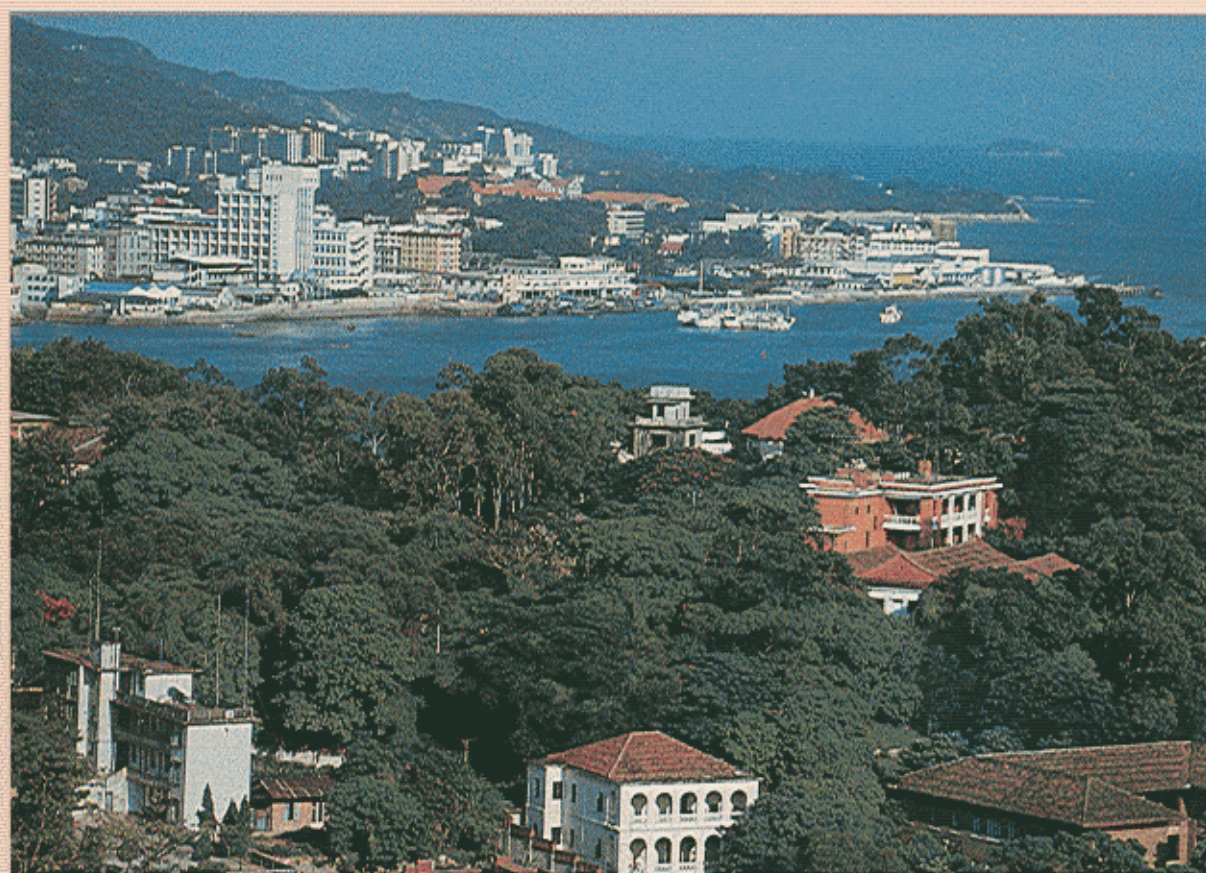


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STRATEGIC
MANAGEMENT PLAN
FOR MARINE POLLUTION
PREVENTION AND
MANAGEMENT
IN XIAMEN



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GEF/UNDP/IMO Regional Programme for the Prevention and Management
of Marine Pollution in the East Asian Seas

**STRATEGIC MANAGEMENT PLAN
for Marine Pollution Prevention and
Management in Xiamen**

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FOREWORD

The primary objective of the Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas (MPP-EAS) is to support the efforts of the 11 participating governments in the East Asian Region to prevent and manage marine pollution at the national and sub-regional levels on a long-term and self-reliant bases. The Programme framework is built upon innovative and effective schemes for marine pollution management, technical assistance in the most strategic marine sector of the region, and provision of opportunities to attract other agencies and the private sector for funding and investment. The Programme has a two-pronged strategy—achieving regional cooperation and sustainability, and capacity building. The more specific strategies to attain its objective are:

- Develop and demonstrate workable models on marine pollution reduction/prevention and risk management.
- Assist countries in developing the necessary legislation and technical capability to implement international conventions relating to marine pollution.
- Strengthen institutional capacity to manage pollution programs.
- Develop regional network of stations for marine pollution programs.
- Promote public awareness on and participation in the abatement of marine pollution.
- Facilitate standardization and intercalibration of sampling and analytical techniques and environmental impact assessment procedures.
- Promote sustainable financing for activities requiring long-term commitments.

One of the Programme's activities in articulating the above strategies is the establishment of demonstration projects. Located in the southern part of Fujian Province, People's Republic of China and north of Taiwan Strait, Xiamen is one of the three demonstration sites of the MPP-EAS. Xiamen consists of the Xiamen Island proper, Gulangyu Islet and the coastal part of the north bank of inland Jiulongjiang River. The Xiamen Municipality comprises six districts and one county, namely: Kaiyuan, Siming, Gulangyu, Huli, Jimei and Xinglin Districts and Tong'an County.

Xiamen Municipality is one of the five “special economic zones” (SEZ) approved by the State Council of the People’s Republic of China. It has been transformed into a beautiful port city with fairly complete infrastructure and vigorous economic exchange, locally and abroad. The industrialization of Xiamen has accelerated in recent years, providing a variety of technologically advanced products that are very competitive in the international and domestic markets.

The pace of economic development in Xiamen compounded by population increase have exerted significant impacts on the coastal environment, especially those associated with pollution and resource-use conflicts. Traditional management approaches to mitigate those impacts have not been successful. The MPP-EAS selected Xiamen as a demonstration site which adopted the integrated coastal management (ICM) framework to address the effects and potential consequences of socioeconomic activities and marine pollution.

The *Strategic Management Plan for Marine Pollution Prevention and Management in Xiamen* articulates the adoption of the ICM approach and contains strategic actions and guidelines for both short- and long-term management of coastal resources in Xiamen. It addresses the management problems identified in the *Coastal Environmental Profile of Xiamen*. The plan emphasizes the balance between economic development and environmental management, stressing the sustainable use of the coastal and marine resources. The goal is to improve the marine environmental quality of Xiamen while ensuring sustainable development. This plan has been adopted by the Municipal Government of Xiamen as a general framework for marine environmental management.

Chua Thia-Eng
Regional Programme Manager
GEF/UNDP/IMO Regional Programme
for the Prevention and Management of
Marine Pollution in the East Asian Seas

PREFACE

Before the 1980s, large-scale reclamation of nearshore areas in Xiamen significantly altered its coastal environment. However, water quality, in general, was considered clean. The level of economic development, especially industrialization, was relatively low and largely dependent on the municipality's primary resources such as agriculture and fishing. Thus, pollution input associated with land-based activities was relatively small.

In the 1980s, the State Council of the People's Republic of China declared Xiamen a Special Economic Zone (SEZ). Since then, the socioeconomic growth of Xiamen Municipality has increased due to its policy of building Xiamen into "a modern, international, maritime and scenic city." This policy has set new requirements for the use and management of Xiamen's natural resources, particularly its coastal lands and waters. As a consequence, industrialization and urbanization accelerated; population growth increased; uses of coastal and marine resources diversified and intensified resulting in severe space competition, resource-use conflicts, and pollution. These adverse consequences of unregulated economic growth and population increase resulted in the reduction and deterioration of natural habitats and living resources, siltation and erosion, retreat of shoreline, and blocking of navigation channels.

These problems on resource-use conflicts and pollution call for innovative approaches to manage the coastal environment and its resources. Apparently, China's traditional coastal management system could not keep up with its rapid economic development. In the early 1980s, a nationwide comprehensive survey on coastal resources was carried out to provide a scientific basis for its rational use and to improve its management. However, coastal management system still remains fragmented.

The weakness of traditional approaches to coastal management has been recognized. Thus, efforts were made to explore better management alternatives that could promote sustainable resource use and ensure healthy socioeconomic growth. In 1993, the Xiamen Demonstration Project (XDP) was launched under the Global Environment Facility/United Nations Development Programme/International Maritime Organization (GEF/UNDP/IMO) Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas (MPP-EAS). One of its subprojects led to the development of a Strategic Management Plan (hereinafter referred to as the Plan) which applies the integrated coastal management (ICM) system in tackling marine pollution problems affecting Xiamen.

This Plan contains strategic actions and guidelines for both short- and long-term management of the coastal resources in Xiamen including the prevention and management of land-based pollution sources and its impact. The goal is to improve marine environmental quality and maintain socioeconomic growth in a sustainable manner.

The Plan has the following sections:

- strategic management objectives;
- management policies and methods;
- content and schedule of the management plan;
- methods for implementation, monitoring and evaluation of the management plan; and
- budgetary arrangements.

Coastal management is considered here as a government intervention. This Plan provides the required instructions, guidelines, procedures, and methodologies for implementing, monitoring, and evaluating coastal management actions with the participation of all the stakeholders and concerned sectors. Therefore, the Plan must be adopted by the government and incorporated into its overall socioeconomic development program.

Initial draft of the Plan was sent to various government agencies and sectors such as the Municipal Environmental Protection Agency, Harbour Authority, Maritime Safety Superintendency, Urban Planning Bureau, Fishery Agency, Economic Planning Commission, Legislative Bureau, Marine Management Division, Marine Management Branch of the State Oceanic Administration (SOA), and the District Governments, as well as individual experts of various disciplines. The final draft of the Plan incorporating the comments and suggestions from these institutions and individuals was then reviewed and endorsed by the Experts Committee. It was adopted by the Executive Committee for the Xiamen Demonstration Project on 18 November 1995 as the guiding framework for managing coastal and marine environment and the natural resources in Xiamen.

The Plan was drafted with the participation of various institutions and individuals. The Team would like to extend its sincerest gratitude to these participating institutions and individuals which are too numerous to mention here. It also wish to thank, in particular, Dr. Chua Thia-Eng and his staff at the Programme Development and Management Office (PDMO) in Manila for their help and technical guidance in completing the Plan.

Integrated Task Team of the
Xiamen Demonstration Project

EXECUTIVE SUMMARY

The sea is the resource base for Xiamen's economy to survive, develop and boom. Xiamen's socioeconomic development and its inhabitants' well-being is closely linked to the marine environment. Therefore, integrated coastal management (ICM) and marine environmental protection are urgent and important factors for the success of the ninth five-year plan and the planning for the year 2010 of Xiamen Municipality. Based on the objectives of national economy and social development to build Xiamen into "a socialist, modern, international, and scenic port city" and the analysis of Xiamen's coastal environmental status and management problems — the Strategic Management Plan for Marine Pollution Prevention and Management in Xiamen sets the general objective and their implementation modalities for the ninth five-year period and the year 2010. This plan includes the management approaches and tactics, tasks and their schedules, monitoring and evaluation mechanisms, and sustainable financing requirements.

