of NEMA that identify the need for "duty of care" and advocates the "precautionary principle".

7.2 Literature

The following conclusions are drawn from an assessment of the existing literature:

- The existing literature facilitates an understanding of the impacts caused by ORVs on beaches, specifically concerning the impact on the surface sand, and at a depth of 20cm. There is literature on the impacts of ORVs on ghost crabs and other macrofauna.

- There is a need for further research on the impact of ORVs on beaches to take into account the variability that exists within and between sandy beaches in South Africa. Such research would contribute towards a better understanding of the impacts caused by ORVs on beaches over a period of time; and,
- The regional impact of permitting ORVs on beaches in accordance with the ORV Regulations (2001) needs to be investigated, in terms of habitat requirements for specific bird and animal species.

7.3 Experimental Investigation

The findings of the assessment of the distribution of Median Sand Particle Size indicated that the sand particle sizes were uniformly distributed within the experimental area. The investigation found a slight variation between the size of sand particles found at the surface and at the depth of 20cm on both days, and this was considered to be the natural sand particle distribution found within the beach section investigated. It is likely that the dynamic nature of the inter-tidal zone effectively "replaced" any temporary impact on the sand particle size distribution caused by the passing of an ORV, within the next tidal cycle.

The findings of the experiment (sand density component) were assessed using statistical analysis, and these findings were evaluated in terms of the literature review. The conclusions from the statistical findings are discussed below.

The case study area was conducted in the section of beach between the high water mark and the low water mark, where the influences of the tide are continuously experienced. This implies that the beach morphology will differ from one day to the next and within each tidal cycle due to the dynamic nature of the inter-tidal zone. The area between the high and low water mark can be expected to differ when the same section of beach is compared on two consecutive days.

Although the experiment was conducted during a Spring Low Tide on two consecutive days, the water table was at different levels beneath the sand with the area demarcated for the experiment. On Day One, the water table was at a depth of approximately 25cm.

On Day Two the water table was at a depth of approximately 20cm. Within the sample area on both days, the level of the water table was closer to the surface the further north the sand sample was taken; i.e. the level of the water table differed within the sample area on both days. The level of the water table affected the depth to which the sand could be potentially compacted by the passage of the ORV during the low tide period. The sand sample was collected at a depth of 20cm, and where the water table was high the sand of the collected sample was loose and saturated with seawater.

The statistical test results for TEST A rejected the Null Hypothesis when comparing the densities of the sand samples for Day One and Day Two. This reflects the expected outcome that the beach morphology (and therefore the densities) of the beach sand in the same section of beach on two consecutive day, will differ. In addition, the high water table experienced during the collection of the sand samples differed on both days, and affected the potential compaction of the sand at a depth of 20cm after the ORV made a number of passes.

Reference is made to the statement by Brown and McLachan (1990) that: "Large volumes of sea water are filtered by the inter-tidal and sub-tidal sand bodies of beaches. Fine-grained beaches filter smaller volumes but the water has a greater resistance time in this sediment than coarser beaches." The sand at the experiment area at Leven Point was classified as "medium". The "medium" permeability of the sand could explain the relatively high water table during low tide experienced on both days.

Reference is made the statement that: "The shearing and compressional effects of vehicle passage extend to a depth of 20cm..." (Leatherman and Godfrey, 1979). It is unclear exactly where this reference to the "compression effects extending to a depth of 20cm" refers to, i.e. either the inter-tidal zone or the backshore. The research at Level Point comparing sand densities at a depth of 20cm indicated no significant difference after the ORV made a number of passes. (Refer to TESTS C1 to C4).

Reference is made to the findings of Anders and Leatherman (1981) that states that: "Direct displacement experiments showed that ORV traffic compacts beach sand at depth, but loosens the surface of the beach, thus rendering it more susceptible to aeolian

and/or swash activity." This statement infers that compaction of the sand can occur at the backshore where aeolian activity is prevalent, and at the foreshore or inter-tidal zone where there is swash activity. The research at Leven Point comparing surface densities conferred with the research that the surface of the beach is loosened with passes made by an ORV. Refer to TESTS B1 to B3. The experiment did not investigate beach erosion.

The high variability found within beaches and specifically within the dynamic inter-tidal zone therefore makes the assessment of the potential impact caused by ORVs within this zone very difficult. The very nature of the inter-tidal zone effectively "removes" any temporary impact on the sand density caused by the passing of an ORV within the next tidal cycle.

The investigation of the presence of ghost crabs adjacent to the experimental area identified what was likely to be a normal ghost crab population for the area investigated. The area could be considered to be an undisturbed area, as no recreational ORVs were permitted north of Level Point.

7.4 Conclusions Drawn from Interviews and Visual Observations

The informal interviews held with the officials from KZN Wildlife at Cape Vidal during July 2001, together with the visual observations made prior to the promulgation of the ORV Regulations, served to highlight the popularity of ORVs on beaches for recreational purposes. The Marine Conservation Official of KZN Wildlife was of the opinion that if the controls were stopped that the ORVs would have an impact on the beach.

Although strict access controls were in place and served to control the access of ORVs to the beach at Cape Vidal, the promulgation of the ORV Regulations has effectively prevented the recreational use of ORVs at Cape Vidal. This was observed during May 2002 at Cape Vidal following the promulgation of the ORV Regulations in December 2001. Tour operators are making use of the provision in the ORV Regulations to drive on the beach with tour groups.

8 RECOMMENDATIONS

The Study has investigated the management aspect of the impact of ORVs on beaches as controlled by policy and legislation. The ORV Regulations (2001) stipulate certain conditions and areas where ORVs are permitted within the coastal zone. The ORV Regulations serve to enforce greater control and management of ORVs on beaches within specially identified areas, called Recreational Use Areas (RUA's) (regulation 5). RUA's can be designated by fulfilling the requirements of section 24(7) of NEMA "in respect of the investigation, assessment and communication of the potential impacts of the activities associated with recreational vehicle use in the proposed recreational use area" (ORV Regulations, 2001).

The following recommendations are considered to be applicable to the designation and ongoing management of Recreational Use Areas in terms of the ORV Regulations (2001), from a biophysical perspective:

1. There is a need for further research on the impact of ORVs on beaches to take into account the variability that exists within and between sandy beaches in South Africa. Such research would contribute towards a better understanding of the impacts caused by ORVs on beaches over a period of time.
2. ORVs should be restricted to the area between the high and low water mark on a beach or the "wet sand", as originally identified in the General Policy (1994).
3. ORVs access should be prohibited for a specified period proceeding and following high tide, as originally identified in the General Policy (1994).
4. ORVs should be prohibited to drive on the beach between dusk and dawn to minimise the impact on macrofauna, such as ghost crabs. Exceptions should be made for organisations, such as the Angling Associations and 4x4 Clubs that advocate their own code of conduct for beach driving.
5. In areas where potential Recreational Use Areas are identified, the Conditions of Approval in the Record of Decision issued by the relevant Environmental Department, should contain a requirement that the long-term effects on the macrofauna are monitored by an ecological scientist. This would be applicable to potential RUA's in marine reserves and other coastal protected areas.

6. The regional impact of permitting ORVs on beaches in accordance with the ORV Regulations (2001) needs to be investigated, in terms of habitat requirements for specific bird and animal species.
7. The seasonal closure of beaches should remain in those areas managed by KZN Wildlife during the turtle breeding season.

9 FINAL SUMMARY

The policy and legislative changes that have taken place to effectively enforce stricter control of ORVs on beaches have been successful. In particular from the perspective of the Minister of Environmental Affairs, Mr Vali Moosa who stated that: "We must act before it is too late to protect our environment" (Natal Witness, 5 June 2001), the ORV regulations have helped create an awareness of the management of ORVs on beaches. There however, remains a conflict in interests between the different user groups such as the conservationists, angling associations, and tourist-based organisations.

It is the finding of this Study that the impact of ORVs within the lower inter-tidal zone is difficult to determine due to the dynamic nature of this zone and the high variability that occurs within and between beaches. It is likely that the very nature of this dynamic inter-tidal zone effectively nullifies any impact that could have been caused by an ORV within the short-term. The findings of this Study support the physical boundaries for ORV management as determined by the General Policy (1994) that restricted ORVs to the area between the high and low water mark or "wet sand". Various recommendations are made to advocate the conservation of the biophysical environment of the inter-tidal zone on beaches, and which are applicable to the designation of Recreational Use Areas in terms of the ORV Regulations (2001).

The legislative management of ORVs on beaches has evolved over a period of time in response to a range of influences and changing circumstances within the various social, political, historical, economic and physical systems. This Study has investigated the physical system in depth where appropriate, in terms of the biophysical parameters within which ORVs are managed on the beach. Effective governance is therefore being achieved through integrated decision-making and ongoing management of the impact of ORVs on South African beaches. This effective governance which has resulted in the conditional banning of ORVs from beaches has resulted in promoting the ecological integrity of beaches.

Sustainable coastal development highlights the need to take into account the current reality of prevailing circumstances, the uncertainty of the future, limited understanding of coastal

ecosystems and communities, and the complex interactions between and within the human and non human components of the environment.

This study has not addressed the social, political, historical, or economic systems within the realm of sustainable coastal development that influence the management of ORVs on beaches in South Africa.

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Visitor Use Zones within the GSLWP

Inshore
Offshore
Ponta do Ora
KOSI BAY MOUTH
KOSI BAY SOUTH
N13 Point
MANGUZI
KOSI BAY
KWA DAPHA
ROTHLER POINT
RABBIT ROCK
CASTLE ROCK
DOG POINT
BLACK ROCK
ROCKTAIL BAY
LALA NECK
ISLAND ROCK
MR 439
MBAZWANA
High Density use zone
3 MILE REEF
4 MILE REEF
5 MILE REEF
JESSER POINT
SEE SAWDS
TO GAUTENG
VIA PONGOLA
MKUZI
MUZI PAN
Low Density Use Zone
Limited Use Zone
Limited Use Zone
Wilderness Zone
INDIAN OCEAN
LIBERTY POINT
MR 439
P 414
PALMS BAY
Wilderness Zone
Low Density Use Zone
HLUHLUWE
N2
CAPE VIDAL
Low Density Use Zone
CHARTERS CREEK
MR 380
FERRIERS ROCKS
Moderate Intensive Use Zone
ST LUCIA VILLAGE
High Density use zone
MR 237
Low Density Use Zone
MTUBATUBA
MAPELANE
N2
P 232
SOKHULU
TO DURBAN

N
W
E
S

LUBOMBO Spatial Development Initiative

Department of Environmental Affairs and Tourism

GREATER ST LUCIA WETLAND PARK
Integrated development management plan

EnviroMap

LEGEND

- Main Roads
- Sites / Towns
- Park Development Node

VISITORS USE ZONES

- *Wilderness*
- *Limited Use Zone*
- *Low Density*
- *Moderate Density*
- *High Intensity*
- Khula Village

ZONATION PLAN FOR THE MAPUTULAND & ST LUCIA MARINE RESERVES

- *A- Sanctuary Zone*
- *B- Restricted Zone*
- *C- Controlled Zone*
- *D- Proposed extension of Marine Reserve*

APPENDIX 1: PHOTOGRAPHS OF EXPERIMENT AT LEVEN POINT ON DAY 1

Plate 1: View north of beach study area

Plate 2: View south of Leven Point sign

Plate 3: View of area & ORV prior to conducting experiment

Plate 4: View south of tracks after 10 passes

Plate 5: Close-up view of tracks after 10 passes

Plate 6: Close-up of tracks & cyclinder after 10 passes

Plate 7: 20cm deep hole for sand sample after 10 passes

Plate 8: View south of ORV during 20 passes

Plate 9: View north of ORV during 20 passes

Plate 10: View east of ORV during 20 passes

Plate 11: ORV tracks after the 20 passes

Plate 12: View of 20cm deep hole after 20 passes

Plate 13: View west of beach slope to primary dune after ORV

Plate 14: View west of Transect A after 20 ORV passes

Plate 15: View east of Transect A after 20 ORV passes

APPENDIX 2: PHOTOGRAPHS OF EXPERIMENT AT LEVEN POINT ON DAY 2

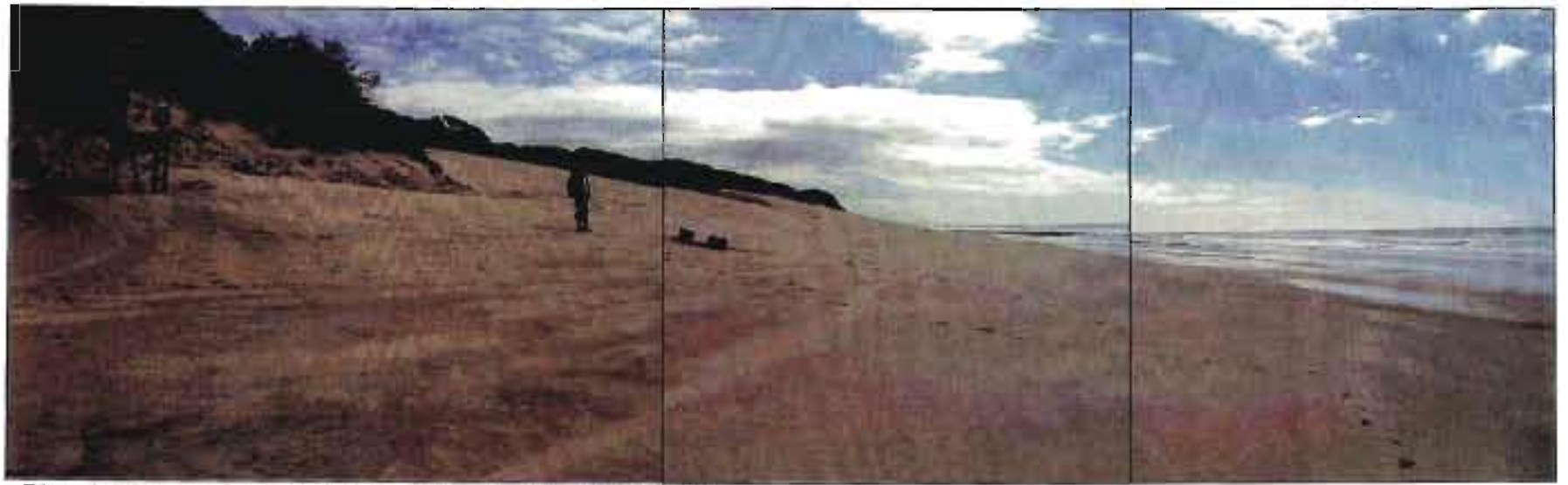


Plate 1: View north of beach at Leven Point before experiment

Plate 2: View south of experiment area before ORV

Plate 3: View north after 10 passes

Plate 4: View north east of marked crab burrows

Plate 5: Close-up of crab burrow

Plate 6: View east of study area of Transect A

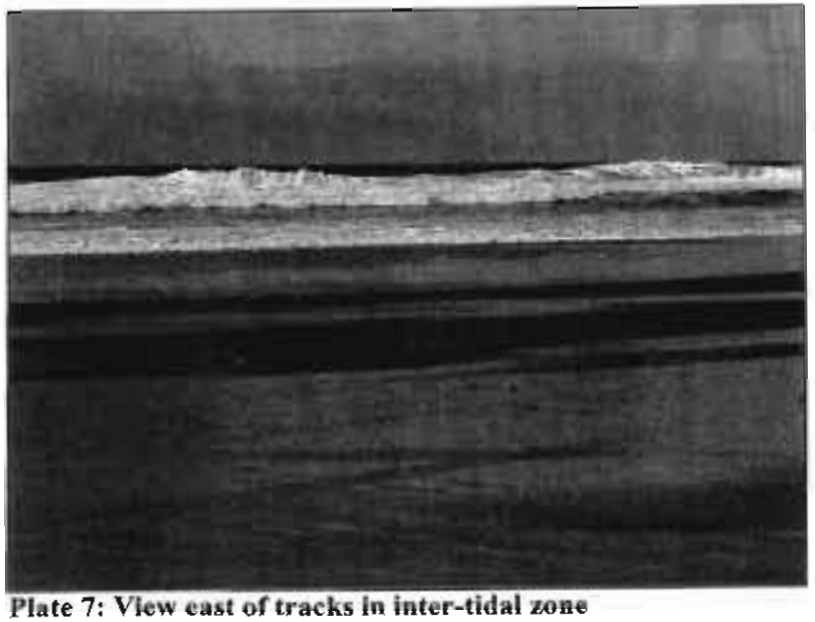
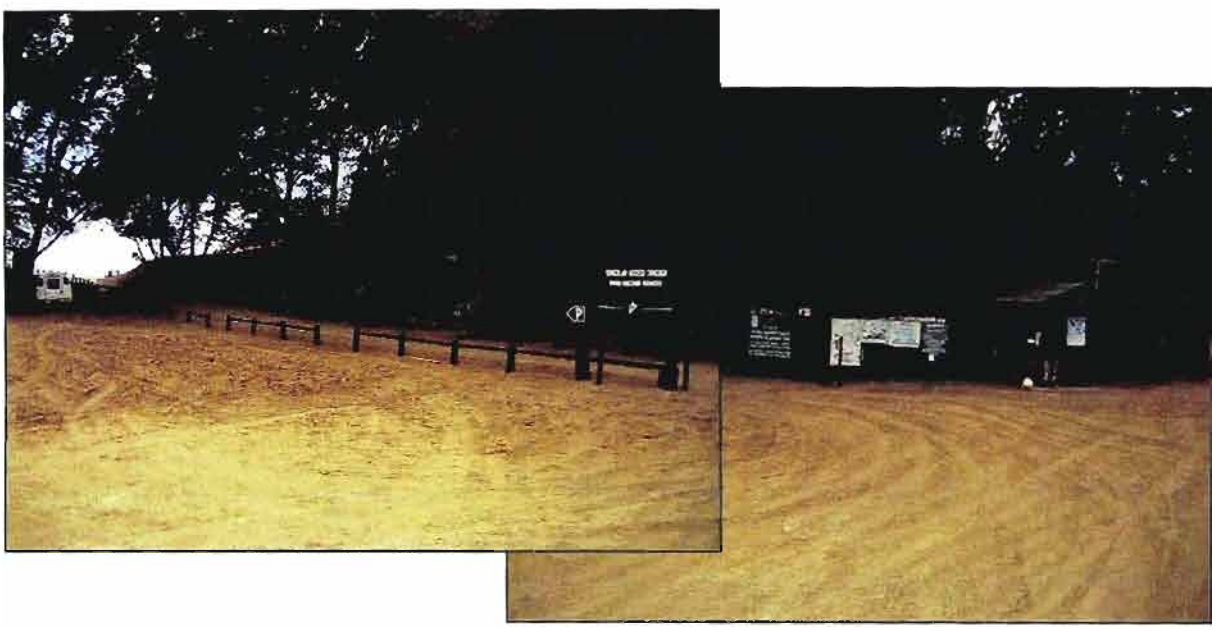


Plate 7: View east of tracks in inter-tidal zone

APPENDIX 3: CAPE VIDAL (JULY 2001)



Plates 1 & 2: View south-east of entrance to beach at Cape Vidal with security guard at gate

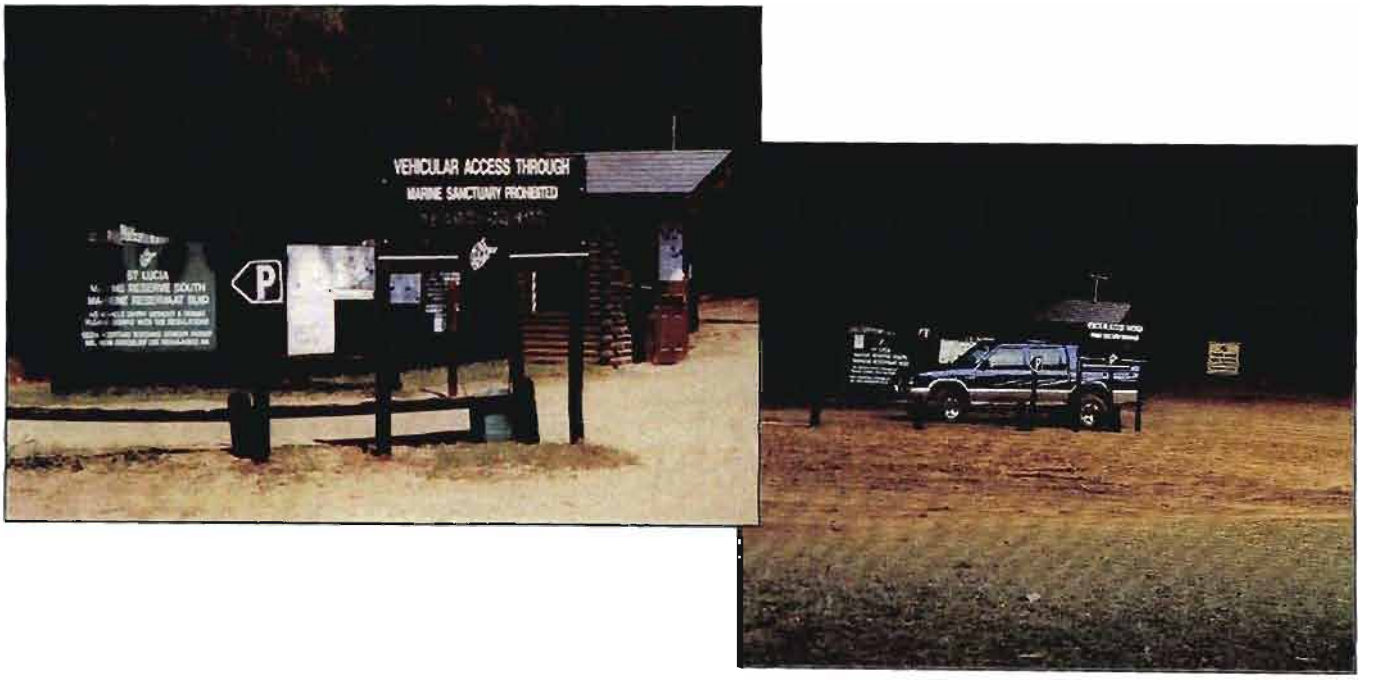


Plate 3: "Vehicular access through Marine Sanctuary prohibited"
Plate 4: ORV entering access to Cape Vidal Beach

Plate 4: View west of entrance onto beach and ORV tracks

Plate 5: View north from Cape Vidal entrance

Plate 6: Recreational fishing south of entrance at Cape Vidal

Plate 7: ORV driving on beach above high water mark

APPENDIX 4:
PHOTOGRAPHS AT CAPE VIDAL AFTER THE ORV REGULATIONS (MAY 2002)

