FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI, NIGERIA
INSTITUTE OF EROSION STUDIES (IES)

PROCEEDINGS

1ST OF THE INTERNATIONAL TRAINING WORKSHOP

ON

EFFECTIVE WATERSHED MANAGEMENT FOR ENVIRONMENTAL HAZARD CONTROL/ MITIGATION IN NIGERIA

DATE: 8TH-10TH FEBRUARY, 2016

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BASIC CONSIDERATIONS IN WATERSHED PLANNING AND MANAGEMENT

PRESENTED

BY

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AT THE FIRST

INTERNATIONAL WATERSHED MANAGEMENT WORKSHOP OF EROSION STUDIES

ABSTRACT

Watershed Management Strategy is a work plan design to achieve a long term sustainable ecosystem balance within a watershed. It could exist as a master plan, blueprint, policy of action and scheme. It is aimed at defining watershed status and identifying specific problems that will determine actions and solutions path. It must as well define goal, set guidelines for implementation and establish a mechanism for monitoring and evaluation. This paper presents practices that could be geared towards the preservation of suitable existing land use practices, and to overcome identified problems or restore conditions to desired environmental level. The basic tasks and strategy for and effective strategy are also highlighted and pilot projects that have been executed to test their efficacy.

OUTLINE

1.0 INTRODUCTION

Watershed Management Strategy is a work plan design to achieve a long term sustainable ecosystem balance within a watershed. It could exist as a master plan, blueprint, policy of action, scheme, etc.

It answers the following questions:

- Where are we now? Defining Status and problem Identification
- Where do we want to go? Goal Definition
- How will we get there? Process and Guideline
- How do we know if we have got there? Evaluation and Monitoring

An effective strategy must define status and identify specific problems that will determine actions and solutions path. It must as well define goal, set guidelines for implementation and establish a mechanism for monitoring and evaluation.

DIMENSIONS OF WATERSHED MANAGEMENT STRATEGY

Prevention and restorative are two branches of watershed management. The selection of these different treatments listed earlier is based on site conditions, resources, and causes of degradation, and not necessary by personal preference (Chang, 2013).

Preventive Strategy: This involves those geared towards the preserving suitable existing land use practices. This can be applied to watershed with little or no disturbance. It's implementation is always cheaper and more cost effective that the restorative strategy. This is to ensure the use of land in accordance with its capability as defined in land use classification systems (Sheng, 2001). Land owners are encouraged to do cultivation with conservation practices on classified arable and set aside or do reforestation and protective measures on non-arable lands such as steeps slopes with high potential of severe erosion and mass movement. Land capability mapping, watershed characterization, flood and erosion risk assessment and vulnerability index mapping are preventive strategies. They are effective, but not all expensive (Petrone and Preti, 2010).

Restorative Strategy: The aim of this is to overcome identified problems or to restore conditions to a desired level environmentally. The purpose of this is to control soil erosion, to upgrade water quality, to improve habitats, and to bring back land productivity. This measure is necessary to remediate watershed damaged by natural disaster such. Environmental hazard (flood and erosion) mapping is a restorative strategy.

2.0 BUILDING BLOCKS FOR WATERSHED MANAGEMENT

These are specific projects necessary for planning and implementation and provide the conditions and momentum necessary for a successful watershed management. They present the basis for translating planning into actions and realization of watershed management goals and objectives. The figure below shows schematics of various basic units for the implementation of watershed management strategy.

2.1 MECHANICS OF GULLY EROSION

This involves an assessment of shear strength and shear stress across a vertical section across a gully face.

