

1. The terms of SOUTH PACIFIC COMMISSION were very broad, including all aspects of the ecology and environment of the Kingdom of Tonga. Since only three weeks were available for this initial survey and the Government required urgent advice on certain subjects such as the environmental implications of petroleum development, this first report concentrates on certain priority problem areas. It has also been necessary to restrict the geographic scope of this report to Tongatapu except in a few subjects where information was available on 'Eua. Further consideration of 'Eua and the other districts will have to await another visit.

2. This report will first consider the environmental resources of Tonga and the principles necessary for their management, and then discuss some ENVIRONMENTAL AND ECOLOGICAL REPORT ON TONGA from pollution, before suggesting ways in PART I : TONGATAPU can best organize and implement its environmental management activities. The recommendations have been grouped at the end of the report for convenience.

3. The environment is everything around us. It is the air we breathe, the land on which we grow our food, the water we drink, the shade of the trees, the invisible microbes that cause decay or disease, the plants, animals, insects, fish, corals and even other people. Usually we do not think about the environment unless something in it changes, yet it contributes much to the quality of life of each individual. Indeed, many things which we take for granted in the natural environment would be very expensive to replace.

by
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4. Ecology is the study of the relationships between man or other organisms and the environment. It is a way of asking questions or finding answers, rather than an answer in itself. It means looking at all the inter-relationships between parts of the environment including man, and seeing how those parts fit together and affect each other. It often gives the possibility of predicting problems and thus of taking action to avoid them.

5. Environmental management applying ecological principles is an essential part of the development process. It means paying attention to all aspects of the environment, to ensure that changes brought about by development do not cause undesirable costs and that available resources are used in the most efficient way possible.

6. Just as the natural biological communities of the forests, reefs and seas have lived profitably for thousands of years, so does an ecological perspective whereby society ask how it can continue to maintain itself long into the future. It is important to plan for one year or five years, but it is not enough. We must consider what we leave for our children, and for generations to come. The many little changes which we hardly notice may add up to very big changes over time, and ecology can help to understand what this will mean for the future.

I. INTRODUCTION

Terms of reference and scope

1. The terms of reference of this study were very broad, including all aspects of the ecology and environment of the Kingdom of Tonga. Since only three weeks were available for this initial survey and the Government required urgent advice on certain subjects such as the environmental implications of petroleum development, this first report concentrates on certain priority problem areas. It has also been necessary to restrict the geographic scope of this report to Tongatapu except in a few subjects where information was available on 'Eua. Further consideration of 'Eua and the other districts will have to await another visit.

2. This report will first consider the environmental resources of Tonga and the principles necessary for their management, and then discuss some present and potential threats to those resources from pollution, before suggesting ways in which the Government can best organize and implement its environmental management activities. The recommendations have been grouped at the end of the report for convenience.

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5. Environmental management applying ecological principles is an essential part of the development process. It means paying attention to all aspects of the environment, to ensure that changes brought about by development do not cause unacceptable costs and that available resources are used in the most efficient way possible.

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7. On the whole, there are still not many environmental problems in Tonga. The traditional way of life included many sound environmental management practices which proved their worth over hundreds of years. There has been some gradual decline in environmental resources with modernization and population expansion. However, the present acceleration in development and potential future changes will require that the Government take a much more active role in environmental management than in the past. Failure to act in time could result in a significant loss of resources on which the country must depend for its survival, and a mortgaging of the future for the short term benefit of the present.

II. ENVIRONMENTAL RESOURCE MANAGEMENT IN TONGA

Renewable and non-renewable resource use

8. At present (discounting as yet unproven mineral resources), the principal resources of the Kingdom of Tonga are all what are referred to as renewable resources, that is they are potentially able to produce indefinitely if properly cared for. Good soil and the crops planted in it, a growing forest, a fish filled lagoon, and ground water are all potentially renewable resources. We catch some of the fish, and more will grow; we follow a sound rotation of crops and fallow, and the harvests remain good; we take water from wells, and the rains replace it. But all renewable resources have a limit, and if we go beyond that limit, we may destroy the resource. An over-exploited soil may permanently change its structure and become less fertile; a reef from which too much life is taken may become a simpler less productive community; a well from which too much water is taken may become contaminated with salt water.

9. Minerals like oil are non-renewable, we remove them and use them and they are gone. We can treat any resource as a non-renewable resource, cutting down all the trees in a forest, catching all the fish on a reef, or eating all of the pigs on an island. We may do much better in the short term, but what happens afterwards?

10. An unexploited resource is like money under the mattress; it is not doing anyone any good. A well-managed resource is an investment earning interest. Over-exploiting a resource is like spending your capital; you may do well for a while, but in the end nothing is left. It is hard to avoid the temptation to cash in resources quickly, as many a new country has done to get off to a quick start. Sometimes this is necessary to raise capital for other productive investments, particularly if there are no agricultural exports or non-renewable mineral resources to provide an initial capital accumulation. But increasingly, the future of a country lies in its renewable resource management, and this often requires a sound understanding of the ecological basis of resource productivity on which an optimum sustainable yield policy can be based. Such a policy aims to produce the best yield from a resource over the long term without damaging the ability of the resource to keep producing.

11. Renewable resources cannot be valued at their current market price but at their replacement cost. A healthy lagoon can produce fish very cheaply, but its real worth is the cost of replacing that source of protein, perhaps with imported canned fish, if the lagoon fishery were destroyed.

The Pacific Islanders have been fortunate to have many of their basic requirements provided at little or no cost by their environment, giving a relatively high quality of life even without development. Unwise development could easily lower rather than raise that quality of life by damaging existing resources and encouraging a change from local self-sufficiency to dependence on imports. Imported foods, for instance, are often not as nutritious as the traditional diet they replace.

Land and Soil

12. One of the most basic resources in Tonga is the land and its soil, and the proper management of this environmental resource is essential for the future of the Kingdom. Tongatapu is fortunate to have excellent soil permitting very productive agriculture with a minimum of inputs such as expensive fertilizer. The two principal threats to agricultural productivity at present are the removal of good agricultural land from productive use by development, and the failure to cultivate land that is available. Each house, store, road, school, factory, cemetery, government facility, garbage dump, etc. covers productive soil and reduces the land available for agriculture. Such development should be directed towards the least productive land areas so that the maximum possible area of good soil can be reserved for agriculture. An expanded physical planning capability in government can encourage this, and will be discussed in more detail in Section IV below. RECOMMENDATION 1.

13. The failure to cultivate land, or its abandonment, is a complex problem involving the difficulty of finding stable overseas markets for agriculture produce at reasonable prices and the large number of Tongans going overseas to work. Unless there is an adequate motivation to develop the land, it is only natural that the people will only plant enough for their immediate use. However, as the population increases and transport and marketing improve, the Government may need mechanisms to encourage better land use and higher agricultural productivity. The tax allotment ('api) system is an excellent basis for encouraging land use. There are provisions in the Land Act concerning abandoned or unplanted land [sections 44 (2), 61 (c), and 68], but taking away an 'api from its holder is an extreme measure and should only be considered as a last resort. For land that is left unused beyond the normal fallow period, a warning system could be developed, with a first warning after 3 years that an 'api qualifies for ejectment proceedings, and possibly a second warning after 4 or 5 years before an allotment is declared abandoned and reallocated after 5 to 7 years.

14. A more positive approach is to develop ways for an allotment to be voluntarily and temporarily made available to others if the holder goes overseas or is otherwise unable to utilize it. This is now sometimes done informally, but more formal mechanisms may be needed. It should be possible to arrange for simple short-term agricultural leases for one year or one crop. It could even be useful to establish in the Ministry of Lands and Survey a Land Management Office where people unable to develop their 'api because of absence, old age, etc. could place it for management for a set period or for an indefinite period (with a requirement of one year's notice of intention to resume control). People needing land, either because they have no 'api or because they want to grow crops for export, could then obtain it temporarily through the office, either for one crop or for a longer period, depending on what was available. The user would pay a rental charge to the office, which would deduct a percentage to cover its own operating expenses and send the rest to the holder of the 'api. Mechanisms such as this would encourage better land use without disturbing the basic land tenure system in Tonga. RECOMMENDATION 2.

15. While there is no danger of soil erosion on Tongatapu, preliminary evidence suggests that parts of 'Eua are highly susceptible to erosion damage. The steeper parts of 'Eua, both the whole eastern side and the ravines and certain other slopes on the western side, should probably be maintained in forest cover to control erosion and (on the western side) to protect important water catchment areas. The vulnerable areas should be clearly defined, and should be excluded from allocation as tax allotments as well as cultivation or timber exploitation for which they would not be well suited in any case. Since these areas are also among the most interesting scientifically, it would be best to give them park or reserve protection (see the section on Conservation below). Further comment on this problem will have to await a more detailed study of 'Eua.

Water

16. Water is an essential resource for life, and can easily become a limiting factor in development. Existing sources of water must be protected to maintain their long term productivity.

17. The ground water of Tongatapu serves as the principal water supply for a growing population. Because of the geological structure of the island, the ground water is vulnerable to contamination from the land surface, whether by chemicals used in agriculture, drainage from dumps, pit toilets or malfunctioning septic tanks, pollution from industries or oil development, seepage from cemeteries, or other sources. The principal groundwater reserves and their recharge zones should therefore be mapped as one input to physical planning, and activities in these areas that might contaminate the groundwater resource or reduce the recharge rate should be restricted. Potentially damaging activities should be located outside of groundwater reserve areas. It may in the future be necessary to pass water legislation giving legal authority to manage the groundwater resource, to control activities within defined reserve areas, and to regulate wells to control salt-water penetration. Further comments on dangers to the groundwater of Tongatapu are included in the section on Pollution. RECOMMENDATION 3.

18. On 'Eua, the water catchment areas are particularly vulnerable; removal of the forest cover in such areas could cause serious erosion, reducing water quality and decreasing the yield of the catchment. These areas should be protected for their primary value of water catchment by giving them a special reserve status under the Parks and Reserves Act. These reserves could also contribute to forest conservation on 'Eua.

Sand

19. The Third Development Plan and the Superintendent of Lands have both raised the problem of sand extraction from beaches for construction or other uses. Shore line processes, including the production and transport of sand, are very complex, but the following general principals may help to understand the resource management problem.

20. Sand is produced on tropical coral islands by biological production (sand from seaweeds or foraminifera), by erosion on the reef (waves grinding down corals, parrot fish eating rock) or by erosion of coastal deposits. On high islands, sand is also carried down by rivers.

This sand is moved by waves, wind and currents until it is either deposited on the shore, or carried into deep water (where it is lost to the island). Sand on beaches is not stable, but is constantly being moved and re-deposited. Some beaches build up in calm weather and are washed away in storms, others may be built up by storm waves and then gradually eroded. Often sand is transported from one beach to another along the shore. Removing sand from one beach could thus cause the disappearance of beaches which are "down stream" in terms of sand movement.

21. When sand is extracted from a beach, the remaining sand will be redistributed to re-establish a stable beach line and slope. If the process continues, beach disappearance and coastal erosion may result. Such erosion can be some distance from the site of sand removal.

22. If sand extraction stops, the natural processes of sand production on the reef or in the lagoon may gradually replace the sand over a period of years. Beach regrowth may be faster if it is in an area of active sand transport, but such areas of sand transport should be treated as single beach systems for purposes of sand removal.

23. By rotating sand extraction activities between the different beach systems of an island, it should be possible to make maximum use of the natural sand-producing capacity. Some beaches of tourist or recreational importance may have to be excluded to avoid an inevitable reduction in beach size. However, sand, like all resources, is limited, and a great increase in exploitation may not be possible. Further requirements would have to come from quarries on land or from dredging sandbanks offshore. The latter can have serious environmental effects including destruction of fisheries resources by siltation, and even cutting off the sand supply from beaches causing their disappearance. Any decision on major sand removal offshore, as with any big coastal engineering project, should be preceded by an expert study of the coastal processes involved. RECOMMENDATION 4.

Plants and Animals

24. The natural biological resources of the land are of interest both for what they can produce or control, and as reserves of genetic resources, untapped biological potential which may in the future provide new tree crops or medicines, better pest control or other as yet undreamed of benefits. Unfortunately, little remains of the original forest, fauna and flora of Tongatapu. Conservation of the genetic resources of the Kingdom will have to be concentrated on other islands such as 'Eua. On Tongatapu, it is the coastal vegetation and foreshore zone that is the most important remaining biological resource, as it helps to control coastal erosion and to protect inland areas from storm damage as well as contributing to scenic beauty. The mangroves in particular are important in building and protecting land, as well as in providing food to the reef and breeding areas for fish and other animals. Such areas have little or no potential for agriculture and care should be taken that they are not included in tax allotments or otherwise allocated to development. The Lands Department should develop maps delineating such critical habitats, as well as conservation areas, habitats for endangered species, critical water catchments, forest reserves and other areas where biological resources should have priority, as a contribution to physical planning.

25. Trees and vegetation can be important in protecting crops from destruction by hurricanes. In areas where hurricane damage is possible, the government should encourage the planting of trees as windbrakes.

Such plantings can have many benefits, including reducing evaporation from the land, providing shelter for insect-eating birds, and supplying valuable wood.

26. The remaining island wildlife also needs to be given consideration for its scientific importance and traditional significance. Birds, fruitbats and other animals depend on adequate areas of forest or trees for their existence. If they are not to disappear entirely from Tonga, areas of habitat of adequate size will need to be reserved for them. Usually appropriate forest habitat can be found on land without great potential for agriculture or forestry, such as on mountain tops, in steep valleys or critical watersheds, in inaccessible areas or on remote islands. Such areas should eventually be given park or reserve status to protect them from degradation.

