Chapter 3

Identified Existing Coastal Problems

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3.1 Findings on Coastal Problems

Various types of coastal problems in North Sulawesi have been unearthed through the analysis of collected data and information, the outcomes of interview surveys, field reconnaissance, and working group meetings and Sub-Steering Committee meeting. In general, coastal problems can be categorized into two types: those caused by natural process and those caused by human activities. Problems caused by natural process such as climate, waves, geographic conditions and biological process are beyond the planning scope; therefore, the interventions only on the problems caused by human activities are going to be discussed in this Study.

The problems on coastal environment including coral reefs caused by human activities can be divided from the viewpoint of problem types as follows:

- destruction of coral reefs;
- disappearance of coral reefs;
- deterioration of coral reef environment;
- inappropriate coastal spatial use;
- danger to marine wildlife; and
- beach erosion.

The first three problems pertain to the deterioration of coral reef ecosystem. These problems caused by human activities can be further categorized into two: direct impact and indirect impact. "Destruction of coral reefs" and "Disappearance of coral reefs" are problems caused by direct impact. The other one, "Deterioration of coral reef environment," is caused by indirect impact through changes in the environment of coral reef such as water pollution and sedimentation from the land-based activities, and garbage thrown by people. "Inappropriate coastal spatial use" is caused by both direct impact and indirect impact. "Danger to marine wildlife" also falls under indirect impact, because it

does not affect the coral reef environment and ecosystem directly. However, a healthy marine wildlife is a component of a healthy ecosystem, which could be ruined by human activities.

(1) Destruction of Coral Reefs

Destruction of coral reefs means that components of coral reef environment especially corals themselves and the seabed are destroyed by some physical forces. Mainly, coral reefs have been destroyed by dynamite fishing and coral mining. These activities were identified as serious problems in the Study Area.

a) Destructive fishing practices

One of the biggest threats to coral reefs is still dynamite fishing. Dynamite fishing is still practiced on a daily basis in a large area. Damaged coral reefs were identified in a wide area of the Study Area. Illegal fishermen practice dynamite fishing on coral reef flats and reef edges mainly. Other destructive fishing such as traps made of bamboo (*Bubu*), Gillnet, Encircling net (*Darape*), and Drive- in fishery with Drift gill net (*Paka-paka*) are also seen in the Study Area. These fishing practices destroy coral reef by penetrating and trampling reefs with those gear.

b) Coral mining

Corals can be used for construction and building materials. Although there is no written information on coral mining practice over time in the past, evidence of coral mining activities is observed by the Study Team in almost all coastal villages. There are mainly two types of users. One is people who live in rural areas where construction material is limited. For these people, there is no other way but to use corals. The other type is people who live in urban areas and utilize coral as material for septic tank. It should be emphasized that it is one of the biggest threats to coral reefs in the study area. Although coral mining is prohibited, often people do not know that the use of coral is prohibited, and because of the economic gain by selling corals as construction materials, it is not so easy to stop this activity, even though people are aware of the regulation.

c) Anchoring and trampling

When boats including those used for fishing, tourism, and other purposes are anchored on coral reef, this could easily damage corals because of its fragile physical structure. Specifically, damage is caused by impacts of dropping anchor and pulling it up, and the movement of the anchored boat by currents and waves.

People engaged in recreational water activities such as walking and diving including scuba diving and snorkeling can unconsciously cause trampling damage to coral reefs.

(2) Disappearance of Coral Reefs

This section describes what happens due to loss of some areas of coral reefs, which also brings negative impacts to land.

Increasing land demand and expanding urban areas caused by population concentration and industrialization provide the reasons for reclamation. Consequently, a part of the Manado shoreline has been reclaimed, structures have being constructed along the coast since 1997, and a seawall was constructed along the shoreline of Bitung in the 1960's. These coastal developments cause the area's loss of coral reefs.

In rural areas, people who live on shore construct simple structures against beach erosion and wind waves for protection of their houses. They use wood, rocks and also coral rocks for construction of these structures. This affects not only the reclaimed area but also the surrounding area. Reclamation causes changes not only in the shape of shoreline but also in current pattern. As we know, changes in shoreline might result in water pollution with stagnant water, and/or beach erosion and sedimentation.

(3) Deterioration of Coral Reef Environment

Coral reef is affected by not only destructive activities directly but also deterioration of coastal environment and habitats for marine life on coral reefs indirectly. It means that changes in environment of coral reefs such as water pollution, sedimentation and deterioration of other ecosystem affects conditions of coral reefs.

a) Water pollution

Population pressures from concentration of population and industrialization are brought along with urbanization and can cause problems of scattered garbage on shoreline, and water pollution due to discharging of sewage and industrial wastewater. In the urban area, absence of implementation regulations for land use is also seen. The problem of scattering of garbage is common in North Sulawesi. Garbage is thrown on shore because of lack of people's awareness and the absence of a waste collection system. Scattering of garbage causes water pollution; also plastics and other garbage possibly entangle with coral, mangrove, and other marine life, resulting in the deterioration of landscape. As a result, the value of tourism resources will decrease.

