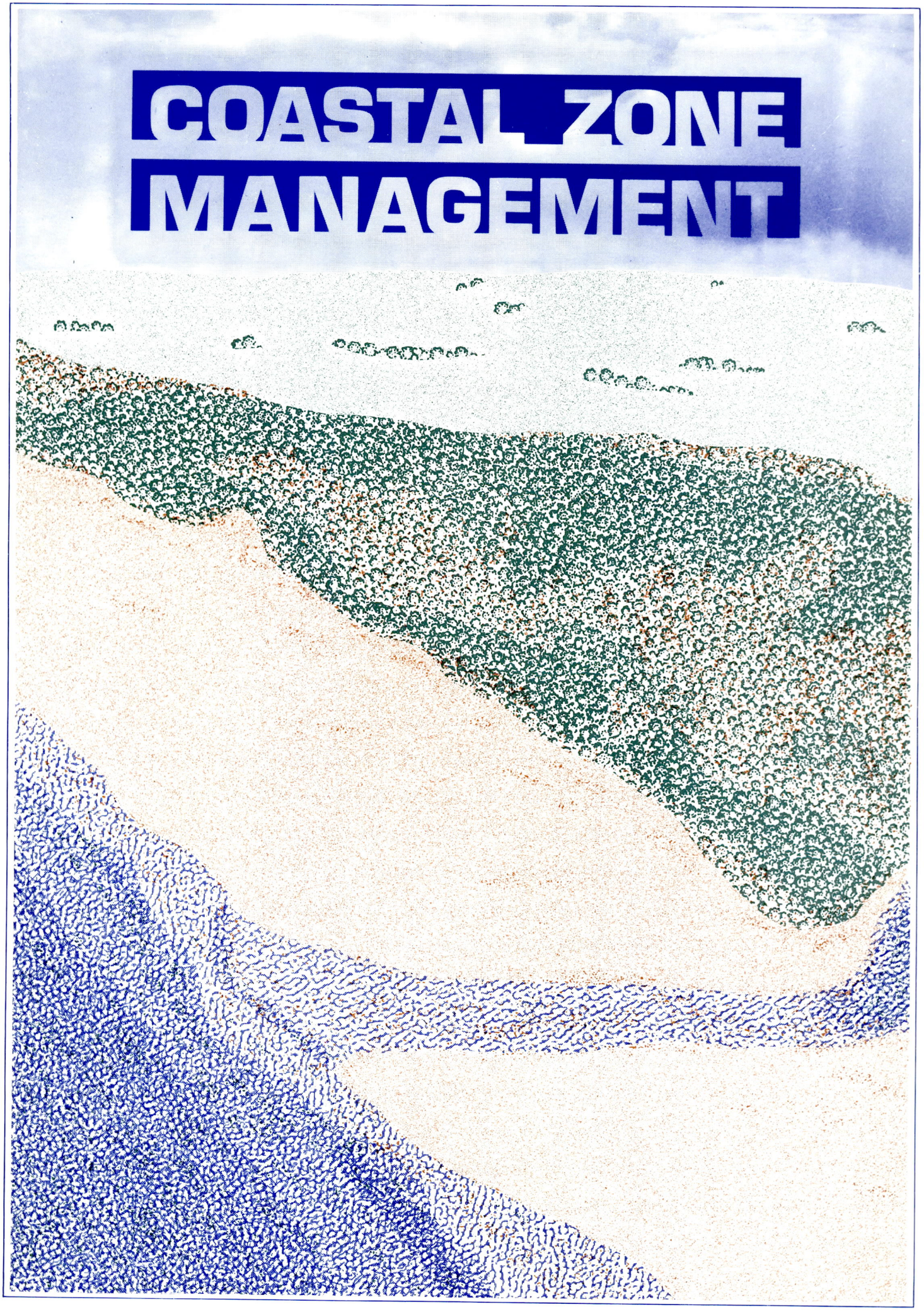
COASTAL ZONE MANAGEMENT



C O A S T A L Z O N E M A N A G E M E N T

PROCEEDINGS OF A SEMINAR

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FOREWORD

The Natal Town and Regional Planning Commission is well aware of the value of the Natal Coastal Region for South Africa. This region, which includes coastal waters, beaches, dunes, estuaries and lagoons, has a unique and sensitive ecology. It is of course also the focus of increasing development pressure.

The Commission realises that management skills and knowledge are required to manage such an asset in a sensible manner. Local authorities, whose activities have an important influence on the region, often do not readily have these skills and knowledge.

The purpose of the seminar was to convey some of the knowledge and skills acquired during the past few years to local authorities. It is hoped that it was a help to them in their approach to some of the everyday problems which emerge in the use and conservation of this extremely important part of our heritage.

WELCOME

by S.O. BASSON

Die Edele die Administrateur van die Provinsie van Natal, mnr Stoffel Botha, dit gee my vanmore die grootste plesier om u baie hartlik welkom te heet. Your Honour we are looking forward very much indeed to your opening address in a few moments. Mr Dering Stainbank, MEC, we thank you for coming and welcome you very much this morning. We know you have a very busy programme and we appreciate the fact that you found time to be with us this morning. Honoured guests, those particularly who have come such long distances, and to those of you who have shown sufficient interest to be present with us this morning, I extend an extremely warm welcome on behalf of the Natal Provincial Administration.

During the course of its 32 year career the Natal Town and Regional Planning Commission has devoted a very considerable slice of its energy and funds to promoting research into a wide spectrum of environmental planning matters. Not the least of this effort is being expended in appraising the Province's coastal environment where so much potential for development lies and where the threat of environmental degradation is at its highest. When talking about the coastal environment we must not think just in terms of land resources, we must not only project our thoughts above the water mark, but below it as well I believe. In fact I would like to go so far as to say that when talking about the coastal zone we are also talking about those in-shore waters stretching out to the continental shelf. We are I suggest bound to consider both coastal land and coastal waters as an integral system. Coastal wetlands and estuaries have a necessary function providing food and shelter for fishes, crustaceons and molluscs. It has been estimated for example that coastal waters, in other words those waters above the continental shelf, constitute 10% of the world's oceans, but from which 90% of the world's fish catch originates. That's why I believe our thoughts should extend out as far as the contintental shelf. Viewed in this perspective one cannot but feel horrified at the way in which we seem to be pouring

industrial effluent and domestic waste into the sea, a monstrous cutting off of our noses to spite our faces. With ever growing concern therefore the Commission has viewed with dismay the continual ill-treatment of our in-short waters, the denudation of the coastal bush, the trampling of the dune vegetation, the indiscriminate reclamation of wetlands and the siltation and pollution of our estuaries. It was thus that the Commission saw a compelling need to embark on a cohesive programme of research into those natural elements which together go to make up that unique strip of territory called the Natal Coast. The ultimate aim of this research programme will be to evolve a set of policies and strategies for rehabilitating a largely degraded environment and for channelling development pressures into spheres where no further violence will be done to the coast's natural assets. The programme of investigation is still in its infancy and there is still a lot to be done, but I am delighted to say that we are enjoying the full and forthright support of the Department of the Environment Affairs which has not only appointed the Natal Town and Regional Planning Commission as its agent in Natal, but came very generously to light with no less than R50 000 during the current financial year and have given an indication that something in the region of R200 000 during the 1984/1985 year may be forthcoming. This will supplement the Town and Regional Planning Commission's very slender personal financial resources. We are indeed grateful.

Now in making up its mind where to start, the Commission saw the estuaries as the priority target for its initial thrust and the result was George Begg and his magnum opus on "The Estuaries of Natal" followed shortly in 1979 by the "Policy Proposals for the Estuaries in Natal". A further report by Mr. Begg, "The estuaries of Natal", is in preparation and will be launched, hopefully, early in the new year. While on the subject of estuaries I want to tell you about the Estuary Action Committee, because the story of the Estuaru Action Committee is the story of the Natal Provincial Administration's involvement and total commitment the fight against the mindless assault on our environment which must trouble the mind of every thinking person. Having received George Begg's research findings on the estuaries the Commission could easily have thanked him for it, dusted its hands and

consigned it to the nearest bookshelf. However, in the event, it recognised that it had a continuing obligation to set about doing something about preventing further estuary degradation and actively spreading the "Gospel according to St George". Time does not permit me to elaborate on the work of the Estuary Action Committee but if any of you have a couple of hours to spare I would be very willing to bore you with an account of the work of this committee. Suffice it to say that it has made its impact, as some of the local authorities may very well know, and I believe that it has for the Natal Provincial Administration and the Commission, broken new ground in the way of positive follow-up action on research findings.

While talking about conservation action I would be grossly in default if I did not mention the Siyaya Catchment Project initiated by the Commission in recognition of the fact that rehabilitation of the estuaries is, as much if not more, a catchment problem as a coastal management problem. This project is a pilot study into the problems of catchment management of a whole river system - admittedly a small river system - but the low state of our knowledge suggests and dictates that we should have small beginnings. A wide cross-section of government departments and agencies representing a number of different disciplines are participating in this invaluable study, which I'm very pleased to say is making extraordinarily good progress.

Now ladies and gentlemen, it is not my intention to pre-empt the other speakers at this symposium. During the course of the proceedings most of what I would have liked to have told you, will no doubt be told you by others far more eloquently. It remains therefore for me to fulfil my allotted task which is formally to once again welcome you all here on behalf of the Commission and the Natal Provincial Administration. In particular I would like to reiterate my welcome to His Honour the Administrator and to say to him how much we value his being able to fit this symposium into what I know, Sir, is indeed a very busy schedule.

Ladies and gentlemen it is my great pleasure and my privilege to call upon His Honour to deliver the opening address.

OPENING ADDRESS

by HIS HONOUR J.C.G. BOTHA

Mr Chairman, Ladies and Gentlemen.

I am grateful for the opportunity to launch this Seminar and, in doing so, to say same words about a subject which is of vital concern to all of us.

This Seminar is concerned basically with environmental conservation. It is also concerned with salvaging one of our most valuable natural resources - the coastal zone - that narrow strip of territory straddling the interface between land and sea. It is here, at this interface, that pressures on land (and water) are at their greatest. It is here that competition between differing interests holds the potential for conflict.

Mr Chairman, no thinking person today can fail to be deeply concerned at the way in which our environment is being degraded, our resources squandered and the sea polluted. When one hears that the deserts of this world are encroaching every year by an area equivalent in size to that of Belgium, one cannot but be appalled and dismayed.

A book entitled "Brain 2 000" by the novelist, Ernest Gann, was recently published. It is a work of fiction but there is an element of plausibility about it which is disturbing. The story is woven around the consequences of extracting billions of tons of oil from certain areas of the earth's crust, thereby disturbing its rotational equilibrium. The mind boggles at the prospect of a world wobbling on its axis and, needless to say, in the book an ingenious hero materialises to save the situation. In the real world of course, heroes of this calibre are conspicuously rare.

Furthermore when I hear scientists talking about the "greenhouse effect" I really do feel like asking them please to "Stop the world, I want to get off!" In case some of you don't know what the "green-

house effect" is, I should explain that it is a phenomenon which, I am told, is predicted to happen as a consequence of increasing levels of carbon dioxide in the atmosphere - a result largely from burning all those billions of tons of oil and other fossil fuels. Evidently, carbon dioxide is "transparent" to short wavelength radiation (e.g. visible light) but "opaque" to long wave-length radiation (e.g.infra-red). Evidently too, when shortwave radiation from the sun is reflected off the earth it gets changed to long wavelength radiation which tends to get reflected back by a carbon dioxide-enriched atmosphere. The scenario conjured out of this hypothesis is a gradual build up of heat which is unable to escape into space resulting in rising ambient temperatures leading ultimately to catastrophic climate changes.

Mr Chairman, some cynic has truly said: "Let no one underestimate man's capacity for fouling his own nest!"

I am greatly encouraged and heartened therefore by the campaign being spearheaded by the Natal Town and Regional Planning Commission through its Estuary Action Committee to help stem the tide of environmental degradation which seems to be threatening the well-being of us all. Compared to the total environment, the contribution to conservation and rehabilitation being made in the relatively restricted field of coastal zone management may appear small, but in the long run I believe that sounder progress is to be achieved by a series of small steps rather than by a "giant leap for mankind" (after all there are some pretty severe environmental problems on the moon as well!). In any case proper management of the coastal zone is only one of many facets of a multidimensional drive in the conservation field which is gathering ever greater momentum. I am thinking, for example, of the Department of Environment Affairs. The mere fact of its creation as a separate, powerful ministry, instead of being tacked on as a minor appendage to another department, is indicative of the Government's determination to fight for a better environment.

Mr Chairman, as I see it, the main purpose of this Seminar is not simply to discuss the mechanics of pollution control or of restoring

dune vegetation or whatever (important as these things are), but to create an awareness amongst the local authorities and, through them the community at large, of the need to conserve a threatened natural resource and to sharpen our appreciation of the problems confronting those whose responsibility it is to manage that resource. And that is why so many of you here today are representative of, or associated with, the local authorities. My Executive Committee and I believe that the local authority's role in coastal zone management is a vitally important one.

If you go along with that thought then you will appreciate far more keenly than I the magnitude and complexity of the task you face. I should say the task that we face since we are in this together and I wish to emphasise that you can rely upon the Natal Provincial Administration to afford you whatever support lies within its powers to give.

In the coastal zone we are confronted by two potentially conflicting forces. On the one hand there is a powerful motive to conserve the coastline in order to preserve the very character and charm (what Mr Pistorius in his North Coast Report refers to as the "genius loci") which annually attracts hundreds of thousands of visitors to the beaches. On the other hand there are almost irresistable development pressures aimed at exploiting the tourist potential of the area.

One of our main tasks, and one which must receive top priority will, I suggest, be to reconcile in some way the dream of the entrepreneur with the vision of the conservationist. I say this with all due respect to the local authority representatives here today, but what I see on the coast today I find hardly inspiring. With some notable exceptions existing development is, in my opinion, brash and insensitive, paying scant respect to the fragile and intimate character of much of our coastal landscape.

I know that the Commission would like to see a new approach to development on the coast; a development which is sensitive to, and interwoven with, the local environment and which pays more than mere lip service to the legitimate demands of the conservation lobby. It can be done and has been done with conspicuous success at, for example, San Lameer. There is no reason why it cannot be done elsewhere.

I see this Seminar as the beginning of much bigger things. I see it as the first of many follow-up seminars. I also see it as a monumental challenge, but that, I suggest, is one good reason for taking that challenge up. And if the situation seems to be reminiscent of David facing Goliath, then all I can say to you is: "Look what happened to the giant!"

Mr Chairman, Ladies and Gentlemen, I wish you well in your deliberation and I am sure that positive conclusions will emerge from these proceedings. I have pleasure in declaring this Seminar open.

RESPONSIBILITIES IN COASTAL ZONE MANAGEMENT

by A.M. LITTLE

THE THEME

The theme for this paper is drawn from Clark's "Manual on the Conservation of Coastal Zone Resources" in which he says .... "each coastal ecosystem must be managed with respect for the relatedness of its parts, and the utility of its whole".

THE SETTING

Natal has a fairly small share of South Africa's 2 900 km of coast line. Nevertheless, the 540 km stretch from Port Edward to Kosi Bay is, on average, fairly intensively developed, with some areas of very highly concentrated urban development. Durban is at present South Africa's most active general harbour and metropolitan area, although Richards Bay will probably be larger when fully developed. The Natal South Coast is established as a holiday makers' playground, with a string of coastal resort towns; and this type of development is also spreading along the coast north of Durban. The immediate hinterland is used intensively. Rolling fields of sugar cane exploit one of the most fertile agricultural belts in the country - but they are being supplanted by manufacturing industry, especially alongside river courses, by towns, and by spontaneous settlements which are the prelude to permanent urbanisation. These areas are establishing pressing needs for work opportunities, organised housing - and a voice in the management of the land they occupy. The character of the coast is still discernible. There is the sea, open beaches, wide horizons, the undulating dunes, patches of lush green vegetation in coastal and dune forest, and the 73 estuaries and lagoons. There is the marine life, the coastal climate, the sound of the ocean and the sea breeze. All these things combine to create a certain "genius loci", which is highly prized and which needs to be respected.

In these few sentences I have sketched not only the setting, but I have highlighted the problem - or is it the goal - of management : the need to combine the process of development with the character and richness of the coast through conserving its natural assets. The purpose of this management strategy must be to achieve not only balance, but unity.

THE COMPONENTS

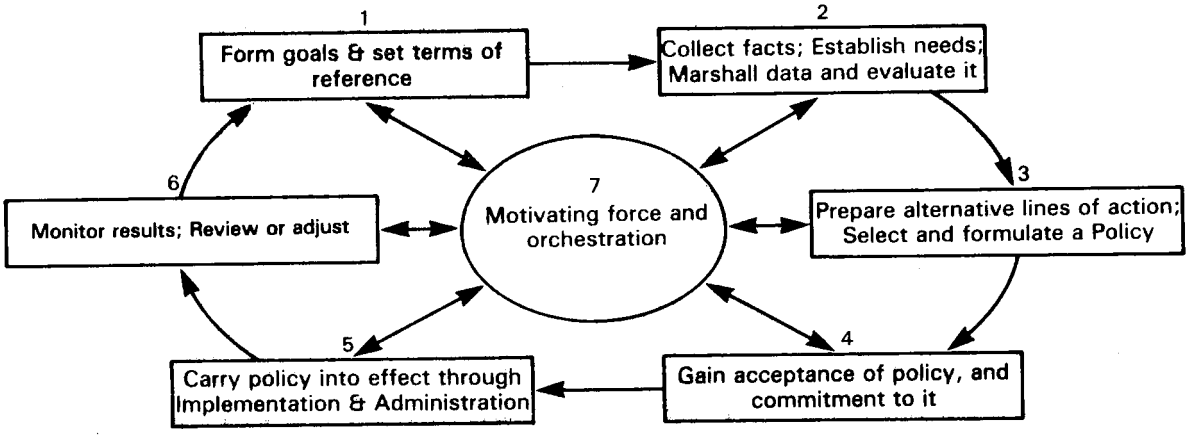
Because no one part of an ecosystem operates independently of another, a management plan must embrace all the components. The main physical components which occur in the Natal Coastal Zone are:

- The ocean
- Beaches and dunes
- Rivers and other catchments
- Natural resources
- Scientifically important areas
- Cities, towns or holiday resorts
- Roads, railway pipe lines and other service infractures
- Farms
- Recreation areas
- Visually important features

THE MANAGEMENT PROCESS

Management is an on-going process, and the following diagram illustrates the main elements.