Plate 1: Notice board at entrance to Cape Vidal Beach of prohibition of ORV's

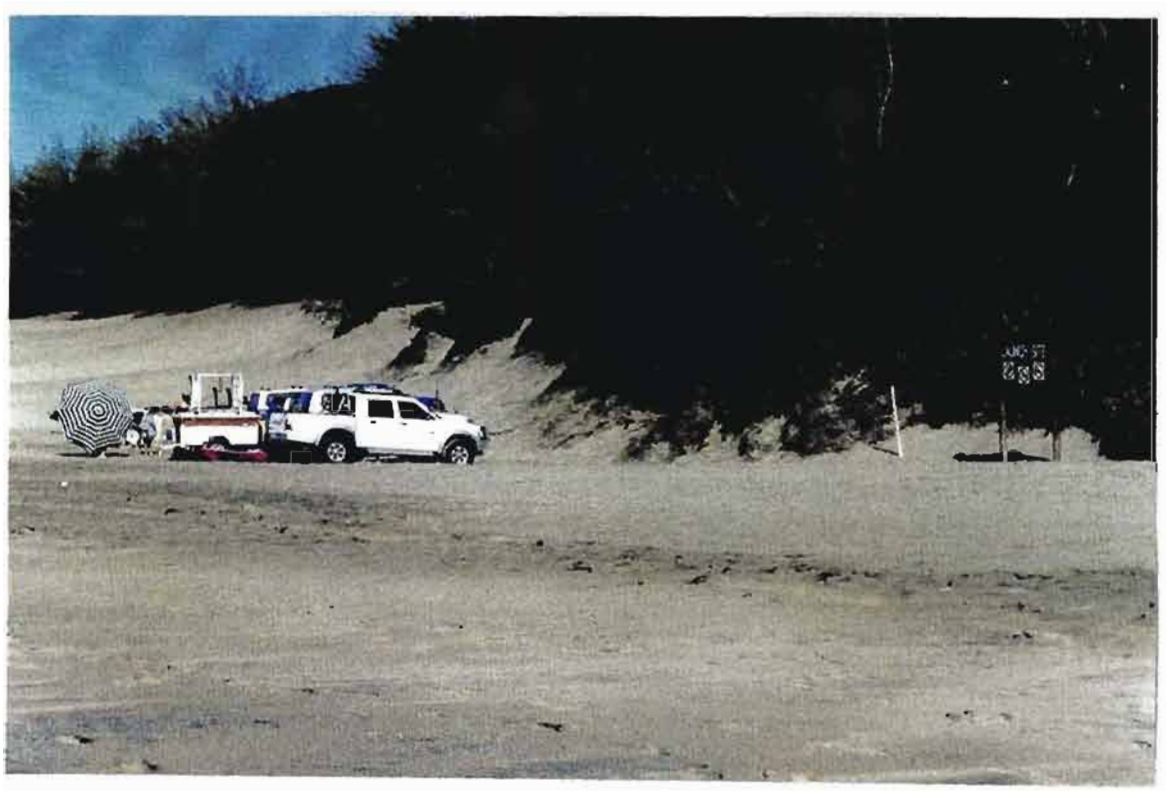


Plate 2: View south west of demarcated area for ORV's for boat launching

Plate 3: View north along beach at Cape Vidal entrance of tour operator driving on beach in far distance

Plate 4: View north of Cape Vidal beach of people on beach, tour operator, and tracks from boat launching

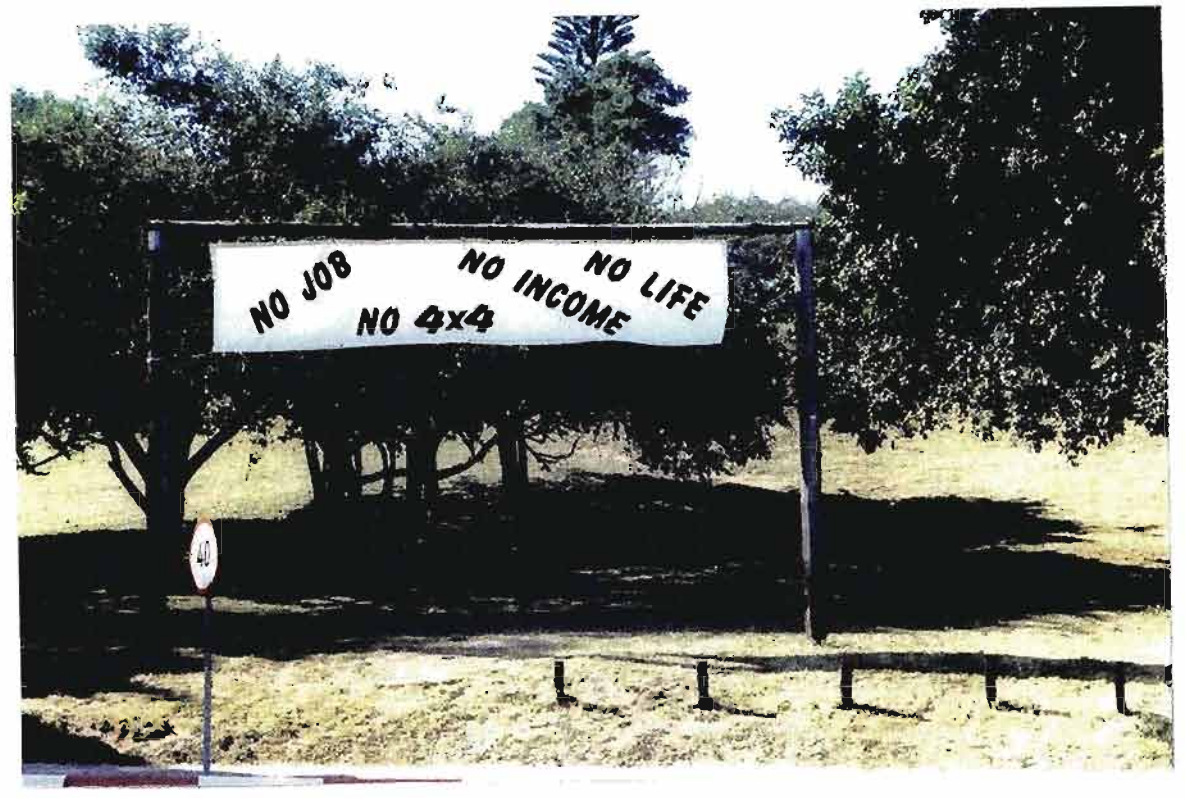
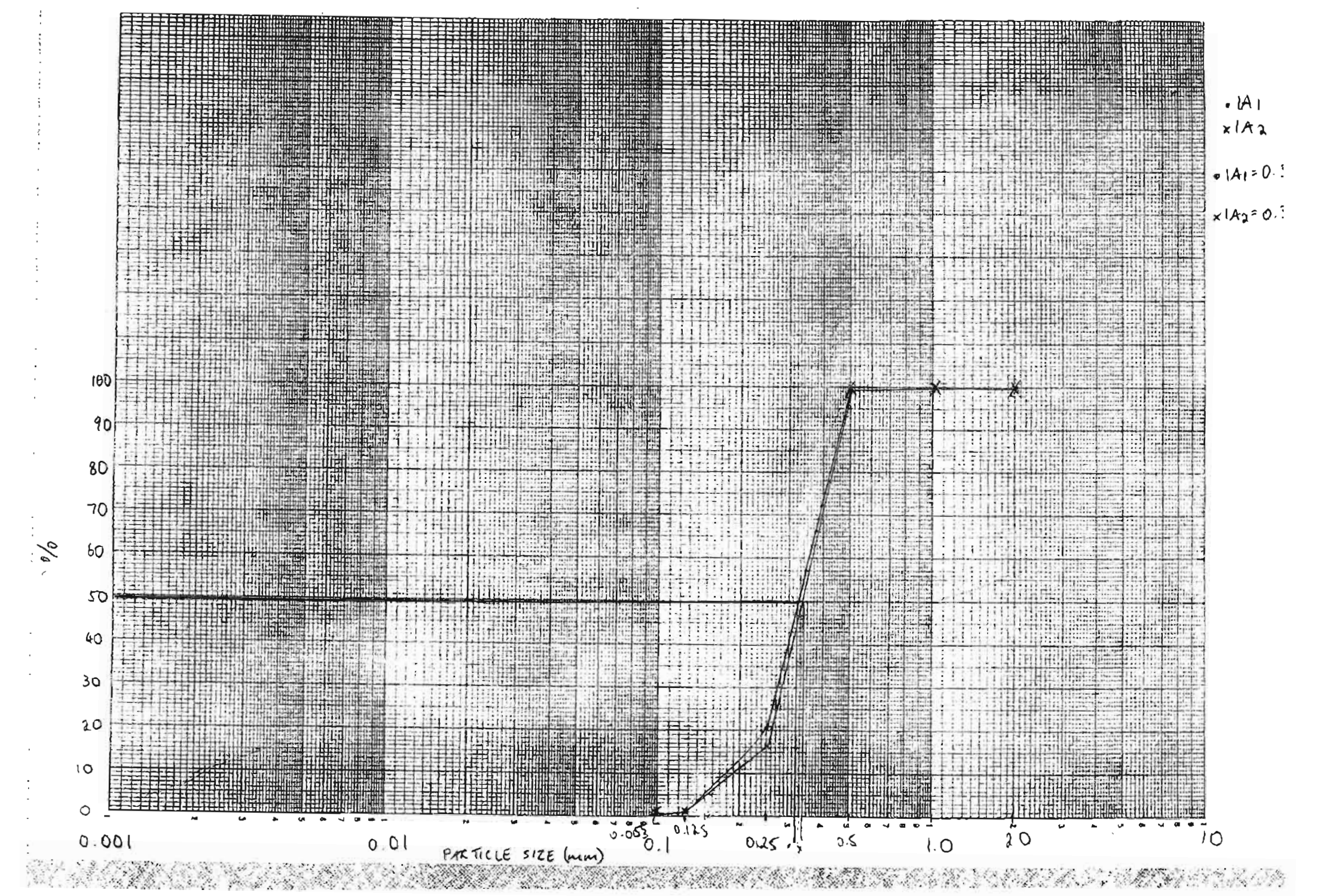
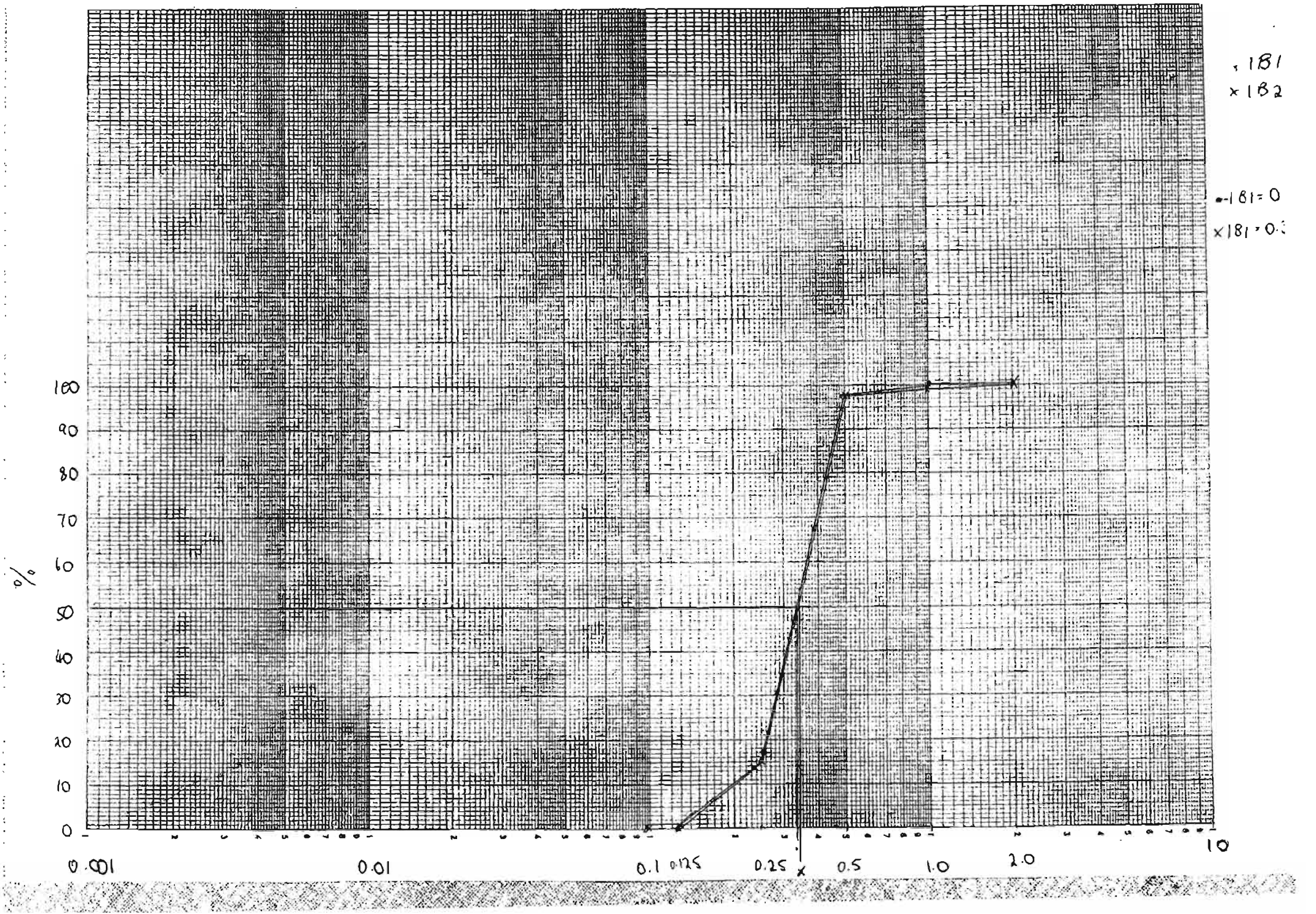


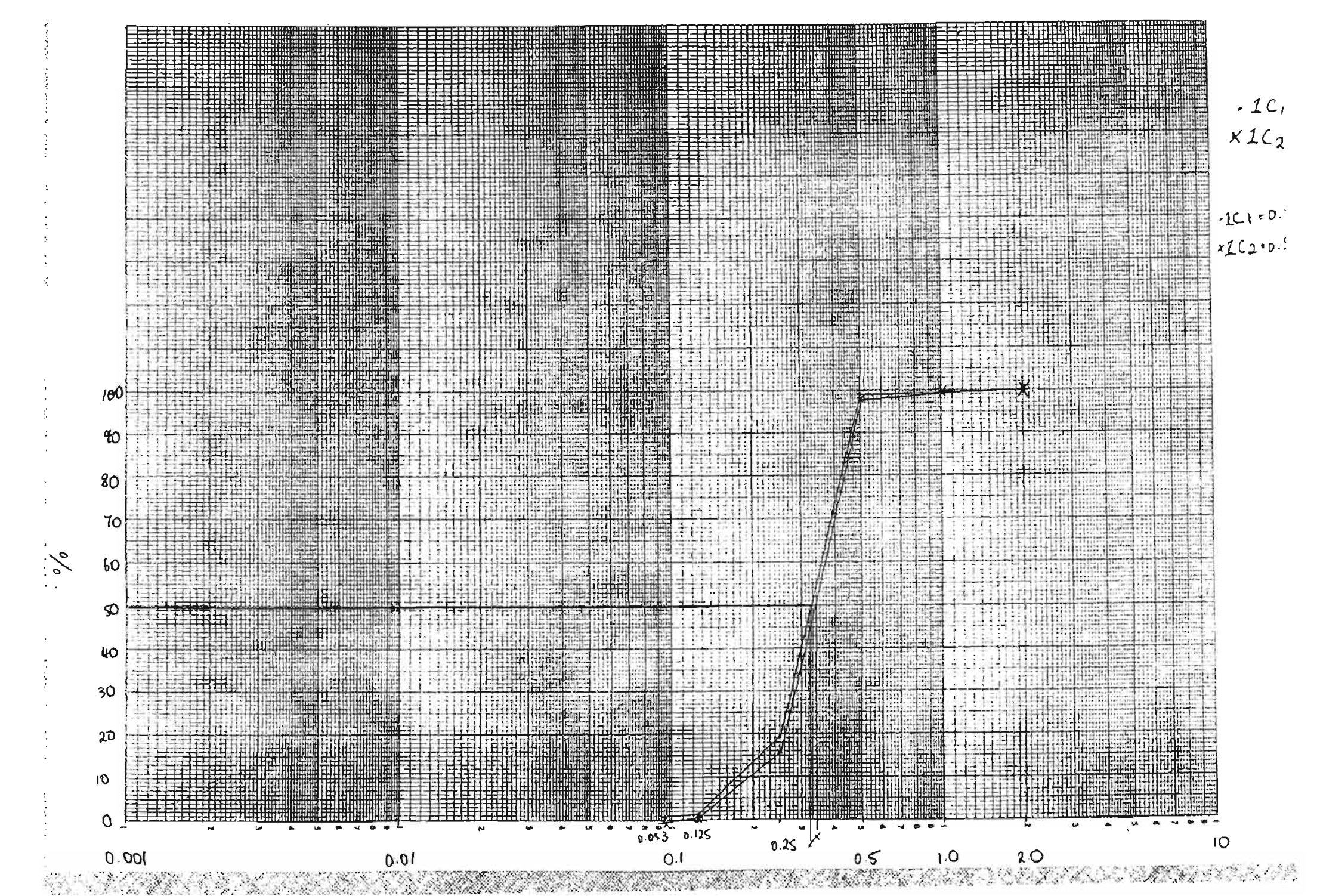
Plate 5: Sign at entrance to St Lucia erected by community members protesting ban on ORV's from beaches

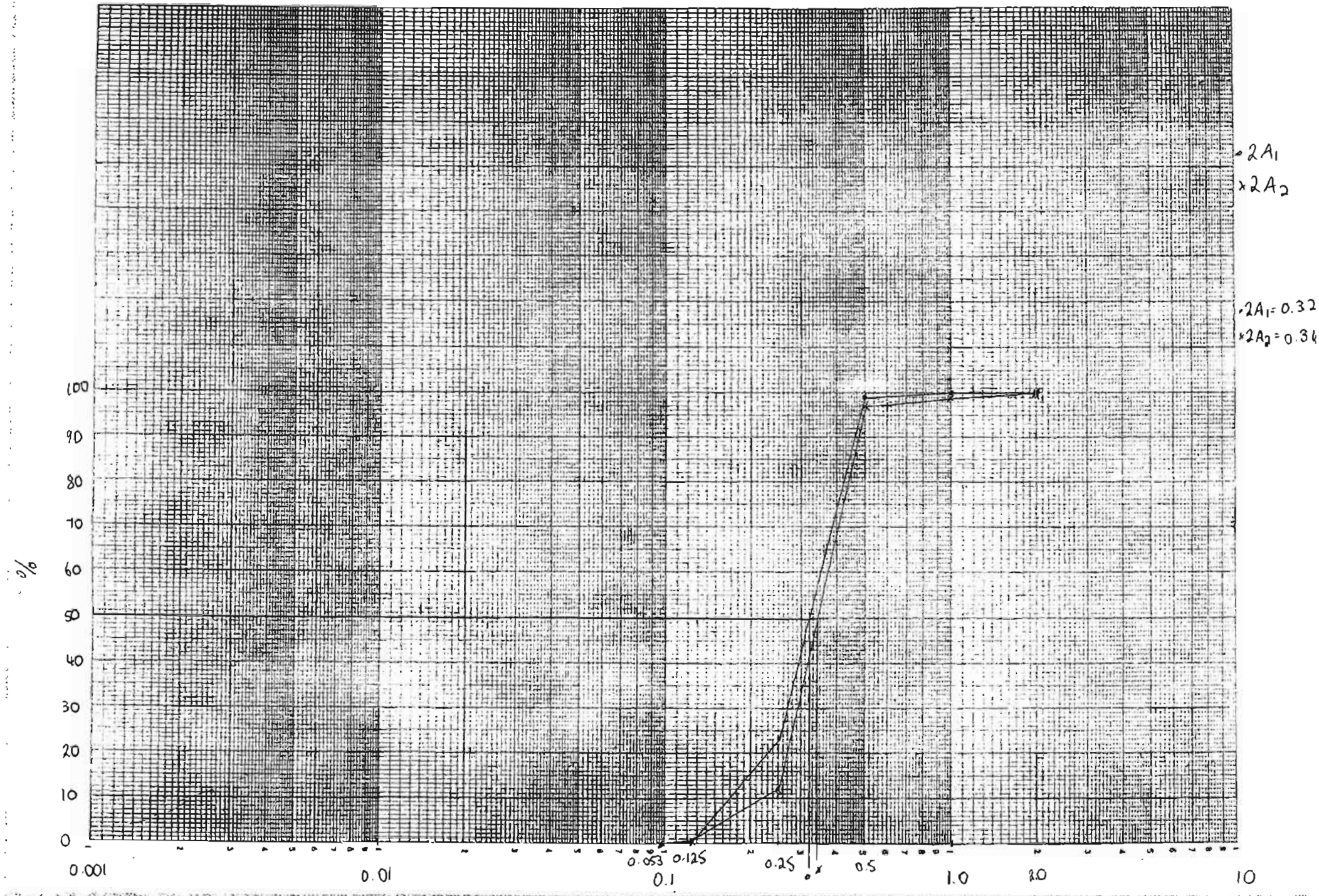
APPENDIX 5:

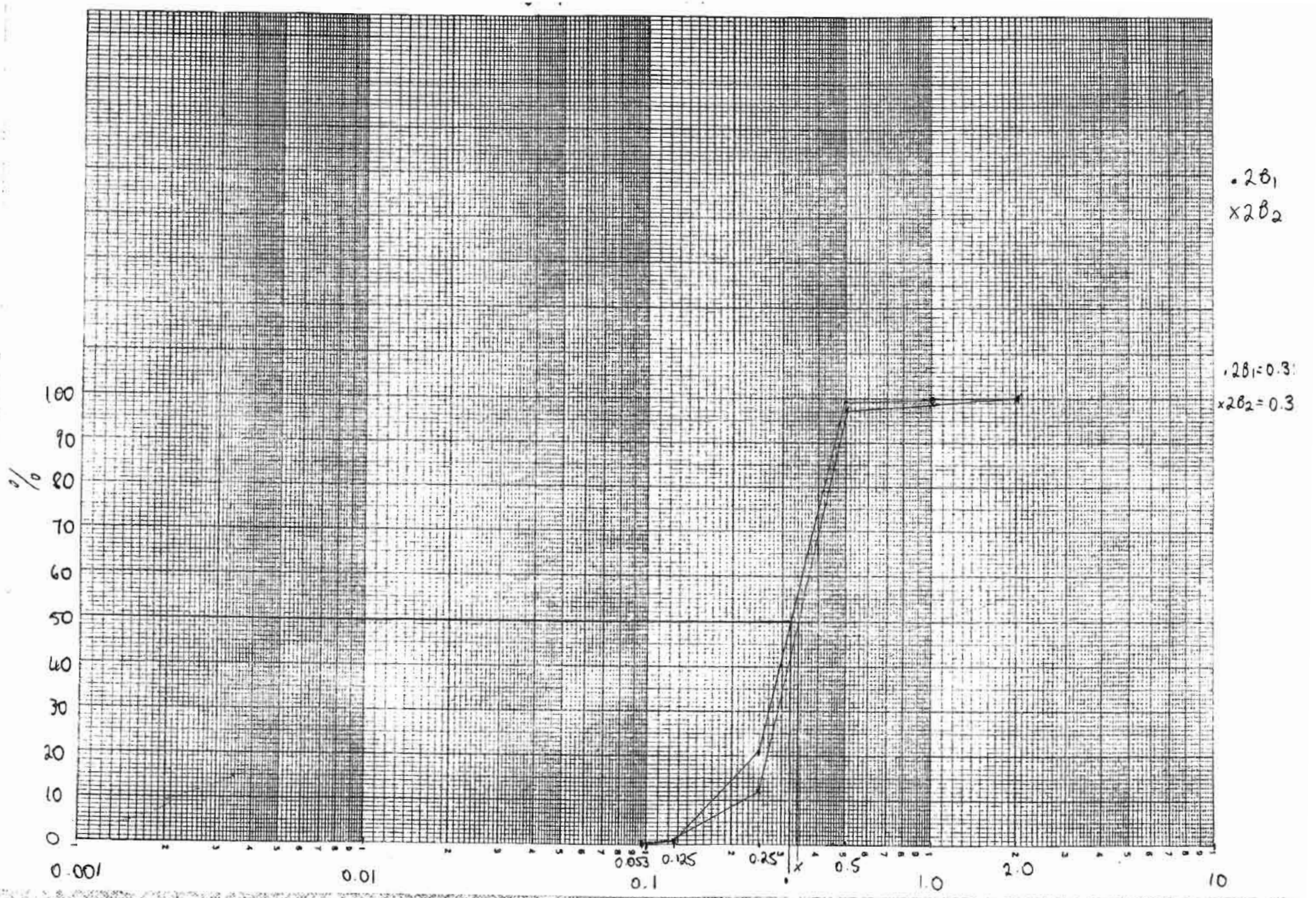
GRAPHS TO DETERMINE MEDIAN PARTICLE SIZE: DAY 1 AND DAY 2