Forests

27. Because of the development of most available land for agriculture, the forest areas of Tonga are now limited to 'Eua and some of the less accessible islands, and only 'Eua has the potential at present to meet some of the country's need for timber. Cutting native forest is like mining; unless natural regeneration of desirable trees is encouraged or the area reafforested with commercially-useful species, the result is a long-term loss of forest resources. Native forest cutting should be seen as a stop-gap measure while forest plantations are growing to maturity, and timber production should be converted from native forest exploitation to plantation forestry as quickly as possible. Progress has so far not been great, and even the Third Development Plan goal of 200 acres per year of reafforestation has not yet been met. Effective forest management will require that the necessary areas be established as forest reserves or reserved areas under the Forests Act to implement their long-term dedication to forest production as defined in the Third Development Plan. The reserved areas should be reafforested at at least the rate specified in the development plan. Areas not scheduled for immediate reafforestation could be cultivated temporarily as at present, but such temporary use should not delay their replanting to trees at the appropriate time.

RECOMMENDATION 6.

Reefs and Lagoons

28. The reefs, lagoons and coastal waters of the Kingdom are important environmental resources, providing protein, sand, handicraft materials, coastal protection, waste purification and other values. Replacing these resources with imports or investments would be very expensive, so it is important to maintain their productivity. Marine ecosystems tend to be highly interrelated, with fish perhaps finding shelter in the reef, feeding in the shallow seagrass flats, and going into the lagoons and mangrove areas to breed. Destruction of even part of one area can thus affect the resources of a much larger area, and the gradual destruction of coastal habitats can have a big effect on fisheries without the cause being apparent. Over-fishing, breaking corals with crow bars, and other destructive fishing methods such as poisons or explosives, can also reduce reef productivity, as can coral collecting. Corals are like forest trees and the fish are like birds; kill one and the other will vanish.

29. There are also close links between development on land in coastal areas and the productivity of the marine environment. Construction or paving can change storm runoff patterns killing adjacent reef corals with fresh water. Drainage of sewage or agricultural fertilizers can change the nutrient balance of the ecosystem. Dredging, land reclamation, and construction of wharves or other facilities can alter water circulation patterns and thus life in affected areas. The gradual destruction of fisheries productivity is a major problem throughout the Pacific, and will require the co-ordinated efforts of fisheries officers and those who control coastal development if this decline is to be arrested and productivity restored. RECOMMENDATION 7.

30. The Fanga'uta lagoon is and will continue to be a significant environmental management problem. The poor water circulation in the lagoon and resulting long residence time means that substances going into the lagoon tend to accumulate. The increasing human population around the lagoon has put additional stress on the lagoon ecosystem, both directly through heavy collecting of fish, shellfish and other foods, and indirectly by cutting mangroves and adding through their sewage to the nutrient load in the lagoon waters. The few bacteriological samples taken during this survey (see the section on Pollution below) suggest that at least parts of the lagoon are now badly contaminated, a condition that has probably been made worse by the drought. The disappearance of valuable shellfish and jellyfish from parts of the lagoon and the increasing cloudiness of the lagoon water are signs that the lagoon ecology is being changed. Such bodies of water are subject to eutrophication, an increase in nutrient levels causing faster growth of seaweeds and plankton. This over-production can lead to instabilities including accumulations of rotting plant material that can kill off fish and shellfish and produce bad odours. This can be both a nuisance to adjacent residential areas and a potential health problem.

31. It will not be easy to correct this situation. The wastes of the surrounding human populations are all put into the ground, where they eventually will enter the groundwater. The major inputs to the lagoon would thus be from runoff after heavy rains and from the continual seepage of contaminated groundwater into the lagoon (there is a constant flow of groundwater into the sea). The Nuku'alofa garbage dump is so situated that it drains in the lagoon while at the same time gradually engulfing a valuable mangrove area. It should be relocated to another site where a sanitary landfill can be practiced. The hospital passes its wastes through a badly overloaded treatment plant and then pumps them into soak pits where they enter the groundwater. The only direct input from the hospital into the lagoon is rainwater from the roofs, which should have no significant impact on lagoon ecology. The cooling water from the power plant may well be affecting at least part of the lagoon, since many tropical marine organisms are already living close to their upper thermal limits, but the effect is probably less in a shallow lagoon already subject to solar heating than it would be in a coastal area. The newly installed storm drains from the new Public Works facility are a considerable danger because of the possibility that the runoff could include oil, petrol or chemicals from spillage in the compound. There was apparently no consultation with the Fisheries Division (responsible for the lagoon reserve) or the Health Department (responsible for approving discharges) prior to the construction of these drains.

32. The lagoon has already been declared a reserve, but it will be necessary to be extremely careful with further development around it if the situation is not to deteriorate further. It may eventually become necessary to install sewage collection in all the major villages around the lagoon, with the effluent piped after treatment to a less vulnerable area. Particular attention will be needed in the development of the new industrial park to ensure that it does not add to the lagoon problems. A detailed study of the lagoon ecology could suggest the most appropriate steps for its proper management.

Corals

33. Since coral exploitation is now being discussed in Tonga, the follow comments are presented on the management of this resource. Corals are slow-growing colonies of tiny animals whose skeletons help to build tropical reefs. The coral animals feed on tiny creatures (plankton) in the water, and also get energy from sunlight via tiny plants living in their tissues. If corals are kept in cloudy water or are covered by sediment, they will die. Reef corals are like forest trees; they may be hundreds of years old, and if broken or killed, can require decades to grow back. Corals provide food and shelter for many fish and other reef animals, and their destruction can produce a great reduction in fisheries potential. Corals are to fish what forest trees are to pigeons.

34. While the most valuable use of coral may be as productive habitat for reef fisheries, several types of coral exploitation can be considered:

35. **TOURIST SOUVENIRS:** Tourists often like to take home small pieces of coral, perhaps painted or attractively mounted, as souvenirs. Since even small corals may be several years old, the accessible colonies can be rapidly over-collected, destroying the beauty of the reef and harming fisheries. If such collecting for sale to tourists or for export is to be permitted at all, it should be restricted to certain fast-growing species such as branched Acropora or Pocillopora collected from limited areas. It should even be possible to farm appropriate species by planting out fragments or reproducing colonies and proper substrata.

36. **PRECIOUS CORALS:** Certain deep-water corals or gorgonians have red, black or golden skeletons suitable for making jewelry. They are extremely slow-growing and are rare and difficult to collect. Some can be found by deep-diving, but most are dredged, an environmentally-damaging process involving the dragging of heavy baskets or nets across the bottom. Because of their very slow growth, the precious corals can hardly be considered a renewable resource, but it may be possible to accelerate their regeneration by careful harvesting practices like removing only part of the animal, and this should be encouraged.

37. There may be a good export market for precious corals, but this is the type of resource that might more appropriately be used to develop a local labor-intensive skilled industry, if adequate stocks of corals are available. Coral jewelry is a high-priced product easily shipped by air. It might first be appropriate to seek expertise to undertake a resource survey. If the results are encouraging, steps could be taken to train local collectors and jewelry makers, and to develop markets for the products.

38. **BULK CORAL MINING:** Coral is limestone and thus a potential bulk industrial product. Coral rock and natural gas can be used to make cement. Unfortunately coral dredging or mining is environmentally very destructive, producing silt that can smother corals and destroy fish habitat over a large area. Such mining can also accelerate coastal erosion. Cement manufacture produces dust that could harm populated or agricultural areas if poorly located. The environmental costs and benefits should be examined with great care before deciding on such an industry in a country like Tonga. A small-scale plant meeting local needs and moderate exports might be environmentally manageable if natural gas is locally available.

39. Coral skeletons can also be used as a filter material in air pollution control equipment. If the volume to be mined is small and the price is good, this might be worth considering, particularly if oil is not found and the impact on fisheries can be controlled. **RECOMMENDATION 9.**

Conservation

40. Conservation is an essential aspect of resource management involving among other things the protection of native fauna and flora and the establishment of parks and reserves. Such actions ensure that the natural heritage of Tonga is preserved so that the maximum number of long-term options are available for the people. Tonga now has two important pieces of conservation legislation, the Birds and Fish Preservation Act as amended in 1974 and the Parks and Reserves Act 1976. It is now necessary to begin planning for the inclusion of appropriate areas under these acts.

41. There can be several reasons for establishing conservation areas:

- (a) the preservation of genetic resources for possible future use;
- (b) the protection of areas of scientific interest, including biosphere reserves to become part of the UNESCO network for understanding and monitoring the world environment;
- (c) the development of tourism, recreation, and historic sites, and areas contributing to public education about Tongan culture and the environment;
- (d) the establishment of reserves as a resource management tool, whether as centers of reproduction and repopulation to maintain the productivity of a reef fishery, as seeding stands to assist natural forest regeneration, or to protect water supplies, control erosion, etc.

Often a single area can serve several of these functions.

42. The eventual goal of a complete park and reserve system should be to protect examples of all significant ecosystems in the country. In Tonga, priority should be given at present to forest areas, important habitats for land and sea birds, sea turtle nesting areas, coral reefs and other critical marine habitats, sites of great interest to tourism, and whales. However, overall physical planning should include all potential park and reserve areas that should be protected from development. **RECOMMENDATION 10.**

43. The criteria for selecting parks and reserve areas are quite variable depending on the purpose of the park or reserve. Parks are open to visits by the public, so this designation should be used for areas intended for public use or areas where such visits will not damage the features being protected. In reserves, the first priority is given to protection and entry can be controlled or prohibited if necessary.

The term National Park should only be used for very large and significant areas (preferably over 1,000 ha); the only area in Tonga that might qualify for this designation is the proposed park on 'Eua.

44. Any declared park or reserve should have within it some feature of particular importance; an historic site, a unique feature, the habitat of an endangered species, a site for important scientific studies, or an outstanding example of a significant ecosystem. If a biological feature is being protected, it is important that the area or population size included in the reserve is large enough to maintain the species or habitat, and that the area is as far as possible ecologically autonomous, that is, that it is not dependent on areas outside the reserve for food supplies, breeding areas, etc. Sites should be chosen with as little human disturbance as possible, nor should they be susceptible to human impact or pollution in the future. The boundaries should be so chosen that they are easily defined and recognized by the public. Reserves should not be in areas with important traditional or subsistence use, or such traditional use should be permitted by regulation if it does not threaten the purpose of the reserve. Public education is an essential part of park and reserve establishment, for without the support of the people, enforcement will not be possible. In certain cases such as local fisheries, reserve establishment may actually benefit adjacent traditional fisheries by providing centers for breeding and repopulation, and some modification of traditional rights is therefore warranted and should be well explained to the people affected.

45. The boundaries of marine parks should extend from the mean high water mark at least to a depth of 50 meters (164 feet) which is about the limit that a person can dive without special equipment, or else to the base of the reef if shallower than 50 meters. In some areas, it may be better to specify the limit as being a certain distance offshore, or following a line between two readily recognizable points. If there are significant features to protect in deeper waters (precious corals, for instance), the reserve should be extended accordingly.

46. The following sections discuss some possible park and reserve areas on and around Tongatapu which should be considered for declaration under the Parks and Reserves Act of 1976.

47. **HA'AMONGA TRILITHON HISTORIC PARK:** This 47 acre (19 hectare) area of great cultural and archaeological interest was proclaimed as a park by the King in 1972, and this status should be formalized by declaration under the Parks and Reserves Act.

48. **MUI HOPOHOPONGA COASTAL RESERVE:** This length of coastline at the eastern most point of Tongatapu was also set aside by Royal proclamation in 1972. It should be declared a reserve incorporating approximately 16 acres (6.4 ha) of unallocated coastal land and the foreshore, and include a marine reserve down to a depth of 50 metres (164 feet) if it has sufficient natural interest.

49. **HA'ATAFU BEACH PARK AND MARINE RESERVE:** This popular beach has a rich and scientifically interesting fringing reef which warrants protection as a marine reserve, while the beach and adjacent rocky coastline have scenic and recreation values. An appropriate length (at least 300 metres/1,000 feet) of the foreshore should be declared as a park so that it will be freely open to public use and recreation, while the adjacent reef down to a depth of 50 metres (164 feet) should be given marine reserve status. This should help to discourage the gradual destruction of corals that would otherwise occur with increasing use by tourists and visitors.