The present document contains six chapters.

Chapter I has four parts. The first concisely analyzes the environmental status of Xiamen. The second characterizes the benefits from marine pollution prevention and management in Xiamen Municipality. The third illustrates the existing issues and problems with the current marine management. And, the fourth analyzes the changing marine environmental quality in Xiamen focusing on marine pollution, ecological and environmental changes, and their consequences. Although the coastal water of Xiamen Municipality basically meets the requirement of Class II of the National Seawater Quality Standards, serious pollution in various levels are observed in some localities such as the Maluan Bay and the Yuan Dang Lake.

The major management problems in Xiamen are:

1. weak capability for pollution prevention and mitigation;
2. lack of integrated planning, uncoordinated or unregulated marine resource development;
3. single sector-oriented policy-making and ineffective coordination;
4. inadequate legal system for effective resolution of multiple coastal resource-use conflict and poor law enforcement;
5. insufficient funding for integrated environmental management;
6. weak marine environmental consciousness among the policy-makers and lack of awareness by the general public;
7. low capability of integrated management;
8. lack of sound scientific knowledge;

9. scattered sources of data and information and lack of interdisciplinary and cross-sectoral exchange, analysis, and assessment;
10. outdated coastal zone management concepts; and
11. inaction on resource-use conflicts and pollution across administrative boundaries.

Finally, with human induced ecological and environmental changes, Xiamen coastal lands and waters have gradually become a complex of natural and artificial ecosystems with increased vulnerability. The pollution risk is growing with the uncontrolled coastal developments such as the following:

1. causeway construction and reclamation which changed the hydrology and flushing capability of the coastal waters that led to the degradation of habitats and siltation of navigation channels;
2. intensified coastal land uses and construction activities which increased the quantity of sand and pollutants in the sea and altered the navigation channel;
3. overexploitation of fisheries resources which destroyed nearshore living resources;
4. urban effluent discharge which polluted the coastal waters and affected residents' health through the consumption and use of aquatic products;
5. intensified mariculture which polluted its surroundings and affected navigational safety;
6. sharp increase in the number of coastal factories and ships of various sizes which increased the possibility of spill accidents; and
7. sand quarrying and unregulated construction on beaches which resulted in erosion and coastal retreat, and damage to coastal infrastructures and ecosystem.

Chapter 2 presents management strategies, including the general objective and specific objectives, as well as the phased targets for the ninth five-year plan and the year 2010 of the Strategic Management Plan.

The general objective of the Strategic Management Plan is to develop and strengthen the integrated coastal management (ICM) system in Xiamen by implementing a series of actions for the prevention and control of marine pollution to make its coastal lands and waters clean, safe and amenable. This aims to achieve a harmonious integration of the marine environmental protection and socioeconomic development for Xiamen Municipality.

The objectives for the year 2000 are the following:

1. to establish and strengthen the ICM framework and its effective operational mechanisms;
2. to develop comprehensive laws and rules for ICM, in general, and prevention and mitigation of marine pollution, in particular;
3. to formulate and implement scientific marine functional zonation scheme;

4. to develop a system of monitoring, surveillance, prevention and response for marine accidents;
5. to establish a preliminary framework on sustainable financing mechanisms for marine environmental management;
6. to strengthen law enforcement and the training of personnel; and
7. to mitigate marine pollution, particularly in Yuan Dang Lake and Maluan Bay, to ensure that their water quality meets the current seawater quality standards of Class III. The water quality of the West Harbor shall meet Class II standards. The other sea areas shall maintain their good environmental quality.

The objectives for the year 2010 are the following:

1. to establish a comprehensive legal framework for the prevention of marine pollution including legislation, regulations, implementing rules, and technical standards;
2. to improve marine functional zonation scheme and waste water discharge;
3. to develop the information system on integrated environmental monitoring and surveillance with the participation of adjacent regions and to strengthen the networking of such a system with regional mechanisms for marine pollution prevention and management in the East Asian Seas;
4. to further expand international exchange and cooperation in the development of ICM and for the prevention and management of marine pollution;
5. to further strengthen the system of environmental emergency preparedness and response;
6. to establish a sustainable and reliable financing system for marine environmental protection;
7. to effect total quantity control of marine pollution by land-based sources;
8. to maintain marine ecosystem health; and
9. to achieve sustainable uses of marine resources.

The specific objectives of the Plan are the following:

1. to strengthen integrated coastal management system in Xiamen Municipality;
2. to establish comprehensive and operational local regulations;
3. to enhance the integrated management capability for pollution source control and mitigation;
4. to maintain the environmental quality of the coastal lands and waters;
5. to develop sustainable and reliable financing mechanisms and options;
6. to advance monitoring, surveillance, evaluation, and information management systems; and
7. to enhance public awareness and participation.

Chapter 3 describes the policies and tactics to implement the strategic management objectives, including (a) integrated planning and management; (b) resource evaluation

and environmental accounting; (c) principles of marine area use and pollution damage compensation; (d) precautionary principles; (e) public participation; and (f) sustainable financing mechanisms for environmental management (e.g., market-based instruments).

Chapter 4 presents an action plan and a schedule for achieving the general objective. The actions cover: (a) establishment of an ICM system; (b) development of ICM-oriented legislation and regulations; (c) development of scientifically sound marine functional zonation scheme; (d) application of ICM system for marine pollution, prevention and mitigation, protection of endangered species, and preservation of scenic spots; (e) development of an action plan for environmental protection and contingency planning in the West Harbor; (f) strengthening ICM capability; (g) establishment of an integrated marine environmental monitoring, surveillance and evaluation system; (h) strengthening marine environmental public awareness; (i) promotion of training and education for human resource development and uses; (j) development of stable and reliable financing mechanisms for environmental management; and (k) establishment of an integrated information system for ICM and coastal users.

Chapter 5 introduces various arrangements required for the implementation, monitoring and evaluation of the strategic management plan, which includes the implementors, monitoring and review procedures, evaluation criteria, and the public opinion poll.

Finally, Chapter 6 covers the budgetary requirements for implementation. The total budget for the ninth five-year plan is estimated at 59.345 million RMB (about US\$ 7.237 million).

提 要

海洋环境与厦门市的社会经济发展息息相关。因此,海岸带综合管理和海洋环境保护是确保厦门市达到“九五”计划(1996-2000)和2010年规划目标的十分迫切的任务。厦门市海洋污染防治和管理战略计划根据“将厦门建成一个社会主义现代化国际性港口风景城市”这一国民经济与社会发展目标和厦门海岸带环境状况分析,提出“九五”期间和2010年的战略计划的总体目标和实施方案,确定了管理方针、策略和任务及其时间安排,提出该计划的监督和评价机制,并提出可持续的经费估算。该战略计划共分为六章。

第一章分四节:第一节简要分析环境现状。第二节分析了厦门市开展海洋污染防治和管理的有利条件。第三节着重揭示现行海洋管理中存在的问题。第四节分析了厦门海洋环境质量的变化趋势。分析着重于海洋污染、生态与环境变化及其影响。尽管厦门海域基本保持国家海水标准的二类海水水质,但有些地方例如马銮湾和员当湖已出现不同程度的严重污染。

管理的主要问题包括:

1. 污染防治能力薄弱;
2. 缺乏总体规划,海洋资源开发无序;
3. 政出多门,协调不力;
4. 法规体系不能有效解决各种海岸带资源利用冲突,执法不力;
5. 环境综合管理投入不足;
6. 决策层海洋环境意识薄弱,公众宣传不足;
7. 综合管理能力亟待提高;
8. 缺乏充分的科学的认识;
9. 资料和信息零碎,缺少交流和综合分析评价;
10. 海岸带管理观念滞后;
11. 涉及周边海域的资源利用冲突和污染问题有待进一步协调。

由于人类活动引起的生态和环境的变化,厦门的海岸带和水域已逐渐演变为自然人工复合生态系统,同时

无控制的海岸带开发活动也使污染的风险加大,例如:

1. 筑堤和围海造地,改变水动力和冲刷能力,导致生境变化、航道淤积;

2. 沿海陆地的开发建设活动,增加泥沙和污染物的入海通量,堵塞航道;

3. 酷渔滥捕破坏近海生物资源;

4. 城市排污造成海域污染,并通过水产品影响公众健康;

5. 过度的海水养殖,既污染环境,又影响航运安全;

6. 沿海工厂企业和海上大小船只的骤增使事故发生的风险越来越大;

7. 海滩取沙和不合理的占滩建筑,导致滩蚀岸退,破坏滨海景观和生态系统。

第二章提出了计划的总体和具体目标,“九五”期间与2010年的阶段目标和管理战略。

战略管理计划的总体目标是:通过实施一系列预防与控制海洋污染的海岸带综合管理行动,建立健全海岸带综合管理体系,实现厦门海洋环境保护与社会经济发展的协调统一。

2000年目标是:

1. 建立健全海岸带综合管理框架及有效的运行机制;

2. 制定海岸带综合管理的综合性法规及预防和减轻海洋污染的专项法规;

3. 编制和实施海域功能区划;

4. 建立海洋监测监视和事故预防与应急系统;

5. 建立海洋环境管理的可持续财政机制的初步框架;

6. 加强执法力度和人员培训;

7. 减轻海洋污染,重点是员当湖和马銮湾,确保该水体水质达到现行三类海水水质标准,西港水质达到现行的二类海水水质标准,其他海域保持现有的环境质量。

2010年目标是:

1. 建立预防海洋污染的综合性的法律框架,包括法规、规章、实施细则和技术标准;

2. 调整改进海域功能区划和废水排放标准;

3. 建立与邻近海域的统一监测监视信息系统并实现与东亚海域海洋污染预防和管理项目区域性网络联网;

4. 进一步加强海岸带综合管理和海洋污染预防与管理的国际间交流与合作;
5. 进一步健全环境应急系统;
6. 建立可持续的和可靠的海洋环境保护的财政系统;
7. 实行陆源入海污染物的总量控制;
8. 保持海洋生态的良性循环;
9. 实现海洋资源的持续利用。

具体目标是:

1. 加强厦门市海岸带综合管理机构;
2. 颁布可操作的综合性地方法规;
3. 增强控制污染源和减轻污染的综合管理能力;
4. 维持海岸带和海域的环境质量;
5. 建立可持续、可靠的财政支持机制;
6. 建立现代化监测监视、评价和信息管理系统;
7. 提高公众海洋意识, 促进公众参与。

第三章论述了实现战略管理目标应采取的方针和策略, 包括: 1. 综合规划和管理; 2. 资源评价和环境核算; 3. 海域有偿使用与海域污染损害赔偿原则; 4. 预防为主的方针; 5. 公众参与; 6. 环境管理的可持续财政机制, 例如, 市场化方式。