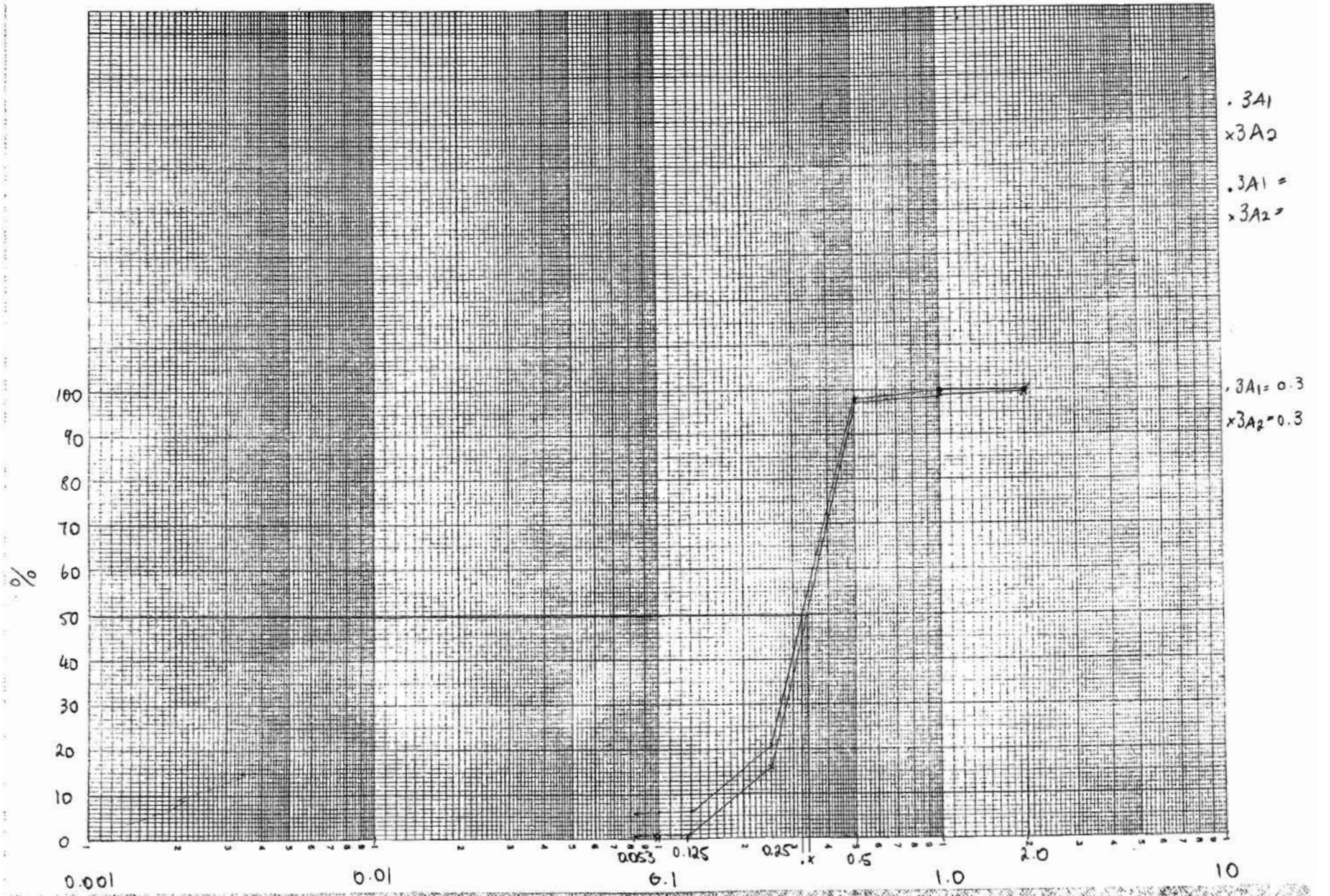

• IA1
× IA2
• IA1 = 0.
× IA2 = 0.
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.063
0.125
0.25
0.5
1.0
2.0
10
PARTICLE SIZE (mm)

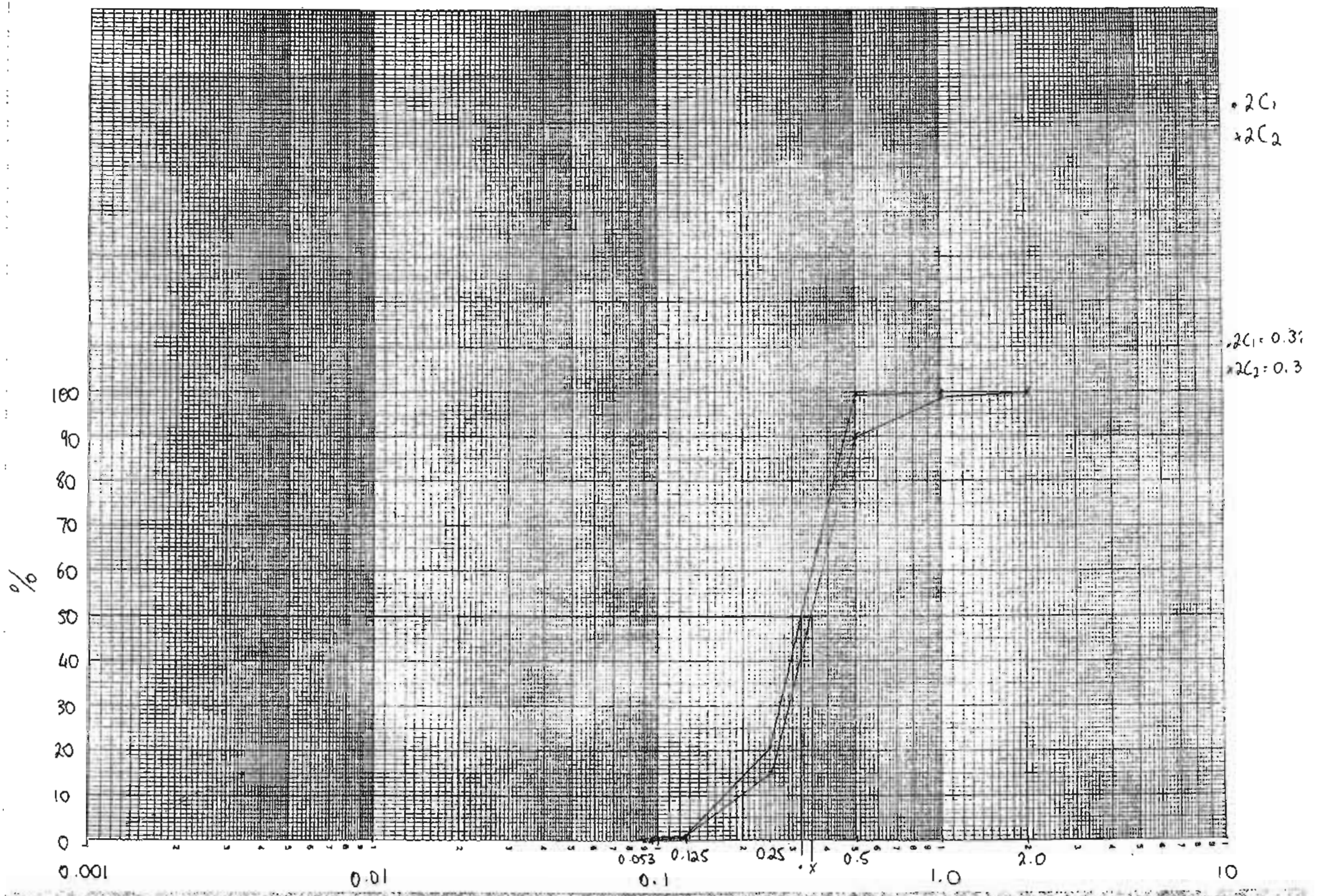

×181
×182
●-181=0
×181=0.
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.25
0.5
1.0
2.0
10

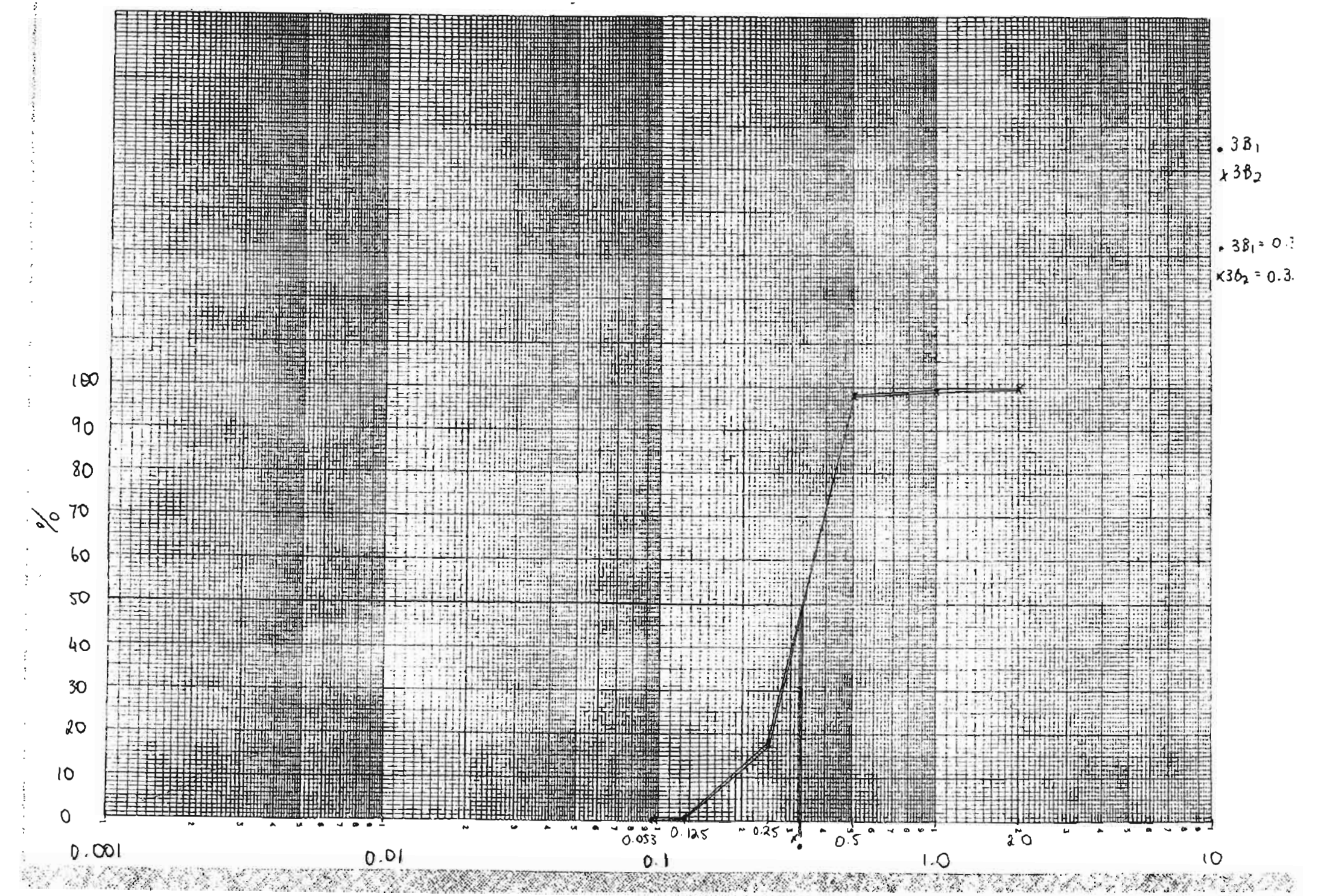

·1C1
×1C2
·1C1 = 0.
×1C2 = 0.
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.5
1.0
2.0
10
0.053
0.125
0.25

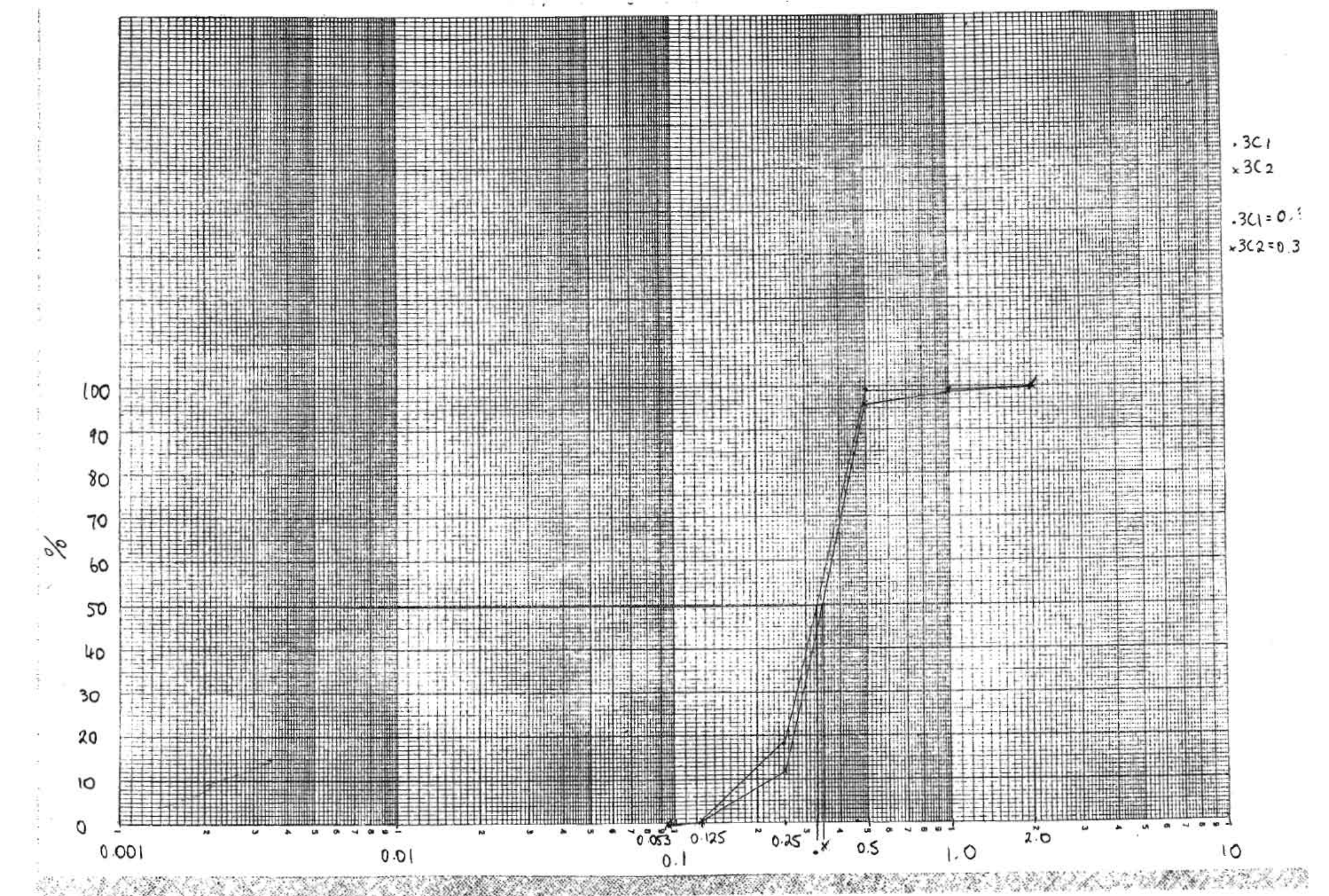

•2A1
×2A2
•2A1 = 0.32
×2A2 = 0.34
100
90
80
70
60
50
40
30
20
10
0
%
0.001
0.01
0.1
1.0
2.0
10
0.063
0.125
0.25
0.5

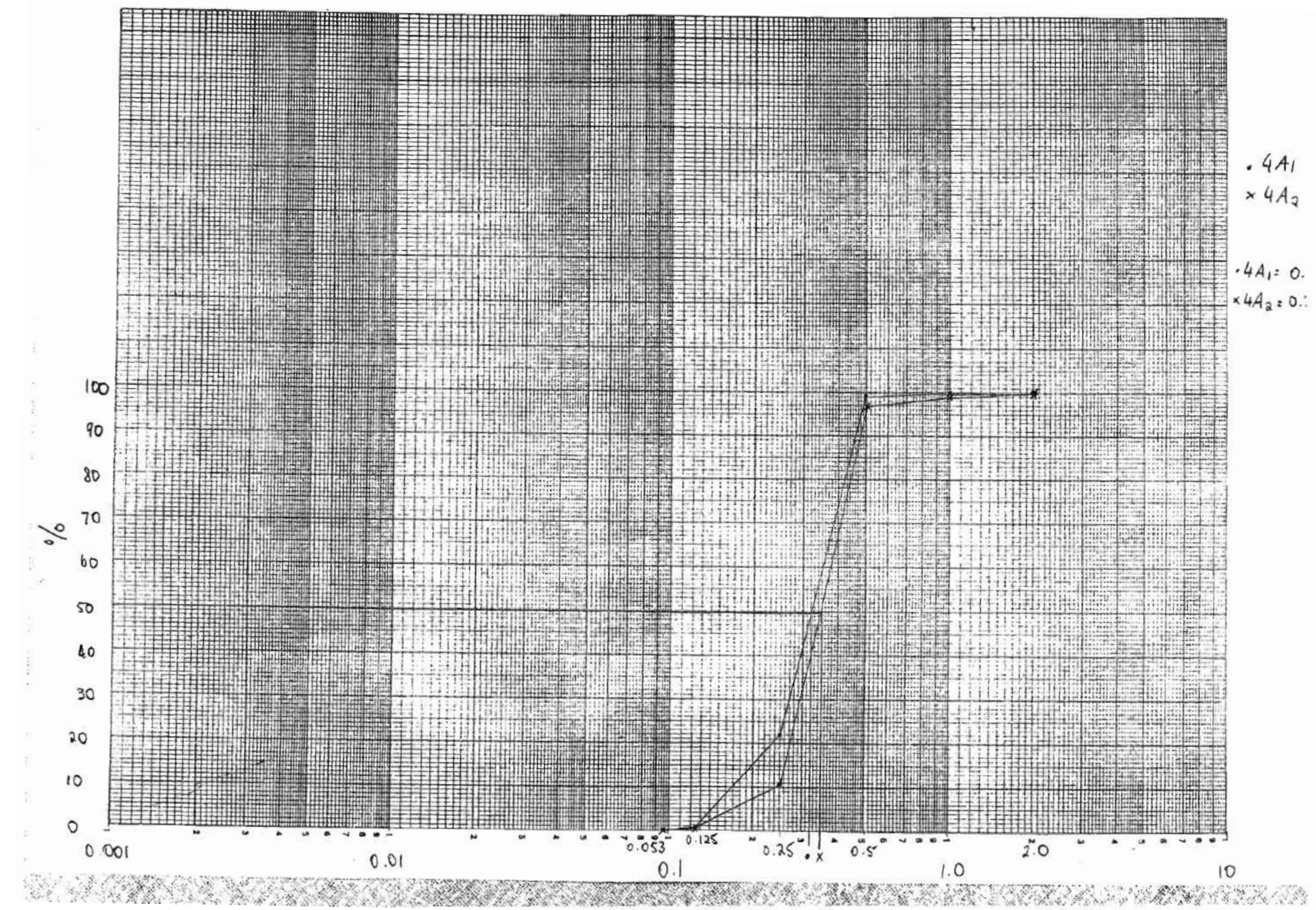

•2B1
×2B2
•2B1=0.3
×2B2=0.3
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
2.0
10
0.053
0.125
0.25
0.5

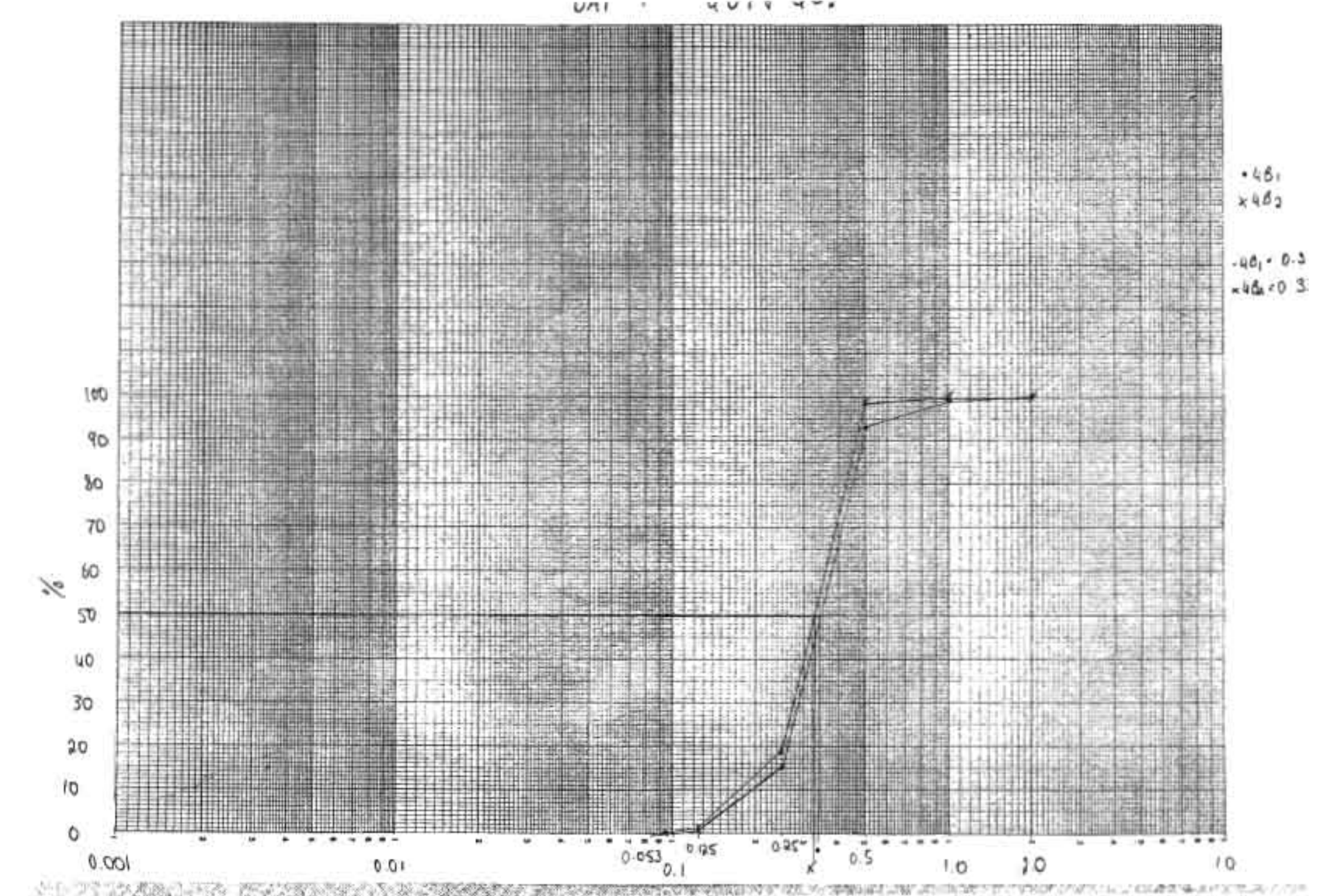

. 3A1
×3A2
. 3A1 =
×3A2 =
. 3A1 = 0.3
×3A2 = 0.3
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.0053
0.125
0.25
0.5
2.0