50. Other areas on Tongatapu may be worth considering later, including the Terraced Tombs, the blowholes and other sites of importance to tourism. The declaration of such sites can both heighten their attractiveness to tourists and make it possible to control tourist impact, erect signs and educational exhibits, and otherwise maintain and improve the areas. There is no point in declaring the small park areas in Nuku'alofa and along the lagoon which have no natural or historic features of interest unless the Government feels the need for greater controls in such areas.
51. **PANGAIMOTU REEF PARK:** The area of coral reef and sand flats west of Pangaimotu Island could be developed as a site for tourist visits and glass bottomed boat tours because of its proximity to Nuku'alofa. The reef, which is best developed on the northern side, has suffered somewhat from over-fishing and tourist collecting, but could be restored and perhaps even improved with the addition of substrates to encourage coral and reef development. The park designation would encourage public use while protecting the natural features of the area, but it may be necessary to classify this area as a marine reserve as well so that fisheries officers can assist in its supervision.
52. **MONUATE MARINE RESERVE:** The reef to the south and west of Monuate Island is one of the richest in the vicinity of Tongatapu and is a good example of sheltered reef development, with many fragile corals, algae and fish. It should be declared a marine reserve, and entry should only be permitted with permission. It would be wise to include the island in the reserve if there is no objection on the part of the owner.
53. **MALINOA ISLAND:** This island of historic interest is an obvious site for a park or reserve. A study should be done of the surrounding reef to determine if it has sufficient interest to be included as a marine reserve.
54. **HAKAU' MAMA'O REEF MARINE RESERVE:** This reef area of 642 acres (260 ha.) was set aside by Royal proclamation in 1972. Its isolation makes it a logical choice for protection as an example of an exposed reef in the Tongatapu area. It has not yet been possible to survey this site to verify its scientific interest, but if it is typical of the northwest reef areas, its status should be formalized by declaration under the Act.
55. **ATA ISLAND RESERVE:** Two other islands near Tongatapu also have considerable conservation interest. Ata Island is a significant seabird nesting site, and may well have other conservation importance because of its lack of human disturbance. It is too inaccessible for it to have any development potential. There is a 1968 Cabinet decision that Ata Island be left undisturbed as a bird sanctuary. While the detailed study of the natural values of Ata has not yet been completed, the available information and the lack of other major seabird breeding areas in the vicinity suggests that reserve status is appropriate and should be so declared.
56. **'EUA NATIONAL PARK:** 'Eua contains the major remaining forest and land bird habitat in the Kingdom and the only potential for a significant National Park. The recent New Zealand Royal Society Expedition has identified the areas of major conservation interest, including the whole eastern slope and certain of the ravines and small areas of adjacent uplands on the western side. These areas have little or no development potential; indeed,

the susceptibility of 'Eua soils to erosion suggests that any development or logging in the steep areas of the western slope could endanger the agricultural areas and water supplies below. I recommend that a decision in principle be made to establish an 'Eua National Park, and that a detailed study be made to determine the most appropriate boundaries for such a park. Plans could also be prepared to develop certain limited means of access to the park and other facilities for tourism, education and eventually research. Such a park could also make possible Tongan participation in the world network of biosphere reserves being encouraged by UNESCO. RECOMMENDATION 11.

57. **TURTLES AND WHALES:** Two groups of migratory animals also require some protective action if they are not to be driven to extinction. Both are the focus of international conservation campaigns to which Tonga could contribute. If population numbers can be restored, they could again become useful resources for the people of Tonga; failure to protect them could mean the permanent loss of valuable resources. The first are the sea turtles. The Leatherback turtle is now entirely protected, and the other species have a closed season from 1st November to 31st January, under the Birds and Fish Preservation Act, but the serious decline in the populations suggest that further measures are needed. It may therefore be necessary to create seasonal turtle sanctuaries on Islands such as Luanamu, Nukulei and Fonuaiki in Ha'apai and Maninita in Vava'u, and even to try to re-establish breeding populations on beaches from which they have vanished.

RECOMMENDATION 12. Whales are also in serious difficulty internationally from over-killing, and as Tonga is a breeding area for Humpback whales, Tongan whalers are taking them at a particularly vulnerable time in their life history. If it is possible to find alternate employment for the whalers, perhaps even with a grant to assist in research on whales, Tonga should ban all whaling as a contribution to an international moratorium on exploitation until the populations recover and the level of permissible harvest is better understood. This could perhaps be done by order under the Whaling Industry Act (Cap.77) by including whales on the protected list of an appropriate international convention such as one of these mentioned below.

RECOMMENDATION 13.

58. **INTERNATIONAL CONVENTIONS:** A Convention on Conservation of Nature in the South Pacific was drafted at a Plenipotentiary Meeting held in Apia, Western Samoa in June 1976. The Kingdom of Tonga may wish to consider becoming a party to this Convention by depositing an instrument of accession with the Government of Western Samoa. The Convention will come into force when ratified or acceded to by four countries.

59. **INTERNATIONAL CONVENTIONS:** Acceding to the Convention would mean that the Government agrees that conservation of nature is an important national goal and subject for regional co-operation. Under the Convention, the Government would accept the obligation to identify natural areas and features worthy of protection and to establish national parks and reserves conforming to internationally-accepted standards. Information from each Government on the areas protected and the regulations that apply to them would be shared with other Parties to the Convention. There is also the obligation to protect indigenous fauna and flora from unwise exploitation, and to compile a list of species in danger of extinction that require complete protection. The Convention provides for continuing consultation and co-operation among the parties in research, training and exchanges of personnel.

60. The implementation of the principles in the Convention would still be a matter for Government decision in the light of the resources available and other factors. The Kingdom of Tonga could advance quickly towards implementation with its proposed parks and reserves under the Parks and Reserves Act 1976 and the species protected and reserve established under the Birds and Fish Preservation Act. Further progress should not be too difficult.

61. In addition to contributing to a co-ordinated regional approach to the conservation of nature, becoming a party to the Convention may make it easier to obtain international support for such things as surveys and management plans for parks and reserves, training of park personnel and studies of endangered species. The South Pacific Commission is charged with continuing bureau duties under the Convention, and would be able to advise the government on further steps that might be appropriate and on the sources of aid available.

62. There are other international conventions concerning conservation to which the Kingdom of Tonga might well wish to become a party, including:

International Convention for the Regulation of Whaling.

International Plant Protection Convention and/or
Plant Protection Agreement for the South-East Asia
and Pacific Region.

Convention on International Trade in Endangered Species
of Wild Fauna and Flora.

RECOMMENDATION 14.

63. **PARK AND RESERVE MANAGEMENT:** The establishment of parks and reserves in Tonga will require a strengthening of the Government's ability to supervise and manage them. Much of the day-to-day supervision of the areas on Tongatapu can be handled by the Police as part of their normal duties, and the Fisheries Division should be able to take responsibility for the marine reserves in the Tongatapu area, since they will also contribute to fisheries management. However, each park and reserve should eventually have a management plan developed for it, specifying the actions or regulations necessary to preserve the features for which it was established, and the improvements that would make it more educational or more accessible to the people of Tonga and to tourists, if appropriate. Some of the initial work can be done, if necessary, by outside consultants from SPC, IUCN or bilateral sources, but the continuing management of these important parts of Tonga's heritage will require the establishment of the position of Ecologist or Conservation Officer in the Ministry of Lands, Survey and Natural Resources. This officer could prepare and implement management plans and develop other aspects of the Kingdom's conservation programme, and eventually supervise field officers or park rangers who may become necessary in the future. The Ecologist could also make important contributions to other aspects of the Ministry's responsibilities which will be discussed in more detail below. While the Ecologist can provide the necessary technical expertise and prepare recommendations, a broadly based decision-making body will be required, and this has been anticipated in the provision of the Parks and Reserves Act for the creation of a Parks and Reserves Authority. The expanded Authority should probably be appointed at the same time that the first parks and reserves are declared under the Act, so that it can approve management plans for these areas as well as consider future park and reserve proposals. The Authority should be chaired by the Minister of Lands, Survey and Natural Resources, with the Superintendent of Lands as Secretary, and a membership including the Director of Agriculture,

the Fisheries Officer, the Director of Education, the Tourist Officer, a representative of the Tongan Traditions Committee, a representative of the Central Planning Office (the Environmental Assessment Officer if one is appointed), the Ecologist, and possibly representatives of the nobility and the public. RECOMMENDATION 15.

III. POLLUTION

64. Any substance or object which is not naturally present in the environment and which is harmful to some aspect of the environment can be called a pollutant. Pollution in the environment is like poison in the body. One of the goals of environmental management is to reduce or eliminate sources of pollution, both to protect public health and to prevent damage to natural resource productivity. The following brief comments outline the major present and potential sources of pollution in Tonga and the kinds of dangers they may present.

65. HUMAN WASTES: In traditional island life, and in small rural villages today, the people lived close to nature, with few environmental problems other than those associated with lack of development. But as human settlements increase in size and density, the natural environment is no longer able to cope with man's requirements, and governments must make increasing efforts to maintain environmental quality. On Tongatapu, the primary environmental problem in human settlements is waste disposal, not only in Nuku'alofa, but in all the communities surrounding the lagoon. A few spot checks suggest that these are relatively high levels of environmental contamination by sewage. How much of this is surface pollution, and how much may have entered and been spread by the ground water is yet to be determined. Table 1 lists the levels of bacterial pollution measured during this survey. Significant pollution by coliform bacteria often suggestive of sewage has been observed along the Nuku'alofa waterfront, and high levels in Fanga'uta Lagoon. It should be noted, however, that the number of samples in this brief survey is very small and can only indicate that a more detailed study of the problem is needed. It was not possible in the time available to do the additional tests necessary to distinguish between total coliform and intestinal coliform bacteria. The counts given here for the lagoon are higher than those of earlier studies; it may be that with the prolonged drought there has been less flushing of the lagoon by rainwater, permitting pollution to accumulate.

Table 1 Bacterial Pollution

<u>Site</u>	<u>Total bacteria (colonies/ml)</u>	<u>Coliform bacteria (colonies/100 ml)</u>
Royal Palace reef	6	0
Vuna Wharf	39	9600
Dateline Hotel beach	10	400
Fanga'uta Lagoon near dump	about 6000	12300
Hospital storm drain	485	6000
Fanga'uta Lagoon near Hospital	4	14700
Nuku'alofa tapwater	0	0

Call tests made with Millipore samplers and incubated at 35°C

66. As noted above in the section on the lagoon, this situation can probably only be improved by the installation of sewage collection and treatment facilities in Nuku'alofa and other communities along the lagoon, but this would be very expensive and would require international assistance which is already being explored. In the meantime, a more thorough survey of the present extent of bacterial pollution, the possible risks to public health, and any temporary measures that could be taken to improve the situation would seem to be in order. Since such pollution can cause disease in swimmers or those who eat seafoods from contaminated areas, some controls on these activities may be needed if high levels of pollution are confirmed by further studies.

RECOMMENDATION 16.

67. **SOLID WASTES:** Another aspect of waste disposal that becomes increasingly complex with population growth and economic development is the disposal of solid wastes such as cans, bottles, garbage, old cars, etc. The present open dump in Nuku'alofa is unsanitary and is probably contributing to lagoon pollution, as well as destroying a valuable mangrove area. The best type of site for solid waste disposal on Tongatapu would be in a quarry near the coast where seepage from the dump would not endanger the main groundwater reserves. The quarry could also supply crushed rock to cover the garbage, making a sanitary landfill possible, and the land could eventually be reclaimed for other uses. If such a site can be found, the present dump should be closed and relocated.

68. There are also ways in which the amount of wastes can be reduced. Many of the wastes that do not decay and are thus hardest to dispose of, like bottles, cans and other metal and plastic objects, come from imports. Replacing imports with local production can reduce this waste disposal problem. One island group in Micronesia greatly reduced their imports of canned and bottled beverages by encouraging all stores, restaurants, bars, etc. to stock refrigerated or cooled drinking coconuts, which are just as refreshing, more nutritious, and locally-produced, as well as being easier to dispose of afterwards. The same islands also have a successful beverage container deposit scheme: a two-cent tax is collected on all imported cans and bottles, and one cent is returned when the container is brought to a central collection point, while the other cent covers the government's cost for crushing the containers in a sanitary landfill.

69. The increasing problem on Tongatapu of abandoned vehicles could perhaps be similarly solved. If the Government collected a disposal deposit on each imported vehicle, this could either be refunded when the vehicle was properly disposed of by the owner, or used to reimburse the Government for collecting the vehicle and carrying it to the dump. RECOMMENDATION 17.

70. The quantity of wastes on Tongatapu at present is probably not sufficient for recycling to be economic. Aluminum cans have a high value as scrap and would probably be the first waste component to be worth separating out for recycling, as has recently been done on Saipan.

71. If oil is discovered, the quantity of wastes will inevitably increase with greater prosperity, and all aspects of waste disposal will require more attention by the Government.

72. **INDUSTRIAL WASTES:** Since two of the most important environmental resources of Tonga, the groundwater and the coastal fisheries, are both particularly susceptible to damage by pollution, it will be necessary to require adequate treatment of any liquid or solid wastes from industrial developments, or their recycling into other useful products. The present Health Department practice of prohibiting all coastal outfalls except for stormwater, may have to be re-examined in certain instances where permitting a waste to seep into the groundwater might cause more difficulties than draining it into the sea at a point where rapid dilution was possible (the north shore of Tongatapu and the lagoon are not good in this respect). The possibilities for safe waste disposal should be an important factor in the choice of sites for industrial developments such as a cannery or sugar refinery. Industries with particularly toxic wastes which cannot be made safe through treatment should not be permitted in Tonga. **RECOMMENDATION 18.**

Air and Ocean Pollution

73. Two environmental resources should not present any pollution problems in the immediate future. The air and the open ocean away from coastal areas are sufficiently vast relative to the scale of activities in Tonga that any pollution released into them should be rapidly diluted to harmless levels. There may be temporary concentrations of smoke over Nuku'alofa under certain atmospheric conditions, but as the sources are largely wood or coconut husk fires, this should not present a significant health hazard. While much attention is now being paid to problems of ocean and air pollution at a world level, they need not be given a high priority in Tonga at the present time.

Petroleum

74. While oil has not yet been confirmed in Tonga the possibilities of pollution during exploration and production are such that it seems warranted to devote a major section of this report to the environmental impacts of oil and their control by the Government.