第四章提出行动计划和时间进度安排。具体活动包括: 1. 建立海岸带综合管理体系; 2. 制定海岸带综合管理的法规和规章; 3. 制定科学合理的海域功能区划; 4. 运用海岸带综合管理体系预防和减轻海洋污染, 保护濒危物种和风景名胜; 5. 制定西港环保行动计划和紧急事故应急计划; 6. 加强海岸带综合管理能力; 7. 健全海洋环境监测监视和评价系统; 8. 增强公众的海洋环境意识; 9. 发展培训和教育事业, 促进人才开发和使用; 10. 建立稳定可靠的财政支持机制; 11. 建立综合的信息系统, 为海岸带综合管理和海域使用者服务。

第五章对战略计划实施、监督和评价方案进行论述, 包括监督监视程序、计划完善过程、评估标准和民意测验方法。

最后, 第六章是实施战略管理计划的经费估算。估计“九五”期间的总预算金额为5934.5万元人民币。折合723.7万美元。

LIST OF ACRONYMS

COD	Chemical Oxygen Demand
GDP	Gross Domestic Product
GEF/UNDP/IMO	Global Environment Facility/United Nations Development Programme/International Maritime Organization
GIS	Geographic Information Systems
ICM	Integrated Coastal Management
MPP-EAS	Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas
MMF	Marine Management Foundation
PDMO	Programme Development and Management Office
SOA	State Oceanic Administration
XDPP	Xiamen Demonstration Project
XDS	Xiamen Demonstration Site

Environmental Status and Management Issues



ENVIRONMENTAL STATUS AND MANAGEMENT ISSUES

Environmental Status

Marine Pollution. Since the 1980s, Xiamen coastal waters have experienced changes in various areas, but in general, the water quality remained under Class II of the National Seawater Quality Standard. In some areas, however, this is not the case. Based on the analysis of chemical oxygen demand (COD), fecal coliform count, total inorganic nitrogen, inorganic phosphorus, oil in seawater, and sulfide and organic matters in sediment, the environment of Maluan Bay showed that it is seriously polluted. The concentrations of other parameters, except for oil and inorganic nitrogen, have exceeded Class IV standard. On the other hand, the environmental quality of Tong'an Bay is good and meets Class I standard, except for COD and total nitrogen contents which are below par. The concentration of fecal coliform in Tong'an Bay water is much lower compared to other areas and is suitable for shellfish culture safe for human consumption.

Ecosystem Health and Threats. Xiamen has several types of marine ecosystems, such as inner bay, estuary, and islands. Xiamen's marine primary productivity is high. Chlorophyll-a averages at 2.5 mg/m^2 over time. Primary productivity averages at 167

$\text{mg-c}/(\text{m}^2\text{-d})$. More than 1,300 marine species are recorded in Xiamen coastal waters. With intensified human activities, Xiamen coastal waters have become a complex mix of natural and artificial ecosystems with increased sensitivity and vulnerability.

Major ecosystem changes in Xiamen coastal waters are the following:

1. *Habitat Alteration and Degradation* - The causeways of Gao-ji, Maluan, Yuan Dang and Dongyu have reduced the water surface of the West Harbor by about 40 percent. The lower tidal flat has been reduced to 30 km^2 which led to dislocation of marine habitats such as spawning, nursery, and feeding grounds as well as migration routes. The sediments off Liuwudian in Tong'an Bay changed from coarse to muddy type due to unregulated coastal reclamation. Consequently, the lancelet (*Branchiostoma belcheri*), a protected fish species that used to inhabit the sandy bottom, disappeared from this area. Reclamation activities are still going on and the habitats are further being altered.
2. *Deterioration of Seawater and Sediment Quality* - The cumulative effects of marine pollution have degraded seawater and sediment quality in Maluan Bay and north

of West Harbor. These resulted in reduced seafood production, and adversely affected human and ecosystem health. Biomass have decreased or have been depleted of sensitive species, but pollution-resistant ones have increased. Thus, the change in species composition, especially phytoplankton contributed to red tide occurrences.

3. *Endangered Species-*

Once widely distributed in Xiamen Island, Tong'an, and Dongyu Island, mangroves can be found only in few areas in Haicang and Dongyu Island. Egrets, the mascot of Xiamen, once were quite common in the West Harbor, particularly in Yuan Dang Lake, all disappeared due to pollution. Recently, the egrets have returned as a result of a comprehensive pollution control and improved environmental quality program. The lancelet is an endangered species in Xiamen. It used to be an important fishery resource. Its past annual

production off Liuwudian in Tong'an County reached 280 tons. However, this fishing ground had disappeared. In addition, the Chinese White Dolphin (*Sousa chinensis*) which were frequently observed in Xiamen

coastal waters during the 1960s can rarely be found nowadays.

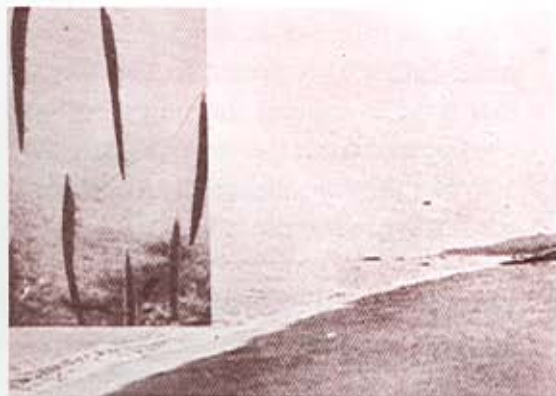
The main causes of ecosystem changes in Xiamen coastal waters are:

1. *Construction of Causeways and Reclamation* - The Gao-ji causeway greatly reduced the water exchange between its east and

west sides. The reclamation of Xinglin Bay, Maluan Bay, and Yuan Dang Lake reduced tidal water influx by about 110 million m^3 per tidal period. In addition, the ongoing and planned coastal engineering may cause major loss of beaches and shallow water areas by 6.5 km^2 and further reduce the influx by about 15-20 million m^3 per tidal period. Over forty years, Tong'an Bay has been reclaimed to about 30 km^2 . All these factors have induced changes in the hydrodynamic regime by reduction of tidal influx, and isolation of the inner bay from the offshore waters. Consequently, the pattern of flushing, siltation and erosion in coastal zones of Xiamen have weakened the capacity for pollutant dilution and diffusion. Habitat conditions changed and altered the structure and function of marine ecosystems. Thus, the functional integrity of Xiamen's coastal ecosystem is at risk.



Xiamen's mangrove forests are found only in Haicang and Dongyu Island.



Branchiostoma belcheri or lancelet (inset) in its intertidal zone habitat (sandy beach).

2. *Soil Erosion* - Apart from the influence of the Jiulongjiang River runoff, the loss of vegetation due to development activities along the West Harbor led to soil erosion and increased quantity of sand and pollutants in coastal waters. Coastal reclamation without cofferdam also put large amounts of sand and mud inshore, thus compounding the siltation in navigation channels and water pollution.
5. Pell-mell aquaculture development in tidal flats and shallow waters changed the ecosystem conditions of the culture areas and also caused marine pollution.

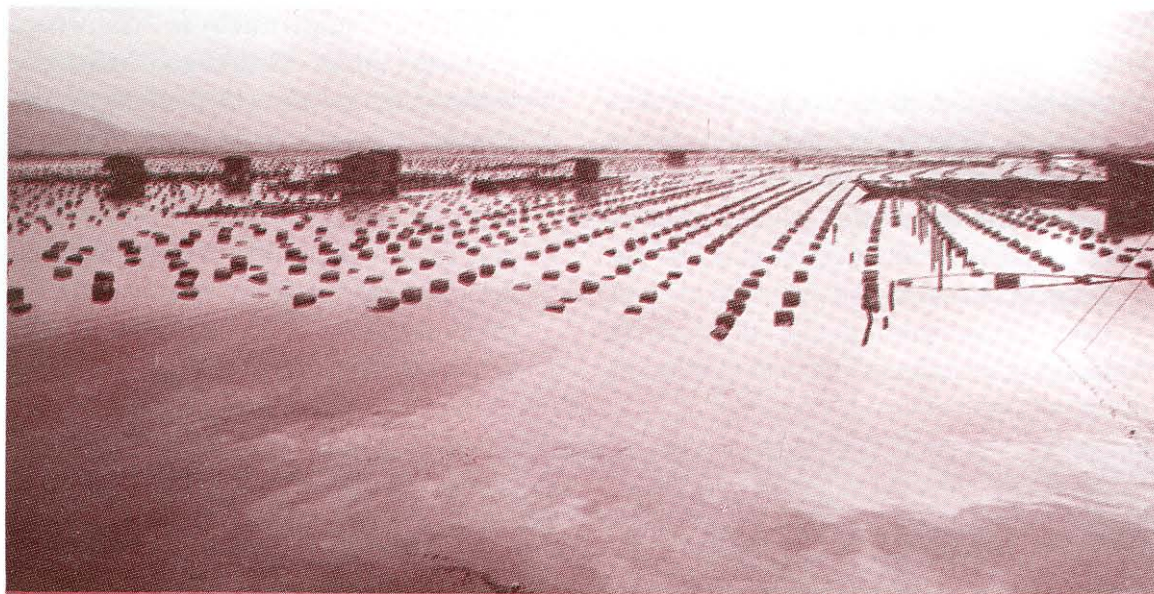


Coastal reclamation without cofferdam.

3. *Overfishing* - Although laws and regulations on fishery resources protection came into effect years ago, they have not been effectively enforced. Unregulated fishing is common in Xiamen waters, especially the use of illegal fishing gears and methods that cause serious damages to living aquatic resources.
6. Pollution by oil spills and waste discharges from ships.
4. *Urban Effluents* - At present, only the Yuan Dang Sewage Treatment Plant is in operation. It handles 30 million tons of waste water per year which is clearly not sufficient for the whole urban area. With rapid economic development and population growth, waste water



Waste water being discharged along coastal waterways.



Pell-mell aquaculture development in tidal flats (Xinglin Bay).

7. *Shoreline Erosion* - In the north, east and southeast of Xiamen Island, beaches have been eroded and the shoreline have receded. This was due to illegal quarrying and unregulated construction over the past ten years which altered the geomorphic balance along these shores.

Environmental Trends

Targets of Socioeconomic Development. The socioeconomic development goal in Xiamen is to build “a modern, international, scenic port city,” with prosperous economy, advanced science and education, effective legal system, civilized society, a healthy environment and high standard of living. Xiamen Municipality is projected to have a population of 1.35 million, a GDP of over 40 billion RMB and a port-handling capacity of 35 million tons by the year 2000. For the year 2010, the population is projected to be at 1.7 million and the GDP to 200 billion RMB. Industrial development

such as for machineries or equipment, electronics, petrochemicals, energy, metallurgy, and construction materials will be crucial in the realization of the development goal.