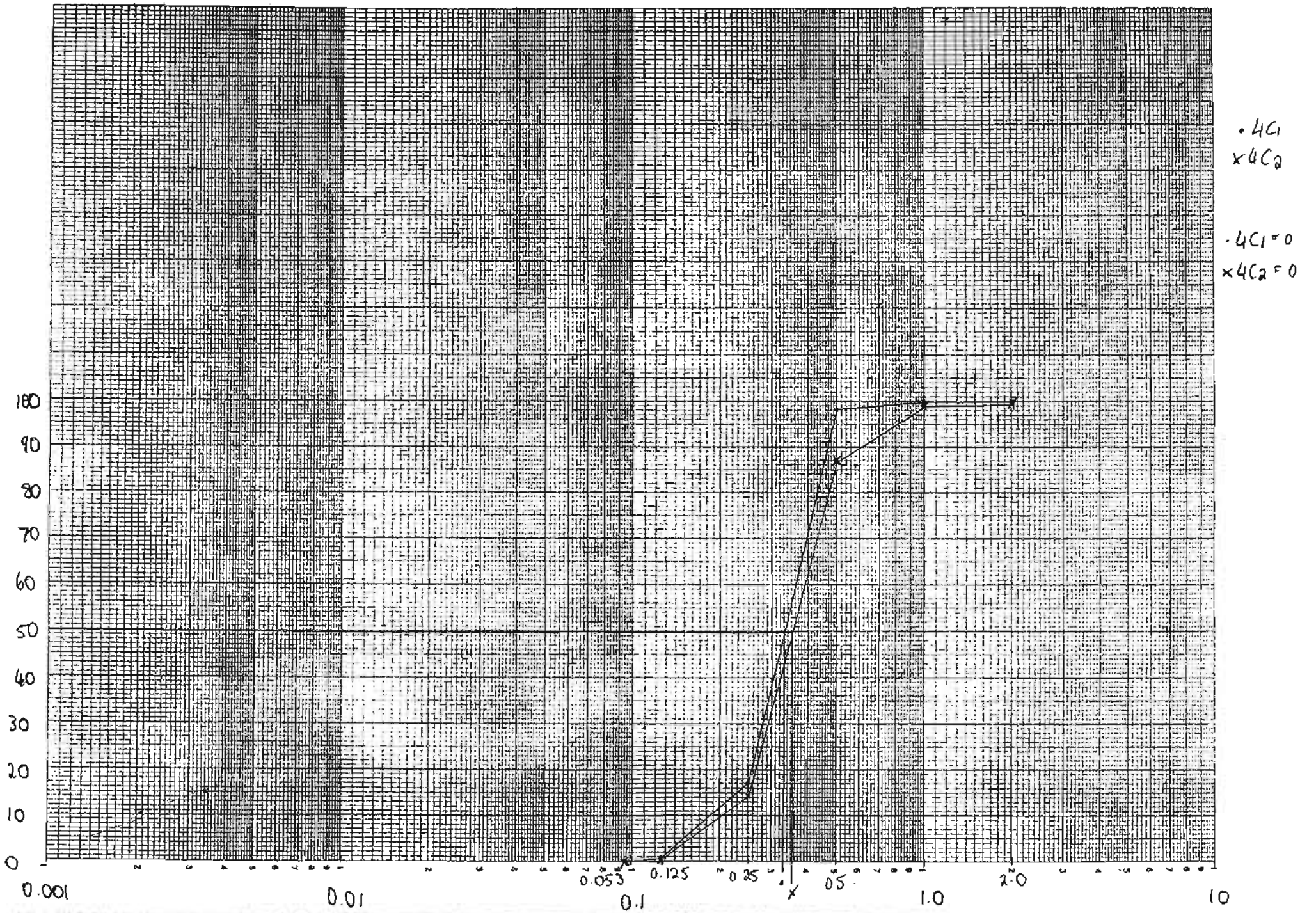

• 2C1
× 2C2
•2C1 = 0.3
×2C2 = 0.3
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
0.5
2.0


• 3B1
x 3B2
• 3B1 = 0.
x3B2 = 0.3.
%
180
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
0.5
2.0


.3C1
×3C2
.3C1 = 0.1
×3C2 = 0.3
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10

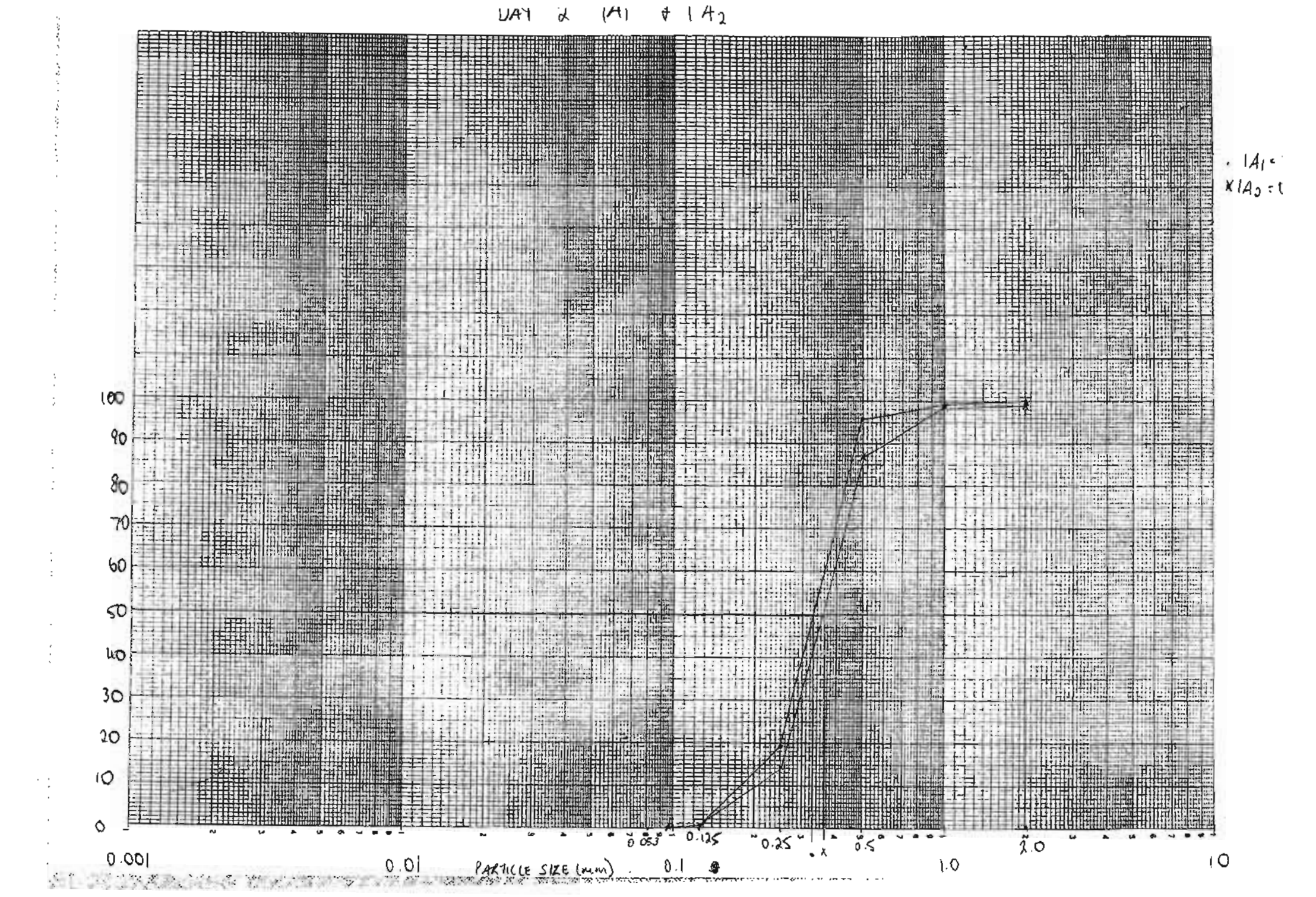

• 4A1
× 4A2
•4A1 = 0.
×4A2 = 0.
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
0.5
2.0

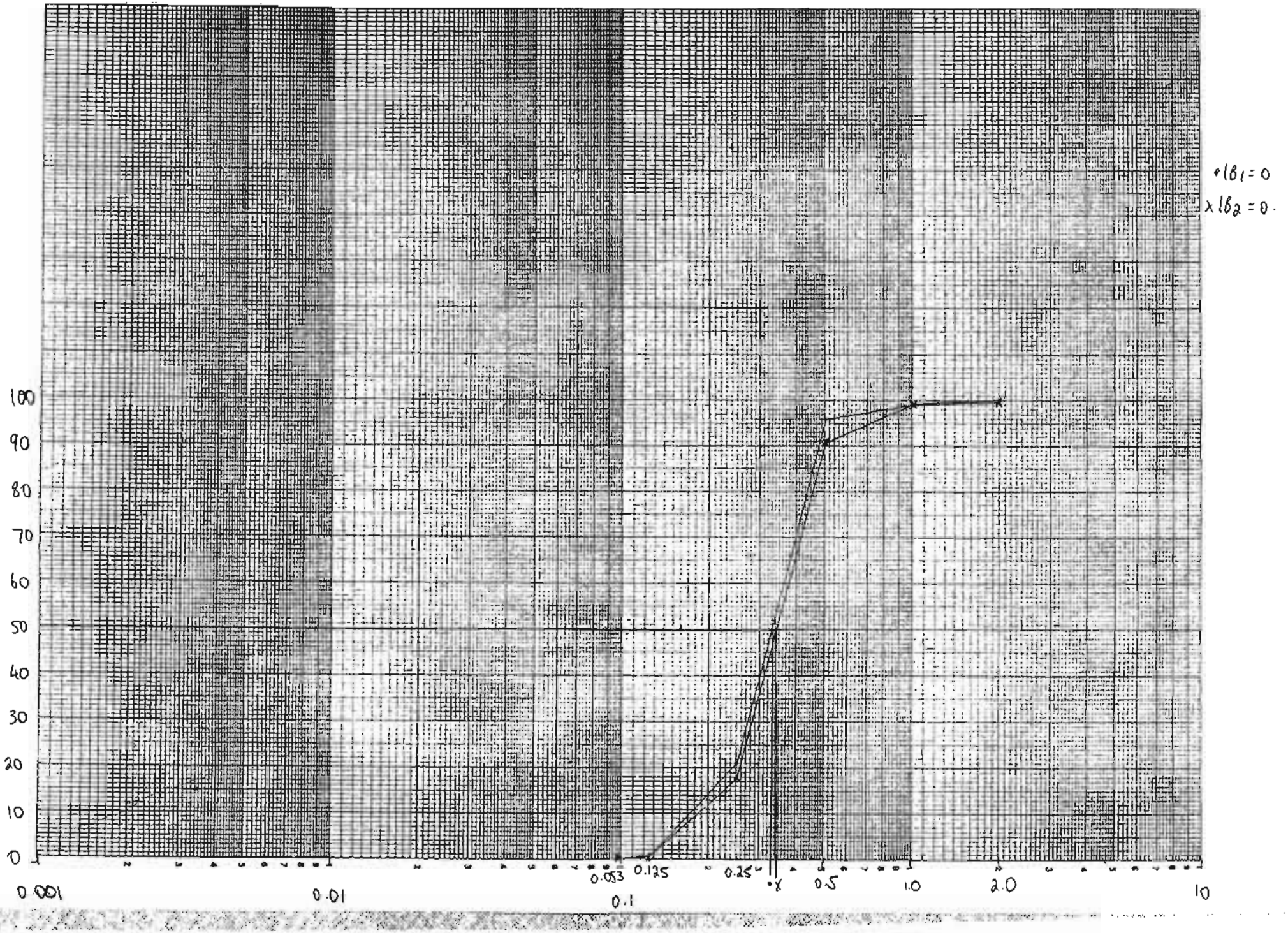

•Δδ1
×Δδ2
-Δδ1 = 0.3
×Δδ2 < 0.3
100
90
80
70
60
%
50
40
30
20
10
0
0.001
0.01
0.053
0.1
0.95
0.5
1.0
10
10

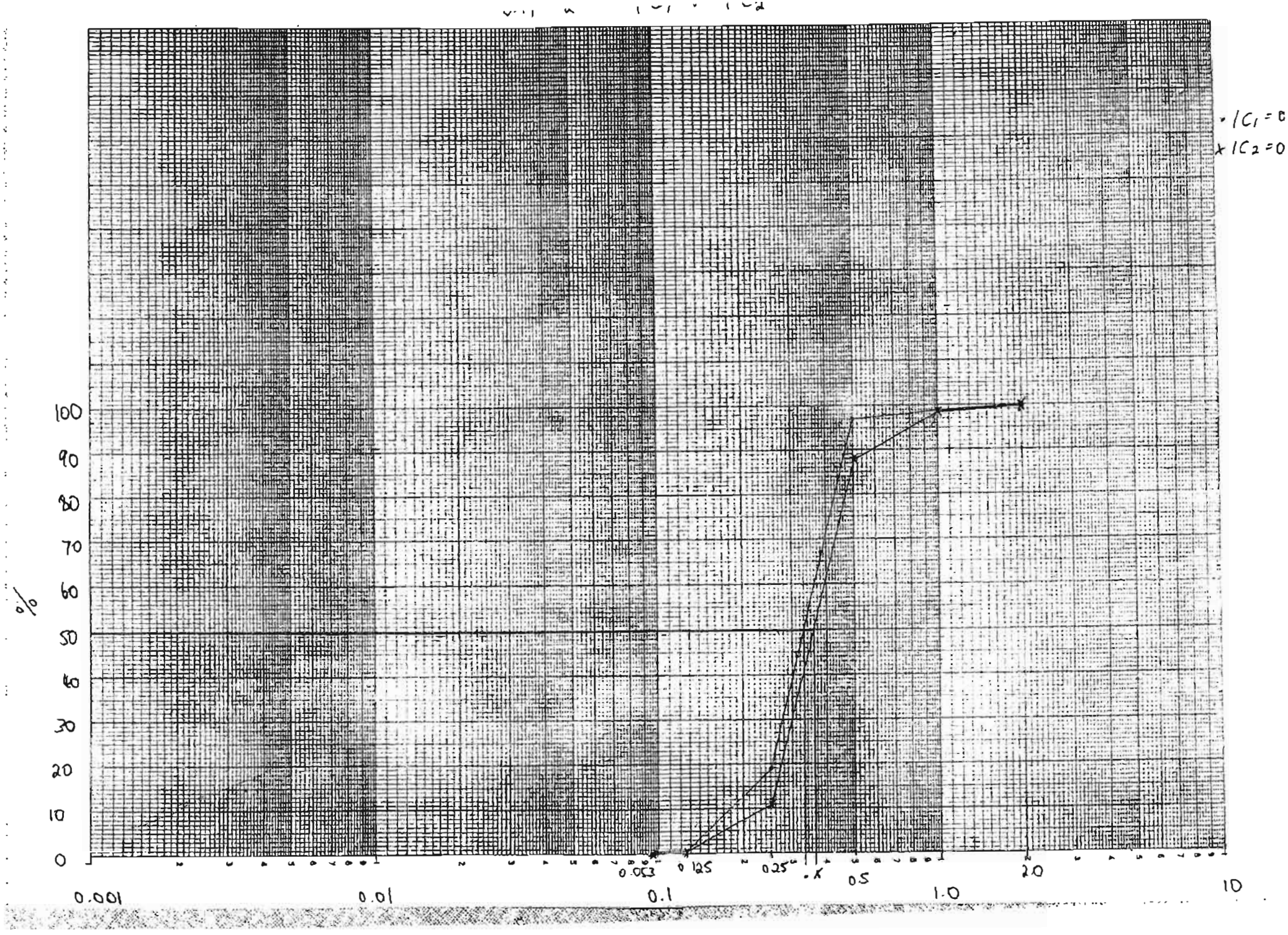

•4C1
×4C2
•4C1 = 0
×4C2 = 0
180
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
0.5
2.0

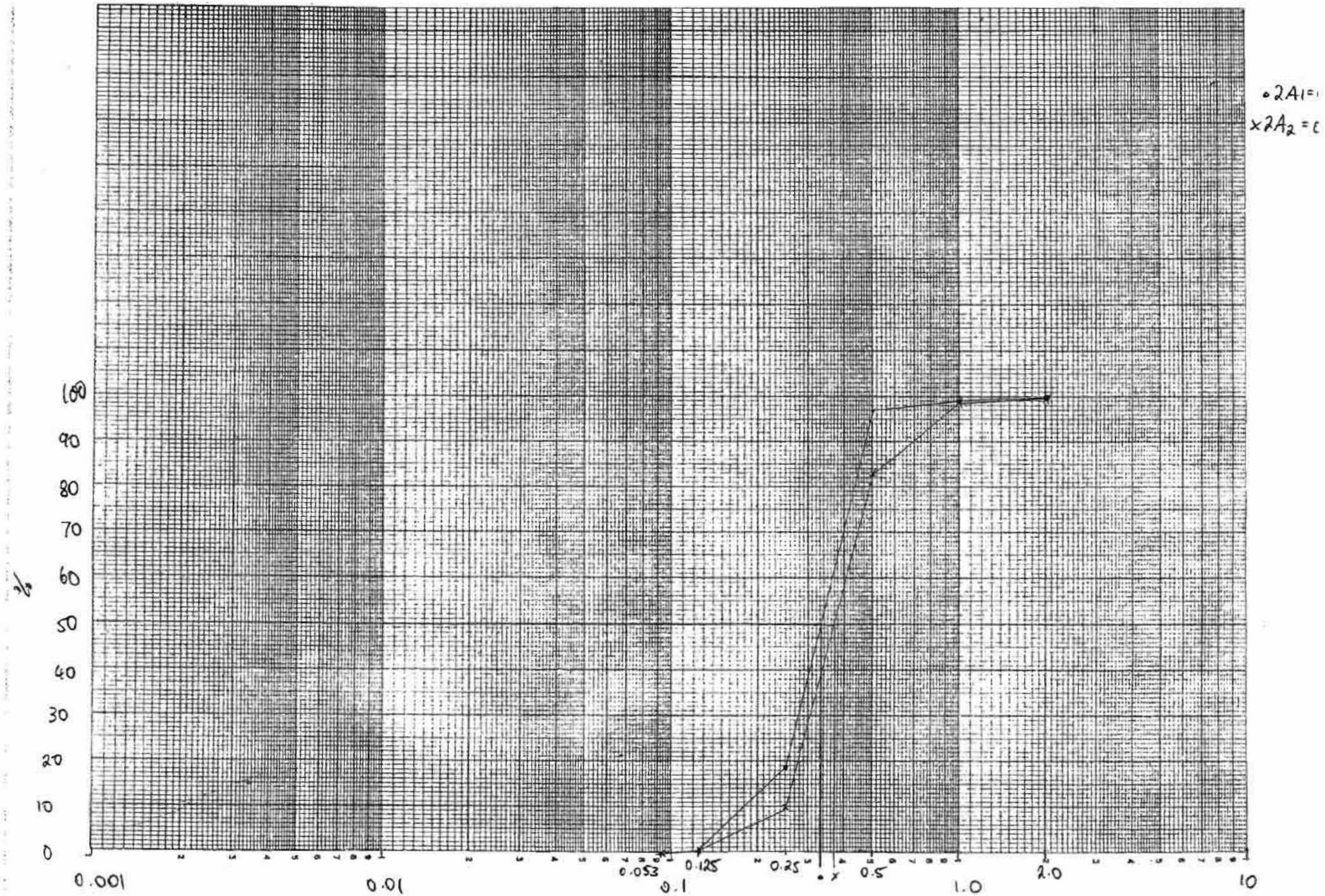
APPENDIX 5:

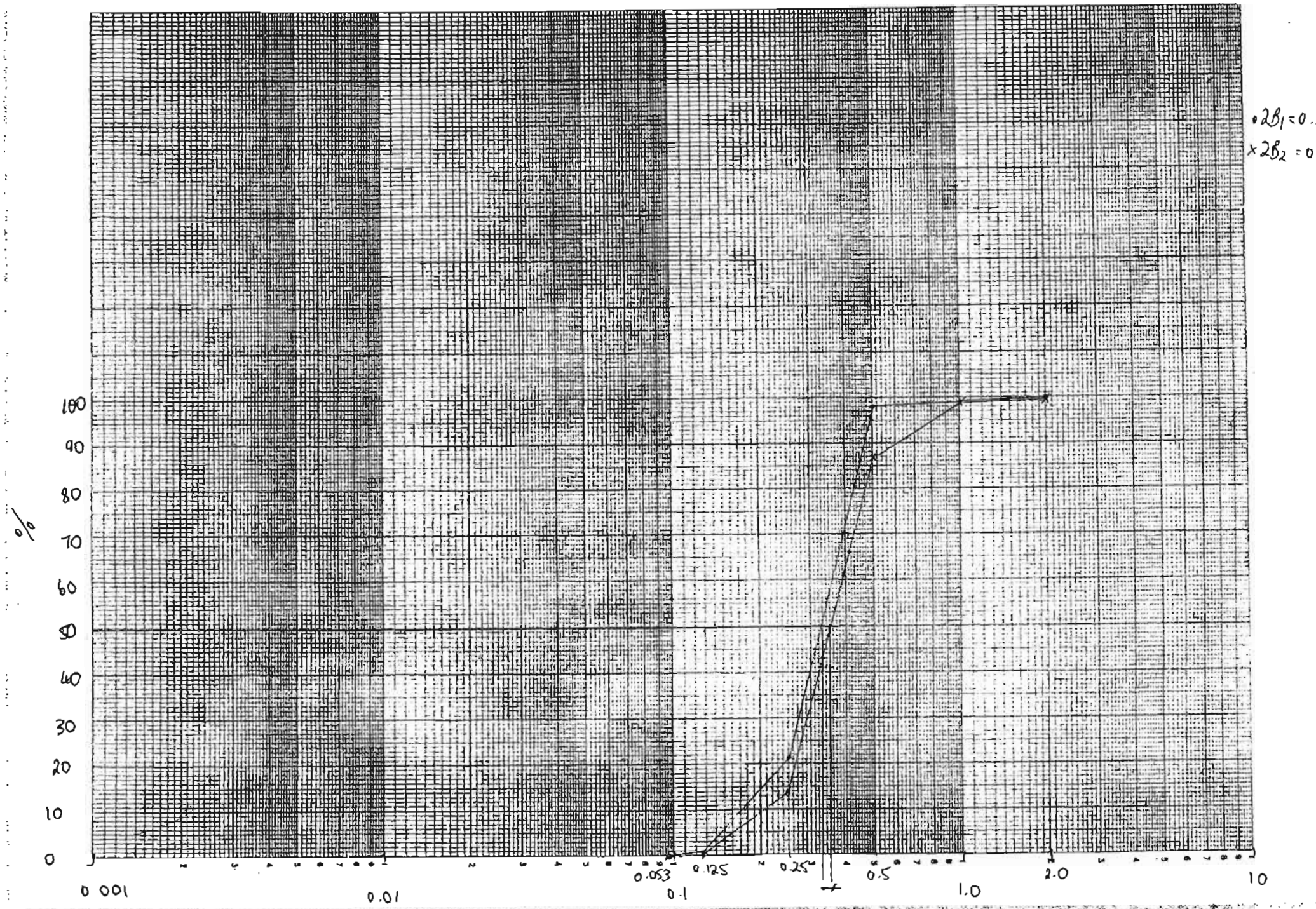
GRAPHS TO DETERMINE MEDIAN PARTICLE SIZE: DAY 2