Overuse of fertilizers and pesticide, and refining process of gold by illegal miners cause water pollution. Pesticide and mercury may be accumulated and bodies of marine life such as bottom fishes, shells and other benthos are contaminated. It is possible that rumors of mercury contamination have negatively affected market prices of marine products, even though there is no case of contamination.

b) Insufficient public health/sanitation/basic hygiene

In coastal communities, public health concerns vary from community to community. In some coastal communities, village leaders or religious leaders initiate community cleanliness from the entrance to the end of a community. However, in most coastal communities in the Study Area, cleanliness seems not to be a matter of concern to them. Knowledge of sanitation and personal hygiene seems also very low, possibly due to the following reasons: lack of opportunities to learn, lack of proper sanitation facility to use, and difficulty to change their accustomed daily practices passed on from generation to generation.

c) Sedimentation by inappropriate farming

Improper development of inland area can cause soil erosion. The impact of sedimentation of eroded soils on the coral reef is very critical for the survival of reefs. From the viewpoint of coastal environment, activities on land are important, because problems on land can reach coastal water areas through rivers or go directly to the sea. Areas where there are slope farming and shifting cultivation in steep slope areas have a high possibility of soil erosion.

d) Deforestation of mangrove forest

It is estimated that 200 ha of mangrove forest are being affected yearly by activities of local people such as deforestation and barking trees. This corresponds to 2.5% of the whole mangrove area. Mangrove trees are used as construction material, and the bark is used as dyestuff for trawl nets. This has been happening for the past 20 years. The mangrove has functions of catching eroded soil from the land, preventing coastal erosion, providing habitats and egg-laying sites, etc. These functions will be seriously damaged in future if the deforestation and/or barking continue as ever, and it can affect the coastal environment.

Cutting of mangrove is prohibited by regulations, however, the economic value and necessity of mangrove trees for daily activities are high for community people, so that mangrove forests are disappearing gradually and steadily.

(4) Inappropriate Coastal Spatial Use

There are many users of coastal area including coral reefs. In North Sulawesi, it would be true that the manner in which one uses coral reef affects other users of this resource. The following are very common causes of conflicts arising among users, and between management side and user side:

a) Lack of coastal area spatial plans

BAPPEDA province and municipalities/regencies have spatial development plans including regulation on conservation area and buffer zone established by Law No. 32 (1990) and others. However, specific spatial plan and regulations on coastal areas have not been established yet by province, nor other levels of local government except Minahasa regency. Minahasa is now developing their coastal management *PERDA* particularly on marine sanctuaries. These plans and regulation aim to control coastal spatial use. There are also no appropriate regulations for controlling and inviting development in order to carry out the implementation of plans.

In the case of the seafood restaurants in Kalasey, these were granted business permits but no building permits from the public works office were obtained. Because there is no system to control such cases; restaurants are built and operated freely. The coordination of different agencies with interests on coastal spatial use is absolutely necessary.

b) Obstruction of coastal use by marine culture due to non-arrangement of coastal facilities

Seaweed farming has been booming in recent years. Number of people engaged in seaweed farming has been increasing rapidly and there are limited people engaged in pearl farming as well in the study area, even in Bunaken National Park. Facilities of seaweed farming are being set up in shallow waters. There are conflicts among seaweed farmers, because the setting up of these facilities follows the rule of "First come, first served." These facilities of seaweed farming and pearl farming pose problems to other coastal users who fish, navigate boats, and others.

c) Deterioration of landscape caused by inappropriately designed and destroyed structures

Landscape of urban coastal area of Manado and Bitung including ports is deteriorated by inappropriate structures due to non-enforcement of regulations and/or presence of destroyed structures on shorelines. At the ports in Manado and Bitung,

especially Manado port, squatters are occupying the coastal area and the coastal water of the port is polluted because sewage and garbage are discharged without treatment from inland and from the slums. The odor of the water is also not acceptable as a costal touristic place.

Some structures on the coastal area in Manado such as Kalasey seafood restaurants are designed inappropriately because there are no building criteria set for those buildings. They are built on the coastal water area without any consideration of preventing natural disaster. These structures are seen not only in urban areas but also in rural areas. In Nain, for example, the people enticed by seaweed culturing, started to build houses on coastal waters and this is giving impacts on the area by discharging all sorts of living waste. Such housing are seen in many other coastal communities in North Sulawesi. These factors not only decrease the quality of coast but also degrade the landscape.

(5) Danger to Marine Wildlife

The endangered marine wildlife are seen not only inside but also outside of protected areas, and marine wildlife is still caught in the study area. The marine wildlife seen in the Study Area is *Dugong dugon* and sea turtles. Coelacanth has been seen twice in the last few years around Manado Tua Island area.

Although *Dugong dugon*, an endangered species, should be protected according to law, they are still caught accidentally or intentionally, and processed into meat for sale and for consumption. It indicates that people's awareness should be promoted.

(6) Beach Erosion

There is no baseline data and no information on the trend of shoreline changes such as beach erosion and accretion. However, there are several clues that point to eroded areas along the shoreline, such as erosion scarps, fallen and falling trees in the east of Inobonto, and the presence of coastal defense structures along the west side of Manado Bay. Another effect of beach erosion is loss of land. Erosion can also cause houses, plantation, and coastal forest to collapse. It is required that a baseline survey be carried out widely.

