Environmental Guidelines for Coastal Tourism Development in Sri Lanka

Edited by

Kate Sullivan
Lalith de Silva
Alan T. White
and
Mervyn Wijeratne

1995

Coast Conservation Department

Ceylon Tourist Board

Coastal Resources Management Project of
The University of Rhode Island

United States Agency for International Development

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Foreword

The coastal areas of Sri Lanka are famous for their beautiful beaches, lush vegetation, rocky headlands and hospitable culture. This reputation has encouraged a large and expanding coastal tourism industry. Tourist visits to Sri Lanka are expected to more than double by the year 2000. Thus, although the prospects for significantly increased economies from tourism are very good, the possibility of increasing rates of environmental degradation is also likely.

The purpose of this book is simply to provide information to tourism developers and other persons about how to avoid unnecessary environmental problems from coastal tourism development. A primary message is that planning for environmental protection is much better and less costly than reacting to past mistakes. Another message is that unless coastal environments are protected and enhanced in the next ten years in Sri Lanka, tourism will almost certainly decline in response.

Tourists in the 1990s are increasingly conscious about the environment at and near their abode. They often have little patience with polluted and unsightly areas. They will more often choose destinations where tourist operators are sensitive to the environment and actively working to improve the environment rather than disturb it. More and more tourists worldwide are looking for "ecotourism" outlets for their travel and vacations.

Sri Lanka has a tremendous potential to further develop its coastal areas in a manner sensitive to the natural limits of the environmental resources of beaches, coral reefs, water quality, land and culture. This book should assist in providing guidance in the process of deciding about development options and procedures to minimize damage to the coastal environment. Being alert to "carrying capacity" and what is "sustainable" are the guiding lights for all development. Let us make our tourism industry sustainable in a meaningful way and protect our coastal environments.

H.M.S. Samaranayake
Chairman
Ceylon Tourist Board

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Hotel designs which include large setbacks from the beach with gardens, shade trees and recreational space are preferred by almost all tourists

Tourism and local people cannot be separated and must be planned for to minimize negative social relations

1. Introduction: Tourism and Environment in Sri Lanka

Background

Tourism in developing nations plays an important role in obtaining foreign exchange and providing employment. Growth in this sector has been rapid and continuous in tropical developing countries over the past few decades and is occurring at a rate higher to that of developed nations due to the year round availability of sea, sun, and sand.[49] Since most developing nations do not have regulations or resources for coastal environmental protection, economic gain has been the primary focus of tourism. Thus, most coastal tourism has had negative environmental and social impacts which will increase with expansion unless preventive measures are adopted.[40]

In Sri Lanka, coastal tourism accounts for 80 percent of the total tourism infrastructure in the country and a significant portion of the national economy[31] (Figure 1). In 1994, about 400,000 tourists visited the country, this is projected to increase to about one million by the year 2000 (Figure 2). Sandy beaches, warm tropical waters, coral reefs, and lush vegetation are some of the primary natural and physical attractions of Sri Lanka's coastal region for tourists. Cultural attractions include friendly people, archeological sites, religious and historical features, which enhance the physical attributes of the country.

Tourists seek areas with plentiful cultural and natural attractions. This is evidenced by the rapid expansion of nature-based tourism in tropical developing nations.[4] This type of tourism relies on the natural features of the country as well as on cultural and archeological sites, much as Sri Lanka's tourism does. It can generate revenue for local economies, boost public awareness of the need for conservation, and provide new incentives for residents and government agencies to better regulate natural resource uses.[4] **However, increased tourism infrastructure can place demands on these natural resources, resulting in resource degradation and tourism decline.**

Hikkaduwa, Sri Lanka's most developed beach-resort area, is an example of this dependence on natural resources. Hikkaduwa is the site of a national marine sanctuary, which houses extensive fringing reefs and sandy beaches. These features helped to make Hikkaduwa a popular destination for foreigners. Unfortunately in recent years, these features have been deteriorating from tourism

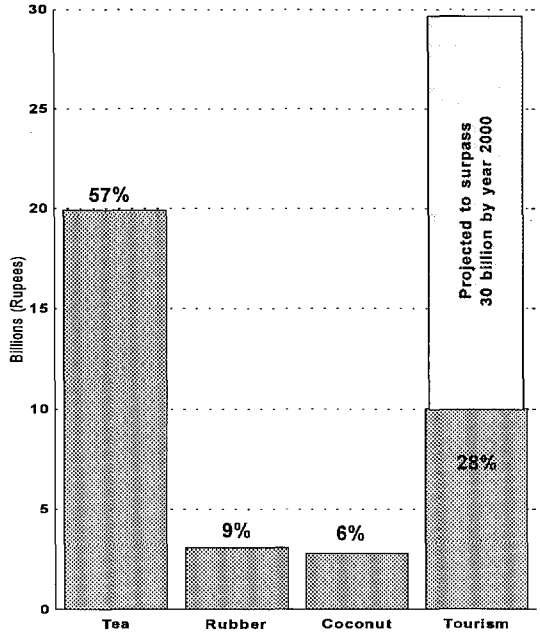


Figure 1. The value of tourism to the national economy of Sri Lanka in 1994 [8, 11]

development and related activities. Today, Hikkaduwa is faced with costly management needs to restore environmental quality.[43]

Improper sewage disposal and treatment by hotels and restaurants has led to groundwater contamination and decreased coastal water quality.[28, 30] Thus, installing sewage collection and treatment facilities is now a necessity for Hikkaduwa. It has been estimated that environmental degradation will lead to tourism declines if better safeguards and management are not implemented, resulting in a significant decline of net economic benefits by 2002.[43] Conversely, if proper sewage and garbage facilities are installed, and the coastal environment is protected in Hikkaduwa, increased tourist arrivals can be accommodated, resulting in higher net economic benefits (Figure 3).

Moreover, high coastal populations in Sri Lanka further compound natural resource degradation. Sri Lanka's population of 17 million is expected to double by the year 2040. Thirty-four percent of the population lives in the coastal zone with more expected to move to coastal areas in the next few years.[25, 31] For example, the south coast area has a population density of 450 persons per square kilometer which is expected to increase to 1,000

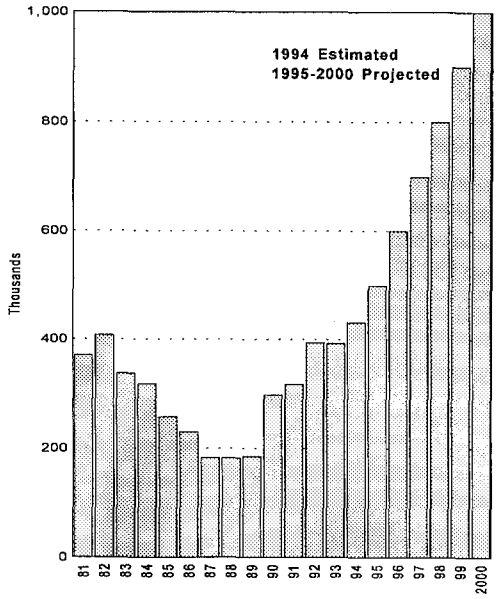


Figure 2. Tourist arrivals in Sri Lanka 1981-2000 [10, 11]

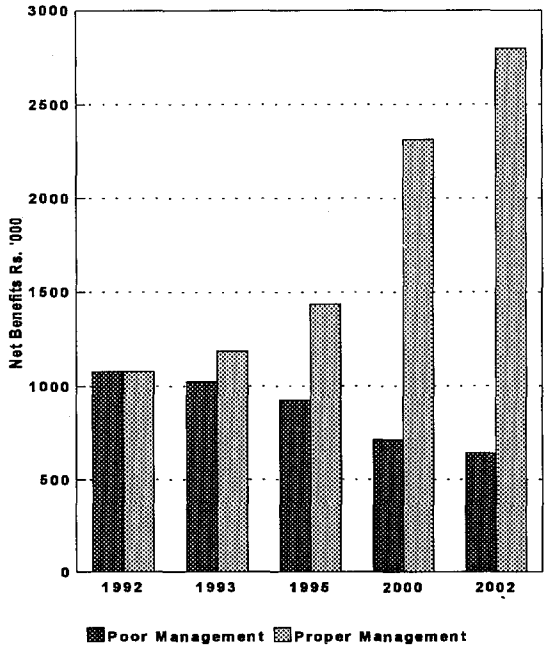


Figure 3. Projected tourism revenues resulting from poor and proper management of coastal resources in Hikkaduwa [43]

by 2001.[38] Population increases and limited land will place greater stress on natural systems of the island, making planning and conservation measures increasingly important.

Tourism, which is expected to expand rapidly with the decline of civil unrest, will further stress natural systems. **As an important source of foreign capital, tourism expansion is seen as economically desirable. It is therefore necessary to design and construct tourist facilities that are harmonious with the natural environment.**[45]

Emergence of Tourism in Sri Lanka

Tourism in Sri Lanka was first sanctioned by the British in 1930 when a policy of tourism development was implemented.[17] Between 1948 and 1956, tourism increased followed by a decline as the result of a change in government policy to stop tourism promotion. During the years 1958-1966, no tourist statistics were kept. In the late 1960's however, a new policy for tourism development was adopted, resulting in notable growth through the early 1980's. After 1983, tourism declined substantially due to civil disturbances. This decline continued until 1989 when peace and order began to improve (Figure 2). Currently, tourism development is being promoted by the government since it provides employment, foreign exchange and builds the national economy. Active overseas promotion as well as access to an international airport have aided in this expansion.[45]

Tourist arrivals in 1993 of 392,250 had an estimated value of US $215 million. The Ceylon Tourist Board predicts that by 2001, 1 to 1.4 million tourists will visit Sri Lanka annually,[10] resulting in the need for construction of more hotels, restaurants, shops, transport and recreation facilities (Figure 4).

Past development has not been well regulated or managed, resulting in environmental degradation problems such as decreased water quality, increased runoff, and destruction of natural vegetation.[31] **A goal of managing future development is to minimize environmental impacts through better planning and siting techniques.**

Purpose of Environmental Guidelines

These guidelines are intended to inform developers about their role in coastal ecosystem management. Tourists, and therefore tourism developers, constitute a large segment of all users of coastal resources. Their activities are of primary concern to coastal managers. Economic success in the tourism sector depends heavily

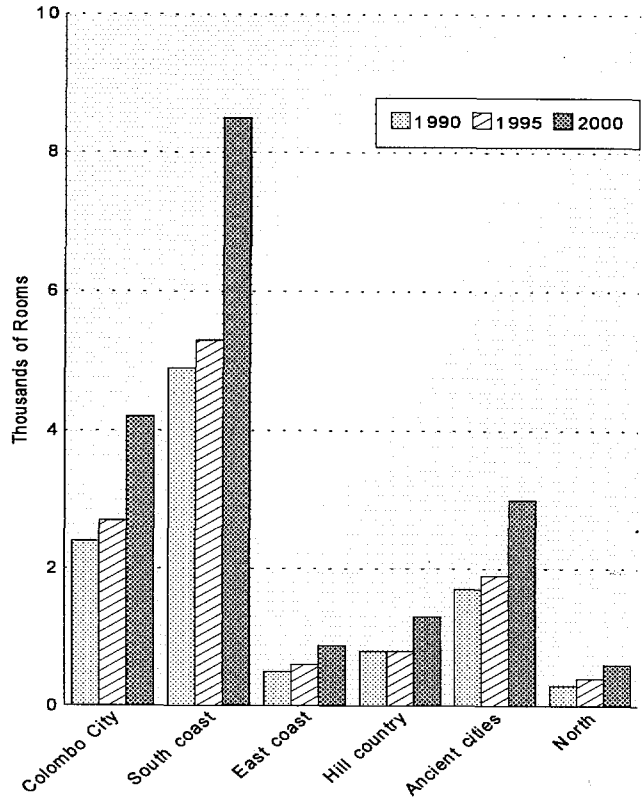


Figure 4. Projected development of hotels by room capacity [39]

on the health of the natural resources upon which tourism is built.[13] If coastal waters become polluted by hotel waste water discharge, tourists will go elsewhere. Since coastal tourism is widespread throughout the Asian region, it is important to maintain and where possible enhance the environment to remain competitive. As shown in Figure 5, tourism will decline without good conservation policies.[27]

These guidelines will provide developers with references and resources available to help in the planning stage and permitting process. Much time is spent in this phase of development, resulting in losses for all involved. Although the Sri Lankan government does not have the means to regulate and enforce comprehensive tourism development rules, it is concerned about the natural coastal environment through the efforts of the Coast Conservation Department.

Tourism projects can be designed to have minimal negative impacts and potentially positive impacts. To sustain the projected increase in tourism, development must be designed to harmonize with the environmental surroundings, not only for maximum

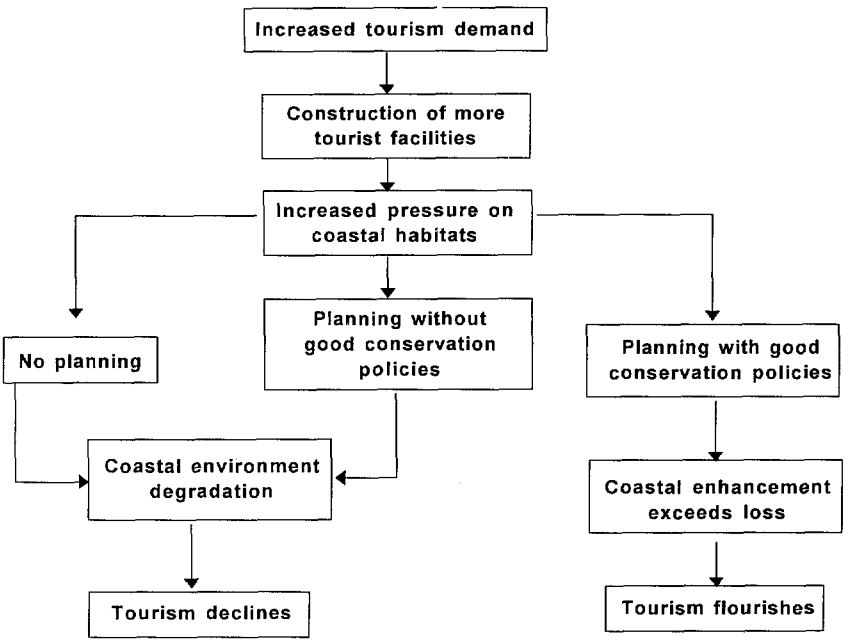


Figure 5. The relationship between tourism development and conservation planning

profitability. **Designing for maximum profitability may seem the best option for the short term; however, over the long term, the cost of environmental damage will outweigh economic gains.** It is important to remember that development, if done haphazardly, can damage the very resources that attract tourists. If, on the other hand, ecological parameters are considered prior to construction, resources of value to tourists will be sustained, as well as the tourist industry as a whole. Environmentally friendly and sustainably managed tourist resorts will attract the growing number of "ecotourists" in the world. Ecological sustainability goes hand-in-hand with economic sustainability as shown in Figure 6.

The following sections describe important coastal processes and ecosystems in Sri Lanka and relate these to development and its potential impacts. Building considerations such as setbacks, landscaping, siting, septic tank and water-well placement, and waste disposal are reviewed. Lastly, references are provided to help developers and potential developers find accurate answers quickly.

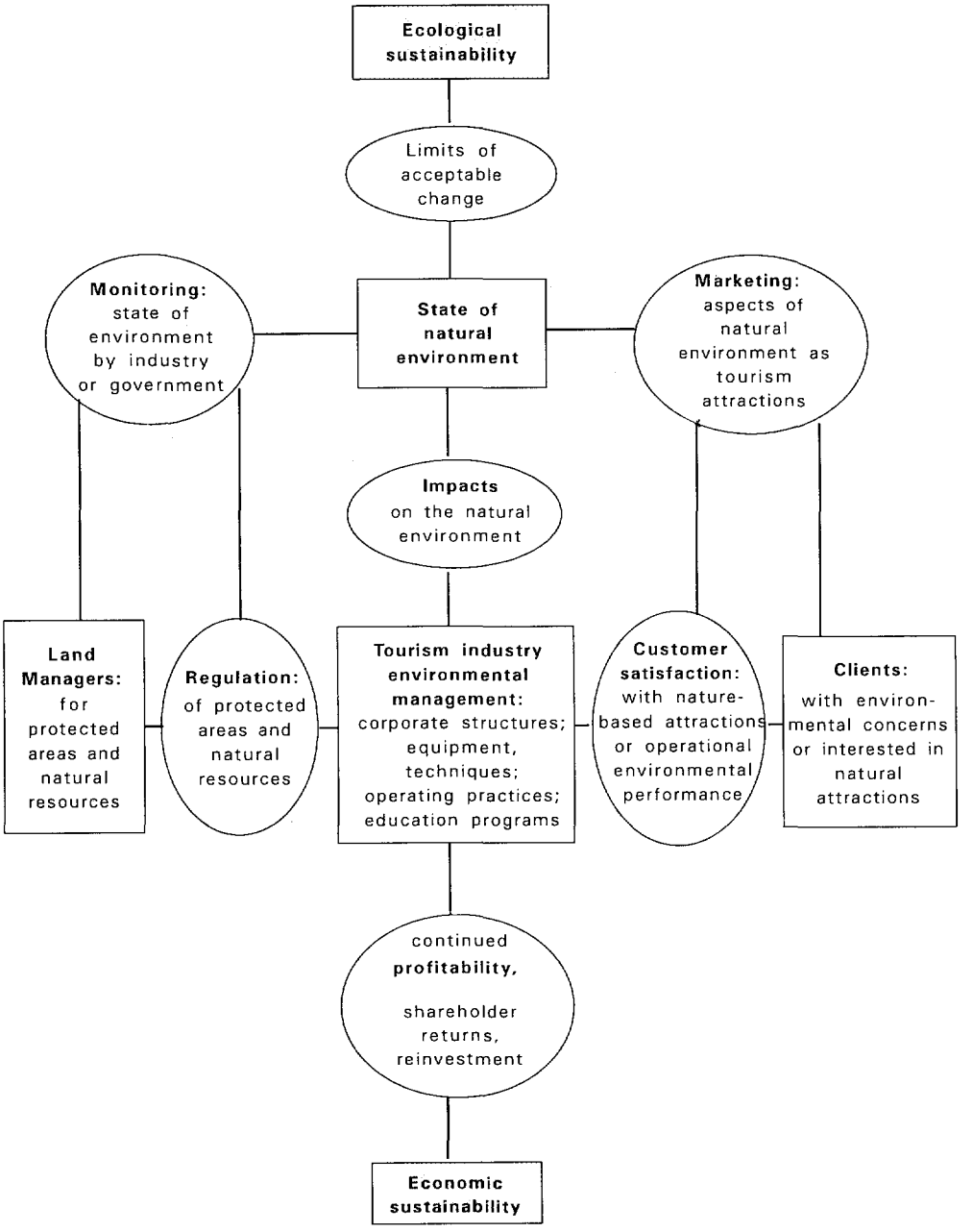
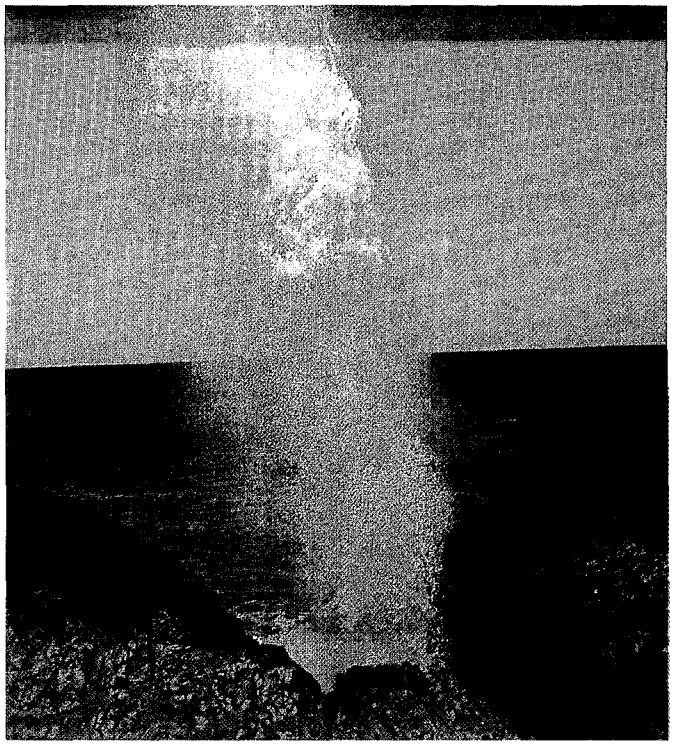
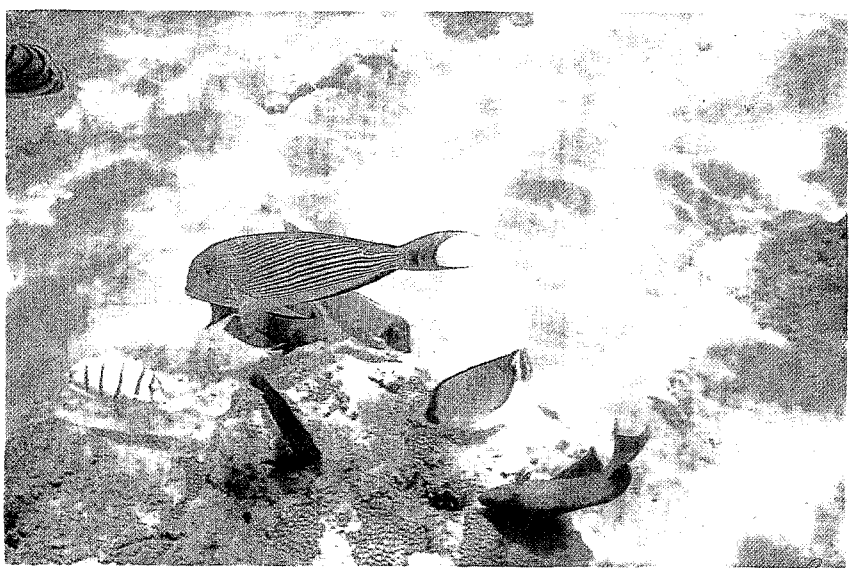