100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
PARTICLE SIZE (mm)
0.1
1.0
10
0.063
0.125
0.25
0.5
2.0

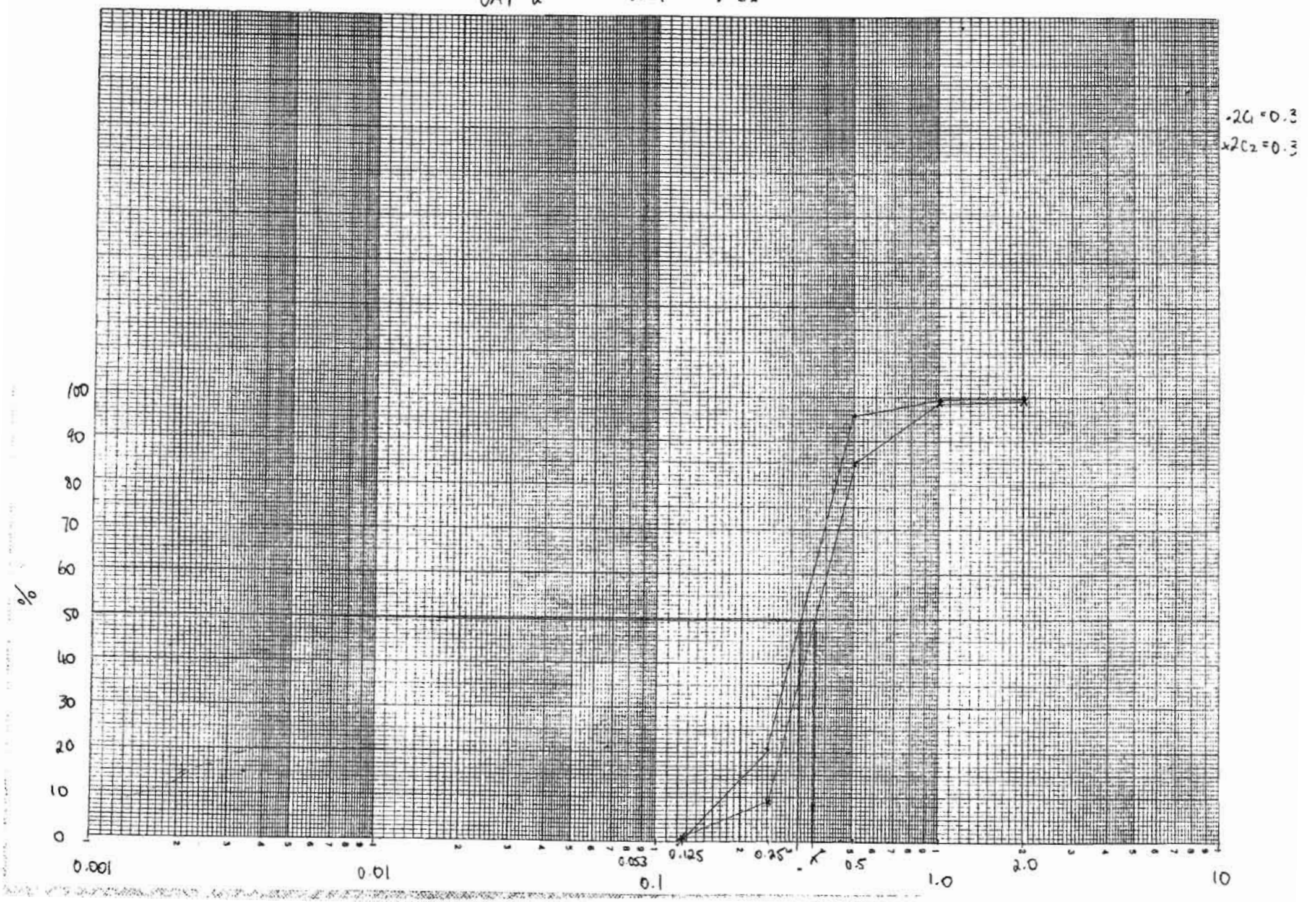

•IB1 = 0
×IB2 = 0.
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10

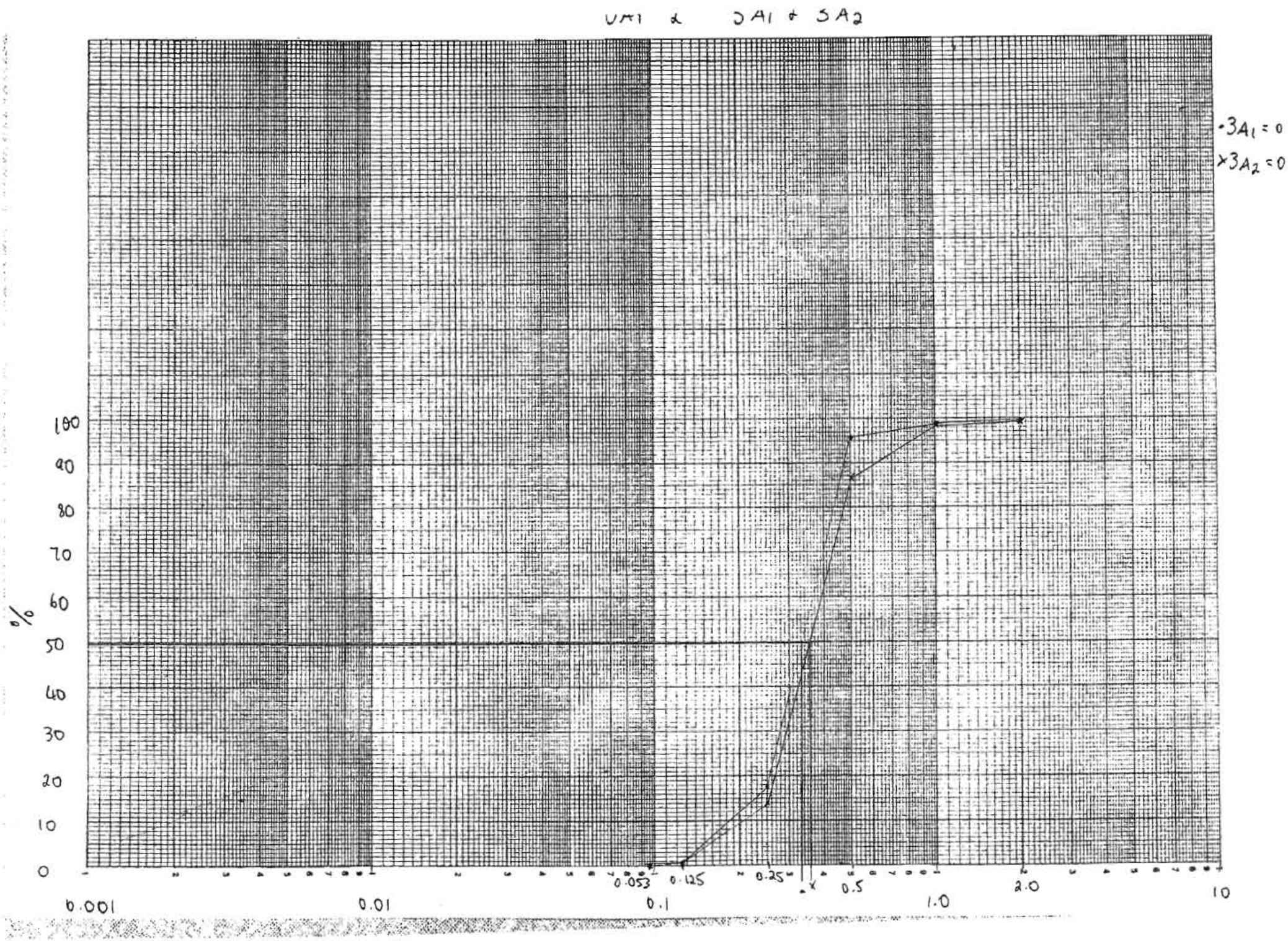

• IC1 = 0
× IC2 = 0
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
K
0.5
2.0

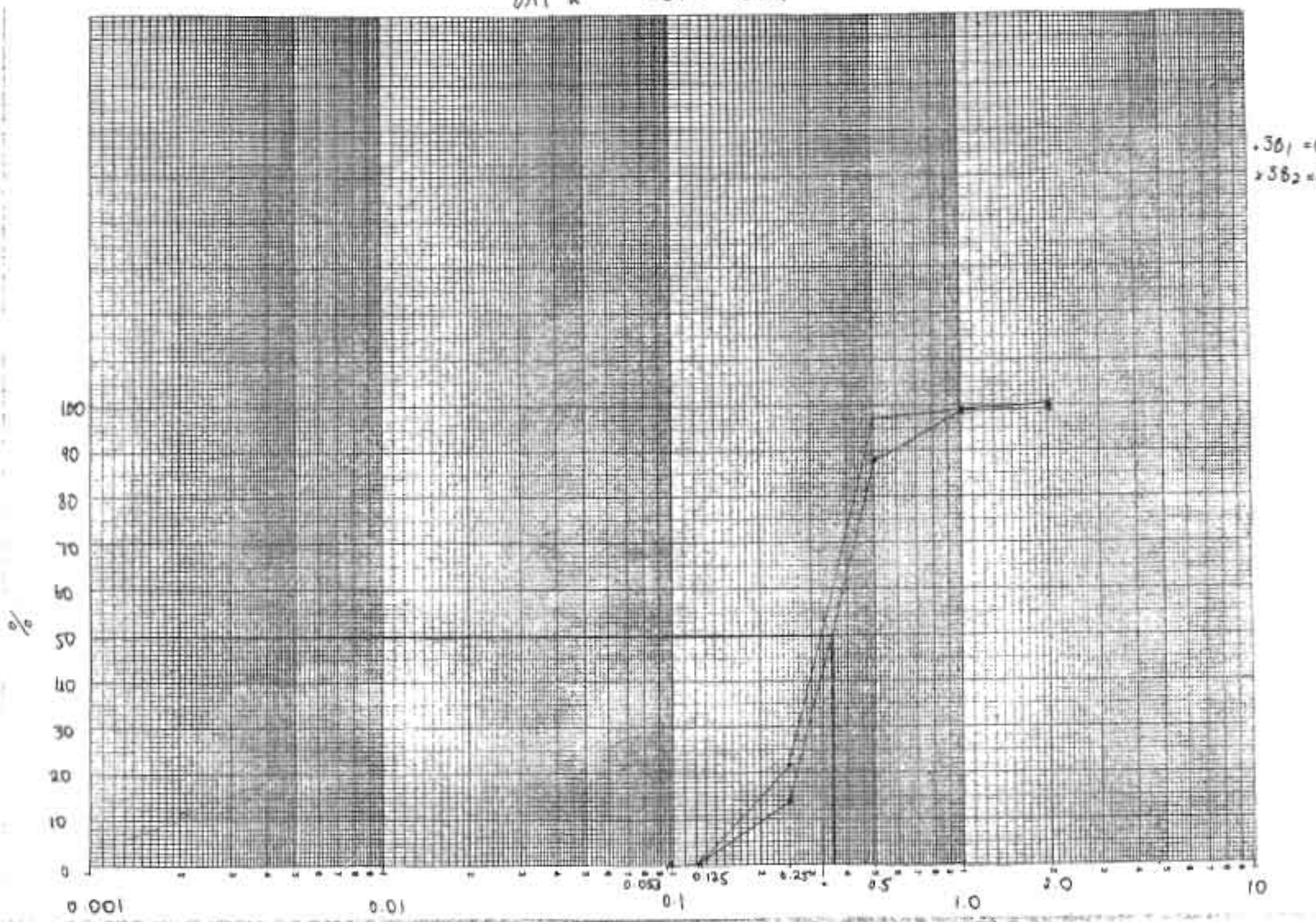

• 2A1 =
× 2A2 =
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10

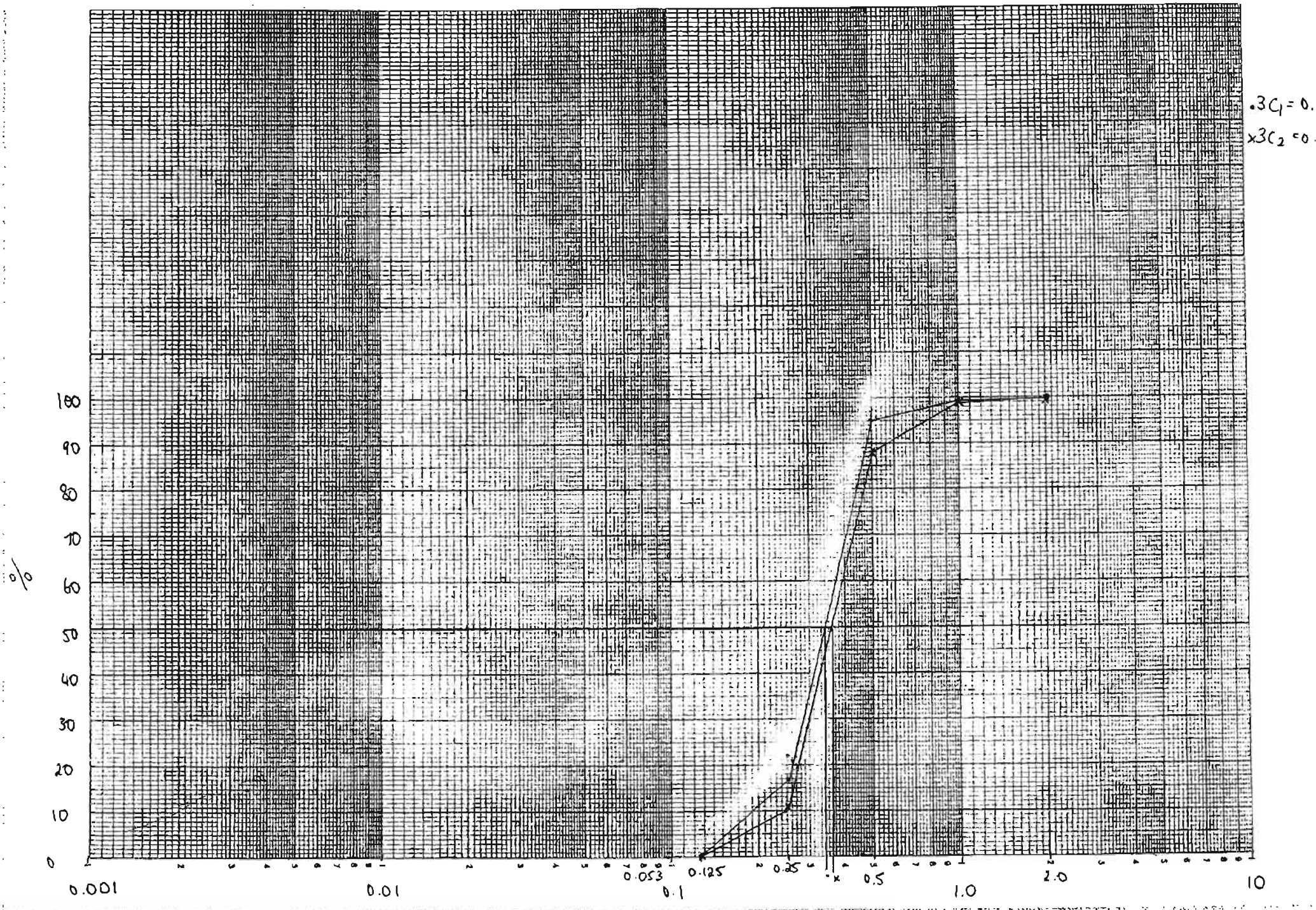

•2B1 = 0
×2B2 = 0
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.063
0.125
0.25
0.5
1.0
2.0
10

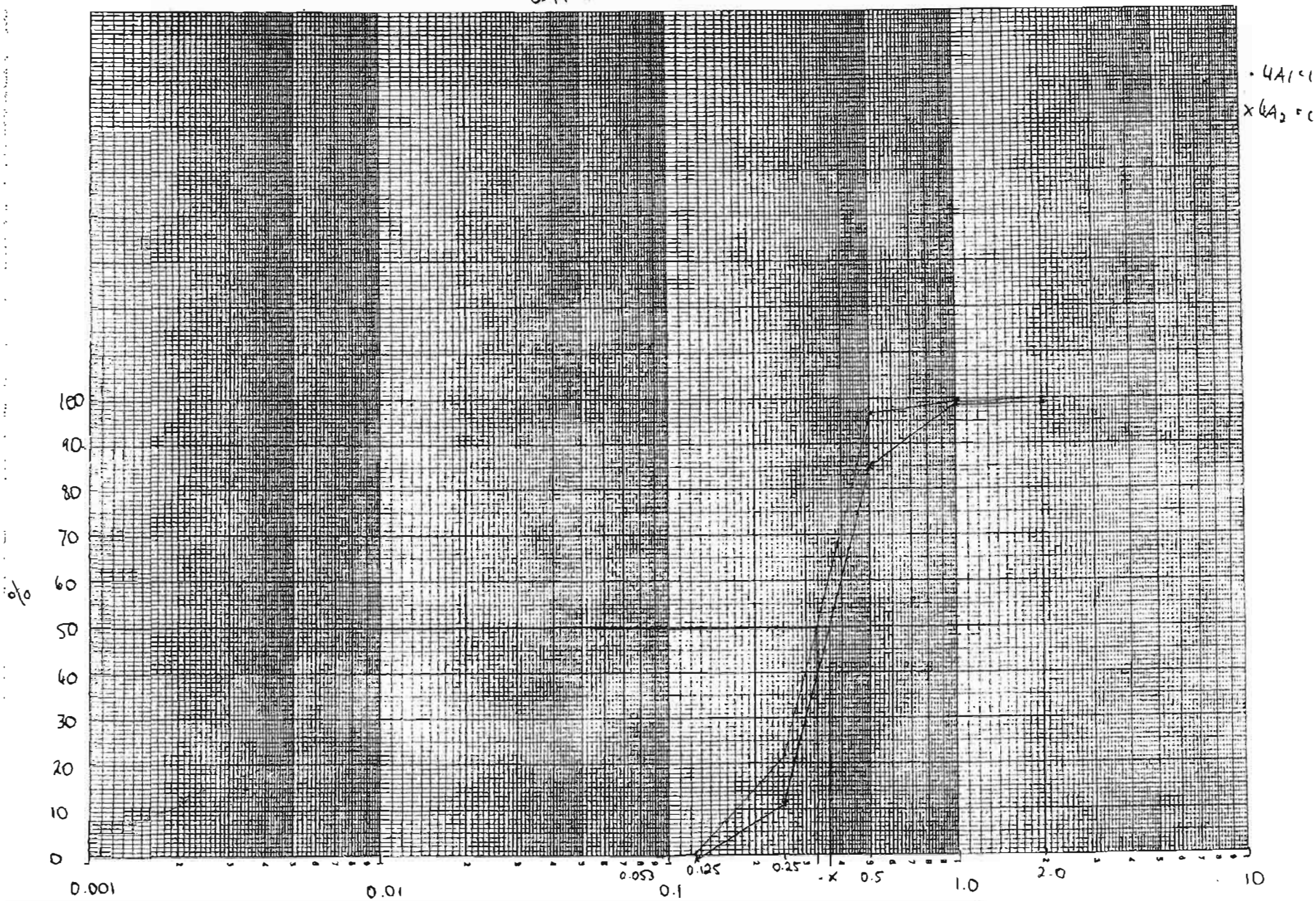
DAY 2 $2C_1$ & $2C_2$


-2C1 = 0.3
x2C2 = 0.3
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10
0.053
0.125
0.25
0.5
2.0

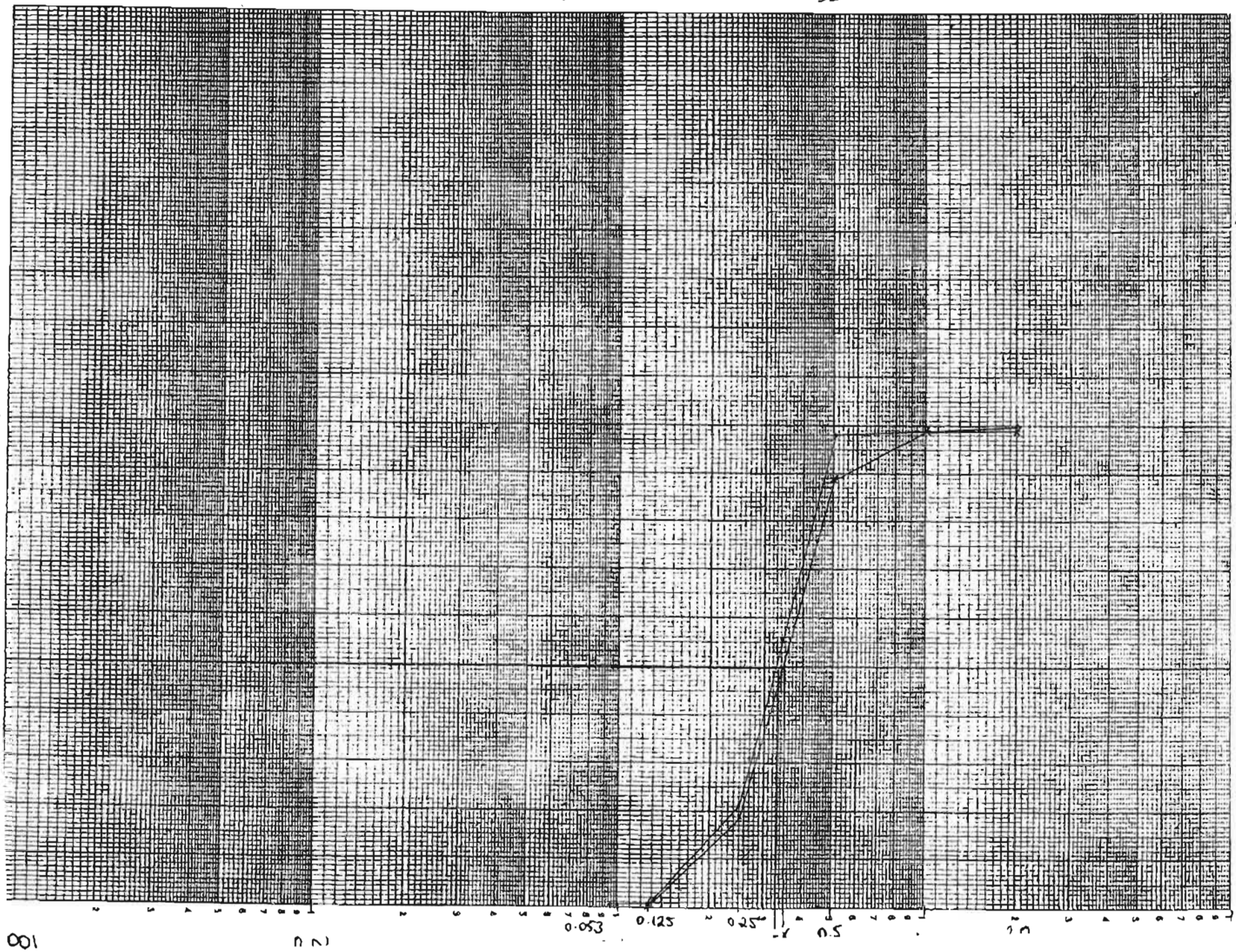

UA1 & SA1 & SA2
·3A1 = 0
×3A2 = 0
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10