Figure 1.0 below shows a cross section of a gully face in Enugu

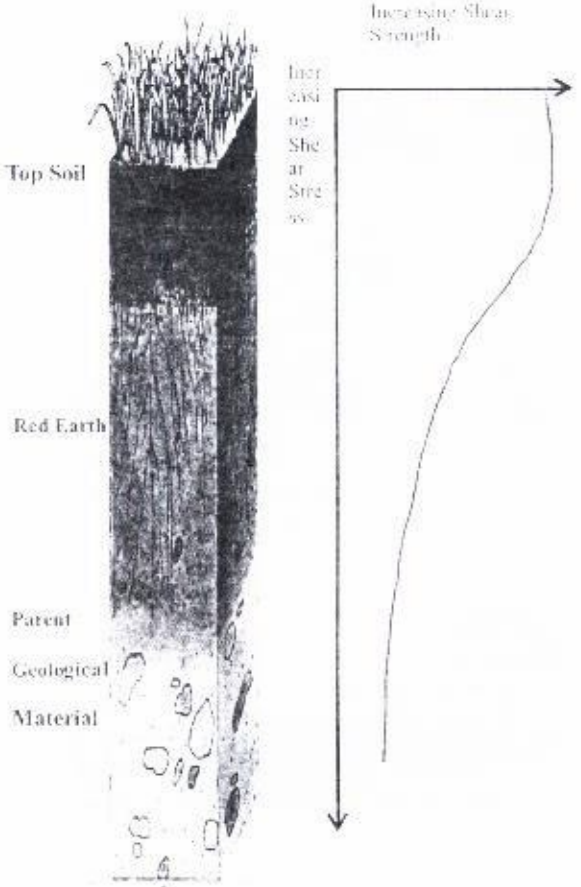


Figure 1: A generalized Profile of Gully Face Showing the Three Major Horizons- Top Soil, Red Earth andUnweathered Parent Geological Material

The activities of Construction companies have increase the emergence of erosion development especially around earth and tarred roads

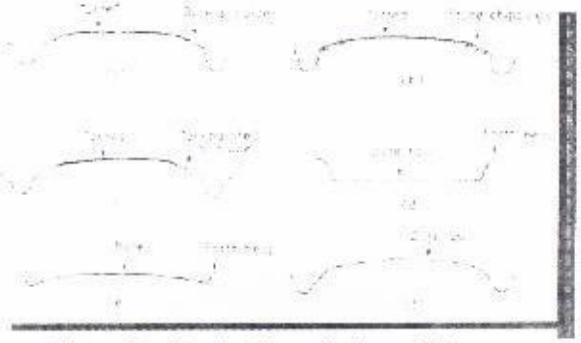


Figure 2.0: Vertical Cross Sections of Some Existing Roads: (a) – (c) : Tarred Roads (Highways); (d) – (f) Earth (Rural) Roads – Schematic.

Model Road Design for Reduced Impact: Road design should factor erosion control measures such as dense grass cover at the edge of the tarred surface and a curve tarred surface to enhance fast run-off over road effective water drainage.

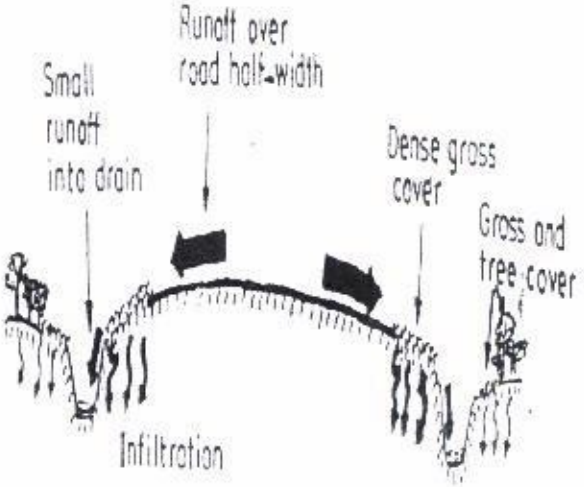


Figure 3: A Schematic Vertical Cross -Section of Model Roads; Reduction of Runoff Concentration Through Infiltration Over a Densely Grassed Shoulder is Illustrated

2.2 LAND CAPABILTY ASSESSMENT

Land capabilityis the inherent physical capacity of the *land* to sustain a range of *land* uses and management practices in the long term without degradation to soil, *land*, air and water resources. *Land capability assessment* can help determine the suitability of land for industrial, settlement and waste/landfill.