Table 3.1 Summary of Coastal Problems in North Sulawesi

Types of Problem	Problems	Causes
Destruction of coral reefs	Inappropriate resources use	• Destructive fishing • Coral mining
	Inappropriate activities	• Anchoring • Tramping
Disappearance of coral reefs	Reclamation	• Increasing of land demand
Deterioration of coral reef environment	Water pollution	• Discharging of sewage • Discharging of industrial wastewater • Throwing of garbage • Inappropriate use of mercury in refining of gold
	Insufficient public health/ sanitation/basic hygiene in coastal communities	• Lack of education, information and awareness campaign by government
	Sedimentation	• Inappropriate farming (slope farming, shifting cultivation)
	Over-cutting of mangrove	• High economic value
Inappropriate spatial use	No plans and regulation for coastal spatial use	• Encroachment on shoreline by illegal settlers and buildings
	No arrangement of coastal facilities	• Obstruction of coastal use by marine culture
	Deterioration of landscape	• Inappropriately designed or destroyed structures
Danger to marine wildlife	No protection of marine wildlife	• Unknown or lack of information on protection of wildlife
Beach erosion	Beach erosion	• Natural process • Construction of structure on shore and other human activities

Source: JICA Study Team

3.2 Structure of Coastal Problems

Findings of coral reef problems were pointed out in the previous section. In this section, the causes of coastal problems are discussed. Coastal problems are various and complex, because one problem can be caused by several reasons, and one reason could be the cause of several problems. The structure of coastal problems in North Sulawesi is shown in Figure 3.1. The coastal problems are categorized into five according to the location and subjects as follows:

- inappropriate land use;
- population concentration and industrialization (Urbanization);
- inappropriate coastal spatial use;
- inappropriate coastal resource use; and
- no protection of marine wildlife.

(1) Inappropriate Land Development

As mentioned earlier, the causes of coastal problems are based not only in coastal water but also in the inland area. Location of land-based problems, which can generate a multitude of other problems, can be at both rural area and urban area. Using the Universal Soil Loss Equation, the areas where there is a high possibility of soil erosion are identified in the Study Area. High potential of soil erosion is seen in the area where the slope is steep and has sparse vegetation. Discharged soil into the sea covers coral reefs so that corals and other marine life depending on coral reef become extinct, and coral ecosystem converts to seagrass ecosystem because of difficulty of restoration. In these areas, serious soil erosion may occur in the extensive agricultural farm of alang-alang grassland. Shifting cultivation in steep slope area also may lead to soil erosion, especially the middle and downstream of Lomagin river basin, and between Kema and Bentenan.

There is limited information on harmful substances that impact on coastal areas. It seems, however, that the inappropriate use of mercury and agricultural chemicals causes water pollution as pointed out by BAPEDALDA and other agencies. Although small-scale miners are illegal, the authority does not control them. Not only are they using land inappropriately but they are also discharging wastewater into rivers from the gold refining process, which discharges mercury and tailing. It may be that overuse of fertilizer and pesticide also causes water pollution in coastal water. These activities may affect the coastal environment and ecosystem.

(2) Population Concentration and Industrialization (Urbanization)

Comparing with rural areas, urban areas such as Manado and Bitung have different problems on coastal management. Population density of the most concentrated area in Manado and Bitung municipalities are over 200 persons/ha. Population growth rates of these municipalities are 2.35% and 2.08% (1980-98) respectively and are significantly higher than that of rural areas. Urbanization occurs with rapid population increase and concentration, and mostly with industrialization. Population concentration and industrialization cause increasing land demand so that urban areas have to expand at whichever directions land is available. If the land is limited, demand of sea reclamation and encroachment on shoreline also increase accordingly.

Population concentration and industrialization bring urban environmental problems one way or another. They generate huge amounts of garbage and wastewater. Garbage, then, easily entangle on corals and others under the sea. Wastewater from households, factories, markets and other places are discharged into the sea and rivers and, in most cases, wastewater is not treated at all. The water in Manado Port has apparently been polluted by wastewater discharged from households and market place, and the absence of public toilets in the port area is making it worse. In the water area of Bitung, spilt oil probably from vessels and/or inland is always seen.

(3) Inappropriate Coastal Spatial Use

In the aspect of coastal spatial use, problems are seen in three areas; encroachment on shoreline by illegal settlers and buildings, obstruction of coastal use by marine culture, and inappropriately designed or destroyed structures.

An increasing population density and industrialization lead to increased land demand for industrial, commercial and housing purposes. As a result, some people encroach on shoreline, although it is prohibited officially. In Manado, shoreline or coral reef areas were reclaimed for development of commercial center. Small-scale reclamation can be seen even in the rural area for housing and breakwater construction.

Seaweed farming and pearl farming have a potential to boom in the Study Area because marine culture is economically attractive and look more stable than fishing. However, these facilities can pose problems to other coastal users who fish, navigate boats, and so on.

Inappropriate spatial use in the coastal area leads to coastal problems such as badly changed landscape due to inappropriately designed or destroyed structures on shoreline. This is especially evident in Manado area.

(4) Inappropriate Coastal Resource Use

With regard to the coastal area of North Sulawesi, some of the most serious problems are caused by inappropriate coastal resources use. Destructive fishing practices, such as dynamite fishing, poison fishing, and *paka-paka*, and coral mining has resulted in the depletion of fishery resources due to destruction of fish habitats. Although these activities have already been prohibited, they have a lasting effect.

