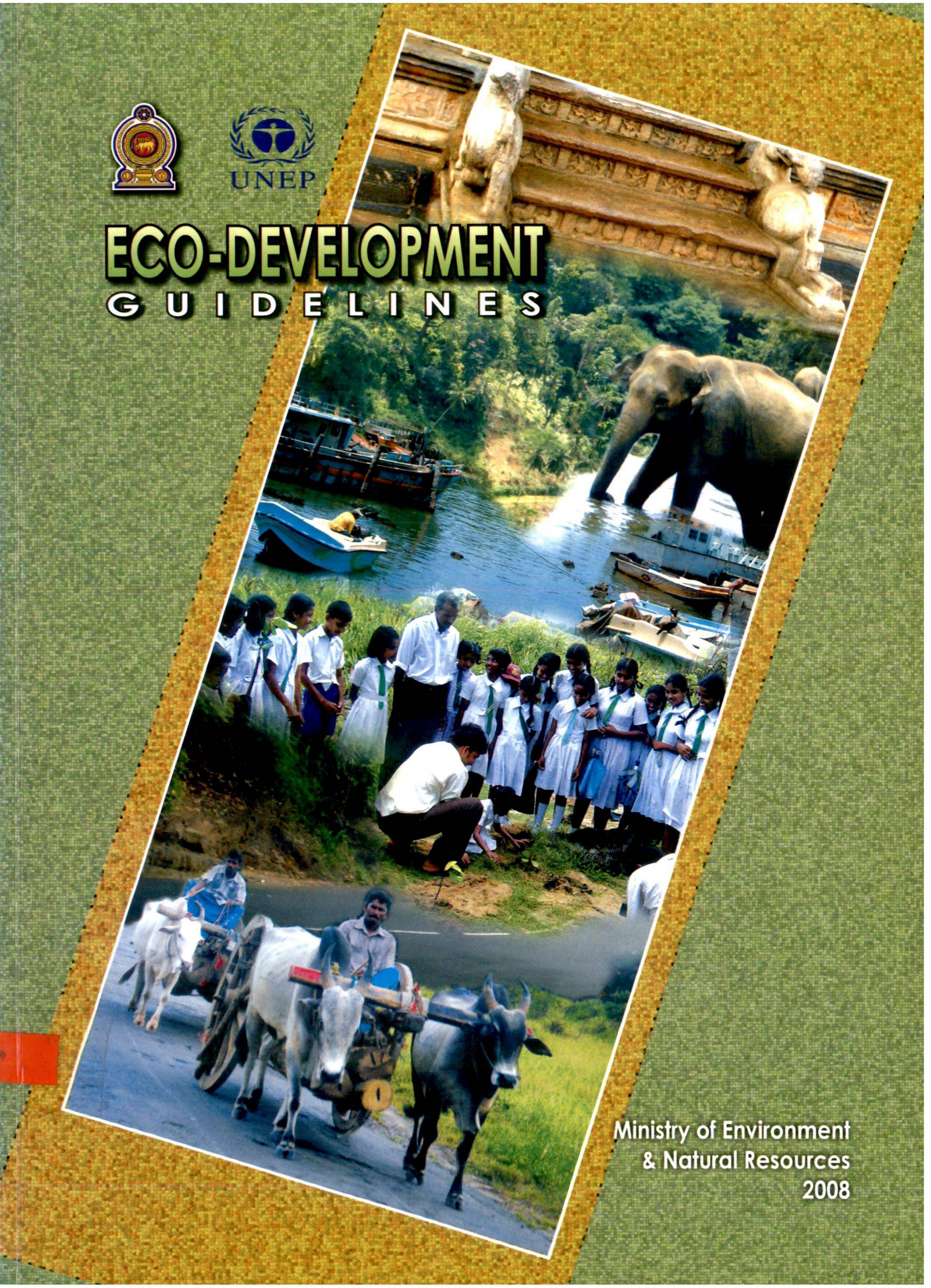

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2008

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Edited by : Prof. Harsha Munasinghe,
Senior Lecturer,
Faculty of Architecture, University of Moratuwa.

Mr. Anura Jayatilake, Director,
Environmental Economics & Global Affairs Division
Ministry of Environment and Natural Resources

Special Assistance : Ms. Anoja Herath (Assistant Director)
Mr. R S A Ranasinghe (Enviornment Management Officer)
Ms. Ruchira Perera (Enviornment Management Officer)
Mr. Ruwan Weerasooriya(Enviornment Management Officer)
Mr. Sanjaya Bandara (Programme Assistant)
Ms. Vindya Hewawasam (Research Assistant)
Ms. Tamara Amarasinghe (Project Assistant)
Mr. Amila Ranga (Office Assistant)

Printed by : HansiGraphics & Advertising
Telephone - 0777 261 931
E-mail: hansigraphics@sltnet.lk

Foreword

During a Regional Mission by UNEP to Sri Lanka in May 2005, it was agreed to implement a Pilot Project on the Bali Strategic Plan of Action in keeping with the national priorities. Accordingly, the UNEP provided financial assistance to develop an eco-fishing village in Kahandamodera, Tangalle Sri Lanka to contribute to integrated energy, water and waste management in tsunami reconstruction process, to prepare eco development principles and conservation of Maragala mountain range in order to protect the upper watersheds.

The project was completed in 2007, and the outputs were presented to the UNEP. As a follow up action on the project, the Ministry initiated a process to prepare a comprehensive set of guidelines for eco development. These guidelines were prepared based on the conceptual framework for sustainable development prepared during the pilot project.

The Ministry has already taken initiatives to promote these guidelines in the development process through the on going projects implemented by this Ministry and also agencies coming under its purview and these guidelines would be further improved through their applications in development programs.

This Ministry looks forward to applying the best practices accumulated from development projects in our efforts to achieve sustainable development and I recommend these guidelines to be used as a primary tool in implementation of development projects from their inception to completion.

I wish to thank UNEP for providing financial support for the process and all others who contributed to the preparation of these guidelines.

M A R D Jayatilake
Secretary
Ministry of Environment & Natural Resources

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Acknowledgment

The implementation of three projects under the Bali Strategic Plan of Action (BSP) was coordinated by the Environmental Economics & Global Affairs Division under the Ministry of Environment and Natural Resources. As the Project Director, I thank many individuals and organizations who contributed to the successful completion of the Project.

At the outset, my most sincere thanks go to Mr. M.A.R.D Jayatilake, Secretary to the Ministry of Environment & Natural Resources, Mr J. R. W. Dissanayake, former Secretary to the Ministry of Environment and Mr. W.R.M.S. Wickramasinghe, Additional Secretary (Environment & Policy) Ministry of Environment & Natural Resources for their valuable advice and guidance which contributed greatly to the success of the Project.

We also take this opportunity to express our gratitude and thanks to Regional Office Asia and The Pacific of the United Nations Environment Programme (UNEP-ROAP) for providing financial support to implement the project under the BSP. In particular we thank the efforts of Mr. Surendra Shrestha, Director, ROAP and Dr. Subrato Sinha, Environmental Affairs Officer, UNEP-ROAP in providing us necessary guidance for the implementation of the project.

Taking this opportunity, we wish to place on record our appreciation to Postgraduate Institute of Management (PIM) and Prof Harsha Munasinge, Senior Lecturer, Faculty of Architecture, University of Moratuwa, for providing technical inputs and guidance for the project. Finally we are grateful to the staff members of the Environmental Economics & Global Affairs Division of the Ministry of Environment & Natural Resources who have contributed in many ways to make a success of all our efforts in this project.

Anura Jayatilake,
Director (Environmental Economics & Global Affairs Division)
Ministry of Environment and Natural Resources

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1.0 INTRODUCTION



Many Asian countries including Sri Lanka have implemented numerous environmental laws and regulations containing provisions for air and water management, waste quality management, waste disposal and the protection of natural resources, to cover such development activities as siting, dredging, land clearance, filling and construction.

There are planning permits for some of these activities, each permit having its own special requirements. Though central to maintaining environmental quality and protecting valuable resources, it is understandable that many people – specially developers- have become confused or frustrated by the maze of legal demands of permit processing.

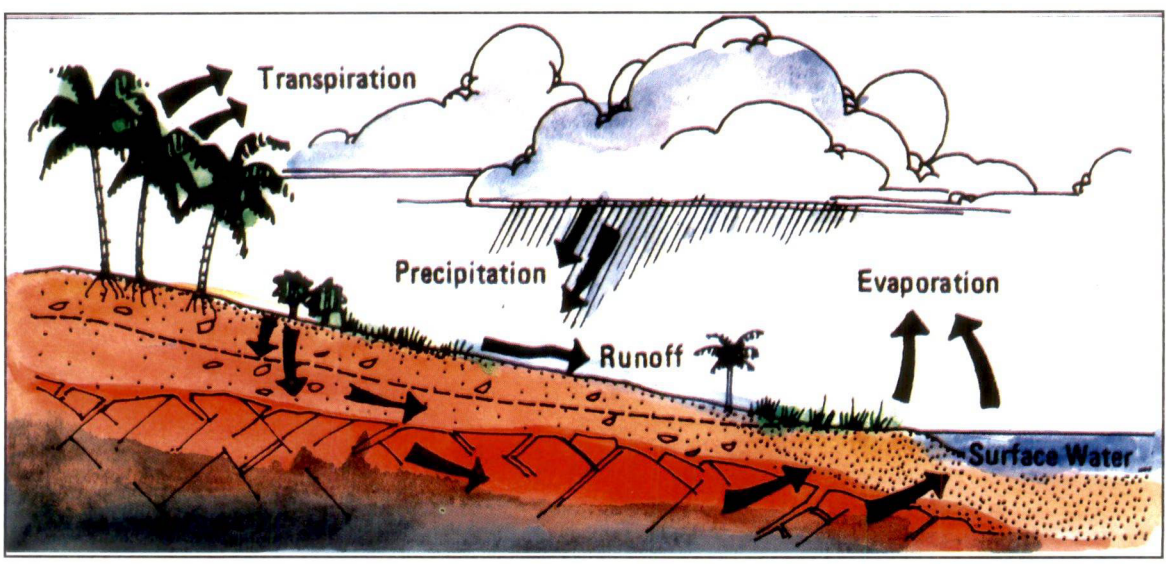
It is also the case that environmental considerations are not always fully integrated in to development planning or implementation. In both cases, a better understanding of the need to take environmental considerations in to account in proper planning, design and implementation will assist in reducing the risks of post development problems and associated costs.

2.0 NATURAL ENVIRONMENTAL SYSTEMS

All development projects have some impacts on natural systems, whether it is clearing forest, changing river flow, affecting ground water recharge, or altering the appearance of landscapes. natural systems consists of a series of cycles, or 'chain reactions' the disturbance of which often leads to profound though not immediately obvious effects. Some knowledge of the natural system is therefore essential to the developer for environmentally-sound planning and management.

The principle cycles and systems are described below.

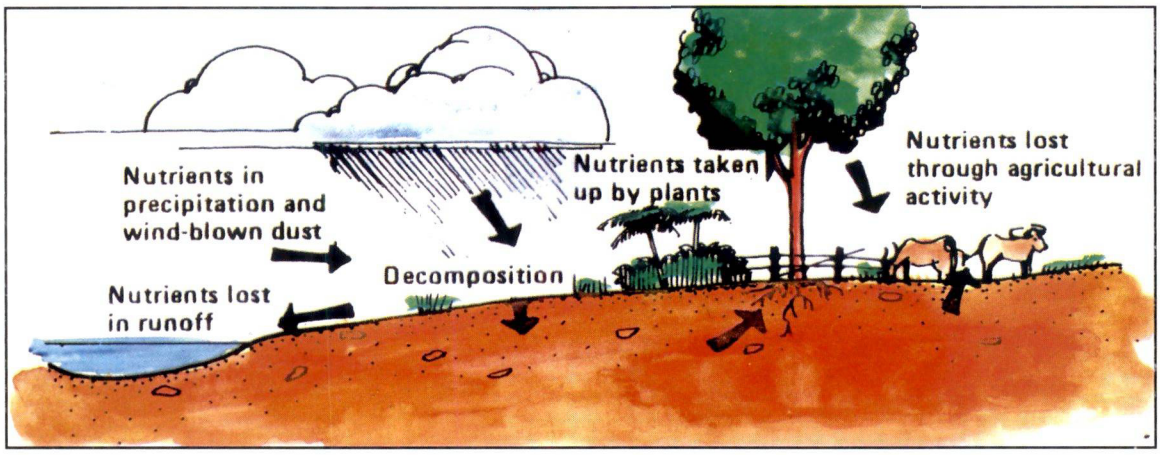
2.1 The Water Cycle



The WATER (hydrological) CYCLE is the constant movement of water through natural systems. Water falls to earth as precipitation, where it either seeps in to the ground, flows along the surface to river screams, evaporates, or is taken up by plants and release to the atmosphere. Ground water flows very slowly through subsoil's and bedrock until it enters nearby streams, lakes or other wetlands. Water evaporating from lakes, rivers and the ocean forms clouds; precipitation from the clouds completes the cycle. The water cycle provides a basic link between natural systems such as forests, wetlands and other aquatic habitats, and is important to man in maintaining water supplies and removing degrading pollutants.

2.2 The Nutrient Cycle

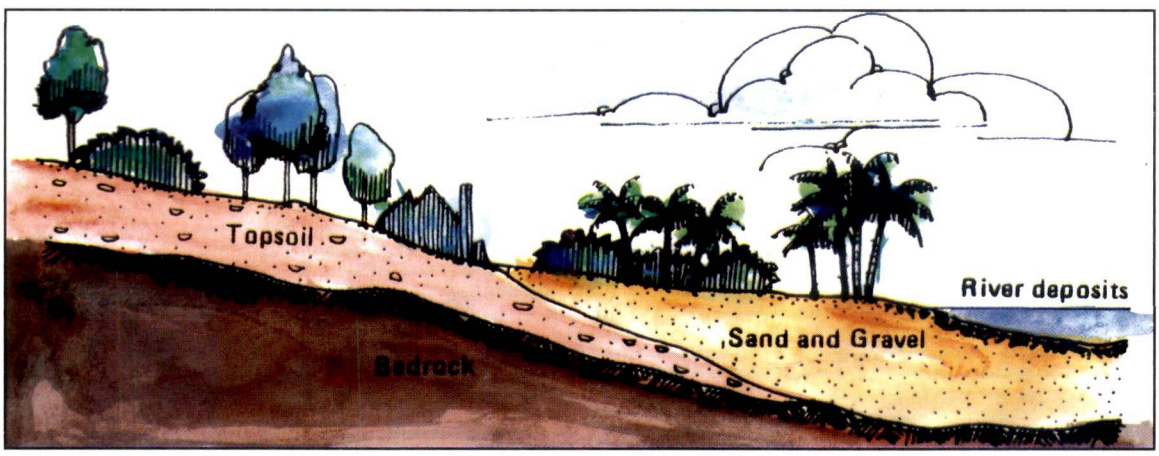
The cycling of nutrients (including organic compound and minerals) is essential in maintaining natural systems. Mineral elements from rocks are made available to plants and animals by weathering, and by dissolving and entering the water cycle. Nutrients in the soil are taken up by plants and passed on to grazing animals and finally predators. They are returned to the soil through decomposition.
Additions to the nutrient cycle occur through precipitation and wind blown dust, and



nutrients are lost through erosion and runoff, hunting and harvesting of trees and crops. Environmental disturbance may cause more nutrients to be lost than add, upsetting the nutrient cycle of an area and decreasing its productivity.