Figure 6. Where tourism and ecology meet--major links [6]

Some coastal features such as this "blowhole" attract tourists and should be left unobstructed by development





Coral reefs and their fish attract tourists for viewing in glass-bottom boats or by snorkeling; at the same time, reefs must be protected from physical damage and pollution

2. Sri Lanka's Coastal Region: The Resources

Coastal Ecosystems: Introduction and Importance to Tourism

Sri Lanka has a diverse coastal environment with a variety of ecosystems. These include sandy beaches, coral reefs, rocky headlands, sand dunes, mangroves, wetlands, estuaries, lagoons and seagrasses (Figure 7). Each ecosystem plays a critical role in maintaining the health of the coastal zone as well as of maintaining the health of each other. This interrelatedness makes the coastal zone one of the most sensitive geographic areas. Damage to a coral reef, for example, will allow greater wave action on shore, causing beach and dune loss. **It is nearly impossible to alter one feature of the coastal zone without causing damage to another feature, either directly or indirectly.** For coastal development projects, a sound understanding of coastal systems is necessary to avoid unnecessary environmental degradation. Although it may not be possible to avoid all damage, it is important to choose the development location and activities with the least negative impacts.[26]

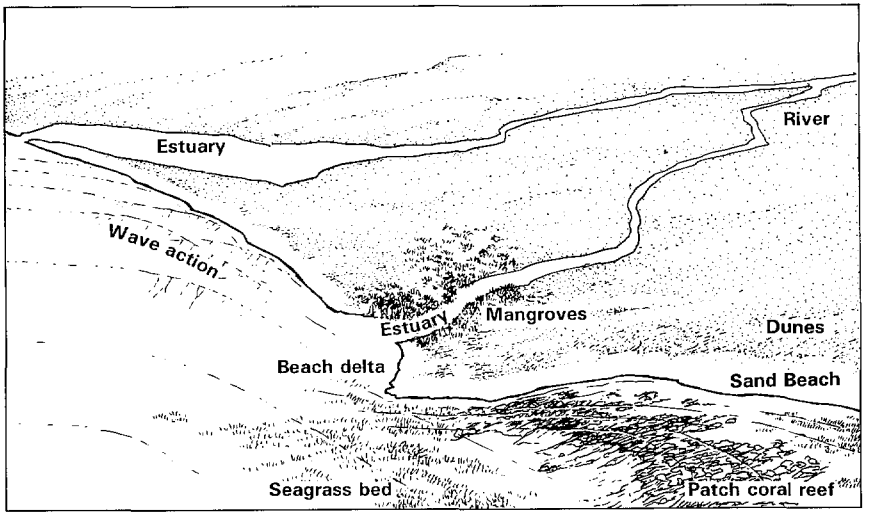


Figure 7. Important coastal ecosystems and habitats [26]

Maintenance of coastal ecosystems is essential to sustain the tourism industry. One of the primary reasons why Sri Lanka is a popular tourist destination is its abundance of sandy beaches, clean tropical waters, abundant sea-life, and lush vegetation. If these are taken away, tourism would decline drastically. **Tourism is a renewable industry as long as it takes care of the coastal systems which attract tourists.** If coastal resources are used unwisely in Sri Lanka, tourism will decline as tourists seek other areas in tropical Asia.

No charge is levied for use of coastal resources. Developers do not pay for guests to have access to sandy beaches or nearby coral reefs, yet these features are the base of their thriving businesses. All that is required in return for this free use of resources is that each developer make special efforts to prevent coastal degradation. The following provides a brief description of coastal ecosystems in Sri Lanka indicating their benefits to tourism and to coastal areas.

Beaches and Erosion in Sri Lanka

Sand beaches, which occur along about 70 percent of the shoreline, are the focal point of coastal tourism in Sri Lanka. Sunbathing, swimming, frisbee tossing, and walking are just a few of the recreational activities common on beaches. Also, sandy beaches provide soft, even footing for entry to the sea. Many development activities decrease the value or existence of beaches and it is therefore necessary for the developer to understand beach dynamics prior to development.

Beaches are dynamic, unstable systems which are constantly subject to the forces of erosion, the removal of sand; and accretion, the deposition of sand. The condition of a beach is a reflection of the balance between erosion and accretion. Worldwide, beaches are subjected to erosional forces that outweigh depositional forces, resulting in beach loss. In Sri Lanka, there are few accreting beaches and most are eroding, causing economic losses to property owners and to the tourism sector (Figure 8).

Beaches will have different qualities at different times of the year depending on exposure to waves, coastal type, littoral drift, and human interference (Figures 9 and 10).[49] Land development adjacent to the beach is the largest threat to beach stability as beaches need room to move. **If beaches are not given adequate room to move, erosion and property damage occur.** Beaches protected by coral reefs are usually the best place for development in the tropics as reefs produce sand and buffer against waves, making the beach more stable.[14]

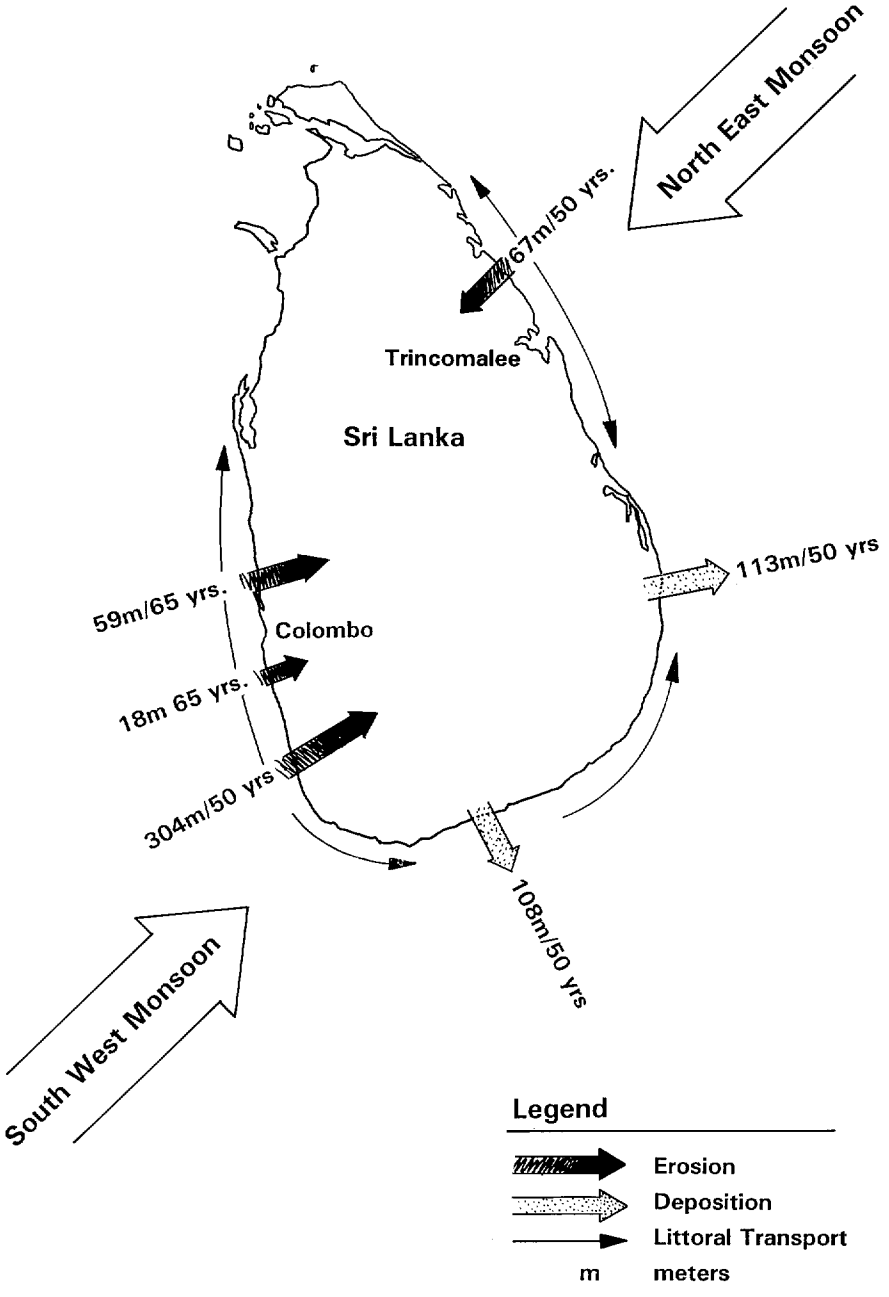
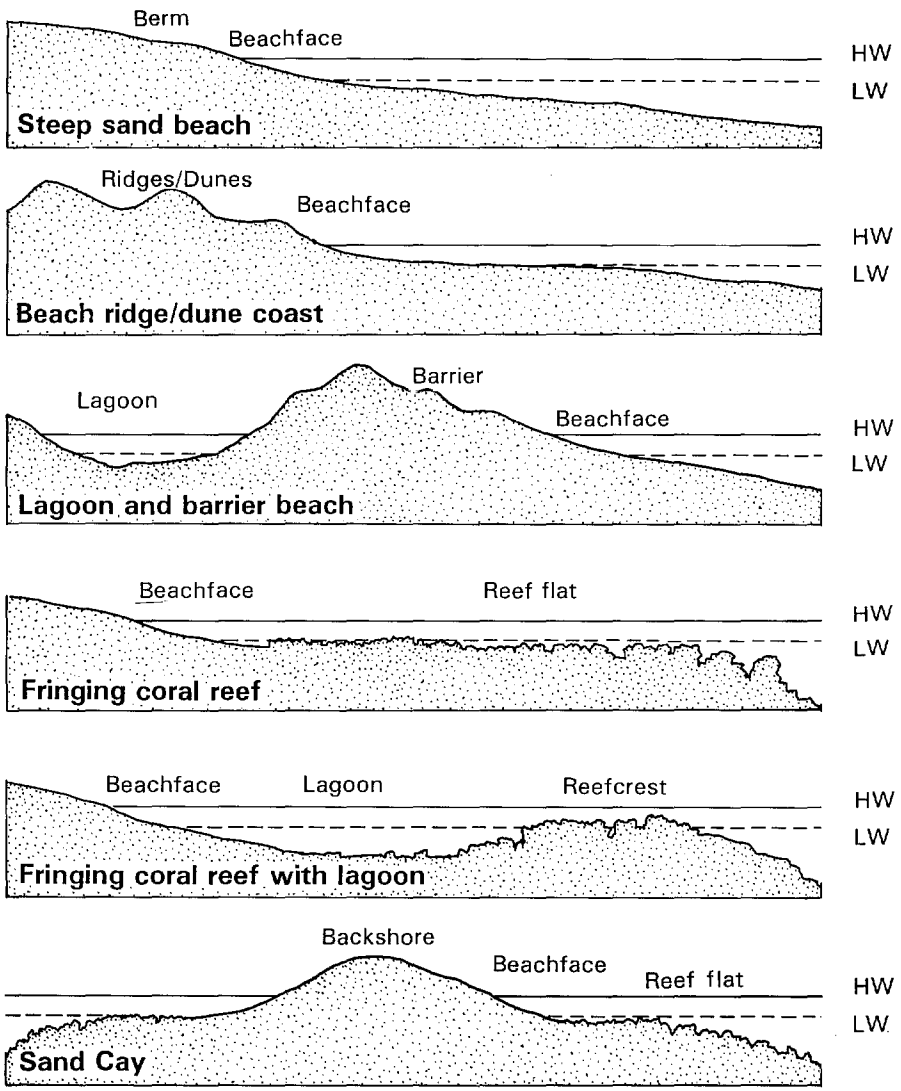


Figure 8. Areas of beach erosion and deposition in Sri Lanka [19]



HW - mean high water
LW - mean low water

Figure 9. Sandy and coral coast profiles[49]

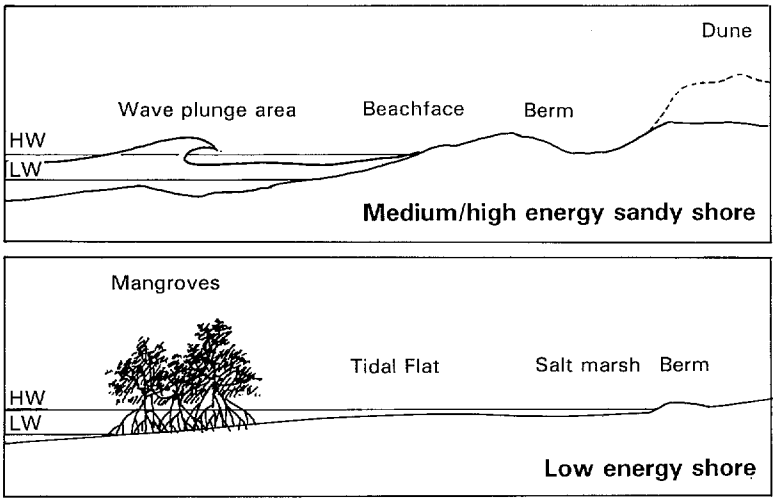


Figure 10. Cross-section of typical beach types in Sri Lanka [42]

Beaches act to buffer wave action, protecting the shore. Many animals also live in the sand and others nest, breed, or lay eggs on beach or berm. Sand removal from beaches, dunes, or near shore waters is hazardous as this allows greater wave shock, leading to erosion and recession of the beach.[14] **In developing coastal hotels, sand removal for construction or design purposes should not be done.**

Sand beaches are used by the fishing industry for boat landing and fish drying, the coir industry for drying coconut husks, as well as the tourism industry, and the construction industry for the sand itself. Overdevelopment, poor planning, and unmanaged sand mining have induced severe erosion problems in some areas.

There are three principal forces of coastal erosion in Sri Lanka:[19]

1. Natural processes such as monsoon generated waves or tidal inlet migration;

2. Human induced changes such as:
   a. sand and coral mining in coastal areas
   b. building structures which inhibit longshore sediment transport
   c. construction of groins and seawalls which adversely affect adjacent coastal areas; and,

3. Biological activity such as reef destruction caused by starfish or natural death.

Methods of Erosion Control

Methods used to prevent beach erosion include "hard" engineering solutions which are permanent features designed to reflect or dissipate incoming waves and "soft" engineering solutions which do not involve hard structures. Examples of hard engineering solutions are seawalls, bulkheads, groins, and jetties. **Soft engineering solutions such as planning, setbacks, or beach nourishment are usually preferred because hard structures often accelerate sand losses.** Also, once hard structures are in place, they are costly to maintain and difficult to remove to correct a mistake or to adapt to new changes.[12]

Seawalls, bulkheads, and sheet piling are solid vertical walls constructed of concrete, masonry, or metal which all serve the same purpose. The main advantage of using these methods to combat erosion is that they require less material and space. However, due to their verticalness, reflective wave energy is maximized, creating the potential for undermining and destruction. Groins and breakwaters are structures predominantly built with rocks. Groins are placed perpendicularly to the shoreline and trap sand on the updrift side by extending out into the water and interrupting the littoral drift, causing deposition of sand. However, after the water column loses its suspended sand load, its velocity increases, causing it to wrap around the groin and pull more sand away from the down-drift side, resulting in beach loss and erosion. Jetties are a series of groin-like structures that are shorter and placed evenly along a beach. Similar problems can occur with jetties (Figure 11). Therefore, if groins are not properly used or positioned, more damage may result than if the beach were left alone (Figure 12).

Offshore breakwaters are placed parallel to the shoreline. The ocean-facing side of the breakwater absorbs wave energy, causing wave and current action to decrease on the shoreward side. Coasts situated behind well placed breakwaters have decreased erosion potential and still allow long shore transport to occur naturally.

Revetments are sloping rock walls and similar protective structures that are used along the coast to prevent undermining and erosion of coastal lands. The slope of the wall and the spaces between the rocks act to effectively dissipate wave energy and minimize reflective waves. Revetments require a large amount of coastal area and building materials, making them a less economically viable alternative.

Setback lines are designed to act as a standard line, on the ocean side of which, development or construction of any kind is prohibited. In Sri Lanka, formal setback lines have been established by the Coast Conservation Department. **Setbacks are based on**

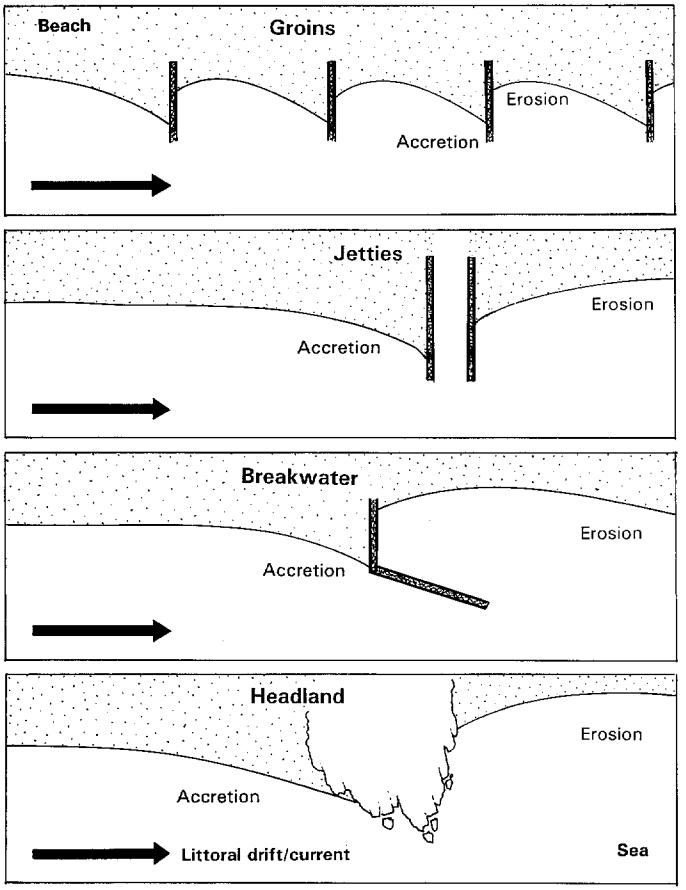


Figure 11. Examples of downdrift erosion resulting from hard engineering solutions and of headlands [12]

such characteristics as erosion rates, dune protection, flood hazard, potential storm waves, elevation, and vegetation type. By considering these variables, setbacks are established to prevent the negative effects of erosion while still allowing development to occur at a distance that is safe from erosional forces. Section 4 discusses setback laws in Sri Lanka in conjunction with construction.

Beach nourishment is another form of erosion control in which sand is brought onto an eroding beach to replace lost sand. Nourishment is an on-going process of erosion control, as imported sand will be transported over time. Nourishment can be costly and the economic costs of renourishment should be weighed against the social and economic benefits of the beach area to be nourished.

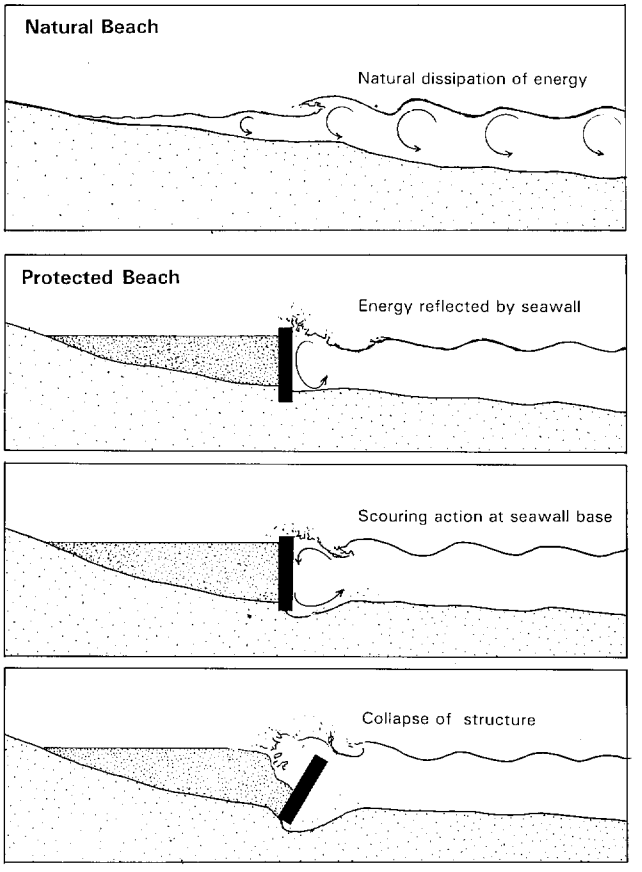


Figure 12. Undermining of a seawall built on a high energy coastline [15]

In all options of protecting coastal areas from erosion, the science is highly imprecise and costly. Engineering studies to determine placement of the structure, obtaining permits, building materials and construction are some of the initial costs. Long term maintenance can be very costly depending on the structure used or the erosional forces of the area. The only method of avoiding these costs is to not develop along eroding beaches. If development is to occur on these beaches, setbacks must be followed and perhaps expanded to prevent property damage and large economic costs (see Section 4).