The Management Process



The responsibilities for management rest with all the participants in these steps. The motivating force and orchestration process which is shown in a central position is not to be viewed as "the management". It is a unifying effort which combines the input by the many participants in steps 1 to 6.

The best illustration of this management process is in the human body. It is a unity in operation. I remind you of excerpts from a passage from 1 Corinthians 12 .... "The body is not made up of one part but of many. If the whole body were an eye, where would the sense of hearing be? If the whole body were an ear, where would the sense of smell be? ... The eye cannot say to the hand "I don't need you!" And the head cannot say to the feet "I don't need you!" ... There are many parts, but one body."

Each of the organisations which is involved in Coastal Zone Management has a particular function (see the example of the Estuarine Programme). Each function of the Management Process is part of the unity.

Surely this is the only type of management which is appropriate when tackling an ecological unit like a Coastal Zone.

PROGRESS IN COASTAL ZONE MANAGEMENT

The following table has been drawn up to give an approximate overview of our current progress in Coastal Zone Management and, of course, to illustrate gaps.

Progress in Coastal Zone Management

	Goals	Research	Policy	Commitment	Implementation	Monitor
Ocean	●	●			*	*
Beaches & Dunes	●	*				
Estuaries	●	●	●	●	●	●
Rivers & Catchments	●	*			*	*
Natural Resource Areas & Scientifically Important Features	●	*				
Cities, Settlements & Resorts	●	●	●	*	*	*
Roads, Railways & Infrastructure	●	●	*	*	*	
Farms	●	●	●	*	*	*
Recreation Areas	●	●	*			
Visually Important Features						

Note: ● substantial action
* on-going progress

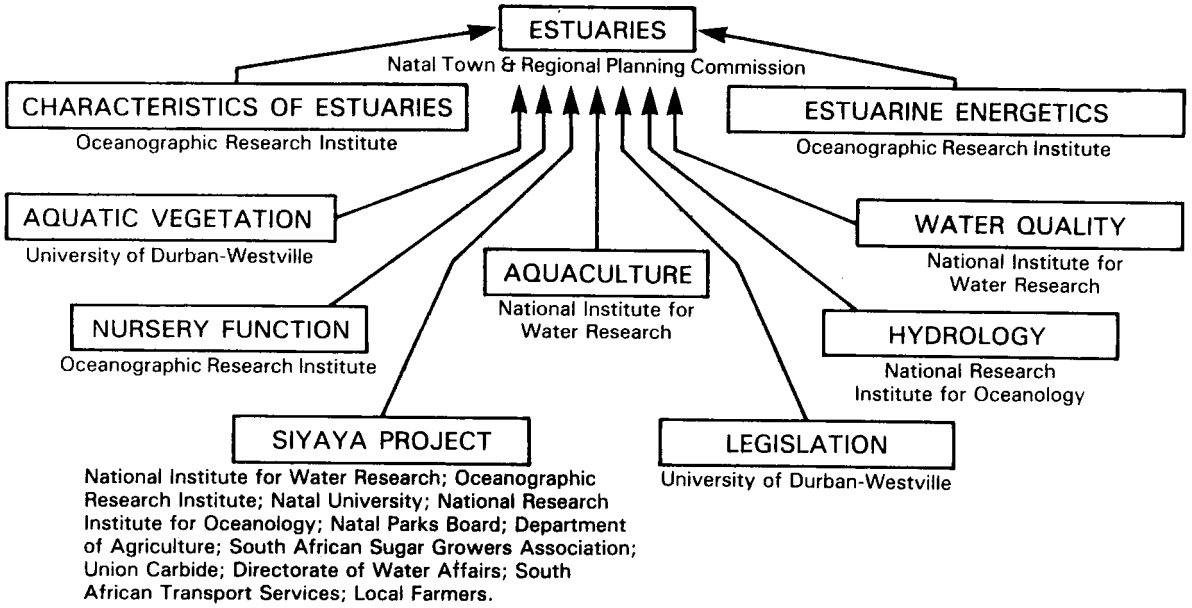
Fortunately we have a well-developed and flourishing estuarine programme, which is supported by excellent work in rivers research; and both can be related to regional and town planning policies and controls. The estuary programme can conveniently be used to pick out the main "management organisations". In this, I must pay tribute to the leadership, energy and commitment provided by Mr George Begg since 1977.

1.	Form Goals and set Terms of Reference	Oceanographic Research Institute, National Institute for Water Research, Natal Town and Regional Planning Commission, University of Natal

THE GOAL OR MANAGEMENT OBJECTIVE: To maintain and, where possible, enhance the values of Natal's estuarine areas for the benefit of this and succeeding generations of South Africans, and as part of an attempt to establish a cohesive management policy for the Natal coast as a whole.

2. Research

A suite of research projects has been launched, co-ordinated by the Commission and executed by numerous bodies:



National Institute for Water Research; Oceanographic Research Institute; Natal University; National Research Institute for Oceanology; Natal Parks Board; Department of Agriculture; South African Sugar Growers Association; Union Carbide; Directorate of Water Affairs; South African Transport Services; Local Farmers.

3. Policy*

Department of Agriculture and Land Tenure
Department of Agricultural Technical Services
Department of Agriculture - KwaZulu
Department of Environmental Planning and Energy
Department of Water Affairs
Lake Areas Development Board
Natal Parks, Game and Fish Preservation Board
National Research Institute for Oceanology
South African Railways
Natal Town and Regional Planning Commission
Oceanographic Research Institute

* Using the Departmental titles as in 1979 when the Policy was prepared.

4.	Gain Acceptance of Policy	Oceanographic Research Institute; Town and Regional Planning Commission; Local authorities on the Coast.
5.	Implement	Estuary Action Committee - Chaired by Natal Town and Regional Planning Commission. It calls upon all bodies mentioned in 3 and 4 and certain industries to use their powers to 'maintain and, where possible, enhance the value of Natal's estuarine areas...'
6.	Monitor, Review, Adjust	Oceanographic Research Institute, National Institute for Water Research; Natal Town and Regional Planning Commission.
7.	Orchestration	Natal Town and Regional Planning Commission, supported by Department of Environment Affairs.

MANAGEMENT FOR UNITY

This brief examination of our progress in the Coastal Zone, and particularly our experience in estuarine and planning matters helps to show the practicability of the concept of a unified management process.

Let me, however, put forward some specific ideas for consideration:

1. One of the most exciting developments in Coastal Zone Management has been the proposed establishment of a coastal zone branch at Government level within the Department of Environment Affairs. This will co-ordinate many aspects at that level and will consequently help to formulate direction and give leadership.

I must, however, plead that this co-ordination be expanded so as to include the development controlling departments, such as the Department of Constitutional Development and Planning, Department of Agriculture, South African Transport Services etc. Our experience at "regional" level shows that it will be impossible to achieve implementation of proposals without marrying "environmental" and "developmental" needs and skills.

2. I have mentioned the leadership being given by the Government through the Department of Environment Affairs. The Department has agreed to fund the establishment of an Estuarine Research Unit in Natal, with a strong bias toward practical issues. It has been agreed that this will be housed at the National Institute for Water Research in Durban and that the Town and Regional Planning Commission will be responsible for administra tion and co-ordination. This is a particularly welcome move.

3. The next area I must mention is the essential partnership between the "planners and managers" and the "scientists and researchers". Only the latter can set standards, explain processes and monitor the effects of action. But they must rely on adminstrators to take action and to control developments. The happy partnership between the National Institute for Water Research and the Natal Town and Regional Planning Commission for nearly 30 years should give encouragement as we tackle other components in the Coastal Zone.

4. Gaining public acceptance of policies, and then commitment to them by statutory bodies, are both relatively unchartered areas in South Africa.

As one follows the development of a Coastal Zone Policy along the Oregon Coast, one is struck by the heading of "Citizen Involvement" even at the stage of setting goals. It occurs again at the point of accepting a policy and continues through the stages of implementation. It is seen as a fundamental part of the management process in which all interested parties, especially pressure groups, and the public at large, should be involved. The Commission tries to gain "consensus" in reaching decisions - a term which means "general agreement based on good relationships and common understanding of all those involved in the process." It seems to me that if we institute this kind of management, the need for Environmental Impact Assessments may be reduced. Only in exceptional circumstances should it be necessary to invoke legal procedures in order to adjudicate between conflicts.

5. Experience at regional and local levels leads me to believe that we have generally adequate legislative powers to control development and conservation together, provided there is overall public agreement. We also have well-experienced officials who work together in Natal as a team when it comes to formulating policy but who need further encouragement to commit their Departments to those policies.

CONCLUSION

Finally, I return to the theme of the paper which is the need, at this moment, to evolve a system of "unifying management" of the Natal Coastal Zone.

I have defined this sort of management as - the continual co-ordination of human activities according to a unifying policy which will bring together peoples' needs for homes, work, food, relaxation; and the conservation of essential coastal resources.

What we must strive for, is the "organic unity" which characterises a termite colony, and which allows the collection of individuals to work towards a single aim.

I have shown that there are many contributors to management in the coastal zone - land owners, developers, conservationists, scientists, officials and particularly local authorities. All have an important part to play. If one falls short, the policy will be jeopardised.

Thus it is appropriate to quote from the Oregon Planning Commission: "We might look to commitment as the key word in preparing a plan and solving problems identified by the plan. In this regard, commitment has a special meaning. By definition, it is an agreement or pledge to carry out a specific course of action .. in a sense, a determination to see that the job gets done. Without commitment, planning is an exercise in futility and will result in frustration and meaningless expenditures of time, effort and public monies."

Will you commit yourselves to the programme?

THE PRINCIPLES OF COASTAL ZONE MANAGEMENT

by A. HEYDORN

Geagte Meneer die Voorsitter, baie dankie vir die vriendelike woorde, ek hoop ek kan teregdoen daaraan, en Geagte Meneer die Administrateur baie dankie ook dat u hier is vandag.

Ek wil graag begin net deur te sê dat dit is vir my wat 'n ou Nataller maar nou 'n Kapenaar is, gee dit my plesier om te sê dat dit lyk my dat Natal in baie opsigte die leiding neem. Die werk wat die Oseanografiese Instituut met die finansiële ondersteuning en die steun van die Natalse Stads- en Streekbeplanningskommissie onderneem, soos wat in George Begg se werk uiting gevind het, word nou voorgesit en uitgebrei na die kus as 'n geheel en dit het aan die Kaap van die eenheid van Estuaries en Kusnavorsing waarvan mnr Basson gepraat het en ek sal op die tafel buite sit twee kopieë van opvolgdokumente wat eintlik op dieselfde lees geskoei is as die wat hier in Natal begin is. Dit is 'n voortsetting en ek is bly dat die doel eintlik is om samehangendheid in kusbestuur te bewerkstellig. So ek sal hierdie op die tafel sit ter insae van mense wat belangstel.

I also want to mention that Mr Ken Bromley asked me to bring copies of a lecture which was given by Mr Ed Bickerton of the Estuarine Coastal Research Unit NRIO giving examples of considerate and inconsiderate development of a coastline. I have brought copies and I have put them on the table outside.

Now to outline my talk very briefly. I want to define the coastal zone, then give a thumbnail sketch of the South African Coast Environment and talk about some ecological planning principles and evaluation of opportunities and constraints of coastal zone management, and then end up with some key criteria.

Coastal zone management implies the effective utilisation and conservation of a coastal zone as a dynamic eco-system in the interface between sea and land. The present paper is structured on the premise of this definition.

My approach today is not to talk just about Natal; I've been asked to talk about principles, which cover the wider context of coastal zone management in Southern Africa.

The coast is 3 000 kilometres from the Orange River Mouth round to Ponto de Oro. The mountain ranges round the periphery of the coast are well known to you. But the important thing is the various climatic regions. These are the summer rainfall area extending from east of Port Elizabeth to Ponto de Oro. There is the bimodal rainfall area having rainfall throughout the year, and then of course the south-west coast with the winter rainfall area, and the semi-arid area of Namaqualand. I think that it is quite clear that coastal zone management procedures cannot be the same in a coast of such varied types.

False colour photographs from the Nimbus satellite illustrate very clearly the Auglhas current moving away from the coast in the Agulhas bank region. The upwelling of the Benguela current is not a well-defined current such as the Agulhas current but it is a rather sporadic pulsing of cold, nutrient rich water which is brought to the surface. The south coast area is a mixing area, and these currents basically determine the climate of the ocuntry. A consequence of this in general is great biotic diversity, great species diversity - as the anglers will know, you catch many more species of fish along the east coast. The interesting mixing region ends somewhere at the Breede River and the area next to it is where the kelp starts, which is an indication of the upwelling. On the west coast and south-west coasts the waters are more productive (that is why the commercial fisheries are centred there) but there is a smaller species diversity. The consequence is basically that your sport fisheries are better developed along the south-east and east coasts and your commercial fisheries are better along the west part of the coast. For each coastal sector there are of course a number of basic components, and their inter-ac-

tions are of vital importance to the functioning of the coast as a whole. There are the dunes, the beaches and the inter-tidal zone, the intra-tidal zone, the continental shelf and the estuaries and the river mouths.

Now if the ecological viability needs a sound ecology, it is obvious that disruption of the interaction between any of the components of the zone should be avoided as far as possible. This can lead to a formulation of certain basic ecological planning principles which need to be incorporated in all coastal zone management procedures. Now these principles I think are holistic - they apply to any coastline - and therefore I am quoting from the Coastal Zone Conservation Commission of California which drew up the California Coastal Plan in 1975. There are 5 points, and I'll leave it to you to decide to what extent you think that they are applicable to our situation here in South Africa.

The first is: "That no one part of an ecosystem operates independently of any other, therefore alterations within one part of an ecosystem should be as carefully considered as the impacts on other portions of the ecosystems." Think about what I said about dunes, beaches, estuaries, and so forth.

Secondly "air, soil, water and light are the basic physical requirements for an environment to sustain life". I think we all are in agreement with that.

Thirdly, "organisms have requirements essential to life and if any of these requirements are met in amounts too small to satisfy the organism concerned, it will not be able to survive in a particular area". I do not want to lose myself in detail but mention was made earlier on of the nursery function of estuaries essential to the juvenile stages of many marine organisms including fish, and the worry there is about the fact that a decline in the angling potential of for example the Natal coast, might be related to that.

The fourth principle and this is very important, is that "people are an important part of coastal ecosystems". We must conserve with a human orientation. People change the ecosystems and in doing so can improve human living conditions but changes in the natural environment can also result in undesirable consequences as for example, the introduction of pollutants into the air and the water, which can harm human health, - just to mention one example, and there are many.

And then finally, which to me is the most important one, is that "every ecosystem has a carrying capacity which is limited. Coastal zone management must recognise the limiting factors and they should be of primary concern in environmental analysis. People must recognise the balance of nature, and limit use of natural resources so that they do not destroy options for the future. This avoidance of the destruction of options for the future is of vital importance".

These are not my words, these come from the California Coastal Commission, but ending the quote now "conservation of these principles will inevitably impose certain constraints on the manner in which the coastal environment can be utilised. In the formulation of an effective coastal zone management policy the opportunities offered by the coastal environment must therefore be assessed in the light of constraints which must be imposed to protect the resources which form part of, and are intrinsic to, that environment, to protect these resources against premature depletion". And so let's just evaluate for a minute or two what opportunities and constraints are really involved in coastal zone management.

In other countries such as South Africa there is a strong tendency for the concentration of human activity on the coast, with the consequent danger of overloading the carrying capacity of this somewhat fragile and dynamic border between the terrestial and the marine environments. The coastal zone is thus used for numerous commercial purposes, such as for example industry, agriculture, forestry, recreation, mining, urban township development, etc. and each of these is a perfectly legitimate activity which cannot be criticised and should not be criticised. So the opportunities offered by the coastal environment

include for example the availability of fresh water. In the Cape Province, 90% of the population of over 6 million people live in a 100 kilometre broad strip along the coast from the south-west coast eastwards. This is largely because of the availability of water brought about by the orographic rainfall patterns associated with the coastal mountain ranges, where the warm sea air condenses against the mountains, rain falls, and the water drains back into the sea. Secondly, the second opportunity is aesthetic attraction. Because of our good climate and the abundance of beaches for bathing, diving, surfing, and the opportunity of other water-orientated recreation in estuaries and river mouths, tourism and the development of a holiday-home industry has flourished. So this is a very definite opportunity. A further opportunity is the availability of renewable living resources. By this I mean particularly the fish stocks supporting both commercial and recreational fisheries with the associated industries which in Natal are important - ski boats, outboard motors, fishing tackle, etc. Then of course there is the opportunity for transport by sea between South Africa and overseas ports, which in turn stimulates the development of industry, and therefore export trade. Finally it has been recognised that there is the possibility of cheap disposal of effluent in the sea, effluent pipelines being cheaper to construct than recycling works, and because of the dilution capability of seawater. We know little about the long term ecological effects of this, particularly in micro-ecology.

Now constraints on effective coastal zone management are imposed by a number of natural and man-induced practices which include the high energy and the dynamic nature of the South African coastal environment which renders many forms of coastal development difficult and expensive. For example let's say, a marina development on the Natal coast where the rivers will come down in flood every so often will be a difficult proposition. Consideration must therefore be given to the enormous natural forces such as the action of waves, wind, tides, precipitation and river flow interacting with the geomorphological and the biotic features of the coast. The natural control mechanisms and sediment transport processes should therefore be disrupted as little as possible. Here for example, the unnecessary disruption of vege-

tation-stabilising dunes, riverbanks, and estuaries should be avoided. The second constraint is the highly variable nature of the coastline which is characterised by steep slopes, and summer rainfall. The third constraints are of course the extremes in weather conditions in the same coastal regions, where long periods of normal weather are interspersed by severe droughts - which I needn't underline at the present moment. Then again, the extreme floods which will come as certainly as we are all sitting in this hall at this moment.

Cognisance must therefore be taken of the strong possibility of episodic events which seem to occur at irregular intervals - they can come at any time from twenty to a hundred years. It is under such circumstances that functional flood plains and unimpeded river channels are of cardinal importance. This is graphically illustrated on many parts of the coast but particularly graphically during the Laingsburg floods of 1981 with severe loss of human life.