2.3 Soils

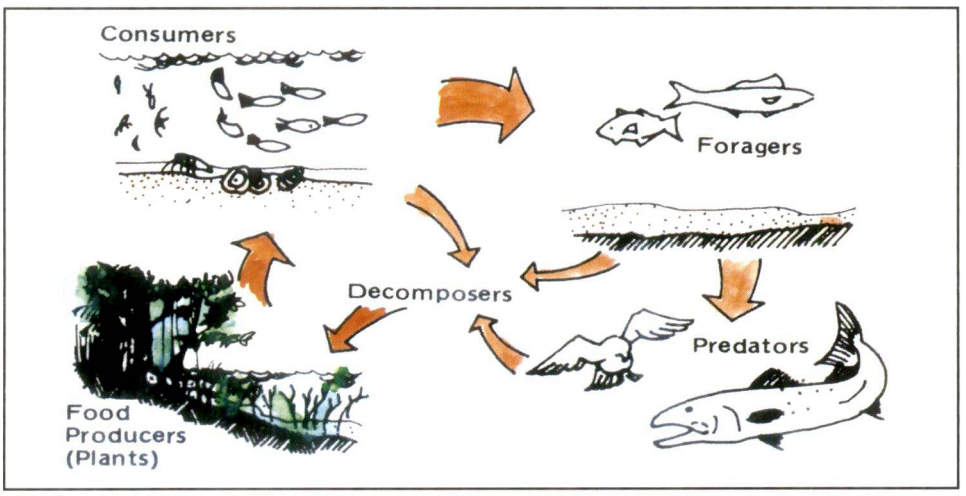
SOILS develop over time by weathering of bedrock and the combined action of local climate and living organisms on bedrock and accumulated material. Unconsolidated



materials extend from the land surface down to bed rock. The ability of ground water to travel through alluvium is directly related to the amounts of silt and clay; the more silt and clay, the slower the water will travel. Sand and gravel deposits contain very little silt and clay, and ground water can travel through them very easily. Such deposits are usually found in river valleys.

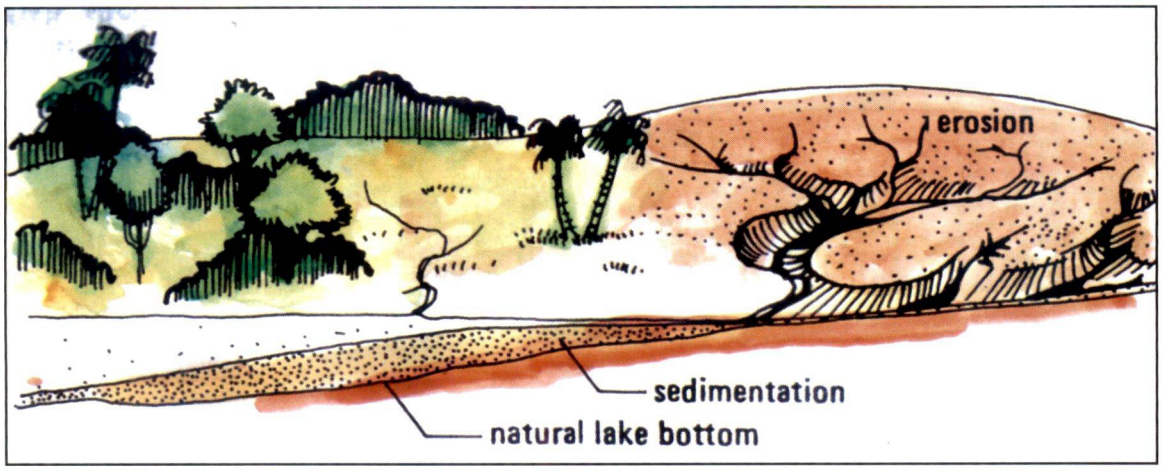
2.4 The Aquatic Food Web

THE FOOD WEB of coastline and rivers begins with dead plants and animal matter and other sediments flowing into rivers and estuaries from upland areas. These materials are converted into food by shoreline vegetation (including algae), bacteria and minute floating



plants (plankton). The plants are eaten either by small fish, shellfish and other invertebrates, or by microscopic floating animals, (zooplankton) which, in turn, are preyed upon by larger animals. Large fish, birds and man are at the top of the food web, the latter having no natural predators. Other animals feed on dead plants and animals, reducing them to basic chemical constituents. These materials are used by plants, thus completing the cycle.

2.5 Lakes, Rivers & Streams

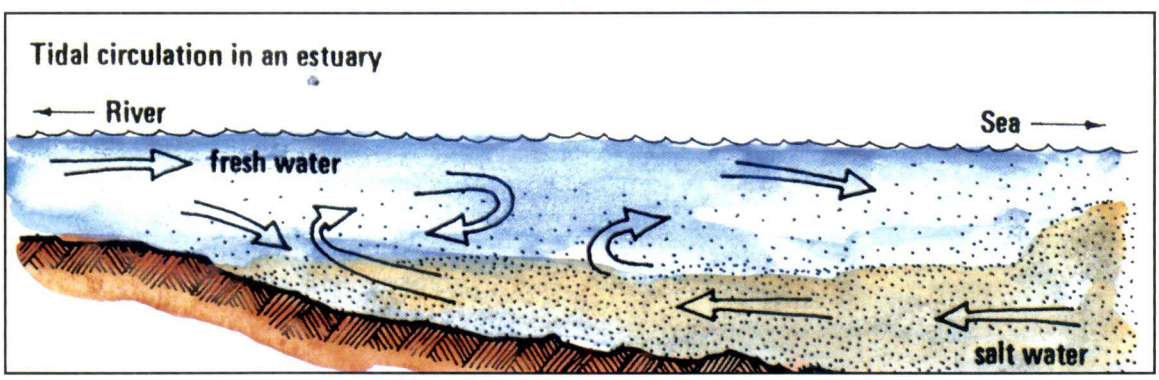


LAKES, RIVERS AND SREAMS are heavily influenced by surrounding upland areas. If the amount of organic material (from sewage systems, agricultural runoff or industrial sources) entering bodies of water increases, growth of aquatic plants also sharply increases. This process, known as 'eutropication' , often causes the oxygen dissolved in the water to be depleted, killing fish and most other animals.

The loss of upland vegetation (due to construction, deforestation, fires and other activities) exposes the soil and creates erosion problems. Silt carried by runoff pollutes the water then eventually settles to the bottom, killing aquatic plants and animals and causing lakes, ponds and stream channels to silt up.

2.6 Coastal Systems

2.6.1 Estuaries

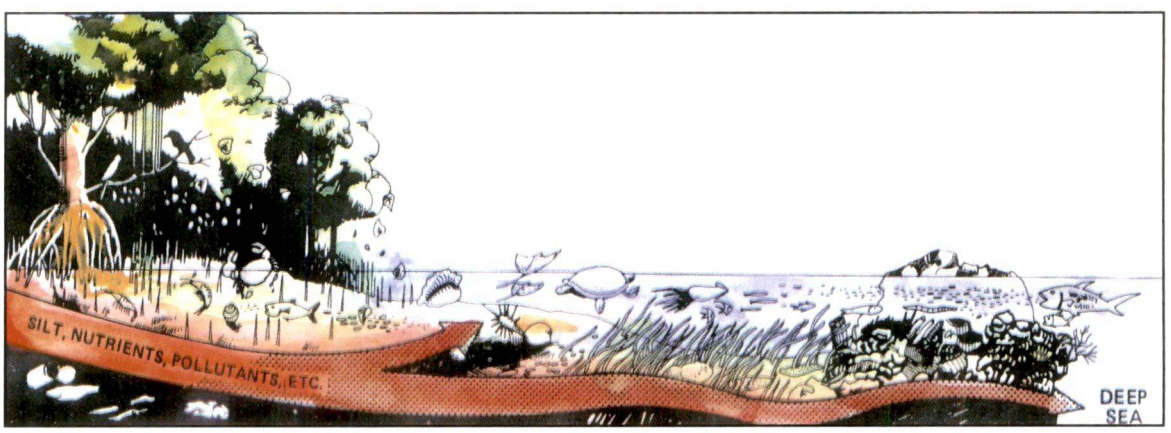


ESTUARIS are river mouths and bays where fresh and salt water meets. Because salt water is slightly heavier than fresh water, it usually moves up the estuary beneath out flowing

fresh water. Fine-grained material tends to move upstream by this process, frequently causing dredged channels to silt in quickly. The mixing of water in estuaries creates nutrient rich habitats favourable to many forms of life, and helps to 'clean' polluted water. Many fish are dependent upon estuaries as nurseries.

2.6.2 Tidal Wetlands & Coral Reefs

TIDAL WETLANDS, which include mangrove and beach vegetation, provide many benefits to man. They serve as buffers against storms and typhoons, refuges for wild life, nurseries for various forms of marine life, and pollution filters, removing contaminants from water flowing through them.

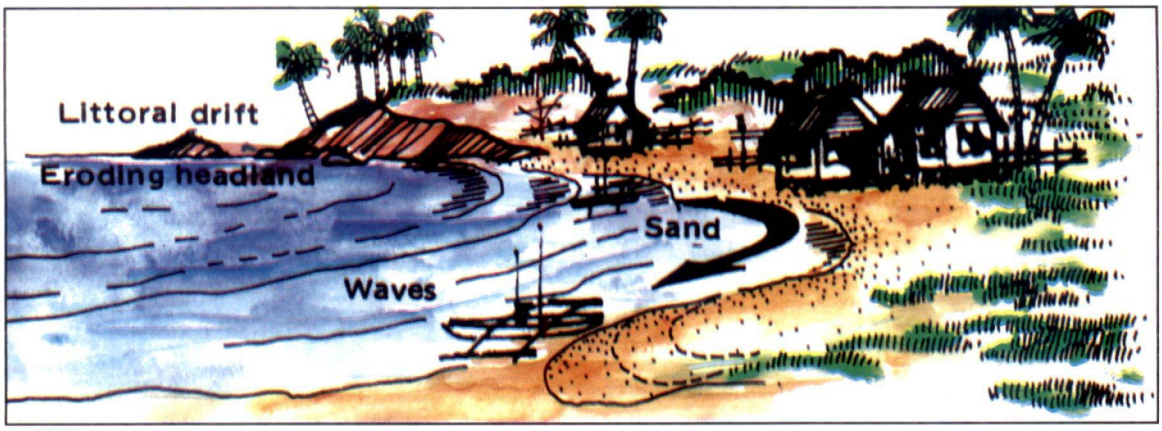


Fishery resources consist primarily of corals, fish, shellfish and seaweed. Both CORAL and ROCKREEFS are valuable resources, coral reefs being one of the most productive eco systems. They are presently threatened by quarrying for lime or construction material, silt-laden rivers, and fishermen who use explosives or poisons.

MANGROVES are highly productive ecosystems, being a source of nutrients for inshore waters. They support a large number of animal species by providing breeding, nursery and feeding grounds. These include a variety of birds, fishes and crustaceans such as prawns, crabs and cockles. Mangroves also provide coastal protection and stabilization by acting as buffers against erosion caused by current and storms. They also play an important role in flood mitigation and maintenance of water tables.

2.6.3 Beaches

BEACHES protect wetlands and adjacent uplands from storms and erosion, provide wildlife habitat, and are of obvious scenic and recreational value. Waves and wind are constantly altering beaches and shorelines, especially during and after storms. The action



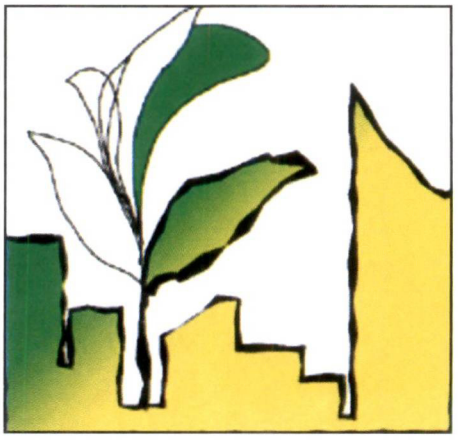
of tidal current and waves striking a shoreline at an angle slowly moves sand and other materials along the shore. This littoral drift, as it is called, resupplies eroding beaches with sand transported from offshore or other points along the coasts. Erosion and movement of sand above the shoreline is reduced by vegetation, which traps and anchors the sand against natural forces. Manmade erosion results from sand extraction from river mouths and beaches, removal of mangrove, and infrastructure construction.

2.6.4 Shore lands

SHORELANDS exert an important influence on the natural systems of the coastline. The amount and quality of fresh water draining from shore lands in to estuaries determines the salinity and water quality of all coastal waters. The salinity interns help determine the animal and plant species in the estuaries and to a degree the wetland vegetation bordering the estuaries. The influx of nutrients from inland areas to the coast makes estuaries highly productive areas for fisheries.

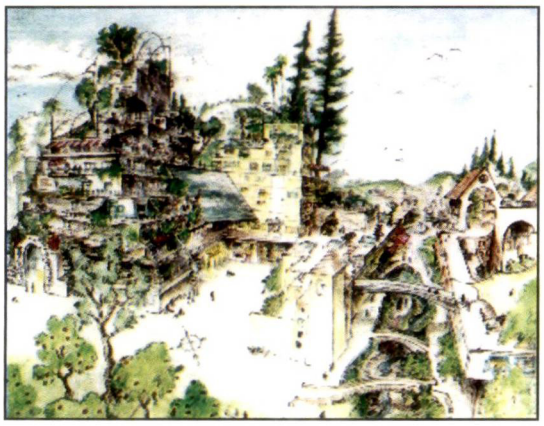


3.0 CONCEPTUAL FRAMEWORK FOR ECO CITY DEVELOPMENT



Since rebirth of the concept of Sustainable Development in 1987 with the publication of the report of World Summit on Environment and Development or the well-known Bruntdland Report and the Earth Summit of 1992, every nation is rather alarmed of the need to build ecologically-sustainable buildings.

Sri Lanka needs to create cities that are healthy living containers of *good life*. There have been many attempts by urban planners/ designers to make the city a healthy living container. Most of those attempts evolved around the need to strike a correct balance between the nature where the city is located and human action upon it. The linking of *good life* with ecology gave birth to the idea of *Eco-city*, which was mostly dependent on nature, its resources and its continuity in its so-called original form. Promoting nature as a bio-centric entity that controls itself, the *Eco-city* has become a life territory, a placed defined by its life forms, its topography and its biota, rather than by human dictates. As such, this type of *Eco-city,* being over-dependent of the carrying capacity of *land,* hampered the growth of the city demanded by the social evolution.



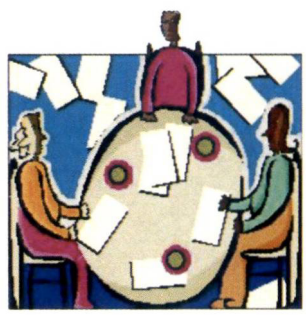


With the rejuvenation of the concept of 'sustainable development' in 1980's, city development was to be pursued in conjunction with the protection and preservation of the earth's resources for current and future generations. Since this reincarnated concept placed most of its emphasis with the materialistic values of natural resources that were on the other hand understood as

objective, the nourishing of the liveable city was a struggle to the preservation of natural resources, again seriously checking the human growth. There have been *many* successful attempts to manage resources, to develop ecologically-friendly-materials, to shift towards renewable energy sources. They all compromised the diversity and the particular identity of the living container called city, thus bringing it to the brink of becoming a non-city for not fostering the growth of *good life*.



Among the weaknesses in those approaches is turning the city into a *stereotyped* built environment, which does not accommodate the evolved social-cultural aspects and not geared to strengthen their continuity. The need to bring society and culture to the centre of decision making with regards to city planning in order to develop a holistic approach unique to the particular place is long due. As we know, the cultural dimension represents a critical question in pursuing sustainability. Culture, considered as the whole of values, meanings, symbols, ideas, organisational rules of a society, which are reflected in the way the society itself shapes institutions, uses environment and nature, regulates human relationships. Therefore, our project finds this lack of orientation towards accommodating the cultural dimension in *Eco-city planning* as the point of departure.



3.1 Aims and Objectives

Our hypothesis would be applying the concept of *smart growth* that with its vision to build Eco-communities may integrate *nature,* where the city is built, *man,* who came to the nature, *society,* evolved by him to survive in the nature, *institutions* and *shells* developed by that society, thus developing a holistic approach.