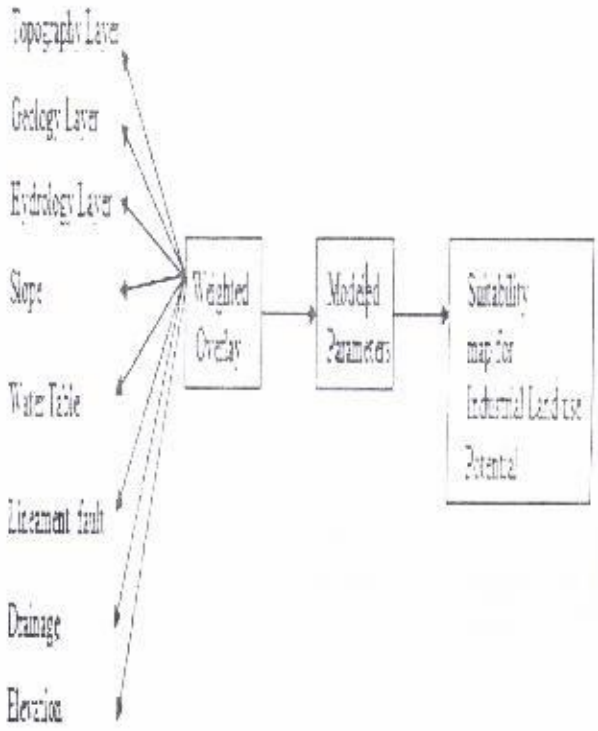


Figure 4: A Schematic of Geographic Information System Parameters shown in layers for Land Capability Index.

Case Study: Enugu Region

A pilot study was conducted in Enugu Metropolis where areas were rated based on their suitability for wasteland, residential, industrial areas.

Outputs of this research as represented in figure 5.0, shows that Obeagu, Oruku and Agbani are low suitable for residential and industrial purpose, and suitable for wasteland. Nsude and Umuatugbu area is not little or not suitable at all for any purpose.

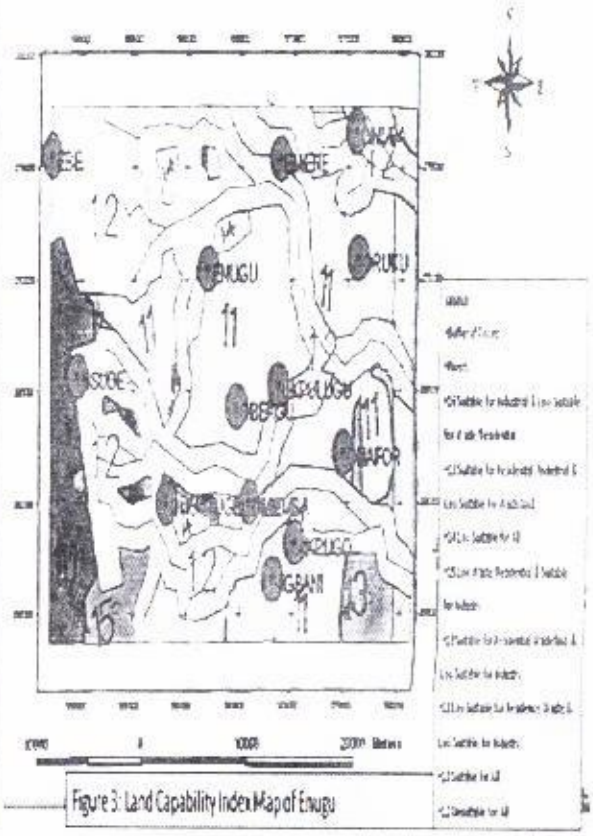


Figure 5: Land Capability Index Map of Enugu

Case Study: Orlu

A pilot study was conducted in Orlu and Environs to rank suitable zones for industrial development. Outputs of this research as represented in figure 5.0, shows that Areas that constitute best locations here include: Amaifeke, Akokwa, and parts of Isiekenessi. Most locations in Orlu, Ihita-Nansa, Okohia, and a part of Osumoghu are not favourable for industrial development.