180
90
80
70
60
50
40
30
20
10
0
%
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10


0
10
20
30
40
50
60
70
80
90
100
%
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10

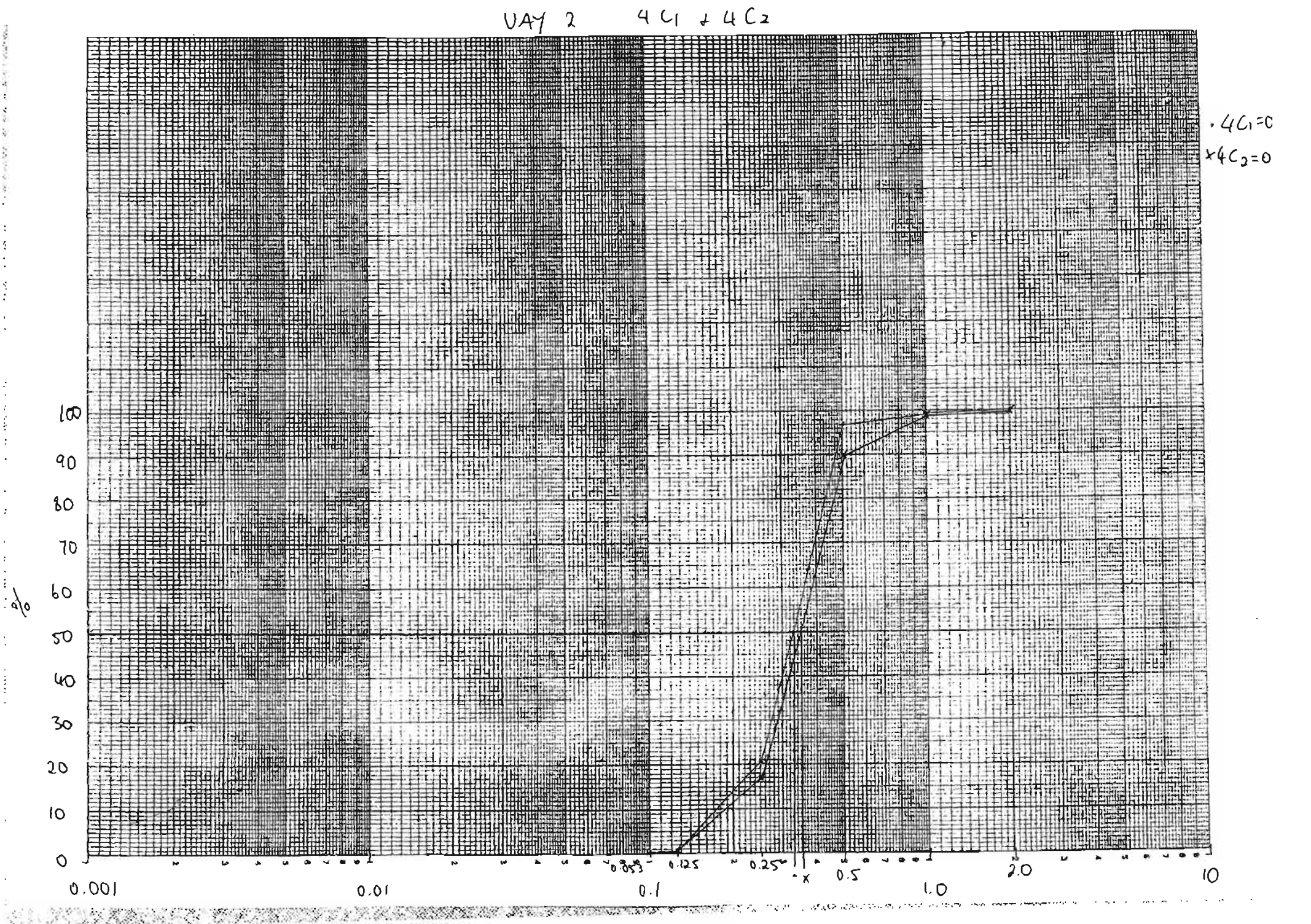

UAY 2 4M1 + 4A2
• 4A1 = 1
× 4A2 = 1
100
90
80
70
60
50
40
30
20
10
0
%
0.001
0.01
0.1
0.053
0.125
0.25
0.5
1.0
2.0
10

DAY 2 $4B_1$ & $4B_2$



• $4B_1 = 0.33$

× $4B_2 = 0.35$


UAY 2 4C1 + 4C2
• 4C1=0
× 4C2=0
%
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
2.0
10
0.125
0.25
0.5
x

APPENDIX 6: TABLE OF DENSITIES & MEDIAN PARTICLE SIZES OF SAND SAMPLES

DAY 1: 21 JULY 2001

Sand sample	**A1** **Surface sample**	**A2** **Sample at depth of 20cm**	**B1** **Surface sample**	**B2** **Sample at depth of 20cm**	**C1** **Surface sample**	**C2** **Sample at depth of 20cm**
Number of passes by ORV						
No pass	**1A1**	**1A2**	**1B1**	**1B2**	**1C1**	**1C2**
Density	1.437	1.429	1.347	1.503	1.591	1.499
Median particle size	0.320	0.340	0.330	0.340	0.325	0.340
1 pass	**2A1**	**2A2**	**2B1**	**2B2**	**2C1**	**2C2**
Density	1.409	1.443	1.464	1.383	1.443	1.450
Median particle size	0.320	0.340	0.320	0.340	0.320	0.350
10 passes	**3A1**	**3A2**	**3B1**	**3B2**	**3C1**	**3C2**
Density	1.467	1.381	1.442	1.460	1.468	1.361
Median particle size	0.320	0.340	0.330	0.325	0.330	0.345
20 passes	**4A1**	**4A2**	**4B1**	**4B2**	**4C1**	**4C2**
Density	1.423	1.406	1.386	1.427	1.446	1.452
Median particle size	0.320	0.350	0.340	0.330	0.330	0.350

DAY 2: 22 JULY 2001

Sand sample	A1 Surface sample	A2 Sample at depth of 20cm	B1 Surface sample	B2 Sample at depth of 20cm	C1 Surface sample	C2 Sample at depth of 20cm
Number of passes by ORV						
No pass	**1A1**	**1A2**	**1B1**	**1B2**	**1C1**	**1C2**
Density	1.490	1.617	1.545	1.582	1.523	1.485
Median particle size	0.330	0.370	0.330	0.345	0.330	0.360
1 pass	**2A1**	**2A2**	**2B1**	**2B2**	**2C1**	**2C2**
Density	1.405	1.494	1.536	1.498	1.527	1.563
Median particle size	0.330	0.370	0.330	0.350	0.320	0.360
10 passes	**3A1**	**3A2**	**3B1**	**3B2**	**3C1**	**3C2**
Density	1.526	1.530	1.510	1.444	1.522	1.449
Median particle size	0.330	0.355	0.325	0.355	0.340	0.360
20 passes	**4A1**	**4A2**	**4B1**	**4B2**	**4C1**	**4C2**
Density	1.542	1.487	1.529	1.512	1.532	1.548
Median particle size	0.330	0.360	0.330	0.350	0.330	0.350

APPENDIX 7: STATISTICAL ANALYSIS RESULTS

Refer to Table 2: Summary of statistical calculations for Mann-Whitney U Test

TEST NO.	GROUP 1	GROUP 2	CALCULATED *U* VALUE[1]	TABLED[2] *U* VALUE	ACCEPT[3] / REJECT[4] NULL HYPOTHESIS
A.	**DAY 1**	**DAY 2**			
A1.	No pass all density data for Day 1	No pass all density data for Day 2	9	5	ACCEPT
A2.	All pass density data Day 1	All pass density data Day 2	27	99	**REJECT**
A3.	1 pass for surface & 20cm depth for Day 1	1 pass for surface & 20cm depth for Day 2	5	5	**REJECT**
A4.	10 passes for surface and 20cm depth for Day 1	10 passes for surface and 20cm depth for Day 2	6	5	ACCEPT (Note: that for 1-tailed test significance level at 0.05, table U value is 7. The Null Hypothesis would be rejected for 1 tailed test).
A5.	20 passes for surface & 20cm depth for Day 1	20 passes for surface & 20cm depth for Day 2	0	5	**REJECT**
B.	**SURFACE (DAY 1 & 2) NO PASS**	**SURFACE (DAY 1 & 2) AFTER PASSES**			
B1.	Surface no pass for Day 1 & 2	Surface 1 pass for Day 1 & 2	14	5	ACCEPT
B2.	Surface no pass for Day 1 & 2	Surface 10 passes for Day 1 & 2	16	5	ACCEPT
B3	Surface no pass density data for Day 1 & 2	Surface 20 passes density data for Day 1 & 2	16	5	ACCEPT
C.	**20cm DEPTH (DAY 1 & 2) NO PASS**	**20cm DEPTH (DAY 1 & 2) AFTER PASSES**			
C1.	No pass 20cm depth for Day 1 & 2	1 pass 20cm depth for Day 1 & 2	10	5	ACCEPT
C2.	No pass 20 cm depth for Day 1 & 2	10 passes 20cm depth for Day 1 & 2	7	5	ACCEPT (Note: for 1-tailed test significance level at 0.05, table U value is 7. The Null Hypothesis would be rejected for 1 tailed test)

[1] Calculated U value for Significance level for two-tailed test at 0.05

[2] Tabled U value for Significance level for two-tailed test at 0.05 (Fowler, Cohen & Jarvis; 1998).

[3] Accept Null Hypothesis if calculated U value exceeds the tabled U value.

[4] Reject Null Hypothesis if calculated U value is equal or smaller than the tabled U value.

TEST NO.	GROUP 1	GROUP 2	CALCULATED *U* VALUE[1]	TABLED[2] *U* VALUE	ACCEPT[3] / REJECT[4] NULL HYPOTHESIS
C3.	No pass at 20cm depth for Day 1 & 2	20 passes at 20cm depth for Day 1 & 2	11	5	ACCEPT
C4.	10 passes at 20cm depth for Day 1 & 2	20 passes at 20cm depth for Day 1 & 2	12	5	ACCEPT
D.	**SURFACE (DAY 1 & 2)**	**20cm DEPTH (DAY 1 & 2)**			
D1.	Surface no pass for Day 1 & 2	20cm depth no pass for Day 1 & 2	16	5	ACCEPT
D2.	Surface 1 pass for Day 1 & 2	20cm depth 1 pass for Day 1 & 2	16.5	5	ACCEPT
D3.	Surface 10 passes for Day 1 & 2	20cm depth 10 passes for Day 1 & 2	9	5	ACCEPT
D4.	Surface 20 passes for Day 1 & 2	20cm depth 20 passes for Day 1 & Day 2	18	5	ACCEPT
E.	**ALL DENSITY DATA (DAY 1 & 2) NO PASS**	**ALL DENSITY DATA (DAY 1 & 2) AFTER 20 PASSES**			
E1.	No pass density data for Day 1 & 2 (all surface & 20cm depth)	20 pass density data for Day 1 & 2 (all surface & 20cm depth)	54	37	ACCEPT
F.	**NO PASS DATA**	**ALL PASS DATA**			
F1	No pass density data for Day 1	All pass density data for Day 1	38	24[5]	ACCEPT
F2	No pass density data for Day 2	All pass density data for Day 2	40	24[6]	ACCEPT

[5] Robertson (1998)

[6] Robertson (1998)

TEST A1

NPar Tests

Mann-Whitney Test

Ranks

	day	N	Mean Rank	Sum of Ranks
density	1	6	5.00	30.00
	2	6	8.00	48.00
	Total	12		

Test Statistics[b]

	density
Mann-Whitney U	9.000
Wilcoxon W	30.000
Z	-1.441
Asymp. Sig. (2-tailed)	.150
Exact Sig. [2*(1-tailed Sig.)]	.180[a]

a. Not corrected for ties.

b. Grouping Variable: day

TEST A2

NPar Tests

Mann-Whitney Test

Ranks

	group	N	Mean Rank	Sum of Ranks
allpassdata	1	18	11.00	198.00
	2	18	26.00	468.00
	Total	36		

Test Statistics[b]

	allpassdata
Mann-Whitney U	27.000
Wilcoxon W	198.000
Z	-4.271
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[a]

a. Not corrected for ties.

b. Grouping Variable: group

Test A3

NPar Tests

Mann-Whitney Test

Ranks

	day	N	Mean Rank	Sum of Ranks
passes	1	6	4.33	26.00
	2	6	8.67	52.00
	Total	12		

Test Statistics[b]

	passes
Mann-Whitney U	5.000
Wilcoxon W	26.000
Z	-2.085
Asymp. Sig. (2-tailed)	.037
Exact Sig. [2*(1-tailed Sig.)]	.041[a]

a. Not corrected for ties.

b. Grouping Variable: day

TEST A4

NPar Tests

Mann-Whitney Test

Ranks

	day	N	Mean Rank	Sum of Ranks
passes	1	6	4.50	27.00
	2	6	8.50	51.00
	Total	12		

Test Statistics[b]

	passes
Mann-Whitney U	6.000
Wilcoxon W	27.000
Z	-1.922
Asymp. Sig. (2-tailed)	.055
Exact Sig. [2*(1-tailed Sig.)]	.065[a]

a. Not corrected for ties.

b. Grouping Variable: day

NPar Tests

test A5

Mann-Whitney Test

Ranks

	day	N	Mean Rank	Sum of Ranks
pass	1	6	3.50	21.00
	2	6	9.50	57.00
	Total	12		

Test Statistics[b]

	pass
Mann-Whitney U	.000
Wilcoxon W	21.000
Z	-2.882
Asymp. Sig. (2-tailed)	.004
Exact Sig. [2*(1-tailed Sig.)]	.002[a]

a. Not corrected for ties.

b. Grouping Variable: day

TEST B1

NPar Tests

Mann-Whitney Test

Ranks

	nopass1pass	N	Mean Rank	Sum of Ranks
surfacenopass1pass	1	6	7.17	43.00
	2	6	5.83	35.00
	Total	12		

Test Statistics[b]

	surfacenopass1pass
Mann-Whitney U	14.000
Wilcoxon W	35.000
Z	-.641
Asymp. Sig. (2-tailed)	.522
Exact Sig. [2*(1-tailed Sig.)]	.589[a]

a. Not corrected for ties.

b. Grouping Variable: nopass1pass

Test B2

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
surfacenopass	1	6	6.83	41.00
	2	6	6.17	37.00
	Total	12		

Test Statistics[b]

	surfaceno pass
Mann-Whitney U	16.000
Wilcoxon W	37.000
Z	-.320
Asymp. Sig. (2-tailed)	.749
Exact Sig. [2*(1-tailed Sig.)]	.818[a]

a. Not corrected for ties.

b. Grouping Variable: passes

Test 33

NPar Tests

Mann-Whitney Test

Ranks

	nopass20pass	N	Mean Rank	Sum of Ranks
Surfaces	1	6	6.83	41.00
	2	6	6.17	37.00
	Total	12		

Test Statistics[b]

	Surfaces
Mann-Whitney U	16.000
Wilcoxon W	37.000
Z	-.320
Asymp. Sig. (2-tailed)	.749
Exact Sig. [2*(1-tailed Sig.)]	.818[a]

a. Not corrected for ties.

b. Grouping Variable: nopass20pass

TEST C1

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
20cmdepth	1	6	7.83	47.00
	2	6	5.17	31.00
	Total	12		

Test Statistics[b]

	20cmdepth
Mann-Whitney U	10.000
Wilcoxon W	31.000
Z	-1.281
Asymp. Sig. (2-tailed)	.200
Exact Sig. [2*(1-tailed Sig.)]	.240[a]

a. Not corrected for ties.

b. Grouping Variable: passes

Test C2

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
depth	1	6	8.33	50.00
	2	6	4.67	28.00
	Total	12		

Test Statistics[b]

	depth
Mann-Whitney U	7.000
Wilcoxon W	28.000
Z	-1.761
Asymp. Sig. (2-tailed)	.078
Exact Sig. [2*(1-tailed Sig.)]	.093[a]

a. Not corrected for ties.

b. Grouping Variable: passes

test C3

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
depth	1	6	7.67	46.00
	2	6	5.33	32.00
	Total	12		

Test Statistics[b]

	depth
Mann-Whitney U	11.000
Wilcoxon W	32.000
Z	-1.121
Asymp. Sig. (2-tailed)	.262
Exact Sig. [2*(1-tailed Sig.)]	.310[a]

a. Not corrected for ties.

b. Grouping Variable: passes

TEST C4

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
DEPTH	1	6	5.50	33.00
	2	6	7.50	45.00
	Total	12		

Test Statistics[b]

	DEPTH
Mann-Whitney U	12.000
Wilcoxon W	33.000
Z	-.961
Asymp. Sig. (2-tailed)	.337
Exact Sig. [2*(1-tailed Sig.)]	.394[a]

a. Not corrected for ties.

b. Grouping Variable: passes

TEST D1

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
position	1	6	6.17	37.00
	2	6	6.83	41.00
	Total	12		

Test Statistics[b]

	position
Mann-Whitney U	16.000
Wilcoxon W	37.000
Z	-.320
Asymp. Sig. (2-tailed)	.749
Exact Sig. [2*(1-tailed Sig.)]	.818[a]

a. Not corrected for ties.

b. Grouping Variable: passes

TEST 02

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
POSITION	1	6	6.25	37.50
	2	6	6.75	40.50
	Total	12		

Test Statistics[b]

	POSITION
Mann-Whitney U	16.500
Wilcoxon W	37.500
Z	-.241
Asymp. Sig. (2-tailed)	.810
Exact Sig. [2*(1-tailed Sig.)]	.818[a]

a. Not corrected for ties.

b. Grouping Variable: passes

TEST 03

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
position	1	6	8.00	48.00
	2	6	5.00	30.00
	Total	12		

Test Statistics[b]

	position
Mann-Whitney U	9.000
Wilcoxon W	30.000
Z	-1.441
Asymp. Sig. (2-tailed)	.150
Exact Sig. [2*(1-tailed Sig.)]	.180[a]

a. Not corrected for ties.

b. Grouping Variable: passes

Test 04

NPar Tests

Mann-Whitney Test

Ranks

	passes	N	Mean Rank	Sum of Ranks
position	1	6	6.50	39.00
	2	6	6.50	39.00
	Total	12		

Test Statistics[b]

	position
Mann-Whitney U	18.000
Wilcoxon W	39.000
Z	.000
Asymp. Sig. (2-tailed)	1.000
Exact Sig. [2*(1-tailed Sig.)]	1.000[a]

a. Not corrected for ties.

b. Grouping Variable: passes

TEST E1

NPar Tests

Mann-Whitney Test

Ranks

	GROUP	N	Mean Rank	Sum of Ranks
density	1	12	14.00	168.00
	2	12	11.00	132.00
	Total	24		

Test Statistics[b]

	density
Mann-Whitney U	54.000
Wilcoxon W	132.000
Z	-1.039
Asymp. Sig. (2-tailed)	.299
Exact Sig. [2*(1-tailed Sig.)]	.319[a]

a. Not corrected for ties.

b. Grouping Variable: GROUP

APPENDIX 8: COPIES OF NEWSPAPER ARTICLES

Table 1: Newspaper articles of relevance

NO.	DATE	NEWSPAPER / MAGAZINE	ARTICLE TITLE
1	5 June 2001	The Natal Witness	Minister says protecting the environment starts at home – Changing attitudes.
2	11 June 2002	The Mercury	Law will allow Govt to confiscate equipment. Vehicle beach ban looms.
3	5 July 2001	The Natal Witness	Conservationists hail key step in replenishing fish and bird stocks – Plan to ban wheels from beaches.
4	November 2001	Natures Voice (in North Glen News)	Restricted beach access
5	Mid-December 2001	Umhlanga Globe	4x4 Drivers please note.
6	December 2001	Gateway to KwaZulu-Natal	Beach driving is restricted.
7	December 2001	Gateway to KwaZulu-Natal	Restricted beach access.
8	January 2002	Natures Voice (in North Glen News)	Off-road vehicles banned on beaches.
9	19 January 2002	The Natal Witness	Beach ban on 4x4s starts.
10	19 January 2002	The Natal Witness	KZN Wildlife and public concerned over banning of 4x4s
11	25 January 2002	The Natal Witness	New 4x4 laws hit businesses hard.
12	Summer 2002	Uwandle: KwaZulu-Natal's Coastal Management Newsletter	4x4 Beach Ban begins.
13	9 February 2002	The Natal Witness	Axles of evil.
14	24 February 2002	Sunday Tribune	4x4 ban hits poor hardest.
15	March 2002	Getaway	Beach driving ban enforced in KZN parks.
16	3 March 2002	Sunday Tribune	Call for ban to be banished.
17	4 March 2002	The Natal Witness	St Lucia residents protest 4x4 beach ban.
18	24 March 2002	Sunday Tribune	4x4 beach ban: St Lucia Easter plea for relief fails.
19	26 April 2002	Natal Mercury	Court upholds vehicle beach ban.
20	13 June 2002	Natal Witness	Exemption to 4x4 beach ban
21	July 2002	Gateway to KwaZulu-Natal	Reprieve for 4x4s on St Lucia beaches
22	12 November 2002	Natal Witness	No place for 4x4 'ruffians' here
23	17 November 2002	Natal Witness	Not all 4x4 owners are ruffians
24	17 November 2002	Sunday Tribune	Proposal may ease 4x4 beach tensions
25	19 November 2002	Natal Witness	Watch out for Turtles

THE NATAL WITNESS, TUESDAY, JUNE 5, 2001

Minister says protecting the environment starts at home

Changing attitudes

PHILIPPA CAMERON

"WE South Africans must act before it is too late to protect our environment." This was the message from Environmental Affairs Minister Valli Moosa on the eve of Environmental Week, which runs from June 4 to June 8.

In an interview with the *Witness*, Moosa said the people of this country need to change their attitude.

"We need to develop a new culture of picking up our litter and cleaning up our environment. We could start in our own homes — separating our litter for proper recycling, scaling down the use of plastic bags and using bags that can be reused."