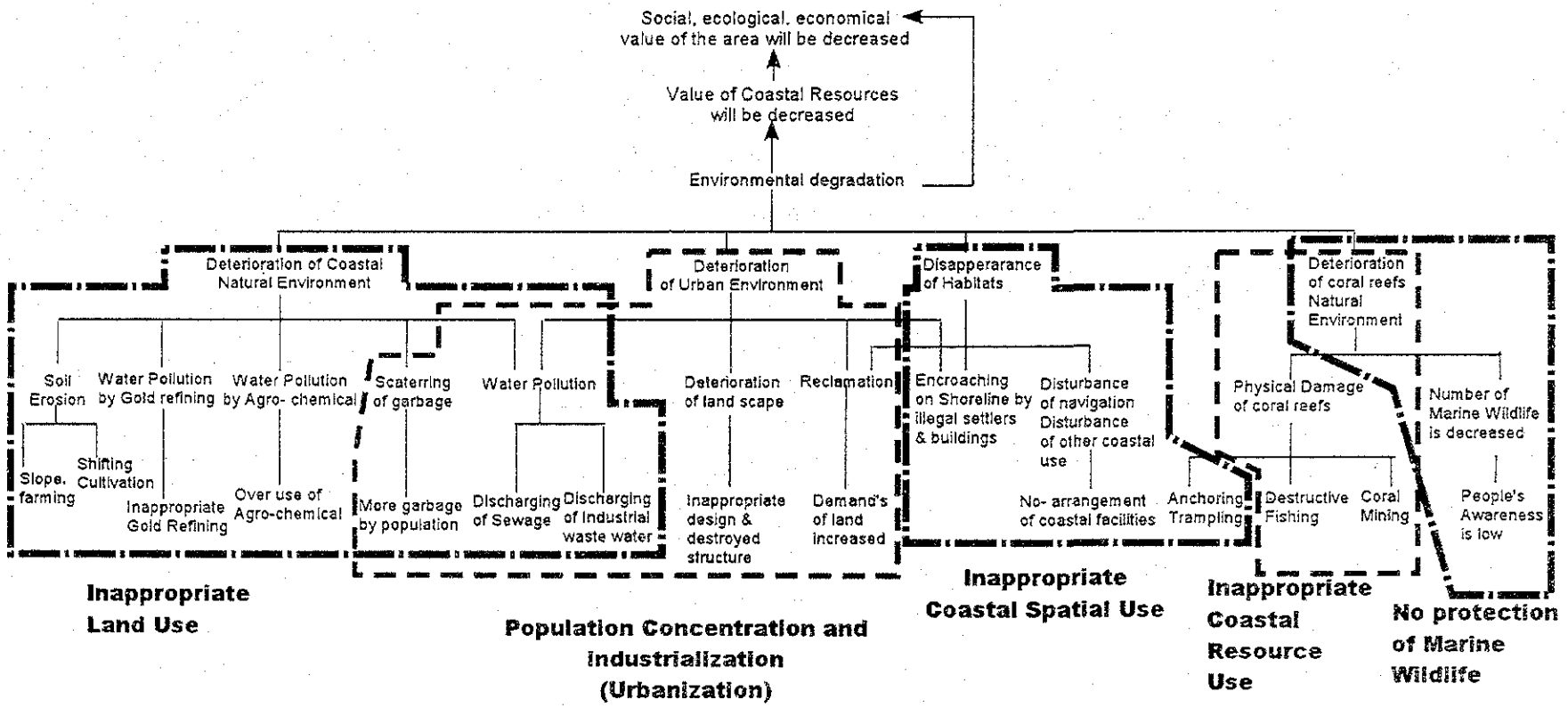
Community people are aware of the environmental problems and their causes and effects to some extent; however, they do not know what actions to take to solve these problems. Moreover, they seem not to realize their ability to solve these problems. They always wait for somebody else to provide a solution to their problems because they have been accustomed to someone else deciding what is good for them. Under the decentralization policy, communities need to be encouraged to take up their role and responsibility in order to realize their betterment by their own efforts.

The other cause of people's behavior towards their natural resources is common property open access regime of coastal resources. In the centralized management regime, the local area started to lose their traditional way to manage their natural resources due to absence of a traditional legal basis framework. As a result, the role of community level coastal resources management has been undermined in North Sulawesi, and it has been replaced by an open access regime, which offers "free for all" with uncontrolled entry for resource use and gives greater economic incentive to the users, and encourages the users to exploit as much of the resource as possible before others do.

(5) No Protection of Marine Wildlife

From the observation of what is happening in the communities, marine wildlife is not protected well in the Study Area. People still catch and kill endangered wildlife such as Dugong dugon. The reason could be that: 1) people do not know which marine wildlife should be protected, and the value of these marine wildlife; or 2) simply the economic value is more attractive than the protection of those animals. The combination of both may be a reasonable explanation for the problem. In the case of Dugong dugon, they are facing serious problem of survival.

The basic information and data regarding these wildlife is not existing in the Study Area. Therefore, it is important to have a cooperative effort to collect as much information and baseline data of these wildlife as possible and make appropriate strategies to protect wildlife including community based protection.



Source: Result of Provincial Steering Committee Meeting (compiled by JICA Study Team)

Figure 3.1 Structure of Coastal Problem in North Sulawesi (Cause – Effect Analysis)

3.3 Findings on Institutional Aspect of Coastal Management Problems

The previous section discussed what the coastal problems are and the structure of problems. The causes of the coastal problems vary from people's awareness to the economic and institutional matters. In this section, the institutional and administrative aspect of coastal management problems is summarized.

(1) Unclear Functions of Government Agencies under Decentralization Policy

In general, related regulations of decentralization were established in 1999, and decentralization came into force in 2001. Administrative functions and rules have been transferred to the local governments. However, detailed scope of work is not stipulated in related regulations. Together with the lack of prescribed guidelines and regulations for coastal management, coastal management in an integrated sense has not been in the stage of implementation. It is essentially important to clarify the functions for coastal management by each government and set guidelines and regulations in order to start the integrated coastal management in the Area.