In planning a coastal tourist establishment, the hazards of beach erosion may be avoided by following the "golden rules for combating beach erosion":[20]

- **"Understand the natural beach system before it is altered. Site-specific studies may be required at many locations to insure wise planning decisions.**
- **Develop a setback line before construction begins.**
- **Where a major obstruction to longshore transport is built, such as a large harbor, allow for an adequate sand-bypassing system.**
- **Where possible, use soft solutions, such as sand nourishment or diversion of channels, rather than hard solutions, such as revetments or seawalls, to solve beach erosion problems.**
- **Maintain a prominent foredune ridge.**
- **If a beach is valuable for tourism, recreation, or wildlife habitat, do not mine the sand from the dune, beach, or nearshore bars.**
- **Do not panic after a storm has drastically altered the beach. Wherever possible, let the normal beach cycle return the sand."**

Coral Reefs

Coral reefs are a valuable tourism asset. Reef tourism produces millions of dollars of foreign currency annually and is a popular attraction to many when choosing a vacation destination. Therefore, healthy reefs are important not only ecologically, but also economically.

Ecologically coral reefs provide habitat and feeding areas for many finfish and shellfish species. They are one of the most biologically productive ecosystems on Earth, provide protection against wave action and storms and supply nutrients to nearby economically important fish stocks. In Sri Lanka, fisheries supply over 50 percent of the total animal protein consumed and the success of these fisheries is partially dependent upon healthy reefs.[23]

Coral reefs occur along exposed coasts, away from rivers, estuaries and silty, sediment rich shores. Fringing reefs are connected to the shore and generally occur below the low tide level, however, parts of the reef may be exposed at low tide. This nearshore distribution makes them more susceptible to human activities.

Coral reefs need clean and clear water with low sedimentation to sustain their growth and thereby support the greater reef community. Increased water temperature, influx of fresh water, and excess nutrient and sediment loading all cause coral destruction and can increase with tourism development.

Uses of coral reefs in Sri Lanka are numerous and not always sustainable. Collection of souvenir coral fragments, reef fish and invertebrates for the ornamental fish and aquarium trade, and careless use of glass-bottomed boats in the tourist sector are a few

examples of non-sustainable uses. Much coral damage has occurred in Sri Lanka within the last 10-15 years leaving some reefs with mostly dead coral.[34,1]

Potentially damaging activities of coastal development include:[47, 37]

- **Increased siltation and sedimentation from dredging, filling, or coastal construction;**
- **Pollutants and excess nutrients from waste disposal, sewage discharge;**
- **Discharge of large volumes of fresh water from storm water outfalls, increased surface runoff from surface paving or vegetation removal;**
- **Guests exploring the reef, resulting in coral breakage.**

Coastal Wetlands

Coastal wetlands are important to tourism in their ability to remove pollutants from waterflows before they enter the main water bodies. This function protects beaches and coral reefs and coastal water quality--the most important coastal tourism assets. Secondly, wetlands can provide direct benefits that are largely overlooked. Mangroves, lagoons, and salt marshes are ideal settings for activities such as bird watching or nature photography. Estuaries are ideal locations for canoeing and other water sports and activities which need more protected waters than those afforded by the Indian Ocean. By utilizing wetlands in controlled ways for activities such as these, tourism assets are diversified and therefore appealing to a larger segment of travelers.

Coastal wetlands of Sri Lanka include seagrass beds, lagoons, estuaries, mangroves and salt marshes, each of which play an important role in the coastal environment and economy. Estuaries and lagoons are important fishing grounds, salt marshes and mangroves act as natural filters for polluted or sediment laden runoff, as juvenile fish habitat and spawning areas, as natural barriers to erosion, and as processors of nutrients to be sent into adjacent waters.

Seagrass beds are composed of salt tolerant plants and occur in shallow nearshore waters, estuaries, lagoons and adjacent to coral reefs. Seagrass beds hold sediment in place, support a rich detrital community, upon which many commercially important fish depend and provide habitats for nearshore species.

Lagoons are brackish water bodies as they are either permanently separated from the ocean or are separated only during part of the year, resulting in lowered salinity.

Estuaries are partially enclosed bodies of water directly connected to the ocean. Within an estuary, salt water mixes with fresh water from runoff or from rivers. Estuaries are also nutrient rich due to mixing of fresh and salt waters. The nutrients attract fish and other organisms, making estuaries highly productive. Similar ecological roles are performed by estuaries and lagoons. These functions include exporting nutrients and organics to coastal waters via tides, providing habitat for commercially important marine species, and acting as breeding and nursery areas for migratory species of fish and birds.[14]

Mangroves are communities of salt-tolerant woody plants that occur primarily along more sheltered coastal areas, especially along embayments or within estuaries or lagoons. Mangroves trap and retain sediment, absorb coastal storm and wave energy, provide shelter for juvenile fish and invertebrates and assimilate nutrients to convert to plant tissue, which is broken down and circulated into coastal waters. Removal of mangroves will result in decreased water-quality and species diversity and thus decreased wildlife for nature viewing and educational activities of tourism.

Linkages of Coastal Ecosystems

The above ecosystems combined form the coastal environment. These ecosystems are connected to one another via several mechanisms including tides, currents, waves, nutrients, the hydrologic cycle and sedimentation (Figure 13). **It is important when designing a development project to understand these mechanisms and to predict how the development project will affect these processes.** Disruptions in these processes can lead to severe environmental damage.[26]

The hydrologic cycle refers to the cycle of water through natural systems (Figure 14). Water is evaporated from the surface or transpired by plants, forming clouds. Clouds build and produce precipitation, which filters into the ground forming groundwater, which slowly finds its way back to lakes or streams or the surface to be evaporated again. The hydrologic cycle acts to distribute nutrients and sediments among natural systems and when it meets the ocean, marine forces such as tides, currents, and waves act to distribute it further.

Coastal development projects that alter runoff patterns, rivers, or ground water tables are not only disturbing that waterway, but also the rest of the cycle. Studies need to determine water conditions and sinks prior to construction and water ways should to be left intact as much as possible.

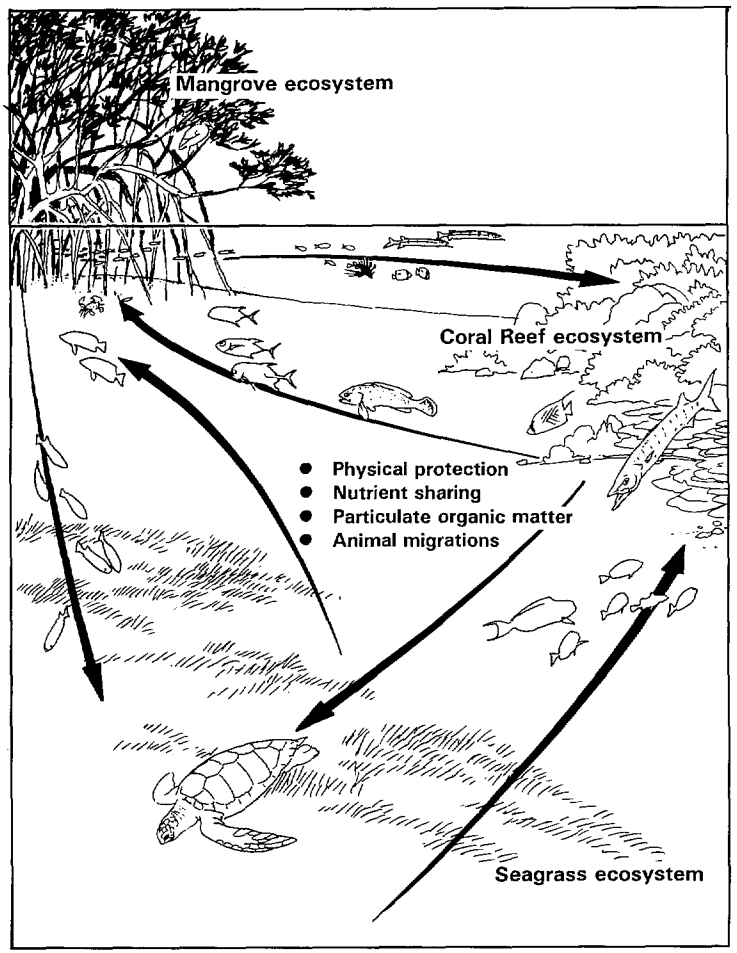


Figure 13. Mutual contributions of tropical coastal habitats [47]

Tides are a constant force in coastal waters and must be considered when planning a coastal development. Tides vary according to geographical location and may occur twice daily or once daily. The difference between high and low tides along with slope of the beach will determine the amount of beach that is available for sunbathing. Tides are influenced by the lunar cycle, creating some tides that are higher than others. Storms also influence tidal range and can cause severe damage if not planned for. In low lying areas, storm and spring tidal ranges must be calculated prior to development.

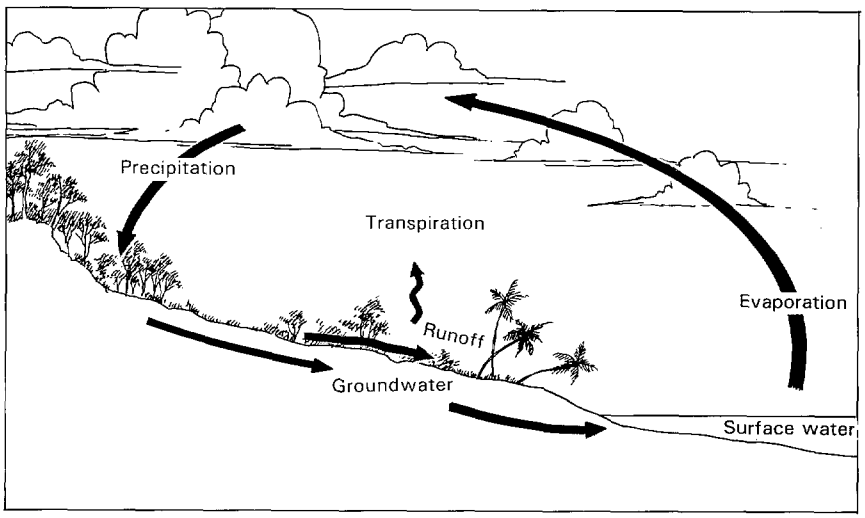


Figure 14. The hydrologic cycle [35]

Waves are an important energy form to consider, especially in areas unprotected by coral reefs, islands, or barrier beaches (Figure 15). Coastal areas exposed to direct wave action tend to be less desirable for swimming, although areas with swells may be attractive to surfers. As waves are generated by wind systems, seasonal variations in wave strength will occur in many areas. It is important to be aware of weather patterns as seasonal changes caused by waves can be quite severe in some coastal areas.

Currents are portions of the ocean which in mass move in a continuous direction. Currents act to transport sediments and can be dangerous for swimming and coastal recreation. Currents can be either tidal or wave generated.

Tides, waves, and currents transport nutrients, fresh water, and sediments throughout nearshore waters and play an important role in coastal flushing. Flushing acts to redistribute water, thereby reducing the effects of coastal development and pollution. These are important natural processes, without which, coastal waters could be degraded. They are also important factors in siting a development as they can create large economic losses in property damage and can be undesirable for many tourists.

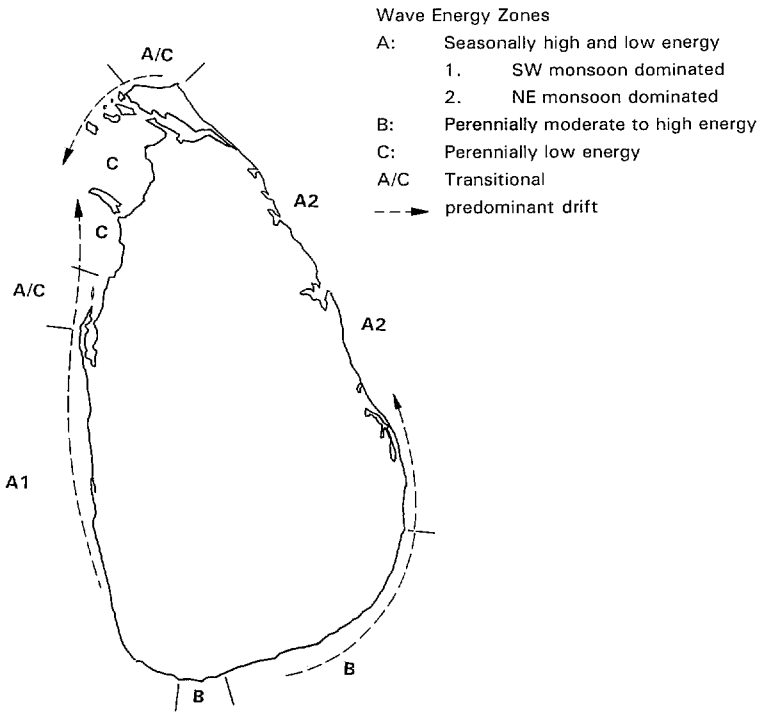


Figure 15. Wave energy zones of Sri Lanka, indicating predominant drift and sand transfer [42]

Summary

The Coastal ecosystems common to Sri Lankan coasts and their linkages must be considered in planning for development. Natural beach erosion processes and sand transport dictate setback requirements and the need to maintain natural beach vegetation. Marine and fresh water quality maintenance is determined by the type and impact of coastal facilities and their waste treatment process. Aesthetically pleasing coastal features such as coral reefs, vegetation, clean beaches and water attract tourists while disturbed and polluted systems repel tourists. Thus careful maintenance and enhancement of the coastal system is the only sustainable path for tourism development.

3. Development and the Coastal Environment

As the success of any coastal tourism venture is dependent upon maintaining a healthy environment, a further understanding of how the coastal zone is affected by development and vice versa, is necessary. The potential for overexploitation of coastal resources is high. The consequences are biological and economic stress, loss of future development opportunities, and increasing user conflicts.[14] There are many avenues by which development can reduce environmental quality. Improper waste-water discharge, removal of natural vegetation, and placement of permanent structures too close to the beach are a few examples.

Carrying Capacity

Most problems related to coastal development are the result of placing too much stress on limited coastal resources, a condition known as exceeding the carrying capacity. **The carrying capacity**

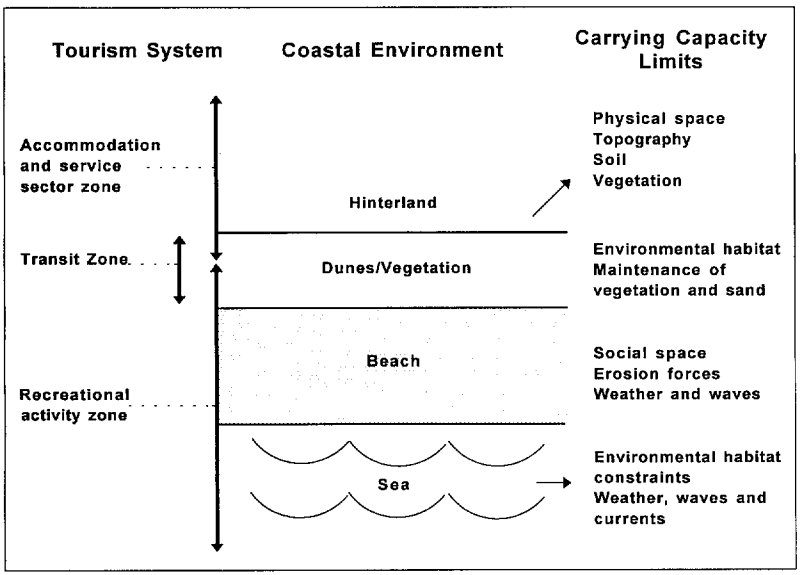


Figure 16. Carrying capacity of the coastal zone environment in relation to tourism [33]

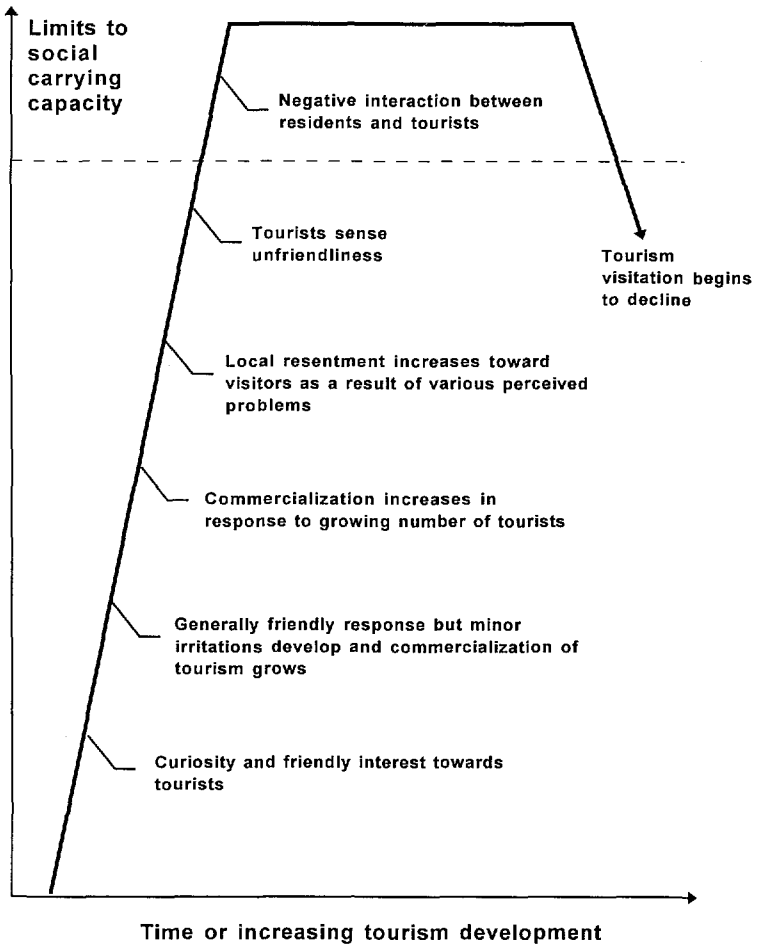


Figure 17. The relationship between tourist resident relations and carrying capacity [29]

of an area is the capacity of an ecosystem to sustain different resource uses. Carrying capacity is not a fixed amount and varies with geographic areas as well as by human uses.[14] Carrying capacity can be reduced by both human and natural forces or can be maintained or increased through proper management. When resources are utilized beyond their carrying capacity, overall benefits derived start to decrease, resulting in economic decline, loss of employment, income and foreign currency earnings.

Carrying capacity can be physically, environmentally, or socially limited. Figure 16 illustrates the general relationship between carrying capacity, the coastal environment and tourism. Figure 17 illustrates social carrying capacity in tourist and local resident relations.

Impacts

A development project can have several types of impacts on the coastal ecosystem. Table 1 lists impacts of particular concern in coastal regions in Sri Lanka. All impacts start with the action of resort development. Resort development requires a physical modification of the environment. These modifications are known as causal factors. The important thing to remember is that the development activities themselves do not initiate the impacts, rather it is the causal factors they require such as vegetation removal or dredging that initiate the impacts. Therefore, **the method of development is as important as how the development is operated. If one can limit impact chains by not allowing them to begin, the development project will be more harmonious with its surroundings.**[41]

Impacts can be negative or positive, direct or indirect, long term or short term, and can have social, economic or physical consequences. Overall, impacts reflect the values that people place on the resource and the effects of a resource use.[41] Effects, or impacts, are usually quantifiable and observable. Direct impacts are the first change of what has social value in an impact chain while indirect impacts are those resulting from the first order impacts. Figure 18 illustrates an example of a tourism development activity and its potential impact chains. Long term impacts are related to the day to day operations of the development including such processes as waste disposal and water discharge. Short term impacts are the ones associated with the actual construction and include vegetation removal, increased runoff, or noise and dust pollution.

Impacts can also be cumulative or immediate. Cumulative impacts refer to the net impacts of different uses on the same resource. Although a single use may not cause significant problems alone, it can have severe consequences in conjunction with other uses. In order to plan for cumulative impacts, it is important to understand what uses are being made of the resource at present as well as what additional uses, if any, the resource can sustain. Figure 19 depicts the relationship between time and the location of the impact.