Further constraints are conflicting interests - the point made earlier by your Chairman. Industrial development and the associated need for the disposal of waste products conflict with the requirements for maintaining a high aesthetic standard, recreational health and food producing potential in the coastal environment, and I agree that you are faced with a dilemma. Finally a point which I think has got to be mentioned - and I am not trying to put my finger on a sensitive place - but I think that if we are going to be effective we have to be honest. In many places there are vested interests which are coupled with a lack of concern or ignorance of long term serious environmental effects. This frequently leads to damage to entire ecosystems through degradation of components of the ecosystems which have got to interact, such as floodplains, river mouths and lagoon areas.

The final constraint is a very understandable one, and that is the lack of finance particularly at local authority level; this frequently precludes proper environment orientated long-term planning and tends to promote any form of development which can generate revenue through rates. When such an approach is followed however, the long term costs

of the degradation of the environment which is attracting the development, the long-term degradation of that environment, often outweighs the short term gains.

There is at present a complicated system of legislation pertaining to coastal zone management which leads to divided control and that is a major problem.

So we come to the key criteria for effective planning of the coastal zone and its implementation. Now the identification of constraints such as those outlined above, underline the need for stating in clear terms, the key criteria in coastal zone management and their practical implementation. Professor Clark who is the author of the book "Coastal Ecosystem Management" was mentioned earlier on, and he attended an international symposium on sandy beaches and ecosystems held in Port Elizabeth earlier during the year. During the symposium he made the following points relating to key criteria, and I think this underlines what has been said by myself and previous speakers. Firstly the management of any component of the coastal zone can only be effective when seen in an overall context of coastal zone management. That means that the need for cohesive planning along the whole of the coast line is imperative.

Secondly for effective implementation of management procedures they must be attuned to natural processes and this means that they must be seen in relation to coastal environments for watersheds in catchments and the water in the sea below the breaker influence. Then the key to implementation of successful management is simplicity, in spite of the complexity of both administrative and legal systems, the weakness which we have admitted. Thus the problem frequently inherent in management is the complexity of governmental systems. There can for example be several authorities which evolve along central, provincial and local levels of government and this can lead to boundary disputes as to where the jurisdiction of each authority ends. I'm sure that many of you know what I'm talking about. But in spite of all this, all interactive processes of an administrative and ecological nature must be considered, so what I'm saying now in capital letters is that

administrative processes should be structured according to the components and the processes which are identifiable in the ecosystems which need to be managed, so that successful coastal zone management can only be successful if it is in tune with the processes which govern the functioning of that environment, be it estuarine, beach environment, or any other coastal environment.

Therefore it is of great importance to get managerial agencies to recognise themselves as being responsible for the whole ecosystems and to guard against the manipulation of components of ecosystems only, such as dunes, beaches or floodplains. For these reasons it is equally important that scientists should recognise that they are responsible for the transmission of information about the processes and functioning of ecosystems in understandable form, to environmental management agencies. It doesn't help that they come with fancy scientific papers and nobody can understand them. They must make quite sure that their research even if it is of a fundamental nature should eventually be relevant to the need for scientifically based environmental management.

But ladies and gentlemen, we live in a realistic world and in spite of recognition of the need for a realistic approach to ecosystems as advocated above, exigencies dictate very often the need for utilisation of ecosystem components. To achieve this without causing unnecessary damage, overall environmental management plans need to be drawn up in which the determination of boundaries is very important. George Begg has brought out a very good one; for example he says that: "while a river might be a useful boundary to an administrator the ecologist might insist that watersheds should be used so that effective management of catchments can be achieved". The ecologist would therefore strive to separate coastal ecosystems into components which can practically be used by administrators who eventually bear the responsibility and get all the complaints. Now this has been successfully done in the United States of America - it's been a painful process but they have achieved it - but the alignments of boudnaries must be coordinated with due regard for the relationship between the natural and the administrative processes - a point I made earlier.

So in conclusion Mr Chairman bear in mind the diversity of natural features of the South African coastline and the administrative and socio-political complexities which are typical of our country. It does not surprise me that coastal zone management in South Africa has in many respects been floundering for many years. Let's be honest and admit that. The administrative processes have been too complex, the channels of communication have been too obscure and information about coastal ecosytems has been inadequate. So are we progressing? Great efforts have been made over the past ten years to coordinate and direct research at national level to provide the necessary information on the functioning of coastal ecosystems. While not perfect, a good information base is now available, and it is one which can be used. Up to this level much has been done to create effective administrative procedures, although control over activities of individuals or individual local authorities is frequently inadequate. I think in many cases a final decision is made by the driver of a bulldozer. This happens, and there are examples of it.

This situation has been more complicated even at central government level because of a tendency towards compartmentalisation of the terms of references of the individual government departments; this led then to the undesirable complexity of legislation pertaining to the coastal zone and in many cases to problems of divided control. Now these problems have been clearly recognised and efforts are therefore being made to overcome them and I think the establishment of a Council for the Environment through the publication of the Environment Conservation Act No. 100 of 1982, is significant in this context. The brief of this Council is (and I quote from the act): "To advise the Minister for Environment Affairs on the coordination of all actions directed at or liable to have an influence on any matter affecting the conservation and utilisation of the environment." The working group of the coastal zone management appointed by the Council for the Environment has already been mentioned and the subcommittee on coastal zone management is to be formally constituted before the end of the year. The working group has up its sleeve the report and recommendation for the implementation of a more effective management procedure

of the coastal zone. This is being finalised but it has not come from above. It comes from people who have been invited from every sector of coastal zone management - for example from Natal Mr Tony Little has contributed very substantially to this document. Management guidelines for estuarine and coastal environments for both the Cape and Natal have been prepared. I mention George Begg's work, and this green report which I put on the table is another effort to do this; they are starting points and it is an ongoing task.

Therefore I'd like to end this address by expressing some reason for optimism that a cohesive management policy for the South African coastline will become a reality in the not too distant future but let's not think of pie-in-the-sky. I think that such optimism must always be tempered at all times by the knowledge of the enormity and the complexity of the task, particularly in the light of the rapid growth of the South African human population which is the cause of so many problems and the right for "demands by all for a place in the sun" - to quote, Mr Sol Kerzner - somewhere along the country's beautiful coastline.

BILHARZIA AND NUISANCE MOSQUITOES IN THE COASTAL ZONE OF NATAL

by C.C. APPLETON & F.A. DONNELLY

Bilharzia and nuisance mosquitoes are but two of the problems which local health authorities have to cope with in the Natal Coastal Zone. Where necessary they have to implement control measures - measures which have on occasions earned them criticism in the past. The aim of this talk today is to try, with the benefit of the hindsight provided by research, to put these problems into some sort of perspective. Let us deal first with bilharzia.

The free-living stages of the parasite (the miracidium and the cercaria), and also its snail intermediate hosts, are freshwater organisms. Even in fresh water however the probability of any of these stages being completed is small and the further we progress clockwise around the cycle set out below it becomes less and less likely that the next stage will be completed successfully. For instance it has been calculated that only something of the order of 0,004% of cercariae emerging from an infected snail will succeed in

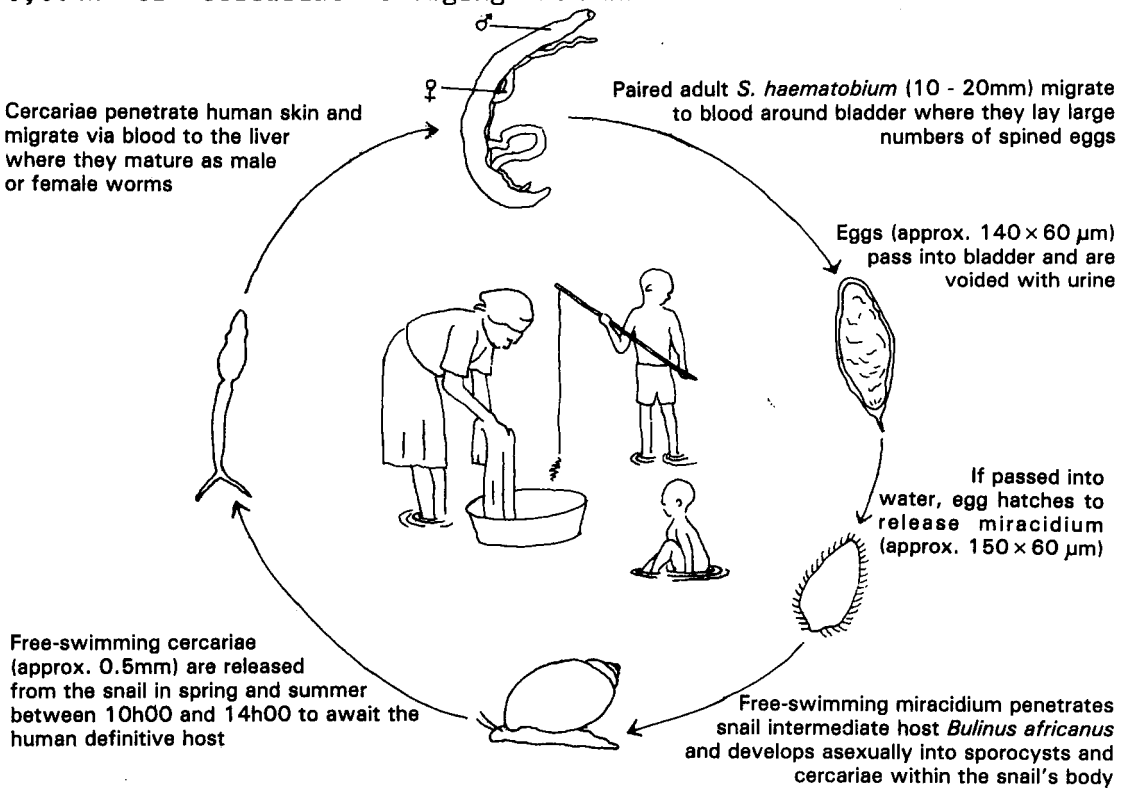


Figure 1

infecting a person. Only about 2% of snails would have been infected in the first place. A hatchable egg has a probability of only 3-5% of being deposited in a place where it can infect a snail. Under all but the most favourable conditions, therefore, the parasite will probably not survive to maturity. The mere finding of a snail of the appropriate species is not sufficient evidence for erecting signs warning of bilharzia transmission in the habitat concerned nor for applying molluscicides there. This is an important concept as far as a realistic understanding of the trans-mission of bilharzia is concerned and we will come back to it later.

From time to time reports reach our Institute from general practitioners saying that they have patients who have contracted bilharzia in one or other of the Natal lagoons or estuaries. We have always tended to treat these claims with caution. We know only too well that in many of the rivers in question foci of transmission of both Schistosoma haematobium and S. mansoni do exist within a few kilometres of these mouth areas; but until recently we did not know what the salinity tolerance of either the parasite or its snail intermediate host was.

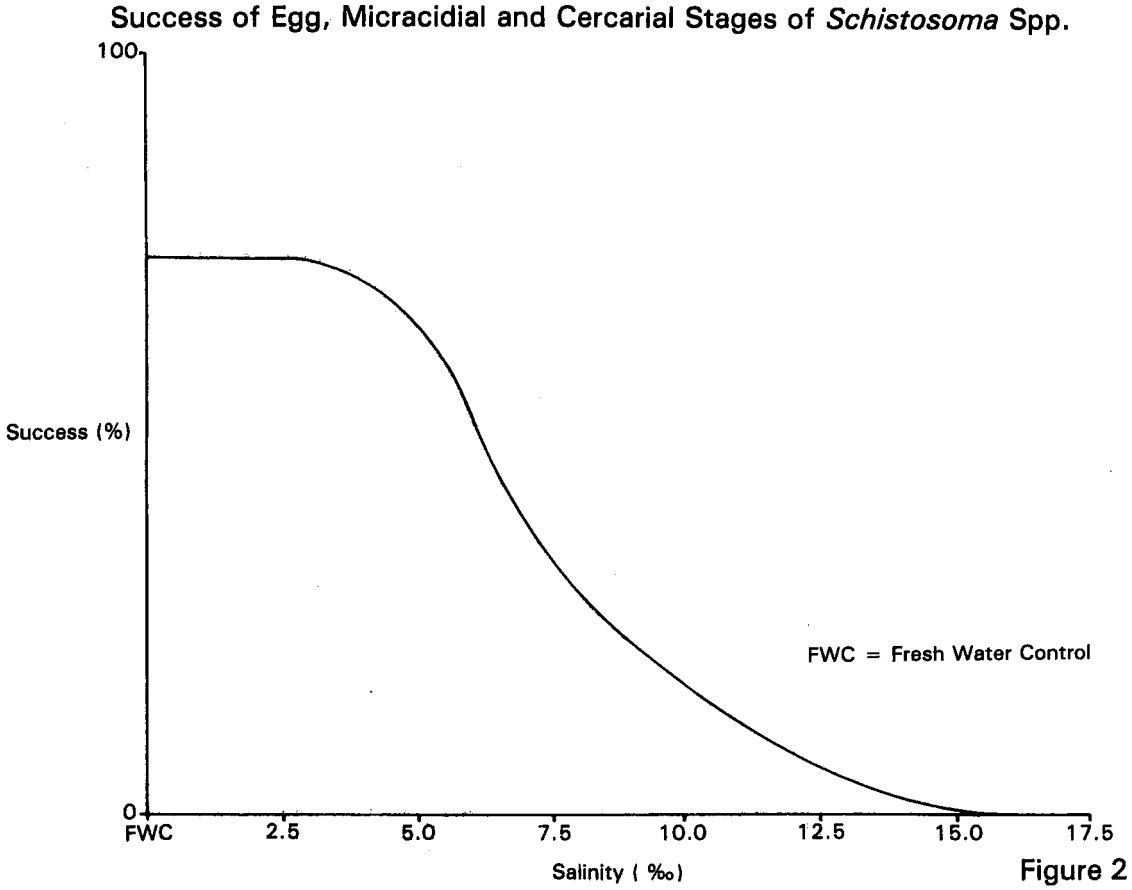


Figure 2

Recent field and laboratory work has provided some answers to this problem of defining the salinity limits of bilharzia transmission in lagoons and estuaries. Firstly, the adults of the common snail host in our area, Bulinus africanus, can survive reasonably well (60% for 32 days) in salinities up to 3,5°/oo (10% sea water) but its juveniles are not nearly so tolerant. They have a survival rate of only 15-20% over the same salinity range. If its juveniles are unable to survive under these conditions, then this snail species clearly cannot maintain expanding populations in saline or even in brack water. These juveniles are undoubtedly the most sensitive and selective stages of the snail's whole life-history. They do not survive because they cannot regulate the balance of water and salts moving in and out of their body fluids as the salinity of the water they are living in rises above a level of approximately 3,5°/oo.

This suggests, quite correctly, that if the snail can't build up populations in these lagoons or estuaries then no bilharzia transmission can take place there either. Indeed, a focus of transmission cannot become established there but because adult snails are considerably more tolerant of saline conditions than the juveniles there is a chance that already infected adults could be washed down to the coastal zone from one of the foci in fresh water further upstream. These immigrants could then continue to release infective cercariae into the water for a period of several weeks or even months.

What then do we know about the free-living stages of the bilharzia parasite itself - what salinities can they tolerate and for how long? Starting with the eggs which must reach water, if they are to have any chance of survival at all, we know now that the hatching success of the eggs of all three species of bilharzia falls rapidly at salinities above 5°/oo (15% sea water). Even if they were to successfully hatch and infect a snail there it is unlikely that the snail would survive the parasite's mandatory 42-day incubation period before the next stage, the cercariae, are ready for release; certainly not in salinities over 7°/oo (20% sea water). This pattern of decreasing activity on the part of the parasite with increasing salinity of the water is, not surprisingly, also shown by the other free-living stages. The generalised response of these stages to salinity is shown in Figure 2.

The life span of the cercariae which emerge from snails under saline conditions remains unchanged from the normal 43 hours or so up to salinities 5°/oo but at higher levels this longevity drops rapidly. Also, their ability to infect laboratory rodents and develop into adult worms drops as the salinity is increased. This is perhaps the most important knowledge of all. At best only 30% of Schistosoma mattheei cercariae and still smaller numbers of S.haematobium and S. mansoni were able to successfully infect rodents at even the lowest salinities of less than 2°/oo (6% sea water). In addition, there is evidence to suggest that while most of these cercariae, up to about 80% at salinities below 5°/oo, will penetrate skin, only something of the order of 25% of these will actually mature.

In summary then, our data suggest that even if there is sufficient, regular human contact, a focus of bilharzia transmission cannot become established in water with a constant salinity higher than 2,3-3,5°/oo, (7-10% sea water) and probably even less. Estuaries and lagoons, particularly those which are mixed with respect to salinity and show no evidence of stratification, are dynamic systems and, even if they remain at or below this level for weeks at a stretch, it is inevitable that salinities will rise sooner or later and that when they do, the snails will die. It seems reasonable to conclude therefore that under these situations, with odds like these stacked against it, and recalling what was said at the start of this talk, the chances of contracting bilharzia under estuarine or lagoonal conditions is at best remote though it is theoretically possible. We do not know how these results apply to stratified systems where haloclines trap saline water below fresh surface water.

How then do we answer those who claim to have picked up the disease in such a situation? One of the problems may lie with the method of diagnosis on which the claim is based. Where eggs have been found in stool or urine examinations the patient undoubtedly does have bilharzia and the answer might lie in a closer questioning of the patient as to his/her movements over the previous 6-12 months or so.

The average life span of the adult bilharzia worm is in the order of three years though it may be longer. If the diagnosis was made by one of the routinely used immunological tests, it may in fact be a false positive result due to cross-reaction with dermatitis caused by the avian equivalents of the human bilharzia parasite. We know that estuary-frequenting birds such as gulls and terns carry blood-flukes belonging to the general Gigantobilharzia and Austrobilharzia but we do not yet know where these parasites are being transmitted.

So much then for bilharzia.

Lets turn to the mosquito problem in this coastal zone. Without any doubt there are areas where mosquitoes are troublesome but the severity of the problem appears to vary from year to year, depending on environmental factors such as rainfall. In order to assess the extent of the problem in the coastal areas of Natal, questionnaires were sent out in February of this year to the health departments of 27 local authorities. Replies were received from 22 of these (a creditable 82%) of which 17 (77%) answered that they had had complaints about nuisance mosquitoes. An analysis of these 17 replies is given in Table 1.