(2) Lack of Right Persons for Coastal Management at Responsible Agencies

Local governments such as provincial, municipal and regency governments already have coastal management related sections. However, there are very few technical staff, and also some staff have different academic backgrounds from their job description and this makes it hard for them to carry out their job. The local academy, Sam Ratulangi University, has been producing many technical talented human resources such as regional planners, fishery resources experts, environmental experts and others. Governments are not making the best use of these human resources.

(3) Possibility of non- Utilization of Existing Management Resources of Central Governments

Before decentralization, central government agencies such as Department of Agriculture, Ministry of Foreign Affairs (*Dalam Negeri*) and Administration Reform (*Aparatur Negara*) carried out management tasks so that each one has its own data, which are very quantitative and valid data/information, even though these agencies do not have an integrated data for planning and implementation of management. The problem area arises when a decision is made to abolish these agencies. The local governments have to face this problem and make an effort to keep these agencies operating for their own sake.

(4) Gaps in Government Functions and Financing

In the process of government reform, there are new sections/divisions designated to coastal management and holds a name with either "coastal" or "management" in provincial offices. Also the Provincial Board of Environmental Impact Assessment (BAPEDALDA) was established at the provincial level as well as the regency/municipality level. However, the newly established organizations have not been filled with staff holding appropriate backgrounds. It would still take time to solve this problem since personnel arrangement is carried out from the top of governmental hierarchy.

Finance is becoming a serious constraint for coastal management due to transition of government reform. As an example, the budget of North Sulawesi province for fiscal year 2000/2001 is suspected to decrease about 50% of its previous budget, even though the previous fiscal year is only for nine months, from April 2000 to December 2000, because year 2000 was the transition period of fiscal year system. This problem comes from modification and substantial decrease of Balancing Fund (*Dana Perimbangan*) from central government to province. At the moment, the central government and provinces are negotiating about the allocation of General Allocation Fund (DAU) and Special Allocation Fund (DAK) to fill the gap from previous years. The Contingency grant has been additionally allocated to the province from the national budget up to the request in 2001. However, development budget and routine operation budget still do not exist in 2001. If the current budget situation would not improve, the financial condition will be faced with serious problems. These insufficient budget might affect all other activities such as planning and implementing of environmental / coastal management policy.

(5) Lack of Necessary Information and Data for Coastal Management

Although governments, academic institutions and foreign aid programs/projects have conducted surveys and research work on coastal areas, coverage areas are spotted or coverage fields are narrow. Take the case of the mining problem in North Sulawesi. The seriousness of this problem has never been determined based on a scientific survey.

Any management planning requires spatial data. Specific areas such as protected areas, potential areas and hazardous areas should be clearly delineated. It is necessary that the scientific and spatial data be used for policymaking, political decision-making and planning for coastal management. Resources management requires contents of utilized resources, reserved areas, and amount of available resources. However, there is limited available data, even of important resources for North Sulawesi. In the case of fishery resources, only fishery production data of five Fish Landing Offices (*PPI*) and eight

Fishing Auction Markets (*TPI*) are available. These data from *PPI* and *TPI* account for around 20% – 30% of total catch amount.

There are several reasons for the lack of necessary scientific data and information. First, the importance and value of verified data is not recognized by the related agencies. This has become a negative circle as follows: the agencies do not have scientifically sound data and information, thus they are not aware of its benefit to their planning and monitoring of implementation. Therefore, they cannot feel the importance of good data and information. Also a mechanism to share and disseminate these related data and information does not exist, so that naturally the data collection methods are not based on common technical guidelines nor are they uniformly formatted. Therefore, it is hard to accumulate and share good data among related agencies.

(6) Some Management Issues in the Marine National Park

It seems that there are two main management issues pertaining to the Marine National Park in the area. They involve institutions and management aspects as follows:

a) No basic law and guidelines for protected area management

Basic law and guidelines for protected area management have never been established in Indonesia so that allocation of responsibilities among governments is not clear. Also because of the absence of a basic law, many related regulations are applied as substitute for basic law and as a result, the whole regulation structure became very complex and difficult to understand

b) Management issues: park boundary and implementation of patrolling and monitoring

Management issues can be divided mainly into two: 1) Park Boundary and 2) Implementation of Patrolling and Maintenance.

In Bunaken National Park, which covers only the coastal water but not the island, community people live on the land area of islands, which are not covered by the national park. In other words, a community is surrounded by the national park, but community people do not live inside the national park administratively. However, it is important to include the land area to control human activities, which are affecting coastal environment. Otherwise, the National Park can be affected by human activities from the land, despite the fact that it is a national park.

Some community people are not aware that the coastal water in front of their community is designated as part of the national park. Whether known to them or not community people often do not consider protection of national park from the evidence physically seen in the national park area. That evidence includes seaweed culture instrument, scattering of garbage, dynamite and poison fishing, and many others. Routine work such as patrol and maintenance of park facilities are not implemented properly due to shortage of human resources and budget. Hence, destructive fishing such as dynamite fishing is still occurring even inside the national park.