Table 1. Potential impacts of concern and tourist development activities which may cause them[15]

Impacts of Concern*	Tourist Development Activities Which May Cause These Impacts
Coral Reefs and Seagrass beds	
° Physical damage to coral reefs and collection of organisms	° Reefwalking, collection of souveniers from reef, boat anchoring
° Increase in freshwater runoff and sediments	° Land clearing for construction
° Introduction of waterborne pollutants (nutrients or pesticides)	° Fresh water influx from waste water pipes from poorly treated sewage and improper disposal methods
Estuaries/lagoons	
° Encroachment	° Land-filling for siting of structure
° Changes in sedimentation patterns	° Placement of structures on beach/in coastal waters
° Changes to the salinity regime	° Fresh water runoff
° Introduction of waterborne pollutants	° (see coral reefs)
° Destruction of submerged and fringing vegetation	° Run-off, sedimentation, recreational uses
° Inlet modifications	° For harbor maintenance, siting considerations
° Loss of fishery habitat	° Land-use modifications, increased run-off, sedimentation; pollution increases from sewage, waste water disposal
Mangroves	
° Changes in freshwater runoff, salinity regime and tidal flow patterns	° (see coral reefs, estuaries/lagoons)
° Excessive siltation	° Construction activities, waste-water discharge, sewage
° Introduction of pollutants	° (see coral reefs, estuaries/lagoons)
° Conversion of mangrove habitat and overharvesting of resources	° For use as a tourist development site
Salt Marshes (tidal flats)	
° Degradation of bird habitat or seed fish collection sites	° Discharging wastes, physical alteration for tourist uses
° Obstruction of storm-water runoff	° Altering tidal flats for development purposes
Barrier Beaches, Sand Dunes and Spits	
° Sand mining	° For construction purposes
° Erosion	° From disregarding setback regulations, improper placement of coastal structures
° Dune migration	° Removal of natural vegetation

* These impacts of particular relevance to Coast Conservation Department and are highlighted in the Coastal Zone Management Plan for Sri Lanka

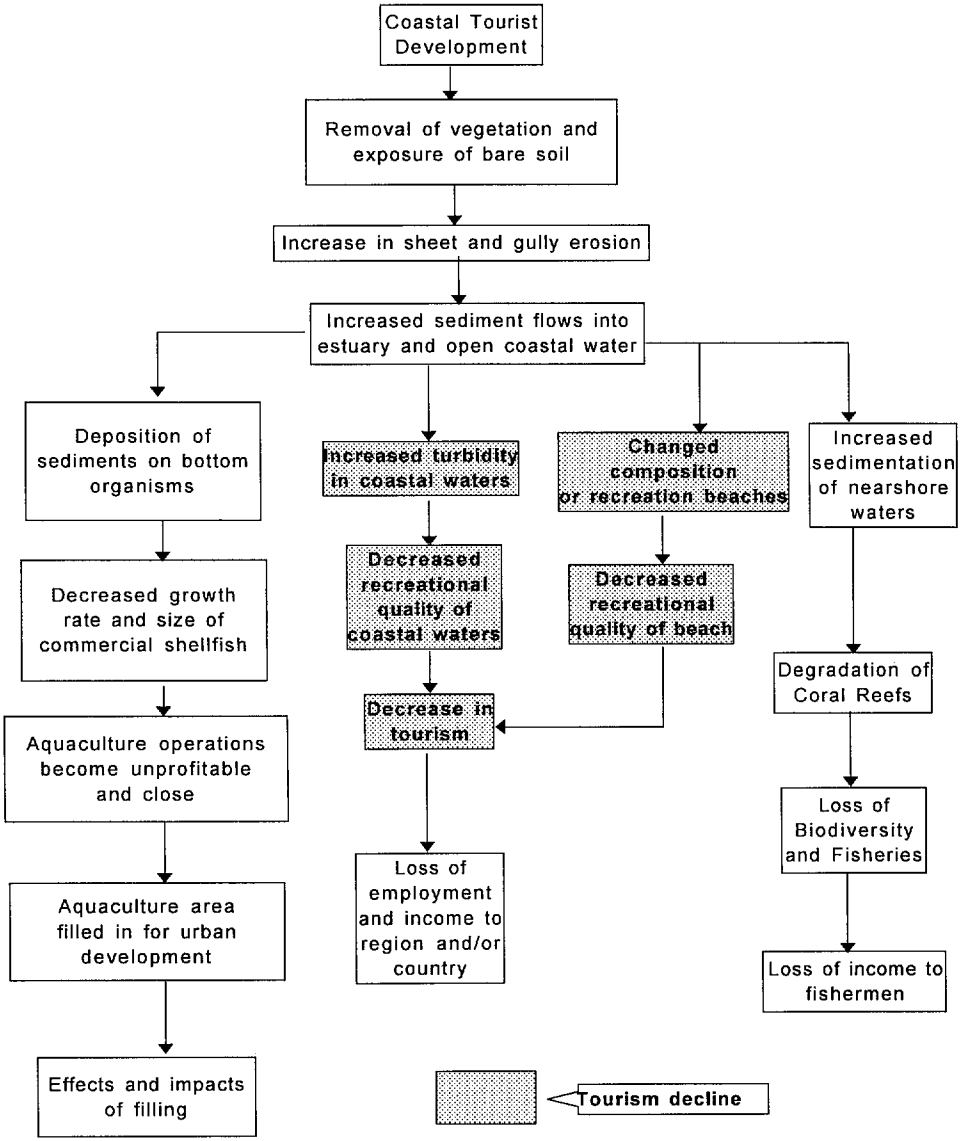


Figure 18. A coastal tourism impact network with direct and indirect impacts [41]

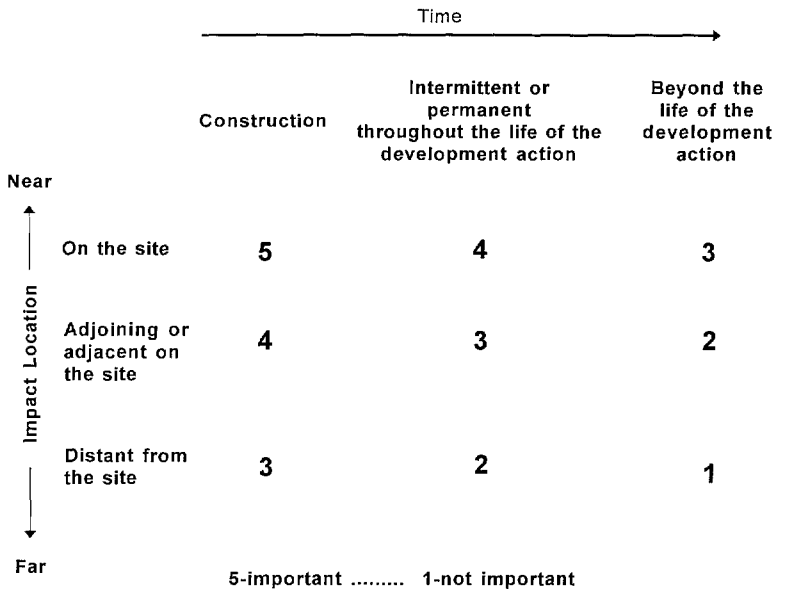


Figure 19. The relative importance of tourism development actions and impacts by location over time [41]

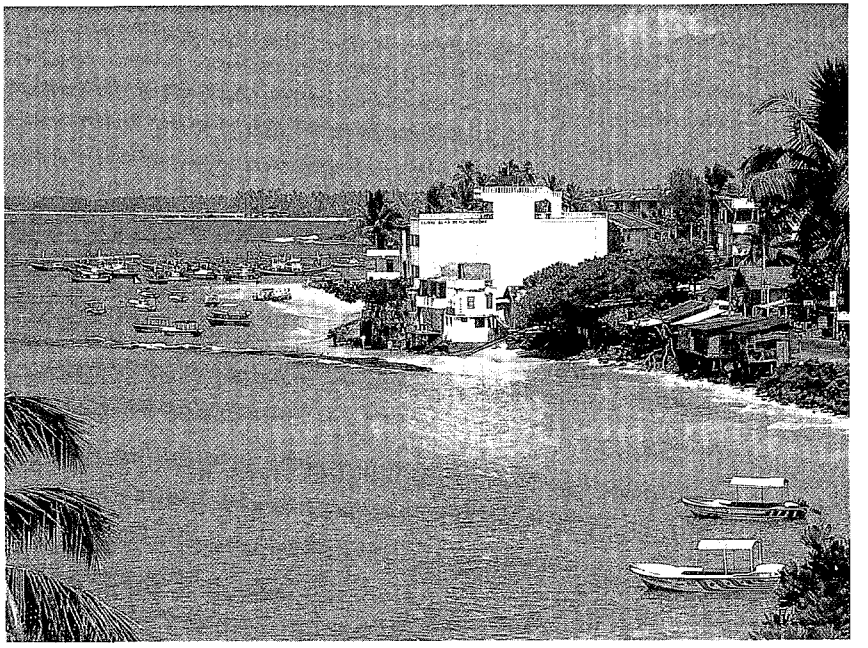
In areas where there are many coastal resources users, it may not be prudent to plan a hotel development. The impacts from the hotel and associated tourism may exceed the area's carrying capacity, resulting in increased user conflicts and decreased resource sustainability and economic losses for all involved. A careful prestudy must be conducted to determine the suitability of an area for tourism development in regards to carrying capacity. A tourist development not only includes the actual building to house the tourists but also the inevitable restaurant, shops, and service facilities that accompany it. All of these must be considered to determine impacts on carrying capacity. The extent and scale of impacts will depend on the size and type of tourism development in relation to the fragility of its surrounding environment.[51]

Coastal tourism developers must consider how their project will affect the coastal ecosystems (see Section 2). As these systems are interconnected, developers must assess the extent to which their actions will affect the coastal region as a whole. Activities such as filling of a wetland or mangrove, will increase the amount of pollutants reaching nearshore waters, will reduce local fish stocks

by removing habitat and breeding grounds, and will reduce nutrients to nearshore waters. This will cause economic and social losses to other user groups as well as to the tourism sector due to decreased water quality. A healthy coastal region will attract tourism, while a polluted one will discourage tourism. Table 2 describes tourism activities, their direct and indirect impacts and possible mitigation measures.

Summary

The "carrying capacity" of a development area will depend on the extent and condition of the existing coastal resources in relation to the scale of development, the activities proposed and the potential impacts to be caused by development. Carrying capacity is also addressed when environmental assessments are conducted for a development project as discussed in Section 4.



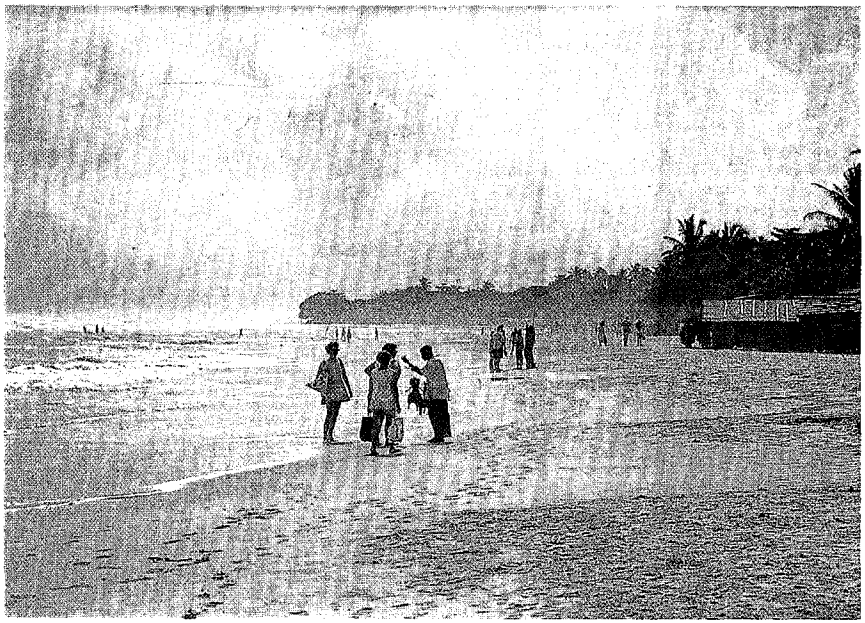
Hikkaduwa is an example of overdevelopment too close to the beach so that the "carrying capacity" of the natural environment has been surpassed

Table 2. Summary of potential direct and indirect negative impacts and mitigation measures

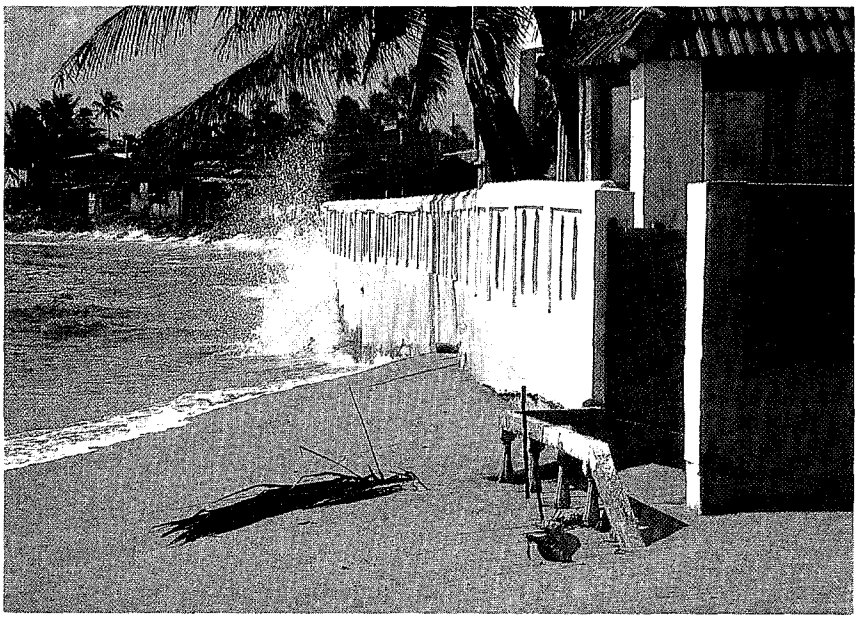
Potential Negative Impacts	Mitigating Measures
Beach mining of sand for construction **Destruction of reef** for aggregate materials used in construction	° Control construction contractor ° Submit plans in accordance with local ordinances on beach sand mining ° Monitor construction
Destruction of habitats (wetlands, forests, other unique/sensitive areas) or cultural, historical and archaeologically important sites	° Areas considered for development should have zoning plans to account for natural geographic and socioeconomic condition ° Development based on an inventory of resources ° Existing laws on habitat protection followed
Erosion resulting from uncontrolled clearing, infrastructure construction such as roads	° Erosion and sediment control plans ° Revegetation ° Grading controls and drainage beams ° Settling basins
Loss of "free" environmental services from natural systems and degradation of air, water, land resources	° Carrying capacity defined so that target tourist population can be sustained by existing infrastructure and resources ° Include improvements in project design ° Determine thresholds of use for local resources
Water pollution from inappropriate sewage or solid waste disposal ° marine effluent disposal ° residential sewage disposal ° infiltration to groundwater	° Allowance made for use of existing collection and disposal system or construction of on-site sewage treatment plant ° Liquid waste not discharged onto beaches, coral reefs, or other sensitive areas ° Verify local capacity to monitor and enforce pollution regulations ° Proper placement of septic tanks ° Capacity of treatment facilities, waste reduction ° Litter receptacles
Solid and liquid waste disposal creates nuisance conditions adjacent to amenities	° Appropriate waste disposal options required to manage potential problem ° Landfill versus incineration alternatives, and waste minimization considered ° Routine clean-up

Table 2 Continued..

Potential Negative Impacts	Mitigating Measures
Access problems created ° traffic congestion ° minor and localized air pollution ° people density greater than services	° Access problems minimized by integrated planning to reduce traffic and pedestrian congestion, noise
Congestion, overcrowding	° Design urban areas and transport networks according to carrying capacity of natural setting
Conflicts with other resource use such as fisheries, agriculture	° Identify potential conflicts, discuss with users ° Conceive tourism development in framework of national, regional, local socioeconomic development plans ° Identify zones most suitable for tourism
Sea turtle nesting affected (special case)	° Beach monitoring for turtle protection coupled with beach zoning and development guidelines to preserve the natural beach environment ° Restricting night activities and lights on nesting beach during egg-laying and incubation periods
Displacement of human population	° Program of compensation and resettlement ° Guidance for people in their newly resettled area
Beyond capacity to manage the "tourist or related environment" ° legislation constraints ° agency support lacking ° staffing and financial resources to mitigate impacts absent ° inadequate training in environmental management	° Comprehensive legislative action frequently required to address impacts and their monitoring and evaluation ° Staffing and equipment support must be budgeted, to mitigate impacts and monitor the "environmental protection plan" or other mitigation plan
Multiplier effect on other industries causes increased stress on natural resources or services (craft market, vendor, taxi driver, suppliers, farmers/fishermen)	° Set limits on extent of development ° Provide adequate infrastructure and services support to meet physical, social and economic needs of the region ° Recognize that "overbuilding" may be a persistent problem



Wide sandy beaches provide optimal settings for coastal resorts because erosion is usually not severe and tourists like space to walk and play



Hotel structures too close to the beach and water cause beach erosion and eventually collapse

4. Development Guidelines: Site Use

Sustainable design is not a reworking of conventional approaches and technologies, but a fundamental change in thinking and in ways of operating--you can't put spots on an elephant and call it a cheetah.--C. Franklin[46]

Planning and development in coastal areas of Sri Lanka is not sufficiently systematic, leading to environmental decline. Voluntary measures by private developers and individuals are necessary to change this pattern, thus preserving the scenic and natural attractions of the coastal zone. This chapter outlines the considerations that tourist developers should make when planning to develop within the coastal zone. With better planning and integration with the community, overall socio-economic benefits from natural resources will increase and last much longer.

These recommendations will vary slightly according to the environmental and social aspects of the proposed development area. The purpose of the following section is to indicate all aspects of development which may impact the environment, whether negatively or positively. Topics covered include siting, setbacks, and landscaping. Section 5 covers infrastructural needs such as water supply, sewage, waste water, and solid waste disposal.

Site Selection for a Tourist Establishment

Coastal land is a limited resource valuable for many different uses. It is therefore important that any development which does not require a coastal location be built inland from the coastline. By doing so, greater access for all users is established as is land for strictly water-dependent uses. **Supporting facilities for tourist resorts should be located away from the coast as much as possible as locating these facilities on the shoreline occupies valuable space, pollutes nearshore waters with increased surface runoff, and greatly increases the chances of storm damage.**

Some environmental variables to consider are the type of beach, the amount of beach available for recreation, and whether the beach is eroding or accreting. Another consideration is whether the ocean is suitable for the activities of the proposed establishment (i.e. are potential clientele primarily swimmers and bathers and if so, are water conditions suitable for these uses?). Another consideration is whether the overall ecosystem can support another hotel. Will this project overburden the local water quality or the site carrying capacity?

Other considerations relate to sewage and water systems. It is important to test the proposed development area to determine whether there is an adequate supply of fresh water, and if there is an appropriate site to place the well (see Water Supply). Further, this site must be properly placed in relation to the sewage system to protect against fecal contamination (see Waste Disposal).

Further, a careful review of the surrounding ecosystems must be conducted to determine what impacts, if any, the proposed project may have on these important coastal ecosystems. **By anticipating the potential impacts before they actually occur, the method with the least impacts can be adopted and the expected impacts can be planned for and lessened.** Developing along the coast can have a wide range of impacts as illustrated in Section 3. Proper planning and siting will minimize these impacts.

Social aspects to consider when siting a tourist facility include a careful assessment of all local uses of the proposed development area, including potential ways to limit the impacts on local uses. A development project that inhibits the traditional uses of a region will most likely not be welcomed by the community, resulting in decreased living quality for local people as well as decreased vacation quality for visitors. Another social variable is determining the type of clientele expected to frequent the establishment and planning according to desired needs.

The above considerations are all components of what is referred to as an Environmental Impact Assessment (EIA). Although this is a required process for tourist development projects of 100 hotel rooms or more, or at the discretion of the Director, Coast Conservation Department for projects in the coastal zone, an informal EIA should be conducted for a development of any size.[9] One of the main benefits from conducting the EIA, aside from the assured maintenance of good environmental quality, is economic. Conducting an EIA will save developers money in the long term and will facilitate construction and operation of the facility. An outline of issues and information required in an EIA which will satisfy requirements of the Central Environmental Authority and the Coast Conservation Department are provided as follows:[51]

Task 1. Description of the Proposed Project. Provide a full description of the project and its existing setting, using maps at appropriate scales. The proposed project should include: general layout (size, capacity, etc.); pre-construction and construction activities, operation and maintenance; life span; plans for providing utility, waste disposal, and other necessary services; physical setting, ecological setting, demographic setting, socio-cultural setting, and institutional setting.

Task 2. Description of the Environment. The natural environmental resources of the development site and its surrounding area should be described and mapped in relation to the proposed project. Pertinent information includes:

a. topography and ground conditions;
b. location of water supplies and its movement through area;
c. existing vegetation patterns and types;
d. existing wildlife, its habitat and nesting patterns;
e. distribution of ecosystems described in Section 2; and,
f. existing plans for adjacent areas such as a protected area.

Task 3. Legislative and Regulatory Considerations. Describe the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection of endangered species, siting, land use control and rights of indigenous peoples, at international, national and local levels.

Task 4. Determination of the Potential Impacts of the Proposed Project. Special studies may include the following:

- Environmental carrying capacity of sensitive ecological sites or cultured properties.
- Social carrying capacity, including attitudes of local people to the proposed influx of foreigners and potential sources of conflict.
- Physical carrying capacity of local infrastructure and public services (if not adequately addressed in feasibility studies).

Task 5. Assist in Inter-Agency Coordination and Public/Non-Government Organization Participation. In tourism projects, it is critical to involve all potentially involved government agencies, especially at the local level. It is also important to provide complete information to the affected community, so that community members can form their opinions about the project.

Use of a Consulting Team. A typical EIA team may have any or all of the following disciplines: environmental impact specialist; civil engineer: wastewater, roads, ports and harbors, water supply; ecologist; cultural specialist such as park and recreation planner; urban sociologist or anthropologist; specialist in tourism supply/demand analysis; and legal expert(s) on land tenure, environmental law, cultural property protection.