Environmental Change. Environmental problems are exacerbated due to existing backward and inadequate infrastructures for urban development and environmental facilities that cannot keep pace with the economic development of the city. The marine environment would suffer and environmental problems could be serious. Before the year 2000, most of the pollutants are predicted to be discharged continuously into the Maluan Bay and Yuan Dang Lake, unless major measures will be taken. This could aggravate water pollution in the northern part of the West Harbor and Yuan Dang Lake even if there were substantial pollution mitigation in the past. The environmental quality for the rest of the West Harbor could also be reduced if the waste water treatment plants at the Xiamen Island and the Songyu-Haicang areas are

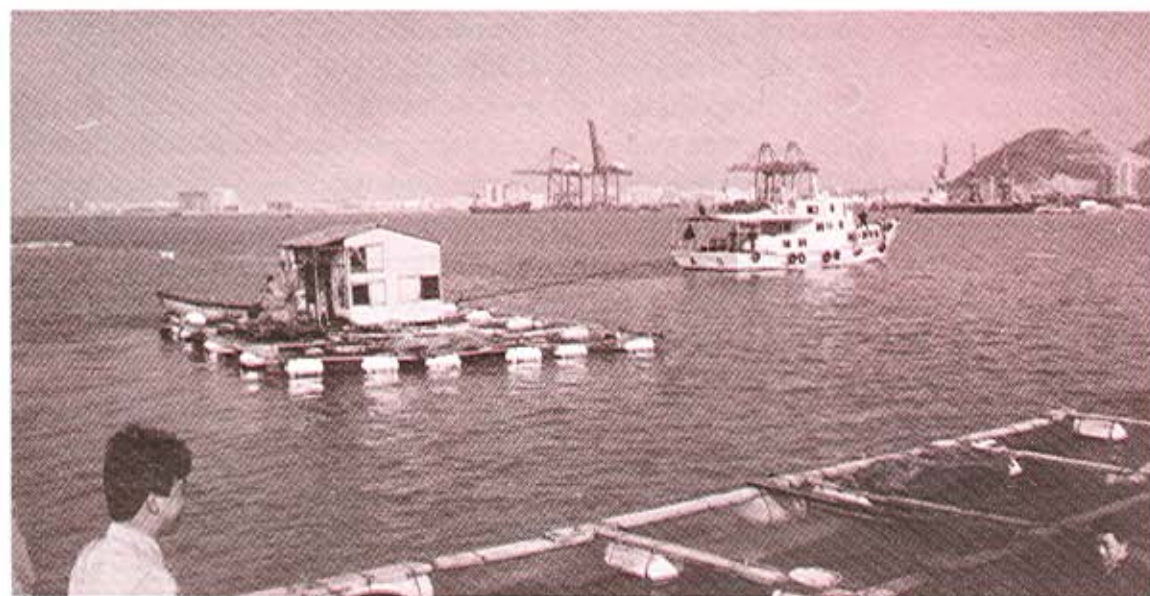
not constructed and operated as planned. Also, the environmental quality of Tong'an Bay would be affected by coastal industries and mariculture.

The ecological balance of Jiulongjiang River Estuary and the Outer Harbor would gradually deteriorate because of the discharge of industrial waste water. On the other hand, the Eastern Channel and the seas around Dadeng Island would maintain its healthy ecosystem if precautionary measures will be taken.

Management Issues

Despite mitigating efforts toward marine environmental protection in Xiamen, certain management issues are significant due to rapid socioeconomic development. The marine environmental management problems are as follows:

1. *Multiple Use Conflicts and Lack of a Master Plan* - Coastal natural resource use and environmental protection have been managed thus far by individual line
2. *Single Sectoral-Oriented Policy and Weak Coordination* - There are 12 sectors from the central, provincial, and local governments engaged in coastal management. They carry out their respective functions without integrated planning and coordination which result in fragmented policy-making and sometimes coastal use conflicts.



Conflicts between mariculture and port development i.e., mariculture rafts encroaching into navigational channels

3. *Drawbacks in Rules and Regulations* - Although basic marine environmental legislation and some specific management measures have been developed, their integrity and complementarity are inadequate. There is no legal framework that considers the totality and interrelatedness within the coastal environment, let alone detailed provisions and technical instructions for ICM. The existing laws and regulations basically recognize the system of sector-oriented legislation and management without holistic concept and consideration for the overall benefit being derived from multiple coastal uses. Thus, some laws and regulations need to be modified and specified accordingly in response to this need.

Moreover, the enforcement mechanisms and procedures for coastal environmental management are yet to be established. These should include regulations concerning the prevention and control of pollution incidents by ship which are not yet in order. Generally, the laws and regulations for ICM are still pending.

4. *Weak Capability in Pollution Prevention and Mitigation* - Facilities for pollution prevention and mitigation are inadequate. Sewage pipeline system is incomplete. The total volume of waste water in Xiamen Municipality is estimated at 100×10^6 t/a. In contrast, their treatment capacity is about 35×10^6 t/a. Factories suffer from inherent shortage of waste treatment facilities that are poorly designed and technologically outdated. Also, there is a growing number of motor vehicles resulting in increased atmospheric pollution.

The capability for prevention and management of marine pollution from port and ship is very low. At present, only Dongdu Port is constructing pollution control facilities. However, these facilities will soon become inadequate to meet the requirements for pollution prevention and mitigation due to rapid port expansion. Other port areas have no such facilities at all. Preparedness and response systems are urgently needed to tackle oil spill and the spill of dangerous chemicals. In view of a projected increase in port handling capacity by 20 million tons per year for the next five years, the intensified sea traffic in the West Harbor and inadequate sea traffic control will increase the probability of oil and dangerous chemical spill. Thus, the establishment of a pollution control contingency system is an urgent task at present.

5. *Insufficient Funding for Integrated Environmental Management* - Shortage of fund makes it difficult to achieve the objectives of environmental protection. According to statistics, the fund for environmental protection in Xiamen Municipality has increased in recent years, accounting for 0.8 percent of the GDP. However, it is still insufficient as 2.19 percent would be necessary for effective pollution prevention and environmental protection. Environmental funding is primarily dependent on government appropriation. With insufficient funding, many important environmental projects remain unimplemented.
6. *Weak Environmental Public Awareness* - At present, there is a tendency to place marine environmental protection behind marine development and exploitation. This is partly due to low

environmental public awareness. In order to sustain the socioeconomic development of Xiamen Municipality, there is a need to enhance environmental education and awareness, especially among the citizenry of Xiamen.

7. *Low Capability of Integrated Coastal Management* - Integrated coastal management requires a combination of consultative mechanism, various types of expertise, competent personnel, effective administration and communication, etc., which are all deficient in Xiamen.
8. *Inadequate Scientific Knowledge* - For a long time, the development and management of the coastal zone in Xiamen Municipality were hardly based on the scientific understanding of the processes in the coastal and marine systems. A typical case was the construction of the Yuan Dang and the Maluan causeways which had considerable adverse effects on the coastal ecosystem. These effects included changes in hydrodynamics, siltation of nearshore areas and navigation channels, reduction of environmental carrying capacity, and marine pollution.

In addition, there were few studies concerning vital issues on marine pollution and management, such as impacts of vehicular exhausts, mariculture, port and ship pollution, emergency management for oil spill and chemical accidents, effects of sand and pollutants transported from the Jiulongjiang River to the channelization and environmental quality of the West Harbor, forecasting impacts of socioeconomic development on the environmental quality of the West Harbor and other areas, as well as the long-term variability of the marine ecosystem.

9. *Lack of Sound Information System* - Many marine environmental studies and investigation have been carried out by scientific research institutions and universities. Marine monitoring, surveillance, and environmental impact assessments have been conducted by marine management and environmental protection agencies. Consequently, considerable amount of marine environmental data have accumulated. However, most of these are not systematically collected over time. Thus, these could not provide sufficient scientific information useful for the integrated coastal management of Xiamen.

There are three major problems. First, the area under study is limited. In the past, research activities were mainly directed to the West Harbor and the Estuary. Few studies were done on Tong'an Bay, the Outer Harbor, and the Eastern Channel. With Xiamen's socio-economic expansion—urban activities, the production and continuous migration of people toward the eastern, northern, and southeastern parts of Xiamen Island and Tong'an County—coastal environmental conditions in these areas need urgent assessment.

Second, there is no thorough study on pollution sources except for the West Harbor where land-based sources of pollution were investigated in 1989. However, the study has not been updated on recent changes associated with Xiamen's rapid socioeconomic development. Information on sea-based pollution sources is deficient including pollutants entering the coastal waters through the atmosphere and urban storm runoff.

Third, information management is poor. Sets of information are scattered without being shared among various research institutions and government departments. This makes systematic use of information and data difficult. In addition, information service system for decision-making in environmental emergency response is lacking.

10. *Outdated Coastal Management Concept*

- The coastal zone is a geographical continuum between land and sea with multiple features. Thus, one component (be it terrestrial or marine) cannot be taken in isolation with the other components when considering coastal resource utilization and development. Otherwise, multiple coastal use conflicts can be particularly serious. Therefore, coastal management must change from the traditional mode of strictly sectoral resource exploitation and environmental protection into a new and integrated management approach for both policy and strategy. The present management and administrative modes by sectors on the coastal zone are actually simple extension of land use experience. Such types of management will certainly result in the development and exploitation of marine resources by sectoral interests. This will hamper the optimal utilization of various marine resources on a sustained level. Integrated planning and development by various sectors should be conducted in the light of interactions and interdependence of coastal resources. Thus, new management concepts and strategies must be adopted to combat these short-term and single-sectoral perspectives for the rational and sustainable development of coastal resources among relevant sectors and stakeholders without compromising the

functional integrity of coastal and marine ecosystems.

11. *Transboundary Problems* - Environmental pollution occurring beyond Xiamen's jurisdiction would also have significant effects on Xiamen's marine environmental quality. For example, the waters under the jurisdiction of Xiamen Municipality receive pollutants from Jiulongjiang River and adjacent regions which have adverse effects on the marine environmental quality of Xiamen.

Advantages and Opportunities

Xiamen has many advantages in adopting the integrated coastal management (ICM) for the prevention and mitigation of marine pollution. Government leaders at various levels are paying increased attention to coastal development, resource conservation and management, thus creating a favorable policy-making climate for ICM. Xiamen has local legislative rights as empowered by the National People's Congress, an advantage to undertake marine management initiatives. With steady economic growth as a Special Economic Zone since the 1980s, Xiamen's poverty level has reduced, people's living standards enhanced as well as increased the demand for the protection of resource base and ecosystem health. The strong scientific marine research capability in Xiamen can be tapped for improving marine management. Such efforts resulted in some measures of success in environmental protection and in addressing marine pollution. These efforts clearly demonstrate that despite the issues and problems mentioned earlier, Xiamen possesses the requisites and capability to rationally use and protect its coastal and marine areas.

Objectives of the Plan



OBJECTIVES OF THE PLAN

General Objective

By the beginning of the 21st century, Xiamen will become a socialist, modern, international, scenic port city. It will have an industrial-based economy with per capita GDP equivalent to that of medium-income countries in the world and a high living standard.

For this purpose, its economy must go hand in hand with improving and/or maintaining public welfare and ecosystem health within the context of sustainable development. Thus, this Plan has the overall objective of implementing a series of action plans for the prevention and mitigation of marine pollution through:

- a) establishing and strengthening the ICM system;
- b) maintaining the harmony between marine environmental protection and socioeconomic growth to achieve sustainable development of coastal resources; and
- c) making the coastal areas productive, clean and safe.