World Environment Day was established by the United Nations General Assembly in 1972 to mark the opening of the Stockholm Conference on Human Environment. From this, the United Nations Environmental Project, which is one of the bodies responsible for co-ordinating the commemoration of World Environment Day, selects a city as the main venue for international celebrations — this year it will take place in Adelaide, Australia.

The minister said the theme of this year's Environment Week is "Clean up South Africa for a better life".

"We are focusing on action to protect the environment," Moosa said. "We will be launching waste management projects at the Batho Township in the Free State, we will be highlighting our work on the coast with a tour around the peninsula ending at the newly declared Walker Bay Whale Sanctuary and, on the seventh, in line with the international theme, 'Connect to the world wide web of life', we will be relaunching the DEAT website."

There are a number of environmental issues that are on top of the minister's list, including the restructuring and transformation of the fishing and tourism industries; the expansion of conservation areas; the revising of air pollution standards and a new drive on waste management with a waste summit being convened in September this year.

Another issue high on Moosa's agenda is environmental education.

"The Department of Education has been co-operative in this regard," he said. "We are already integrating environmental education into the curriculum. We do this with a vision to ensure that this becomes a way of life, not just a subject at school."

In his budget speech to Parliament last week, Moosa emphasised that the country's guiding principle must be sustainable development and sustainable use of natural resources. He reported that his department will spend R30 million in the rehabilitation of wetlands and employ 1350 people in poverty relief projects aimed at the rehabilitation of the coast.

He announced that new standards for emissions were being published for public comment after a study conducted and modelled around the Durban South basin, which is a high air pollution zone.

"Industrial development does not have to be accompanied by a denial of clean air for our citizens," he said.

He also announced the publication of draft regulations aimed at prohibiting the driving of 4x4 and other private vehicles on beaches.

"On the Wild Coast, the state has proceeded to crack down on persons who have erected illegal holiday homes. Forty-six summonses have been served on illegal cottage owners. Eight cottages have been demolished and 27 arrests have been made."

The Department of Environmental Affairs and Tourism has a number of goals it hopes to achieve during the week: to highlight the role of government, stakeholders and individuals; to encourage environmental initiatives that will provide for job creation and poverty alleviation; to encourage community involvement and participation in the protection of and preservation of the environment; and to increase awareness of environmental issues.

A list of all the government activities that taking place during World Environment Week can be found at www.environment.gov.za

LAW WILL ALLOW GOVT TO CONFISCATE EQUIPMENT

Vehicle beach ban looms

MELANIE GOSLING
Cape Town

WHILE Pieter Niemand was fishing from the shore near Strandfontein, a quad bike tore past, narrowly missing his child.

"I was so angry. He nearly took my kid out. Those quad bikes and beach buggies scream around the beach all day, over the dunes, and no one does anything about it.

"But now, instead of controlling the bad guys, the government's going to ban all vehicles on beaches and so penalise guys like us, who are responsible. Angling is a national and a provincial sport, but we won't be able to continue if we can't use vehicles on beaches," Mr Niemand said.

Mr Niemand was commenting on the draft legislation published by the department of environmental affairs and tourism two weeks ago which aims to ban all vehicles from the coastal zone.

The ban would not apply to vehicles on a public road in the coastal zone, those used in a rescue operations, state employees on official business, or within a proclaimed harbour.

Applications may be made to use vehicles to launch boats within demarcated sites, for scientific research and for certain approved activities such as harvesting seaweed.

For the rest, vehicles are banned from all beaches, dunes, estuaries and coastal wetlands.

The proposed law allows the government to confiscate vehicles.

Mr Shaun Schneier, of marine and coastal management, said the reason for the ban was both environmental and social.

"There is conflict between those who want to enjoy the wilderness atmosphere of the coast but have to watch their children like hawks to ensure they don't get run over."

In KwaZulu-Natal, where the rare leatherback and loggerhead turtles nest above the highwater mark, the hatchlings have to contend with many natural predators on their way from the nest to the sea. In the past few decades, vehicles have become another threat. The turtles also become trapped in the deep tracks left by vehicles.

❑ The public is invited to comment on the proposed regulations, published in Government Gazette number 22335 of May 29, 2001, by writing to S Schneier, Private Bag X2, Roggebaai, 8012 or fax (021) 418-2582, or send an email to: schneier@mcm.wcape.gov.za. Deadline for comment is June 29.

Conservationists hail key step in replenishing fish and bird stocks

Plan to ban wheels from beaches

CRAIG BISHOP
Environment

PROPOSED regulations banning all wheeled vehicles from beaches have been hailed by conservationists as a key step to replenishing endangered KwaZulu-Natal coastal bird and fish stocks.

However, a recent deadline extension until July 16 for public comment on the regulations has resulted in several municipalities sending objections to national Environmental Affairs and Tourism Minister Valli Moosa, claiming that the regulations will, if enforced, cripple local economies which rely on tourist access to beaches.

The draft regulations, which were advertised in the *Government Gazette* on May 29, propose a sweeping ban on off-road use of vehicles on the coast for recreational purposes, but provide for the use of vehicles in demarcated areas for boat launching, subject to environmental impact assessments. Severe penalties, such as confiscation of the vehicles and stiff fines, are also provided for.

The new proposals are expected to address shortcomings in the national policy on beach driving, enshrined in the Environment Conservation Act 73 of 1989, according to regional conservation officer Cedric Coetzee.

"The minister has to address the problem from a national perspective. We do believe that we are in control at the moment."

Shortcomings include insufficient penalties for transgressors and the inability of local authorities to police access to all routes to their beaches.

The Department of Environmental Affairs and Tourism said this week that driving on beaches threatens rare dune vegetation, turtles' eggs and birds' nests, as well as prehistoric middens.

"The use of vehicles for recreational purposes on the coast is increasing. This use is increasingly damaging coastal ecosystems and historical sites, and is diminishing the quality of the recreational experience of the public. This diminishes the value of the coast, a vitally important national asset," said Moosa's spokesman, J.J. Thabane.

Marine and Coastal Management's Colin Attwood said that certain fish species, such as the dusky cob, have "collapsed", meaning they are unable to replace numbers lost through fishing. The spawning capacity of the cob has declined by 95% over the last 100 years, he said.

"It stands to reason that most fishermen will not walk the 15 or 20 kilometres to get to a site. And if they do they will only be able to take out two or three fish rather than a bakkie load. Fifty years ago there were large sections of inaccessible coast. If the regulations come in, these natural refuges will recover."

Professor Phil Hockey, of the internationally recognised black oystercatcher conservation programme, said that the new regulations could protect certain estuarine and lagoon bird species. "The obvious areas are St Lucia and Kosi Bay. The regulations do extend to protect estuaries and lagoons, so any reduction of disturbance in these areas can only be beneficial to birds."

But not everyone is happy with the proposals. A group of concerned Mtubatuba residents have formed a committee to take action against the proposals and have sent a petition with over 1 000 signatures to Moosa's office. While the committee agrees that vehicles do damage beaches, they claim that restrictions are already in place governing access to beaches.

Mtubatuba Mayor Chris Swart said yesterday that local communities would be hardest hit by the regulations. About 500 000 tourists visit the area each year. "They rely on the annual influx of tourists to sell arts and crafts. People from Gauteng and other places come here specifically because of the open beaches and if they are banned from doing so, they will not come."

Swart said restrictions already in place, under the national Environment Conservation Act, mean that most provincial beaches are already clean and healthy. "We feel these regulations are not the right way to go about protecting beaches. Some sort of impact assessment for each separate area is required rather than a blanket ban on the whole coastline."

4.

NOV. 2001

Restricted beach access

STRICT measures will be in place along the coast of the Greater St Lucia Wetland Park, to ensure that the sea-turtle nestings are as successful and undisturbed as possible.

For this reason beach access from Cape Vidal to Sodwana Bay and Nine-Mile Beach, as well as at St Lucia Estuary, will be closed to all vehicle traffic from 7pm to 5am every night until Friday, March 15, 2002.

No beach vehicle travel is permitted at any time north of Mbibi, nor may any vehicle travel through the Sanctuary area between Red Sands and Leven Point, midway between Cape Vidal and Sodwana Bay.

Visitors are welcome to walk these beaches at night but are requested not to interfere in any way with nesting sea-turtles. NATURES VOICE

5.

UMHLANGA GLOBE MID-DEC. 2000

4x4 Drivers please note

CERTAIN sections of beaches at St Lucia, Cape Vidal and Sodwana Bay will be closed to vehicle traffic from 7pm to 5am daily, from now until 31 March 2001.

This is due to the annual KZN sea-turtle nesting season having started, with the first Leatherback and Loggerhead sea-turtles making their appearance along these beaches.

At St Lucia the beach 2km north of the demarcated bathing area will be closed from 8pm to 5am daily.

The beach 2km north of the Cape Vidal Beach access will be closed from 7pm to 5am daily, while at Sodwana Bay the beach will be closed from 6pm to 6am daily from now until 15 January 2001, with vehicle access permitted on the immediate beach at Jesser Point only - no vehicle access will be permitted onto the beaches north and south of Sodwana.

6.

Beach driving is restricted

Only certain types of vehicle are allowed on the beach

MANY places along the KZN coast can only be accessed by driving on the beach. While this is loads of fun, it is necessary to take care of both the environment and your vehicle.

Vehicles on the beach have a negative impact on the sensitive plants and animals which occur along the dunes and sand. Please bear in mind that you may not park or drive on the sensitive area above the high-water mark.

Also, when driving, look out for the bird chicks that hide in vehicle tracks.

Only certain types of vehicle are allowed on the beach.

All vehicles must be roadworthy. Two-wheel-drive vehicles must have 205 or bigger tyres, and pressure must be less than 1,2 bar.

Before you drive onto any beach in Umlalazi, Mapelane, St Lucia, Cape Vidal or Sodwana Bay, you must be in possession of a valid KZN Nature Conservation permit.

These may be applied for and purchased at the offices of any of these reserves.

Remember that infringement of any regulation will result in your permit being withdrawn.

No vehicles are allowed onto the beach between Mabibi and the South Africa/Mozambique border.

There is a marine reserve between south Cape Vidal and the Mozambiquan border, and a marine sanctuary between Leven Point and Red Sands. These areas are clearly demarcated by beacons and signs. You may not stop for any reason whatsoever.

Areas controlled by local authorities, such as town boards and municipalities, may have their own regulations - it is advisable that you contact the local authority before entering any beach under its control.

7.

Restricted beach access

STRICT measures will be in place along the coast of the Greater St Lucia Wetland Park, to ensure that the sea-turtle nestings are as successful and undisturbed as possible.

For this reason beach access from Cape Vidal to Sodwana Bay and Nine-Mile Beach, as well as at St Lucia Estuary, will be closed to all vehicle traffic from 7pm to 5am every night until Friday, March 15, 2002.

No beach vehicle travel is permitted at any time north of Mbibi, nor may any vehicle travel through the Sanctuary area between Red Sands and Leven Point, midway between Cape Vidal and Sodwana Bay.

Visitors are welcome to walk these beaches at night but are requested not to interfere in any way with nesting sea-turtles.

Off-road vehicles banned on beaches

THE Minister of Environmental Affairs and Tourism, Mr Valli Moosa, has announced regulations to control the use of off-road vehicles (OVRs) on the coastline.

According to the Ministry of Environmental Affairs and Tourism, the purpose of the regulations which were published in the Government Gazette on December 21, 2001, is to provide national legislation in the interests of the environment, human safety and the enjoyment derived from coastal recreation.

The regulations impose a general ban on the use of OVRs on the coast for recreational purposes.

The regulations allow for applications to be made for licenses to operate boat launching sites and for permits to use vehicles for the purposes of scientific research, non-recreational activities permitted in terms of fisheries legislation, a tourism business conducted by a tour operator and gaining access to properties which have no road access.

The director general of the Department of Environmental Affairs and Tourism may also designate certain recreational areas for the use of OVRs, although this will only be considered once an evaluation of the various ecological requirements of coastal areas has been carried out. The regulations include strict penalties to deter transgressors, including the seizure and confiscation of vehicles used illegally.

Sodwana Bay was a 4x4 enthusiasts dream.

NATURE'S VOICE JANUARY 2002

NATAL WITNESS
19/01/02

The beach at Sodwana Bay was crowded with 4x4s this week, but from tomorrow it will be a different picture.

Photo: IAN CARBUTT

Some coastal businesses, off-road enthusiasts not happy as new law kicks in

Beach ban on 4x4s starts

CRAIG BISHOP

SOUTH Africa's beach eco-systems will be given a chance to recover from decades of abuse by 4x4 drivers when Environmental Affairs and Tourism Minister Valli Moosa's new legislation banning 4x4s from beaches comes into effect tomorrow.

However, many KwaZulu-Natal coastal businesses claim the legislation could put them out of business. 4x4 owners have also told the *Witness* that they will take their money to beaches in Mozambique if the legislation comes into effect.

In addition, KZN Wildlife has expressed concern that the legislation could impact on one of the province's biggest money spinners – Sodwana Bay, which hundreds of 4x4 drivers visit annually.

The legislation imposes a general ban on the use of off-road vehicles (ORV) on the coast for recreational purposes. However, applications can be made for licences to operate ORVs resources and promote tourism. In terms of the National Environmental Management Act of 1998, government is required to give special attention to sensitive coastal eco-systems.

"We will be consulting with the scientific community to establish which areas cannot be classified as recreational zones," Makwakwa said.

Sodwana Bay Dive Association chairman Greg De Valle said the multi-million rand diving industry is at risk.

'The new legislation will impact on everyone'

"People are saying if they cannot drive on to the beach and offload expensive dive equipment, then they will go to the more accessible beaches in Mozambique. This will impact on everyone from the shore fishermen and tourist resorts to the local community-wide industry," he said.

4

Photo: IAN CARBUTT

A young tourist pushes a wire 4x4 along Sodwana Bay beach. As of tomorrow, this will be the only type of off-road vehicle allowed on South Africa's beaches, subject to certain conditions, due to national legislation.

KZN Wildlife and public concerned over banning of 4x4s

From page 1

KZN Wildlife CEO Khulani Mkhize said his organisation welcomes any move to protect the environment but admits that the legislation could impact on annual revenue from Sodwana Bay.

According to the Wildlife financial officers, R580 000 was raised last year from beach permits, which cost R150 each. Over R670 000 was raised from gate fees, 10% of which goes towards Wildlife Community Trust fund.

"This does pose a challenge in terms of managing our income. But while there may be a slight negative impact, it is a sound decision in terms of the environment."

The full text of the regulations is available on www.environment.gov.za. The Department of Environmental Affairs can be contacted at (021) 402 3504.

THE NATAL WITNESS, FRIDAY, JANUARY 25, 2002

Controversy deepens as ...

New 4x4 laws hit businesses hard

CRAIG BISHOP
Environment

THE controversy surrounding new national legislation to ban 4x4 vehicles from beaches deepened this week after it was revealed that coastal businesses from Mtunzini to Sodwana Bay are all reporting cancellations and loss of revenue.

Locals in the Sodwana Bay area also said a decline in tourist numbers is impacting on their informal businesses.

Sodwana Bay Lodge manager Phillip Healy yesterday reported cancellations and guests leaving early from the lodge because of the new legislation.

"We have had numerous complaints directed at us from people who now cannot drive their vehicles on the beach. There are very serious concerns that while things are not too bad at present, they may well get worse."

Healy said he was happy with the existing KZN Wildlife beach permit system. "They could raise the cost of the permits and thereby decrease the numbers of vehicles on beaches. However, there has been zero communication between government and local businesses and tribal authorities."

KZN Wildlife conservator in Sodwana, Ian Porter, said all KZN Wildlife resorts from Mtunzini to Sodwana Bay are feeling the impact of the new legislation.

"It is impossible to quantify at the moment but they are all losing bookings and people's reasons are the same – they cannot drive their vehicles on the beaches."

Mabaso resident Patrick Nxumalo said roadside curio shop owners are all concerned that they are not selling their products and that "things could get worse before they get better".

Under the new legislation, applications can be made for licenses to operate 4x4s for scientific research, boat launching, non-recreational activities permitted in terms of fishing legislation, tourism businesses and for gaining access to properties that have no road access.

4X4 BEACH BAN BEGINS

Those caught driving an off-road recreational vehicle across a South African beach on or after January 20, 2002 will be dealt with strictly, including having their 4x4 seized and confiscated, says the Department of Environmental Affairs and Tourism (DEAT).

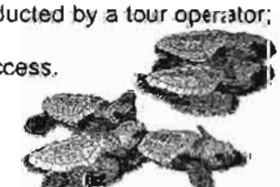
The use of 4x4s on beaches has increased, and their negative impact on the country's coastal environment is considerable. As popular as these 4x4 vehicles have become, their sheer size, number and power have the potential to irreversibly damage our coastal landforms, ecosystems and archaeological sites. Certain coastal landforms - including dunes, salt marshes, estuarine sands and mud flats - are easily damaged by vehicle traffic.

The regulations impose a general ban on the use of 4x4s on the coast for recreational purposes. However, certain uses of vehicles within the coastal zone are permissible, including the use of a vehicle by an employee of the state for the purposes of performing public duties and the use of electrically-propelled vehicles by physically disabled persons.

The regulations also allow applications to be made for:

- licences to operate boat launching sites;
- permits to use vehicles for the purpose of scientific research;
- permits for recreational use within a recreational use area;
- permits for non-recreational activities allowed in terms of fisheries legislation;
- permits for a tourism business conducted by a tour operator; and
- getting to properties without road access.

Applicants for such permits will be required to follow environmental impact assessment procedures.



Attempts to preserve the coastal ecology do not go far enough

Axles of evil

by
YVES VANDERHAEGHEN

THE rumblings against Minister Wielie-Valli's banning of four-wheel drives from the beaches are starting to grow. A sensible policy is being dragged into court to defend itself against a bunch of self-serving environmental vandals trotting out that most tired of modern-day shibboleths: "It's bad for business".

As if the very worst thing in the world that anyone can do — moral, legal, political — is to harm business. Companies can keep pumping their filth into streams, kill the fish, poison people, but don't ask them to stop because that's "bad for business". Three thousand people die in the attack on the World Trade Centre and American politicians urge the country to go shopping. Because it's "good for business". And what's good for business is reason enough. If you don't get that, well, Duh!

The only problem with the Environmental Affairs and Tourism Minister Mohammed Valli Moosa's attempt to preserve the coastal ecology is not that it is making a few anglers and divers walk a bit farther but that it does not go far enough.

Tourists, who have assumed a god-status and whose goodwill is so treasured that all manner of debasement and displacement is indulged to humour them, have become the measure of value for any activity or policy. Disregarded is the fact that as their numbers proliferate they defile the very object of their desire, taking the magic out of adventure and the beauty out of the wilderness through their mere presence. A presence made worse because they come not on two feet but on four wheels. Four wheels powered by fuel sucked from the soil by dictators, leaving a scar on the land and poison in the air.

"Give me silence, water, hope," wrote the poet Pablo Neruda. His words speak for all people who should be places of solitude and serenity, places where human batteries can recharge. That's what they're there for. Otherwise, if it's crowds that thrill you, go to Disneyland or any other abomination of a theme park.

Furthermore, to reverse the trend of ordinary South Africans being unable to take pleasure in their own country because the best bits have been cordoned off for the use of dollar millionaires, the minister should launch a national lottery. Only winning ticket holders will be granted access to unspoilt wildlife areas, low-impact shuttle services will provide limited transport and the proceeds of the lottery will finance the running of the resorts.

'As tourist numbers proliferate they defile the very object of their desire, taking the magic out of adventure and the beauty out of the wilderness through their mere presence.'

Having cleaned up the wilds, Moosa should then hit the road and wage an all-out war on the axles of evil. For that he'll need a few other ministers on his side. There was a hopeful moment a few years back when KwaZulu-Natal's energetic transport MEC S'bu Ndebele looked as though he was taking the bit between his teeth in trying to reduce and regulate traffic congestion. He'd recognised that the free-for-all on the freeways is a nightmare, and that if the numbers of cars keep growing as they have been then the entire countryside would have to be under tar, which his department had no chance of beginning to fund.

One of his suggestions was that motorists travelling alone in a car should be fined, which took off like a seized engine and that's the last anyone ever heard of the idea. But there was a welcome boldness of vision there which held the promise of a car-free, noise-free, fume-free environment. The drawback was — and still is — that an adequate

to make his plans work. With reliable, clean, safe buses and trains, it would be possible to declare cities car-free zones, or to limit numbers by, as in Paris for example, allowing even- and odd-numbered registrations in on alternate days. Good public transport would also signal the end of the taxi menace. What was that about "bad for business"?

For good measure, to halt the carnage beyond the city limits, and to give more force to the Asiphephe campaign, why not follow the American example and reduce the speed limit to 90 km/h. Better yet, follow then health minister Nkosazana Zuma's approach to smokers: impose massive punitive taxes on all fossil fuel users (because damaging the environment is not the sole preserve of 4x4 traction terrorists) to fund a national alternative energy programme. That should drive most cars off the road. "Another world is possible" is the rallying cry of the anti-globalisation lobby. A car-free one sounds perfect.

The enviro activist, Edward Abbey, wrote, way back in 1967, an "elegy" to an American wilderness being destroyed by the twin onslaught of tourists and cars. Called *Desert Solitaire* it describes a couple of years he spent in the fifties as a park ranger in the Arches National Monument in Utah and the inexorable destruction of the physical and spiritual beauty of the land he was entrusted to look after.

In a bitter exhortation to the reader, he wrote: "Do not jump into your automobile ... and rush out to the canyon country hoping to see some of that which I have attempted to evoke in these pages. In the first place you can't see anything from a car; you've got to get out of the goddamned contraption and walk, better yet crawl, on hands and knees, over the sandstone and through the thornbrush and cactus. When traces of blood begin to mark your trail you'll see something, maybe. Probably not ... Most of what I write in this book is already gone or going under fast. This is not a travel guide but an elegy. A memorial. You're holding a tombstone in your hands. A bloody rock. Don't drop it on your foot — throw it at something big and glassy."

Another world is possible. Banning 4x4s from the

14.

SUNDAY TRIBUNE
24 FEB. 200~

4x4 ban hits poor hardest

JILL GOWANS

THE government's ban of 4x4s on beaches is hitting the poor hardest in coastal KwaZulu-Natal.

Caiphas Mkhwanazi, leader of the 15 000 people of Khula village, near St Lucia, is a worried man. "People are losing jobs, the women in the craft market are not selling much, and sellers on the roadside are closing their stalls. We're a very poor people," he said this week.

Next Saturday Mkhwanazi and a group of his people will join a march through St Lucia to protest against the ban which has been in place since January 20. They will be joined by people from the Dukuduku settlement and KwaMsani near Mtubatuba.

Ghost town

The march is being organised by Lafras Uys who has been in the St Lucia tourist business for 28 years. He said: "St Lucia became a ghost town overnight. The general consensus is that turnover has dropped by 60%. We face a bleak Easter."

One of just two garages in St Lucia has closed. Owner Pierre Dreyer said: "I've stopped ordering petrol because there aren't enough customers."

Wayne Orlandini owns two restaurants in the town: "We have had four very bad weekends in a row and I've earmarked six staff for retrenchment in the next two weeks."

Cedric Coetzee, regional manager for Ezemvelo KZN Wildlife said: "We're trying as quickly as possible to produce a policy on vehicle use in the coastal zone of the Greater St Lucia Wetland Park. This will be followed by an application for recreational use zones within five areas including Sodwana, Cape Vidal and St Lucia."