Special planning standards for beach resorts which may determine the suitability of a site are shown in Table 3.

*Table 3. Selected common planning standards for beach resorts** [52]

Type of Accommodation	Space Required
a. Hotels	
Economy	10 meters²/bed
Average	19m²/bed
Luxury	30m²/bed
b. Seaside holiday villages	15m²/bed
c. Apartments in beach resorts Studios	36m²
1-bedroom unit	53m²
2-bedroom unit	80m²
3-bedroom unit	110m²

Infrastructure	Requirement
a. Water (daily consumption per person)	
Mediterranean resorts	200-300 liters/day
Tropical beach resorts	500-1,000 l/day
b. Sewage disposal (no main system)	0.3 hectare/1,000 persons
c. Access road and parking	
Parking lots	1/2-4 bedrooms
Overall density	5-25 percent of site

Tourist facilities	
a. Swimming pool (resort hotel)	3 meters² of water/user
b. Open space (seaside resort)	20-40 m²/bed
c. Shops	0.67 m²/bed

Beach capacity (for resort excluding facilities)

	meters²/person	persons/meter of coast for 20-50 meter of beach
a. Low standard	10	2.0-5.0
b. Medium standard	15	1.5-3.5
c. Comfort	20	1.0-2.5
d. De luxe	30	0.7-1.5

Beach facilities — Sanitary facilities in ratios of 5 water closets 2 lavatory basins and 4 showers for every 500 persons

Resort density	
a. In Spain, Greece, Bali, Honolulu	60-100 beds/hectare
b. Club Mediterranee Village	20 beds/hectare

* Based on European and American experience

Setbacks

Important in siting a tourist resort are setback guidelines and regulations. A setback is defined as an area left free of any physical modification. **Setbacks are important because they allow for natural coastal processes to occur uninterrupted and ensure both physical and visual access to the coastline.** The major objectives of setbacks are:

1. Protecting life and property against erosion and storm surge.
2. Minimizing public investment in coast protection.
3. Protecting and enhancing the scenic value of coastal environments.
4. Minimizing use conflicts among various types of activities taking place in the coastal zone.
5. Ensuring public access to and along the coast.
6. Maintaining consistency among national and regional laws and plans.
7. Ensuring consistency between national level goals and environmental objectives.
8. Protecting vulnerable coastal habitats, such as sea turtle nesting grounds.
9. Providing buffer zones around coastal archeological, historical and cultural sites.

By allowing seasonal or long term changes and storm surges to occur, economic losses will be minimized as coastal structures adhering to setbacks will generally avoid most of the severe damage (Figure 20). The Coastal Zone Management Plan lists specific setback requirements for the different regions of Sri Lanka, although a general allowance of 60 meters from the mean high water mark is considered desirable.[15] The revised Coastal Zone Management Plan (1996) allows for variable setbacks which depend on the section of coast and the rates of erosion, the type of structures to be constructed and an overall appraisal of the site and its limitations.

Although some tourism developers feel setbacks decrease their establishment's desirability to tourists, there are several advantages to having setbacks in place. In a resort or tourist area, the land between development and the beach can be enhanced and provide attractions to tourists. Most tourists come from countries where they have spent months indoors avoiding the cold. When they travel to Sri Lanka, they want to spend as much time as possible outside. The beach will always be an attraction but open, landscaped spaces away from the water can be equally as appealing in providing:

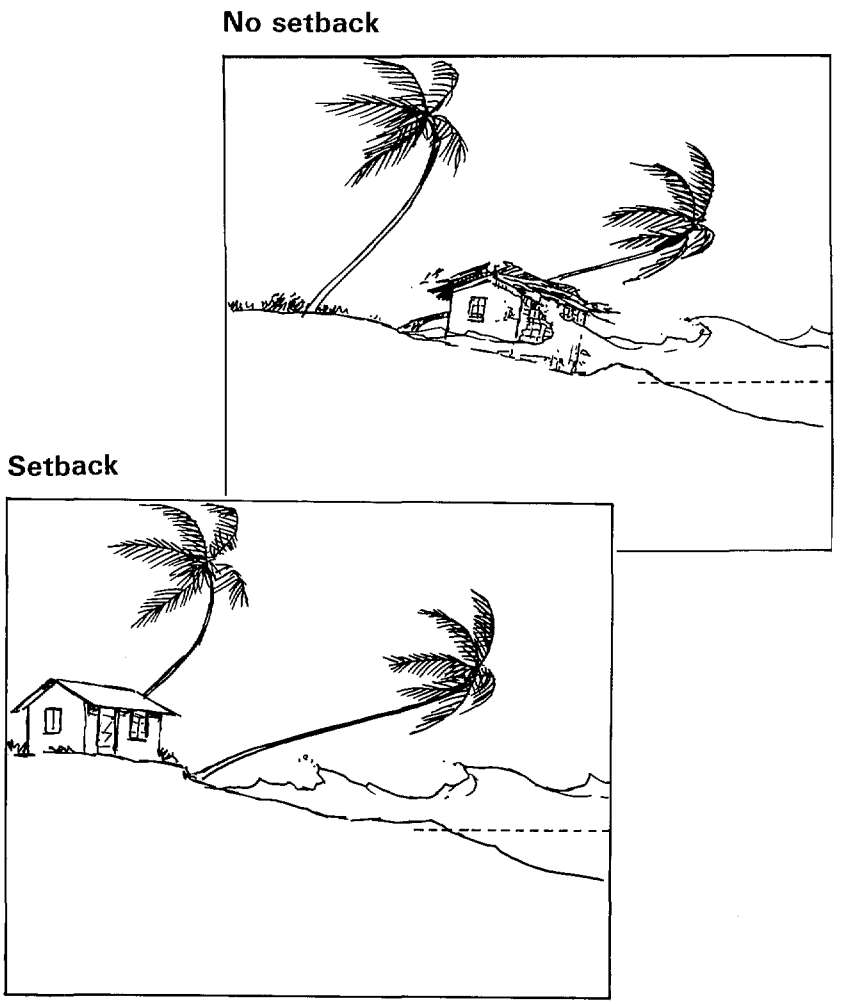


Figure 20. The importance of setbacks in relation to minimizing economic losses associated with coastal storm damage [35]

- Shade from the sun and heat
- Place for artists or photographers to work
- Native vegetation which provides tourists an opportunity to study indigenous plants and trees
- Open space to enhance the view of the coastline and ocean.

In addition to abiding by setback requirements, tourist developers should also consider several variables before choosing a site. These variables are economic, technical, environmental and social. In general, planning at this stage of the development project

is the most important as proper planning can save large economic and time investments in the future.

Development Near Cultural and Archeological Sites

Sri Lanka has a rich cultural and archeological heritage and some of its finest sites are located in the coastal regions. The Coast Conservation Department is charged with "the preservation of important archaeological, historical and cultural sites, as well as the coastal zone's scenic beauty and important recreational areas."[15] Within this framework, the Coast Conservation Department has formalized Archaeology Department zoning laws within its permitting process. The main requirement is that development is prohibited within 200 meters of designated sites.

Further, the CCD has the authority to modify, or if necessary, prohibit, development within the coastal zone if it is believed that this development threatens to destroy or decrease the qualities of the site which make it unique and important. Lastly, development in the vicinity of these sites will be in accordance with all other Ceylon Tourist Board, Coast Conservation Department and Urban Development Authority guidelines and regulations for tourist facilities in the coastal zone.

Design for Aesthetics of Area

Along with the regulatory considerations, design should be sensitive to the aesthetics of an area. If the development is within view of an important site or building, the tourist facility should not be taller than that site. **The design of the exterior of the building should also be harmonious with the architectural style of the site.**[46] A famous example of this type of planning is the city of Washington D.C., where several historical monuments have been designed with a compatible architectural style and buildings within the city cannot be higher than the Washington Monument. These design guidelines make Washington a popular tourist destination as they enhance the significant features of the area.

In Colombo, there is a good example of how this type of planning can enhance as well as detract from important buildings. Opposite the Galle Face Green, the impressive Galle Face Hotel and complementary buildings across the street, offer an example of 18th century colonial architecture. Off-white concrete and red-tile roofs complement each other from either side of Galle Road. Further south beyond the Galle Face Hotel, however, a large high-rise overshadows the Galle Face Hotel. The overall effect is to minimize

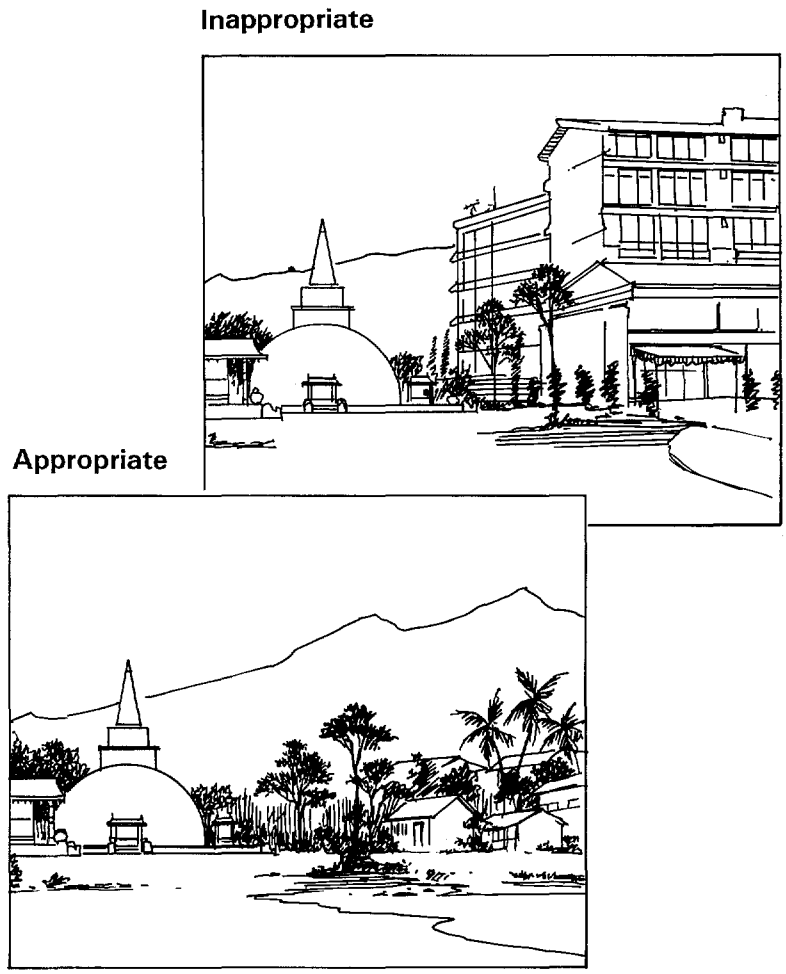


Figure 21. Graphic representation of how scale and architectural style enhance historic or cultural sites[35]

the effect of the well planned, harmonious buildings. Figure 21 illustrates this type of good and poor planning.

These planning considerations do not have to be applied solely to buildings, however. They can be applied to archaeological ruins and scenic areas as well. In Hikkaduwa, preserving scenic beauty was not a priority. This is evidenced by the number of high-rise style hotels adjacent to the beach which obscure the view from the road. **As less and less visual and physical access is available to tourists, the greater the likelihood that they will go elsewhere to better planned areas.**

The Tangalle Bay Hotel, in contrast to Hikkaduwa hotels, blends with the rocky headlands and cliffs and light sandy beaches of the area. This Hotel was designed and built in the early 1970s to harmonize with the landscape. By designing in this style, it has effectively kept the focal point where it should be, on the coastline and scenic beauty of the area. Building in this style is also economically beneficial as wind and storm damage to the exterior of the building is minimized. Figure 22 represents this type of planning.

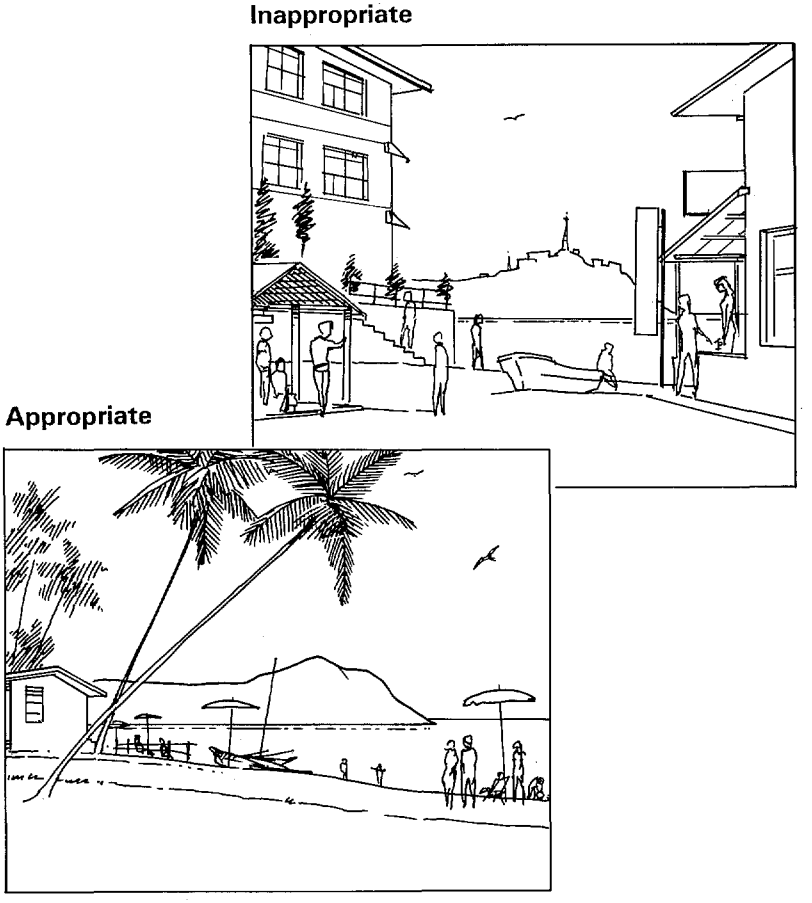


Figure 22. Graphic representation of how scale and architectural style can enhance scenic quality [35]

These considerations are particularly important in areas of cultural, archaeological, and scenic beauty, but should also be considered for any tourist development. Planning and design which enhance Sri Lanka's natural coastal assets protects the main attractions of tourism.

Landscaping

The coastal regions of Sri Lanka contain delicate species of vegetation which provide protection from storms, habitat for birds and mammals, shade from the sun, and a barrier to erosional forces of the ocean. **The best approach concerning vegetation removal and landscaping is to leave as much of the preexisting vegetation in place as possible.** Removal of vegetation will increase erosion of valuable topsoils, siltation and pollution to local waters, and overall costs of the project. Further, large trees can take decades to grow and should therefore be considered an asset for the shade and beauty they provide to the landscape. It is unrealistic, however, to assume that most vegetation will be left intact. The value of maintaining trees and vegetation is summarized in Figure 23.

The landscaping requirements of any tourist facility will vary according to physical parameters such as soil type, exposure to elements such as winds and saltwater, amount of rainfall, and contour of the development area. Requirements will also vary according to the social dimension of the facility. Some social parameters include the type of tourist desired, privacy, and visual aesthetics. Practical considerations include the amount of maintenance that will be invested in the landscape, as well as cost. An overall plan should be developed with the consultation of someone who knows about vegetation in Sri Lanka and who is familiar with the physical constraints in a given area. Unplanned landscaping can lead to future problems such as obscured views or buckled pavements. Planned landscapes can enhance the atmosphere of a resort and provide guests shade and privacy.

Physical factors affecting the choice of plants include:[22]

- **Rainfall characteristics of region, including seasonality and amounts**
- **Direction, velocity, and nature of prevailing winds**
- **The composition of soils and their movement/stability**
- **The presence of adjacent water bodies other than the ocean such as rivers, swamps or lagoons**
- **The types of wildlife in the area**
- **The amount of salt water intrusion into coastal soils during storm seasons.**

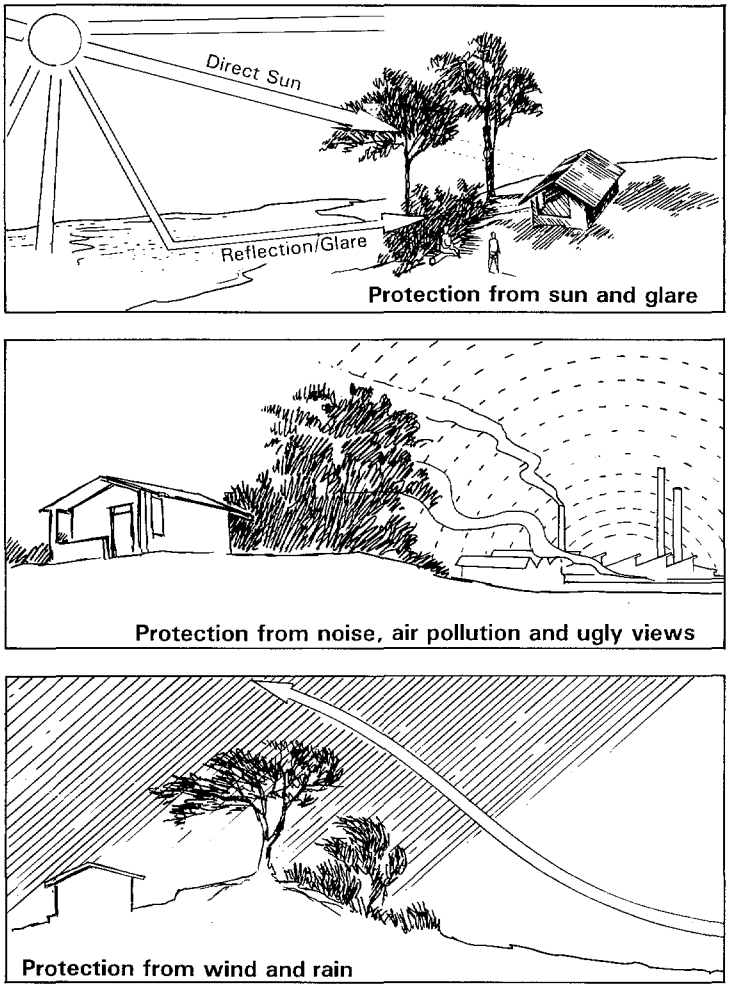


Figure 23. Services provided by trees and vegetation which enhance the environmental quality of a coastal tourist facility [32]

The following suggestions can help to increase the value of the landscape as well as to protect the natural environment from negative impacts of vegetation removal.[22]

- **When possible, protect natural vegetation from construction activities.**
- **When landscaping use indigenous plant species whenever possible.**
- **Be realistic about the design of the landscape in terms of your ability to maintain it.**

- **Root-balled trees are not good alternatives to leaving trees in place as they are expensive to translocate, are subject to sudden death due to stress, and take many years to establish themselves.**
- **Choose trees and shrubs that root vertically and deeply rather than species that root horizontally or shallow to avoid damage to foundations, walkways, or other surface structures.**
- **Use flowering and fruiting species that attract birds, mammals and insects if these are desirable to your guests.**
- **Use hardwood species so that there is less chance of damage to property or injury to guest from falling branches and limbs.**
- **Use species with graceful shapes that do not all lose their leaves seasonally, but do so throughout the year.**
- **When using coconut, remember that these trees will grow very tall and may pose a hazard to an adjacent building or people from falling fronds and nuts.**

In Sri Lanka, coastal areas can be divided into two regions: those affected by the southwest monsoon and those affected by the northeast monsoon. The regions in between are generally well protected by bays, headlands, and sand dunes, but may be limited by rainfall. Landscaping in the coastal zone of Sri Lanka therefore involves two basic climatic zones as illustrated in Figure 24:

A. Hot and wet with primarily sea breezes, typified by the climate of Colombo.
B. Hot and dry with primarily dry land breezes, typified by the climate of Trincomalee.

Soil types in both zones A and B can be of a sandy quartz type and in areas located near fringing reefs, soils can be of white sand consisting of weathered coral grains. In zone B laterite cliffs contain soils with a high iron composition and in other regions, acidic, spongy or muddy soils are common which are vulnerable to erosion.

Planting can occur in two belts.[22] Belt 1 is adjacent to the ocean and will contain the hardiest, most resistant species. Belt 1 is extremely important in protection against erosion and storm damage. Planting of vegetation should begin in Belt 1 so as to provide protection for the more decorative and varied plants of Belt 2. For both zones, Jonklaas recommends that plants be obtained from nurseries with similar soil types.