Our project, *Ecological Paradigms in Planning the Future City,* aims at collecting and processing data of the practice of Eco-city planning globally and the using, proposing, testing and disseminating that processed knowledge to be used in the Sri Lankan city thus facilitating the liveability of the city. As an end result, the project will outline a set of guidelines in the shape of a tool-kit that could be used to promote good life in the city. We intend to achieve the following objectives to achieve this aim:

1. Reviewing literature:
2. Preparing a check list for assessing the city planning:
3. Shaping design briefs to be used to inform prospective developers and designers of the possible eco-appropriate growth patterns:
4. Enlarging awareness of the developed frameworks through a set of workshops:
5. Preparing ground works for the development of educational programmes at various levels-primary, secondary and tertiary.

The method of study can be explained in the following chart:

Historical and Theoretical Analysis
1. concepts and definitions,
2. Paradigms and forums,
3. Literature analysis,
4. International discourses

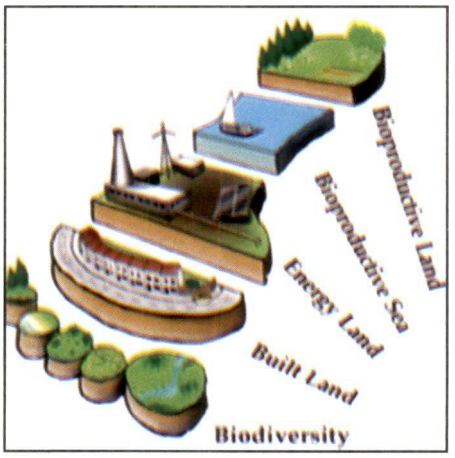
Eco-cities-case study
1. Case study analysis
2. Learning from *Las Vegas*

Testing Planning Tools
1. Workshops
2. Study programmes
3. Planners' forum

Future Trends and Forecasting & Results

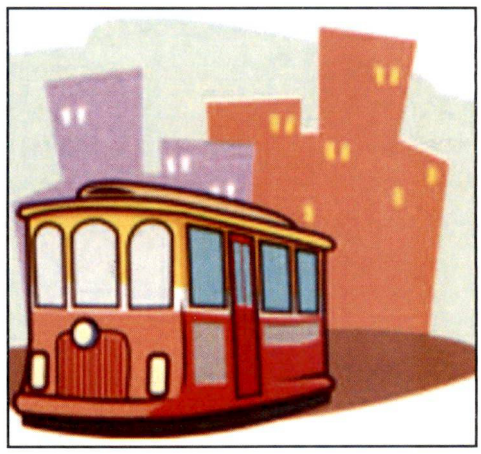


3.2 Concept of Ecological Sustainability

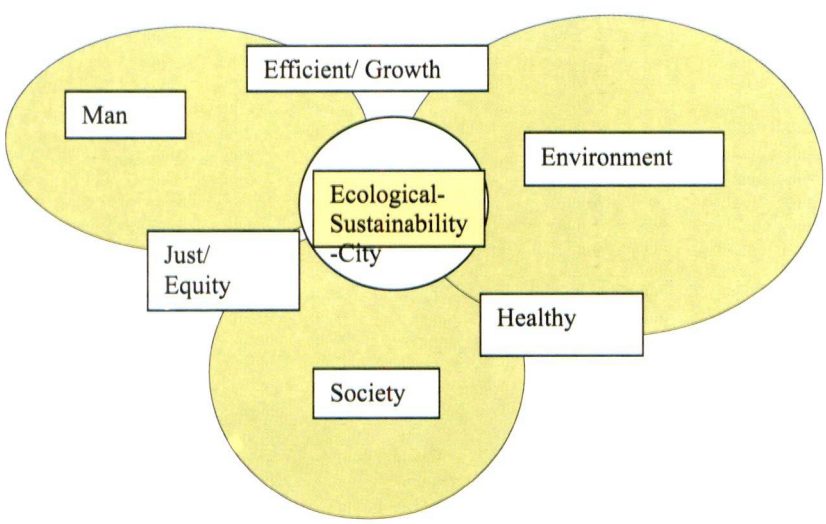


Ecological footprint that is adopted in the UK cities is central to urban policy. The report, *Towards an Urban Renaissance,* discuss Economic, Social and Environmental contexts. Yet, how they are integrated to create and nourish the Eco-city is not clearly defined. The European Commission adopted Communication COM(2004) 60 *Towards a Thematic Strategy on the Urban Environment,* in January

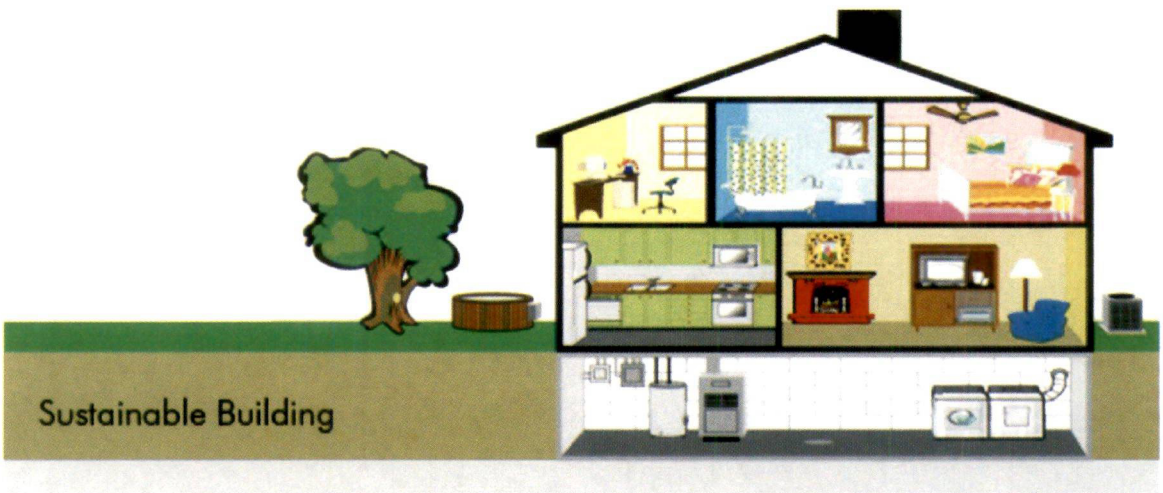
2004, which sets out the Commission's idea for the Thematic Strategy on the Urban Environment due in Summer 2005. The four themes; environmental management, urban transport, sustainable construction, and urban design are cross cutting with nature and have strong links with many environmental issues. The well-known Brundtland Report (1987) defined clear principles of sustainable development for policy makers, and the following will apply for the development of the Eco-city planning:



1. Changing current patterns of economic growth, technology, production and management which may have negative impact on the environment and population;
2. Ensuring employment, food, energy, safe water, and sanitary services for all populations;
3. Protecting natural resources for future generations;
4. Integrating economic, environmental and population considerations in policy decision-making and populations.

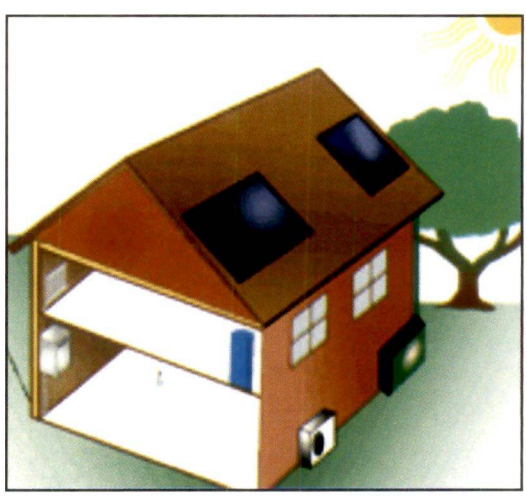


As a whole these policies may assist developing countries and transition economies as well as the older cities of the developed countries, in which the de-industrialisation has created many *brown fields*. These policies may be considered as broader frameworks in which each city should develop its own unique set of policies. The issue with regards to the current implementation, being a top-down, also makes their application difficult. Our new proposal can be illustrated in the diagram below;



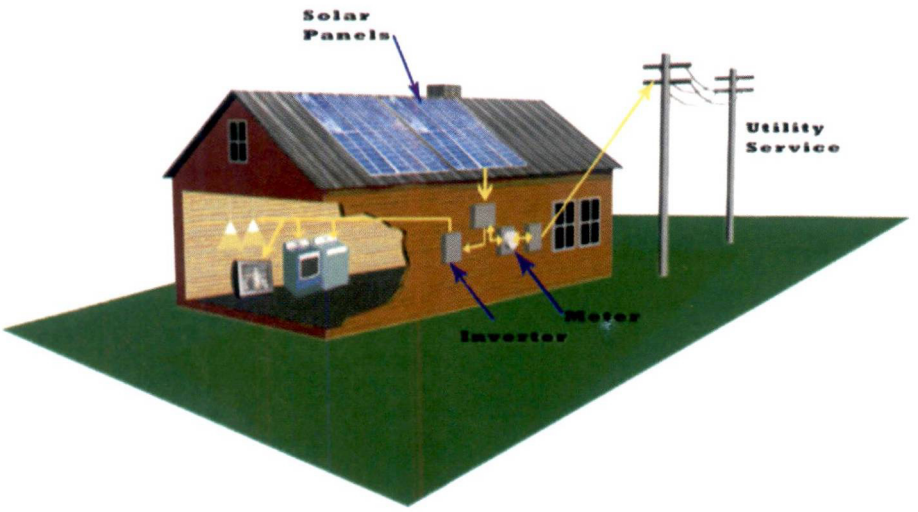
3.3 Concept of Sustainable Building

No built environment stands still and has been dropped down from the space. It is a dynamic representation of diverse understanding between flesh and stone. In other words, the particular socio-spatial matrix shows an evolving value system of man, society and environment. Learning to respect and respond these volatile forces and then evolving designing criteria for less-destructive additions will lay the foundations towards the Ecologically-sustainable design. Among the tested tool for this are Strategic Planning, Eco-city Zoning, Proximity Laws, Increased Diversity, and Clustered Development. In addition, we shall also pay attention to governance and communicative planning tools to have the society involved in decision making. It is essential to understand deeply the relations between life patterns of individuals, their social context and reality, their way of ascribing values



with the environment in order to make built environments ecologically sustainable. Our intention is to promote a building process, which will necessarily upgrade the living standards of the society.

The concept of Smart Building is suitable for the planning of the ecologically sustainable building as a tool. Smart Building advocates how the growth itself should be tied to the quality of life and how and where it is not, it should be pursued. This can be defined as the building practice that strives for integral quality: including economic, social and environmental performances, in a very broad way. The rational use of natural resources and appropriate management of the building stock will contribute to saving scares resources, reducing energy consumption and improving environmental quality.



Smart building essentially involves considering the entire life cycle of buildings, taking environmental quality, functional quality and future values into account. As the need for housing is being achieved quantitatively, it is important that the authorities now pay more attention to qualitative aspects of the built environment. As a whole, these buildings shall be resource efficient, energy efficient, pollution preventing, harmonising with the natural environment, and of integrated and systematic approaches. It is important note that this could be achieved at different levels: policy level, planning level, spatial development and at last, building level.

The first and foremost step of towards sustainable building would be empowering a state agency to clearly define what sustainable building is and, then popularise the term among stakeholders. The following principles are proposed to be considered in an action plan for Smart Building at,

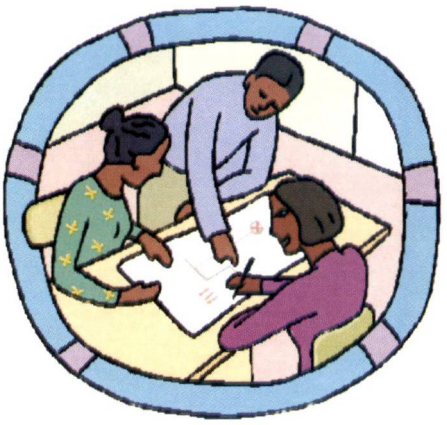
3.3.1 Policy Making Level:

1. Use of tested tools such as Environmental Impact Assessment and Strategic Environmental Assessment in selecting sites for new developments, and use of Strategic Environment Assessment to determine the size and types of new developments or rehabilitating the existing built environments,
2. Making tools to enable and empower communities in order to accommodate their evolved values in to the centre of decision making,
3. Making individuals and grass root level community groups accountable for not only achieving results but also maintaining the achieved results,
4. Facilitating the establishment of Grass Root Movements at each living quarter and supporting their existence,
5. Facilitating democratic mechanisms of decision making through participation by using Communicative Planning as a tool to build up a close rapport between the community and decision making,
6. Limiting the state intervention to the minimum and bring a balance between a top-down fostering and bottom-up decision making as it is described in the concept of Environmental governance,
7. Decentralising the financial management and environmental management through tax policies, incentives, and real estate management,
8. Decentralising the energy production and distribution, resource use and control, and the waste management,
9. Promoting research and development of Eco-materials in building construction and that of reusing the materials,
10. Developing study modules at different levels, university, schools and vocational collages, to train the professionals in sustainable building.

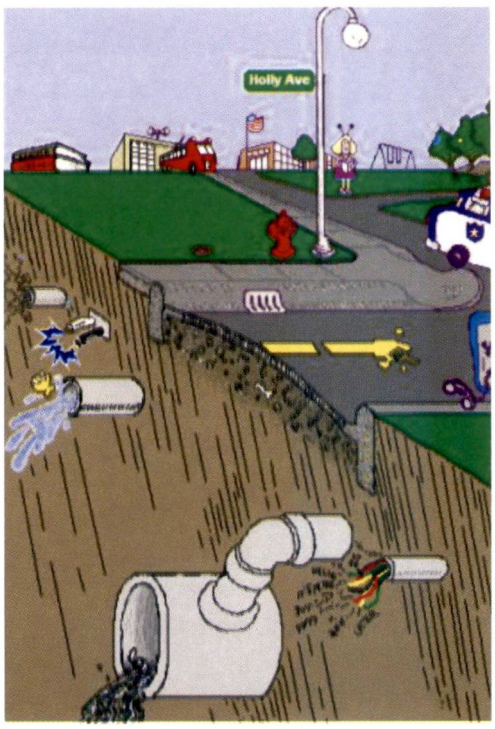
3.3.2 Planning level:

1. Controlling the contemporary sprawl by declaring Environmental zones and integrating them in a Master Plan/ Structure Plan, which would promote inter-related growth pockets,
2. Screening new economic development to ensure that the new development will not drain out the existing resources and will not generate unmanageable waste,
3. Promoting new economic activities that will build up the resources of the place where the new development is in order to bring about new economic spheres,

4. Promoting mix development rather than zoning based on functions to avoid the excessive and unwanted mobility of people; turning built environments into cultural diversities that would thrive as Smart Growth points,



5. Developing proper links between different quarters by introducing planned road networks to minimise the unnecessary wastage of resources and generating waste,
6. Refurbishing unhealthy and under-used residential pockets by designing a land use pattern that follow the morphology of the particular city thus improving the social infrastructure and minimising traffic thus reducing the emission of gas and repairing the damages caused by the quantitative-dominated settlement planning,



7. Rehabilitating the existing residential districts by removing the buildings that are not Smart in terms of environmental quality, energy, resources, and production of waste by designing planning guides,
8. Inserting a system of waste management along with each living quarter to ensure the healthy living.

3.3.3 Spatial Development Level:

1. Understanding the particular Spatial Quality of the built environment, and then designing a spatial structure criteria that is desirable for the evolving social-spatial understanding,

2. Developing concepts similar to the Urban Village adopted in Seattle, USA to strike a balance between diversity and identity as well as continuity and change,



3. Promoting the city spaces as a mixed used and socio-cultural diversified liveable containers that is dwelled and inhabited by *many* but within the evolved norms,

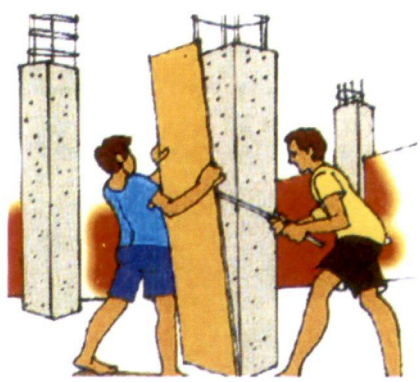
4. Promotion of the sharing of non-renewable resources such as water, energy, and above all the social responsibilities,

5. Inserting pedestrian links within the housing districts while regulating vehicle access to the minimum necessary to allow more spaces of living as it is successfully adopted in the Green-finger plan of Viikki, Helsinki, Finland,

6. Designing and construction of common spaces used for outdoor living and social activities thus fostering the community living; the best examples being the central courtyard trapped by the humble dwellings of the North Western province,

7. Recommending spatial design tools such as veranda, courtyards, etc to make the dwellings liveable and less expose to the hazardous environmental conditions.