75. **GROUNDWATER POLLUTION:** Certain environmental aspects of oil exploitation and oil pollution are of particular relevance to Tongatapu and its surrounding waters. A spillage on land would first contaminate the soil. Such contaminated soil would probably have to be physically removed before the land could be returned to productive agricultural use. With a highly permeable soil layer overlying porous limestone, spilled oil would rapidly saturate the soil and seep down into the underlying rock until it reached the groundwater level. The oil would float on the groundwater and would spread or migrate along the groundwater surface towards the coast where it would eventually seep out into the sea. Once the oil comes in contact with groundwater, soluble oil fractions would dissolve into and contaminate the water. The rate of contamination would probably be accelerated by tidal movements in the groundwater level and by water percolating from the surface after rains. Such contamination can be tasted at levels as low as 0.1 part per million and its removal from drinking water is quite difficult. Some components of crude oil are also cancer-producing. Given the lack of alternative water supplies on Tongatapu, it is obvious that contamination of the groundwater by oil, drilling mud, water or brine should be avoided at all costs. Since there are no known methods of removing oil pollution once it penetrates the subsoil, the emphasis will have to be on preventing spillage at the surface or on very rapid cleanup of spilled oil before it penetrates the soil layer. **RECOMMENDATION 19.**

76. **MARINE POLLUTION:** While relatively little is known about the effects of oil in the tropical marine environment, the evidence suggests that many components are highly vulnerable to oil pollution. In shallow lagoons, pools and back-reef areas where water circulation is sometimes restricted, oxygen levels can drop very low at night. Spilled oil has a high biological oxygen demand (BOD), especially in the tropics, and this additional demand could make such areas anaerobic, suffocating all the plants and animals. Many tropical marine organisms also live very close to their lethal upper temperature limit. A surface layer of oil could cause enough of a temperature rise (by absorption or prevention of evaporative cooling) to kill them. Once killed it can be many years before such communities recover. Mangroves are also sensitive to the effects of oil. A spill of fuel oil in the Caroline Islands killed affected mangroves and similar death or defoliation have been reported elsewhere. Since lagoon, shallow reef and mangrove areas are important to the whole reef ecosystem, providing food and nursery areas, their damage by oil pollution would threaten the productivity of the entire reef. Such areas are also important for food gathering. Corals themselves have not been shown to be too sensitive to oil floating on the surface, and most fish are able to escape from polluted areas. However, oil does enter marine food chains where it can persist for years, producing an unacceptable oily taste and possibly a cancer danger in fish and shellfish.

77. The oil most likely to be spilled in Tonga would have a high percentage of toxic fractions, which would make it more dangerous to marine life. Its impact would also depend on the location and weather conditions at the time of the spill. Oil is rapidly moved in the direction of winds and currents, and this should be carefully considered in siting oil facilities, whenever possible, so that a spill would be carried away from vulnerable areas important for fisheries, tourism or conservation. Oil spilled under heavy wave or storm conditions would be rapidly mixed with the sea water and would thus have a much greater and probably catastrophic effect on all marine life. Since spills can be caused by storms (shipwrecks or hurricane damage to port or offshore installations) these extreme conditions need to be considered in planning or choosing between options.

78. Oil spills are highly damaging to tourist amenities (tar on beaches, smells, dirty water, disturbed or dead reefs, discolored shorelines) and particular efforts are needed to protect sites of importance to tourism.

79. **GOVERNMENTAL CONTROLS:** With oil development some environmental damage cannot be avoided. Oil or other materials will be spilled, whether through human error, technical miscalculation, or unforeseen factors. There is always some margin of error that it is not economical to anticipate. It is the role of government to define what kinds or amounts of damage are totally unacceptable and must be avoided through all technically feasible means (even to the extent of prohibiting certain development), and what types will simply require compensation for damage caused, since it is sometimes cheaper to pay compensation than to undertake expensive protective measures.

RECOMMENDATION 21.

80. The petroleum industry is highly complex, and the government regulation of the industry is normally also highly complex. A useful guide for government practice can be found in the excellent report "Petroleum Exploitation: Data Requirements and Environmental Protection" by the Commonwealth Secretariat (numbers in parenthesis below refer to pages in the report). The challenge for Tonga will be to simplify the regulatory process to bring it within the scale and capabilities of the country without sacrificing the essential control and supervision necessary to protect the interests of the Government and people of Tonga.

81. At present, Tonga lacks even the most basic environmental safeguards to protect its interests. It is not illegal to spill oil on or otherwise contaminate the lands or waters of the Kingdom. The present Petroleum legislation provides for compensation for damage only to the owner of the land leased by the developer. Groundwater contamination leaving villages without water, a spill at sea destroying resources on which fishermen depend for their livelihood, or a big pollution accident damaging Tonga's image as a tourist destination with its economic effects on the tourist industry, are not adequately covered by existing legislation. These legislative gaps should be filled regardless of the outcome of the present petroleum exploration.

82. As soon as oil is discovered, the Government should establish within the Ministry of Lands Survey and Natural Resources a capability to supervise and inspect the petroleum industry comparable to the Petroleum Directorate described in the Commonwealth Secretariat report referred to above (64-68). The cost of this and other supervisory services should come from the permit and license fees levied on the industry (60-61). To begin with a single Petroleum Inspector with a technical and engineering background in petroleum exploitation would be adequate. Other staff could be added as the industry expanded. The Inspector would review all reports submitted by the developers, and through regular site inspections would verify that all conditions required by the government were being met. In the event of a pollution accident, he would be in charge of clean-up operations. It will be necessary to hire an expatriate initially for this position until a Tongan can receive the necessary technical training, since the inspector will need to understand the engineering requirements of oil installations and to be able to interpret the data and samples provided by the developer.

83. It may prove necessary in addition (or in place of a full-time inspector in the initial stages) to bring in one or more short-term specialists from time to time for a detailed inspection of the developers' operations and records. Such inspections would provide a continuous incentive to the developer not to take short-cuts. CFTC or bilateral sources might be approached to make such assistance available.

RECOMMENDATION 22.

84. ENVIRONMENTAL PROTECTION: The development of petroleum exploitation will also require the appointment of officers with environmental expertise (see chapter IV below) who would monitor the effects of oil drilling, storage and shipment on the environment. These officers would make regular surveys and samples to see if damage was being done to important island resources (68, 82-83). It is normally the responsibility of the Government to establish baseline criteria of environmental quality and to prove the actual state of environmental resources before development begins. The developer can then be required to prove effective clearance and clean-up after he has completed his activities. He should be required to submit clearance survey reports and assessment reports for any environmental damage caused by his activities (78-79). In the Tongan situation, it may be necessary to have the developer co-operate in the initial environmental baseline surveys, for instance, by taking samples of groundwater in the areas around the drilling sites and analysing them for hydrocarbons. Repeating these samples would show if contamination was taking place. Eventually the government should do such sampling itself. RECOMMENDATION 24.

85. The Government should, at a very early stage, decide what resources and areas must receive complete protection from the damaging effects of oil development. The Fisheries Officer, for example, should identify areas essential to fisheries (important fishing grounds, breeding areas, etc.); the Water Board should define the groundwater reserves to be protected; the Tourist Authority should list important tourist sites and beaches; etc. The conditions in these areas should be described so that if there is damage later, there will be a basis for seeking compensation from the developer. This report should be made available to the developers as a guide to their activities.

RECOMMENDATION 21.

86. REQUIREMENTS: The Government will need to be very clear in advance as to what it requires of the developers. All operations and facilities should conform to the standards of the American Petroleum Institute (A.P.I), the Institute of Petroleum, or another specified international authority (71). The Developer should submit reports to the Government at each stage in its operation, containing all information required by the Government. In addition, the Government should reserve the right of access to all data, cores, samples, drilling logs, etc., with safeguards to protect the confidentiality of the information so supplied. As Government expertise increases, it may wish to have appropriate samples, core sections and other information deposited with the Government. These points are discussed in more detail in the Commonwealth Secretariat report.

87. These requirements will need to be defined in Legislation and subsidiary regulations. Many such laws have recently been adopted by other countries with oil resources, and it should be possible to obtain from the United Kingdom, Canada, the United States, Norway, etc. models that could be simplified and adapted to the Tongan situation. Adopting technical regulations already developed elsewhere such as those published by A.P.I. will be easiest both for the Government and the developers, who are already accustomed to working under such regulations. RECOMMENDATION 23.

88. The personnel of Webb Resources seem most co-operative, but legislation and government supervision will still be necessary to keep standards up and to avoid accidents.

89. SPECIFIC REQUIREMENTS FOR PETROLEUM OPERATIONS: The following are not intended to be all-inclusive lists, but to highlight important points concerning Tongan conditions.

(a) Land drilling sites

- The principal danger is contamination of the groundwater, so wells should be cased down to oil-bearing strata, and no drilling should be permitted in fault or fracture zones where leakage bypassing the well might be possible.
- Areas liable to oil or other materials spillage should have the means of catching and holding or removing such spillage before infiltration to the groundwater is possible.
- Groundwater should be monitored for contamination by hydrocarbons, saltwater, or other materials or chemicals used in drilling.

- Any accidents or spillage should be immediately reported to the Government, and clean-up undertaken at once by the company.
- All wastes should be disposed of by approved means (93-95).
- Oil from well tests should be made available to the Government if it so desires for such uses as dust control on roads.
- For well abandonment, the well must be properly plugged and the site cleared (70-71). The area should be restored to its original condition if the government so requests. RECOMMENDATION 19.

(b) Pipelines

- Pipelines from well sites should be equipped for rapid leak detection and shut-off. They should be regularly inspected for leaks or damage. Buried pipelines should be avoided in areas with groundwater resources, as they could have slow leaks which might be difficult to detect.

(c) Storage and trans-shipment

- The greatest dangers of oil pollution will come during storage, while loading on board ships, and while those ships are in Tongan waters, and so these facilities and control regulations should be designed with great care. Much can be accomplished by siting such facilities where an accident could do the least damage. The north side of Tongatapu, including Nuku'alofa, is particularly vulnerable because of the extensive shallow reefs, mangrove areas and lagoon, the high population and tourist activity, and the fact that the prevailing winds would carry any oil spilled into the most important areas. It would be best if a new port could be built where prevailing winds and currents would carry pollution away from the islands. While dredging and sea-wall construction would be required, these works could be designed for pollution containment and control. It would be better to sacrifice the environmental resources of a limited local site than to have later damage over a wide area. A detailed environmental impact study of alternative proposed sites and facilities should be required of the developer by the Government. RECOMMENDATION 20.

(d) Shipping

Since shipping is a major danger, the government may need to define its safety requirements for tankers, and in particular adopt regulations concerning tank and bilge cleaning and the disposal of oily wastes. Tonga may wish to become a party to the appropriate international conventions on this subject (117-118)*. Since this would be a regional problem, it may be necessary to consider the preparation of a Regional Seas Convention defining pollution control and environmental protection requirements for the whole South Pacific. The United Nations Environment Programme has done this for other regions and could assist here. RECOMMENDATION 26.

90. **LIABILITY:** It is generally accepted that a polluter should be responsible for any damage he causes, and this should be incorporated in appropriate legislation, perhaps a broad Environmental Protection Act. A developer should have unlimited liability for damage to any property, resources, human health or economic interests resulting from his activities. He should be required to restore damage to its original state if technically possible, or to pay compensation based on the time for which resources are lost and the cost of replacing them (the value of a fish resource is not just the market price of the fish, but the cost of importing replacements of equivalent nutritive value and of finding new employment for the fishermen). If the resource destroyed is a renewable resource, and thus equivalent to a capital investment, compensation should be in capital capable of providing an equivalent continuing income. Such resource valuations should be done if possible as part of the initial environmental baseline surveys and then regularly updated, as they will be more difficult to establish after pollution has occurred. RECOMMENDATION 31.

91. **POLLUTION CONTROL:** The procedures and responsibilities for pollution control should be clearly defined by the Government and the developer before an accident occurs, as a rapid response can often limit the damage done. The developer should have the necessary equipment and control materials available. The Government could contribute manpower from the defence forces, prison, and government technical services, and vehicles,

* *International Convention for the Prevention of Pollution of the Sea by Oil, including 1969 and 1971 Amendments.*

International Convention on Civil Liability for Oil Pollution Damage.

International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties.

International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage.

Convention on the Prevention of Pollution from Ships.

boats, or earth-moving equipment as needed. The developer should either deposit a Pollution Bond with the Government, or else agree to reimburse the government for any expenses incurred in pollution clean-up and restoration. Contingency plans should be developed, with a clear designation of the person to have overall authority in case of an accident (103-105).

92. It might be appropriate, as the petroleum industry develops to the point where a major accident is possible, for Tonga to conclude an agreement with an appropriate metropolitan country for assistance in case of a major oil spill. Australia, New Zealand, and the United States are all developing stockpiles of pollution control equipment and materials capable of being airlifted to the site of a spill. It could be most helpful for Tonga to be able to call quickly on experience and material aid from such a source. RECOMMENDATION 25.

93. Eventually, the Government should consider the need for it to obtain insurance against oil pollution from unknown or unidentified sources. This may become important with increasing tanker traffic, as an oil slick drifting in from the sea is seldom easy to trace back to a responsible source.

94. **BROADER IMPACTS:** The development of petroleum in Tonga would have many indirect social and environmental effects that must be carefully considered by the Government. Puerto Rico, which is at a comparable state to Tonga in oil development, has reserves believed to be at least twice the size estimated by Webb Tonga for planning purposes, and it estimates the net profit to the Government as \$13,000 million over 25 years. On this basis Tonga might expect, if its reserves prove out, to average \$100 to \$250 million per year over 25 years.

95. To be able to use even a fraction of such funds effectively, Tonga would need to greatly increase its trained manpower base (administrators, accountants, construction workers, technical personnel, etc.) as well as its infrastructure and general capital-absorption capacity. Spending money is hard work. If the economy expands too quickly, the Government could lose its experienced employees to private enterprise, or find other major imbalances or blockages in its development plans. All the ministries have plans shelved for lack of funds, but it may be wiser to allow for a gradual expansion in government activities to avoid overwhelming the system and to allow time for necessary adjustments.