Table 4 provides a general list of species that are suitable for use in Belts 1 and 2 in dry and wet regions. In small regions, other species may be available and may be the best alternative for that area. Again, using indigenous, naturally occurring vegetation

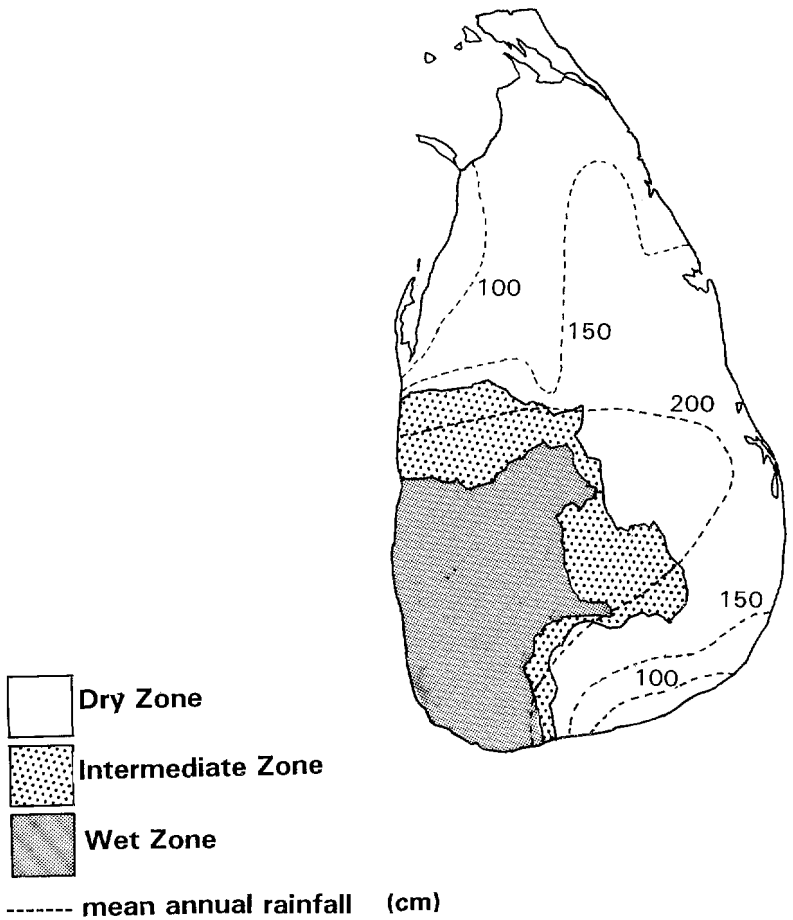


Figure 24. Dominant climatic zones of Sri Lanka [42]

is the preferred option. Table 5 provides developers with an overview of plants available and their suitability for salt exposure. It is recommended regardless of species chosen, to leave as much of Belt 1 vegetation in place and to replant this zone as quickly as possible to prevent serious damage. Once Belt 1 vegetation is in place, Belt 2 vegetation will establish itself quickly and with less effort.

The primary variation in species between these two zones is availability of fresh water. Therefore, if ample watering supplies are available for landscaping purposes in the dry zone, then wet zone species may be used. However, this is not recommended as

water availability can vary over time--as can cost--and a shortage of water may result in death to imported plants and trees, resulting in economic losses. It is advisable to use species with tolerances compatible with the local climate.

Table 4. Belt landscaping species [22]

Vegetation Type/Function	Dry Zone	Wet Zone
Belt 1 (Adjacent to sea)		
Sand binders	*Spinifex*	*Spinifex* *Ipomoea* (Morning glory)
Wind breaks	Palmyrah palms	*Scaevola* *Pandanus* (Screw pine)
Trees/shade trees	Palmyrah palms *Terminalia* (Wild almond) *Thespesia populnea* *Casuarina* (Ironwood) Yucca	Coconut palm *Thespesia populnea* (Suriya) *Terminalia* *Casuarina*
Deterrent Flora, fencing and barriers	(same as wet zone)	*Cereus* and *Opuntia* (cactus) *Pandanus* *Agave marginata* (aloe)
Ornamental ground cover		*Crinum*
Belt 2 (Inland of Belt 1)		
Sand binders	Indigenous grasses only	Most grasses and Ipomoea
Wind breaks	*Thevetia* *Thespesia populnea*	*Thevetia* *Hibiscus* *Barringtonia* *Pandanus*
Ornamental shrubs and trees	*Nerium oleander* *Bougainvillea* *Morinda* (Indian mulberry)	*Bougainvillea* *Codiaeum (Croton)* *Allamanda*
Trees	*Casuarina* *Eucalyptus* *Terminalia* Palmyrah *Phoenix* Sylvestris, *Ficus bengalensis*	*Pisonia alba* *Barringtonia* *Ficus bengalensis* (Wild fig) *Terminalia* *Plumeria*
Ornamental ground cover	*Catharanthus roseus*	*Catharanthus roseus*
Deterrent Flora	(all other listed dry zone	*Euphorbias* (Daluk)

Note : In brackish water lagoon and estuary areas the following plants types may also be used: Nipa palm (*Nipa fruticans*) and Mangroves (*Sonneratia, Rhizophora and Bruguiera*).

When watering plants, use of gray water from shower drains and kitchen sinks should be considered, especially in areas where water demand is greater than water supply. In using this method, water is recycled, thereby reducing economic costs associated with water use while at the same time conserving a valuable and limited natural resource. If gray water is to be used, the use of laundry and kitchen soaps that are biodegradable and have reduced phosphate should be preferred as these extra nutrients can be harmful to coastal waters and groundwater supplies.

Further, any watering of vegetation should be done after sunset to allow maximum absorption of water. **Watering of vegetation in the morning or during the day should be avoided** since a large amount of the water will evaporate and therefore be wasted. Also, some plants will be scorched by watering during the daytime.

Planting Seasons

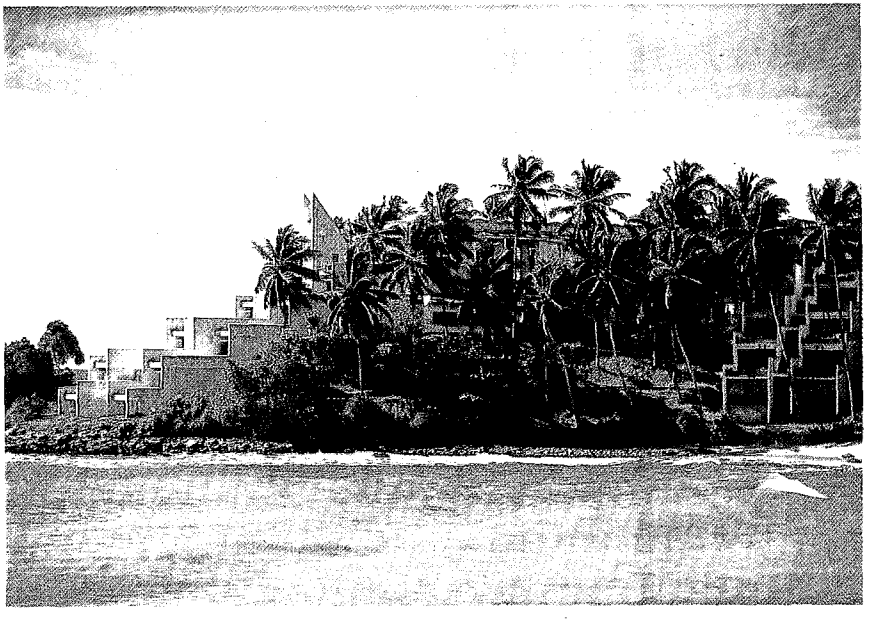
It is very important to replant coastal areas in the correct season. In Sri Lanka, the south and southwest region should plant in October through the end of December to benefit from the inter-monsoonal convectional and southwest monsoon rains. On the east coast, planting should start in November with the Northeast monsoon and can continue until the end of February. The arid northern regions, planting should occur in November and December.

For the first few years, it is important to protect young plants from wind and storms, especially in the southwest. Also, in the southwest, it is advisable to spray plant stems and leaves with fresh water to protect them from scorching by salt in the air.

Construction Activities

This phase of development is responsible for much of the environmental damage which occurs in the coastal area. During construction, vegetation is not only removed, but also destroyed by heavy trucks and machinery, laborers, and construction materials. **To minimize vegetation damage which increases erosion, provide well marked roads and paths which will decrease the amount of other roads and pathways. Designate areas for materials to be stored and whenever possible, build platforms out of scrap materials to keep heavy objects off the vegetation.** These simple measures will decrease longer term impacts associated with increased erosion and storm water runoff.

Another important safeguard during the construction phase is to build protective cages around valued trees and shrubs to protect them from accidental damage from heavy machinery. To aid in the protection of these plants and trees and to minimize worker health hazards, applying water to dirt areas and roadways is recommended to keep airborne pollutants to a minimum.



Hotel designs which are sensitive to the local environmental features, do not detract from the natural scenic views such as this hotel near Tangalle

5. Development Guidelines: Water and Waste

In Sri Lanka, there is little infrastructure in place to manage wastes. Therefore, it will be the individual developer's responsibility to design methods of disposal that will have minimal environmental impacts. In all instances, developers should work with local and central government authorities to facilitate the establishment of a central system for disposing and managing wastes from tourist facilities. Until this time, however, proper waste disposal must be conducted by individual tourist facilities. Improper waste treatment and disposal will lead to tourism decline and economic loss.

Potable Water Supply: Assessment and Considerations

Water Supply

The two main sources of water are surface and ground water; both are recharged and sustained through precipitation. Surface waters include rivers, lakes, streams, and springs. Due to their direct contact with human activities, most surface water sources in Sri Lanka are polluted. Groundwater, on the other hand, is located below ground and is classified as such only if the water supply fully saturates the adjacent soil.[7] The upper portion of the groundwater reservoir is referred to as the water table and the primary mechanisms for recharge are water percolation from surface soils during and after a rainfall or by horizontal migration of water along a hydraulic gradient.

Groundwater is the most important source of a fresh water supply and although it is economical to obtain, treatment is necessary to remove impurities. Table 5 lists common impurities and their effects on water quality and use. In the initial site evaluation stage, water supply should be noted and tested to determine what treatment methods will be necessary to make water safe and palatable. A water or sanitation engineer should be consulted in evaluation of the water supply.

Along with a chemical analysis of the water quality, quantity of water supply needs to be estimated to determine the carrying capacity of the water supply. Costs will increase if water needs to be transported to a resort and stored. One resort on Pulau Babi Besar, Malaysia was designed to house 200 guests, but in reality only caters to 50 guests as it is limited by its water supply.[50] Available water sources must be quantified and calculated according

Table 5. Common water impurities and their effect on water quality

Common groundwater Impurities	Effects on water quality and uses
Iron	Stains porcelain and fabrics, clogs pumps
Lead	Toxic to humans, even in small quantities
Carbon Dioxide minerals, Increases	Encourages the formation of carbonates which dissolve increasing hardness, alkalinity, and salty taste of water corrosion and mineral deposition in pipes
Hydrogen Sulphide	Offensive smelling Corrosive to metals Ruins cement and concrete Poisonous in larger quantities
Algae	Clogs pumps, filters, and uptake valves Discolors water, ruins taste
Nitrogen	Indicates the presence of organics, usually from human fecal contamination from poor sewage systems or from fertilizer application to nearby agricultural lands May be in the form of ammonia or nitrate
Oxygen	Is useful for groundwater purification In conjunction with iron compounds will give water a rusty color Will increase corrosion of metals in higher concentrations
Chlorine	In concentrations greater than 1.5 PPM, chlorines and flourines can cause staining of teeth
Dissolved calcium , magnesium salts	Cause hardness in water and corrosion of steam pipes and boilers, leaves deposits on clothes
Clay, silt, other organics	Result in turbidity, or cloudiness, of water.

to average consumption of the proposed development to determine if supply is adequate.

Water Storage and Demand

In considering water supply needs, Table 6 may be helpful in determining the water needs of tourists. Although water supply figures vary drastically, it is important to remember that water supply varies among users. In general, tourists from developed, industrial nations will use more fresh water than will domestic tourists or tourists from other developing nations. Water demand also varies according to the location of the resort, and by the time of day. The highest periods of use are in the early morning and evening period when water use can be as much as 200 percent greater than the average water use. Of course **the design of a tourist facility will also determine the quantity of water used by guests.**

Table 6. Suggested water storage requirements [24]

Type of Building	Measurement	Storage (liters)
Dwelling house	per resident	70
Hostel	per resident	90
Hotel	per guest	135
Commercial building	per person	35
Restaurants	per meal	07

According to the World Tourism Organization standards for resort planning and development, **tropical beach resorts should plan on a daily consumption of water per person at about 500-1000 liters per day.** In contrast, Indian Standards estimate hotel water demand at 180 liters per person per day. Therefore, developers must be wary of very low water storage and consumption figures and keep in mind the special needs of their clientele, when it is primarily western European and of the special water demands for tropical areas.

Many water reducing options are available for large tourist facilities. Options described for Thailand include:[5]

- **Low water demand toilets which use only one-fifth the water of older toilets (5 liters per flush as compared with up to 25 liters in older toilets)**
- **Low volume shower and water basin nozzles designed to use about one-third the water of older designs**
- **Recycling gray-water for use in garden watering**

Parameters to be considered concerning water supply:

- **Is there an available source of water, is it adequate or does it need to be supplemented?**
- **What is the natural quality and quantity of the water supply?**
- **What are the possible additional sources of supply?**
- **What treatment does the water require (filtration, aeration, purification)?**
- **What are the overall uses of the water in terms of people, gardens, pools, etc.?**
- **What is the estimated daily demand for the different uses?**
- **Will the present water supply support future expansion of the tourist facility?**
- **Will the supply be adequate to meet peak demand times?**

- **What are the technical requirements for making the water system operational?**
- **Will the supply be constant or will it vary seasonally?**

In addition to water storage for guests, water must be stored for landscape maintenance as well as for swimming pool needs, and kitchen or laundry use. Further, water must be stored for fire code purposes. Fire storage figures may be obtained from the nearest local fire authority for the region of proposed development, or from the Fire Department of the Colombo Municipal Council.

Location of water-wells

The proper placement of water-wells on the development site is perhaps one of the most important design considerations as water is a fundamental necessity at any tourist facility. Well placement must be done after carefully determining the types of soils on the site, the height of the water table, the location of the saltwater lens in relation to the water-table, and the probable location of septic systems (Figure 25).[21]

In most cases, wells placed in sand and gravel will be less costly and will yield more water than wells placed in fine alluvium or clay soils.[35] If the water table is close to the surface, drilling into deep bedrock is not necessary. If a well needs to be drilled into bedrock, most water will be obtained at a depth of between 200-250 feet. Drilling deeper often yields little extra water and can be very expensive.[35] The benefit of a deep well is the high water storage capacity.

Another concern related to well placement in coastal areas is the risk of salt water intrusion. **Salt water intrusion occurs when fresh water is pumped from the well faster than it can be recharged by rainfall or runoff allowing salt water to enter the well** (Figure 25). Salt water is unsuitable for human consumption and many other uses.[5, 35] A thorough study must therefore be conducted prior to well siting to determine where the water table is located in relation to the salt water lens.

Determining sources of water supply, water storage, and demand must be done at the planning stage. If water sources are too small for the proposed development, alternative sources must be found or the scale of the plan must be reduced. Fitting the size of facility to the natural capabilities of the local hydrologic cycle, ensures that the development will not damage this natural cycle and will have lower long-term costs associated with water.

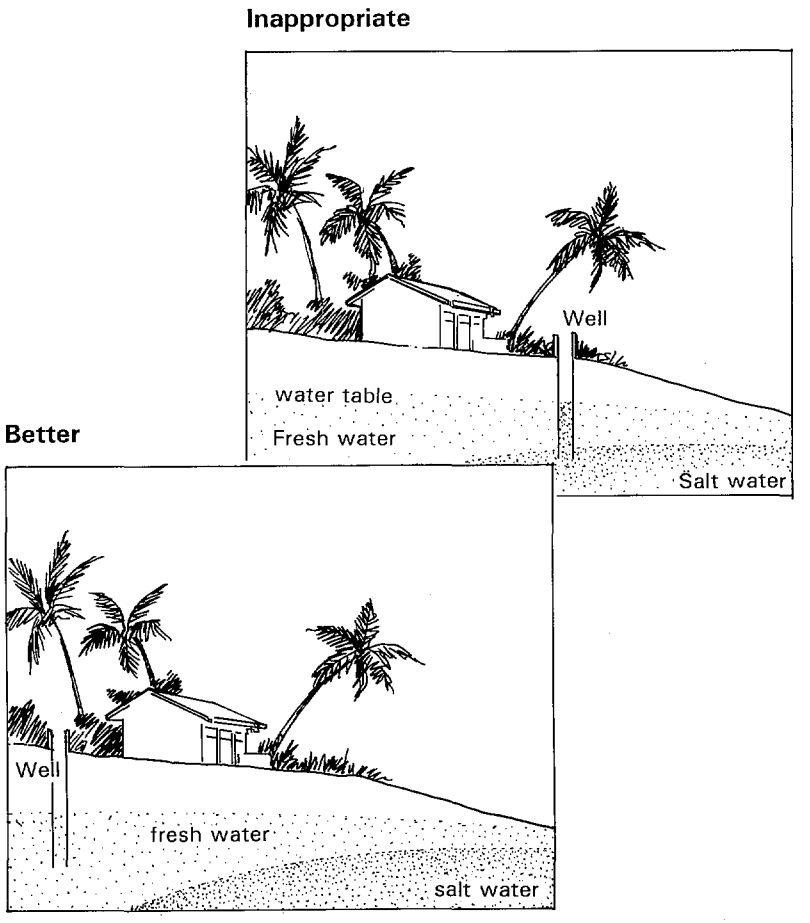


Figure 25. Salt water contamination of wells. The top diagram shows the inappropriate location for a well in relation to salt water. The bottom diagram shows better well placement [35]

Wastewater, Stormwater, and Sewage Disposal

Along with any water supply scheme, there must be an appropriate plan for disposal of water waste, storm water and sewage. Lack of infrastructure development places design responsibilities with individual developers. Design considerations will include size of proposed project, topography of the site, height

of water table at the site location, and location of fresh water well. As fecal contamination of groundwater supplies is a concern of coastal resorts in southwestern Sri Lanka,[36] careful planning of these amenities is essential.

Wastewater

Wastewater or gray water, as used here, is the water stream resulting from water wastes from restaurants and hotels excluding sewage. Wastewater should be separated from storm water and sewage for both treatment and disposal. If the development is an area of water shortage or if the developer wishes to conserve water, wastewater can be reused to water lawns and shrubs or can be diverted for agricultural use.

Reuse of wastewater or gray water is inexpensive and saves groundwater resources. During pipe laying gray water should be led to a separate storage tank. This will help in reducing the overall water volume to the septic system, preventing overload and reducing maintenance costs. If these options cannot be adopted, then the following criteria can be followed in developing a waste water system.

Wastewater collection and disposal

A wastewater collection system consists of a network of manholes and pipes. Pipes can be of a variety of materials depending on financial constraints and site specific characteristics such as soil type or water content in the soil. Solids and storm water runoff should be diverted from entering this system. Drain traps located at the points of entry to the collection system can eliminate solids from entering and possibly clogging the system.

The slope of the pipes must be maintained at a self-cleansing velocity. Sri Lanka Building standards provide for slopes as low as 1:130 for 100 millimeter (mm) diameter pipes and 1:200 for 200 millimeter diameter pipes. These national standards do not have local variations. The recommended minimum pipe diameter is 75mm.

Waste water disposal systems are listed below in order of their desirability.[18, 21]

1. **Diversion for use in agricultural lands or for lawn watering.**

2. **Disposal to a common sewer if one exists.**

3. **Connection to septic tank system soakage pit if the system and the soil are capable of absorbing the extra liquid.**

4. **If the above are not feasible, the following may be considered depending on soil conditions, availability of space, and depth of the water table:**
   a. **Soakage pit if the soil percolation is adequate;**
   b. **Soakage field if the percolation rate is inadequate;**
   c. **Evapotranspiration mound if rock or clay exists at a shallow depth and the water table is high; and**
   d. **Under-drain filter if due to soil conditions, all of the above are unsuitable options.**

Stormwater and surface runoff

Water flowing on the surface during or immediately after a rain storm is called stormwater runoff.[5] Property damage, flooding, death, water pollution and erosion may all result from storm water runoff. Therefore, **coastal tourist facilities must be designed to limit changes to natural runoff patterns and to compensate for those disruptions that are unavoidable.** The overall goals of stormwater management are:[5]

- **Prevent flooding resulting from stormwater surges**
- **Prevent pollution of surface, ground, and coastal waters by removing pollutants acquired from septic systems, pesticides, or other pollutants**
- **Recharge groundwater which minimizes potential water shortages during periods of little rainfall**
- **Prevent soil cave-ins and damage to building foundations**
- **Prevent soil erosion which causes damage to streams, lakes and coastal waters**
- **Prevent siltation of adjacent water bodies**
- **Prevent clogging and backup of storm drains and channels**
- **Protect wildlife and habitats**
- **Protect corals and marine life from siltation and pollution**
- **Protect open spaces, wetlands, and recreational waters which enhance the surroundings**

Runoff from developed areas can contribute large amounts of suspended materials, nutrients, and biological oxygen demand (BOD) as well as fresh water influx to coastal waters;[3] all of which are detrimental to coastal ecosystems. Further, as coastal development not only increases the quantity of runoff but also lowers the quality, runoff must be properly treated and routed to minimize impacts to coastal ecosystems.[3] Stormwater often carries more pollutants than untreated wastewater and causes greater degradation

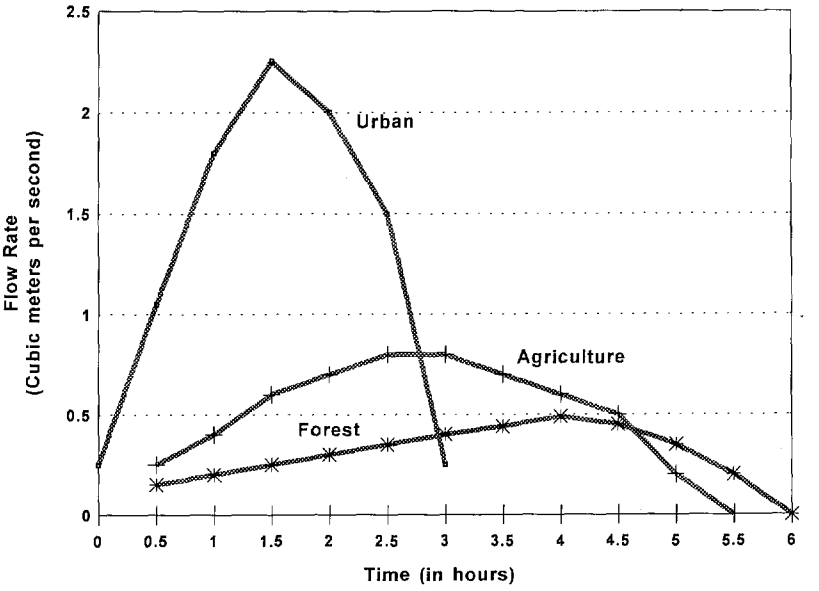


Figure 26. Changes in land use affect the rate and volume of surface runoff and are of particular concern as surface runoff enters coastal waters, resulting in pollution [5]

of coastal waters, lakes and streams.[5] Figure 26 illustrates how development activities alter normal stormwater flow.