TABLE 1

ANALYSIS OF QUESTIONNAIRE DATA ON 17/22 COASTAL AUTHORITIES WHICH HAVE RECEIVED COMPLAINTS ABOUT NUISANCE MOSQUITOES

No. considering a control programme necessary	15/17 (88,2%)
No. using adulticides	3/17 (17,7%)
No. using larvicides	15/17 (88,2%)
No. which have experienced problem in the last 10 years	12/17 (70,6%)

DETAILS OF LARVICIDING OPERATIONS.	NUMBER OF AUTHORITIES USING DIFFERENT LARVICIDES.
Abate (temephos)	8/17 (47,1%)
Filariol (Bromophos)	5/17 (29,4%)
Engine or Paraffin Oil	4/17 (23,5%)
Biological Control	2/17 (11,8%)
More than one Method	4/17 (23,5%)

Certainly a mosquito problem exists over much of the coast from Margate in the south to Lake St. Lucia in the north. All the authorities who consider that they have a problem are engaged in larviciding programmes - by way of contrast only 2 are concerned with controlling flying adults. In most cases the problem is a long standing one. The larvicides of choice are clearly the organophosphates Abate and Filariol in that order and which may be expected to be effective for up to 2-3 weeks or so after spraying.

The saline waters of the coastal zone represent a harsh biological environment and the problem snails and mosquitoes we are concerned with here are essentially freshwater organisms. The difficulties facing the bilharzia snails Bulinus and Biomphalaria, finding themselves in saline water also face mosquitoes here. Unlike the snails however, there is a group of some six local mosquito species whose larvae have the ability to cope with the water-balance problem far better than the snails can. They are able to re-absorb water from their waste products as these are being excreted from their bodies. This, coupled with an unusually impermeable body surface (tegument) has pre-adapted them for life in saline water and those that readily bite man may well become pest species in these areas.

Species like Aedes durbanensis for instance breed commonly in the Phragmites and grass swamps associated with the Illovu estuary and where salinities of up to 12°/oo (34% sea water) usually prevail but which may be much less. Culex thalassius is also tolerant of saline conditions and has been recorded breeding in enormous numbers in water with a salinity of 7,7-10,2°/oo (22-29% sea water).

The Medical Research Council has, over the past two years, been investigating a mosquito problem in the swamps associated with the Mhlatuze estuary at Richards Bay. Although these are freshwater swamps, the methodology developed here would be just as applicable to any of the saline swamps along the coast and will serve as a case study for this talk.

Mosquitoes were sampled using floating eruption traps which are small enough to be handled inside dense Phragmites swamps as well as in grass marshes. Although they are small, they have been up to 48% successful in trapping mosquitoes as they emerge from the water on any night - the small size of the trap is compensated for by using a large number of them - eighty in all.

Use of the familiar bait net and reluctant zoologists as bait, enabled the principal man-biters to be identified. This was done by monitoring the biting activity of the flying adults throughout the night and then plotting the resultant biting cycles of the most common species. These kinds of data, collected along with measurements of wind speed, temperature and relative humidity, have enabled a fairly comprehensive picture of the mosquito problem there to be built up.

These freshwater reed swamps harbour a rich mosquito fauna and common pest species which breed in them are several species of Culex and Mansonia. The latter, particularly, M. uniformis, is probably the most troublesome species here and has in fact been described as the most bloodthirsty mosquito in Africa! To give an indication of the magnitude of this problem at Richards Bay it is worth mentioning that,

despite it being a period of unusually low rainfall, man-biting rates of up to 125/man/hour could still be measured. Furthermore, this represents the count for Mansonia only - there are several other common anthropophilic species there as well.

Mansonia larvae have unusual habits however. They do not get their oxygen directly from the atmosphere as most mosquito larvae do but rather from the air spaces in the roots of aquatic plants. To do this they have to attach themselves physically to the roots near the bottom of the swamp and they do not move about much. This behabiour unfortunately renders them relatively safe from insecticides sprayed onto the surface.

Obviously reed swamps are not the only source of troublesome mosquitoes - several species of Aedes and Eretmopodites breed in temporary water which collects in the axils of Strelitzia leaves in the dune forest and also in those of cultivated banana trees, in tree holes, blocked gutters, tin cans and so on. As an adaptation to this sort of opportunistic existence, the eggs of, for instance, many Aedes species are resistant to dessication and may remain dormant until rains come - this habit coupled with the fact that when they do hatch, they do not all do so at the same time, makes control difficult.

Control of nuisance mosquitoes is currently based on organophosphate larvicides in liquid formulations for many culicines and anophelines and in pellet or granule formations for some other culicines such as Mansonia and the tree-hole breeding Aedes. The control measure adopted should be selected so that it is suited to the particular target species and this may require knowledge as to precisely which species are responsible and exactly where they breed. The Medical Research Council would be willing to investigate any such problems if requested to do so.

ON PROGRESS AND PROBLEMS IN THE REHABILITATION NATAL'S ESTUARIES

by G. BEGG

With over three-quarters of the population of Natal living in the coastal lowlands, there is a distinct danger of overloading the carrying capacity of the coastal zone. This is in fact the very fear that has formed the underlying motivation and rationale for this meeting, as well as drawing us together from many walks of life, as participants at this seminar.

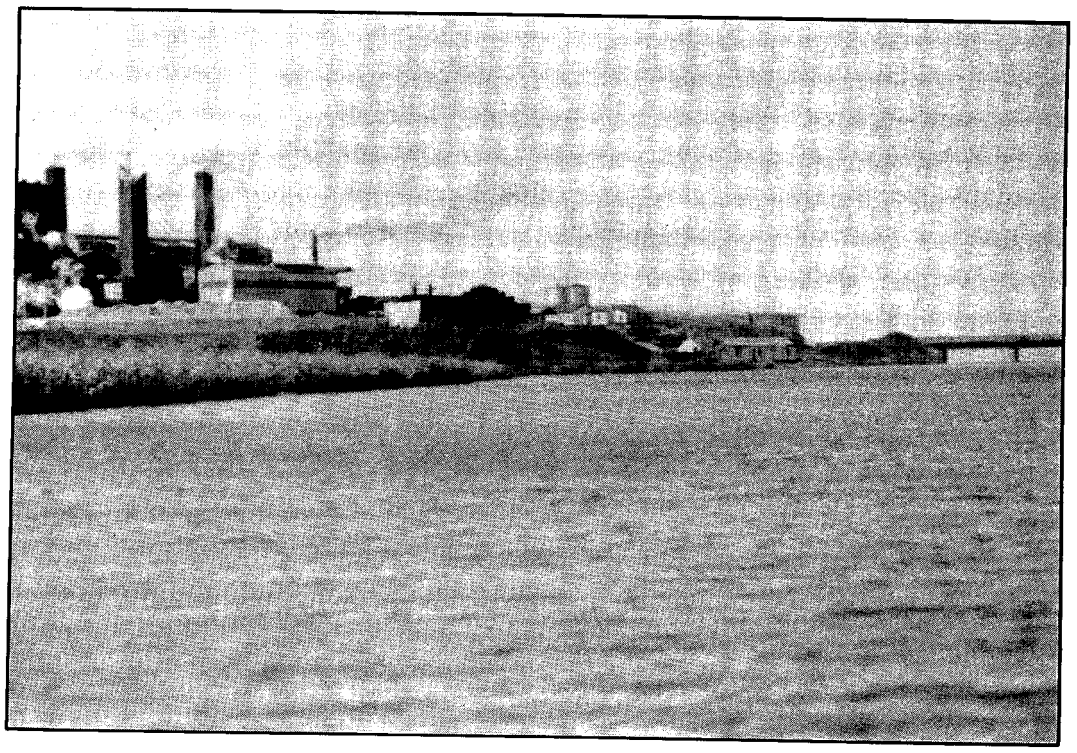
In short, the coastal zone is more intensively utilized than any other region in Natal, mute testimony to which are the sugar-cane covered hills that stretch inland as far as the eye can see; the city of Durban as the nerve centre of South Africa's most busy port; industrial growth points at regular intervals along more than 300 km of our coastline; an intricate network of roads and railway lines to serve these developments, as well as extensive areas for residential and recreational purposes. All of these things provide people with the ingredients which we regard as essential to life, but it is not without some cost to the environment. Plumes of silt opposite each river mouth; the discoloured sea opposite effluent pipelines; barren rocks; empty fishing grounds; litter strewn beaches and sediment filled estuaries are but a few of the symptoms of a coastal environment gradually yielding to the ever increasing, often conflicting demands of man.

For the next half hour I intend to highlight the progress that has been made in recent years (and mostly behind the scenes) by a number of people and organizations who feel sufficiently concerned about the degradation of our coastline, to have actively done something about it. A prerequisite of these activities has been top level commitment to the idea, since this acts as some sort of guarantee that the job gets done. Naturally, some of these achievements have been greater than others, but they all serve to illustrate that each and every one of us can in fact play a part, no matter how small, in relieving the

stresses already evident on the coast. In some instances they can be eliminated all together, or at the very least would ensure that matters don't get any worse. Without commitment however, coastal zone management can rapidly degenerate into an exercise of pure futility.

From an administrative point of view, one of the most important steps accomplished in recent years has been to gain commitment of the Provincial Administration. This, was done after the adoption of a policy statement in 1979. Its purpose was to provide the management guidance necessary to realize the maximum environmental and socio-economic benefits from Natal's estuarine resources. To a certain extent, the following discussion will serve to reveal the extent to which the policies have been felt beyond the realms of the Provincial Administration.

A good place to start perhaps, is the Sezela



(Plate 1): The Sezela Lagoon presently represents a pinnacle of hope that the restoration of such an environment is in fact feasible.

Having featured prominently within the policy document as "a classical example of a polluted coastal lagoon", what is significant about the Sezela today is that since the Sezela Sugar Mill has come under new management, there has been a commitment at management level within the parent Company (C.G. Smith Sugar, (Pty) Ltd.), to rid themselves of this particular inheritance. Accordingly, the company intends to do what it can to restore the Sezela from its present, lifeless condition to something that the manager of Smith Chem. has said he would be "prepared to swim in" before they are finished! This happy state of affairs serves to illustrate that the future of such a system depends significantly on the attitude and values of people, and this will become increasingly obvious as our discussion progresses.

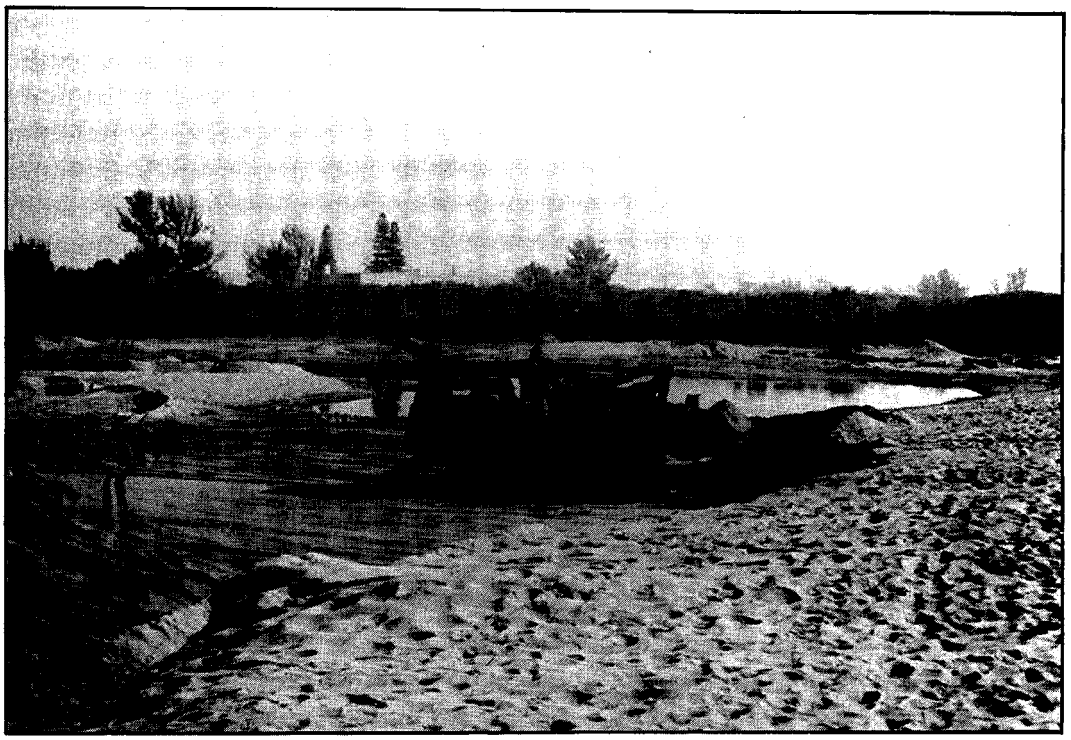
The most critical and significant decision taken by C.G. Smith Sugar was to spend close to a million rand on the construction of an effluent treatment plant, to process all their water-borne waste products from the mill. This plant has been built alongside the lagoon, and in the near future, is expected to discharge an effluent that will meet the gazetted standards laid down by the Water Act. Furthermore, serious consideration is being given to dredging the lagoon so as to rid the system of the overburden of anaerobic deposits that have accumulated there over several decades of waste disposal. These presently deplete the water body of all its oxygen, which is one of the most fundamental of requirements if the system is to support aquatic life at some stage in the future. Flushing of the system by natural means is complicated by the existence of the Sezela dam upstream of the lagoon. However, with supplementary water recirculated from the treatment plant, and from a dam that is presently under construction on the nearby Mkumbane River, future releases of water from the Sezela dam appear to be feasible. In the meantime, a policy of breaching the lagoon artificially has been adopted, to periodically flush the system. This has resulted in some short-lived, but impressive signs of recovery, such as improvements in water transparency and oxygen levels. Management have sanctioned a core survey of the lagoon (to ascertain the nature and extent of the bottom materials that may be dredged) and have suitably equipped their own personnel to monitor the water quality in the lagoon to evaluate the

effectiveness of whatever remedial measures are undertaken. Plans are underway to eradicate the water hyacinth at the top of the lagoon, and the prospect of aerating the water artificially is being examined. This fascinating possibility exists because of the fortuitous production of oxygen as a waste product in the manufacture of furfuryl alcohol at Smith Chem. Taking everything into account therefore, there is no doubt that C.G. Smith Sugar are serious in their intentions, and that their efforts will certainly not go unnoticed or unappreciated.

Moving on from the example set by the Sezela, the Sipingo comes to mind as another filthy and neglected lagoon, polluted by sewage, industrial and domestic wastes. Properly managed however, it could be a priceless asset for the Borough of Isipingo.

The Sipingo began to fall into disrepair when deprived of its freshwater inflow more than 30 years ago. In 1952 the Mlazi River was diverted out to sea, and in 1969 the Sipingo River was diverted into the Mbokodweni. As a result the mouth of the Sipingo closed, and two concrete pipes were installed to prevent flooding. These presently act as the sole means of communication between the lagoon and the sea, and is precisely the sort of "problem child" that the Province's Estuary Action Committee take under their wing.

This Committee examines in detail what steps, if any, can be taken to improve the quality of such an estuary. In the case of the Sipingo however, the prospects of resupplying the system with adequate quantities of clean, fresh water is out of the question. The only potential seems to lie in increasing exchange with the sea. Acting on the advice of one of S. Africa's leading coastal engineers in Stellenbosch, an attempt is therefore being made to co-ordinate the manner in which sand is being extracted for construction purposes, from the mouth of the Sipingo. This is an existing activity, but it needs to be undertaken in such a way that a basin is excavated in the immediate area of the mouth, thereby increasing the volume of water exchanged through the pipes on each tide. The crest level of the sandbar can also be lowered to promote overtopping of the bar at high tide, and if necessary, additional pipes installed beneath the bar.



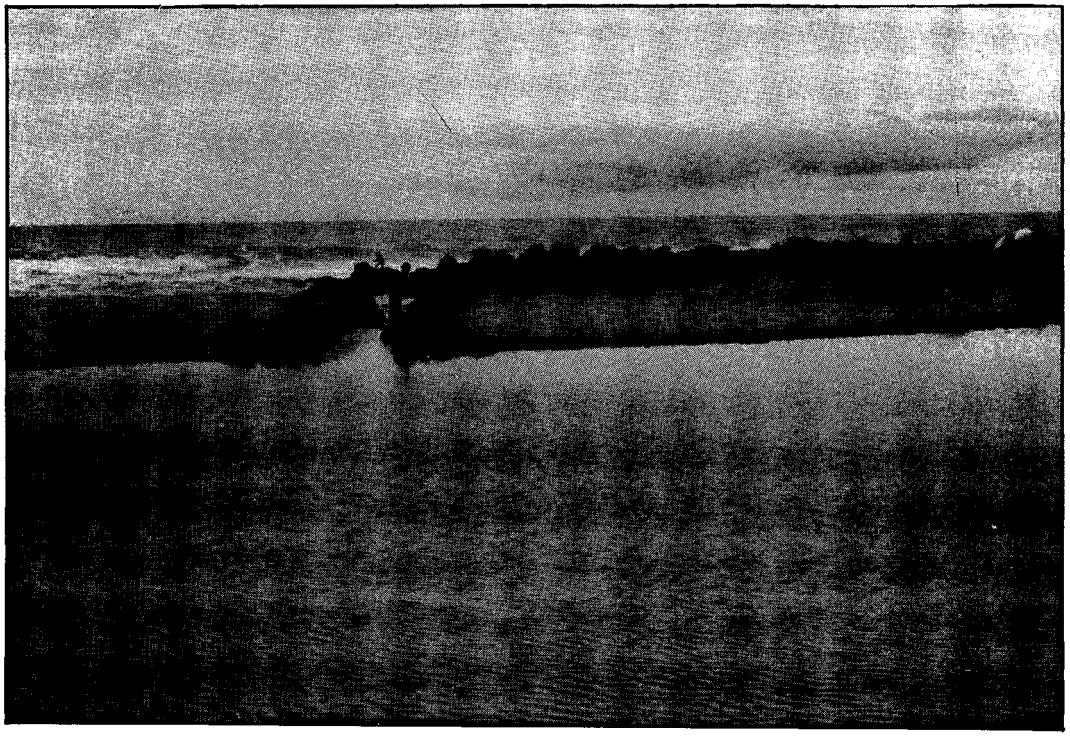
(Plate 2): Restoration of the Sipingo Lagoon partially depends on incrasing the tidal prism by excavating sand from the mouth region.