Chapter 4

Prediction of Coastal Problems in the Future

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Prediction of Coastal Problems in the Future

4.1 Target Years

The target years of the JICA master plan of the Integrated Coral Reef Management Plan are divided into three phases:

- Short-term : Up to 2005 (=target year of PROPENAS and POLDAS)
- Mid-term : Up to 2010 (=target year of RTRW Municipality and Regency)
- Long-term : Up to 2015 (=target year of RTRW Province)

The target years of the master plan should be consistent with the target years of current regulations of the development plans of the Indonesian government, because the dominant projects and programs, shall be implemented by the Indonesia central and local governments. The first phase is targeted in the year 2005, which is the target year of PROPENAS (*Program Pembangunan Nasional*: National Development Program, 2000 - 2005) at the central level and POLDAS (*Pola Dasar Pembangunan Daerah*: Basic Direction of the Regional Development, 2000 - 2005) at the local level, as short-term period. The second phase is targeted in the year 2010, which is the target year of the RTRW (*Rencana Tata Ruang Wilayah*: Regional Spatial Development Plan) of the autonomous regions of regencies and municipalities, and the third phase is targeted in the year 2015, which is the target year of RTRW province.

4.2 Impact on the Coastal Area

The purposes of this section are:

- to make predictions of the size/scale and kinds of important socio-economic factors which are assumed to have impacts on the coastal environment in the future;
- to show some predicted pictures of the real conditions which are influenced by these impacts; and

- to show a clear way to incorporate the strategies that would prevent or minimize those impacts, based on the predictions made, into the master plan, which is to be formulated in the coming phase.

The socioeconomic factors of population growth, spatial coastal use, pollution loads, and coastal resource use are considered as important factors which have potential impacts on coastal environment including coral reefs and their habitats. The population frame is drawn up first, and prediction of the socioeconomic changes is made separately by urban and rural, because the socioeconomic situations in these two areas are very different in terms of scale and kinds of impacts. Those factors that might impact on the coastal area are not only presently existing factors that could change in scale as time passes, but also new factors which might arise in the future.

4.2.1 Population Change

Population is a basic indicator of the pollution loads of a region because the pressure arising from population growth will give direct impacts on coastal resources and spaces. The population is estimated in three different planning phases: from the present to 2005 (for short-term), up to 2010 (for mid-term) and up to 2015 (for long-term). Details of the population projection are described in the Interim Report. The result of the projection is shown in Table 4.1.

Table 4.1 Populations in the Autonomous Regions, 1990 to 2015

	1990 *1)	2000 *1)	2005 *2)	2010 *2)	2015 *2)
Manado	320,600	366,695	416,910	472,846	534,982
Bitung	105,638	141,306	160,656	182,211	206,156
Minahasa	702,604	769,293	813,153	848,704	881,542
B. Mongondow *3)	214,733	245,460	274,439	286,438	297,520
Study Area	1,343,575	1,522,754	1,665,158	1,790,200	1,920,200
North Sulawesi Province *4)	2,477,189	2,820,839	3,029,700 *5)	3,247,801	3,473,027

Notes and sources;
*1) Census data, BPS
*2) Estimated by JICA Study Team
*3) Only within the Study Area
*4) Including Gorontalo Municipality and Regency, and Boalemo Regency
*5) Estimated by BPS

As shown in the above Table 4.1, the population of the North Sulawesi Province will be 3.47 million in 2015, which is 1.23 times of its 2.82 million population in 2000. The population of the Study Area will increase with a higher growth rate of 1.56%, which is more than the provincial rate due to the influence of two urban population growths of Manado and Bitung in the Study Area. The estimated population of Manado and Bitung will be 534,982 and 206,156 in 2015 with an annual average growth rate of 2.55%. The

sizes of the population of both cities are 1.46 times bigger than the size of the existing population in 2000.

On the other hand, the population of the rural area, namely, Minahasa and Bolaang Mongondow regencies, will increase at a lower rate of 0.91% in Minahasa and 1.29 % in Bolaang Mongondow in the period of 2000 to 2015. The changes of the population in the rural areas will not be so significant in general. However, there are several small towns in the rural coastal areas such as Amurang, Likupang, Tately, and Kema, with a population over 5,000, that will have more significant population concentration than that of other rural areas. Some of these towns have the potential to create serious pollution loads to the coastal water in the future due to delay of installation of sanitary facilities.

4.2.2 Environmental Impact in the Urban Areas

(1) Important Factors in the Urban Areas

In the next 15 years, the socioeconomic aspect in the urban areas is characterized by industrialization accompanying population concentration in the area. In summary, the important factors related to the management of the coastal areas in the urban areas over the next 15 years will be three:

a) Acceleration of population increase and concentration in the cities

b) Acceleration of the urban development in the coastal area, including ports, resort hotels, industrial estates, commercial facilities development on reclaimed areas, and illegal settlements or encroachment on the beaches or on the sea areas. Those development activities will give various impacts on the coastal environment and change the natural shorelines to artificial ones.

c) Increase of the pollution loads by increased wastewater and solid waste discharges into the sea

(2) Acceleration of Population Increase and Urban Development in the Coastal Area

a) Manado Municipality

The expansion of the urban area will be toward the fringe areas, where the ring road is to be built, and other areas along the existing roads with comparatively flat areas next to the existing built-up area in the mountainside. However, it is possible to develop the coastal areas of Malalayang and Molas in the future, because both areas are comparatively flat and have good accessibility from the existing urban center,

and the ring road is planned in the area of Molas. The major planned development projects are as follows:

- land reclamation in the seawater front of the city
- Manado fishing port and by-pass roads
- 5 units of star-rank hotels with 864 rooms

b) *Bitung Municipality*

The expansion of the urban area will be toward the fringe areas, where there are comparatively flat areas next to the existing built-up area in the mountainside, because most of the coastal area has already been built-up. Comparing with Manado municipality, the development potential areas are very limited due to the topographical feature of the municipality. However, it is possible to develop the coastal areas of Aertembaga to Tandurusa and Tanjung Merah in the future, because both areas are comparatively flat and have good accessibility from the existing urban center, and the industrial estate is planned in the area of Tanjungmerah. The major planned/ongoing development projects are:

- container port; cargo construction center is now underway but the fishery port development is still in the planning stage.
- industrial estate of 350 ha is planned in Tanjungmerah.