Runoff is difficult to control, but can become almost impossible once the construction of the development is complete. In the past, runoff was treated as a secondary issue to be dealt with as it occurred and not something to plan for. Currently, greater emphasis is placed on planning for stormwater and a pre-development discharge rate standard is utilized. This standard requires that, **the rate, volume, and content of stormwater discharge *after* development must not be greater than the rate, volume, or content *before* site development occurred.** Therefore, planners must consider this issue in the context of coastal tourism development.

The following actions help minimize the impact of runoff:[3]

- **"minimization of disturbances to the existing landscape;**
- **minimization of sealed areas such as roads and parking areas;**
- **use of shrubs which require little or no fertilizer; and**
- **use of contouring to divert runoff to storage areas."**

"The storage areas could be either of a permanent type such as reservoirs, or of a temporary nature such as large low lying areas where evaporation would be enhanced. The runoff could be used for irrigation or discharged after treatment via a submarine outfall."[3] Figures 27 and 28 illustrate two types of appropriate storage basins for runoff water.

If large regions of closed surfaces are unavoidable, materials such as bricks and cobbles should be used instead of asphalt or cement. The spaces between individual bricks allow water to seep into the soil reducing runoff. Vegetation may also be used to filter water and allow percolation and groundwater recharge. Figure 29 illustrates three landscaping techniques that promote water absorption.

Parameters to consider in the design of a storm water disposal system are either system specific or event specific. In system specific parameters, the most important consideration is the coefficient of runoff of the catchment area in relation to the actual catchment area. The coefficient of runoff is dependent on the following factors:

a. form, location, and size of the catchment area;
b. type of land-use;
c. infiltration rate;
d. slope of ground within the catchment area;

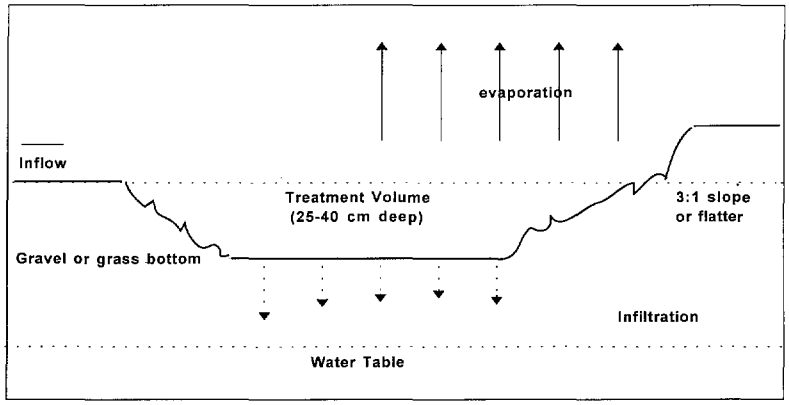


Figure 27. A dry retention basin is one option for collecting stormwater. Runoff is held in this basin until it evaporates or is absorbed into the soil. No discharge occurs in this system [5]

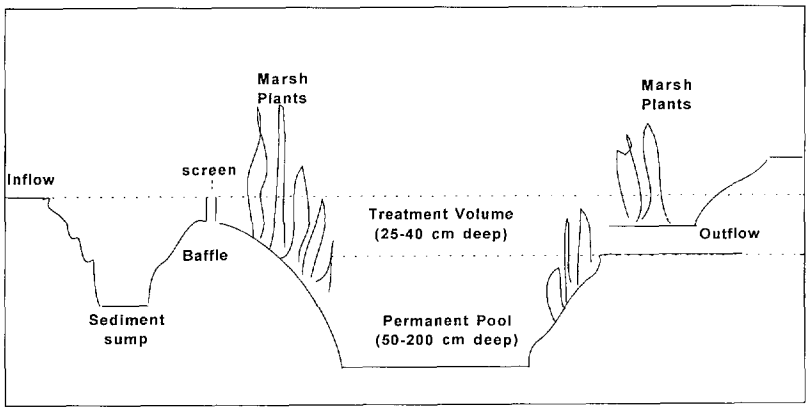


Figure 28. A wet retention pond is another option for storm water storage in which storm water is held and discharged at a rate determined by the size of the outflow pipe. In coastal areas, this limits water inundations associated with large rain storms [5]

e. existence, location, length, size, gradient and condition of the drainage system and canals;
f. size, location, and capacity of the retention areas; and,
g. groundwater table.

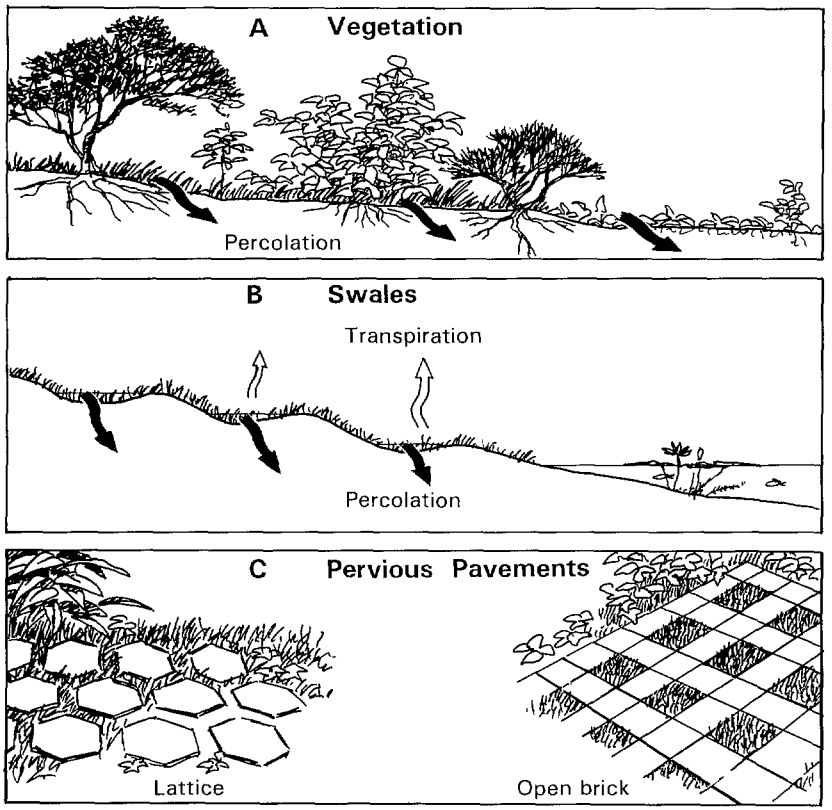
Further, any other sources of runoff in the area which may also fill the catchment depending on contours and location of the site, need to be determined.

Event specific parameters are governed by the intensity of rainfall experienced in the area such as:

a. An intensity of rainfall of 110 mm/hour based on a storm duration of 15 minutes with a return period of 1 year for open drains.

b. An intensity of rainfall of 140 mm/hour based on storm duration of 15 minutes with a return period of 5 years.

The above intensities of rainfall would require large culvert and drain sizes, making the system prohibitively expensive for some projects. Therefore, the following parameters may be considered.



A Provides a ground cover that permits rain to percolate into the ground, preventing runoff flooding while recharging groundwater.

B Grass-lined troughs that collect runoff and allow time for water to percolate into the ground. Swales must be mown to keep the vegetation healthy and to prevent outlet plugging from leaves, garbage, or litter.

C Gravel, brick, or other pervious surfaces. Separations or pore spaces must be sufficient to allow rapid percolation of rainwater.

Figure 29. Several landscaping techniques which will help to minimize stormwater runoff damage [5]

a. For drains--an intensity of rainfall of 90 mm/hour based on a storm duration of 15 minutes with a return period of three months.

b. For culverts and other structures--an intensity of rainfall of 125 mm/hour based on a storm duration of 15 minutes with a return period of two years.

Storm water collection systems

Storm water collection systems should be designed according to the desired velocity of the flow and for ease of maintenance. Closed drains should be provided only if:

- Road width is limited
- Where drains are deeper than 0.75 meters
- Where open drains are not aesthetically appropriate

Storm water from the collection system should be discharged through outfalls to natural water courses, to larger drains or canals, to retention ponds or marshes, or to a soakage system. The discharge through the outfall should be via a silt trap and a screen to prevent debris collected in the open drains from being discharged through the outfall. The placement of the outfall pipes into natural waterways should be in areas with large amounts of flushing and away from coral reefs and other coastal habitats which may be damaged by the outfall.

Sewage disposal

Sewage comprises the waterborne wastes of a human community carried in a sewer system normally containing animal or vegetable matter in suspension or solution, excluding sludge. Sewage can carry human diseases through viruses and bacteria that are pathogenic to humans. **Untreated or improperly treated sewage is a health hazard and can contaminate drinking water sources and coastal waters. Contaminated coastal waters are not suitable for swimming and other recreation activities, resulting in not only environmental degradation, but economic losses from tourist declines and increasing health costs of residents.**

Since there are few central municipal sewage treatment and disposal systems operating in Sri Lanka, septic tanks and soil absorption systems need to be developed. Specifications for these systems are given in the Code of Practice for the Design and Construction of Septic Tanks (Sri Lanka Standard 745 1986).

Large hotels of more than 100 rooms are required to install waste water treatment facilities. A "Biofilter Sewage Treatment Plant" has recently been installed in the Eden Hotel which offers cost effective treatment and recycling for sewage and wastewater. Traditional treatment mechanisms are more costly and expensive to maintain.[16]

Septic systems

The septic system has two primary components: the septic tank which breaks down the sewage through anaerobic action and the soakage tanks or pit which operates aerobically. The septic tank slows down the flow of raw sewage and stimulates the removal of solids either by liquification or settlement. Septic tanks reduce BOD by 30-50 percent and fecal bacteria content is only slightly reduced. Therefore, the effluent is discharged into unsaturated soil to remove more of the solid matter and toxins (Figures 30 and 31).[35]

The daily volume per person is considered to be 80 percent of the per capita consumption of water. The volume of the tank and other design considerations for septic tanks and soakage pits include:

- **the availability of a suitable effluent disposal system**
- **external factors which affect the invert level of the inlet to the septic tank**
- **rainwater drainage at the site and rainwater intrusion, if any, into the sewage system**
- **location must be accessible for maintenance**

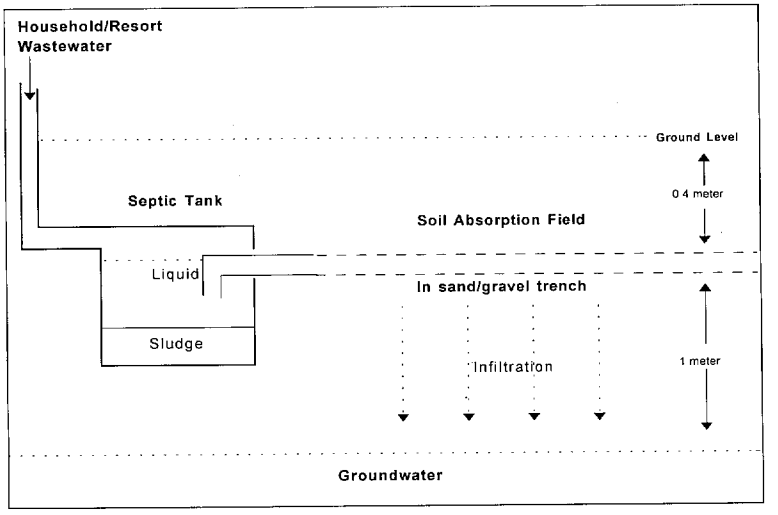


Figure 30. Standard septic tank design [5]

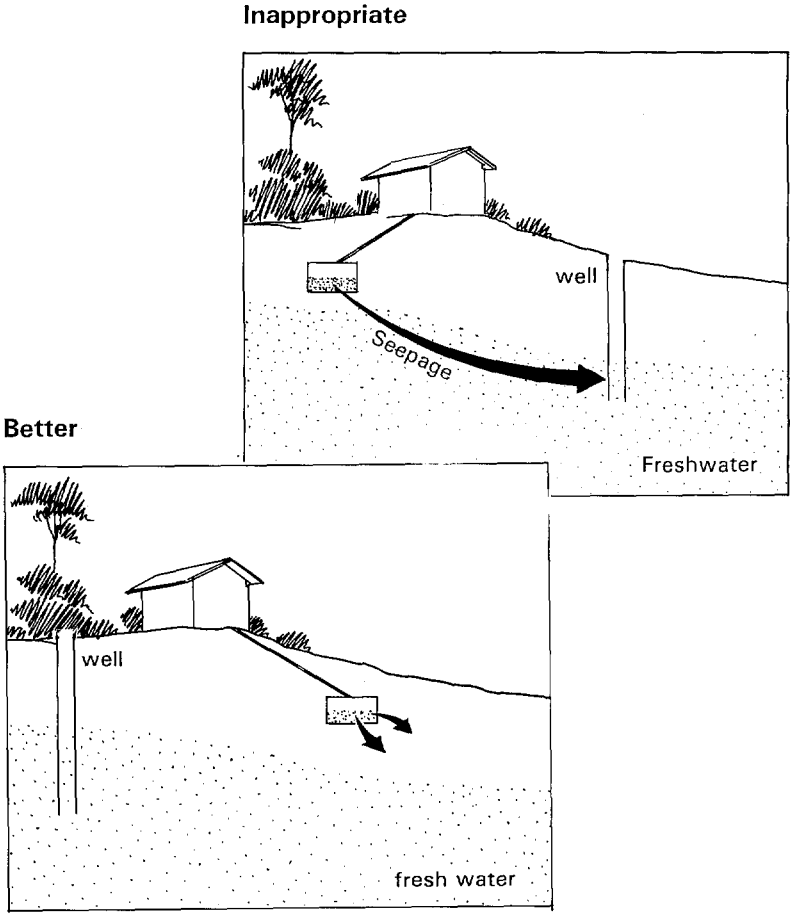


Figure 31. Placement of septic system in relation to soil type and fresh water well. Top--incorrect placement of septic system. Bottom--correct placement of septic system is at least 25 to 30 meters from wells and positioned so that leachate flows away[35]

- the depth at which the tank is to be constructed is dependent partly on the soil conditions and partly on the height of the water table
- number of users and fixtures
- rate of sludge accumulation and frequency of cleaning
- liquid retention time and average flow of sewage

Placement of septic tank

Contamination of potable water may occur if septic systems are improperly placed. Therefore, the placement of a septic system must be done in relation to any existing water-well (Figure 31). Guidelines for residential distances between wells and septic tanks are 75-100 feet.[35] A greater distance will be necessary for larger tourist facilities. Also, the septic tank must be placed in such a way that the materials leached from the septic system flow away from the well (Figures 32, 33, 34).[35]

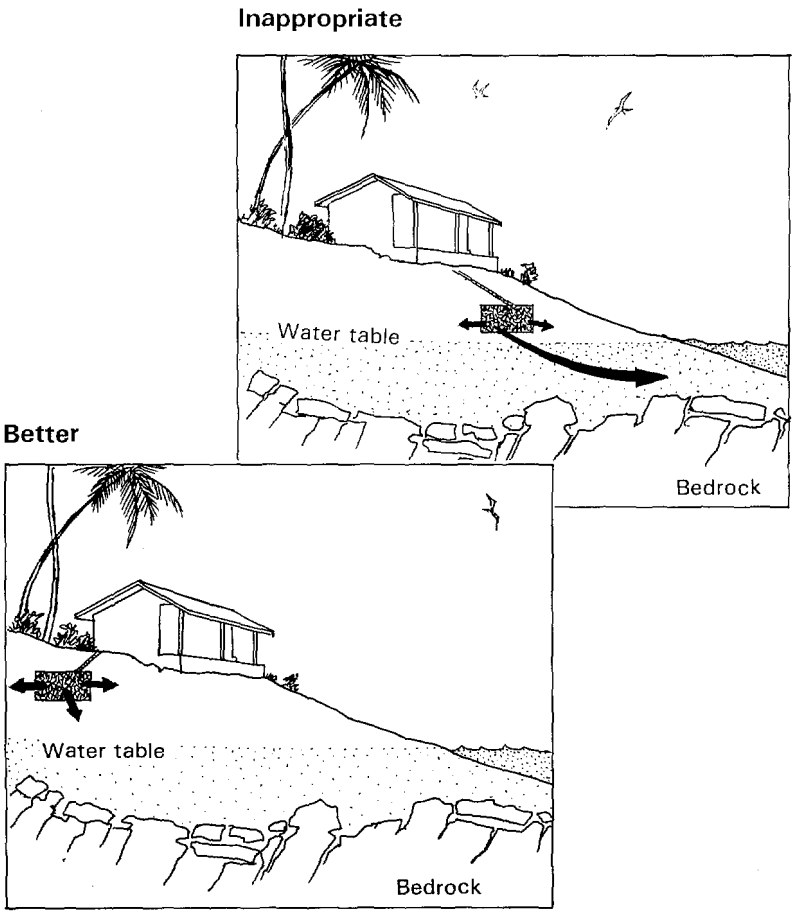


Figure 32. Placement of septic system in coastal areas in relation to groundwater. Top--location of septic system is poor as wastes may contaminate water supply. Bottom--better placement of septic system as there is greater distance between tank and water supply [35]

Septic systems must be installed above the water table as it stands during the rainy season. If the septic system is installed during the dry season, contamination may occur during the monsoon season (Figure 34). Furthermore, septic systems should be placed no less than 50 feet from tributaries to drinking water supplies and no less than 25 feet from lakes, streams, or other water bodies.[35] In coastal areas, however, it is unlikely that a septic system can be placed this close to the ocean as sandy soils are poor choices for septic tank location.