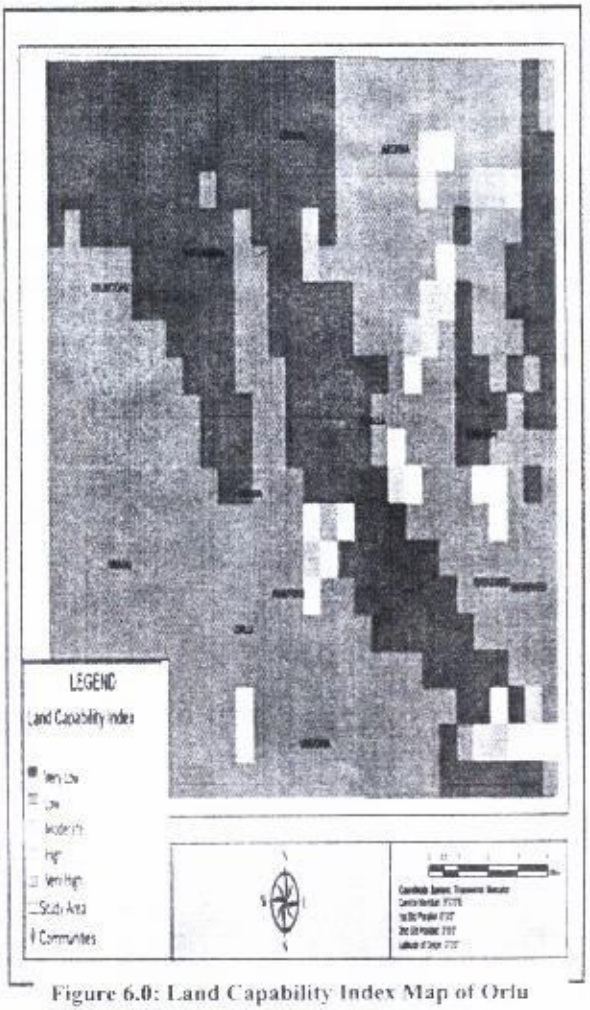
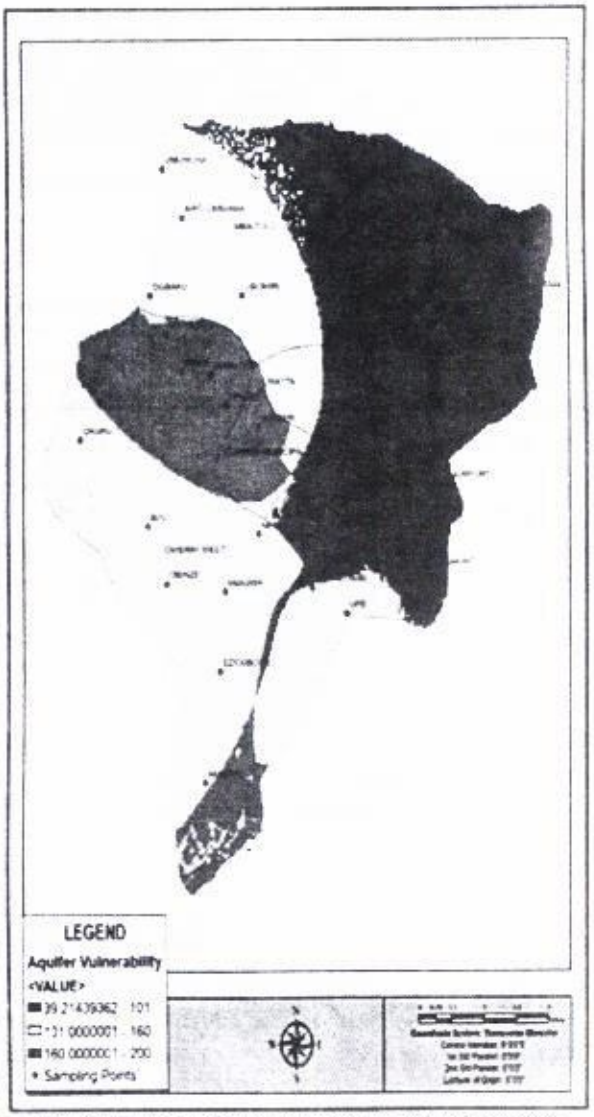