Objectives for the Ninth Five-Year Plan Period:

1. Strengthen ICM and its operational mechanisms.
2. Establish comprehensive laws and regulations for the prevention and mitigation of marine pollution.
3. Formulate and implement a scientifically sound marine functional zonation scheme.
4. Establish a system of marine environmental monitoring, surveillance, and emergency preparedness and response.
5. Build up an initial financial support and management system for ICM and environmental protection.
6. Strengthen staff training and exchange.
7. Dredge silted navigation channels, improve sea traffic control and ensure maritime transportation safety.
8. Prevent the worsening of marine pollution by focusing on water quality in Yuan Dang Lake and Maluan Bay to meet Class III standards; and the West

Harbor to meet Class II standards. At the same time, maintain good environmental quality of other sea area.

Objectives for the Year 2010:

1. Strengthen the comprehensive laws and regulations for marine pollution prevention.
2. Refine marine functional zonation scheme and local discharge standards.
3. Establish a broader-based monitoring, surveillance and information system to cover adjacent regions including networking and initiating international exchange on marine pollution prevention and management within the East Asian region.
4. Further strengthen environmental emergency preparedness and response system.
5. Consolidate sustainable financing mechanisms for marine environmental protection.
6. Exercise control over land- and sea-based pollutants to ensure healthy marine ecosystems and sustainable uses of marine resources.

Specific Objectives

To attain the above objectives of the Plan, the government agencies concerned with marine environment must conscientiously enforce the relevant laws, regulations, policies, and guidelines of the State; implement pertinent international conventions; and

participate in major decision-making on society, economy, urban infrastructure development and environmental protection by the local government.

Establishment of an ICM Mechanism for Xiamen Municipality. It has been recognized that Xiamen's coastal zone management system is characteristically multi-functional and single sector-oriented. To address these multi-faceted issues facing Xiamen's coastal zone, there is a strong need to establish an ICM mechanism for Xiamen Municipality. Such a mechanism should be headed by one of the municipal government leaders. It should have an office which will serve as an operational arm to guide and coordinate the development, management, and protection of coastal resources as well as the prevention and management of marine pollution. In addition, it is necessary to establish a supervisory body to oversee the work of such an ICM mechanism.

Establishment of a Set of Comprehensive Local Regulations. Laws are not only the instruments for regulating social relations and guiding human behavior. They are also essential for the prevention and management of marine pollution. Ultimately, Xiamen Municipality must exercise its rights to strengthen legislation on marine environmental protection, within the national legal framework. By the year 2000, the formulation of four or five special regulations on ICM and marine environmental protection will be brought on the legislative agenda of Xiamen Municipality. This will serve as the legal ground for the management of the sea. It is anticipated that by 2010, regulations for ICM and marine environmental protection shall be fully developed and ICM practices codified.

Strengthening Integrated Management Capability in the Control and Mitigation of Pollution Sources. Xiamen has different pollution sources which need integrated and systematic management measures to control such sources and prevent pollution. Thus, by the year 2000, a system for maritime emergency preparedness and response consisting of organizational mechanisms, regulations and rules, rapid response team and required facilities shall be established. Within ten years, the systems will be modernized.

Maintenance of Marine Environmental Quality. This should be the goal for marine pollution prevention and management plan. The specific objectives are the following:

1. To exercise total quantity control over pollutant discharges from point sources, reduce non-point source pollution, and keep the discharge levels of contaminants within the environmental capacity of the receiving waters;
2. To improve urban sewer network by the year 2000 by constructing and expanding four waste water treatment plants. Additional two to three waste water treatment plants will be built by the year 2010, to strengthen waste water recycling with the goal of totally eliminating direct discharge of untreated waste water into the sea;
3. To develop and protect the shoreline based on scientific principles; complete the northeast coastal protection works to prevent further erosion; strengthen the protection and management of sandy beach in the southeast; and promote tourism development that will strike a balance between sandy beach protection and utilization; and

4. To slow down the rate of coastal reclamation, especially in the West Harbor; eliminate unsound practices of reclamation; protect the forest; and promote the rational use of mudflats and wetlands, to keep the water surface area during high and low tides at 52 km² and 30 km², respectively, by year 2010, in order to maintain tidal flushing capability to improve the water quality to meet Class II seawater standards. Water quality of other sea areas should also meet the prescribed environmental requirements.

Establishment of a Sustainable Financing Mechanism. This mechanism would be an economic pillar for marine environmental protection and integrated management, as well as an important component of the Plan. By the year 2000, a fund for marine environmental protection and integrated management in Xiamen Municipality should be established. Financial input in environmental protection should reach at least one percent of the GDP. In coastal engineering and industrial projects, investment for the environment should account for eight percent of their total inputs. By the year 2010, a sustainable financing mechanism shall be established with active participation from all sectors. This system should be in conformity with the level of socioeconomic growth that will be achieved during that time.

Establishment of a Modern System for Marine Environment Monitoring, Surveillance, Evaluation and Information Management. By the year 2000, the marine pollution monitoring center and network for surveillance and information shall be improved and modernized with links to the regional networks on marine pollution monitoring and information management throughout the East Asian Seas.

In 2010, the routine and ad hoc monitoring, surveillance and evaluation of marine environment, including pollution accidents within Xiamen shall be streamlined as marine pollution monitoring and surveillance in Xiamen and its adjacent sea areas will be integrated over a 10-year period.

Enhance Public Awareness and Participation. Public participation symbolizes a conscientious behavior for environmental protection and a fundamental change in perception. Public participation should be multi-sectoral and integrated at several institutional and administrative levels. There should be at least one training activity every year for the leaders and above the county level positions, and for the managers of various enterprises. By the year 2000, there will be study groups on environmental protection in all the

middle schools and 50 percent of the elementary schools, as well as classes on environmental awareness for kindergartens. Mass media shall carry out well-designed environmental education and publicity activities. Also, public awareness drive should be conducted throughout the year.

Strengthening the Management of the West Harbor to Protect and Improve its Environmental Quality. The West Harbor is an important marine area undergoing socioeconomic development in Xiamen. The West Harbor has the worst water pollution problem in Xiamen. Thus, it becomes a priority area in the municipality for marine pollution prevention and management. It is also urgent that marine management in Xiamen focuses on strengthening management and improving the environmental quality of the West Harbor.

Management Policies and Strategies



CHAPTER 3

MANAGEMENT POLICIES AND STRATEGIES

Integrated Management Strategies for Coastal Planning and Marine Pollution Control

Integrated Coastal Planning Strategy for the Prevention and Management of Marine Pollution.

Marine pollution prevention and management must tackle the causes and consequences or impacts of pollutants. The coastal zone is an ecological transitional belt between the land and the sea with distinct sensitivity and vulnerability to human activities and interventions, making it a critical area for marine pollution prevention and management. Therefore, it is necessary to distill experience and lessons learned from both local and international efforts and initiatives in coastal planning to effect the sustainable and efficient uses of resources as well as the prevention and mitigation of marine pollution.

Integrated Management Strategy for the Prevention and Management of Marine Pollution. Causes of marine pollution are manifold. As such, prevention and management of marine pollution can be effectively handled through ICM coupled with the establishment of a functional zonation scheme.

Strategy of Resource Assessment and Environmental Accounting

Resource assessment and environmental accounting are prerequisite to resource capitalization. Valuation of marine resources and environmental accounting contribute to capitalization of marine environmental management capacity, as well as provide important basis for decision-making in resource development. These form part of the important strategies for marine pollution prevention and management.

Marine Use Fees and Pollution Damage Compensation

The institution of marine use licensing system and the use fee system provide important means for the rational use of the country's marine territory thereby changing the status of unlimited access and unregulated development of marine areas.

Under the general urban planning and marine functional zonation of Xiamen Municipality, the marine management sector should make such arrangements for the paid uses of the sea areas in accordance with the *Interim Regulations Concerning*

Management of Uses of State Marine Areas, jointly promulgated by the Ministry of Finance and the State Oceanic Administration (SOA) on 31 May 1993 which expedited the implementation of licensing and use fee systems for marine uses.

Marine Pollution Damage Compensation.

The system of marine pollution damage compensation is an important economic instrument for marine pollution prevention and management. A policy on local environmental and ecosystem damage compensation should be formulated and implemented at an early date. Environmental and ecosystem damage compensation fees should be levied in accordance with the principles of “polluters pay” or the “developers do environmental protection,” the “resource destroyers do the restoration,” and the “beneficiaries share the compensation.”

The pollutant emission fees should be maintained. The criteria for these fees should be refined. The standards for pollutant discharge fee should be higher than the cost of pollution control and mitigation, depending on the area, time and rate of discharge.

Implementation of Precautionary Principles

The level of marine pollution and its impacts have a temporal dimension. Clean up or treatment of pollutant, especially during a spill is often costly. Pollutant impacts accumulate over time before any significant damages can be discerned. In certain cases, interventions can be made, but not always, given the nature of many pollutants and their synergetic effects on the ecosystems and the environment which are not too well known. Some adverse impacts may be irreversible. Therefore, the

protection of marine environment and ecosystems and the control of marine pollution must be guided by the precautionary principle which emphasizes prevention first in combination with mitigation.

Principle of Public Participation

Public participation makes coastal zone planning more rational, management more effective, supervision more reliable, and investment more diversified. Conscientious public participation in the process of marine pollution prevention and management is an important indication for successful management.

The Establishment of a Sustainable Financing Mechanism

The establishment of a sustainable financing mechanism for marine environmental protection and management is not only a response to a possible funding shortage, but also an effective way of allocating funds. Thus, for Xiamen, it is imperative to have an early adaptation to market economy, apply appropriate economic instruments, create new funding mechanisms and diversify funding sources for environmental protection and management, with a view to establishing a sustainable financing mechanism.

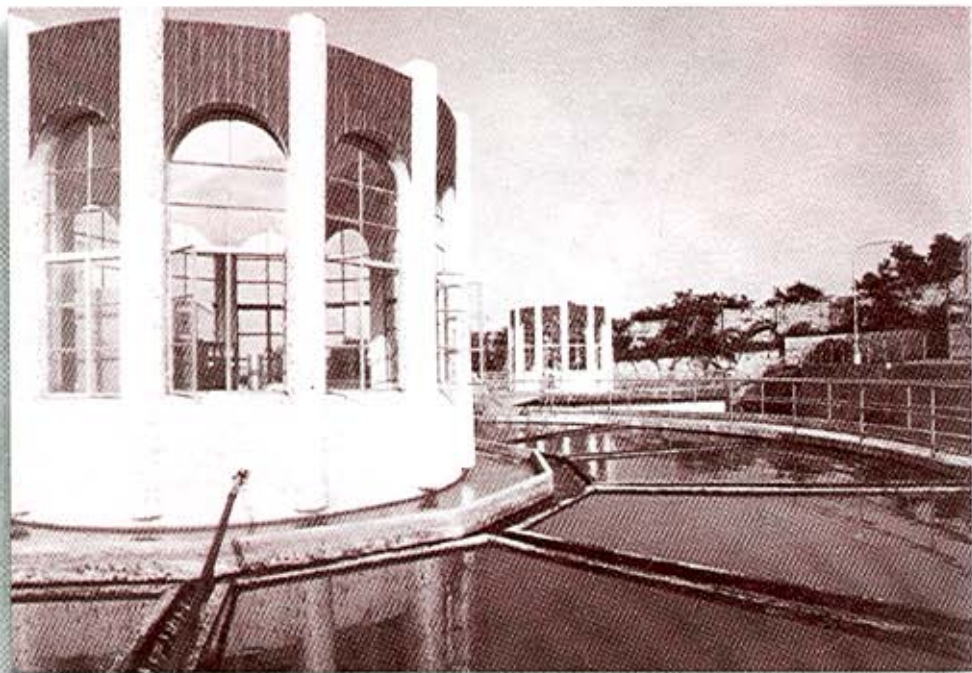
At present, it is necessary to change the single sector-oriented pattern of the government in operating environmental protection facilities and enterprises. Regulations and policies should be adopted to encourage enterprises, cooperatives, individuals, and stockholders to build, establish, and operate environmental industries, such as waste treatment facilities

for both effluent and solids, environmental engineering designs, facilities, materials, including information and consultative services that maintain a good balance between environmental inputs and outputs.