3.3.4 Built Environment level:



1. Documenting the evolved methods of planning, construction, and use of the built environment and disseminating these data to those involved with the shaping of the built environment,

2. Promoting the unique ways of producing a built environment such as the concept of 'Gam-goda' of North western province through testing and further developing to suit the present-day conditions,

3. Promoting architects and other professionals to conduct research on building techniques that have been in use for centuries and developing them to be re-adapted in modern design through incentives in terms of funding, obtaining the planning clearance and technological know-how,



4. Testing the applicability of Vastu and other similar principles of the Science of Architecture to strengthen the continuity of building traditions that are unique to the particular region, locale, and the community,

5. Protecting and enhancing the cultural values of the existing built environments thus reinforcing the continuity of the uniqueness of the particular settlement,

6. Preserving the built environments that possess a heritage value,

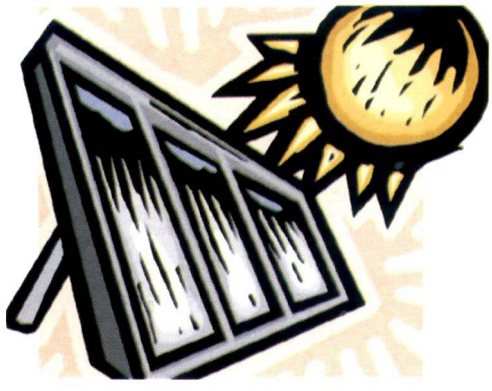
3.3.5 Design and Building Materials

1. Development of design tools for ecologically-sustainable buildings in terms of spaces that are useful and resourceful for good life,

2. Promoting the minimalist built forms to fit the living patterns of people rather than the complicated architectural forms attempted by some professionals,

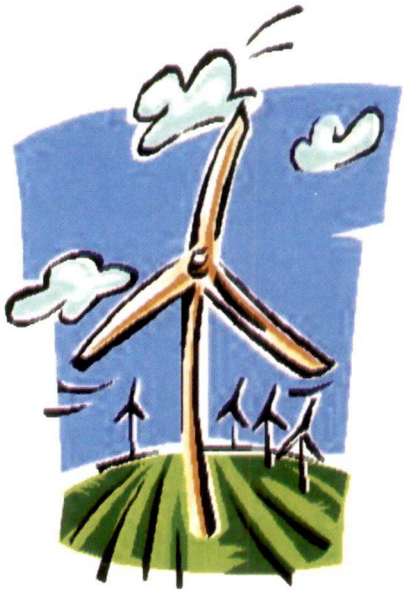
3. Emphasising good architecture as the one that uses natural light and ventilation, that uses the minimum essential resources and energy, and that does not generate Ozone-depletion chemicals,

4. Optimizing the use of spaces through careful design of the overall building and each space in order to keep the use of resources to the minimum,



5. Understanding the best-possible relationship between inside and outside by using the best suited materials for the enclosure and the appropriate location of openings on the enclosure,

6. Designing energy-efficient buildings through proper insulation, high-performance windows, and tight construction,



7. Promoting the use of renewable energy, optimising material use, water-efficient, low-maintenance, recycling waste, optimum value engineering, and grey water catchments,

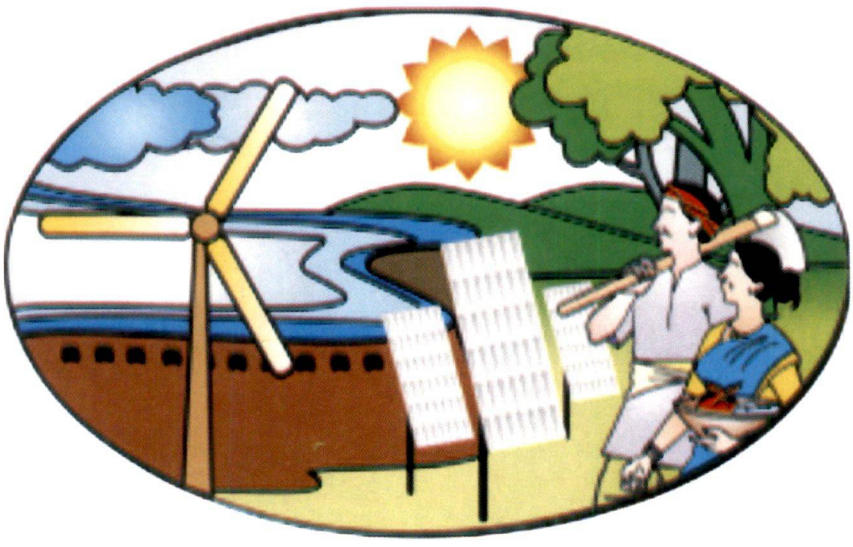
8. Analysis of sites to note the best possible ways to harness the resource values of the place where the building is to be built,

9. Locating and orienting the buildings to optimise the benefits from the Sun, water, and vegetation available in the site and its surrounding,

10. Promoting the use of time-tested building technology of Sri Lanka such as sun-baked brick, compressed earth blocks, compressed earth walls, etc,

11. Encouraging materials with low-embodied energy, materials of high durability, locally produced materials and materials made from recycled materials,

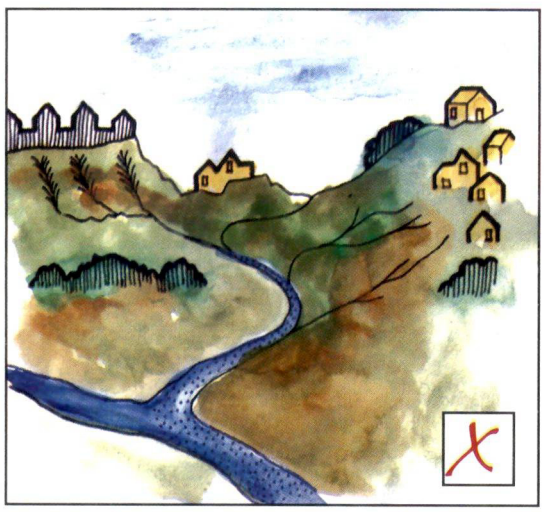
12. Promoting continuous research on the Green materials such as earth, straw, etc, for their suitability in terms of micro-climatic impacts and for their low energy consumption in production.

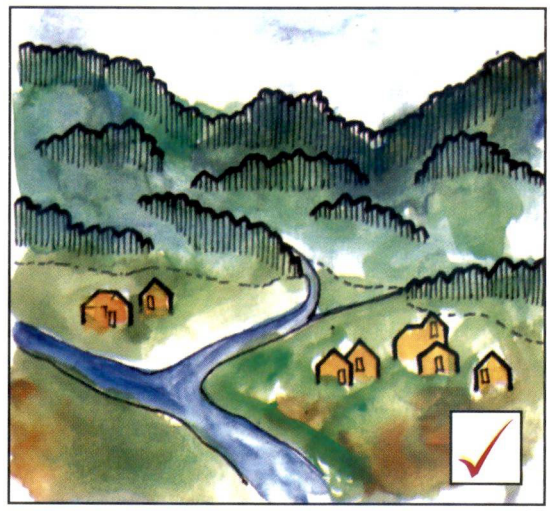


4.0 GUIDELINES

4.1 Management of Natural Eco Systems

4.1.1 Catchments Management

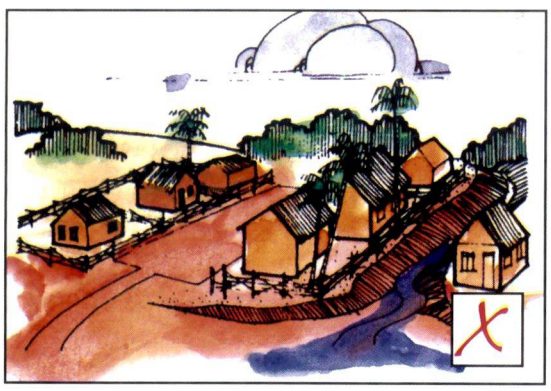


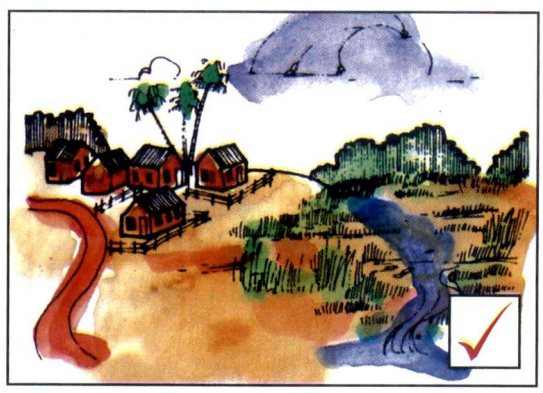


Appropriate catchments management is important for proper drainage, maintenance of ground water and flood control. Careless development upstream, resulting in clearing catchment areas, cause erosion and create flooding and siltation problems downstream as well as reducing dry season water flows. Cleared and sealed areas such as roofs, roads and paving deliver considerable runoff during periods of heavy rain. Maintenance of undisturbed forest in water catchment is very important for maintaining the quality of the water and dry season water flows.

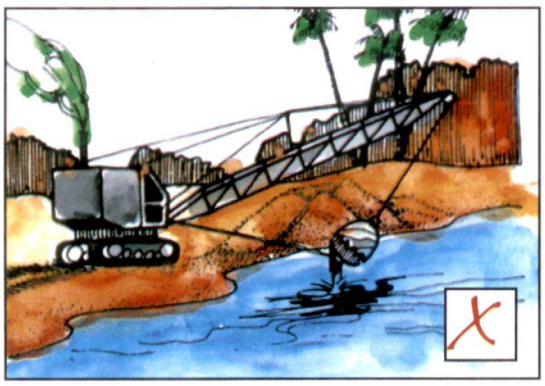
4.1.2 Environmentally sensitive areas

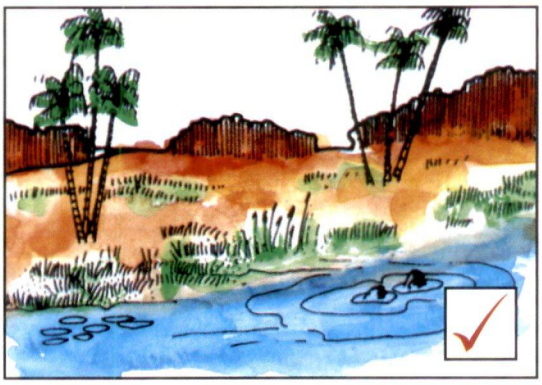
Certain areas are particularly sensitive to impacts from development and special care should be taken with any development in these areas.





4.1.3 Wetland and Rivers

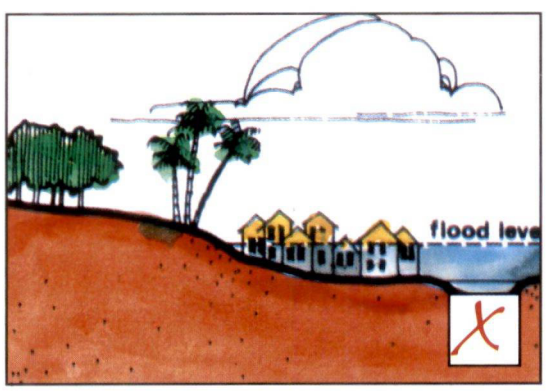


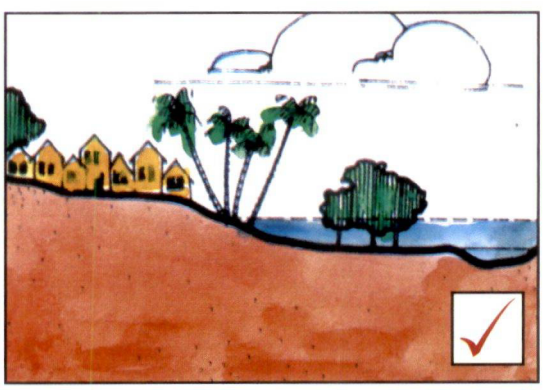


Generally WETLANDS which include Lakes, marshes & swamps should not be filled in or built upon. Developing wetlands destroys wildlife habitats, may increase flood damage through loss of flood water storage areas, and often reduces the ability of a watercourse to cleanse itself of pollutants. Developing wetlands also poses drainage and sometimes subsidence problems.

DREDGING of rivers and wetlands often has numerous adverse impacts. Silt disturbed wetlands dredging impairs water quality and damages productive bottom habitat. Altered speed and direction of flow through dredge channels can increase flooding and erosion problems. If dredging is necessary, the amount should be minimized and dredge spoils should be deposited as suitable sites and confined with dikes to prevent erosion.

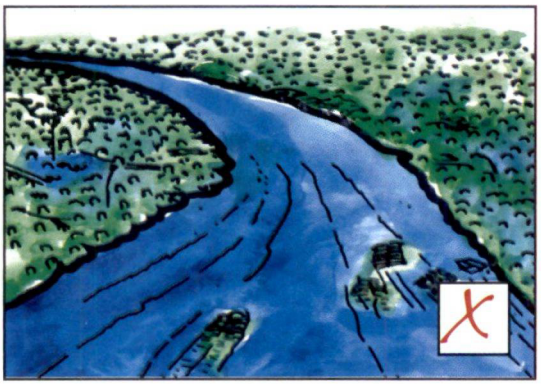
4.1.4 Floodplains

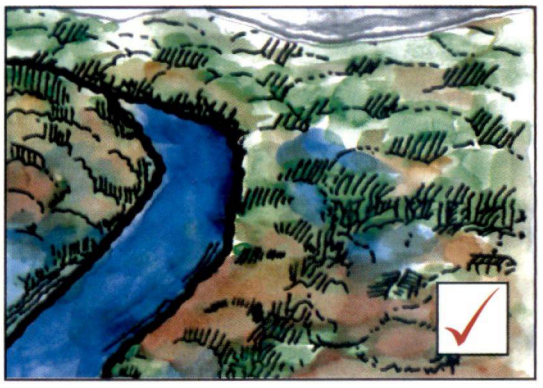




Development of FLOODPAINS may result in loss of life and damage to property from flood waters. Frequently flooded areas should be reserved for open space, recreation, wildlife or agriculture.

4.1.5 Reverie and swamp forests

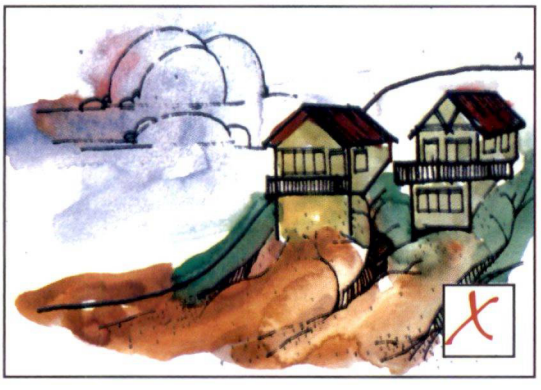


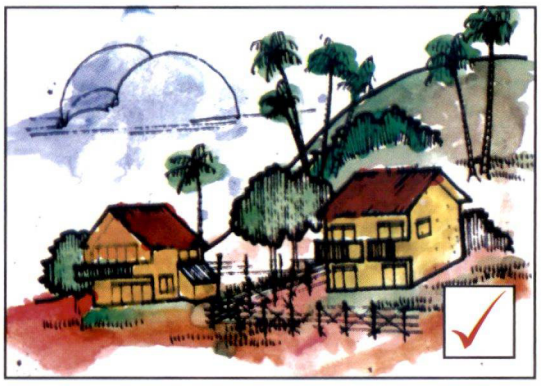


RIVERINE AND SWAMP FOREST in the flood plains pay a useful role in absorbing and retaining flood waters, preventing downstream floods and also trapping sediments and other pollutants.