The chances of really improving the condition of the Sipingo nevertheless depends to a far larger extent on the enthusiasm displayed by the local authority in question. Thus far, the Action Committee's intervention has fostered an interest in rehabilitating the Sipingo, but if this is to become meaningful in the long term, then the effort made will have to be sustained over a long period of time. Furthermore industries in Prospecton presently polluting the system will have to be identified and prosecuted if need be; a campaign will have to be mounted to clean up the surrounds of the lagoon, and trap the refuse that presently washes into the system from a variety of canals; and a sense of environmental consciousness engendered in the community centred around the Sipingo Lagoon.

One of our greatest fears is that the Mgeni Estuary will suffer the same fate as the Sipingo, due to the development of the Springfield flats immediately upstream of the estuary, as an industrial area. Many of you will recall the events that took place in 1981 as a result of the improper disposal of spoil whilst canalizing the region through the Springfield flats. Although no gross ecological damage was detectable downstream, there is no doubt that the recreational value of the estuary suffered a serious set back as a result of the increased silt load of the river, and the flocculation thereof within the confines of the estuary basin. As a result of these events however, the Environmental Committee of the Durban City Council was persuaded to intensify its efforts to employ the services of a firm of environmental consultants, and draw up a carefully constructed management plan for both the Mgeni estuary and the river above it. This task is presently in an advanced stage of preparation; dredging of the southern channel of the region is being contemplated, and there is little doubt that the Mgeni estuary, has a good chance of becoming recognised as an asset that the City of Durban cannot afford either to lose or abuse. It is regrettable however, that generally speaking, it always requires some sort of crisis to precipitate this course of action.

The artificial breaching of lagoons in Natal is an activity that has bedevilled the ecology of these systems for several decades. The digging open of the sandbar that seals the mouth of a lagoon, by mechanical or manual means, is a common practice, but is undertaken for an astonishing variety of reasons. The most common is generally conflict over the level to which a lagoon is "entitled" to rise.

For example, conflicts arise over the inundation of sugar cane fields; the inundation of roads, caravan parks, lawns and footbridges. In every case however, it is man who has under-estimated the extent to which water level can vary in a coastal lagoon. On other occasions, lagoons are opened for nonsensical reasons. For example tourists often dig open a lagoon in the interests of good fun. On the other hand, there is sometimes good reason to open a lagoon, as in a case where it may be polluted.



(Plate 3): The artificial breaching of lagoons is an activity that should shortly be brought under control.

The problem the Province faces however, is to control this activity, because there is every reason to suggest that breaching is seldom undertaken in the best interests of the lagoon. More often than not, breaching is undertaken to protect a vested interest of some description. The block of cabanas alongside the Mbizana Lagoon in Ramsgate is a good example. Many of the local authorities along the coast are also in the forefront when it comes to controversies of this nature, because requests to open the lagoon are naturally directed at the Borough Engineer. For example, an "informed" ratepayer may complain about the breeding of mosquitoes in a lagoon, and demand the problem is overcome by lowering the water level.

A detailed explanation of the ecological effects of breaching is out of place in a forum of this nature, but "in a nutshell" most ecologists regard it to have an adverse effect on the productivity of the waterbody. Flooding also has a bearing on the supply of detritus which the system requires as an essential ingredient in the food web; the hy-

draulic head achieved whilst filling affects self scouring processes when the system finally opens naturally, and a stable water level enhances productivity at a variety of different trophic levels within the system.

Without further action being necessary several steps have already been taken to stop the breaching of certain systems. For example, when the Mhlanga lagoon was declared a nature reserve in 1980 negotiations with Natal Estates (who were then in the habit of breaching the Mhlanga whenever sugar cane fields adjacent to the system, as well as cane extraction roads and a cane loading zone were flooded) have resulted in 200 ha of sugar cane being abandoned. These fields will revert back to reedswamp over the years. The Mdloti was also being breached virtually every month in recent years because of the inundation of cane fields, but these too have been abandoned.

Having recently circulated and analysed a questionnaire that every local authority at the coast received, the Estuary Action Committee is presently of the opinion that with very few exceptions, there is consensus amongst local authorities that the control of breaching is not only desirable, but would also be welcomed. Having been asked by the Department of Community Development (which presently administers the Sea Shore Act) to act as its agent in this regard the Natal Parks Board is likely to become implicated as the organisation responsible for the control of breaching in the near future. Legislation is to be drafted shortly, and a policy of non-interference implemented, although it is recognised that in a few isolated cases some sort of compromise will have to be sought. This may be achieved by determining an optimal level that must be attained before the bar in certain lagoons may be breached.

What is important, is for local authorities to appreciate that the policy will relate only to the breaching of <u>lagoons</u> (i.e. systems that are normally closed). The policy would therefore have no relevance in the breaching of an estuary, because the system is normally open, but may have become temporarily closed.

Bridge construction is another controversial subject in the field of coastal zone management, and particularly if the welfare of Natal's estuaries and lagoons is taken into account, because this activity has also brought about untold changes in these systems over the past 30 - 40 years.

The manner in which the road bridge over the Mpenjati is presently being built serves as a good example, if for no other reason than it exemplifies the lack of communication that still exists between planners and engineers (whether these be the client, his consultants, or the contractors involved) and the futility of having purposely brought these parties together in the joint compilation of the policy statement referred to earlier.

(Plate 4:) Despite a policy adopted in 1979 to apply methods where practicable, "that do not alter water quality and water flow", the standards employed in 1982 on the Mpenjati speak for themselves.

In construction of the new bridge over the Mpenjati no consideration was given (until too late) to assess the environmental consequences of building a solid platform across the lagoon, before piling of the bridge foundations could commence. Having done so, the salinity of the

lagoon was grossly affected, and the area upstream of the structure unnecessarily stressed by impoundment of the river water. Added to this, is the knowledge that this state of affairs is likely to remain in force for two years, as the full duration of the construction phase.

In contradiction of these sentiments however, attention must be drawn to the genuine efforts made by both the Natal Roads Department and their consultants to minimize the effects of bridge construction on the Msimbazi and Mgababa. These include the laying of a pipeline beneath the northern embankment of the Mgababa road bridge; partial extraction of the road building materials that were washed into the lagoon during the construction phase; controlled breaching of the lagoon and vegetative rehabilitation of the diversions which were created. Similar concern has also been shown after construction of the new bridge over the Mkomazi.

It now remains for the S.A. Transport Services to remove the redundant causeway that was built across the mouth of the uMgababa in the late 1930s. In doing so, they would emulate the attitude adopted by their colleagues responsible for the construction of road bridges upstream of the railway bridge and demonstrate their commitment in principle to the spirit in which Natal's estuary policy statement was written (in conjunction with themselves) in 1979. This particular edifice is in fact pictured on page 22 of the Policy Statement, but it may amuse you to know that the Estuary Action Committee was requested by the SATS to first seek the permission of Chief Umnini (and of 50 of his tribesmen) before any such action could be contemplated. This was because the lagoon now lay within KwaZulu. It is sufficient to say that our deliberation with Chief Umnini regarding the wisdom of removing the offending causeway and over the hydraulics of the uMgababa, was a painful but skilful piece of negotiation that even Henry Kissinger would have been proud of!

One of the most exciting developments at present in the field of estuarine rehabilitation is the Siyaya Catchment Project. This is a unique undertaking, that was initiated by the Natal Town and Regional

Planning Commission in 1979 to determine whether the Siyaya Lagoon, degraded beyond recognition, by agricultural mismanagement in this instance, could be restored. As in the case of virtually every other estuary and lagoon in Natal, the answer to this question depends on what changes can be implemented in the catchment area above the system in question. The Siyaya was chosen because it was influenced by a single form of land use (sugar cane cultivation), and because it was small enough (15 km^2) to bring the task within the realms of being practically achievable.

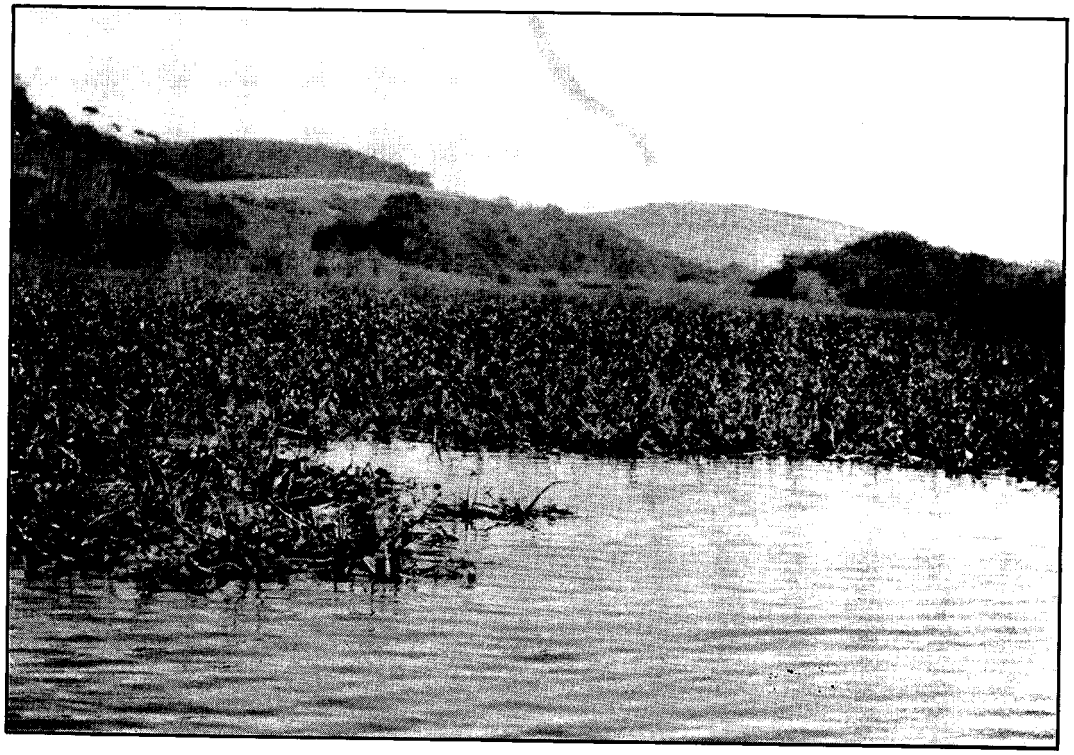
(Plate 5:) The complete loss of open water in the Siyaya Lagoon due to reedgrowth is symptomatic of agricultural mismanagement upstream.

To convince a farming community to implement certain changes that may require modification of their farms, to expend money in bringing about these changes, and to sustain the effort required over a long period of time, is not an easy task. Nevertheless, it is regarded as essential, if soil loss, as the most important single threat to the continued welfare of Natal's estuaries, is to be controlled.

In the Siyaya Project the services of numerous organizations such as the S.A. Sugar Association and Department of Agriculture have been harnessed to help plan the best possible lay-out for every farm in the catchment (taking into account variability in the nature of the soils, topography and hydrology), and in close collaboration with the farmers, gradually implement elements of that plan on a field by field basis, until over the years the whole "jigsaw" finally coalesces into one integrated, well-conserved farming unit. The Soil Conservation Act will also be implemented, with special attention being given to areas where problems arising from streambank encroachment and wetland cultivation have materialized. In fact, today there are certain farmers in the Siyaya replanting streambanks with the natural vegetation that formerly held them intact. Properly constructed waterways are to be built, and the crop itself used as a conservation device, by encouraging practices such as trashing, strip-cropping and minimum tillage. The network of cane extraction roads on each farm is also to be replanned. Furthermore, whilst all this is going on, a multi-disciplinary research effort is being made to determine the physical, chemical and biological responses that should be detectable downstream, arising from improved catchment management.

It is still too early to say that signs of recovery are already evident, but the project has already gone a long way towards showing that given the will "to turn the clock back", then this is the only way in which it can be done. Equally important, is the inspiration that the Siyaya project seems to have given to others, because news of the fact that farming communities elsewhere have voluntarily set out to accomplish the same thing is, to date, one of the most heartening developments of all. At Hibberdene for example, a similar effort is being made in the catchment of the Mhlabatshane; and at Munster, in the catchment of the Kandandlovu. From the sound of things, farmers in the Zinkwasi catchment are also keen to strive collectively towards a similar goal. Once again, the lesson to be learnt is that it is the attitude of people that really counts.

Having purposely highlighted some of the commendable efforts that have been made thus far to improve the quality of Natal's estuaries and lagoons, it should be clear that these serve as little more than the "thin edge of the wedge". The Action Committee has lost as many battles as it has won, and there is still a great deal to accomplish. For example, we have failed to make any impression (so far) on certain local authorities over the issue of waste disposal, in areas that are clearly unsuitable for this purpose. The disposal of refuse alongside the Lovu estuary serves as a good example, because of the attitude "if one local authority can get away with it", so can another. Thus the same problem has materialized alongside the Boboyi near Port Shepstone. The problems that arise from the leachates emanating from dump sites is to be addressed separately during this seminar by a professional in the field, so little else needs to be said. It is necessary however, to point out that if the policy statement is referred to, waste disposal in low-lying areas adjacent to estuaries and lagoons is an activity that is regarded as unacceptable as far as provincial authorities are concerned.



(Plate 6): The Tongati Estuary is next in line as a system in dire need of the care and attention of someone with the right attitude towards management.

As for the future, there are many directions in which the Estuary Action Committee needs to turn, and for this reason it has to select its priorities with care. The control of water hyacinth is one such priority, and an improvement in the ghastly condition of the Tongati Estuary.

In the near future both these issues are to be addressed, with the sole intention of resolving both of them to our satisfaction.

Finally, one cannot draw anything but strength from the achievements of the British in their restoration of the Thames Estuary. Fifteen years ago the Thames estuary closely resembled what can best be described as a septic tank into which an ever increasing volume of industrial waste and sewage poured each day. In actual fact, it bore a striking similarity to our own Sezela Lagoon on the Natal Coast. However, only when matters had got so bad that the reputation of London was declining and the British were sick and tired of living in their own waste, was some positive action taken. In fact, R170 million was spent in restoring the Thames. Today it is an estuary the whole country is proud of and a shining example to the rest of the world of what can be done when there is a genuine commitment to do so. Ninety-six species of fish have returned to the estuary, including salmon; and thousands of ducks and waders may be seen on the shoreline, which for years had been lifeless because of the amount of detergent in the water.

Many of us believe that in Natal, the time has come for people to adopt a similar attitude. This is not just necessary for the sake of co-existing with various other forms of life that share our coastal environment, but because above all else, everyone present in this room and on the street for that matter, is conscious of the fact that the Natal coast is not half the attraction today that it was 10 years ago. Furthermore, as each day goes by the situation gets worse. Some give up in despair and others look around for someone to blame, but very few of us are prepared to "take the bull by the horns" and do something about it. It is necessary to do this for our own sake, for our own children and in the interest of the generations of people that are likely to follow them.

Perhaps therefore a fitting way to end this discussion, is the following quote from an essay by Daniel Kozlovsky on the parameters of an acceptable human ecology.

He defines an acceptable human ecology as something that would "provide each individual with the physical, chemical and biological necessities of life, but only the necessities, thereby assuming that all men, now and in the future, will have them. It would accept the fact that there are too many of us, that each of us wants too much ... It would be an ecology of learning to share and doing without".

THE LEGISLATIVE FRAMEWORK

by J. MALAN

My address will, I hope, be analytical rather than descriptive, practical rather than pie-in-the-sky, a little theoretical having studied law, because I really do feel that the legal remedies cannot be promoted as panaceas to our management problems. That is my point of departure this afternoon. Coupled to that, Professor Rabie, the well-known public lawyer at Stellenbosch University, feels that we have enough laws, and that our laws are as good as anywhere else. Finally, I think the generation of ideas this morning has made me actually change the whole of what I wanted to say, so I will look at various elements that we probably will not touch on today in other speeches.

Why I am analytical is because I really do feel that most of us here who are representing government departments, local authorities, province, boards, etc., know enough about the laws. You I'm sure know more about the particular law that you enforce or carry out than I do. Furthermore, I don't want to bore you more than is absolutely necessary by going through long drawn-out explanations of the laws and legislation.

Secondly, and most importantly, it is imperative that we go beyond the often glib statement that it's the law's fault, and go towards an objective evaluation of the laws that are passed. There's been much said about bad control and inadequate control, overlaps and omissions in the law, complicated laws, inappropriately designated responsibility, etc. I want to focus on three simple words, and on an approach.

The three simple words are:

CONTEXT PURPOSE NATURE

Being a rather simplistic fellow myself I think that this is what should guide one in looking at legislation. I'd like to promote this approach. Any legal framework must work as far as its definition and you've been told of the workings of the Council for the Environment by Alan Heydorn and others.

Fortunately I think we followed some of the guidelines for this approach in trying to see how best we can promote coastal zone management legislation. Now if I can quickly describe that.

We take our goal as "an effective utilisation and conservation of the coastal zone as a dynamic ecosystem in the interface between land and sea". So taking effective coastal zone management as what we hope to achieve, we get on to what is required in order to achieve this goal. Again we've heard about policies today. We know that before we can do something we basically have to know what we want to do and I'm not going to labour on this. However I feel that with due respect to us all here, we don't have that policy yet. Now it's only when you have determined what your policy is - what you want to get out of your management activities - that you can go on to the next step. In other words you can only really determine your legal requirements once you've drawn up a policy. The other requirements - administrative, financial and human resources - are inextricably linked with your legal requirements. In other words, no law can work if it's not socio-politically acceptable. So that's why I say I'm being a bit theoretical. I'm not pushing law per se.

If we feel that once we have a goal and we are not managing to achieve that goal, we have to look to those requirements and identify what the short-comings are. It sounds a round-about way of going about it, but I do feel that we must be absolutely sure of ourselves, that we've identified the deficiencies within one of those requirements. In other words if something isn't happening, if the Seashore Act isn't

being applied or if too many crayfish are being taken out, or if some environmental degradation is occurring we have to look at all these four or five requirements and see whether they are being satisfied. Then if new legislation or changes to existing legislation are needed, we can go from there. I'm labouring this point because I really feel that we so often look towards changing legislation before we've actually scrutinised and worked out exactly where the deficiencies lie.

Now once we get into legislation, once we've decided that we really need that legislation, I feel that there are four basic considerations that we must go through quickly. These are constitutional context, the purpose of the legislation, the nature of the legislation and its scope.