Figure 6.0: Land Capability Index Map of Orlu and Environs

2.3 VUNERABLITY INDEX MAPPING

The Vulnerability Index is a tool for identifying and prioritizing areas according to the pollution risk levels. It identifies the most vulnerable zones through a ranking system that takes into account various parameters. This could be applied in mapping pollution risk in Aquifer, identify areas that could be prone to environmental hazard.

A pilot research to assess parameters that could be used to rank aquifer zones based on susceptibility to pollution was conducted in Owerri and Ikeduru. The parameters considered include: Depth to water table, topography, Aquifer Media, Amount of recharge, Impact of vadose zone, Hydraulic Conductivity.



GROUNDWATER VULNERABILITY MAP OF OWERRI AND ENVIRONS

Figure 7.0

2.4 WATERSHED CHARACTERIZATION

This involves the delineation of boundaries of drainage basins and defining their morphometryin a linear, aerial and 3d perspectives. This forms the basis for understanding pollution trends, natural

drainage systems and setting a framework for environmental hazard prediction

Case Study: Owerri

A pilot study of this was done within three local governments in Imo State: Owerri North, Owerri West and Owerri Municipal. Two principal drainage basin were identified such as Otamiri Drainage basin and Oramirukwa drainage basins.

Table 1.0: Drainage Basins within Owerri and their Morphometry

S/N	DRAINAGE BASINS	1st Order	2nd Order	3rd Order	4th Order	Bifurcation Ratio
1.	Otamiri River Basin	342	231	176	0	140
2.	Oramirukwa River Basin	253	60	272	0	222

This characterization was also used to rank these zones based on flood risk and other environmental indices thus rating Otamiri higher that the other.

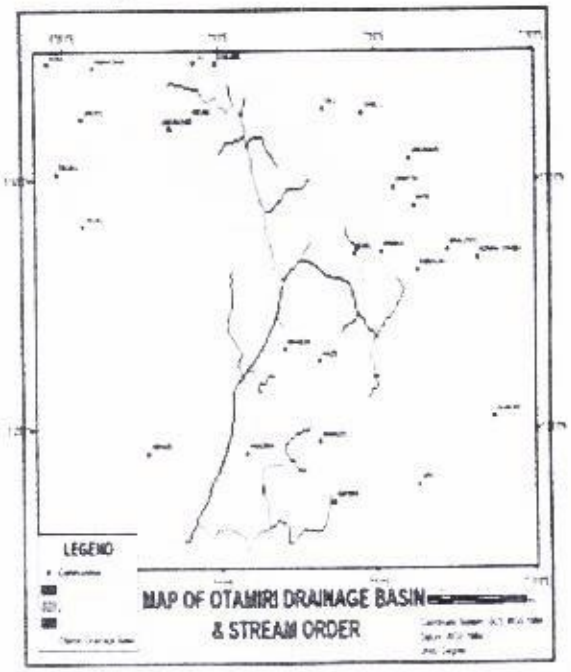
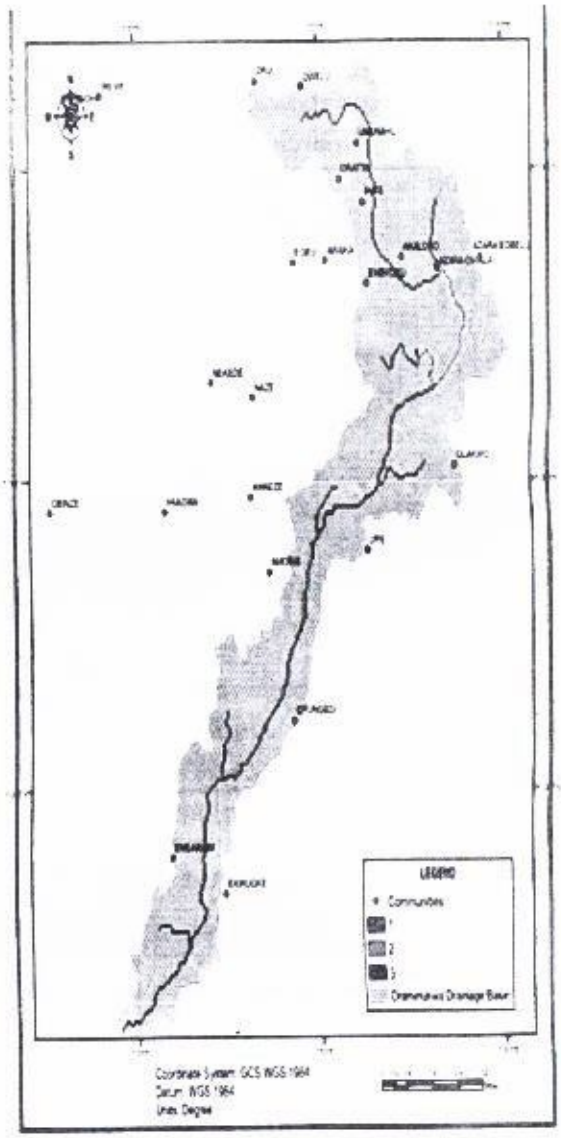