96. Training should be given a high priority so that the Tongan workforce can expand with increasing opportunities. Otherwise it will be necessary to bring in a flood of expatriates with a potentially serious effect on social and cultural stability. An increased expatriate population and greater buying power would greatly increase the flow of imported goods, with accompanying major waste disposal problems. Indeed, there would be an acceleration in all resource demands: water, sand and gravel, wood, food, sewage disposal, recreation areas, and energy, that could create in their turn a new series of environmental problems as resources are pushed beyond their limits. Detailed environmental planning as a part of comprehensive planning would be required to avoid harmful side effects and to prevent resource bottle-necks from interfering with the development process. Such planning should also recognize that petroleum is a non-renewable resource, and thus should encourage the development of a productive base of renewable resources to maintain the prosperity of Tonga, once the oil runs out. RECOMMENDATION 27.

97. The above are general considerations to show the scope of the actions required if oil in economically exploitable quantities is found in Tonga. All the points raised will require greater elaboration in the event that such developments take place. It is important, however, that the developer is clear from the beginning on Government policy with respect to the environment, and that the necessary safeguards are included in any exploration licenses or petroleum agreements signed by the Government.

IV. IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT

Government Organization

98. The Government of Tonga will need to strengthen its expertise in and administration of environmental matters if it is to fulfil its responsibility for the wise management of natural resources, a responsibility that is steadily increasing with development. The environment is a very broad field and involves at least some activities of nearly all Ministries and Departments, yet very often specific environmental concerns do not fall under the jurisdiction of any particular Ministry.

99. Experience in other governments suggests that, to be effective, environmental co-ordination needs to be placed at a high central level where it can carry sufficient weight with all of the Ministries. It is also essential to have some separation between those responsible for development and those responsible for the regulation of development in the broader public interest. Larger governments tend to have an independent Commission on the Environment (N.Z.), Environmental Protection Agency (U.S.A., Guam, TTPI) or Office of Environment and Conservation (PNG). Small governments may have a single environmental specialist (American Samoa, Fiji) supported by appropriate committees or bodies. The following proposals are for a very simple administrative structure with some division of responsibility between review and execution, while taking advantage of the existing experience in various ministries.

100. ENVIRONMENTAL ASSESSMENT AND CO-ORDINATION: Within the present structure of the Government, the logical place for a high-level environmental review and co-ordination of Government programmes is the Central Planning Office. This Office should be given the responsibility to co-ordinate the activities of various Ministries as they affect the environment, and to ensure that they are in harmony with the policy, goals and development plans adopted by the government. It should not implement environmental projects except by providing advice or technical assistance to the appropriate Ministries. There is presently inadequate communication between the various parts of Government on projects, even where there is a need or requirement for review or consultation. The Central Planning Office should act as a kind of environmental "ombudsman", taking up the interests of the environment against those who would disregard sound environmental practice, and seeing that all appropriate authorities are informed and able to comment before a project proceeds.

101. To accomplish this, the Central Planning Office should appoint an Environmental Assessment Officer with the following responsibilities:

- review of environmental impacts of all proposed economic development projects;
- co-ordination of the environmentally-related activities of all Ministries; and

- technical assistance to Ministries in the environmental aspects of project preparation, and in their responsibilities for execution and enforcement of environmental regulations.

102. Initially, the post of Environmental Assessment Officer will probably have to be filled by an expatriate with experience in project assessment and the administration of environmental programmes in government. The Commonwealth Fund for Technical Co-operation has been funding such a position in Fiji, and might be approached for similar assistance to Tonga if an appropriate candidate can be found. The possibilities of bilateral assistance from Australia or New Zealand should also be explored. The U.S. Peace Corps is sometimes able to provide appropriately-qualified people through the Smithsonian Peace Corps Environmental Program. The United Nations Environment Programme is another possible source of assistance, and should be contacted through the United Nations Development Programme.

103. At the same time, a Tongan counterpart should be chosen to receive specialized training and on-the-job experience so that the expatriate can be replaced as soon as practicable. This should preferably be a science graduate with an interest in environmental management such as Saia Kami, although it could also be an economist or public administration graduate with some science courses and willingness to receive further training in environmental science. Environmental management is in many ways a generalist field involving the synthesis of many different kinds of data, and this ability is probably more important than the particular field of specialization. RECOMMENDATION 28.

104. ENVIRONMENTAL PLANNING: Environmental planning is an aspect of physical planning that involves identifying and usually mapping ecologically and environmentally important areas and the present and potential uses of natural resources as a way of identifying possible conflicts and thus guiding development in the least damaging and most productive directions. This report has already identified several kinds of environmental information (fisheries habitats, tourist sites, conservation areas, groundwater reserves, etc.) that need to be compiled as inputs to effective physical planning.

105. The responsibility for physical planning rests with the Ministry of Lands, Survey and Natural Resources, which is most appropriate since this Ministry makes most land-use decisions and has the necessary experience in mapping. Since many aspects of governmental policy concerning the environment must be implemented through environmental planning and decisions on the use of land and other natural resources, the major responsibility for environmental management will fall on this Ministry. This will involve:

- compilation and mapping of data from all Ministries concerning the protection and management of environmental resources, including information on agriculture (present and potential), water supplies, natural vegetation, critical marine habitats, fisheries, forestry, conservation of genetic resources, flora and fauna, waste disposal, historic places, tourist sites, etc;
- preparation of physical or town plans for all parts of the Kingdom as a guide in planning for development;

- delineation of park and reserve areas under the guidance of the Parks and Reserves Authority, and management of these areas as directed by the Authority;
- control of land-use decisions to the extent that this power rests with Government;
- environmental monitoring of petroleum development, sand and rock mining, the effectiveness of conservation measures, and generally as needed; and
- close co-ordination with the Central Planning Office to ensure that economic development plans are consistent with the physical plans, that they are realistic in terms of the limits on available resources and do not conflict with environmental requirements, and that land-use decisions support economic development goals once these are adopted.

106. The Ministry is already in the process of recruiting a Town Planner who will reinforce the Ministry's physical planning capability, but it is evident that there is also a requirement for an Ecologist with a good knowledge of Pacific Island ecosystems, who would:

- serve as conservation officer (see paragraph 63 above), supervising the day-to-day management of parks and reserves, preparing new park and reserve proposals, and training park and reserve staff;
- conduct environmental surveys and monitoring, both for planning purposes and to detect possible environmental impacts from development projects such as petroleum exploration;
- assist in the environmental aspects of physical planning; and
- otherwise advise the Ministry on ecology, natural resources and the environment.

The ecologist should if possible be a specialist in tropical botany or ecology, or in coral reef ecology. His training and responsibilities would be complementary to those of the proposed Environmental Assessment Officer in the Central Planning Office; the former would basically be a scientist providing environmental management information to the Government, while the latter would be more a project evaluator and administrator. The comments above (paragraphs 102-103) concerning the recruitment of the Environmental Assessment Officer apply equally to the Ecologist although the skills being sought would be different with more emphasis on science training for the Ecologist. The International Union for Conservation of Nature and Natural Resources (IUCN) is an additional agency that might be able to help fill this position while a local counterpart was being trained.

107. In order for the Ministry to execute its physical planning responsibility effectively, there needs to be a mechanism for close consultation with other branches of Government. This could best be accomplished by establishing a Physical Planning Committee chaired by the Minister of Lands,

Survey and Natural Resources, which would replace the existing Town Planning Committee and Development Siteing Committee, and would have expanded terms of reference, including:

- decisions on guidelines and policy concerning physical planning;
- approval of physical plans for all parts of the Kingdom, including a master plan for Nuku'alofa;
- recommendations to the Minister on the siteing of major development projects and on specific land-use conflicts referred to the committee; and
- review of development plans and major projects to ensure that they are consistent with physical planning guidelines and environmental resource limits.

This committee would allow all the concerned sections of the Government to contribute to the physical planning process and would encourage better implementation of plans once they are adopted. RECOMMENDATION 30.

108. ENVIRONMENTAL PROTECTION: A major lack in the existing structure of the Government is for means to bring the scattered expertise of the various Ministries to bear on the problems of pollution control and protection of the environment. The additions described above will help where big new projects or planning for the future are concerned, but there are still many present and potential pollution problems that result from cumulative small actions or from existing activities. It would in addition strengthen the role of the Central Planning Office in environmental assessment and co-ordination to be able to refer matters to a technical committee made up of experts from many Ministries. This Environmental Protection Committee, which could be established under an Environmental Protection Act to be discussed below under Legislation (paragraph 115 and Appendix A), should have the following responsibilities:

- to draft regulations concerning substances to be considered as potential pollutants, the permitted concentrations of such substances in effluents or discharges to the air, land, water or sea, the means by which they can be disposed of, and the maximum ambient levels to be permitted in the environment;
- to define the precautions and requirements for the use, handling, packaging, labeling, storage and disposal of environmentally hazardous materials not included under existing legislation (such as the Drugs and Poisons or Pesticides Acts), including the right to require permits for the possession or use of such materials or to prohibit their use entirely in all or any part of the Kingdom.

Such a committee would give the Government a flexible means of regulating any possible pollutant using the technical experience already available to it. Its decisions would be executed by whichever Ministry had the appropriate technical competence, with co-ordination provided by the Central Planning Office. Its responsibilities will increase as new industries and development projects bring new pollution dangers to Tonga, dangers that could seriously threaten valuable Tongan resources.

109. The Environmental Protection Committee should be chaired by the Deputy Prime Minister, with the Environmental Assessment Officer from the Central Planning Office as Secretary, and the following members: the Town Planner and Ecologist from the Ministry of Lands, Survey and Natural Resources; the Fisheries Officer and another appropriate Officer from Agriculture; the Chief Medical Officer (Health) and Senior Public Health Inspector; the Director of the Water Board; the Tourist Officer; a Specialist from the Ministry of Labour; Commerce and Industry and an engineer from the Public Works Department. Other technical experts could be added if appropriate.

110. These relatively simple additions or modifications to the structure of Government in Tonga should provide effective mechanisms for dealing with the full range of environmental problems likely to face the Kingdom of Tonga in the immediate future.

Policy

111. It would be valuable for the Government to adopt a general statement of environmental policy as a guide to all Government departments and as an instrument for educating the general public. A possible draft for such a policy statement follows. It has been based on the principles included in the Declaration of the United Nations Conference on the Human Environment (Appendix B), Fiji's Seventh Development Plan, and the Environment and Conservation Policy of Papua New Guinea.

Environmental Policy for the Kingdom of Tonga

112. The people of Tonga have the right to an environment that provides for their physical and spiritual well-being.

The environment and natural resources of the Kingdom of Tonga will be conserved and used for the benefit of all the people and maintained or improved for the benefit of future generations. This will involve:

- wise use of renewable resources for present development and their management as a trust for the future;
- development of non-renewable resources for the long-term benefit of all the people;
- conservation and replenishment of the scenic and historic qualities of the environment and of Tongan birds, animals, plants, trees, marine life, and natural ecosystems;
- consideration of economic, social and ecological matters together in development planning and in the planning of human settlements;
- prevention of the pollution of the land, air, water or seas at levels dangerous to human health, to plants or animals, or to natural ecosystems;
- requiring those who gain financially from the use of natural resources to pay the costs of environmental protection;
- education of the children and all the people of Tonga about the environment and the common responsibility of all to protect and improve it; and

- ensuring that activities in Tonga do not cause damage to the environment beyond the limits of national jurisdiction. RECOMMENDATION 33.

Legislation

113. Tonga already has a number of Acts with provisions useful for environmental management or conservation, including the Public Health Act (Cap.48) concerning dangers to health and water supplies, the Garbage Act (Cap.57) covering solid waste disposal in Nuku'alofa, the Land Act (Cap.63) with provisions for the use of tax allotments for agriculture, the Forests Act (Cap.70) providing for Forest Reserves and their management, the Minerals Act (Cap.71) controlling mining other than common materials but without pollution provisions, the Fisheries Regulations (Cap.76) prohibiting damaging fishing methods, the Whaling Industry Act (Cap.77) prohibiting the taking of baleen whales and with possibilities for extension, the Petroleum Act (Cap.122) regulating transport and storage of petroleum but saying nothing about pollution damage or compensation, the Petroleum Mining Act (No.3 of 1969) providing for exploration licences and petroleum agreements but without references to accidents or liability, the Pesticides Act 1975 which should permit the effective control of pesticides but is not yet enforced, the Parks and Reserves Act (No.11 of 1976) authorizing the establishment of parks and reserves, the Birds and Fish Preservation Act (Cap.75 and No.24 of 1974) allowing complete protection or closed seasons for specified birds and fish and providing for protected areas, the Preservation of Objects of Archaeological Interest Act (No.15 of 1969) protecting archaeological sites, and the Tourist Act (No.19 of 1976) regulating the tourist industry.
114. The legislation for conservation is quite good, although there is no way at present to protect individual plants, animals or marine life other than birds or fish, to provide selective protection to a species in only one part of the Kingdom where it might be in danger of local extinction, or to establish seasonal reserves. The provisions for most aspects of natural resource management are ample. The major gap is in the lack of legislative provisions to protect the environment from pollution, to permit the Government to control activities which threaten to pollute, and to define liability in case of damage by pollution. The Government would have at present to rely on the nuisance provisions of English common law, or to fall back on laws passed by the United Kingdom Parliament.
115. With the present prospects for petroleum and other development in the Kingdom, this lack should be filled with an Environmental Protection Act that would give the Government the necessary supervisory and regulatory powers and establish in law the "polluter pays principle", that a developer is responsible for any direct or indirect costs of his development and particularly for any damage caused by pollution. A possible draft for such an Act based on a draft prepared by the South Pacific Commission for the Solomon Islands, is attached to this report as Appendix A. RECOMMENDATION 31.
116. It should be noted that this suggested legislation and the subsidiary regulations to be adopted under it would implement the requirement for regulations to prevent pollution of the sea by oil as specified in Article 24 of the Convention of the High Seas to which Tonga is a party.