(3) Increase of Pollution Loads to Coastal Area

Along with the increase of the population in Manado and Bitung municipalities, the quantity of wastewater and solid waste is expected to increase and will give impacts on the coastal area. Predicted qualitative impacts of wastewater pollution and human waste pollution on the coastal areas in Manado and Bitung municipalities are contained in this report.

4.2.3 Environmental Impact in the Rural Areas

(1) Important Factors in the Rural Areas

In the next 15 years, the important factors in the rural areas are the existing activities of illegal destructive fishing and coral mining, which are expected to continue even in the future. Other threats to the coastal area are putting up of fishpens (*Tambak*) and engaging in pearl and seaweed culture and other activities that directly impact on coral reefs and mangroves.

There will be 3 major issues in the rural areas in the future:

a) Fishery, agricultural and tourism development activities will give various impacts on the coastal area, such as deterioration of the seawater quality, change of shoreline forms, inappropriate occupation of sea areas, etc.

b) Wastewater and solid waste problems in the semi-urban areas

c) Overuse and inappropriate utilization of natural resources, which are already critical problems at present, but will continue to pose problems even in the future

(2) Fishery, Agricultural and Tourism Development Activities in the Coastal Area

The major planned and potential development projects are as follows:

a) Mariculture development in Minahasa and Bolaang Mongondow will be promoted also in the future. The expansion of fishpens and seaweed culture will be accelerated in the future and there are potential competitions on coastal spatial use by fishermen on the coast.

b) Irrigation development project is planned in Tumpaan, Kabupaten Minahasa, which faces the south part of the Bunaken National Park.

c) Tourism development potential areas are located in Tumpaan, Belang and Likupang in Minahasa and Kotabunan in Bolaang Mongondow. Environmentally sound development must be introduced in these areas, because although the coral reefs and other ecosystem in these areas are still in good condition, they are vulnerable to the changes of natural environmental conditions.

(3) Wastewater and Solid Waste Problems in the Local Towns

The problems of seawater pollution by discharged wastewater and outflow of dumped waste to the sea area has already reached the critical level in some towns, such as Belang, Amurang, Tumpaan, Talely, Kema, Nain and Likupang in Minahasa and Inobonto in Bolaang Mongondow, and these problems will be more critical in viewpoints of wastewater and solid waste management in the future.

(4) Overuse and Inappropriate Utilization of Natural Resources

Overuse and inappropriate utilization of natural resources, which are already critical problems at present, but will also pose problems even in the future. Activities that fall under this type are as follows:

- destructive fishing,

- illegal coral mining, and
- soil sedimentation on the coral reef habitat (including soil erosion from the land areas of clove trees)

Table 4.2. Summary of Predicted Impacts on the Coastal Areas

	Urban Coastal Area	Rural Coastal Area
Population	Increase to 1.5 times in 2015 *)	Stable population change
	The built-up areas for both cities: 1.5 times in 2015*)	Local towns with an existing population over 5,000: increase similar to the cities
Factors of acceleration by the socio-economic development	Land reclamation and coastal road development in Manado	Mariculture development (seaweed, shrimp, lobster, grouper, pearl, etc.)
	Port development in Manado and Bitung	Beach and tourism facilities development
	Resort hotels and tourism facilities development in Manado and Bitung	Irrigation development
	Industrial estate development in Bitung	Destructive fishing, illegal coral mining in the coastal areas, and gold mining and agricultural activities in the catchment areas will be continued in the future.
		Chemical and fertilizer use for agriculture and mariculture
Impacts on the coastal areas	Eutrophication and deterioration of the seawater quality by wastewater discharge (total BOD generation in the cities will be 1.6 times in 2015) *)	Damages on coral reefs, coral fishes and other marine ecosystems
	Sedimentation and deterioration of the seawater quality by solid waste outflow (total waste generation in the cities will be 1.8 times 2015) *)	Eutrophication, sedimentation of the solid waste, and deterioration of the seawater by wastewater discharge and solid waste outflow in the small towns and river mouths
	Changes to artificial shorelines and landscapes	Sedimentation of soil in the river mouths

Source: JICA Study Team

*Note: *) estimated by the JICA Study Team*

Chapter 5

Planning Framework of the Master Plan

Chapter 5
Planning Framework of the Master Plan

5.1 Planning Goals and Objectives of Master Plan

(1) Planning Goals

The master plan aims:

> *to ensure balance between coral reef conservation and regional development through appropriate use of the coastal area and sustainable use of coastal resources, and to preserve, conserve and rehabilitate the natural environment effectively in the planning area.*

To achieve the above overall goal, it is required that coral reefs should be conserved and used at the same time, because people obtain benefit as providing living space and income sources. It is reasonable to support that the sustainable utilization of coastal resources will improve and stabilize the living standard of people, and also bring about the conservation of coral reefs. This is a structure that the conservation of the coral reefs will bring benefits to both coastal environment and coral reef users.