Figure 8.0



3.0 NEED FOR COLLABORATION

Research collaboration is not an end in itself. It is a means by which academic and industry scientists can advance their own research for companies and government to translating into new technology, products and policies for a better environment

Collaboration is important not just because it is a better way to learn. It's an invincible attraction penetrating every institution and all of our lives. Learning to collaborate itself is part of equipping yourself for effectiveness, problem solving, innovation and life-long learning in an ever changing networked economy. (Don Tapscott, 2009).

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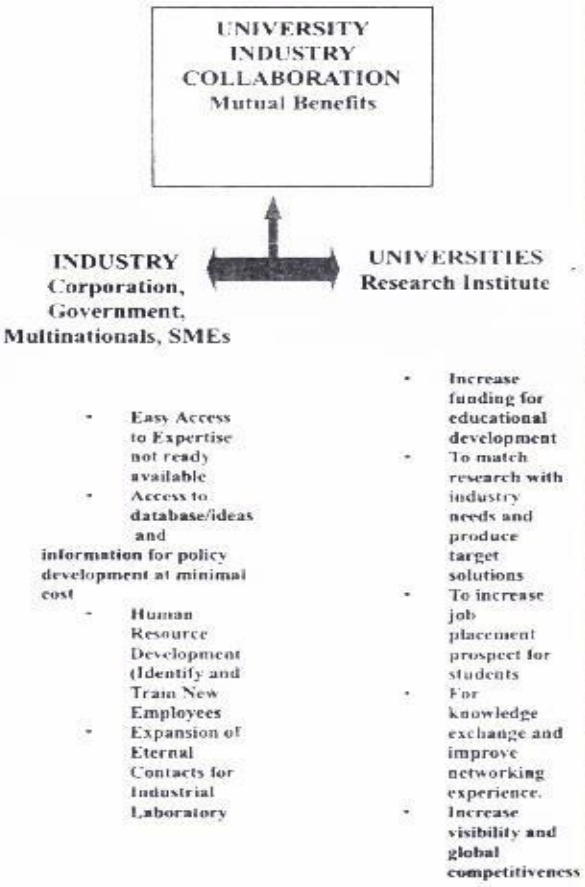

4.0 CONCLUSION

To get to where we need to be, we will have to greatly expand the opportunities for collaboration for in this way will we develop a common language and actions for a better and more sustainable watershed development and management.

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