Clearance or drainage of such forests can therefore include flooding downstream, especially in areas with heavy seasonal rainfall when flash-flooding can cause considerable damage to infra structure and loss of life.

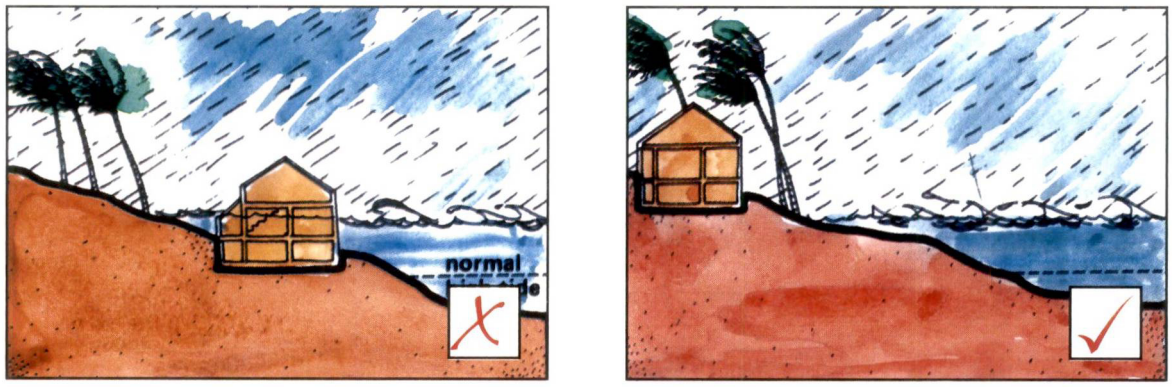
4.1.6 Steep slopes





Unless considerable time and investments are provided for special precautions, STEEP SLOPES should not be built upon. Erosion from the surface runoff is likely to be considerably more severe than on moderate slopes, and the weight of structures on steep hillsides may cause unstable soils to slump and weaken or crack foundations. In extreme cases, mudslides/rockslides may cause buildings to collapse.

4.1.7 Low lying Areas Bordering Estuaries and Coastlines



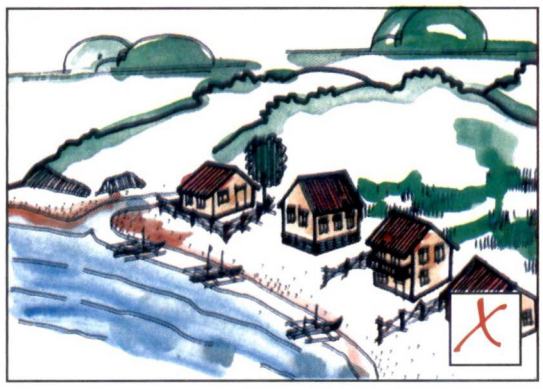
LOW- LYING areas bordering estuaries and the coastline may be prone to periodic flooding and storm damage. Development of these areas should be limited to water- related activities such as recreation; other development should be carefully planned and regulated.

4.1.8 Tidal Wetlands and Flats



Generally, TIDAL WETLANDS and tidal flats should be filled or built upon. High water tables, unstable soils and flooding risk make development difficult. The value of tidal wetland habitats as wildlife reserves, cleansers of pollutants, nutrient producers, spawning grounds and aesthetic attractions make their conservation vital.

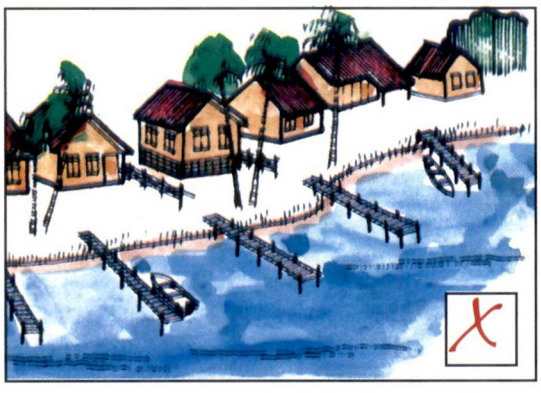
4.1.9 Sandy Shorelines

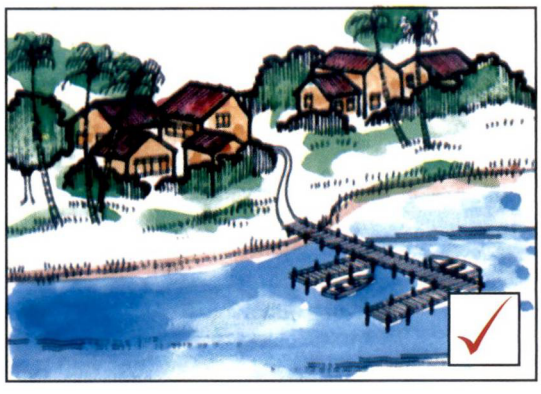




Some SANDY SHORLINES are easily damaged by human activities. Loss of vegetation through trampling will increase erosion. Foundations for structures are usually unstable, danger from flooding may be high and water supply and waste disposal problems are often frequent and expensive. Development of such areas should be appropriated with great care.

4.1.10 Proper Development of Lakefront/ Coastline





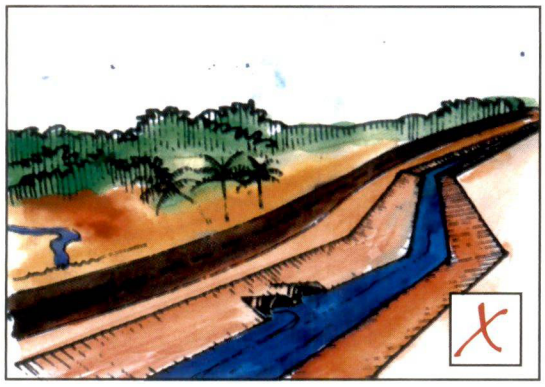
The natural quality and attractiveness of a lakefront or coastline can be destroyed by improper development. Heavy development of the immediate waterfront causes loss to most vegetation and increases danger of pollution from septic systems. Houses should be stet back clustered, with common docks and access points instead of unsightly piers.

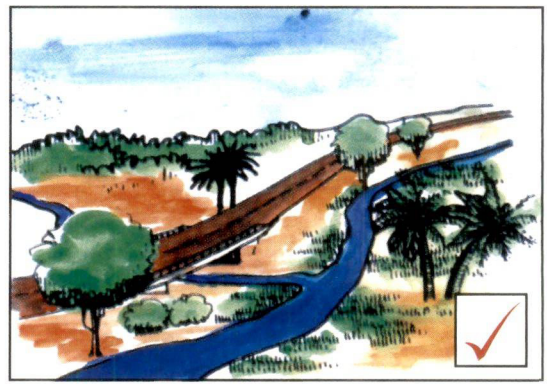
4.2 Urban and Suburban Area Development.

Development of urban and suburban areas will inevitably lead to adverse impacts on natural habitat. Nevertheless, with careful planning, the integrity of natural systems can be conserved. The aim of the developer, therefore, should be minimize adverse impacts by careful selection of sites and methods of development.

4.2.1 Construction Considerations

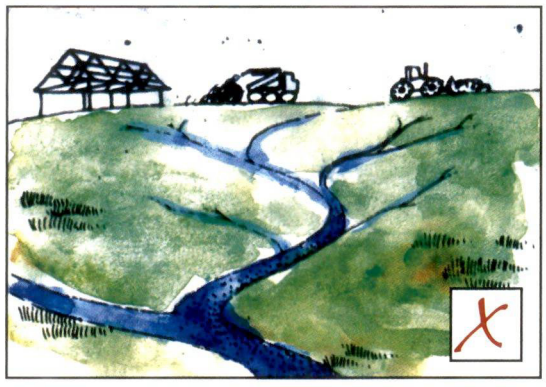
4.2.2.1 Alteration of Surface Water Flow

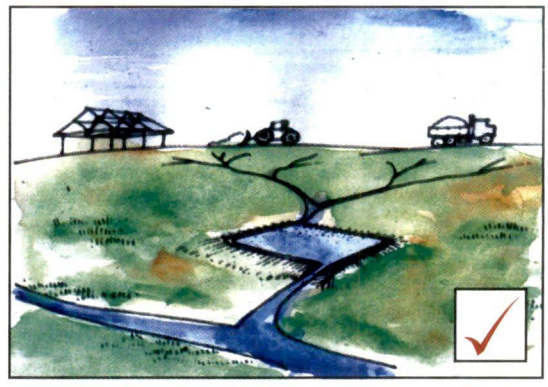




STREAM CANALIZATION and the use of culverts should be minimized. Alteration of the natural flow of surface water usually results in a loss of biological productivity and a reduction in the scenic value of the area. Increased velocity of water flowing through pipes and man-made channels aggravates erosion, especially downstream from the development site.

4.2.2.2 Sediment Control





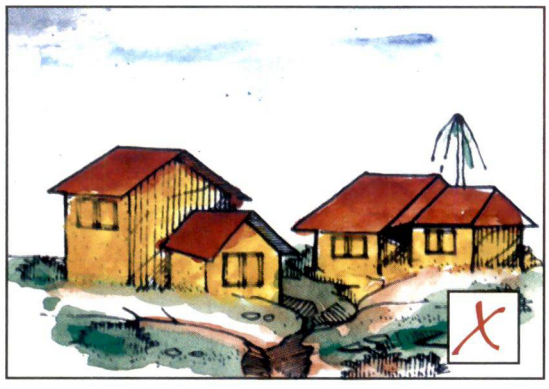
Run off from construction sites can badly pollute streams with silt. Temporary sedimentation basins which allow much of the silt to settle out of the water can reduce

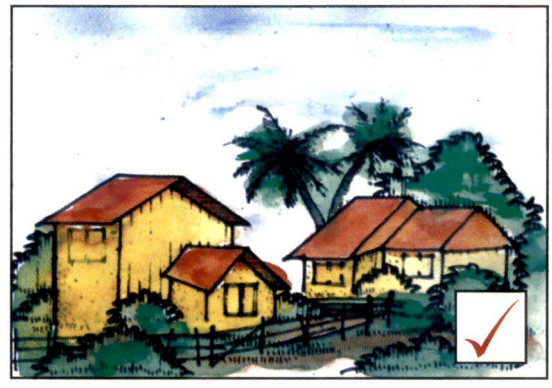
pollution problems. At small construction sites, matting can be anchored to ground where water drains from the sites, or a wetland area could be constructed. Both would trap sediments and stem or slow the flow of the water, reducing erosion and pollution.

4.2.2.3 Site Damage

Erosion, sedimentation and damage to existing vegetation can be reduced by grading only those parts of the site where construction will occur. Fencing off or isolating areas will preserve the natural character of the site and increase its value after construction is completed.

4.2.2.4 Soil Cover



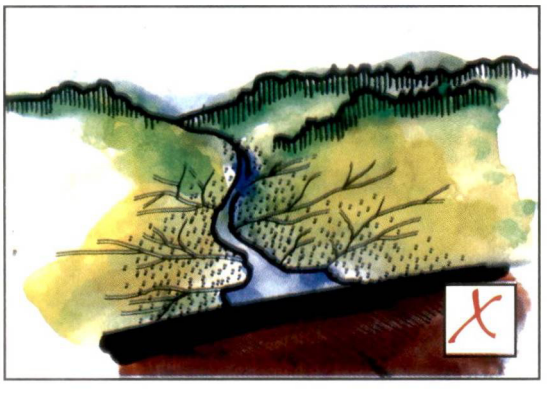


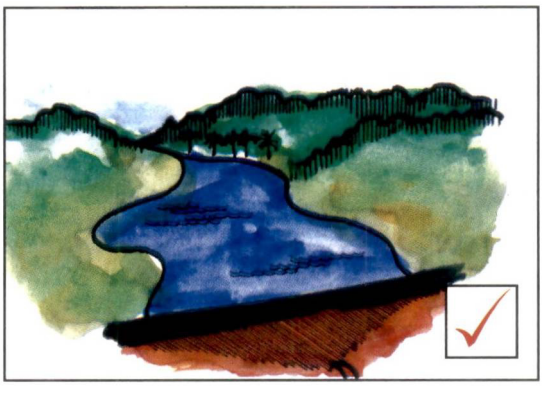
BARE EARTH should be graded and seeded as soon after construction as possible. Allowing exposed top soil to erode, reduces the visual quality of the site, increases sedimentation, and requires unnecessary expense in preparing the area for later landscaping.

4.2.2.5 Dust Control

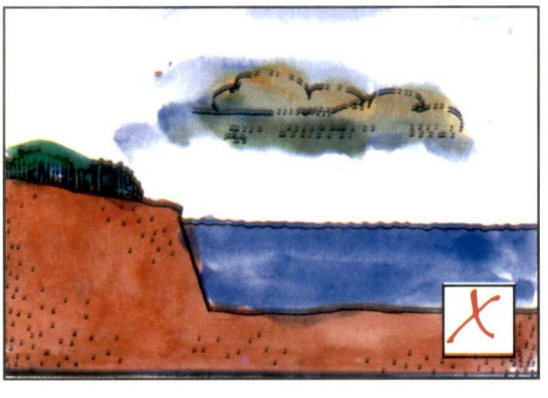
Dust released at construction sites can be a nuisance and a health hazard. Access roads should be regularly sprinkled with water. Trucks hauling earth materials should be equipped with a cover to control dust generation and construction should be timed to avoid periods of heavy rain.

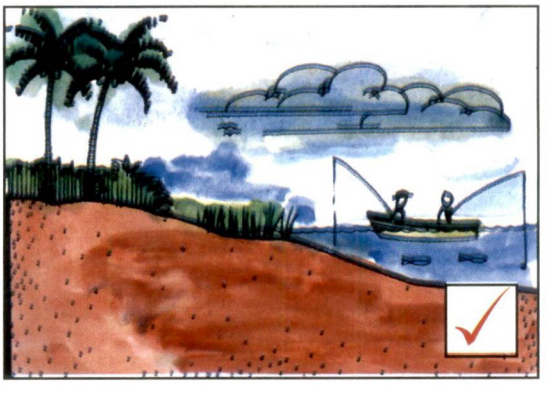
4.2.2.6 Artificial Ponds





Several factors should be considered in planning an ARTIFICIAL POND. If the watershed drainage into the site is too small, the pond may stagnate or not fill properly. If the soil is highly permeable (sand and gravel for instance, the pond may drain quickly. Erosion and pollution upstream may preclude use of a site.



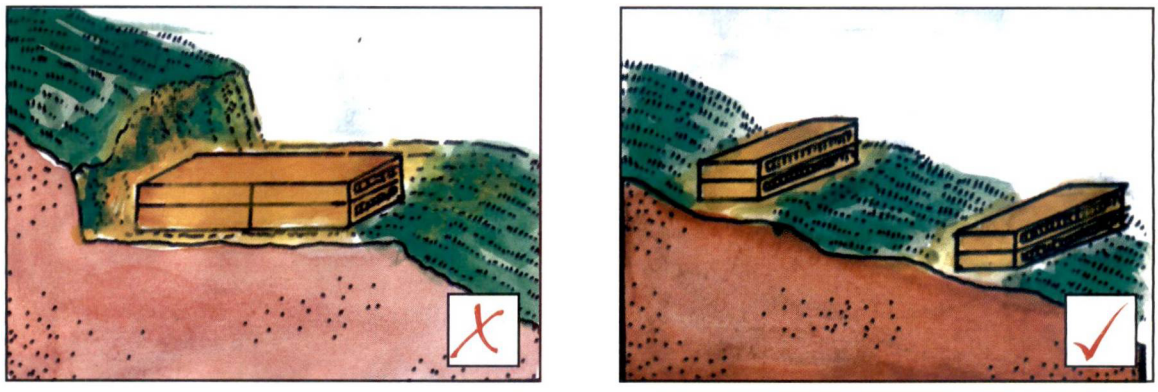


The recreational potential of a site can be increased by designing ponds suitable for stocking with fish. Although design requirements vary from site to site, shallow and deep areas should be combined. Shallow vegetated areas are important as fish and water bird habitat. Steep banks should be avoided.