There is a need to establish a foundation for environmental protection, construction

and management, using various channels within and outside the country for fund-raising. Efforts should be made to seek financial support from governments and international funding agencies, including securing long-term and favorable environmental loans and increasing the amount of international environmental grants.

Strategic Action Plan and Schedule



STRATEGIC ACTION PLAN AND SCHEDULE

To achieve the objectives stated in Chapter 2, and in accordance with the policies and strategies outlined in Chapter 3, the strategic management actions and schedule of implementation are described in the following sections.

Establishment of an Integrated Coastal Management System

Steering Group for Integrated Coastal Management in Xiamen Municipality. A high-level coordinating and steering group for ICM will be established with the Mayor or the Executive Deputy Mayor of Xiamen Municipality as chairperson, and several other deputy mayors as vice-chairs. Under this group, an office will be set up to handle routine activities in the planning, development, construction, and management of the coastal zone of Xiamen Municipality as well as the organization and coordination of various concerned sectors that administer and manage the sea as mandated by law. The specific responsibilities of the Steering Group are the following:

1. Review the medium- and long-term plans on coastal development, infrastructure development, and protection;

2. Review coastal functional zonation scheme;
3. Coordinate the formulation of local regulations, rules and standards concerning ICM;
4. Organize and coordinate various concerned sectors in discharging their respective mandates and law enforcement relating to ICM;
5. Decide on the major issues pertaining to coastal development, infrastructure, and management; and
6. Undertake other tasks assigned by the leaders at the higher level.

Office of the Steering Group for Integrated Coastal Management in Xiamen Municipality. The Office is responsible for the routine activities of the Steering Group. It is the functional sector of the municipal government which manages the overall coastal affairs and coordinates with the General Administration Office. The specific responsibilities of the Office are as follows:

1. Develop medium- and long-term plans on coastal development, infrastructure, and protection for Xiamen Municipality;
2. Develop coastal functional zonation;

3. Organize and coordinate the formulation of local regulations, rules, and guidelines concerning ICM;
4. Supervise and coordinate various management sectors to conduct administration and strict enforcement of laws in accordance with their respective legal mandates;
5. Organize coastal monitoring, surveillance, information management and the review of coastal development projects;
6. Endorse coastal development project proposals;
7. Organize public awareness activities for ICM;
8. Provide guidance on ICM to counties and districts under the jurisdiction of the Xiamen Municipality; and
9. Execute other tasks assigned by the Steering Group.

Three divisions would be set up in the Office of the Steering Group for Integrated Coastal Management in Xiamen Municipality to take care of the general administration, coastal and marine affairs, and legal coordination.

The Consultative Committee for Integrated Coastal Management. This committee is mainly composed of experts who operate during regular sessions. Its responsibility is to provide advice as well as scientific and technological services for decision-making.

At present, the Executive Committee of the Xiamen Demonstration Project (XDP) is

a provisional mechanism for the execution of the demonstration project on behalf of the Xiamen Municipal Government. It is responsible for the approval, implementation, and monitoring of ICM activities and coordination among the different sectors involved in the project. Its effective operation will serve as a demonstration and model for the establishment and operation of integrated coastal planning and management by the municipal government. Such a new government mechanism should be established as soon as possible in order to take charge of demonstration project activities and ensure their continuity.

Strengthening Legislation for Integrated Coastal Management

The guiding concept to strengthen legislation for ICM is that coastal zone must be considered as an ecosystem and a resource system and that legislation must embody the principle that development and the use of coastal resources should go hand in hand with environmental protection.

Legislation for Xiamen coastal zone should be based on actual coastal issues and the development of appropriate measures for integrated management of resource uses and protection including enforcement that complements the national laws. Table 4.1 shows the essential elements for environmental legislation of Xiamen coastal zone.

The legislative elements listed in Table 4.1 should be formulated between year 2000 and 2010, incorporating the results from the subproject studies. This should be put on the legislative agenda for Xiamen Municipality.

Table 4.1. Essential Elements for Environmental Legislation

Elements	Procedures
1. Integrated coastal management mechanism and its mandates	Respective functions among coastal management-related sectors, and procedures for coordination.
2. Coastal environmental management and methods	Procedures for monitoring, supervision and inspection pertaining to the coastal environment.
3. Marine functional zonation and discharge standards	Procedures for investigation and penalization against coastal pollution incidents.
4. Coastal resources management	Procedures for public monitoring and participation.
5. Marine nature reserves	Monitoring procedures for integrated coastal management.
6. Legal responsibilities	

The formulation of the regulations listed in Table 4.2 will be completed by the year 2000 and brought into voting and resolution procedures by the Xiamen Municipal People's Congress or Government into local laws and regulations.

Scientifically Sound Marine Functional Zonation Scheme

The Xiamen Demonstration Site (XDS) has diverse marine resources and a complex marine environment. Yet, there is lack of integrated planning for marine resource development and exploitation, and effective mechanism to address coastal use conflicts, and overcrowded coastal areas.

Agenda 21 for China, as approved by the State Council,

has put China's marine functional zonation as the basis for undertaking ICM. Therefore, it is very urgent and necessary to establish the marine functional zones and integrate it into the general urban plan as the basis for various management sectors in their planning and subsystem zonation to fully optimize benefits from it.

Based on management priorities in Xiamen, marine functional zonation should start from the west and move to the east. The zonation in the west should be completed in the first quarter of 1996. Upon review and refinement, it should be

formally announced for implementation in the third quarter of 1996 by the Municipal Government. The functional zonation for the whole Xiamen seas should be completed within 1996.

Table 4.2. Title of Regulations and their Objectives for Xiamen

Title	Objective
1. Regulations for integrated coastal management	Establish integrated management mechanism and operational procedures.
2. Regulations for the use of sea area	Establish systems for licensing and routing in marine areas and their operational procedures.
3. Regulations for waste dumping at the sea	Define the responsibilities and means of waste dumping management.
4. Regulations for land-based pollution management	
5. Regulations for seawater quality management	Define the seawater standards and management methods.
6. Management rules for nature reserves	Define the management method for nature reserves.

Application of ICM System for the Prevention and Mitigation of Marine Pollution, Protection of Endangered Species and Preservation of Scenic Spots

Application of ICM System for Marine Pollution Prevention and Mitigation. Many factors cause marine pollution. The most important measure for marine pollution prevention and mitigation should aim at the minimization of the amount of pollutants entering the sea through integrated management approaches taking into consideration administrative, legal, and economic means.

To this purpose, the following plans are formulated:

1. *Total Discharge Quantity Control*

- a) Strengthen studies on environmental capacity and refine water quality control planning for various sea areas; develop operational seawater quality standards for Xiamen; and determine the level of reduction for land-based pollutants in the sea and the optimal distribution of quotas for permissible level of pollutant discharges for various sea areas.
- b) Control the waste water discharges in different sea areas within environmental capacity. For industrial waste discharges, strengthen permit system for discharges. Enterprises with level of discharges above standards should be given deadline to make remedial actions. Direct discharge of industrial waste water without treatment should be banned

within the next five-year period. Land-based pollutant discharges should be managed based on the set target for the level of discharges.

- c) Control the direct discharge of waste water into the sea from nonpoint sources in the eastern scenic tourist area by developing and executing a workable plan to tackle bacterial pollution problems due to high fecal coliform level in the Eastern Channel before the end of 1997.
- d) Employ economic instruments for marine pollution control in the next five years. Establish and execute an incentive and penalty system for environmental protection. Effect policies in favor of "clean production." Strictly penalize unlawful waste discharges or discharges exceeding standards. Increase discharge fees above the cost level for treatment.

2. *Practical and implementable management plan for ship-sourced pollution*

- a) Establish in one to two years an environmental emergency management system and a rapid preparedness and response team for pollution accident prevention and treatment.
- b) Strengthen law enforcement to ensure prevention and mitigation of pollution from ship sources and in ports.
- c) Inspection and management of oil jetties, land- and sea-based oil tanks, and especially the storage area of dangerous goods should be strengthened.

3. *Management of solid waste dumping in the sea*
 - a) Carry out regular surveillance and monitoring on the designated dumping sites (once every two to three years).
 - b) Encourage the use of pumping and filling methods for coastal reclamation.
- Application of ICM System for the Protection of Marine Ecosystems, Including Habitats and Endangered Species, and Preservation of Scenic Spots.** Develop step-wise marine nature reserves for marine ecosystem to protect endemic and endangered species. To this end, carry out scientific planning and management, and integrate them into the social development program of Xiamen Municipality.
1. Strengthen the management of lancelet (*Branchiostoma belcheri*) nature reserves. The Xiamen Municipal Government issued the *Regulation Concerning Nature Reserve for Branchiostoma belcheri* and established the reserves at the sea areas around Huangcu, Dadeng, and Eyuyu Island.
 - a) Strengthen their management mechanisms, research and monitoring, and the development of infrastructure.
 - b) Preparations should be made for establishing biodiversity reserves in the eastern shores to protect both the species and ecosystems as well as coastal scenic spots facing the Xiaojinmen Island at the other side of the water channel.
 2. The egret nature reserves at Dayu and Jiuyu Islands have been approved as nature reserves at the provincial level. The *Management Measures for Dayu Island's Egret Nature Reserve of Xiamen Municipality* was adopted by the Municipal People's Congress and took effect in November 1995. The department concerned should come up with the appropriate management mechanisms, personnel requirement, and budget.
 3. Develop nature reserves for the Chinese White Dolphin (*Sousa chinensis*) by 1998.
 - a) Conduct joint study sessions among relevant research institutions and the Taiwan University on the species off Xiamen-Jinmen Islands.
 - b) A preliminary nature reserve survey had been conducted in 1996 to better understand the distribution and habits of the species including environmental requirements for the reserve.
 4. Conduct a feasibility study on the Dongyu mangrove nature reserve in 1996 or 1997 and complete the preparation, application, and approval process.
 5. Develop and implement integrated management laws and administrative regulations, specifically as follows:
 - a) Protect valuable coastal scenic spots, sandy beaches and cultural sites.
 - b) Designate as appropriate, these sites for tourism purposes.