Public Education

117. Environmental quality is an important dimension of the quality of life, and thus affects all of the people. The environment is also influenced in many ways by the cumulative actions of the people, whether it be in discarding wastes, cutting down trees, breaking corals, or killing wildlife. Public understanding of the value of environmental resources and of the need to control their own actions is thus essential to the implementation of environmental management.
118. Environmental education should be included in the formal education programmes of the schools at all levels. The South Pacific Commission will soon be publishing a trial version of a set of environmental education curriculum materials and other materials appropriate for upper primary and lower secondary school use. These should be tried out in Tonga for possible inclusion in the revised curricula now being prepared.
119. The mass media, including radio and newspapers should include occasional programmes or articles on environmental subjects.
RECOMMENDATION 34.
120. An approach that has been very successful in other Pacific Island countries such as the Cook Islands, Western Samoa and Fiji has been to have an annual day or week devoted to the environment. June 5, which has been declared by the United Nations as World Environment Day, could be commemorated in Tonga. Special attention could be devoted to the environment in the media. The schools could have special projects on that day, such as beautifying the grounds of the school or public buildings, planting trees with the co-operation of the Forestry department, picking up rubbish and litter and clearing brush in parks or villages or on beaches, writing essays, making posters or preparing exhibitions on environmental themes, etc. There could also be an emphasis on the traditional aspects of environmental management, such as the planting of traditional trees or foodstuffs that have been neglected in recent years. RECOMMENDATION 35.
121. There are, of course, close links between the environment and the cultural and spiritual values upon which any society is based. The natural environment provided the context within which the Tongan culture and traditions evolved, and its loss would in a sense leave those traditions without roots. The dangers of unwise or too rapid development threaten not only the natural environment but also the cultural, moral and spiritual environment. Societies that have pursued material development exclusively have too often fallen prey to materialism, alcoholism, irreligion, loss of motivation, and abandonment of local arts and traditions, as well as to short-sighted development goals that have too often destroyed the environmental wealth of the country. Development benefits and the accompanying costs should be carefully examined to ensure that they do contribute to the quality of life of the people. It may be wiser in the Tongan context, where the quality of many aspects of life is already very high, to aim for selective development in areas such as medicine, education, communications, transportation and human settlements while keeping the roots of the people in agriculture and fisheries, in the family and village, and in spiritual values. Such development should be based as much as possible on the peoples' own desires and needs, on the greatest possible self-reliance, and on harmony with the potentials and limits of the Tongan environment. Such development is sometimes called eco-development, and is an approach that deserves careful consideration in areas like the Pacific Islands where traditional cultures are very strong and the limits of the environment very close.

122. These issues should be discussed widely by the people of Tonga and all the institutions on Tongan society, including the Government, the schools, social clubs and organizations, traditional and cultural groups, village organizations, and the churches and other religious bodies. The aim should be to seek a consensus on directions for development that are uniquely Tongan and fully adapted to the traditions, culture and environment of Tonga. These directions could then be formulated as a set of fundamental principles to guide future development much as has been done in Papua New Guinea. RECOMMENDATION 36.

V. ACKNOWLEDGEMENTS

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The following publications and reports also provided essential information: Kingdom of Tonga Third Five Year Development Plan (1976); Tonga Water Board, First Report on Geoelectric Survey of Tongatapu Island, Kingdom of Tonga, (1977); Petroleum Exploitation: Data Requirements and Environmental Protection (Commonwealth Secretariat, 1975); R. Braley, Report on a Trawling Survey of Penaeid Prawns in the Fanga'uta Lagoon, Tongatapu (1976) and two reports on the Marine Turtle Situation (1973 and 1974); A.L. Dahl, Regional Ecosystems Survey of the South Pacific Area (South Pacific Commission, 1976); M.P. Francis (ed.), Land, Air and Water Pollution of Tongatapu Island, Tonga ('Atenisi Press, 1976); W.R. Sykes, Vegetation of 'Eua (report to Ministry of Lands, Survey and Natural Resources, 1977); and A.P. Thomson, Notes on Natural Forests of Tonga with Particular Reference to a Proposed 'Eua National Park (1975).

This report is based upon a mission to Tonga from 1 - 21 December, 1977 and an earlier visit from 1 - 5 October 1974.

VI. RECOMMENDATIONS

(The numbers in parentheses refer to the appropriate paragraphs in the text of the report)

ENVIRONMENTAL MANAGEMENT

Recommendation 1: Land-use planning for agriculture

The loss to other uses of productive agricultural land should be controlled through comprehensive land-use planning. (12)

Recommendation 2: Idle land

The Government should encourage the more effective use of agricultural land by developing machinery for short-term agricultural leases and other incentives. (14, 13).

Recommendation 3: Groundwater protection

The principal groundwater reserves and their recharge zones on Tongatapu should be mapped, and steps taken to avoid activities in these areas that might contaminate these essential water supplies. (17)

Recommendation 4: Sand

Sand removal from the beaches of Tongatapu should be carefully regulated to prevent the loss of important tourist and recreational resources. The quantity being removed should not be increased without the advice of an expert in coastal management. If additional sand is needed, it should preferably be obtained by crushing rock from quarries. (20-23).

Recommendation 5: Storm protection

Natural features such as coastal vegetation, mangroves, and trees serving as windbreaks should be maintained or developed for their benefits such as protection against storm damage. (24-25)

Recommendation 6: Forest Reserves

Forest reserves and reserved areas should be established under the Forests Act and reforestation accelerated in these areas so that sustained yield plantation forestry can replace native forest cutting before the exploitable areas of native forest are exhausted. (27)

Recommendation 7: Coastal Planning

Development in coastal areas should be closely co-ordinated with the requirements of critical marine habitats for fisheries through comprehensive physical planning. (28-29)

Recommendation 8: Management of Fanga'uta Lagoon

Major new developments around the lagoon on Tongatapu should be strictly controlled and existing sources of human impact limited to the extent possible in order to slow or even reverse the decline in lagoon quality. A detailed ecological study would help to define the long-term requirements necessary to maintain the lagoon as a productive resource.

Recommendation 9: Coral Exploitation

Exploitation of corals should be strictly limited to protect reef fisheries. Selective development of coral harvesting should only be permitted if it brings great economic benefits to the people of Tonga, and if it can be done on a sustained yield basis. (33-39)

CONSERVATION OF NATURE

Recommendation 10: Conservation Planning

Planning should begin to identify areas representative of the typical and unique ecosystems and natural areas in the Kingdom of Tonga which could eventually receive appropriate protection as parks or reserves, and which should in the meantime be excluded from development planning. (42)

Recommendation 11: Declaration of Parks and Reserves

The following areas should be considered for declaration under the Parks and Reserves Act 1976: Ha'amonga Trilithon Historic Park, Mui Hopohoponga Coastal Reserve, Ha'atafu Beach Park and Marine Reserve, Pangaimotu Reef Park, Monuafe Marine Reserve, Malinoa Island Park or Reserve, and Hakau' Mama'o Reef Marine Reserve. Further study is needed concerning the possible establishment of an 'Ata Island Reserve and a major National Park on 'Eua which could be given world recognition as a biosphere reserve. (47-56)

Recommendation 12: Management of Sea Turtles

Further steps are needed, such as improved enforcement of closed seasons and the establishment of seasonal turtle sanctuaries, to halt the serious decline in turtle populations and thus preserve their long-term value as a resource for the Tongan people. (57)

Recommendation 13: Management of Whales

Tonga should participate in international efforts to protect whales from extinction and to study how to manage whales as a renewable resource. This could include becoming a party to the International Convention for the Regulation of Whaling, and stopping, at least temporarily and with appropriate aid from international sources, the present whaling in Tongan waters. (57)

Recommendation 14: Convention on Conservation

Tonga should consider becoming a party of the Convention on Conservation of Nature in the South Pacific and other appropriate international conventions. (58-62)

Recommendation 15: Appointment of Parks and Reserves Authority

Once some parks and reserves have been declared under the Parks and Reserves Act 1976, an expanded Parks and Reserves Authority should be appointed under the chairmanship of the Minister of Lands, Survey and Natural Resources, in order to develop management plans for the reserves and to consider future proposals. (63)

POLLUTION

Recommendation 16: Bacterial Pollution

A detailed study is needed of present environmental pollution by bacteria from sewage and other wastes, in order to identify the principal hazards to human health and possible control measures. (65-66)

Recommendation 17: Solid Waste Management

The present Tukatonga rubbish dump should be closed if possible and a sanitary landfill established at a more appropriate site. Steps are needed to reduce the amount of solid waste by local substitution for imports, and to eliminate the problem of derelict and abandoned vehicles. (67-69)

Recommendation 18: Industrial Pollution

A review of the environmental impact of new industries and other development projects should precede any decision on approval and siting. Particular attention should be given to the wastes produced and their safe disposal in order to avoid pollution of groundwater or coastal fisheries areas. (72)

PETROLEUM. (The following recommendations concern the present oil exploration on Tongatapu and steps to be taken if exploitable oil reserves are discovered.)

Recommendation 19: Pollution from Petroleum Exploration

Since the groundwater is the most important resource at risk from petroleum exploration on Tongatapu, an urgent study is required of the extent of the risk, the controls necessary to minimize the danger of groundwater pollution by oil or other materials involved in oil well drilling, and the type of sampling or monitoring necessary to detect any pollution that might occur. Every precaution should be taken to ensure the safety of the essential water supplies of Tongatapu. (75, 89 [a])

Recommendation 20: Siting of Oil Facilities

Since the greatest danger of oil pollution is during storage and trans-shipment, the location and design of these facilities should be chosen to minimize the dangers to the environment from oil spills. If necessary, a new port should be built at a site other than Nuku'alofa where a spill could be properly contained or dispersed with minimal damage to fisheries resources. (89, [b] [c])

Recommendation 21: Identification of Critical Areas

The Government should compile a report on critical areas such as fishing grounds and breeding areas, water supplies, tourist sites, recreation areas and beaches, historic sites, etc. where oil pollution would be particularly harmful to the economy or public interest, and every effort should be made to plan the development of the petroleum industry so as to protect these areas from damage. (75-79, 85)

Recommendation 22: Petroleum Inspector

The post of Petroleum Inspector should be established in the Ministry of Lands, Survey and Natural Resources, to be paid for from petroleum permit and license fees, with the responsibility to supervise, inspect and specify conditions for all aspects of the petroleum industry, aided by outside consultants as necessary. (82-83)

Recommendation 23: Technical Standards for Petroleum Industry

The Government should require the petroleum industry to conform to a specified set of technical standards such as those published by the American Petroleum Institute or the Institute of Petroleum. The right of access to all data should be reserved for purposes of inspection and supervision, with due regard to confidentiality. Approved means should be specified for the disposal of all wastes and obsolete equipment, the clearance of drilling sites, and the closure of abandoned wells. (86-89)

Recommendation 24: Environmental Surveys and Monitoring

Surveys of the natural environment, hydrocarbon levels in the groundwater and sea-water, the marine resources of coastal areas, etc. should be made prior to the start of petroleum exploitation to establish baseline conditions so that any damage can be measured. Samples and survey site data should then be analyzed at regular intervals to monitor gradual environmental changes which may be due to oil pollution. (84)

Recommendation 25: Oil Pollution Control

The Government and the petroleum industry should decide on the procedures and responsibilities for oil pollution control before an accident occurs. A means should be established for the developer or other responsible party to reimburse the Government for any expenses incurred in cleaning up an oil spill or in protecting the public interest. The possibility of aid from other countries in the event of an accident should be explored. (91-92)

Recommendation 26: Oil Tanker Regulations

Detailed regulations should be adopted concerning the operation of oil tankers in Tongan waters, and Tonga should become a party to the international conventions on this subject. (89 [d/])

Recommendation 27: Indirect Effects of Oil Development

As soon as exploitable oil reserves in Tonga are confirmed, a major effort in comprehensive planning will be required to anticipate the indirect environmental, social and economic effects of the development of a petroleum industry. To avoid serious social, cultural and environmental changes, a gradual approach may be necessary, with full recognition that petroleum is a non-renewable resource. (94-96)

GOVERNMENT ORGANIZATION

Recommendation 28: Environmental Assessment and Co-ordination

The responsibility for the assessment of the environmental effects of economic development projects and for the co-ordination of governmental efforts in environmental management should be given to the Central Planning Office, and an Environmental Assessment Officer with experience in project evaluation should be appointed in that office. (100-103)

Recommendation 29: Environmental Planning

The capacity of the Ministry of Lands, Survey and Natural Resources to carry out environmental planning, which is a component of physical planning, should be strengthened by the employment by that Ministry of an Ecologist to supervise conservation activities, parks and reserves, and to undertake environmental surveys and monitoring. (104-106)

Recommendation 30: Physical Planning Committee

A Physical Planning Committee should be appointed, replacing the existing Town Planning and Development Siteing Committees, to make policy and guidelines on physical planning, to approve physical plans and master plans, and to review development plans and projects for consistency with physical plans and environmental resource limits. (107)

Recommendation 31: Environmental Protection Legislation

An Environmental Protection Act should be adopted giving the Government the authority to control pollution and making developers liable for any damage they may cause. (114-116, 90, and Appendix A)

Recommendation 32: Environmental Protection Committee

A technical committee should be established under the Environmental Protection Act to make regulations concerning pollution levels to be permitted in effluents and in the environment and the precautions to be taken with environmentally-hazardous materials. (108-109)

Recommendation 33: Environmental Policy

A general statement of environmental policy should be adopted by the Government as a guide to its activities. (111-112)

Recommendation 34: Environmental Education

School and public programmes in environmental education should be developed to increase the general awareness of environmental problems and the support of the public for environmental management measures. (117-119)

Recommendation 35: Environment Day

World Environment Day, June 5, or some other appropriate date, should be adopted as an annual Environment Day in Tonga, during which the schools and all the public would be encouraged to learn more about the environment and to participate in programmes of environmental improvement and beautification. (120)

Recommendation 36: Directions for Development

The people and all the institutions of Tongan society, whether governmental, educational, social, cultural or religious, should be encouraged to consider the kind of development they want, and the mistakes or problems in other countries that they want to avoid, as a basis for choosing a uniquely Tongan approach to development adapted to Tongan culture and environment. (121-122)

PROPOSAL FOR AN ENVIRONMENTAL PROTECTION ACT FOR
THE KINGDOM OF TONGA

Note: It has not been possible to obtain appropriate model legal texts for major parts of this Act, so further legal drafting and definition will be necessary to embody the following concepts in an appropriate form.