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Previously marred by the crisscross of tyres, beaches such as Mapelane (seen here) should now bear only the tread of bare feet.

Beach driving ban enforced in KZN parks

KwaZulu-Natal Wildlife has informed *Getaway* that they are strictly enforcing the beach-driving ban in all coastal protected areas under their control. The country-wide ban on vehicles driving on the beaches of South Africa became effective on 21 January 2002 (see editor's comment on page 5).

The wildlife authority has appealed to all people using the coastal parks of KZN to abide by the new law, as the penalties for transgression are severe – ranging from heavy fines to the confiscation of vehicles.

The only exemptions are for vehicles used for launching ski-boats at demarcated sites, emergency situations, scientific research and conservation management vehicles.

KZN Wildlife has applied for concessions for the establishment of special recreational-use areas. *Getaway* will keep you updated on any developments.

SUNDAY TRIBUNE 3 MARCH 2002

Call for ban to be banished

JILL GOWANS

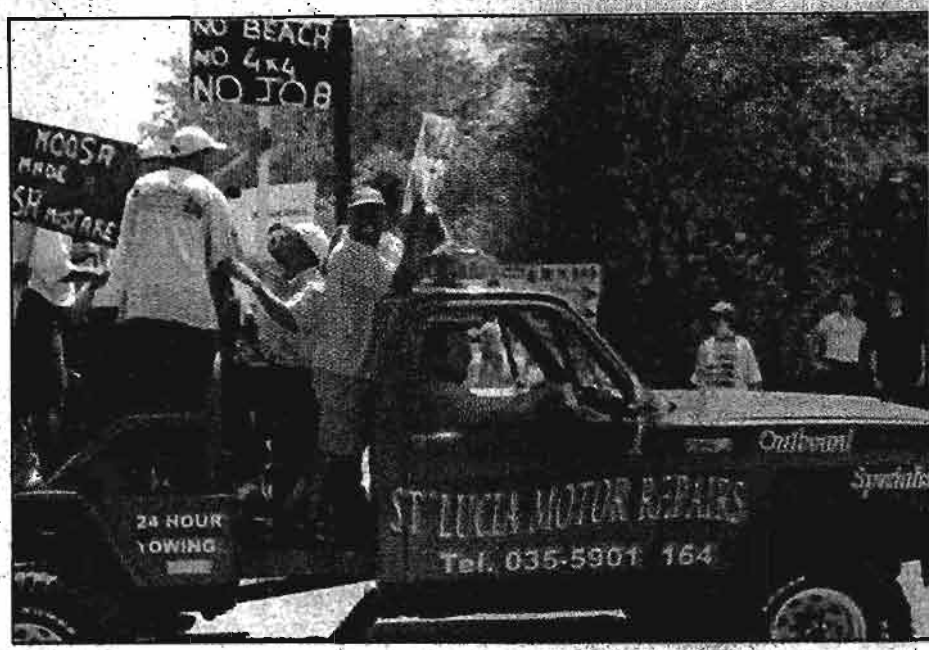
THOUSANDS of people yesterday held a protest in St Lucia against the government's ban on 4x4s on beaches. They came on foot, by bus and in hundreds of 4x4s, wielding placards with slogans such as: "No spenders, no vendors", "Vula amabishi, Vala uMoosa" (Open the beaches, shut down Moosa) and "Valli Moosa, the biggest hijacker of 4x4s by far".

Escorted by a strong police and army contingent, the crowd of more than 2 000 assembled at the entrance to St Lucia before walking down to the main beach. They were followed by dozens of 4x4s.

The protest was called to demand the overturning of environmental minister Valli Moosa's ban of 4x4s on all beaches, which came into effect on January 21.

Said TT Maphanga, leader of the 32 000-strong Dukuduku south community: "All our people are suffering. Many jobs have been lost and curio and fruit sellers are closing down stalls."

Musa Mkhwanazi, leader of the Mpukunyoni community, said: "We have lost jobs and customers. The beaches are now being protected, but what about the people? There's never been a proper environmental study of the effects of 4x4s on beaches."



■ 4x4 owners and community members took to the streets of St Lucia yesterday

For five years Stephan du Toit of Boksburg and 20 to 30 friends have gone four times a year to St Lucia for fishing weekends. He said: "This is our last weekend, unless they open the beaches. We'll go to Mozambique or stay at home and drown our sorrows."

A memorandum was handed to provincial minister of agriculture and environmental affairs, Narend Singh, which read: "The people, in coming here today, now boldly make the statement that enough is enough and insist the minister addresses their concerns within five days and insist that the minister must indicate what ste are to be taken by the government to alle ate their immediate plight."

Singh said KZN Wildlife had develop draft policy documents to be used in sele ing and assessing special recreational u areas for beach vehicles. He said the would be available for public comme before being implemented.

"It is my belief that this ban on off-ro vehicle traffic in the coastal zone, and m sures being implemented by KZN Wildl and the Greater St Lucia Wetlands Pa Authority, will help ensure that the 590k of KwaZulu-Natal's coastline are manag and protected from degradation."

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THE NATAL WITNESS, MONDAY, MARCH 4, 2002

St Lucia residents protest 4x4 beach ban

ST Lucia residents took to the streets at the weekend, protesting against the ban on the use of 4x4 vehicles on beaches.

The regulations include strict penalties, including the confiscation of offenders' driver's licences. While the ban seeks to minimise damage to the coastal ecology, it has not received a warm welcome from beach communities, who feel the ban will negatively affect the local economy by discouraging tourists from coming to the beaches. The demonstrators handed a memorandum to Environmental Affairs MEC Narend Singh, asking him to address their concerns within five days.

— Witness Reporter.

18.

4x4 beach ban: St Lucia Easter plea for relief fails

JILL GOWANS

ST LUCIA citizens and neighbouring communities this week lodged a High Court application in Pretoria for relief over the Easter holidays from the ban on 4x4s on beaches.

The applicants were Piet Lafras Uys, chairman of the Mtubatuba Beach Action committee, Khula village leader Caiphas Mkhwanazi, Timothy Mapanga, leader of the south Dukuduku community and the St Lucia Ratepayers' Association.

The respondent was the National Minister of Environmental Affairs and Tourism (Valli Moosa) whose ban on off-road vehicles on all of South Africa's beaches came into effect on January 21.

Uys, who has been a tourism operator for 28 years, said: "We asked for interim relief at least until after the Easter school holidays for a 8.5km stretch of beach from the Umfolozi River mouth (First Rocks.

"This is because we are all su fering from a steep decline i tourism and related activities lik the sale of craft and vegetable Our mass march here on March showed how desperate we all ar There is still plenty of accomm dation in St Lucia for the holiday even over the Easter weeken April looks very grim.

"The judge felt the minist needed time to submit more doc mentation, so the application wa postponed until June 10 and 11. W are obviously disappointed as th doesn't help our short-term crisis

❑ A draft policy document o beach vehicles has been drawn u by Ezemvelo KZN Wildlife and wi be put out for public commen before being submitted to th national ministry. It proposes sp cial recreation zones for certai Zululand beaches, including S Lucia, Sodwana and Cape Vidal.

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19.

NATAL MERCURY 26/4/02

Court upholds vehicle beach ban

MERCURY CORRESPONDENT

PORT ELIZABETH – The overall ban on vehicle access to South African beaches will remain in force.

This comes after a Port Elizabeth High Court ruling yesterday dismissing, with costs, applications by the South African Shore Angling Association and the Oyster Bay Ratepayers' Association for the total lifting of the ban.

The applicants had contended that Environmental Affairs and Tourism Minister Vali Moosa had over-stepped his authority, which was exclusive to the minister of transport, by approving a ban which involved vehicles.

In his judgment, Mr Justice Andre Erasmus noted, however, that the Seashore Act did not explicitly exclude the powers of other ministers from making regulations regarding the use of the seashore by members of the public.

The objective of the new regulations is to provide for a general prohibition on the recreational use of vehicles in the coastal zone and to provide procedures for approving the use of vehicles in the coastal zone under specific circumstances.

The South African Shore Angling Association argued that it would be impossible to host competitions at certain beaches as these were only accessible by vehicle.

In its counter-argument on coastal marine preservation, the Department of Evironmental Affairs and Tourism said the recreational use of off-road vehicles on the coastline had increased dramatically over the past three decades.

In the absence of regulations which controlled vehicle access to the coastline, this was damaging to the ecologically sensitive coastal areas and also posed a threat to the safety of bathers.

Access

The department said, however, provision could be made for recreational areas where regular access could be made for vehicles, but only with a permit, under strict control and after an environmental impact study had been conducted by local authorities.

Erasmus said as the new regulations did make provision for vehicular access under special circumstances Moosa had not acted arbitrarily in enforcing the beach ban, and therefore did not act unreasonably as contended by the applicants.

20.

NATAL WITNESS 13/06/02

Exemption to 4x4 beach ban

ENVIRONMENTAL Affairs and Tourism Minister Valli Moosa yesterday granted a conditional exception from the ban of 4x4s on beaches for the Mtubatuba Beach Action Group.

This follows an urgent High Court interdict application against the ban brought against the department by the group and residents of Khula Village and Dukuduku South relating to the use of vehicles on beaches. An out-of-court interim settlement was reached. Moosa granted the interim exemption from 5 am yesterday until 10 pm on September 30. Conditions in summary include: limited access to the beach; driving only between the high and low water marks; up to 300 vehicles per day; and access from 5 am to 10 pm. — Witness Reporter.

21.

Gateway to KwaZulu-Natal, July 2002

Reprieve for 4x4s on St Lucia beaches

A TEMPORARY reprieve has been granted to 4x4 users at St Lucia beach.

The Mtubatuba Beach Action Group, including members of Khula Village and Dukuduku south, brought a High Court interdict relating to the use of vehicles on beaches at St Lucia against the national Minister of Environment Affairs and Tourism on socio-economic grounds.

An out-of-court interim settlement was reached and a court order reflecting this settlement was granted on Monday, June 10.

An interim exemption has been granted to 10pm on September 30, with the following conditions:

- Access will be limited to the beach from the access north of the swimming beach to First Rocks;
- Driving on the beach will be limited to between the high water mark and low water mark except for access ramps designated by Ezemvelo KwaZulu-Natal Wildlife (EKZNW) and/or the Greater St Lucia Wetland Park Authority;
- A maximum of 300 vehicles per day will be allowed, controlled by the issue of permits.

These will be available from the EKZNW office at St Lucia at a cost of R50 each and will be valid for the entire period, irrespective of when they are bought.

- Vehicles will be permitted on the beaches daily from 5am to 10pm.

Meanwhile, Ezemvelo KZN Wildlife has prepared a draft document outlining the principles for the use of recreational vehicles in the coastal areas of the Greater St Lucia Wetland Park. These principles are founded on the conservation of biodiversity but also take into account the needs of visitors, thereby promoting the use of the coastal zone for eco-tourism.

This document is intended to assist with the development of a joint application for recreational use areas for the whole of the Greater St Lucia Wetland Park by the Greater St Lucia Wetland Park Authority and EKZNW.

The identification of proposed recreational use areas has commenced, and the draft document will be subject to review by experts in the management of beach environments, including the Oceanographic Research Institute in Durban and the relevant departments of the universities of Cape Town and Port Elizabeth.

This report will be submitted for public review, after which the applications will be submitted to the national Department of Environment Affairs and Tourism.

THE NATAL WITNESS, TUESDAY NOVEMBER 12 2002

Don't wreck our beaches with your vehicles, Valli Moosa tells drivers

No place for 4x4 'ruffians' here

THE 4x4 "ruffians" who insist on driving their vehicles across beaches, destroying fragile ecosystems in the process, have no place in South Africa, according to Environment Minister Valli Moosa.

He was speaking during debate in Parliament on the National Environmental Management Amendment Bill yesterday.

The draft legislation — dubbed "the 4x4 bill" — seeks to give legal certainty to the original act, gazetted earlier this year.

According to an attached memorandum, the bill aims to "provide expressly for measures to prohibit, restrict or control activities that are likely to have a detrimental effect on the environment".

Moosa told MPs in the National Assembly that people should not be allowed to wreck South Africa's beaches by driving their vehicles "willy-nilly" across them.

He said all parties in Parliament are at one on the message being sent to "those who have a disregard for the environment and insist that they have a right to drive their vehicles across sensitive ecosystems".

"We want to protect our environment, and those ruffians who insist on driving their bakkies on the beaches have no place in this country." Moosa said the draft legislation allows for exemptions.

This includes permission to operate on beaches vehicles driven by disabled people, scientists and researchers, or by law enforcement and safety and security personnel.

"Certain very carefully considered exemptions will be allowed, including for *bona fide* sporting activities, such as tournaments that are held under the auspices of the Department of Sport and Recreation.

"But I must make it clear that these exemptions will be few and far between. The idea of exemptions is not to make the exception the rule once again," Moosa said.

Democratic Alliance MP Janet Semple said the legislation has "caused a good deal of concern and anger among those who have become accustomed to free access to beaches in their 4x4 vehicles".

But the "reckless destruction of our beaches by irresponsible elements in our society must be stopped".

She said all true conservationists will welcome the legislation.

The DA will support "any legislation which advances acceptable and reasonable measures to preserve our irreplaceable and fragile natural environment", Semple said.

Moosa, replying to a call by the Inkatha Freedom Party's Lindiwe Mbuyazi to allow 4x4 vehicles onto the beaches of the St Lucia Wetlands National Park, said he cannot allow this.

While recognising the economic hardships being endured by the people of the area, attracting this type of tourist is not the answer.

"We don't need people to come there to wreck those beautiful beaches ...," Moosa said.

All parties in the House endorsed the measure. — Sapa.

SUNDAY TRIBUNE PERSPECTIVES NOVEMBER 17 2002

Not all 4x4 owners are ruffians

The controversial 4x4 on beaches ban imposed last January by Environmental Affairs and Tourism Minister Valli Moosa has had a a major negative impact on the local coastal economy.

This was confirmed in an extensive study done for the Greater St Lucia Wetland Park authority and released this week for public comment. The study looked at marine ecology, park planning, socio-economic factors and tourism, and it had a major input from the public.

The study says: "A fundamental objective of the park is the economic upliftment of local communities through the development of tourism, beach driving and boat launching can play an important part in achieving this as well as allowing people to experience the park's outstanding natural heritage."

We are committed through our own legislation and World Heritage obligations to protect the environment. The study recommends recreational use areas at places like St Lucia, Sodwana and Cape Vidal, plus boat launch sites and other user categories, like concessions. This will not please everyone, but it appears to have found the right balance.

What a pity this study was not done before Moosa acted in a top down manner, exacerbated by his intemperate remarks in parliament this week.

Not all 4x4 owners are "ruffians" and they, like everyone else, are entitled to their place in the sun.

Proposal may ease 4x4 beach tensions

Limited access for vehicles on some Maputaland beaches could get the go-ahead, writes **Jill Gowans**

A 4.5km stretch of beach at St Lucia and 4km at Sodwana and Mapelane are the recreational use areas for 4x4s in the Greater St Lucia Wetland Park, as recommended by a new study.

This may defuse some of the anger at the imposition of a countrywide ban imposed last January by Environmental Affairs and Tourism Minister Valli Moosa. But the ban will remain at Cape Vidal, a popular resort, and there are restrictions on vehicle numbers on the other beaches: just 15 at Mapelane, plus four for concession holders.

The study, done by independent consultants Acer for the park authority, looked at all the issues. There was major public input, from 625 registered interested and affected parties and about 200 written and verbal submissions.

On the down side was the potential impact of beach driving and boat launching on the intertidal sandy beach and rocky shore organisms with loss of biodiversity and an erosion of "sense of place" and the park's unique character and spirit.

On the socio-economic side, it was acknowledged there had been real economic hardship for neighbouring communities, including craft and vegetable sellers and tourism jobs markedly down since the ban.

An increase in crime, poverty and poaching was cited as a potential impact of the no-go alternative. The park is bordered by impoverished communities and tourism is the major factor in their upliftment.

Leaders of the Dukuduku south community, Timothy Maphanga, and Khula village, Caiphas Mkhwanazi, were among a group which challenged Moosa's ban in the Pretoria High Court. Judgment is still awaited.

Lafras Uys, chairman of the Mtubatuba Beach Action Committee, who spearheaded the legal action, said he was convinced Moosa's National Environment Management Amendment Bill – passed by parliament this week – was prompted by their case.

He said if they lost they would seek a community man to present their plight in terms of international law governing world heritage sites to Unesco and the World Court.

The study says many of the negative impacts can be mitigated or managed by limits and controls strengthened by enforcement and monitoring.

In addition to the recreation use zones, there are existing and proposed launch sites at places like Mapelane, St Lucia, Cape Vidal and Sodwana and proposed concession-only launch sites at places like Mabibi, Lala Nek, Bhanga Nek and Rocktail Bay, presumably to service exclusive tourism developments. Concessions were also proposed for turtle tours; there are areas for scientific research, monitoring and world heritage education.

"Not everyone will be happy, but we've adopted the precautionary principle, at the same time as optimising access and supporting sound economic principles," said Andrew Zaloumis, chief executive of the Greater St Lucia Wetland Park authority.

"It's been important to look at beach usage holistically so it examines zonation, beach driving boat launching, scientific research and management.

"The final report, along with public comment, will go to the department with decision-taking by the director-general."

In the meantime, the 4x4 ban remains in place on all beaches.

❑ The public is invited to comment before December 5. Contact Acer on 035 340 2715.

SEE PERSPECTIVES PAGE 4

'A graveyard with electric lights'

JILL GOWANS and CHRIS JENKINS

ZULULAND coastal resorts face an uncertain holiday season as tourists hedge their bets over a 4x4 exemption.

St Lucia, Sodwana Bay and Umlalazi have applied for reprieves, but informed sources say this is unlikely.

Temporary exemptions for St Lucia and Umlalazi have now expired.

"A graveyard with electric lights" is how one St Lucia resident described the holiday scenario. "It's going to be chaos," she said. "People have made provisional bookings on condition the government will grant an exemption. They are not paying deposits. The general vibe is pretty negative."

Lafras Uys, chairman of the Mtubatuba Beach Action Committee, said: "We're in a very difficult situation. One of the holiday flats across the road from me had four cancellations the day Valli Moosa spoke on the ban in parliament last week.

"The ban continues to have devastating consequences: our fruit sellers only ask about the beaches – they say their pawpaws are rotting and they're having to throw them away.

Khula village leader Caiphas Mkhwanazi said: "If the 4x4s don't come there will be no money and no jobs." His despair was echoed by Timothy Maphanga, of Dukuduku south.

Ian Porter, coastal ecotourism manager for Ezemvelo KZN Wildlife, said: "Bookings are down in all our resorts. There is a very negative perception of the coastal environment. The environment department is not top of the pops."

Ron Joubert, manager for Cape Vidal, said: "Demand is certainly not as great as it was. Our annual revenue is down R1 million. Vidal also just doesn't have the parking."

Said Robert Clark, manager of the 600-bed Sodwana Bay Lodge: "We have lost a lot of business. Some of those with timeshare have refused to pay annual levies. They say they bought because they could drive on to the beaches."

Wayne Schick, of the Sodwana Bay Dive Association, said: "Business has dropped for everyone. "People are booking on condition the beaches are open."

25.

Watch out for turtles

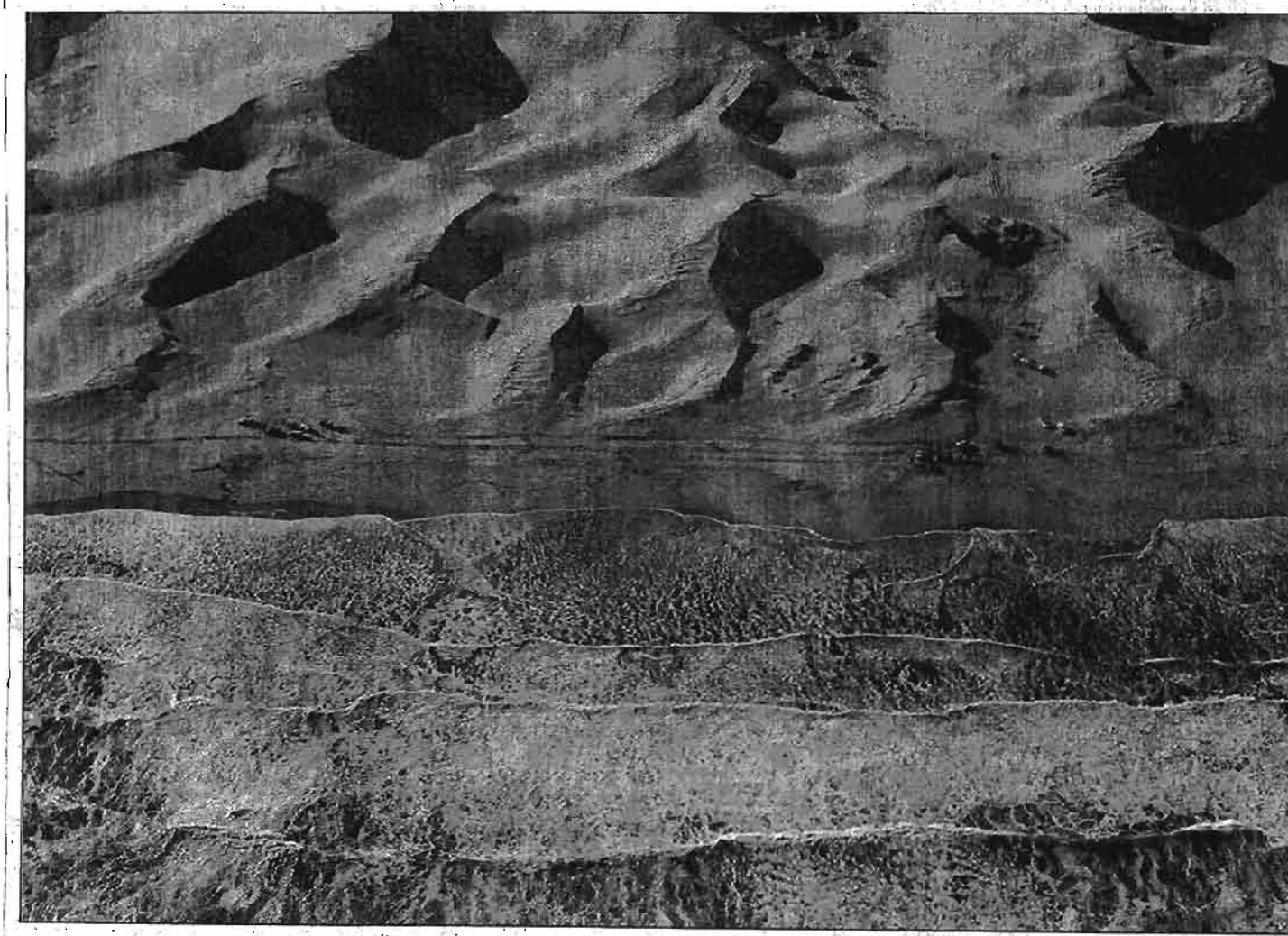

Photo: IAN CARBUTT

4 x 4 tracks on the otherwise pristine Wild Coast mar the coastline's natural beauty and pose a threat to marine biodiversity. The turtle breeding season is also about to start on certain sections of the coastline, sparking off additional fears that the rare species could be decimated by ignorant 4 x 4 beach drivers.