Development of an Action Plan for Environmental Protection and Contingency Preparedness and Response in the West Harbor

As defined in the urban development program, Xiamen Municipality is oriented towards "a modernized, international, scenic port city," following a pattern of centers and satellites built around the West Harbor. This means that the West Harbor serves as the lifeline of Xiamen Municipality. Its environment and resources provide the basis for its socioeconomic development. With rapid urbanization, the West Harbor will experience increased environmental stress. There is a potential for marine pollution accidents since it is a major port area. Therefore, it is urgent to develop action plans for both environmental protection and emergency preparedness and response.

Action Plan for Environmental Protection in the West Harbor

1. *The following approaches should be adopted:*

- a) Address the causes and impacts of the problems affecting West Harbor.
- b) Emphasis should be placed on preventing and shifting reclamation activities eastward including dredging the West Harbor.
- c) Integration and coordination in management.
- d) Strengthen supervision, focused control, and protection of critical areas.

2. *The following work will be accomplished during the next five years (1996-2000):*

- a) Construct secondary waste water treatment plants in Yuan Dang; secondary treatment capacity of 0.1×10^6 t/d in Caikeng; 0.06×10^6 t/d in Xinglin; 0.045×10^6 t/d in Jimei; and $0.08-0.32 \times 10^6$ t/d in Haicang.
- b) Link up sewer systems in the development zones in Haicang, Xinglin and Jimei, with the sewer systems in the Xiamen Municipality, in order to centralize effluent treatment before deep water discharge.
- c) Open up Maluan causeway to enhance and improve water exchange through tidal influx in the West Harbor, reduce port siltation, and increase the regenerating capacity of the coastal waters.
- d) Continue the Yuan Dang Lake Treatment Project.
- e) Initiate study and testing of waste water recycling in the Xiamen Municipality, extend the uses of waste water resources, and explore avenues for recycling industrial and municipal effluents. For this purpose, scientific environmental research projects shall be formulated, validated, and implemented by the year 2000; encourage separation, recovery, and utilization of useful materials from waste; apply and develop environmentally sound techniques

and products; speed up elimination of high cost production inputs in accordance with the national policy to promote “green products.”

- f) In the West Harbor, develop maritime port and control mariculture based on marine functional zonation.

Action Plan for Contingency Preparedness and Response

1. The West Harbor should be the focus of this action plan. A command unit for marine pollution emergency response should have been established by 1996. This unit should consist of the Office of the Steering Group for Integrated Coastal Management, Maritime Safety Superintendency, Port Bureau, Public Safety Bureau (including Fire Brigade and Traffic Police), Environmental Protection Agency, Safety Committee, Office of Sea Defense, Office of Port Committee, Office of Urban Management and the Marine Management Regional Office of Xiamen. It should be directly headed by one of the mayors. Its office should be hosted by the Maritime Safety Superintendency with the responsibility for routine operations.
2. Install advanced emergency response facilities for the Dongdu Port, oil tanks and jetties for Botan, Luyong, Mingda companies; raw material jetties for a gas company and Liheng Chemical Plant; and oil jetties to be constructed at Haicang. Emergency planning and response rules should be developed. These facilities should be registered with the Office for Emergency Command

Unit, and their uses should be directed by the unit during an incident.

- 3) The Command Unit should keep abreast of potential pollution accident sources surrounding the West Harbor and come up with response measures.
- 4) By 1996, scientific research institutions and management sectors should have been organized to survey and analyze environmental conditions in meteorology, hydrology, ecology, and mariculture status of the western waters to grasp key protection targets and establish a list of protection facilities. Potential accident-prone areas and sources will be identified and emergency planning will be developed accordingly.
- 5) Communication facilities and emergency response will be improved. The roving superintendency will also be strengthened. Regular and ad hoc inspections of the potential accident source will be carried out. Emergency response support network among provinces and cities will be developed.

Strengthening ICM Capability

Strengthening Cooperation among the Sectors on Environmental Protection, Marine Development and Management, and Enhancing the Overall Capability in Marine Pollution Prevention and Management

1. Strengthen relationship, cooperation, and exchange among concerned agencies for environmental protection and marine development and management. Under the leadership of

the Steering Group for Integrated Coastal Management, regular and ad hoc inter-agency meetings will be held, enforcement activities will be coordinated, and integrated enforcement teams will be established on the basis of each agency's mandates.

2. Improve and consolidate environmental protection sectors and strengthen their management capability. At present, the functional sectors of the government concerning maritime affairs, resource development and environmental management are not well-structured, poorly staffed, and inadequate to undertake the difficult task of prevention, supervision, and management. Fishery agency, port superintendency and local military forces in Xiamen also share responsibilities in marine environmental management. Therefore, the environmental protection sectors should set up environmental protection mechanisms and provide adequate manpower. They should undertake environmental inspection, monitoring, scientific research, and information dissemination. The municipal marine management division should likewise reinforce its managerial capability.

3) Apply modern environmental management methods. Marine environmental information management is an approach and a tool for marine pollution prevention and management. It is necessary to use modern information management techniques to build up the network on marine management, monitoring, and surveillance, such as the following plans:

a) By 1997, an environmental databank should be established.

b) Computer systems among environmental protection and various other government functional sectors should be linked in a network.

c) Remote sensing and Geographic Information Systems (GIS) should be applied to assist management in decision-making.

d) Managerial sectors should be equipped with relevant technical facilities.

e) A system of marine environmental monitoring and surveillance ships and buoys will be established by the year 2000.

4) Improve staff qualifications. Marine environmental protection and management depend heavily on science. The key to capacity building for pollution prevention and management is to strengthen staff qualifications in resource and environmental management. The staff concerned must understand both technology and management, and should be well-qualified and responsible. The way to do it is as follows:

a) Recruit people with the necessary expertise in resource and environmental management.

b) Provide the incumbent staff with opportunities for training and advanced studies, e.g., in law, policy and modern management.

c) Study tours and exchanges should be organized to expose them to advanced technology and experience, locally and abroad.

- d) Training of all managerial personnel will be completed in five years.

Strengthening Enforcement. Marine supervision brigade should be set up on the sites for integrated enforcement of resource and environmental management following the establishment of an ICM system. To strengthen it, the brigade with multiple functions should be equipped with patrol boats, effective surveillance systems and maritime technical facilities.

In accordance with relevant laws and regulations, the integrated marine brigade should carry out law enforcement and management of resources and environment, monitor waste discharges and waste dumping sites in the sea, navigation channels, anchorages, fishing grounds, etc., and investigate, verify, and handle illegal activities and marine pollution damage cases.

Enhance the Technical Capability and Coordinate the Technical Actions. The ICM needs advanced technology and involves different disciplines, such as marine science, environmental science, ecology, and social science. Hence, ICM depends on the advances of science and technology for the rational uses and protection of marine resources and environment.

- 1) Organize scientific research institutions to study issues concerning the development of coastal resources and environmental protection and access funds from governmental or environmental protection agencies and other sources to support the research projects.
- 2) Maximize the results of marine investigation over the years. Collect, compile and process historical data, and set up information center

and databank to serve the management of marine resource and environment.

- 3) Set up a coordinating mechanism for coastal studies composed of heads of scientific research and academic institutions and projects in Xiamen. This is to focus research and to avoid any duplication of efforts. Focus on in-depth studies of important management issues that will provide technical guidance and advice for strengthening management capability. Assist the Municipal Government in planning and establishing the Xiamen Marine Science and Technology Academy.

Establishment of an Integrated Marine Environmental Monitoring, Surveillance and Assessment System

Many activities in marine monitoring and surveillance have been carried out in Xiamen Municipality. However, these activities are not systematic and sustainable. Moreover, the data are scattered and difficult to use. Therefore, it is necessary to establish a system of monitoring, surveillance, and assessment which is pragmatic, effective, sustainable, combining professional monitoring with widespread public surveillance of coastal environment. Such system should be able to analyze marine pollution causes, assess management effectivity and problems, feedback information for management and decision-making, and provide services for ICM.

A network of professional monitoring and public surveillance system on marine environment should be established in the next five years. The professional monitoring and surveillance system includes:

- 1) A marine environmental monitoring center, a surveillance network, and a system of marine environmental assessment building upon the activities of GEF/UNDP/IMO Xiamen Demonstration Project. The system should conduct integrated monitoring, surveillance, and assessment of marine environment.
- 2) The marine environmental monitoring and surveillance network will be administered by the Office of the Steering Group for Integrated Coastal Management composed of experts in various disciplines from relevant scientific research institutions, universities, governmental agencies, and business sectors. Its monitoring facilities will be gradually updated; data processing and dissemination computerized; and operational procedures and methods standardized. Regular exchange with general environmental information systems will also be conducted.
3. Systematic, regular and special purpose monitoring, such as pollution accidents, will be carried out over Xiamen coastal waters. The status, variations and trends of the marine environment will be assessed and modelled based on the monitoring results which will take into account the socioeconomic features. These analytical results will be feedback to the management sectors, together with programs and recommendations for improvement.

The public surveillance network will observe and report marine pollution events on a broad-scale in order to complement the professional monitoring system. The system will be further strengthened by the year 2010 based on the accomplishments in the next five years.

Fostering Environmental Public Awareness through Information Dissemination

General Strategies:

1. Set up an information dissemination unit within the ICM system which will implement the marine environmental awareness program.
2. Allocate a special fund for marine environmental information drive as a long-term activity. The fund is necessary to ensure the effective dissemination of information over a long period of time.
3. Develop both long- and short-term plans for the marine environmental information drive on Xiamen and integrate these into the overall environmental program for Xiamen Municipality.
4. Set up an evaluation mechanism for marine environmental information drive, assess its effectiveness, as well as supervise and monitor marine environmental education and information drives.
5. Institutionalize *Marine Environmental Protection Day* and *Marine Environmental Public Awareness Week* in Xiamen Municipality as a focused effort for promoting marine environmental awareness drive at certain times of the year.

Short-term Plan:

1. Capitalize on the Xiamen Demonstration Project (XDP) activity on marine environmental awareness.

2. Develop public awareness materials on marine pollution prevention and management in Xiamen under the supervision of the Executive Committee of the XDP and its Office.
3. Carry out a widespread awareness drive among the general public, students and government officials while preparing the plan in order to raise public consciousness on marine environmental protection.

Long-term Plan:

1. Strengthen a system for marine environmental information drive in Xiamen as a subproject of the XDP.
2. Undertake a regular and long-term information and education drive in order to enhance the public awareness on marine environmental protection.

Strengthening Training and Education for Human Resource Development

The development, utilization and protection of the coastal resources need a competent science and technology workforce that is highly qualified. Accordingly, there is a need to develop training and education on marine and environmental science and technology in order to promote human development and utilization.

Inculcate Marine Environmental Awareness in Formal and Non-Formal Education. These educational approaches must be initiated for the grassroots.