ENVIRONMENTAL PROTECTION ACT

An Act providing for the regulation of development projects and of substances and actions dangerous to the environment, the control of pollution, the evaluation of the environmental impact of development projects, the establishment of an Environmental Protection Committee and other such steps necessary to maintain the quality of the environment.

1. Short title and commencement

2. Interpretation

In this ordinance, unless the context otherwise requires -

"Committee" means the Environmental Protection Committee established under this Act;

"degradation" means any change to an environment or component thereof that cannot be demonstrated to be harmless or without effect;

"developer" means the person, corporate body, other legal entity, ministry or governmental body that undertakes, proposes to undertake, or is responsible for a development project;

"development project" means any project or proposal for a project involving the development, alteration, or utilization of the lands, waters, natural resources, minerals, or biological resources of or imported into the Kingdom of Tonga;

"environment" means the surrounding air, land and waters, and the ecosystems, organisms and human beings contained therein;

"natural" means in a state of nature, as it was or would be without any interference or alteration by humans or human activities;

"noise" means any sound over 60 decibels found objectionable by persons of normal hearing, and any sound exceeding 80 decibels;

"organism" means any vertebrate or invertebrate animal, plant, fungus, alga, micro-organism, other living thing, or virus, or the eggs or other parts of the life cycle thereof;

"pollutant" means any substance in an environment that does not naturally occur there, or that occurs in quantities greater than naturally occur there, and that has a detrimental effect on that environment or any component thereof. Any measurable effect shall be considered detrimental unless proven to the contrary;

"restricted substance" means any substance listed in the Schedule of Restricted Substances;

"substance" means any gas, vapor, liquid, solid, organic or inorganic chemical, other form of matter, or any combination thereof.

General provisions for environmental protection

3. - (1) Any person who otherwise than under and in accordance with a valid permit issued under this Act -

- (a) releases or causes to be released a pollutant organism or noise into the environment in such manner as to cause significant harm to the property of another or to the natural environment; or
- (b) causes through his actions the degradation of any watercourse, body of water, marsh, swamp, aquifer, groundwater or lagoon, reef or other coastal or ocean waters, whether fresh or salt;

shall be guilty of an offence and liable to a fine of one thousand pa'anga or to imprisonment for one year or to both such fine and such imprisonment, and shall be liable for any damages caused by such acts, including the costs of restoration to the original state where that is possible.

(2) The complainant or informer in any proceeding under this section other than an officer acting in his official capacity shall receive one half of any fine imposed upon and paid by the offender.

Power to regulate development projects

4. - (1) The Central Planning Office or other Government Authority designated by the Cabinet shall have the power to make regulations or requirements for any specific development project or any class of development projects in the interest of controlling the social, economic or environmental impacts of such projects, including but not restricted to:

- (a) the sites at which a development project may or may not be permitted;
- (b) any specified operating conditions, safety procedures, pollution controls, environmental monitoring, waste disposal methods and/or sites, and restoration of sites for any industry, operation, pipeline, storage facility, trans-shipment procedure or facility, and vehicle or vessel involved in the manufacture, mining, use, transport, storage or handling of any possible pollutant;
- (c) the reporting to the Government of any specified data or information on the development project, including regular progress reports;
- (d) the requirement that the developer possess, stockpile or have ready access to appropriate pollution control or clean-up equipment and materials, and that he make and submit to the Government appropriate contingency plans for pollution control in the event of a spillage or release of a pollutant into the environment; and
- (e) the placement with the Government of a pollution bond and/or the possession by the developer of adequate liability insurance coverage for any damage to persons, property or the natural environment caused by the development project.

(2) The Government shall have the right of access to any data, plans or information necessary to evaluate or regulate a development project, and shall maintain the confidentiality of any proprietary information so supplied.

Pollution control and liability

5. The Government and any authorized officer thereof may with the approval of the Cabinet enter any property, board any vessel, halt any operation or activity, or take any other action including the destruction of property necessary to contain, control or eliminate pollution or the threat of pollution which, in the opinion of the Cabinet, is a major threat to the people, economy, resources or environment of the Kingdom of Tonga or of any area beyond the limits of natural jurisdiction.
6. Any developer or other person responsible for any accident causing or liable to cause damage to the environment or for any pollution not covered by a permit issued in accordance with this act shall report such accident or pollution immediately to the Government, and shall submit to the Government as soon as practicable after the event an assessment report on any damage so caused.
7. - (1) A developer or other responsible person shall be liable without limit for any damage to persons, property or the natural environment caused by or resulting from a pollution accident, development project or activities associated therewith. Such liability shall include the restoration of damaged areas or property to the original state if technically and economically feasible, and/or the payment of compensation to the affected parties based on the time for which the resources or other property are damaged, destroyed or unusable and on the cost of restoring replacing them. Compensation for human disabilities or destruction of renewable resources may be in the form of an invested trust producing interest at the time the trust is established at a level covering the continuing treatment or replacement cost for the disability caused or the resource destroyed.

(2) The Government may recover from the responsible persons any costs incurred as a result of its intervention to prevent or control pollution in the public interest. Other affected persons may similarly recover any costs incurred in protecting their property against pollution or restoring it after damage from pollution, provided that the costs recovered do not exceed the value of the property protected.
8. The Cabinet may require any developer or industry to pay all or a share of the premiums on a Government-held insurance policy against damages from pollution related to that industry but for which responsible parties cannot be identified.

Environmental impact

9. - (1) For any new development project or any modification to an existing development project, involving more than one hundred thousand dollars capital investment, affecting more than 50 acres of land or water area, or producing or expected to produce pollutants, the developer must submit to the Central Planning Office in advance of the start of the project or modification an Environmental Impact Statement describing:
 - (a) the nature of the development activities;
 - (b) the precise areas to be developed;
 - (c) the resources to be used;
 - (d) any wastes, noise or possible pollutants to be produced;

- (e) provisions for pollution control and treatment;
- (f) direct or indirect ecological effects or environmental degradation that might result;
- (g) the present and alternative uses of the land and/or resources to be affected;
- (h) the effect on surrounding human populations;
- (i) a long-term cost-benefit analysis of the project and of major alternative uses for the same resources; and
- (j) any other information required by the Central Planning Office.

(2) The Central Planning Office shall rule within 90 days on the adequacy of any Environmental Impact Statement submitted to it in accordance with the provisions of section 9-(1), either approving the Statement or defining the modifications required for approval. Failure of the Central Planning Office to rule on a Statement within 90 days shall constitute automatic approval of the Statement.

(3) Further regulations concerning the preparation and submission of Environmental Impact Statements may be adopted by the Central Planning Office as necessary.

(4) No work may begin on any development project qualifying under section 9-(1) until the Environmental Impact Statement has been approved by the Central Planning Office.

10. Where the scope and impact of a proposed development project warrant it, the Central Planning Office shall make the Environmental Impact Statement available in a way appropriate to the people most likely to be affected by the project, and shall hold a public hearing on the Environmental Impact Statement prior to approving it.

11. - (1) In approving an Environmental Impact Statement, the Central Planning Office may make recommendations to the Cabinet for additions to or modifications of the proposed development project, or may otherwise define conditions for the approval of the project, necessary to ensure adequate environmental protection.

(2) If these recommendations are accepted by the Cabinet, the project may not begin until the developer establishes to the satisfaction of the Central Planning Office that its requirements will be met.

12. After approval of an Environmental Impact Statement, the Central Planning Office may require regular monitoring or other studies to ensure that the actual environmental impact is as described in the Statement and that any conditions for approval are being met.

13. The Central Planning Office with the approval of the Cabinet may require that the costs to the Government of an adequate review of any Environmental Impact Statement and of any studies or expert opinion required in that review or in subsequent project monitoring shall be reimbursed by the developer.

Establishment of Environmental Protection Committee

14. There is hereby established an Environmental Protection Committee located administratively within the Office of the Prime Minister and advisory to the Central Planning Office.
15. The objects of the Committee shall be:
- (a) to advise the Ministers, the Central Planning Office and other branches of government on the technical aspects of environmental protection;
 - (b) to establish regulations concerning substances hazardous to public health or the natural environment including the prohibition of their importation, manufacture, use or disposal, if necessary;
 - (c) to assist the Central Planning Office in the review of the environmental impact of development projects and in the definition of measures for environmental protection if necessary;
 - (d) to define environmental quality standards, including the maximum permitted concentrations of pollutants in effluents or discharges, and in the natural environment;
 - (e) to specify controls over natural resource exploitation liable to result in significant environmental degradation where this is not covered by other legislative or administrative provisions;
 - (f) to regulate or prohibit the importation of organisms not native to or now present in the Kingdom of Tonga that, if introduced, might reasonably be liable to escape from the area of introduction and to threaten or degrade the natural environment or some component thereof;
 - (g) to require inter-ministerial consultation, review and approval when appropriate;
 - (h) to assign responsibilities for the monitoring and enforcement of its actions under this ordinance and the other provisions thereof to the appropriate Ministries;
 - (i) to consult as necessary with outside experts;
 - (j) to encourage or require research on environmental problems;
 - (k) to assist with school and public programmes of environmental education;
 - (l) to adopt, with the approval of the Cabinet, other measures as necessary to maintain environmental quality.

Membership

16. - (1) The Committee shall be appointed by the Cabinet with the Deputy Prime Minister as Chairman; the Environmental Assessment Officer from the Central Planning Office as Secretary; other Government Officers with appropriate technical expertise as necessary; and, if the Cabinet so chooses, one or more members of the public with technical, scientific and/or business experience, but not to exceed one-third of the membership of the Committee.

(2) The non-governmental members of the Committee shall, unless they earlier vacate their offices or die or resign or unless their appointments are revoked by the Cabinet, hold office for such period not exceeding two years as shall be specified at the time of appointment and shall be eligible for re-appointment.

(3) A non-governmental member of the Committee may be paid and receive from the Government such attendance allowance in respect of his services on the Committee and such allowances for travelling and subsistence in such circumstances as may be generally or specially determined by the Cabinet.

Meetings and Quorum

17. - (1) The Committee shall meet at such times and places as the Chairman considers necessary.

(2) A majority of the members actually appointed shall form a quorum.

(3) All questions shall be decided by a majority of votes of the members present at any meeting of the Committee.

(4) The Chairman shall be a full voting member of the Committee.

(5) In the absence of the Chairman from any meeting of the Committee the members present shall appoint one of their number to preside at that meeting.

(6) The Committee shall keep records of its proceedings.

(7) The Committee may make rules, not inconsistent with the provisions of this section, governing its meeting procedure.

Pecuniary interest to be disclosed

18. - If a member has any pecuniary interest, direct or indirect in any matter and is present at a meeting of the Committee at which the matter is the subject of consideration, he shall at the meeting, as soon as practicable after the commencement thereof, disclose the fact, which shall be recorded in the minutes of the meeting, and thereupon such member may take part in the consideration or discussion of the matter, but shall not vote or otherwise take part in the decision of the Committee thereon.

Staff of the Committee

19. - The Government shall provide or second to the Committee on such terms and conditions as the Cabinet may from time to time determine a secretary and other such officers and servants as he may consider necessary for the proper and efficient carrying out of the functions of the Committee.

Powers of the Committee

20. - Subject to the provisions of this Act, the Committee shall have all such powers as may be necessary to carry out its objects under section 15 and without prejudice to the generality of the foregoing power, the Committee may -

- (a) hold public hearings;
- (b) call expert witnesses;
- (c) require persons to provide any information which in the view of the Committee is necessary for the evaluation of any environmental hazard or impact, provided that any such information that is proprietary in nature shall not be made public;
- (d) issue permission to designated Committee members or delegated officers to enter on any property other than a private dwelling for the purposes of any survey or examination necessary for the proper exercise of its functions under this Act;
- (e) require that an appropriate sample of any substance or specimens of any organism be provided to the Committee or to any person designated by the Committee to permit any identification, analyses or experiments necessary to the proper exercise of its functions under this Act;
- (f) delegate responsibilities for investigation and enforcement under this Act to appropriate ministries, with the provision that complete reports on such delegated responsibilities be provided to the Committee annually and on request; and
- (g) engage in any other activity whether similar to those heretofore specified or not, which may be sanctioned by the Cabinet.

Requirement of Public Access

21. - The reports and decisions of the Committee, and the information on which such decisions are based, shall be open to public access under such reasonable terms and conditions as the Committee may specify, except that this provision shall not apply to proprietary information, decisions or information of a personal nature, and information whose release would, in the opinion of the Cabinet, threaten the security or well-being of the Kingdom of Tonga.