We all know that the South African Constitution Act determines vertical responsibilities, vertical powers, and now the Act 21 of 1971, the National States Constitution Act complicates the issue a little more with the so-called Independent States, and provides yet another constitutional consideration to our environmental legislation. And of course we're going to consider yet new proposals for our constitution. That's the first thing. That's the first part of the framework as it were which we have to be absolutely aware of. The purpose of this is of course that no sub-ordinate legislation can be repugnant to superior legislation or legislation at a higher level. And it is something that we often tend to overlook in recommending changes to the legislation.

Now moving on to the next consideration - the purpose of the legislation. If we feel that we need new legislation or need to change the existing legislation, we have to concentrate on what the purpose of our legislation and other legislation is. Again I think that certain organisations are unjustly criticised for their activities because they are not environmental management orientated, their function is not environmental control, management or conservation. I think this is also where we make a mistake. Certain departments, organisations, and authorities, help to perform a function, which isn't environmen-

tally related directly. They may provide services, infrastructure, whatever. Now the Department of Community Development is a very good case in point. That Department is essentially involved in supplying a service. Now why I stress this is because that Department is also responsible for the Seashores Act, and by understanding that there is possibly a disunity of approach or purpose that one can visualise what legislation needs amendment. In addition one gets dualistic responsibilities where a single department or a single branch of the department will have two purposes, the conservation or protection of a resource and the exploitation of a resource.

Take the Marine Development Branch for example. Some people contend that it is not possible within one department or one organisation to perform both these functions adequately.

Moving on to the nature of the legislation, we find that all legislation can be divided into function specific or location specific categories. In other words the legislation that is function specific generally gives an authority or an agency a limited field of control in a very broad area. For example the Health Act empowers the appropriate department to actually control certain elements, certain activities, very very closely in a very broad area. That is why it's function specific. The next would be location specific where much wider powers are given to the authority involved but normally they are under legally closely defined areas, e.g. boards like the National Parks Board.

Why is this important? It is important because we can, or should be able to focus in our development of the legislation, what we want to get out of our management goal, and whether we are going to focus on the activities of the areas themselves. You'll see again why I stress this point. Because also, for example, we will have to know where to draw the line when we change our environmental legislation. We must know whether we can draw the line at a geographical region or draw the line at the control of certain activities.

A final major consideration is the legal scope, and this really needs no elaboration. We all know that basically there are limits to what organisations can legally go. Within the whole spectrum of legal scope, one can see that organisations can have absolute control, they can have obligatory representation, they can have indirect control or they may just have merely influence or no control at all. Again, when we go to recommendations, when the Counsel for the Environment's working group started taking into consideration what legal amendments would have to be made, we have to go through this type of process; they have to go through those considerations. To sum up the way their recommendations have been formulated, I'll go through some of the deficiencies within the legal system. An uncoordinated approach to coastal zone management has been mentioned before. What we need then, is to draft a policy to apply to the whole country. That's obvious but taking it one step further - how do you implement this policy? One problem has been that people have said that there's not adequate status to the coastal zone management authorities, where there's one or more. We are going to have to take into consideration the constitutional constraints, but within those constitutional constraints, give that authority or those authorities the highest possible power.

Then we move on to the deficiency or the perceived deficiency of having too many authorities. Again by following this procedure fairly closely we can see that we can rationalise authorities, but it has to be politically acceptable. It has to be administratively wise. We don't want to create monstrous monolithic departments that actually can't perform the task any better, and before we look at changing things, we must take into account these types of considerations. We must also accept that no one organisation can control all activities within the coastal zone because this would involve, in effect, the control of every single activity. Following on from this, by saying that we've got a policy which applies to the whole country, it is implied that we're going to try to reduce the number of authorities involved in implementing this policy. We immediately come to the problem of how we are going to implement it. This is an administra-

tive and political problem, it's a problem all the way down the line. But strictly from the legal point of view one must accept two principles. Firstly that whatever the responsibility and whatever the field, we must accept that the powers must match the responsibility. Secondly, we must also accept that if essential organisations were to acquire the overall responsibility for coastal zone management, delegation of responsibilities means basically that somebody else is doing the job, but you have to carry the can. Again with reference to the Department of Community Development I think that we can identify this as being a problem where most of the powers and terms of the Seashore Act have been delegated to local and provincial authorities. The ultimate say has been all in the hands of Community Development, and I feel that the problem of having a department like that delegating its responsibilities away often ends up by the department losing track of what its management goal is.

Finally we come to the crux of the matter, the legislation per se. In other words we've gone through the policy, we've developed a policy, we've given it status, we've assigned it to one department, we've accepted possibly that we will have to have a centralised control, and a decentralised implementation. Now what will the law look like? I think that firstly we need a single act, be it the Coastal Zone Management Act, or whatever. This Act, by nature, will have to have two parts, and this is where this whole approach comes in. It will have to have one section of the Act which gives direct control to one organisation. I don't think we can get around it because this seems an obvious way of eliminating some of the problems that we have. Now when you refer to the other considerations how does one define absolute control? I would recommend that the absolute control be location specific. In other words every single organisation will have control over a limited area, because as I said before, we cannot accept that one single organisation can have direct control over all activities. This will relate to defence, transport and other non-environmental related matters. I think that this narrowly defined area would be a coastline. It would include the seashore, the admiralty reserve and the state land, tidal waters, estuaries, coastal lakes, coastal swamps

and wetlands. In other words instead of saying this department will control a broader area, we are saying that this department will control a narrowly defined area and everything that goes in there. So in effect what you are going to create is an organisation that has the responsibility to control any activity along the coastline itself.

Then I think we go to the second stage. This second stage is the indirect responsibility and this can take it much wider. At this stage I feel we can talk about the proper coastal zone, we can talk about on the landward boundary, either a 300 foot contour, 92 metre contour, water sheds, coastal plains, preferably an ecological boundary as the terrestrial limit; the seaward limit we can take conveniently as the territorial waters or the continental shelf. But I feel now we can have some greater form of control although our scope, our actual legal power, is going to be limited over this greater area.

So to sum up, basically what I'm trying to do this afternoon is to give you an idea of an approach, which, although it is theoretical, I think is also practical. I'm trying to explain what the approach is, what our confinements or restrictions are and from here on we can deal with specifics if necessary. So it will appear that we can accept that the only way to resolve most of the legislative or legal related problems within the coastal zone is to concentrate on its small area, and give wide powers to one organisation. Then, beyond that, within a broad area you have lesser powers. This is the approach that I think the Council for the Environment is following and, as I say, this is the theoretical background that it has been using. I would really welcome specific questions because I deliberately omitted going into detail about individual acts and the application thereof, because at a conservative estimate there are 48 acts or ordinances alone that affect the coastal zone directly and there are something like 12 organisations which affect it directly. I think 99,9% of legislation in this country affects the coastal zone indirectly and probably 99,9% of organisations have something to do with it as well.

THE ROLE OF THE NATAL PARKS, GAME AND FISH PRESERVATION BOARD IN COASTAL MANAGEMENT

by M.M. BROKENSHA and N.T. SNYMAN

INTRODUCTION

For the purposes of this paper, as the field of coastal management is so vast, we have chosen to align our remarks mainly to the marine environment.

HISTORICAL

To understand fully the role of the Natal Parks Board in the conservation of the marine environment it is necessary to trace a little history of the current situation.

Management of the marine resource in Natal commenced as early as 1845 with the appointment of two inspectors employed by the harbour department under the Government of Natal.

The first law to control the marine resource was proclaimed as Law 21 in 1884, superseded subsequently by Law 18 of 1887 and eventually Law 27 of 1890.

The present Ordinance (Ordinance 15 of 1974) and its relevant legislation pertaining to Coastal Management is however largely based on Act 31 of 1906 following the appointment of Harry Colburne Smith as Principal Fisheries Officer of Natal in 1907.

Upon the formation of the Union of South Africa in 1910, the four Governments were offered the option of controlling their own conservation destiny. Natal took the option which resulted in this being included in the Constitutional Act of 1910. To this day, Natal remains the only Province with autonomy pertaining to nature conservation.

In 1912 it was decided that Harry Colburne Smith should relinquish the job of Principal Fisheries Officer as he was an officer of the Union Government and that in future, fisheries management would be considered a Provincial responsibility and the Natal Fisheries Department was then run in succession by officers Bell, Marley and Spradbrow.

In 1947 the then Administrator of Natal, Douglas Mitchell decided on the establishment of the Natal Parks Board.

In terms of Section 4(1) of Ordinance 35 of 1947, the Natal Parks, Game and Fish Preservation Board was then established and the first Principal Fisheries Officer was Len Chiazzari succeeded by the late Eric von Puttkamer and is presently the speaker.

Upon the formation of the Republic of South Africa on May 31, 1961 control of the Conservation destiny of the Province of Natal was once again awarded to Natal in terms of the Republic of South Africa Constitutional Act (No. 32 of 1961).

PRESENT MANAGEMENT

The present management of the coast of Natal is being carried out by 21 White officers of whom 18 are Zone Officers and one is the Regional Scientist and 77 Black uniformed staff.

The management priority is education of the public in the wise utilization of the marine environment and to control possible over-exploitation. These two main objectives are largely achieved by the judicious application of legislative measures which have the effect of slowing down degradation rather than halting it altogether.

Being responsible for more arrests and convictions in the Natal Parks Board than any other Division, my staff are constantly criticized for acting as police officers rather than nature conservation officers,

yet the line drawn between education and law enforcement is such a fine one that the two can hardly be separated. As a very wise Administrator of Natal, Mr Ben Havemann once said to me: "Mr Brokensha, has it ever occurred to you that sometimes the best means of education is a damn good stiff fine."

The control referred to here in terms of legislation has its limitations as well however; for the Provincial legislation only makes provision for the intertidal zone, in a strict manner of speaking, and furthermore only has bearing on fish caught and landed from the Province's shoreline. This situation has been relieved to some extent by appointing each coastal officer as a fully fledged Institute of Sea Fisheries Officer thereby affording more clout in terms of the relevant Government Act in addition to the powers conferred in terms of the Provincial Ordinance. This in effect means that staff have access to ocean-going craft and in turn some of the larger commercial operations such as trawler activities.

Whereas present management is largely the result of historical management practices, the need to base future management on research is recognised. To this end, it warrants mentioning here that for the past decade, coastal staff have already been involved in what is considered in some circles to be the best data collection system in the world.

For this purpose, our staff carry out daily rod counts and record catch statistics relating to Shad, Garrick, Blacktail, Banded Galjoen, Stone Bream, Grunter and the Natal Stumpnose. This in turn is processed by the Oceanographic Research Institute staff in order to establish catch per unit effort, time spent in securing catches and a host of other pertinent data. Other similar research is at present under consideration and thought is being given to include vehicle pressure, total resource utilization and the numbers of animals or organisms taken in relation to offences.

The need for consultation before implementing any new management measure or legislation is also fully recognised and as a result, there are a number of bodies whose findings and opinions are sought before proceeding with any new form of control via the Coastal Fishing Liaison Committee which includes representatives from virtually every institution or body concerned with the utilization of the marine resource in the Province of Natal.

Membership of this committee is by Board invitation and it includes representatives from the Natal Parks Board (including two Board members), Sea Fisheries Research Institute, Department of Sport and Recreation, Department of Environment Affairs, Natal Anti-shark Measures Board, Natal Coast Anglers Union, Natal Indian Anglers Federation, Natal Underwater Union, Oceanographic Research Institute, Natal Ski-boat Association, Zululand Angling League and the Association of North Coast Anglers. The Board has striven for consultation in all marine matters and all proposals are considered by the Coastal Fishing Liaison Committee and only then are recommendations passed to the Natal Parks Board for approval. Thereafter, if necessary, amendments to the regulations or Ordinance are sought via the Administrator in Executive Committee or the Provincial Council.

In addition to the implementation of law enforcement, staff are encouraged to involve themselves in interpreting the conservation effort and this is achieved to a great extent by public speaking, educational outings with schools, and other such similar institutions and activities. Recent management breakthroughs include the establishment of the St. Lucia and Trafalgar Marine Reserves which have already proved their worth as comparative study areas as opposed to 'open' heavily utilized areas.

In order to involve themselves on a 'first-hand' basis so to speak, five officers from this Division recently completed a sport-diver course which enables them to observe underwater activities and to submit observations and recommendations accordingly.

For no other reason than being purely statistical, it may also be worth mentioning that during the 1981 - 1982 financial year, 869 persons were charged and paid fines and admissions of guilt to the tune of R51 445,00 bearing in mind that the number of warnings with no action taken against offenders greatly exceeds the actual number of arrests. During this same period, revenue derived from coastal fishing licences amounted to R216 106,00. It is important to note at this stage that Coastal Fishing licences as well as Freshwater and Hunting licences are Provincial licences, the revenue from which accrues to the Provincial Revenue account and not the Natal Parks Board. The Board's function in respect of licences is merely that of the enforcement agency and the responsibility for the issue of licences is delegated to the Natal Fisheries Licensing Board, an autonomous body appointed by the Administrator in Executive Committee.

PROBLEMS FACING MANAGEMENT

The universal problem which nature conservation is faced with, is essentially a 'people problem', and the Coastal Fisheries section is without a shadow of a doubt the main recipient of this pressure. Staff often feel as though they are totally helpless in the face of the numbers of people which it is necessary for them to deal with. In an attempt to alleviate this situation somewhat, the Natal Parks Board introduced the Honorary Officer system which however, does not seem to have had the desired result; in fact the administration of the system has added to the zone officer's responsibilities rather than alleviating them.

The degree of specialization in poaching has also intensified of late. For example sophisticated radio communication between craft and the shore make it possible for offenders to slip staff or alternatively, to dump or to 'stash' illegal catches for collection at a more opportune moment. We work on these problems continually and we are becoming sophisticated ourselves when combating this type of problem! Some of you may have seen last Sunday's Tribune.

When involved with the management of any entity, one cannot help but be concerned about the collective impact which is brought about by pollution, development of pristine areas, industrialization and poor agricultural practices. It is to be hoped that all these related aspects and the control of them could be co-ordinated in the not too distant future.

FUTURE MANAGEMENT

Efforts are being made to assess the total impact on the marine environment in order to direct future management research accordingly. A management plan which makes provision for more seasonally-closed areas is possible here, for although it eases the task of the resource manager to some extent, history has proved that total prohibition does not always have the desired effect either.

It is also an accepted fact that interpretation will play a far greater role in the management of the coast in future, and staff are already in the process of preparing slide presentations and thought is being given to the production of programmes for television. Underwater trails are being planned and in the St. Lucia Marine Reserve, staff are also considering proposals for trails which will include the whole marine environment as an entity e.g. the dune forests, the dune formation, succession etc.

The present system requires the Natal Parks Board zone officer to be a "Jack of all trades", but the need for specialization is becoming more apparent daily. To this end, it is envisaged that staff will undergo more relevant training for the job and that from this period of training an extended course, designed specifically to qualify an officer in the field of marine conservation, may result, thereby professionalizing and enhancing the quality of management.

Increased utilization of the coastal resource is inevitable, and whereas it is possible to estimate possible population statistics for future projections, the extent of the coastline is already known as is the fact that the available resource will remain basically the same.

What is needed now, is for us, the managers, to establish the ultimate maximum carrying capacity of the resource and to ensure that a slow approach in reaching total utilization is made, and also to ensure that healthy 'nursery' areas are maintained in perpetuity. Whether it is desirable to make attempts to increase resource potential is debatable; but the least which is required, is to ensure continued availability, and to this end it will be necessary to legislate for the conservation of some species in the near future, as it will be too late to close the stable door when the proverbial horse has bolted!

In the face of the rapid expansion of the population, it is also imperative that the difference between managing towards pure recreation and conservation is clearly understood, for whereas it is inevitable that more resort-type facilities will have to be established, it will also be vital to establish conservation areas in which the aesthetic aspects are catered for and that the pristine 'wilderness' concept is included which ought to preclude any development and very little, if any, utilization.

In a country where dynamic progress is the norm, it is also apparent that it often takes no less than a calamity before remedial action is taken. If the Natal Parks Board can plan and as a result can CONTROL the utilization of the coastal or marine resource, then that is the role of the Board in Coastal Management.

CADASTRAL BOUNDARIES IN THE COASTAL ZONE

by R. WEST

Your interest in the boundaries of a property will probably have arisen because you require to know who the owner of that property is, or perhaps of the adjoining property. You may intend leasing, purchasing or expropriating the land, or you may wish merely to control its use. But in all cases, in order to establish ownership of a particular property, we have to identify it and ascertain where its boundaries are on the ground. If you have a problem doing this, you call in the expert - the land surveyor. In this address, I shall attempt to tell you how a land surveyor will, or should, go about this task, and why he does what he does.

If the boundaries are straight lines defined by beacons, a land surveyor can relocate or replace the beacons pretty accurately and without too much trouble, basing his survey on the co-ordinates of the national grid (i.e. trig. beacons), or on beacons of other properties in the vicinity.

In the coastal area however we are frequently faced with what we call irregular, or curvilinear boundaries. Here it is a completely different story, because such boundaries are often ill-defined, they are not static, and are frequently difficult to determine. I say not static because sea and river boundaries change gradually by the process of accretion or decretion. The action of the water of a river may gradually wear away soil from one bank and deposit it at some other place, and the same can happen with the sea. In both cases, the legal boundary of the property is changed.

This is known as the doctrine of alluvium, or gradual imperceptible change, and is accepted in most countries of the world. It is referred to in several Supreme Court cases concerning boundaries.

It is not however this gradual change to, say, the high-water mark of the sea, or to the bank of a river, that gives rise to difficulties, but other factors which I shall come back to later.

In the coastal zone, the two main types of curvilinear boundary are the sea boundary and the river boundary. When dealing with any irregular boundary, we require to know two things about the boundary before it can be surveyed. Firstly, we must determine WHAT the boundary is, and secondly WHERE it is on the ground.

Let us consider the case of a property bounded by the sea. In order to determine what the boundary is, we must examine both the diagram and the deed of grant of the land. From these documents we establish whether the boundary is the high-water mark of the sea, or a line at a distance from and parallel to the high-water mark (i.e. whether or not there is an Admiralty (or Government) Reserve, as it is called in Natal), or perhaps even a straight line boundary. I say high-water mark, although one will seldom find any reference thereto in the documents mentioned. But we have a Supreme Court ruling in this regard (known to us as the Lovemore Case) which states that any description such as "bounded by the sea", or "by the ocean", or "extending to the seashore", or any similar description, shall mean the high-water mark.