4.2.2.7 Buildings in Relation to Soil Conditions

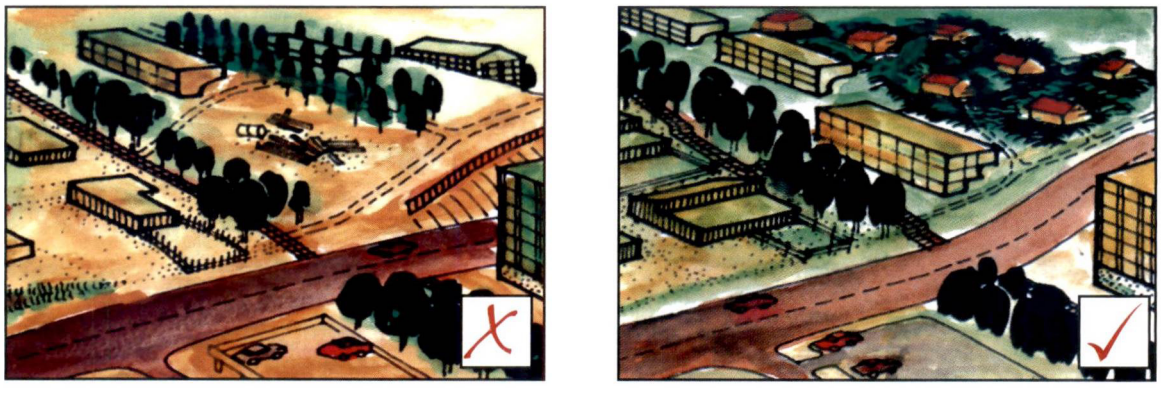
Planning and cost estimates should consider the greater piling costs for high-rise buildings rather than presuming that high-rise buildings are more economical. Light small houses may be founded on ground without piling – even on clay soil if the dry crust is sufficiently thick.

4.2.2.8 Buildings and Contours



Long buildings on a hilly and rocky site give rise to high earth construction costs. Least costs arise when the building is located along the contours. On very hilly and rocky ground it is more economic to use short and high buildings. The soil in rocky areas causes approximately equal additional costs for networks of traffic, water supply and sewage and drainage. Large cuttings and embankments should be avoided in the location of traffic networks, parking places and fields. In the planning of sewage and drainage, the terrain slopes must be taken into consideration so that expensive pumping stations and pressure pipes may be avoided.

4.2.2.9 Earthworks

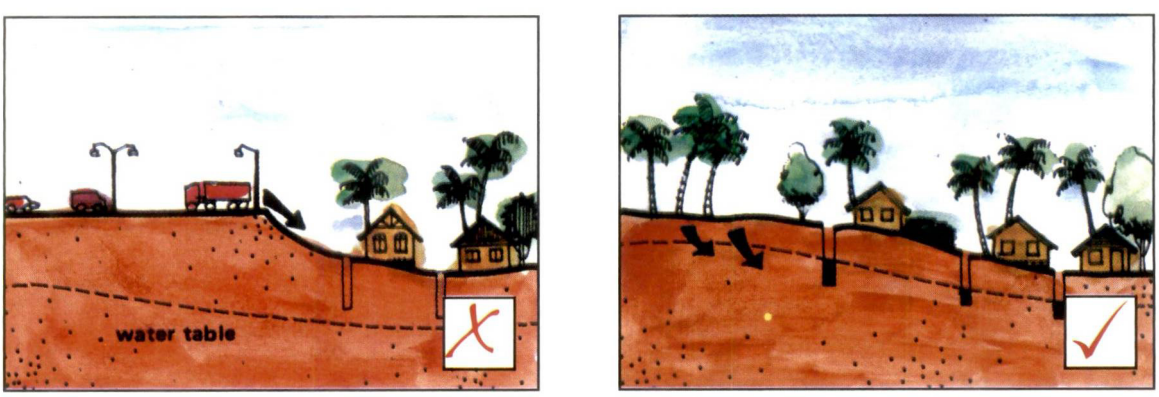


If the large earth construction works are avoided in planning, the original landscape and its beauty may be preserved. Quality usually increases and costs decrease by preserving the existing structure and vegetation in the area.

4.2.2.10 Building Foundations

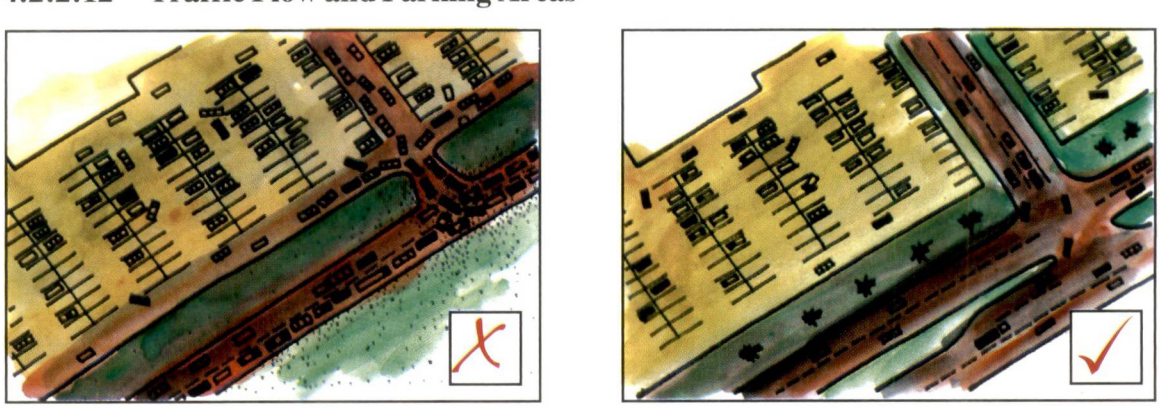
In low areas with high ground water, care must be taken to ensure that BUILDING FOUNDATIONS are above the maximum high water level. Foundations built below the water level may flood and settle, are subject to cracking and, in extreme cases, collapse. Buildings should generally be excluded from such areas, otherwise special engineering measures such as slab foundations or curtain drains must be used.

4.2.2.11 Pavement



Extensive paving over of ground water RECHARGE AREAS causes water to remain on the surface that would normally filter through the soil. This may lower the water table to such a degree that shallow wells go dry. Increased runoff from paved areas becomes polluted, worsens erosion and, because it no longer slowly percolates through the soil, increases the changes of flooding.

4.2.2.12 Traffic Flow and Parking Areas



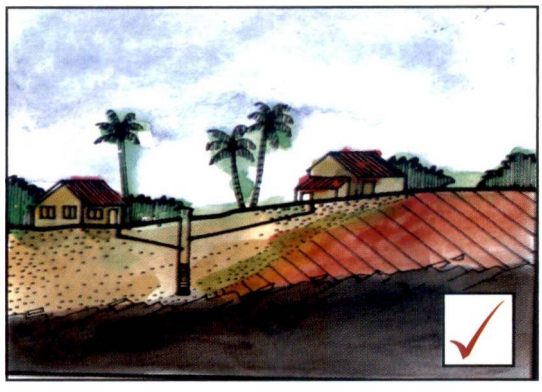
Large developments that are likely to generate a significant amount of traffic should be located in areas where existing traffic flow is good and where roads can handle increased traffic. PARKING AREAS should be designed with easy entrance and exit. Large tress

should be left standing wherever possible, and planting should be encouraged, to provide shade for parked cars. Through traffic should be hindered as little as possible.

4.3 Water Quality

4.3.1 Installation of Wells

Generally, WELLS will be less expensive to install and will yield more water in sand and gravel rather than in fine alluvium or clay soils. Drilling deep into bedrock is often unnecessary if the water table is relatively close to the surface. Installing a single well for several homes rather than using individual wells is less expensive and allows for choice of an optimum site.

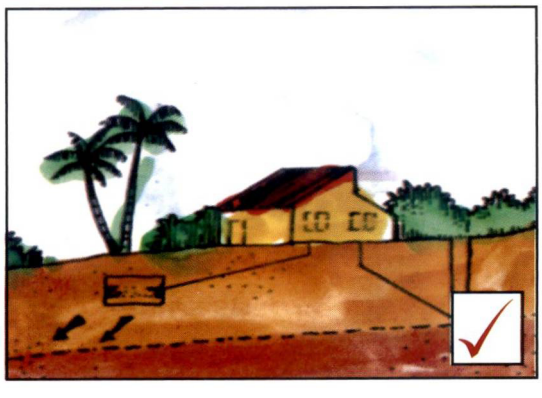


Most water from a bedrock well will be obtained at a depth of less than 200 to 250 feet. Drilling substantially deeper than this level is rarely productive and is often prohibitively expensive. The water storage capacity provided by a deep well can be more cheaply provided by a basement holding tank.



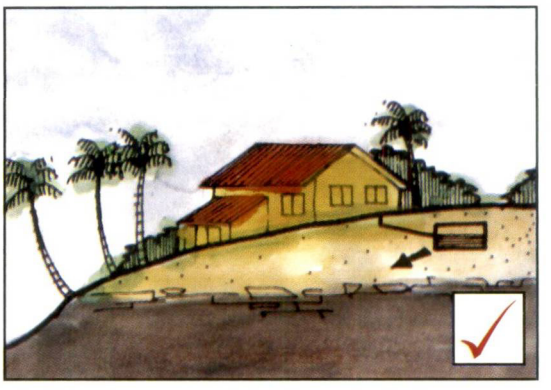
4.3.2 Septic System design in Relation to Soil

Improper septic system design relative to soil characteristics often results in unsanitary conditions. Relatively impermeable soils such as clay may cause sewage to come to the surface, highly permeable soils may allow sewage to enter groundwater or lakes and streams before it is sufficiently purified.



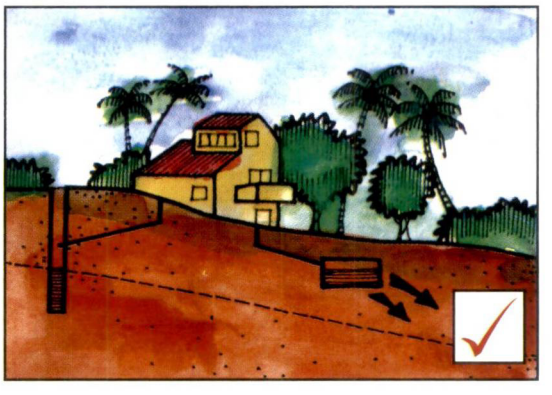
If bedrock is close to the surface, sewage may travel along shallow bedrock and though its

fissures, coming to the surface before it has been adequately purified. Bedrock should be at least 7 feet below the surface. If the depth to bedrock is less than 7 feet, special design may be necessary. The bottom of the leaching trenches must be at least four feet above the bedrock surface.

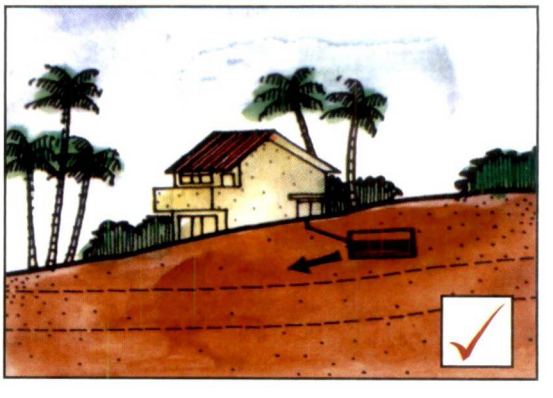


4.3.3 Placement of Septic systems

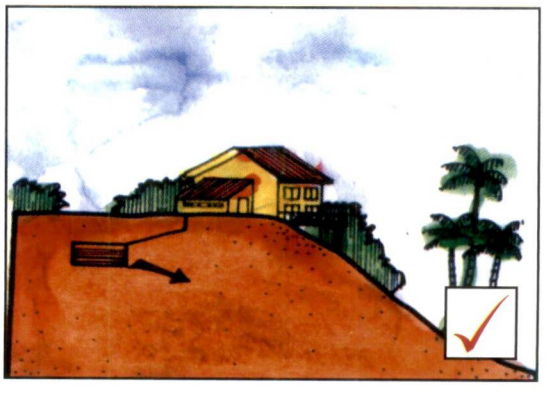
Drinking water can become contaminated by improper placement of septic systems. To ensure reasonable protection from contamination, residential water supply wells should be at least 35 to 50 feet from septic systems. If possible, leaching fields should be placed so that leachate flows away from nearby wells.



A septic system installed above the water table during the dry season may be in or near ground water when the rains come, allowing sewage to contaminate drinking water supplies. Systems should be installed in areas where the land surface is at least 10 feet above the low ground water level and 4.5 feet above the high water level.



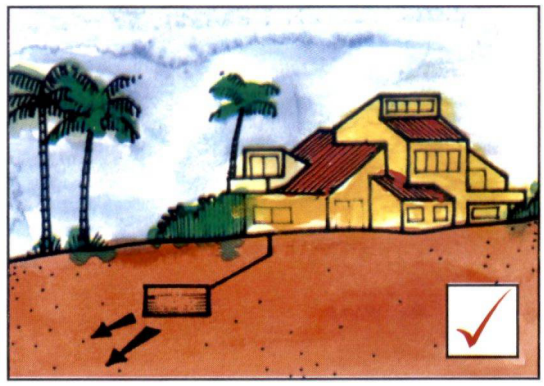
Septic systems should be placed a minimum of 15 feet from steep slopes (of 15 percent or grater), Sewage entering the soil close to a slope will move too quickly to be adequately purified, and may come to the surface creating unsanitary conditions.



Septic systems should be installed more than 50 feet from tributaries to drinking water supplies or 25 feet from any lake, stream or standing surface water. It is recommended that systems

be installed at least 50 feet away from all water courses, since septic system failure can pollute streams, affecting water quality for drinking supplies, and adding large amounts of nutrient matter to lakes and ponds, causing extensive algal growth.

4.3.4 Size of Septic Systems



To function properly, septic systems must be large enough to handle the amount of sewage produced by the water buildings they serve. Otherwise, inadequately purified sewage may reach the surface or contaminate water supplies. Leaching fields should also be of adequate size, dimensions vary according to soil characteristics.

4.4 Harmonizing with the Landscape

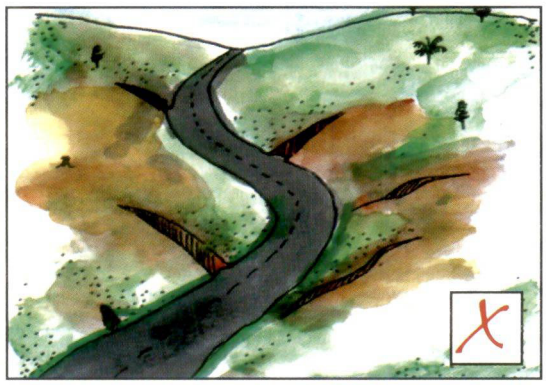
4.4.1 Avoid Hilltops

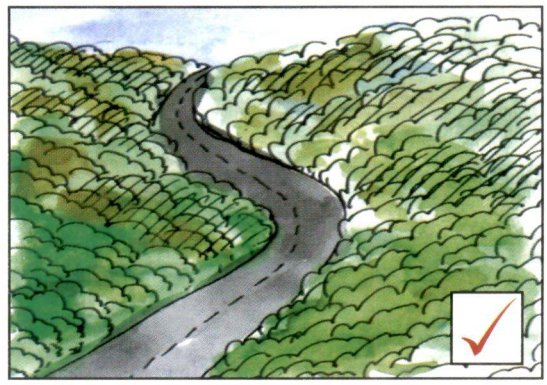




Hilltops should be avoided as buildings sites. Exposure to winds increases storm damage, the natural horizon line is interrupted and buildings are highly visible. Buildings located below hillcrests are more sheltered and are less visible from distant viewpoints.