Restricted Substances

22. - (1) The Committee may issue from time to time with the approval of the Cabinet and by publication in the Gazette, a Schedule of Restricted Substances listing any substance not specifically covered by existing legislation that in its opinion could represent a hazard to public health or to the natural environment, and including the following two classes.
- (a) Class I - substances for which permits will be required for any possession or use; and
 - (b) Class II - substances for which permits will be required for any use other than those specifically mentioned in the Schedule.

(2) The Committee shall assign to the appropriate ministry or ministries the responsibility for the issuance of permits under this section in accordance with any regulations which it may from time to time adopt.

(3) The Committee may adopt regulations governing the importation, manufacture, possession, storage, packaging, labeling, sale, use and disposal of any such restricted substance, including but not limited to generally approved uses or quantities if any, prohibited uses, and requirements for the issuance of permits to any user.

(4) Any person who otherwise than under and in accordance with the regulations adopted pursuant to this Act or with a valid permit issued under section 22. - (2) imports, manufactures, possesses, stores, packages, labels, sells or otherwise transfers, uses, disposes or releases to the environment any restricted substance or who fails to observe any regulation governing that restricted substance, shall be guilty of an offence and liable to a fine of five hundred pa'anga or to imprisonment for three months or to both such fine and such imprisonment, and shall be liable for any damages caused by such offence as may be fixed by the court.

23. - (1) Where there is reason to believe that an offence has been committed in respect to any restricted substance, such substance, together with all containers, machinery, equipment and other objects reasonably suspected to have been used in the commission of such offence, may be seized by any police officer or authorized officer.

(2) Every officer seizing any property under this section shall place on such property, or on the receptacle, if any, in which it is contained a mark indicating that the same has been so seized and shall, so soon as may be, make a report of such seizure to a Magistrate.

(3) In any proceedings in respect of an offence alleged to have been committed in respect of any restricted substance, the averment that any substance is a restricted substance shall be sufficient without proof of such fact unless the person charged proved the contrary.

24. - (1) When any person is convicted of an offence under this section, all restricted substances in respect of which such offence has been committed, and all containers, machinery, equipment and other objects used in the commission of such offence, shall be liable to be forfeited by order of the court recording the conviction.

(2) Such forfeiture may be in addition to any other penalty prescribed for such offence.

Environmental Quality Standards

25. - (1) The Environmental Protection Committee shall adopt regulations defining standards for various parameters of the environment necessary to maintain a desirable level of environmental quality, including the maximum permissible levels of various substances and noise in the environment or in components thereof.

- (2) The standards adopted may apply uniformly throughout the Kingdom of Tonga, or be adapted to particular regions as defined by the Committee.
- (3) Proposed standards shall be published in the Gazette at least 180 days prior to coming into force, and public comment shall be solicited by the Committee through public hearing or otherwise prior to the final adoption of the standards.
26. - (1) The standards for particular substances or parameters may require permits for all releases into the environment of such substances or parameters above a specified minimum level. All new releases must have a permit prior to the commencement of the release specifying the maximum permissible amount of releases and any required conditions.
- (2) For releases existing at the time of the adoption of a standard, the responsible party must apply for a permit within 60 days of the adoption of the standard. Such a permit, when issued, may allow releases at the existing levels for a specified period not to exceed three years from the date of adoption of the standard, by which time the release must be brought into compliance with the permit.
- (3) Permits may be revised or cancelled if necessary to meet or maintain the appropriate standard. The coming into effect of such a revision or cancellation may be delayed for up to three years at the discretion of the Committee to allow adequate time for compliance.
27. - The Committee shall delegate to the appropriate ministries the responsibility for the regular measurement of parameters or substances for which standards have been adopted, for the issuance of permits in accordance with the regulations, and for the enforcement of such regulations. The ministries shall in turn provide the Committee with the information necessary to determine the adequacy of the regulations and to update them if appropriate.
28. - For any development project expected to release a potential pollutant for which no standard has been adopted, the developer must in addition to the other provisions of this Act, notify the Committee of the nature and expected amount of the potential pollutant. The Committee must, within 60 days of the receipt of the notice, announce its intention, if any, to adopt regulations covering that pollutant. Failure of the Committee to issue such an announcement within 60 days shall constitute permission to release the potential pollutant at the level specified in the notice. In such instances, section 26. -(2) shall continue to be applicable.

Introduced species

29. - (1) Where there is a reasonably possibility that the introduction into the Kingdom of Tonga of an organism, species, or category of organisms not native to Tonga might endanger or degrade the environment or some component thereof, either through the fact of being introduced or in the event that such organisms or reproductive stages thereof might escape from captivity or cultivation, the Committee may place such organisms on a Schedule of Prohibited Introductions.

(2) It shall be an offence against this Ordinance to introduce, import, or attempt to introduce or otherwise bring into the land, waters or airspace of the Kingdom of Tonga or to possess within Tonga any organism or any representative of a category of organisms listed on the Schedule of Prohibited Introductions without a permit issued in accordance with section 25. - (3).

(3) Where the introduction of an organism on the Schedule of Prohibited Introductions appears desirable for purposes of scientific research or other exceptional use in the national interest, and the responsible person or organization can satisfy the Committee or its delegated representative under this section that it can safeguard the organism against any intentional or accidental release into the environment, the Committee or its delegated representative may issue a permit for the introduction of said organism specifying the required conditions for introduction, the disposition of the organisms once the required purposes are met, and any other conditions which the Committee defines as necessary to ensure the protection of the environment.

30. - The Committee may adopt regulations necessary to protect the environment against undesirable introductions of organisms, including regulations requiring that the introductions of any or all categories of organisms be declared to the appropriate designated customs or quarantine officers upon arrival, and that a report of the nature of the organisms, the responsible person, and their destination in the Kingdom of Tonga be forwarded immediately to the Committee or its delegated representative. If any organism so introduced is found to be a potential danger to the environment of Tonga, the Committee may order that it be re-exported or destroyed.

Miscellaneous Provisions

31. - Where the interests of environmental protection necessitate co-ordination between ministries on a particular subject or project, the Committee or the Central Planning Office may with the approval of the Ministers concerned require procedures of notification, consultation, or approval between such ministries.

32. - The Committee and the Central Planning Office shall wherever possible delegate the responsibilities for investigation, research, monitoring and enforcement under this Act to the most technically-qualified ministries with the approval of the Ministers concerned.

33. - The Committee shall advise all branches and levels of the Government on all technical matters within its area of responsibility, and may, at its discretion, provide similar advice to persons or organizations outside the Government.

34. - The Cabinet may adopt any subsidiary regulations under this Act necessary to implement the provisions of related International Conventions to which Tonga is a party.

35. - All regulations, standards or schedules to be promulgated under this Act with the exception of those made under section 37 shall be approved by the Cabinet and published in the Gazette at least 180 days prior to coming into force, and public comment shall be solicited through public hearing or otherwise prior to the final adoption of the regulations.
36. - Any actions for environmental protection taken under this Act shall not pre-empt appropriate local or district governmental authorities from adopting their own environmental protection regulations more stringent than the national regulations.
37. - Where there is an urgent need for controls to prevent environmental degradation that are not provided for by any existing legislative provisions, the Committee may prepare for approval by the Cabinet such temporary regulations as may be required. Such emergency regulations shall come into force immediately upon approval by the Cabinet and shall continue in force for a specified period, not to exceed one year from the date of coming into force, adequate to allow proper legislative action.
38. - (1) Any person who fails to observe the provisions of this Act or of the regulations adopted pursuant to this Act, shall be guilty of an offence and liable, except where otherwise specified in this Act or those regulations, to a fine of up to one thousand pa'anga or to imprisonment for six months or to both such fine and such imprisonment.
- (2) Where the offence is of a continuing nature, each day shall be considered a separate offence for the purposes of this Act.
- (3) Where the offence is demonstrated to be the result of wilful negligence, the guilty party shall be liable to an additional fine of up to ten thousand pa'anga.

Subsidiary Regulations

- Requirements for Environmental Impact Statements 9. -(3)
 Environmental Quality Standards 25.-
 Organism Introductions 30.-

Schedules

- Restricted Substances 22. -(1)
- Class I - Permits required for any use.
- Class II - Permits required for any use other than those specified as approved.
- Prohibited Introductions 29.-
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Stockholm 5-16 June 1972.

DECLARATION OF THE UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT

The United Nations Conference on the Human Environment,

Having met at Stockholm from 5 to 16 June 1972,

Having considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment,

Proclaims that:

1. Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights—even the right to life itself.

2. The protection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world; it is the urgent desire of the peoples of the whole world and the duty of all Governments.

3. Man has constantly to sum up experience and go on discovering, inventing, creating and advancing. In our time, man's capability to transform his surroundings, if used wisely, can bring to all peoples the benefits of development and the opportunity to enhance the quality of life. Wrongly or heedlessly applied, the same power can do incalculable harm to human beings and the human environment. We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment.

4. In the developing countries most of the environmental problems are caused by under-development. Millions continue to live far below the minimum levels required for a decent human existence, deprived of adequate food and clothing, shelter and education, health and sanitation. Therefore, the developing coun-

tries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment. For the same purpose, the industrialized countries should make efforts to reduce the gap themselves and the developing countries. In the industrialized countries, environmental problems are generally related to industrialization and technological development.

5. The natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted, as appropriate, to face these problems. Of all things in the world, people are the most precious. It is the people that propel social progress, create social wealth, develop science and technology and, through their hard work, continuously transform the human environment. Along with social progress and the advance of production, science and technology, the capability of man to improve the environment increases with each passing day.

6. A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well-being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes. There are broad vistas for the enhancement of environmental quality and the creation of a good life. What is needed is an enthusiastic but calm state of mind and intense but orderly work. For the purpose of attaining freedom in the world of nature, man must use knowledge to build, in collaboration with nature, a better environment. To defend and improve the human environment for present and future generations has become an imperative goal for mankind—a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and of worldwide economic and social development.

7. To achieve this environmental goal will demand the acceptance of responsibility by citizens and communities and by enterprises and institutions at every level, all sharing equitably in common efforts. Individuals in all walks of life as well as organizations in many fields, by their values and the sum of their actions, will shape the world environment of the future. Local and national governments will bear the greatest burden for

large-scale environmental policy and action within their jurisdictions. International co-operation is also needed in order to raise resources to support the developing countries in carrying out their responsibilities in this field. A growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive co-operation among nations and action by international organizations in the common interest. The Conference calls upon Governments and peoples to exert common efforts for the preservation and improvement of the human environment, for the benefit of all the people and for their posterity.

II

Principles

States the common conviction that:

Principle 1

Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations. In this respect, policies promoting or perpetuating *apartheid*, racial segregation, discrimination, colonial and other forms of oppression and foreign domination stand condemned and must be eliminated.

Principle 2

The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Principle 3

The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

Principle 4

Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.

Principle 5

The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.

Principle 6

The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order

to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of all countries against pollution should be supported.

Principle 7

States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Principle 8

Economic and social development is essential for ensuring a favourable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.

Principle 9

Environmental deficiencies generated by the conditions of under-development and natural disasters pose grave problems and can best be remedied by accelerated development through the transfer of substantial quantities of financial and technological assistance as a supplement to the domestic effort of the developing countries and such timely assistance as may be required.

Principle 10

For the developing countries, stability of prices and adequate earnings for primary commodities and raw materials are essential to environmental management since economic factors as well as ecological processes must be taken into account.

Principle 11

The environmental policies of all States should enhance and not adversely affect the present or future development potential of developing countries, nor should they hamper the attainment of better living conditions for all, and appropriate steps should be taken by States and international organizations with a view to reaching agreement on meeting the possible national and international economic consequences resulting from the application of environmental measures.

Principle 12

Resources should be made available to preserve and improve the environment, taking into account the circumstances and particular requirements of developing countries and any costs which may emanate from their incorporating environmental safeguards into their development planning and the need for making available to them, upon their request, additional international technical and financial assistance for this purpose.

Principle 13

In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and co-ordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population.

Principle 14

Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment.

Principle 15

Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. In this respect, projects which are designed for colonialist and racist domination must be abandoned.

Principle 16

Demographic policies which are without prejudice to basic human rights and which are deemed appropriate by Governments concerned should be applied in those regions where the rate of population growth or excessive population concentrations are likely to have adverse effects on the environment of the human environment and impede development.

Principle 17

Appropriate national institutions must be entrusted with the task of planning, managing or controlling the environmental resources of States with a view to enhancing environmental quality.

Principle 18

Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind.

Principle 19

Education in environmental matters, for the younger generation as well as adults, giving due consideration to the underprivileged, is essential in order to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension. It is also essential that mass media of communications avoid contributing to the deterioration of the environment, but, on the contrary, disseminate information of an educational nature on the need to protect and improve the environment in order to enable man to develop in every respect.

Principle 20

Scientific research and development in the context of environmental problems, both national and multinational, must be promoted in all countries, especially the developing countries. In this connexion, the free flow of up-to-date scientific information and transfer of experience must be supported and assisted, to facilitate the solution of environmental problems; environmental

technologies should be made available to developing countries on terms which would encourage their wide dissemination without constituting an economic burden on the developing countries.

Principle 21

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 22

States shall co-operate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.

Principle 23

Without prejudice to such criteria as may be agreed upon by the international community, or to standards which will have to be determined nationally, it will be essential in all cases to consider the systems of values prevailing in each country, and the extent of the applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for the developing countries.

Principle 24

International matters concerning the protection and improvement of the environment should be handled in a co-operative spirit by all countries, big and small, on an equal footing. Co-operation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce and eliminate adverse environmental effects resulting from activities conducted in all spheres, in such a way that due account is taken of the sovereignty and interests of all States.

Principle 25

States shall ensure that international organizations play a co-ordinated, efficient and dynamic role for the protection and improvement of the environment.

Principle 26

Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.

*21st plenary meeting
16 June 1972*