It is also necessary to examine both title deed and diagram, because frequently one or the other is not clear and unambiguous, and they may also differ from one another. When this latter is the case, the position is that the wording of the grant, if unambiguous, takes precedence over that on the diagram. Here too, we have Supreme Court rulings on this point; the Courts holding that it is the deed that describes what was granted, and the diagram is merely a supporting picture. Disagreement between deed and diagram is however only encountered in the older registrations - for the past 50 or more years the boundaries of properties have not been described in the deed, which merely refers to the diagram, in this regard. This Court ruling has particular influence on any decision as to whether or not the seaward boundary of a Natal property is the high-water mark itself, or a line 150 feet from this line. In other words, whether or not there is an Admiralty Reserve. The depiction of the reserve on a diagram is thus not conclusive evidence of its existence. Once having decided what the boundary is, it is now necessary to determine where the high-water mark is on the ground. Obviously one cannot simply go

down to the beach after the next high tide and have a look! High tides vary far too much from week to week, and depend also on the time of year, the weather conditions, the slope of the land, the existence of sandbars, and other such factors.

One can appreciate that there have been many disputes as to what constitutes the high-water mark boundary and some Court cases on the subject, which latter lead to the high-water mark being defined in the Sea-Shore Act of 1935 as -

> "The highest line reached by the water
> of the sea during ordinary storms occurring
> during the most stormy period of the year,
> excluding exceptional or abnormal floods."

A land surveyor cannot of course wait for the "most stormy period of the year" and "an ordinary storm" to occur before doing his survey! He has to interpret the definition as best he can, and what he does in practice is examine the terrain carefully (especially as regards vegetation) and questions the local fishermen and inhabitants of long standing before deciding on the line to survey.

It may not of course end there!

I spoke earlier of certain changes to curvilinear boundaries that cause difficulties. The high-water mark of the sea may be altered considerably by the activities of man, such as the building of bridges, jetties or groynes, or by sandwinning. These activities may change the de facto position of the high-water mark, but do not affect the de jure (i.e. the legal) position. Legally, and here again we can rely on decided Supreme Court cases (one of which is the 1933 Karim Case in Durban Bay), the high-water mark boundary is where the feature would have been had there been no interference by man.

It is all very well to have such a definite ruling, but it does more to complicate the issue than to resolve it! However, it must be borne in mind that a survey or a re-survey of a high-water mark boundary is usually for the purpose of determining the area of the land for quoting on a diagram, and such depiction of the boundary by a land surveyor does not mean that the boundary is now fixed. Just as it moved by accretion or decretion before the survey, so can it continue to move after the survey.

The only way to prevent movement of the boundary is to have it lawfully established. This can be done in terms of the provisions of the Sea-Shore Act, by substituting a boundary of another kind, such as fixed straight lines defined by beacons, or perhaps some permanent structure such as a sea-wall. The new boundary must be surveyed and an agreement signed by the owners of the properties concerned. This substitution and establishment of the boundary can be done whether the line is the high-water mark itself or a line parallel to it.

I have not specifically mentioned the sea-shore, which is defined as the water and the land between high- and low-water mark, but this is of course of great importance to environmentalists. The sea-shore is controlled through the Sea-Shore Act, and, except for those portions that have been granted to certain local authorities, is owned by the State President (not the State itself).

Let us leave the sea now, and have a look at river boundaries.

Once again we begin with the question of "what is the boundary?" And in the coastal area, this will normally be "the middle of a river", or "the bank of a river", or "the high-water mark", or "edge of lagoon". The diagram may however have a vague boundary description such as "bounded by the river". Once more we have a Supreme Court Case (1917 : Carter or De Bad Case) wherein it was laid down that generally such description shall be taken to be "middle of river". As a result of this court case, the Land Survey Act was amended a few years ago so that a property described as being "bounded by the river" shall be deemed to extend to the middle of the river unless there is acceptable evidence to the contrary, or unless the river is tidal.

Tidal rivers and lagoons have to be examined very carefully as in many cases these have been excluded from the original grants, and are claimed as forming part of the sea.

Fortunately in most cases we find that it is reasonably easy to establish what the boundary is, but as in the case of the sea, determining where it is on the ground is another story.

The middle of a river is not necessarily in the main water channel, or even where the water flows. Based on a Supreme Court Case (known as the Riverton Case of 1921), the Survey Regulations define the middle of a river as "the line midway between the banks". Therefore it becomes necessary to determine where the banks of the river are, and this is where you can often run into difficulties. Many of our rivers have two or even three banks on one or both sides, at different levels, or perhaps no well-defined bank at all. This is especially so in the areas in which you are particularly interested - near the estuaries, and where there are flood plains. The Riverton Case comes to our aid in this matter - to a certain extent - by laying down the rule that the banks of a river are defined by "the highest line reached by ordinary seasonal floods". I stress the word ordinary, and this is important, because exceptional floods or storms must be disregarded. As mentioned before, the banks of a river, and thus also the middle, are not static, but are subject to movement by accretion or decretion. As in the case of the high-water mark of the sea, we have to ignore changes to the banks of the river that have been brought about by sudden movement or the inevitable activities of man - sand-winning, bridge abutments, reclamation.

In the absence of any evidence of such changes, the land surveyor will rely on information obtained from the locals where there is any doubt as to what line can be considered to be the bank, bearing the given definition in mind. Should there be evidence of any unnatural change in the river bank of course, he will have to rely on aerial photographs or any previous surveys of the river that had been carried out before such interference with nature.

I obviously have not touched on all the aspects and variations that could be encountered, but hopefully have been able to show that there is no simple or general solution to the problem. Each case must be treated on its merits, along the mentioned guidelines, and it may even be necessary to go to Court in some instances.

Can you wonder that we land surveyors prefer straight line boundaries!

WASTE DISPOSAL

by R. LOMBARD

It is quite interesting to hear all the different views that we've had expressed here during the course of the day and I would like to present a little bit of a plug for our Institute, the Institute of Solid Waste Management. In fact, hopefully, by the time I have finished talking you might have some inkling that we are a multi-disciplinary organisation, that we strive to embody everything that the enviro-nuts wish to see embodied and that we are working for high standards in the management of waste disposal in South Africa.

We are very much concerned with the question of environment conservation. We work closely with the Departments of Environment Affairs and Health. Lastly - and this is the plug - we definitely need your support. There are many local authorities, particularly those in the coastal zone of Natal who are not supporting the Institute of Solid Waste Management. Ladies and gentlemen I would ask you to give that your very serious consideration.

The disposal of waste is a vast field and time does not permit me to go into the details that are involved. In fact we could hold a week long seminar on the subject.

During discussion, Mr Pistorius mentioned the question of toxic and hazardous waste. There are also things called notifiable waste and these are all the other types of waste that are unacceptable to sewers for one reason or another. Generally they give the waste water manager a problem at the sewerage works. There are industrial wastes, commercial wastes, and domestic wastes. We are going to dwell on those last three because the previous two are highly specialised and I think might not be of sufficient interest to the group present here.

There are many different ways of dealing with waste. We are talking about dry waste, the solid waste, and the liquid waste which are acceptable to Class II Sites. We can incinerate waste but the field is unfotuantely littered with failures. Many people have attempted to incinerate waste. It creates more problems than it solves. You can go the low technology route which historically speaking is basically what a lot of people have been practising. This consists of open burning or burning under uncontrolled conditions and really what you are doing is you are taking the pollution from one phase, the solid phase, and you are converting it into another phase which is the gaseous phase. This creates widespread problems indeed because who knows where the wind blows? High technology is very expensive and again, if it is not managed correctly you can end up with an air pollution problem. I might add that there is the question of waste derived fuel. There have been many experiments. The Americans spent many millions of dollars on pilot plants for waste derived fuel and refuse derived fuel. None of these has proved particularly successful. In these cases you are looking for alternatives to coal or perhaps oil, consequently the economics may not be attractive in South Africa.

There is always a residue after you have incinerated waste because it is not an ultimate disposal method rather it is a volume reduction method. The residue will require disposal.

You can compost waste but again there are intrinsic problems. If you compost wastes as some of the smaller boroughs down in the Western Cape do (and they have a ready market for it in the winelands in the Cape), the cost is about R25 a ton to produce the material, but the market value is considerably less. The ratepayer is expected to subsidise the production of the compost. Again not everything is compostable; all the plastic bags, tin cans, etc., require some alternate form of disposal.

You can recycle. This is resource recovery as the Americans call it. There is a low technology element which involves the traditional scrap

metal, paper collection, plastic collection, glass collection, etc. There is also a high technology side, for instance the recycling of human faeces through a process of drying and irradiation to eliminate all the pathogenic organisms that may be present, and feeding this to cattle. Cattle are, of course, walking anaerobic digesters so you can get meat back from them and you can get fertiliser out the other end. That's high technology! You can recycle blood and fat from abattoir effluents avoiding expensive anaerobic degradation or acivated sludge treatment. We understand that blood meal is valued at between R300 and R500 a ton depending on the state of the protein market. We know that there is a universal shortage of protein particularly for animal feeds. Obviously many of these are still in the experimental phase but there is one plant operating already in the Transvaal which produces blood meal from abattoir effluent.

And then you get landfill. We are going to talk about sanitary landfill and not the other kind of landfill. I will show you what happens when you do the other kind of landfill which is what we call "Sport". It is largely due to ignorance that people have this situation and "Sport" stands for the "Sommer press on regardless technique".

Constituent	Leachate	Raw Sewage
pH	4,9 - 8,4	6,8 - 7,5
C.O.D.	246 - 750000	72 - 1500
Cl^-	116 - 2096	30 - 79
Nitrogen	0,2 - 1106	1,6 - 33
Cd^{2+}	0,003 - 17,0	0,004 - 0,016
Cr^{3+}/Cr^{6+}	0,03 - 0,18	0,05 - 0,13
Cu^{2+}	0,03 - 0,75	0,03 - 0,11
Fe^{2+}/Fe^{3+}	2,0 - 1000	0,35 - 5,6

Table 1. Leachate & Raw Sewage Values
(Results in mgl^{-1})

If you practise "Sport" you have this kind of situation. I have a comparison for you between leachate and raw sewage - none of us would like to have raw sewage in our drinking water (Table 1). If you have a look at what you have got in leachates, I am sure you will agree with me you certainly don't want leachate in your drinking water. Leachate, can be 200 to 300 times more polluting than raw sewage.

Look at the chemical oxygen demand, using a potassium dichromate titration, you can see that leachates can have a COD value of 750 ppm. Sewage is considerably less, I think you will agree with me.

What you must understand about these leachates is that they are concentrated, but have a very low flow rate, provided the disposal site has been correctly selected and operated responsibly. The other problem associated with leachates is heavy metals. Look at cadmium, it is a very bad metallic contaminant in water because it's difficult to remove. Copper in fact has a lower toxic threshold for aquatic life than even cyanide, but everybody gets very excited about cyanide.

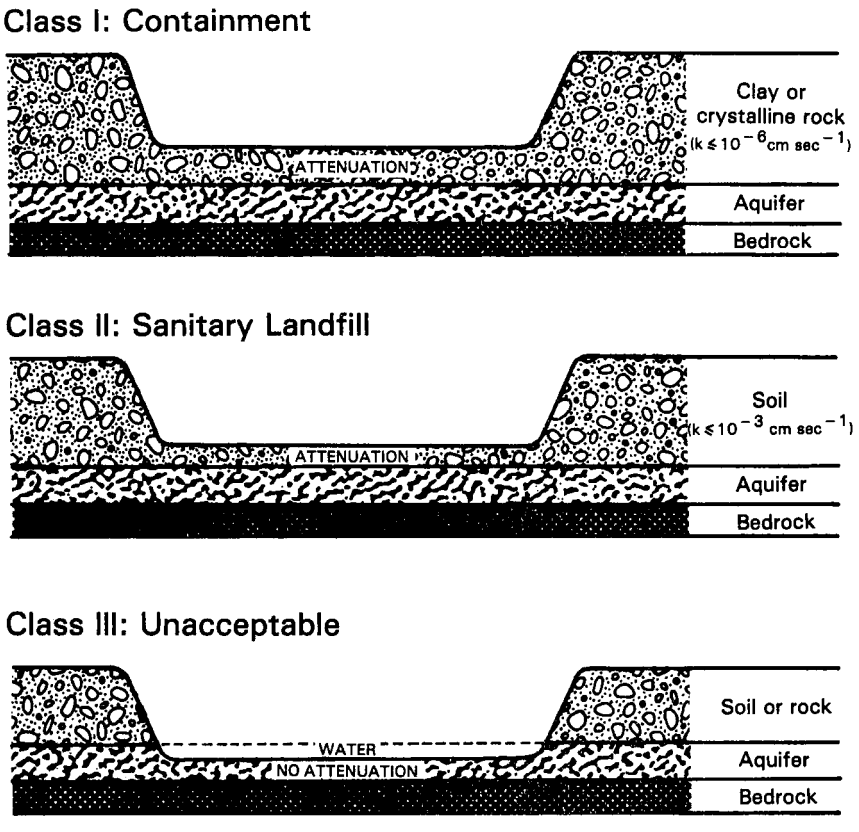


Figure 1

So what can one do to try and circumvent this problem? We have got to figure out how to manage the leachate. I think you can understand that we are talking about a pragmatic approach to the problem of waste disposal and water pollution.

For the very nasty wastes we have a Class I site - that's a containment site (Fig. 1). The substratum above the aquifer is normally selected as being of impermeable material - either a crystalline rock formation, or clay (permeability of the order of 10^{-6}cm/sec) which means that leachate moves through the substratum to the aquifer at the rate of millimetres per annum. That's slow as you will appreciate.

The next type of landfill site is what we call a Class II disposal site. This is acceptable for most toxic and hazardous materials. I think you must understand intrinsically that a lot of these toxic materials can be treated with a Class II disposal site. You must also bear in mind that a Class I disposal site is as scarce as a hen's tooth and if you find one it is very difficult to get it passed by our brethren in the Department of Environment Affairs - Water Pollution Division.

Class II sites also have an attenuation zone but this is a lot thinner (see the figure) and the water table is a lot closer to the base of the disposal site. Attenuation also takes place - I will deal with the various attenuation mechanisms shortly.

The attenuation zone helps to ameliorate the impact of any leachate that might develop in the site before it hits the water table and pollutes the ground water.

And then we have the sort of "press-on-regardless" technique situation at the Class III disposal site which is unacceptable. It is unacceptable because this is the site that leads to major leachate development. In fact the disposal of waste directly into water - such as estuaries, wetlands, or quarries with hydrological continuity with the water table is unacceptable. One must be very careful about this because there are a lot of quarries available in Natal, but in general these quarries never have a dry zone above the aquifer, if you put waste in there you create a long term environmental problem - leachate.

The other problem you have to consider is the 20-year flood line. The new regulations that are being promulgated at the moment deal extensively with this matter. Waste disposal sites cannot be within a 20-year flood line of any watercourse. Likewise also, the presence of a water course must be clearly delineated. So how does one go about solving this problem? The best way is to have a look at the geology of the site because the geology intrinsically influences the attenuation factors that you might find present in the landfill site. Attenuation depends largely on the geo-chemical make-up of the soil and of the rocks that underly the disposal site.

You must consider the wet season water table level because that is going to be important. Even if you are on a seemingly dry disposal site the wet season may be such that the water table can intersect with the base of the disposal site and come into contact with the refuse. As a result of that you may have a serious leachate problem.

If you are restricted to operating in valleys as we are in most parts of Natal you have to design and engineer the disposal site so that you minimise the flow of water due to run-off into that landfill site. I think you must all remember that apart from recent history in Natal, generally the equation of precipitation minus evapotranspiration is positive. This means that we supposedly have a surplus of water which is going to run-off and get into that waste disposal site. And if you do have that situation, you have to make amends by designing and engineering a site, correctly, from the beginning so that if any leachate does develop you can collect and monitor it. It is possible to monitor the quality of that water and understand exactly what it is that you are doing to the environment. And if necessary you can take remedial measures to deal with that leachate.

Now a word about the attenuation factors I mentioned earlier on. Consider the geological substrata beneath the disposal site; filtration, dilution and dispersion take place. Dilution and dispersion is the fundamental philosophy governing the state of the art in waste disposal, as we understand it at the present moment. I am not saying that it may be ultimately correct but that it is currently what is being applied. In South Africa we are going to apply the British code

of practice to the disposal of waste. It has been the most pragmatic code of conduct drawn up anywhere in the world and their regulations have been a lot easier to monitor and apply from the point of view of the governing bodies concerned.

Then there are biological factors which act in attenuation of leachage by bio-degradation through the activity of soil microbes. The growth of the bacteria colonies themselves seems to diminish the pore size and enhance the filtration of the leachate through the material underneath the disposal site. The geochemical factors assist attenuation as well depending on the nature of the material coming through and the composition of the substrata.

There are acid base reactions, redox reactions, precipitation reactions, ion exchange reactions, adsorption and absorption. So we have a lot in our favour to protect the disposal site but bear in mind that this presupposes that you have selected the disposal site which is adequate with respect to those particular factors.

Notwithstanding the attenuation inherent in the geology of the site there is the attenuation that occurs within the refuse itself. Physically, capillarity forces tend to hold the leachate up. Provided the driving head doesn't exceed the capillarity, you will not get a leachate. Biological factors are obviously important in the refuse. The reason refuse smells is because there are bugs active in it, breaking down whatever is present in the refuse. As a result of their activity you have some aerobic and anaerobic activity. I would say the aerobic activity is severely restricted due to the fact that when you seal a working face with more refuse or soil, it rapidly loses its oxygen, because of the activity of the aerobes. So you have a lot of anaerobic activity which means the production of carbyoxylic acids which are apt to complex with some of the heavy metals that were shown you in the leachate in Table 1. And again of course you have a whole host of chemical reactions including many similar to those found in the substrata beneath the disposal site.

If you engineer the disposal site correctly, and you are running it to a reasonably high standard, you can remain very close to standard water conditions in the leachate.

In order to monitor the ground water one establishes a series of piezometers below the disposal site. These are boreholes from which you can draw ground water samples for analysis.