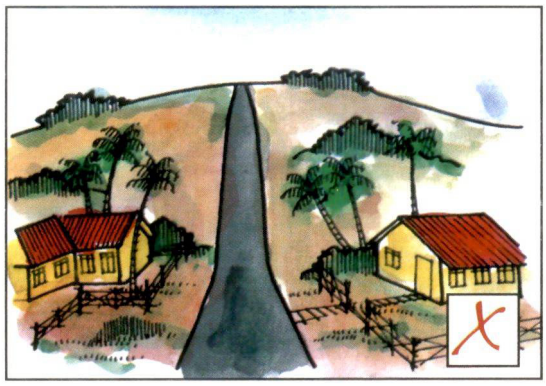
4.4.2 Retention of Vegetation on Highways Slopes.

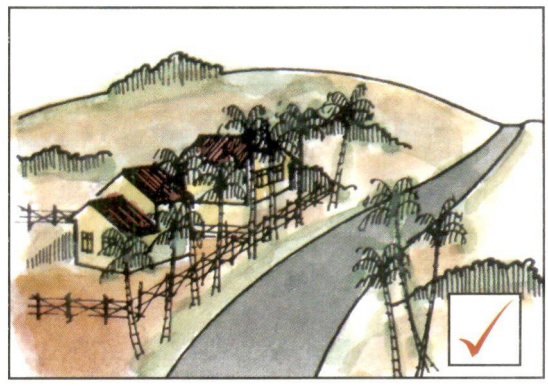




Retention of vegetation on slopes above highways will prevent erosion and landslips, avoiding expensive corrective work and road maintenance.

4.4.3 Contouring of Roads.



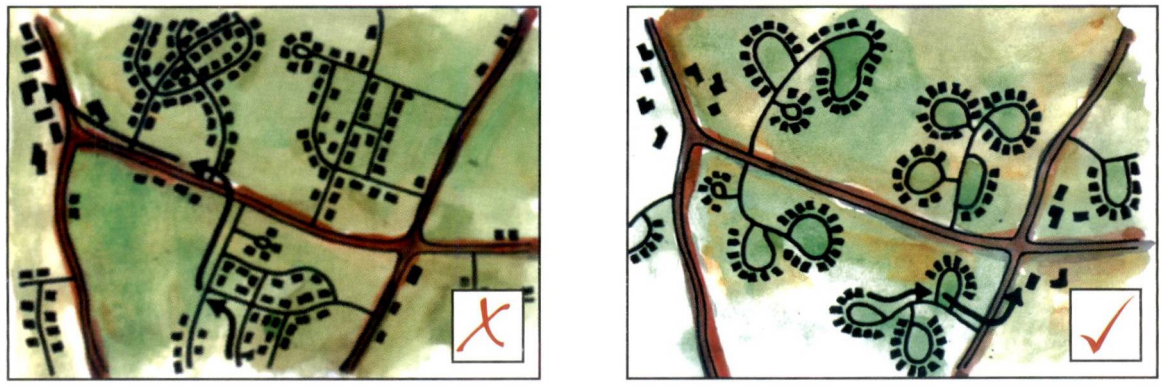


Roads should follow the contours of the site rather than run against them. Roads built straight up and down hills require more grading, are more expensive, need more maintenance, and may increase erosion problems. Visually, a carefully - planned circulation pattern is preferable to a monotonous grid system, and the natural assets of the sites are more likely to be maintained.

4.4.4 Use of curves and Subdivisions

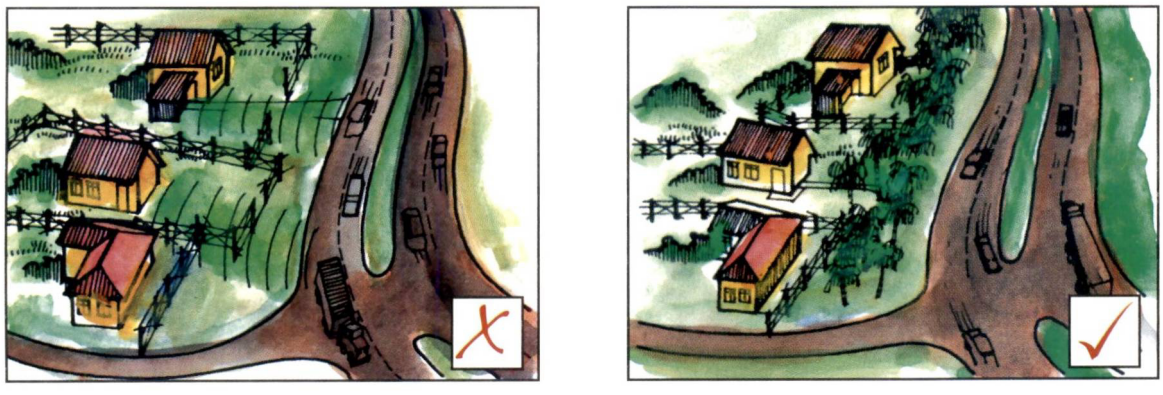
Subdivisions should not be designed with wide 'straight through' streets that encourage outside traffic. Use of curves will improve the visual quality of the subdivisions as well as increase privacy and reduce unnecessary noise and traffic.

4.4.5 Supporting Amenities within Residential Areas.



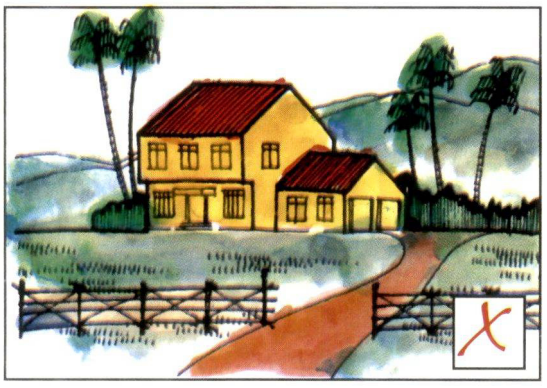
Widely dispersed residential development causes energy to be wasted in frequent and lengthy automobile trips. Increasing density of development and locating subdivisions, schools, areas and employment centers near each other reduces petrol consumption and makes possible the use of alternative forms of transportation.

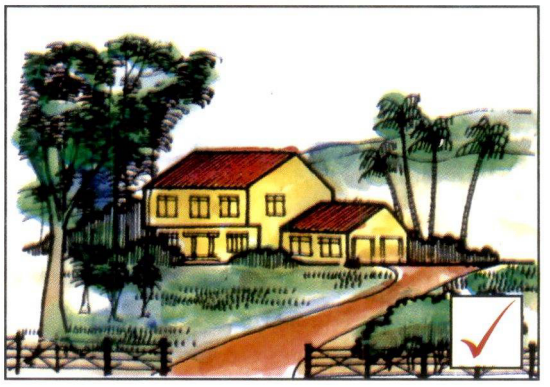
4.4.6 Use of Buffer Areas



Residential areas should be separated from major highways, commercial areas, or factories by buffer areas. Existing or planned vegetation (especially evergreens) and bulldozed earthen banks can effectively increase privacy and reduce noise reaching the development.

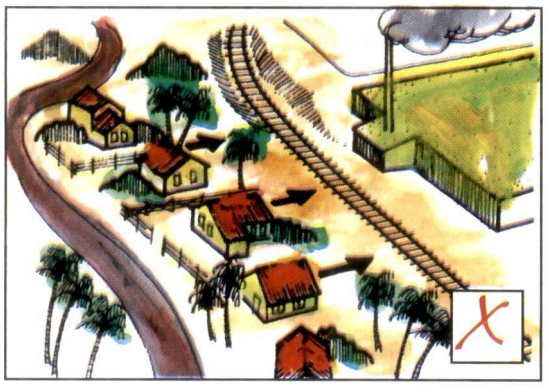
4.4.7 Preserving Existing and New vegetation

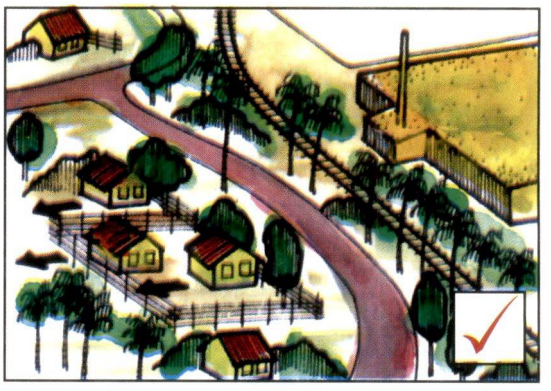




In developing a site, as much existing vegetation as possible should be preserved, Stripping an area of trees decrease its value and reduce its visual quality. When planting new vegetation, it is best to use native species, since they are generally harder and better suited to the site than ornamental and exotic plants.

4.4.8 Avoiding Unsightly Views





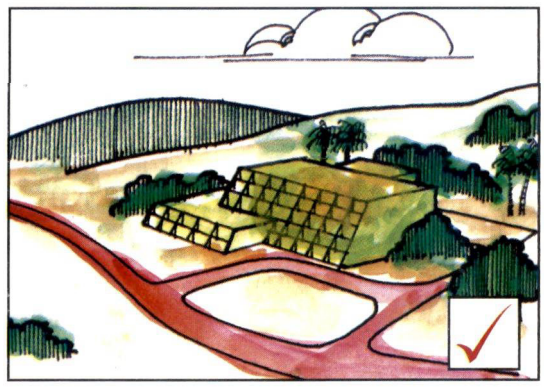
In addition to screening homes from undesirable views, subdivisions can be planned so that houses face away from unsightly buildings, roads and parking lots and take advantage of natural and open space areas. Trees and undergrowth can be tinned to open up distant without stripping the site of vegetation.

4.4.9 Maintain Open Spaces

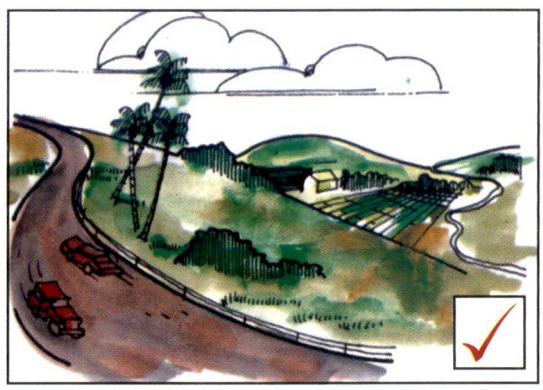
Maintaining portions of a site as open space has many advantages, privacy is improved through separation of buildings or groups of dwellings, car and play areas are separated for greater safety, the value and aesthetic quality of the development are improved. In addition, biologically valuable areas such as wetlands can be preserved, and buildings can be concentrated in areas best suited for them.

4.4.10 Buildings in Harmony with Landscape.

Buildings should be designed to blend with their natural surrounding rather than clash with them. Instead of ignoring or dominating the landscape, large structures should harmonize with the natural features of the area. Use of appropriate building materials and skilful landscaping will make new buildings less obtrusive.



Inappropriate scaling and the architectural style of buildings can visually spoil an entire street. The use of building materials, setback from the street and landscaping of new buildings should harmonize with neighboring structures. Buildings should not "complete" with nearby visual attractions such as mosques, churches, temples and historic houses.

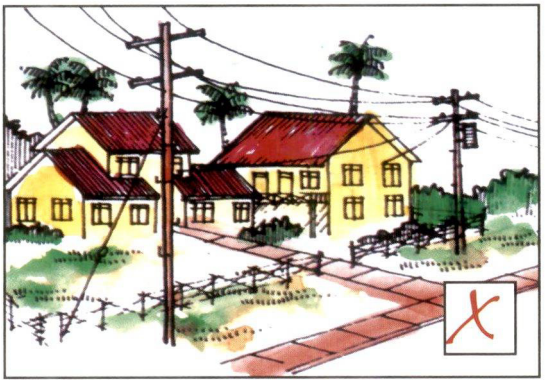


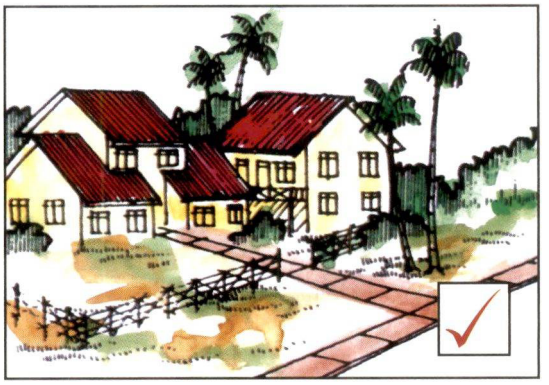
Buildings, signs and parking areas should not block vistas from roads and other public areas. Pleasing views can be maintained by placing utilities underground, landscaping to prevent obscuring the view and locating buildings below or to one side of the line sight.

4.4.11 Compatible Land use

The use of a site should be compatible with other land use in the area. A commercial development that could be an asset in the right location may be a nuisance and an eyesore if improperly sited.

4.4.12 Installation of Utilities

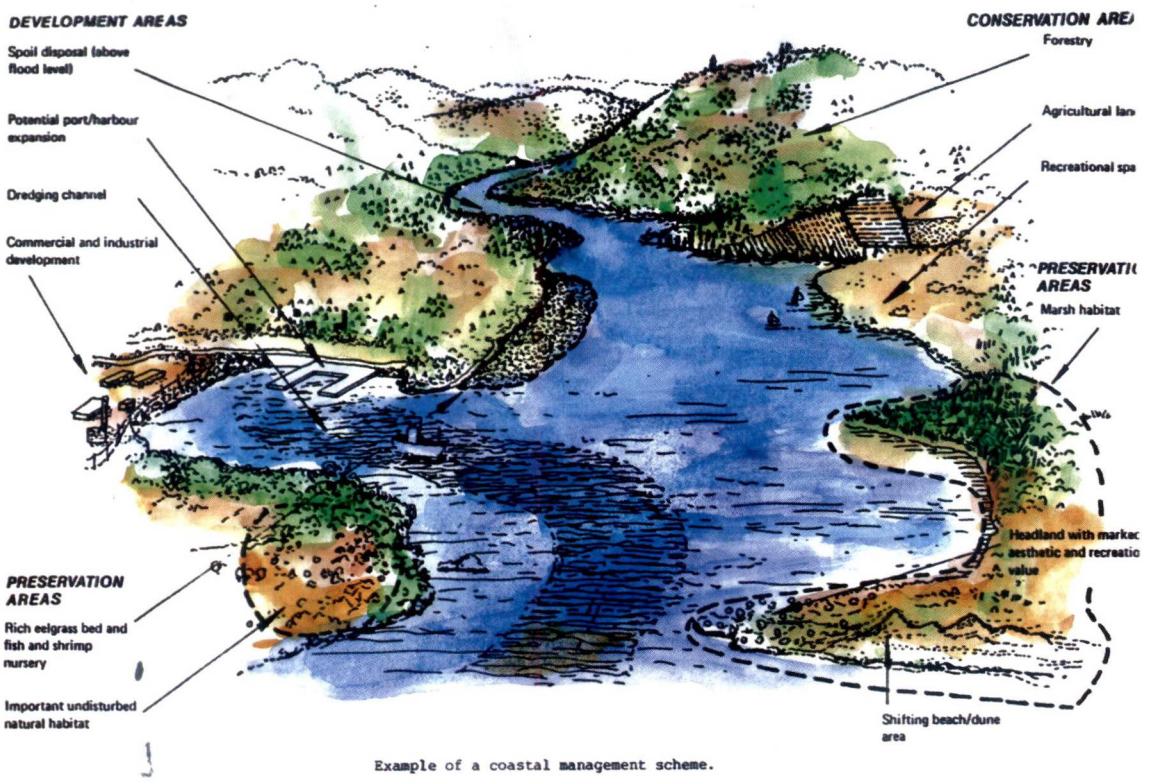




Telegraph poles and overhead wires create a cluttered effect and are susceptible to damage in storms. Installation of utilities can be timed to coincide with road building operations so that expenses and disruption to installing equipment underground are minimized.

5. COASTAL AREA DEVELOPMENT

Many coastal areas are subject to the ever increasing and often conflicting demands of modern living. Nowhere else are so many uses, recreation , fishing, navigation, industrial, commercial and residential development, extraction of mineral resources, water supply and waste disposal concentrated in such a small and vulnerable space.