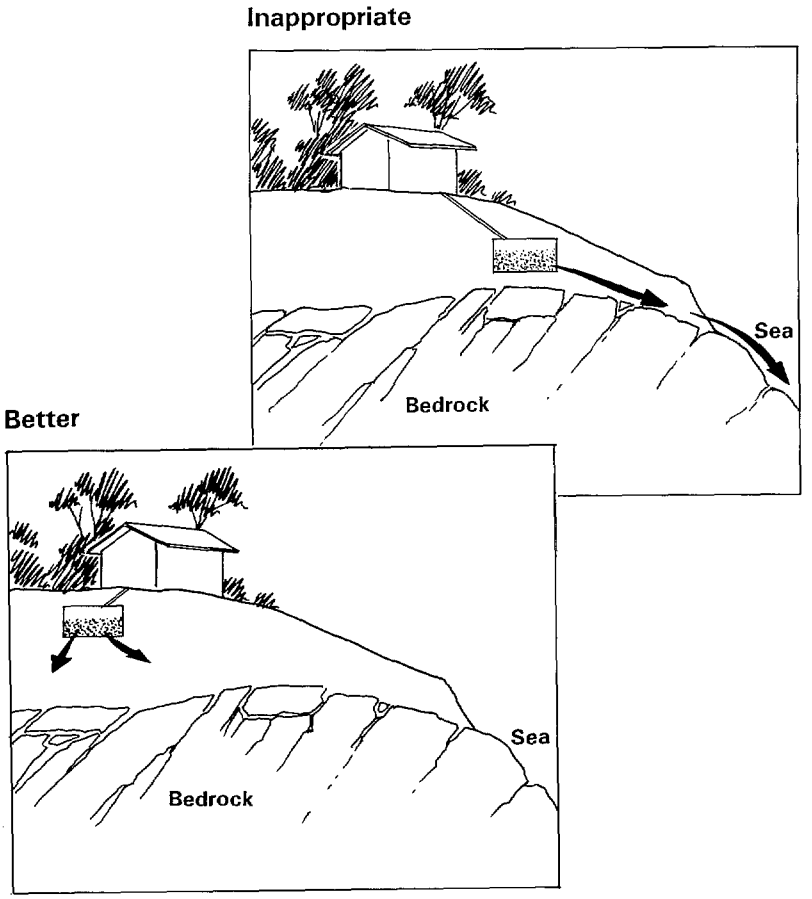


Figure 33. Placement of septic system in relation to soil types. Top--septic tank is placed directly above bedrock, resulting in wastes traveling along bedrock gradient and reaching surface before proper purification. Bottom--better placement of septic system as wastes will be purified in soils above bedrock. The base of leaching fields must be at least one meter above bedrock surface [35]

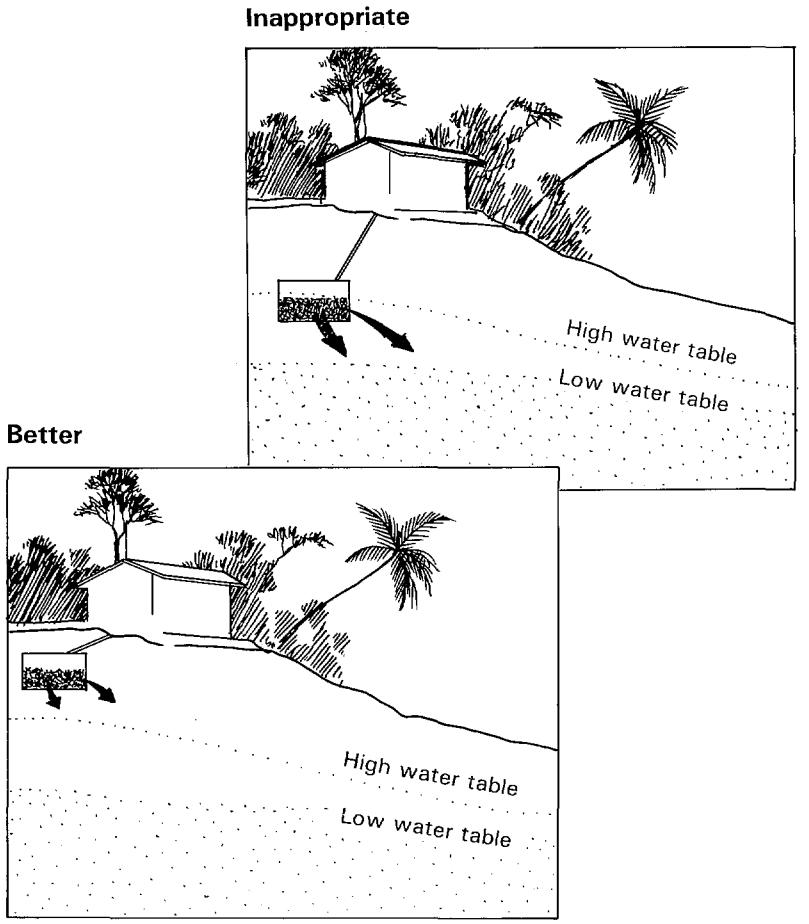


Figure 34. Septic systems must be designed and located with knowledge of where water table is during the monsoon season. Top--septic system installed during dry season contaminates water supply during monsoon season. Bottom--septic tank built well above high water table [35]

Solid Waste Disposal

Disposal of solid wastes (plastics, glass, paper, leftover food) is a difficult process in most tropical developing nations. Public infrastructure for solid waste disposal is lacking in all but the largest cities, and even there, it is usually inadequate. Nevertheless, solid waste management must be viewed as essential for environmental and human health.[48] **In Sri Lanka, which lacks adequate public waste management systems, the developer must plan for solid waste storage and disposal methods for the proposed tourism facility.**

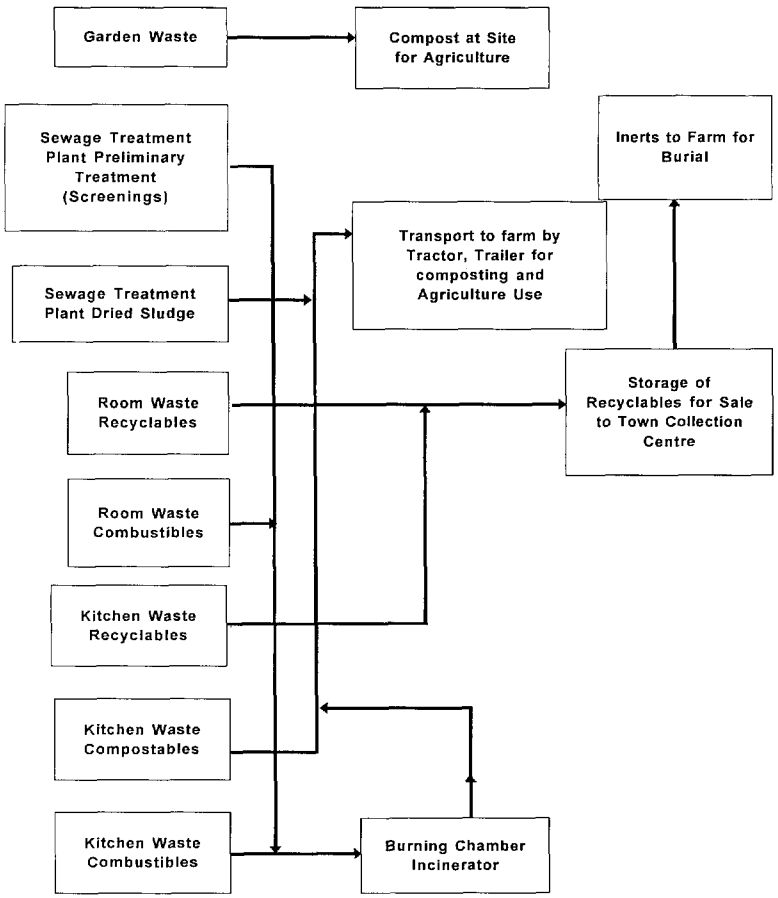


Figure 35. Possible methods of solid waste disposal in Sri Lanka, example of Aitken Spence Hotel Management

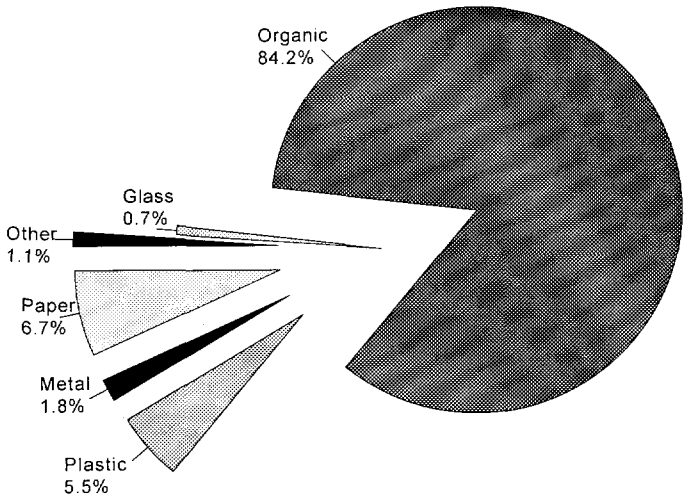
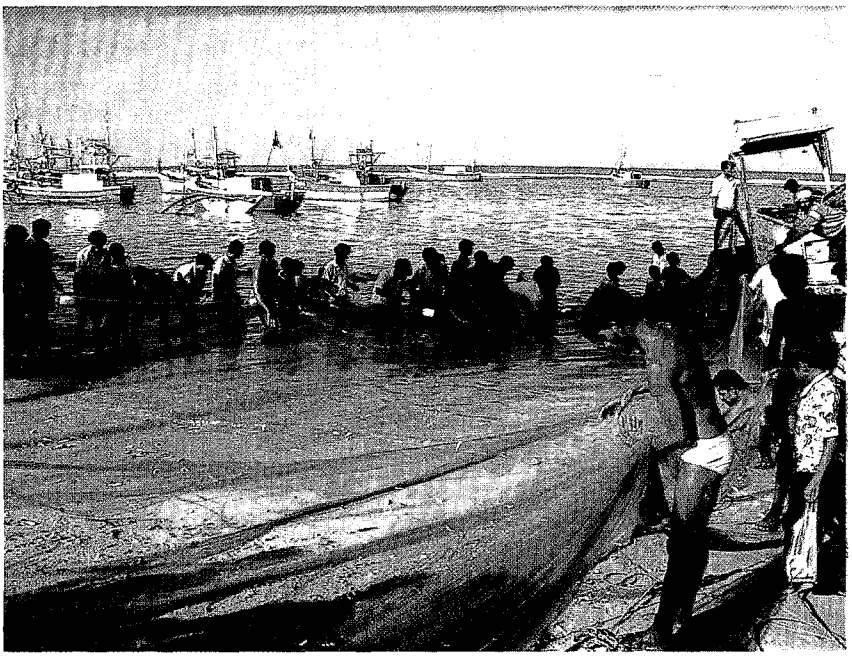


Figure 36. Composition of solid waste in Colombo

Figure 35 shows a scheme of waste disposal. Although smaller scale hotel and guest-houses will not have sewage treatment plants, the distribution of other wastes is required by all facilities, regardless of size. Figure 36 indicates the typical composition of wastes generated by urban areas in Sri Lanka.

Composting of garden wastes (cut grass, dead flowers, tree and shrub limbs) is an excellent way of producing rich soils (Figure 35). By removing garden wastes, nutrients are taken away from the soils, resulting in the need to more applications of fertilizer. If garden wastes are composted and the new soils reapplied, the area will not lose its nutrients and less money will have to be spent to replenish soils. Distribution of kitchen and dining room wastes to local farms is also an excellent way to reduce the amount of trash to bury or burn or place in a landfill.

Total waste treatment and management systems are available in Sri Lanka. One solid waste, wastewater and sewage "bio-converter system" is operating for several hotels in Negombo. The bioconverter takes in kitchen wastes, sewage and wastewater to produce compost (soil conditioner), biogas and useable water. The system not only treats most waste (except certain solid recyclable which are separated) it produces useful products.[44] Such systems should be explored for use in all hotels and resort developments.



Traditional fishing activities require beach space which can conflict with tourist use of beaches and beach access affected by hotel development

The tourism potential of mangrove lagoons for their birds and other wildlife is still untapped in Sri Lanka

6. Regulatory Framework for Coastal Tourism Development

Agencies and Legal Acts Affecting Coastal Tourism

Development activities including tourism in the coastal region of Sri Lanka affect the coastal environment and coastal resources in different ways. They are therefore the concern of a number of governmental agencies listed below and acts summarized in Table 7.

1. The Board of Investment (formerly the Greater Colombo Economic Commission)
2. The Ceylon Tourist Board
3. The Coast Conservation Department
4. The Central Environmental Authority
5. The Urban Development Authority
6. The Ministry and Department of Fisheries and Aquatic Resources Development
7. The Archaeological Commissioner's Department
8. Local government agencies include Municipal Councils, Urban Councils and Pradeshiya Sabhas.

Table 7. Legal acts with implications for coastal tourism development

- Ceylon Tourist Board Act No. 10 of 1966
- Tourist Development Act No. 14 of 1968
- Greater Colombo Economic Commission (GCEC) Law No.4 of 1978
- Greater Colombo Economic Commission (GCEC) Act No. 28 of 1979
- Public Law No.41 of 1978. (Urban Development Authority)
- National Environmental Act No. 47 of 1980
- National Environmental (Amendment) Act No. 56 of 1988
- Coast Conservation Act No. 57 of 1981
- Coast Conservation (Amendment) Act No. 64 of 1988
- Urban Development Authority Planning and Building Regulations, Gazette of March 10, 1986
- Tourist Development (Amendment Act No. 2 of 1987)
- Board of Investment of Sri Lanka Act No. 49 of 1992 (amending GCEC Law No.4 of 1978)
- Schedule of Project Approving Agencies and Schedule of Projects and Undertakings for which approval is necessary under Section 23 of the National Environmental Act. No. 47 of 1980, Sri Lanka Government Gazette No.772/22 (Extraordinary) of 1993 and No. 859/14 of 1995.

The **Board of Investment's** primary concern is the attraction of foreign investment to alleviate balance of payment problems and create employment opportunities.

The **Ceylon Tourist Board** assists with the development of tourism, enabling the country to enjoy the benefits of increased foreign exchange earnings and providing support to the service industries and the traditional cottage industries. The Ceylon Tourist Board Act No. 10 of 1966 requires The Tourist Board as part of its special duties to:

(a) prepare schemes for the establishment, regulation, supervision, development and control of: tourist resorts, tourist services and the employment of persons in tourist services; and to,
(b) formulate a national plan or policy, outlining general proposals for the regulation, supervision, development and control of tourism.

The Tourist Development Act No.14 of 1968 mandates the formulation of a Tourist Hotels Code. The Tourist Development (Amendment) Act No.2 of 1987 requires that no person without authorised approval within a declared tourist development area shall:

(a) "construct or erect any building or structure; or
(b) re-erect, alter or convert any existing building or structure; or
(c) set up or carry on any establishment or business, for the purpose of providing any tourist facilities and services within such (a) tourist development area."

The **Central Environmental Authority** (CEA) administers the National Environmental Act and its regulations. It has designated the Tourist Board as the Project Approving Agency for Tourist Hotels, where such projects are to be located outside the Coastal Zone which is the domain of the Coast Conservation Department.

Tourist hotels are also subject to The National Environment (Amendment) Act of 1988 mandate that: "no person shall discharge, deposit or emit waste into the environment which will cause pollution except: (a) under the authority of licence issued by the Authority (CEA); and (b) in accordance with such standards and other criteria as may be prescribed under this Act."

The **Coast Conservation Department** (CCD) has jurisdiction over two kilometres of coastal sea and a 300 metre strip of land measured from the high water level, as well as 2 kilometres of coastal waterways measured perpendicularly from the seashore. The major concerns of the CCD are prevention of coast erosion, the protection of coastal habitats such as coral reefs, seagrass beds, mangroves and other shoreline vegetation and the prevention of pollution.

The Coast Conservation Department's regulatory policy includes the reservation of setbacks or land where building activity is prohibited or severely restricted. The extent of the setbacks was laid down for each stretch of coastal land in the Coastal Zone Management Plan of 1990. The setback distances have been revised on the basis of improved information available after several years of implementing the Coastal Zone Management Plan regulations. The setback area in the Coastal Zone Management Plan of 1996 is divided into a strict "reservation or no build" zone adjoining the beach and a "restricted or soft zone" on the inland side, where limited development may be allowed (Figure 37).

The **Ministry and Department of Fisheries and Aquatic Resources Development** are concerned with coastal tourism development in areas that have been traditional fishing sites such as Tangalla and Negombo. The right of public access to the beach, particularly of fishermen, has been denied in several areas, leading to user conflicts. The Ministry is the watchdog of the traditional rights of fishermen to beach their boats, to engage in beach seine (*medal*) fishing and provision of space for fishermen to hang nets to dry.

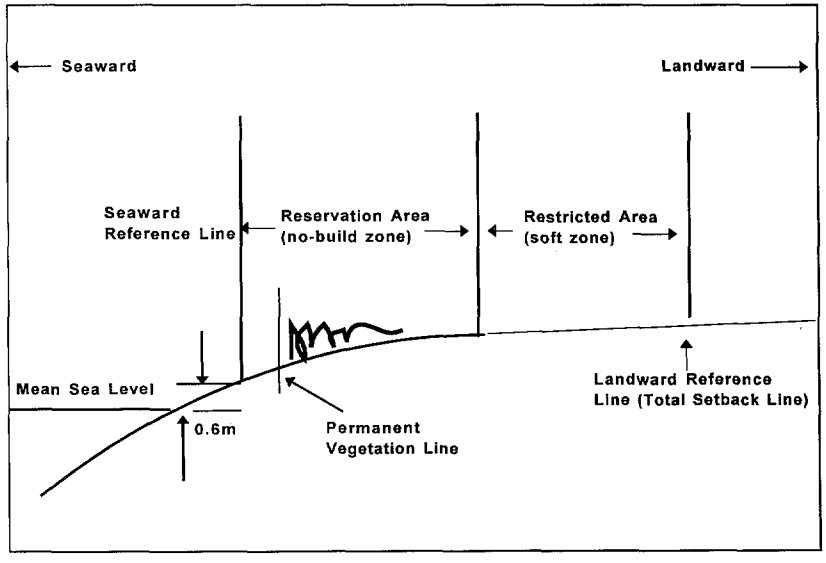


Figure 37. Relative locations of setback areas within the coastal zone

The **Urban Development Authority** has authority over all urban areas. In the case of coastal areas this authority extends up to one kilometer inland. UDA is concerned with: the location of hotels (away from schools, places of religious worship); infrastructure facilities (water supply, sewage disposal, garbage disposal, storm water drainage, electric power, and fire protection).

The Urban Development Authority, under its Planning and Building Regulations (1986), in the interest of harmonizing development with the surrounding (urban) development, can request the developer to make modifications as it deems necessary in the height, architecture, architectural features or facade of any building. The Authority may also direct a developer to landscape the development site and maintain it with planting in a stipulated manner.

Permit Procedures for Coastal Developers

Coastal tourism developers until 1993 had to obtain project approval/clearance from each government agency. **The application procedure has been changed to allow developers to make only a single application to the Tourist Board. Applications for projects to be located in the Coastal Zone are then referred to the CCD for their observations. The present application form includes questions covering the interests of all concerned agencies.**

The Coast Conservation Department may require the project proponent to submit an Initial Environmental Examination Report (IEE) or an Environmental Impact Assessment (EIA) Report before a permit is issued.

All proponents of tourist development (as well as other developers) are required by the Environmental Act to submit within a specified time an IEE report, or, in the case of a hotel or holiday resort or project which provides recreational facilities exceeding 99 rooms or 40 hectares, as the case may be, an EIA report. The IEE or EIA report is made available during a period of 30 days for public comment. These comments are studied by the project approving agency and its decision is then published in the Government Gazette. The overall EIA process is described in a booklet by the Central Environmental Authority.[9]

A permit from the Director of Coast Conservation is mandated by the Coast Conservation Act No. 57 of 1981 for conducting any development activity in the Coastal Zone. The Coast Conservation Department requires a minimum of the following information:

a. **The distance between buildings and the permanent vegetation line on the landward edge of the beach**

b. Elevation of the land with respect to sea level
c. Nature of beach
   1. Approximate width
   2. Type (sandy, rocky, headlands, sand dunes)
   3. Beach stability (erosion/accretion; existing coast protection structures)
d. Special features (coral reefs, sandstone reefs, special vegetation, sand dunes or other natural resources)
e. Coastal structures (piers or jetties, beach protection structures, seawalls, revetments)

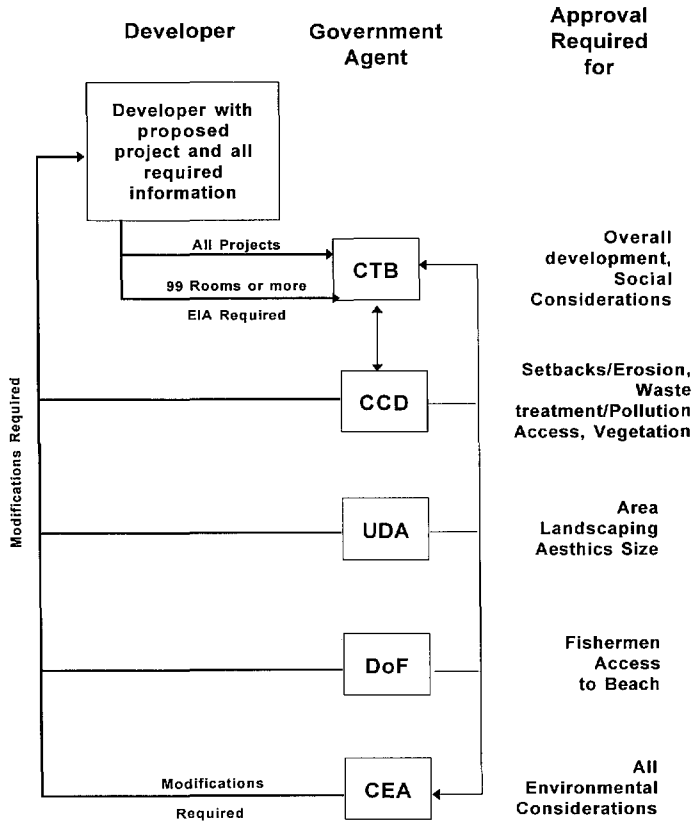


Figure 38. Process to obtain permits/approvals for hotel development in the coastal zone

The Urban Development Authority requires information on:

a. **Proposed land development**
   1. **Land reclamation**
   2. **Land filling**
   3. **Excavation**
b. **Water requirements**
   1. **Source (surface, ground)**
   2. **Quantity (per day)**
   3. **Mode of extraction**
c. **Mode of discharge of**
   1. **Waste water (including stormwater)**
   2. **Solid waste**
   3. **Other effluents**
d. **Electricity**
   1. **Number of kilowatts**
   2. **Source**
e. **Fire protection**

The National Environmental Act, as amended in 1988, mandates that developers must have a permit from the Central Environmental Authority before discharging any effluent or solid waste material into the environment. This Act also specifies tolerance limits for industrial and domestic effluents discharged into marine coastal areas. The revised Coastal Zone Management Plan of 1996 strengthens the Coast Conservation Department role in monitoring and controlling discharges, solid or liquid, in the coastal zone.

Figure 38 indicates the process for obtaining the required permits and approvals from the key agencies for hotel construction in the coastal zone. In addition, proper rapport with the Divisional Secretariat, the Pradeshiya Sabha and resident community in a given development site is essential. **The most important factors for the long-term success of a tourism project, are social integration, sensitivity to local cultural values and adequate regard for environmental quality in all of its dimensions.**

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