But unfortunately "the best laid plans of mice and men gang aft agley" as Robbie Burns said. If you have unseasonably high rainfall, that is, heavy rain in a very short period of time, such as nine inches of rain in a few hours the site will leach anyway! In Table 2 one can see what happens. Just look at the COD; fourteen fold increase. Suddenly you have got a whole lot of chloride coming through. You might say that's not that serious because you are close to the coast. We are in the coastal zone, but if one goes to the Transvaal the same situation could pertain, and that might not be such a comfortable idea particularly in the Vaal system where the salinity is rising alarmingly anyway. Nitrogen starts coming through and heavy metals appear in the leachate. Now that's the leachate developing as a result of very high rainfall, in a very short period of time. It is necessary to engineer a disposal site to control that situation. You must accept that if you agree to pragmatic standards in the management of disposal sites this will happen from time to time.

Constituent	August 1981	October 1981
pH	7,0	6,9
C.O.D.	100	1400
Cl^-	284	2769
Nitrogen	0,9	75
Cd^{++}	-	$<0,1$
Cr^{3+}/Cr^{6+}	-	-
Cu^{2+}	-	0,7
Fe^{2+}/Fe^{3+}	-	15,5

Table 2. Leachate Development as a Result of Heavy Rain. (Results in mgl^{-1}).

But you can plan for this by taking into account things such as the absorbtive capacity of the waste. The average rate of liquid ingress should not exceed fifty percent of the absorptive capacity of the waste itself, which means you minimise the open area that you are working on, at any time, so that the minimum amount of waste is exposed to the heavy rainfall. Now the people who are involved in the industry know that this approach is difficult and almost impossible to achieve. You must slow the migration of the leachate from the disposal site. How do you do that? You can do it by using french drains, you can do it by cascades, there are many methods that can be employed to slow down the rate of migration of the leachates. But remember the philosophy is dilute and disperse! The slower you get the leachate to move through the environment the greater the dispersion and dilution. The more time the microbes have to metabolise the various components, the greater this effect. The situation is not as bleak as it might seem. You can re-circulate the leachate and good results are achievable. You can line the disposal site and try and stop anything from coming out of it altogether. In other words create an artificial Class I disposal site. Unfortunately work that has been done overseas has yielded results that have proved to be mixed blessings. In some cases the material has proved to be satisfactory for a relatively short period of time but there has always been the problem of failure.

Liners will never compensate for poor geological or hydrogeological conditions.

If the site is chosen with the correct geology, you tend to have the possibility of environment recuperation.

Remember that a waste disposal site is a short-term phenomenon in the environment. It is not a pretty thing while you are operating it - in fact it doesn't look all that good, but it doesn't have to stink. If you have designed and engineered the thing correctly, when you have finished with it you needn't have a blot on the landscape for ever and a day.

That leads to site closure because having finished the waste disposal operation, brought the site up to the level that it was designed and planned for, you must seal the site in such a way as to minimise any leachates that may develop thereafter. This would also involve re-vegetating the kind of material that you have applied as final cover in order to prevent erosion, which as you know can enlarge cracks and allow water to enter the fill, and then of course the leachate syndrome starts all over again.

I promised you I would say something about recirculation. Some very interesting results were achieved in 1980. Two gentlemen by the names of Pohland and Kang at the George Institute of Technology used other kinds of experimental units called lysimeters which are special models of waste disposal sites and they recirculated leachates through them.

The results that they recorded were very promising and we have actually managed to duplicate those results in practice. If you do not recirculate this is what happens to leachates (Figure 2). You can see this graph approaches zero asymptotically, which means that the site is going to leach into infinity. I don't know how long that is - you can think about that.

Pohland's and Kang's Findings on Recirculation Leachates

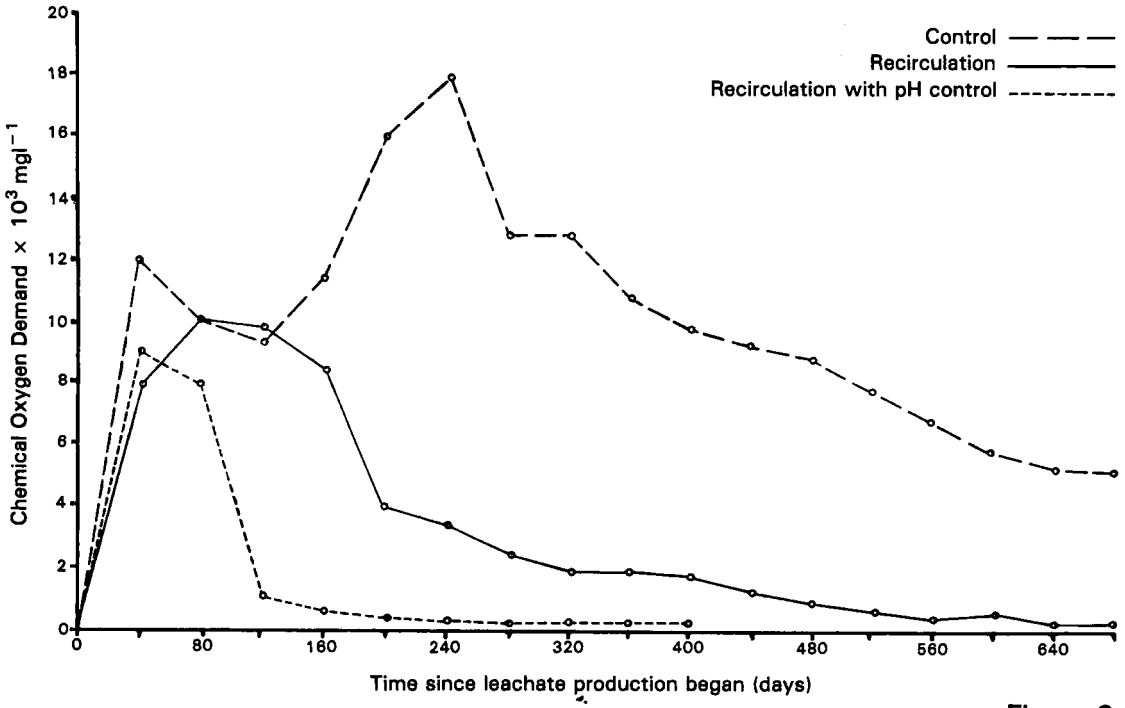


Figure 2

If you just simply recirculate, in other words capture the leachate in some form of collection sump, and spray it back on the landfill site, this is what happens. You can see that you get down to something which is reasonably acceptable very much more rapidly. If you recirculate the leachates derived from domestic waste, and adjust the pH the results are even better. Domestic waste tends to produce low pH leachates, whereas the alkaline pH derived from pH correction will favour the soil microbes that are breaking down the leachate.

Now we have gone a step further. We are actually growing grass on the landfill on an experimental basis to prove that there is nothing intrinsically toxic in the leachate. The grass grows well!

If we are going to ensure that there is nothing toxic in the waste that you are handling, you have got to do some hard thinking about acceptable and unacceptable wastes, particularly with industrial wastes where you are going to have this problem. Try to understand exactly what processes the raw materials undergo, the by-products and the types of waste that are produced. Through laboratory analyses one can pick out which route that waste must follow and the form of treatment required to render it suitable for disposal in a landfill site of one form or another.

If you are going to do that, that presupposes that you have some knowledge of waste treatment processes that you can apply.

You can handle a lot of problem materials with simple inorganic treatment; for instance the acids and alkalis, heavy metals, cyanides, redox compounds, or acid oil waste solutions. You can recycle what the law requires; for instance recycle as many petroleum derived wastes as possible. That which you can't recycle you can fix chemically. That means bonding it onto some substance and therefore rendering it safe for disposal.

For the very nasty things, and these are mostly the toxic organics, in other words those that have a long environmental life (for example DDT), you can encapsulate. This has been generally proved to be cheaper than incineration, but you can also incinerate these materials in purpose built incinerators. If you are doing all of that, then you must obviously be monitoring and controlling what is going on in your disposal site. This involves a data sheet for every notifiable waste. All those hazardous and toxic materials are notifiable waste as well! Laboratory analyses of the materials that you are handling, routine analyses of the waste, is really just an inspection to make sure that what you agreed to receive, is in fact that. Having given permission to someone to dispose of his waste on your disposal site you want to make sure that he is not going to give you a "Micky Finn", because, that is going to bring the Pollution Control Division down on your neck. The ground water has to be monitored because again they ask to see those results and they are rather particular about what they might find.

You have to keep records of the volume of the waste that you are handling this is all part of monitoring and control.

And lastly, if there are any exclusions to the waste that you are going to handle, you have to rigorously adhere to the exclusions. If you make exceptions you can find those exceptions become the rule and you will have very serious problems environmentally.

THE SITUATION AS SEEN BY LOCAL AUTHORITIES

by C. WILKINS

I'd like to start off with the Umzimkulu River. The Umzimkulu is 319 kilometres long and I'd just like to mention the problems that we have there. I'm on the Water Board, Water Corporation, and one of the tributaries is the Umzimkulwana. There is a dam there that is just about silted full, with hardly any storage space left. I became involved in this Umzimkulu River some years ago when they started what they call a tube race. We used to go about 25 miles up the river and get into tubes and make our way down to the sea. Now this sounds all very well, but by the time that I got to the coast I was stinking to high heaven. You've no idea of the pollution in this river, yet we in local authorities are told to keep our towns clean and look after the towns. But the pollution starts at the top of the river and we have no control of that. I was hoping that somewhere along the line there would be liaison between local government and central government to stop pollution upstream.

I was involved in the controversy when they built the Lime Company link. There was an argument about where the road was going to go to the Country Club and I was drawn in to chair a meeting when we had a Lions Club there. The Country Club, and the Umtentweni local authority all had their go at each other. I phoned Mr Pistorius, - I think he was a member. "Would you like to be an arbitrator in this lot?" He accepted. Well I tried to steer this meeting our way and they wouldn't accept that. The argument that we had thrown at us was "Don't confuse us with the facts, let's get on with the job." In the end we settled it I think as satisfactorily as can be.

We have cane on the banks of this river, we have all sorts of activities, we have fishing, we have the sandspit.

The next one I'd like to talk about is the Mbango lagoon. The river is about 8 kilometres long. Now right at the bottom of the Mbango lagoon there are 8 shops, a garage, a rubbish dump, and sportsfields.

The next one is the Boboyi lagoon. Quite unspoilt in many ways but there is a big rubbish dump there as well, on the side of the river.

The next one is the Izotsha lagoon and river which is 16 kilometres long. This is at Shelly Beach and when we were an amalgamated authority we had problems there; people wanted to put all sorts of things on the river and we said "No". I think, as Mr Pistorius pointed out, there was a marriage of four local authorities and one of the big things that caused the divorce was the conflicting interests of different people. And the environment was one of the big things that we differed on. There were some people who wanted all sorts of activities on the beaches, go-karts, you name it, and some who wanted the place to stay the same.

The next one is the Mhlangeni at my home town, St. Michaels-on-Sea, where there's a golf course, and a reed swamp. Now this is where we start getting into trouble, because I can show you a press cutting here when the Uvongo Council turned down a scheme to put water slides and all sorts of things on our beaches. When Uvongo rejected a R300 000 scheme they called us stupid, and that we were against progress. I think the word that has been most prostituted in the English language is the word "progress". They don't even know what it means any more. Fortunately for us we take the people of Uvongo along with us, and the support we have had from the public is incredible. We shall stick to our guns; we don't want this sort of activity on our beaches - we believe that the beaches are there for everybody to enjoy. You know, these people come with these fancy schemes, and say that they provide an amenity for the people. But we have an amenity! We have the sea there and that is what brings the people there. We're not saying you can't have a water slide. We've got I think 25 hectares and we said "You can put your slide there". Then they say, "But there're no people there!"

The next river we come to is the Uvongo River which is very dear to me and which is about 16 kilometres long. The only little problem we have, is a stone quarry up the river. We had a few brushes with the man there who runs it, but he saw our way. Formerly they put all the slimes into the river, but now it is working very well and it is a public relations exercise which has been very successful.

I felt many years ago so strongly about this river that I produced a booklet called "Uvongo River Reserves, A Wildlife Guidebook". In it there are articles by T.C. Robertson and other important people - Dr Wager, and I think Professor Gevers. I had hoped to bring some of these books with me today but something went wrong along the road. However, Mr Bromley here has promised to send these little books out to you people if you're interested. What we do normally is to sell them not at R20 a time, but only 50c, and the money we collect for these books we use in the preservation of our environment. We are not selling these books to you. We in Uvongo will donate them to any of the public here. Anybody who would like a copy can have one for free.

I'd like to read a press report here about the Uvongo lagoon. A lot of you know about it, that "the Uvongo Council tends to tighten up restrictions on the Uvongo lagoon and surrounding cliff areas to ensure more effectively the preservation of natural beauty. It has given notice of its proposal to amend the town planning scheme by rezoning that area, portion of the remainder of Lot 155, from 'amenity reserve' to 'conservation reserve'. The designation 'amenity reserve' provides for the development for amenity purposes, prime consideration being the conservation of natural flora and fauna and protection of water courses". I know our town planning department will give us 100% support in this project. We're doing this because we feel that this lovely little area must be preserved for all time.

The next one I want to talk about is the Kongweni lagoon which is in Margate and I feel that although it is not in my town at the moment I'm closely involved with it.

We got involved with this because of what happened over the years. They spoilt the bed of the river by throwing rocks in, and they built a swimming pool - an olympic size swimming pool - on the beach! This swimming pool was a big problem. I can remember saying at a public meeting - and it was eventually reported in the press - "Building a swimming pool on the beach is like putting a zoo in the Kruger National Park". And it's true. The people come to the sea. Do you think a man in Jo'burg picks up the paper and says "They've got an olympic size swimming pool down on the coast; let's go and spend a holiday there?" They come to the sea, so I don't think we want to compete with the big cities. The next thing that happened is that high rise buildings went up on sand dunes there. They're contravening the town planning regulations, but I can tell you when you end up in the high court in Maritzburg you haven't got anybody with you, you're flying solo. And when you talk to the Town Planning people, they start polishing their glasses.

So we end up with the legal blokes, and they don't argue good or bad, they just argue technicalities.

So I went along to these people, to the developers, and said to them "You know, you've broken the law". So they agreed to consolidate the plots and we got the correct F.A.R. We still have the eleven storey building there though.

The next thing that happened was that the river came down in flood. We had 7 inches of rain in one night, and you can't believe what happened. The river took its old course through the bowling greens, and ended up, almost one metre away from this huge high rise building - which was soon to be sold on sectional title!

So I took the bull by the horns and went to Cape Town and saw someone from the Department of Agriculture and Land Tenure. I said "Man, you know you've leased this - don't you want it back?" Now on this lot you've got go-karts, you've got hurdy-gurdies you name it, you've got it on the beachfront there. That's all very well, you can lease the

stuff out to people and get rent from it, but you know the Central Government is taking half of this lot before you even start. So I don't think that's a proposition, and that's why in Uvongo we are very jealous of our beachfront. We don't believe in all this, and are very fortunate that we get the support of the public. I think it's a public relations exercise, and I think we must take the public with us. If we are honest with the public we will get their support.

I've got on my notes here the two p's : pollution and progress. Pollution is a problem. I saw a slide just now with all those tins and things that you saw. Nowadays, when archaeologists dig up civilisations of 2000 years ago, they find beautiful stone things. Mr Chairman, ladies and gentlemen, in 2000 years time they will dig up our civilisation. What are they going to find? I think tea bags and jubu cans. I honestly believe that together we should do something about this question of beer cans. I brought this up at a conference recently and got no response, but if a deposit was paid on every can, I think this would go a long way towards solving the problem. You don't see any litre Coke bottles lying around, because it's currency. It's worth money. But the carton and the plastic bag are worth nothing, so if a deposit had to be paid on all these goods we could stop all this nonsense.

We have just embarked in Uvongo on a very exciting project which is what we call a regional sewerage scheme. We are going to do the reticulation, and the water corporation is going to do the disposal and purification. Years ago this scheme was put forward by the Province and I supported it at that stage, but I was treated as if I had smallpox or something. Well it has come to fruition and we are the first local authority down there to adopt this. It's going to be a long uphill battle but we've taken the public with us; I think it's going to cost us money but I think in the end we are going to win.

You know we are experiencing a high rate of development, unprecedented in the history of our area, and we have all sorts of pressures put on

us, so I'd like the town planning department to give us support when we have these problems. Like when we have people breaking the law on town planning and exceeding floor area ratio, and so forth. As I've said earlier, when you end up in the high court you're on your own and you're not arguing right or wrong, you're just arguing technicalities. I'd like to see stricter control over this type of breach of the law. Ladies and gentlemen I feel this coast that has been given to us is not ours. We are just the custodians. We are just looking after it, and we have to hand it over to our children, so I think its our responsibility that we hand it over as pure and unsullied to our children as we got it. And I have here an SOS : "Save our Soil" and "Save our Sea". This is very important.

I put a thought to all you fellows with your degrees. You know we talked about the fish life this morning. I'm not a fisherman but there is a decrease in the fish life in our rivers and sea. I've often thought that with all these cane fields and farming activities, where all sorts of chemicals are applied, all these chemicals leach out into the sea and I wonder if this doesn't have some effect on the fish life and ecosystems in those areas. I've seen people using insecticides to kill the grass, and in the Cape I've seen the roads department spray the grass with these insecticides. Then comes the rain and all the stuff leaches out into the vineyards. Whole vineyards have died and I think there should be some control over that. I haven't got my facts, but I was wondering whether this whole question could be looked into.

Now we've been called in effect "Stoppers of Progress". What you do on our lagoons, and what we want to encourage are such things as boating, windsurfing and those activities that go with the sea. We don't want to see all these hurdy-gurdies. You know, ladies and gentlemen, we live in a plastic world today. You know we even eat and drink plastic food today. I want to try and offer a natural environment to the people who come on holiday. You can't tell me that somebody coming from Hillbrow or living in high rise buildings like cows in a battery system want to come back to that building. They want to breathe fresh air.

Mr Chairman I think that is all I have to say. I'll be glad to answer any questions. I want to make it quite clear that I'm not speaking officially on behalf of the local authorities but the local authorities do have a problem.

We are the lowest tier of government. We have more rocks thrown at us because the people can get at us. We're in town everyday. We are not like the politicians who live in Pretoria and Cape Town where you can't get at them. Everyday we meet our ratepayers and they are all having a go at us. Our idea is to take the people into our confidence, explain to them, and in that way we will get their support.

Thank you.

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