Introduce marine environmental courses in the secondary and elementary levels. Study groups and summer camps on marine environmental sciences for youths and teenagers must be organized. In addition, marine environmental protection subjects should be integrated at the tertiary or college levels, technical or vocational schools, media-based or correspondence schools, and adult education schools to mold and develop professionals in the field. It is highly suggested for Xiamen University to offer courses on environmental protection and management and formulate a marine management curriculum. Marine and environmental education program should be developed as part and parcel of the overall program to build Xiamen into a *City of Learning*.

Strengthen On-the-Job Marine Environmental Education and Training. Marine environmental seminars should be organized for decision-makers (at the municipal level) at least once a year to sensitize them on marine and environmental protection as an underpinning state policy. A system of on-the-job training for government staff should be established. Staff training and examinations should be planned and implemented. Persons without such training should not be qualified for the posts. Relevant universities and their departments, as well as scientific research institutions should be asked to conduct various training courses. Arrangements should be made for some staff to take refresher courses in universities or research institutions. Marine and environmental professionals should address their respective knowledge gaps. They should also study economics, laws, and management. Finally, they should take

advantage of the current demonstration project to foster exchange with other countries and to increase the level of marine and environmental science and technology in Xiamen as a whole.

Strengthen Human Resource Development. At present, Xiamen lacks professionals in marine economics, law and policy, and ICM. Many senior professionals will retire soon. Thus, it is necessary for them to take effective measures to actively train their understudy in science, technology, and management, including:

- a) Selecting young scientists and engineers for professional training in marine engineering and technology, economics, law and policy study;
- b) Educating students for doctoral and masteral degrees in Xiamen University on integrated coastal and marine management; and
- c) Fostering international exchange, e.g., sending some persons abroad to study and take up training and refresher courses.

Development of Sustainable and Reliable Financing Mechanisms for Environmental Management

The establishment of a financing mechanism has economic underpinning for Xiamen's integrated coastal and marine management. The specific plan for developing Xiamen's marine integrated financing mechanism includes:

- a) A feasibility study on integrated marine management foundation;
- b) Establishment of the foundation;
- c) A study on financing mechanisms for integrated coastal and marine management; and
- d) The establishment of these financing mechanisms.

Subproject for a Feasibility Study on the Establishment of a Foundation. A subproject for an integrated marine management foundation will be set up under the XDP. A scientific, rational and implementable plan will be developed in a year as preliminary groundwork for this foundation.

Establishment of the Integrated Marine Management Foundation. This will be established within the Office of the Steering Group for Xiamen Integrated Coastal Management.

Study of a Financing Mechanism for Integrated Coastal and Marine Management. A project to study financing mechanism for Xiamen's integrated coastal and marine management will be organized, taking into account the advanced experiences at home and abroad, in light of particular features of socioeconomic development and environmental protection in Xiamen.

Establishment and Strengthening of Financing Mechanisms for Integrated Coastal and Marine Management. This should be a dynamic process consistent with the pace of socioeconomic development. It should also build on the experience of developing the foundation.

Establishment of an Information System for ICM

Investigate the Flux of Pollutants Entering the Sea and Develop a Prediction Model for Pollutant Distribution. Based on the investigation of land-based pollution sources along the West Harbor in 1989, further investigation of the sources need to be carried out. The database for land- and sea-based pollution sources in other sea areas should also be improved. Pollutant flux and prediction model should be established to assist in the formulation of pollution mitigation and management plan.

Study Marine Environmental Capacity and Develop its Variation Model. The marine environmental capacity of different sea areas will be studied based on hydrodynamics and other environmental conditions such as marine functions and effluent discharge status. This is to develop a dynamic model that will quantitatively predict the environmental quality of different sea areas and assist in the formulation of integrated pollution management, including the waste water treatment plan and pollution reduction scheme.

This study will be carried out in two phases: (1) an environmental capacity study of the West Harbor with project establishment in 1997 and completion in 1998; and (2) an environmental capacity study of Tong'an Bay, the sea areas around Dadeng, and the Eastern Channel by the year 2000.

Study the Establishment of a Warning System for Marine Environment and Ecosystem. The West Harbor is the most polluted compared with other water bodies

in Xiamen. Since the 1980s, red tides have occurred several times. It is necessary to set up a warning system to reduce hazard loss.

Study the Optimal Economic Model for Integrated Development and Uses of Coastal Resources. The coastal resource development and environmental protection are all systems engineering. Its subsystems are interdependent and interactive. The use of one subsystem will certainly produce either beneficial or adverse impacts on other subsystems. To obtain optimum input, output and net benefits, it is necessary to study the optimal economic model for coastal resource uses in harmony with environmental protection.

The development of the optimal model is a process for improvement in our understanding. It can be derived through multiple analytical comparison of socioeconomic and environmental cost and benefit associated with different types of coastal resource uses, input and output ratio for various development schemes, resource evaluation, and environmental accounting. The establishment of such an optimal development model would provide harmonization of economic, social, environmental and resource benefit.

Develop an Environmental Information System Integrating the Geographic Information Systems (GIS). An environmental information system will be developed to provide an advanced tool for management and decision-making. It will include the following three components:

1. Monitoring and surveillance system to gather reliable data, to track marine environmental changes, and to provide scientific basis for decision-making;

2. Environmental databank to provide relevant environmental and developmental information services at home and abroad; and
3. Develop GIS through the implementation of the XDP to better address information needs of management.

In line with the environmental information system of Xiamen Municipality, prevention and management of marine pollution activities will be extended to the adjacent regions. Thus, an integrated information network to cover these regions will be developed.

Implementation, Supervision and Evaluation



CHAPTER 5

IMPLEMENTATION, SUPERVISION AND EVALUATION

Implementing Mechanisms

At present, the Executive Committee of the Xiamen Demonstration Project and its office are the principal bodies at the municipal level tasked for the approval, implementation, supervision, and coordination of demonstration project activities across various sectors. In the near future, the said body would be responsible for the implementation, coordination, and supervision of the present Strategic Management Plan. Before 1998, it is necessary for the body to establish an organizational structure for the integrated coastal management of Xiamen. Such organizational structure will be headed by the mayor or a deputy mayor, with an office to implement the Strategic Management Plan and to ensure continuity in its implementation.

Supervising the Implementation

There are two levels of supervision on the implementation of the Plan. One is carried out by the municipal government, under the responsibility of the Executive Committee of the Xiamen Demonstration Project (XDP) and eventually by the

proposed mechanism for Xiamen's Steering Group on Integrated Coastal Management. The second is the supervision by the Xiamen People's Congress over the implementation of the Plan by the municipal government. These supervisory bodies should actively perform their respective functions in the implementation of the Plan.

The process for supervision is as follows: the Office of the Executive Committee of the Xiamen Demonstration Project or the Office for Integrated Coastal Management presents a written report concerning the implementation (i.e., problems resulting from the implementation process) and submits it once every six months. The report is submitted to the Supervisory Division of the municipal government and the Municipal People's Congress. The municipal government then prepares and submits an annual report to the Municipal Congress.

Modification of the Plan

The Steering Group for Integrated Coastal Management should review every six months the progress of implementation, identify the problems, modify and/or update the Plan. However, any amendment should take effect only upon a vote during the general meeting of the Executive

Committee of the XDP and the Steering Group for ICM. The amendment should first be reported to the department responsible for the review and approval of the Strategic Management Plan. Major modifications must be considered and endorsed by the concerned authorities. All plans and their modifications must be reported to the Municipal Congress.

Criteria for Evaluation and Public Opinion Survey

The evaluation criteria for the implementation of the Strategic Management Plan are;

1. integration of the Strategic Management Plan into the national economic and social development programs for the Xiamen Municipality;
2. harmonization of economy and environmental programs for sustainable development;
3. rational uses of marine resources;
4. effective prevention and management of marine pollution;
5. efficiency in integrated management; and
6. support from the public.

Public polls should be conducted in four stages during the implementation of the Plan. The first in the end of 1995, the second in July 1998, while the third and fourth will be in the year 2000 and 2010, respectively.

The poll consists of two components: the first one is to assess the level of public environmental awareness and participation. The second one is to evaluate the implementation, effectiveness, and improvement required for the Strategic Management Plan. The results of these public polls should reflect the continuous progress and achievements in implementing the Strategic Management Plan.

Budgetary Arrangements



CHAPTER 6

BUDGETARY ARRANGEMENTS

The budget for the strategic management plan initially covers a five-year period (1996-2000). The total fund for the Plan is RMB 59,345,000. The budget for the period to the year 2010 will be worked out by the turn of the century.

This fund has been largely incorporated in the regular budget of various ocean-

related sectors. Special funds will come from the Xiamen Demonstration Project (XDP) of the Prevention and Management of Marine Pollution in the East Asian Seas (MPP-EAS), as well as the Marine Management Foundation, and other governmental agencies. It is expected that funding sources will be expanded and diversified during the implementation process incorporating sustainable financing mechanisms.

ACTIVITY	FUNDING REQUIREMENTS (IN 1,000 RMB)
1. Establishment of marine management organization	9,675
2. Refinement of integrated coastal management legislation	500
3. Marine functional zoning	1,250
4. Development of integrated management plan for control and mitigation of marine pollution and protection of endemic species and scenic spots	1,800
5. Development of integrated management plan for control and mitigation of marine pollution	1,000
6. Development of management plan for the protection of marine ecosystem and scenic spots	800
7. Development of action plan for environmental protection and accident prevention and response for the West Harbor	2,600
8. Development of the marine environmental plan for the West Harbor	1,500
9. Development of action plan for accident prevention and response	1,100
10. Strengthening the integrated coastal management capability	20,300
11. Strengthening the cooperation of various sectors to increase the overall capability in marine pollution prevention and management	12,000
12. Strengthening the enforcement of environmental management laws and regulations	800
13. Strengthening the environmental science, technology and coordination	7,500
14. Refinement of a system for marine environmental monitoring, surveillance, and assessment	7,700

ACTIVITY	FUNDING REQUIREMENTS (IN 1,000 RMB)
15. Monitoring and surveillance of the Subproject Demonstration Site	700
16. Establishment of a monitoring center and surveillance network	7,000
17. Strengthening information dissemination on marine environmental protection	3,500
18. Subproject Public Awareness for the Demonstration Project	3,500
19. Establishment of the information dissemination sector and fund for marine environmental protection	3,000
20. Training and education to promote manpower development and utilization	2,300
21. Popularization of environmental education in the professional levels	1,000
22. On-the-job training and education	500
23. Manpower development and deployment	800
24. Development of fund-raising plan and the establishment of reliable financing mechanism	5,020
25. Subproject of the foundation's feasibility study	520
26. Establishment of the foundation's management organization and its operation	3,000
27. Study of the financial mechanism for marine environmental protection and integrated coastal management	1,500
28. Strengthening the construction of information system	4,700
29. Development of prediction model of pollutant distribution	500
30. Development of the dynamic model for marine environmental capacity	600
31. Study on the optimum economic modelling of coastal resources development	1,000
32. Establishment of an environmental information system	2,600