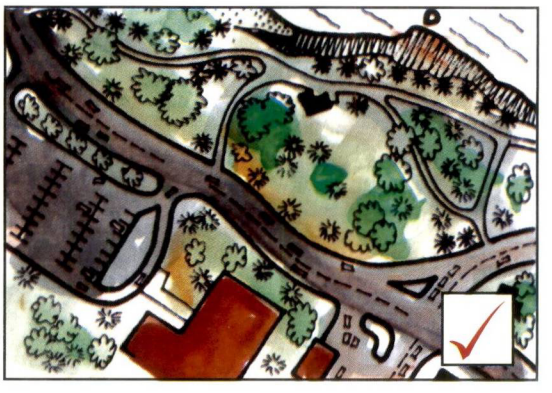


Example of a coastal management scheme.

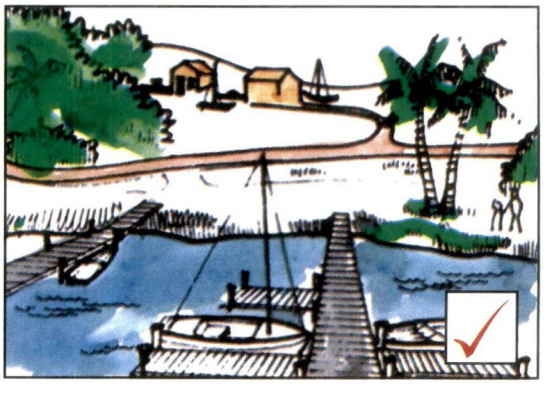
At present, planning and development in estuarine and coastal areas is often conducted in an independent, fragmented fashion often at great cost to the natural environment. Rational planning and evaluation is therefore required, through which environmental controls can be formulated and implemented. This section outlines some of the special factors that should be considered when dealing with a site on or near the coastline.\

5.1 Coastline Land Development

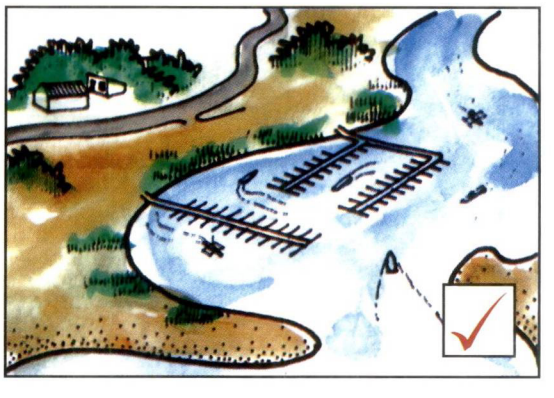
5.1.1 Location of Development



Buildings and other types of development that do not require a COASTAL LOCATION should be inland of the coastline. Locating such development inland will keep coastal areas free for more appropriate water related uses.

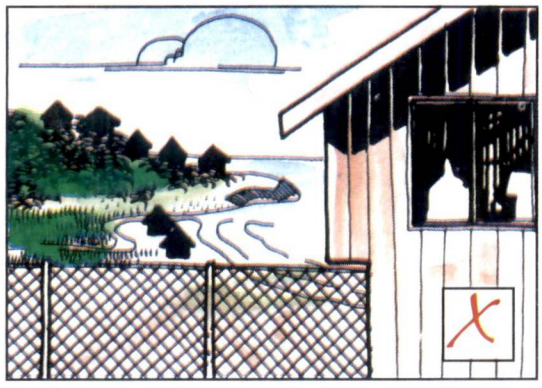


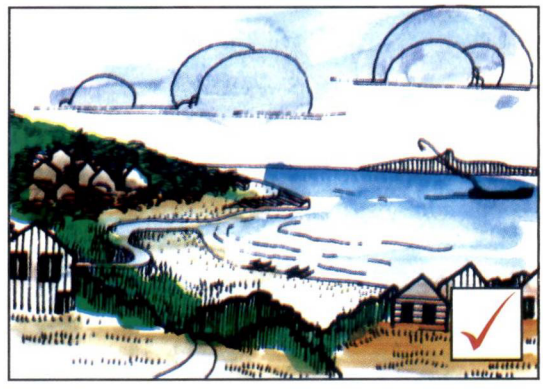
SUPPORTING FACILITIES for marinas, including buildings and storage areas, should be located inland. Locating these facilities on the shoreline occupies valuable open space, pollutes surrounding waters with storm runoff, and greatly increase the probability of serious storm damage.



MARINAS should be located in areas with steep banks and good water circulation, that provide wave and storm protection. In many cases, the natural shoreline can be largely preserved by placing boat slips farther out into the water and connecting them to the shore with wharves. This will reduce expensive dredging and bulk heading, and will preserve the shoreline for recreation and wildlife.

5.1.2 Scenic Quality

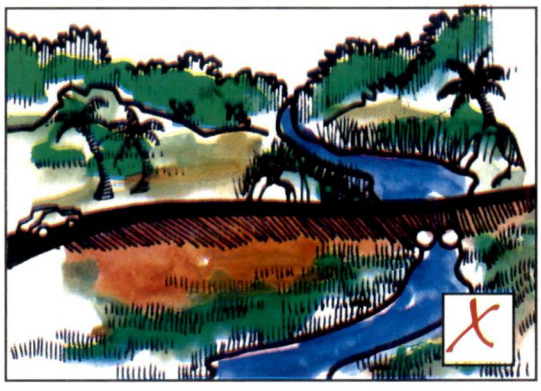


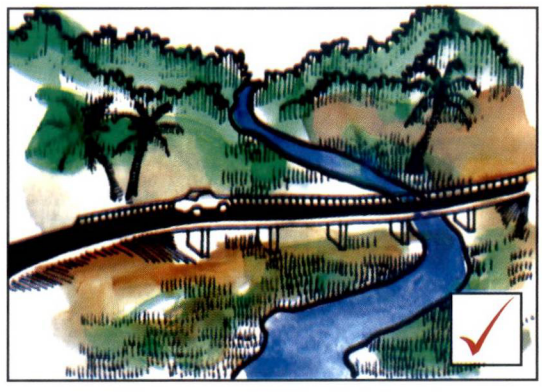


The design of any coastal development should take SCENIC QUALITY into consideration. Public access to scenic views should be readily available. Vistas of estuaries and coastal areas can be preserved through the use of buffer zone or by planning the size and location of roads and structures bearing in mind their visual impact.

5.2 Coastal Water Systems and Development

5.2.1 Use of Bridges, Causeway and Docks

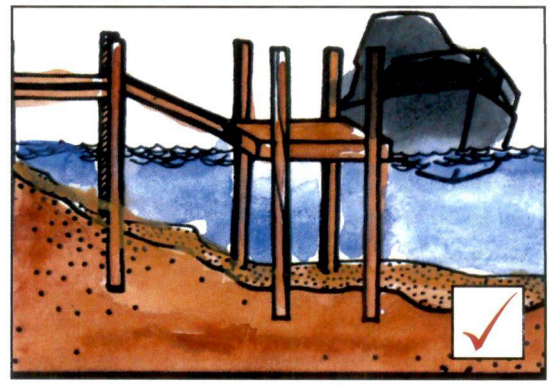




Bridges Causeway and docks in tidal waters and wetlands should be built so that water circulation is not blocked or impeded. Bridges are more desirable than culverts; pile supported causeway across marshes and tidal flats preserve natural habitat and are less disruptive than solid fill.

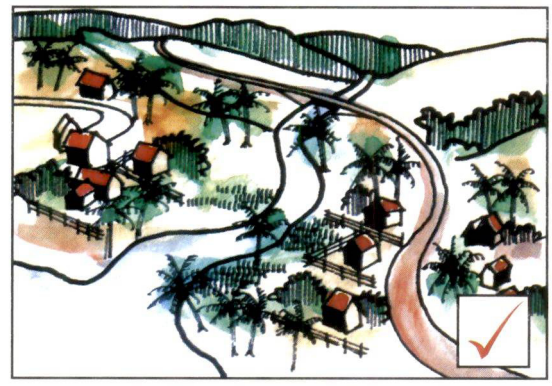
5.2.2 Use of pilings

If it is necessary to install a structure in tidal water, pilings are better than fill. Water, sediments and wildlife can move freely beneath the pilings where a solid structure would have created an obstruction. Pilings are also cheaper.

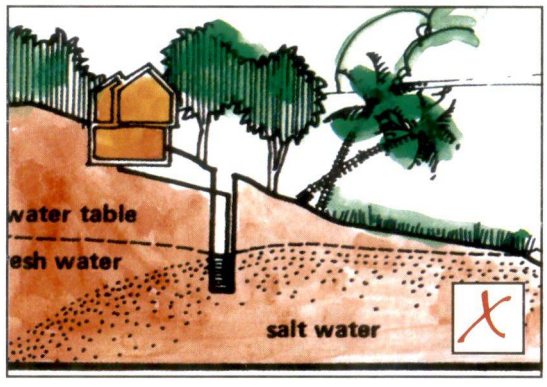


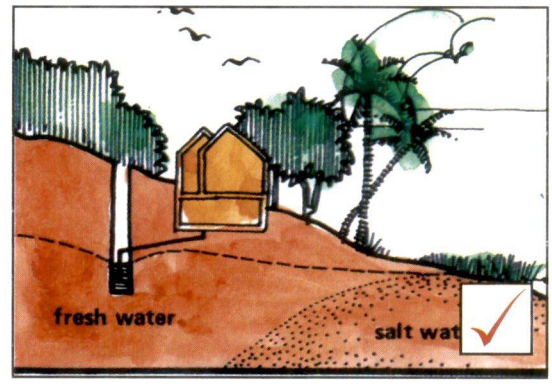
5.2.3 Maintain Natural Drainage patterns

Natural drainage patterns of shore lands should be maintained. Canalization and diversion of coastal streams can increase pollution, change salinity levels and decrease biological activity in estuaries by diverting flow from marshes, tidal flats and other shallow areas.



5.2.4 Placement of wells



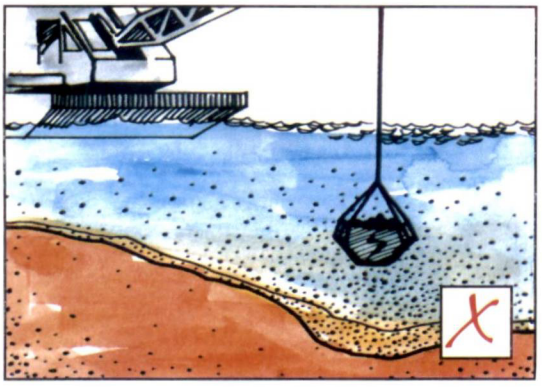


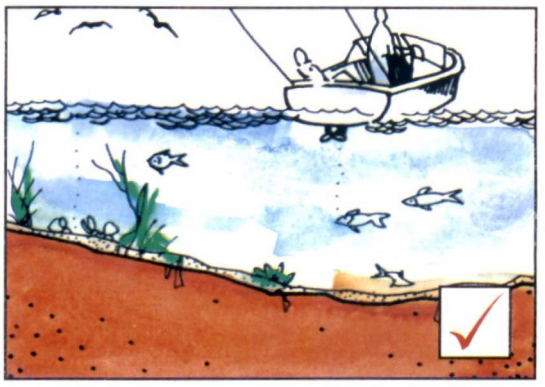
If WELLS are to be used for water supply, fresh groundwater may be in short supply in many coastal areas. Pumping water out of the ground sometimes causes salt water to contaminate wells. This potential problem should be studied thoroughly prior to development of a coastal site.

5.2.5 Septic Systems

Poorly planned SEPTIC systems can be especially troublesome near the coastline. Since the water is usually close to the surface, waste water may enter the ground water before it is properly cleansed. Highly permeable sandy soils and relatively impermeable wetland soils require special consideration in design and may limit development sites. Bedrock close to the surface may also cause problems.

5.2.6 Impacts of Dredging



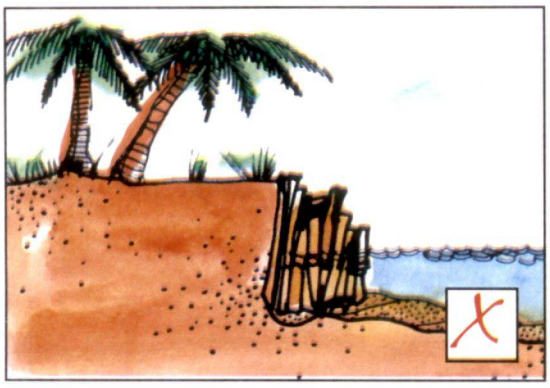


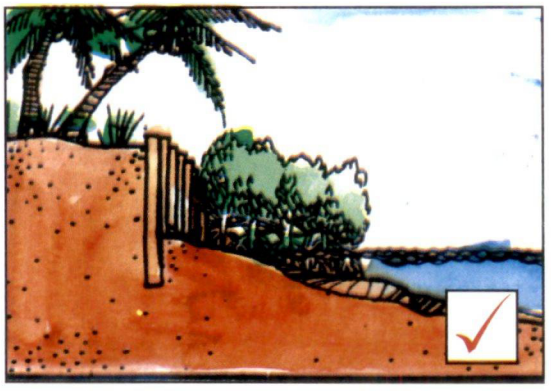
DREDGING frequently changes water circulation patterns and salinity and releases pollutants from bottom sediments, Fine silt disturbed through dredging clouds and water and creates poor habitat for bottom organism after settling. The silt is easily moved by tides and currents. Clogged channels may require frequent re-dredging. Whenever possible, dredging should be avoided. If it is necessary, the amount dredged should be minimized and disposed of with care.

5.2.7 Reclamation of Coastal and Tidal Waters

It is always advised that coastal and tidal waters should not be filled or otherwise altered. Filled tidal areas are often subject to flooding and may result in erosion problems. In addition, filling alters the flow of water and sediments and destroys wildlife habitat and productive shallow areas.

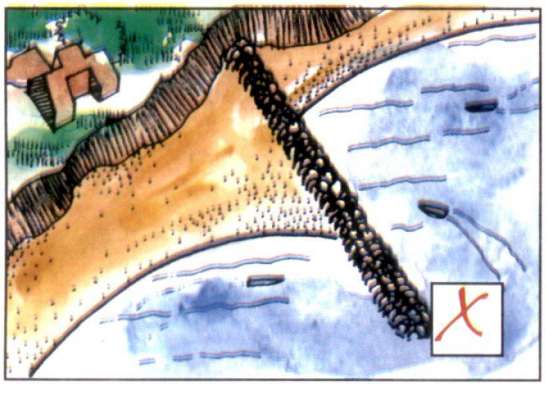
5.2.8 Avoid Bulk heading

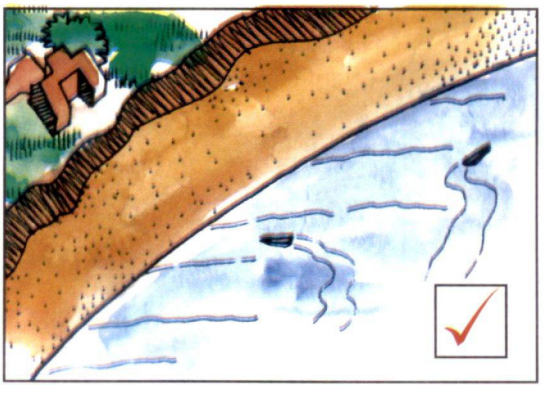




With careful planning, BULKHEADING can usually be avoided by locating development away from eroding shorelines. If not, it may be possible to retain or establish a buffer strip of vegetation between the bulkhead and the water. This will prevent undermining of the bulkhead and will protect wildlife habitat and increase productivity.

5.2.9 Eroding Beaches





JETTIES, GROINS AND OTHER STRUCTURES perpendicular to the shoreline often cut off the transport of sand by wave action. Sand may build up on one side of the barrier while the beach on the other side is starved of sand and erodes away. Avoiding such structures allows natural process to resupply eroding beaches with sand.

References

1. A Guide to Development in Urban and coastal Areas, Colin Rees, Asian Wetland Bureau, (1990)

Contact Details:
Environmental Economics &Global Affairs Division
Ministry of Environment & Natural Resources
342, Pitakotte, Kotte.
Tel: 011-2816970
Fax: 011-4410236
E-mail: eeconga@yahoo.com