(2) Target of the Master Plan

The Study Team already identified that coastal environment of North Sulawesi is being deteriorated by human activities (Chapter 3). It should be emphasized that situation of coastal environment in North Sulawesi is critical. If there is no interventions/action taken, not only individual income and quality of life will be decreased but also regional economy will be crushed. Destructive and inappropriate activities and manners should be discontinued as soon as possible. To achieve the above-mentioned planning goal, the following target should be achieved.

> At least, environmental conditions in coral reefs should be ensured at conditions of the year 2000, and should be restored in the near future.

5.2 Planning Issues

The Study Team found various and serious coastal management problems in the Study Area. However, it is not reasonable to think that a single plan can address all the problems, because sometimes some problems differ in aspect and scope. Identification of management issues should be considered by type of problems, management capability, environmental conditions, and socio-economic situations.

Some of the problems have already been taken up by related agencies. For example, Bunaken National Park management has been implementing a Natural Management Program (USAID) in the last 10 years. Coastal protection including beach erosion problem was taken up in the Master Plan of Protection of Coastal Area in North Sulawesi by the Department of Public Works in 1997 and 1998. Therefore, these two aspects of coastal problems will not be included in the master plan.

Management issues to be solved are identified in the master plan as follows:

- spatial use of coral reefs including the coastal water and the land should be used appropriately considering coral reef environment, coral reef ecosystem, and potentiality of the coral reefs. **[appropriate spatial use]**
- coral reef resources should be used by appropriate amount and manners of gathering considering coral reef environment, capacity and potentiality of coral reef resources. **[sustainable resources use]**

5.3 Planning Approach

The following approach shall be adopted for the formulation of the master plan:

- integration approach;
- problem-solving approach and preventive approach;
- scientific data based approach; and
- bottom-up approach and top-down approach.

(1) Integration Approach

It is required that coral reef management should involve integration or a comprehensive approach, because coral reefs could be used for growth of local economy and national economy owing to their rich biodiversity and high productivity. Coastal area is found with both the sea and the land. There are lots of beneficiaries from the coastal area.

What is integrated coastal management? Integration involves the following four combinations: environmental conservation and development, coral reef ecosystem and

other ecosystems, the sea and the land, and government, community and private sectors as follows:

Conservation of Natural Environment – Regional Development
Coral Reef Ecosystem – Other Ecosystem
Coastal Use – Inland Use
Governments - Community - Private Sector

Conservation of natural environment and regional development

Coastal resources can be used for regional and national development. Most of coastal resources depend on natural environment. If coastal natural environment is deteriorated and damaged by human activities, coastal resources will be exhausted. Then, people will lose their property and income. There is linkage between the quality of environment and the quality of people's life. That is why the master plan aims to ensure balance between regional development and coral reef conservation.

Coral reef ecosystem and other ecosystems

The study title is "Integrated Coral Reef Management Plan in North Sulawesi" so that major target of the master plan is coral reefs. In the study area, however, coral reefs always do not have a singular existence. The main structure of coral reefs has several patterns, which are accompanied with sandy beach, rocky shore, mangrove forest and tidal flat. Coastal water flows to coral reef from other shoreline type of beaches, and to other shoreline types of beaches from coral reefs. It is considered inappropriate that coral reefs are separated from other types of shoreline in a management plan, because they are all affected by each other. Therefore, it is difficult that coral reefs are separated from other ecosystems in the master planning. This is the reason why coral reefs and other coastal environments are the planning target in the master plan.

The sea and the land

The coastal area is faced with the land area; consequently, land-based activities can influence coastal environment inventory directly or through rivers. This impact from the inland causes deterioration of coastal environment, so that use of inland should be seriously considered in master planning. These factors should be taken into account for coastal management.

Governments, community and private sector

The coastal area has various users, such as local people and people from outside, and different types of use, such as industrial use and non-industrial use, public use and profit use. Coral reefs are used in the same way and by the same groups of people. These groups or stakeholders are related to one another, but sometimes conflicts arise among them. It is a big issue how coordination can be achieved among users in a limited area and for limited coastal resources. Therefore, related communities should be involved in the master plan (see Figure 5.1).

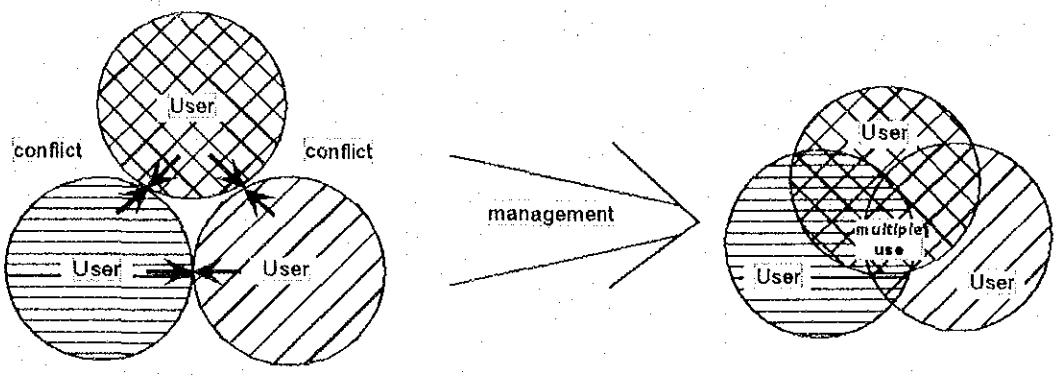


Figure 5.1 Conflicts Solved by Management

(2) Problem Solving Approach and Preventive Solution Approach

There are a number of coastal problems in the study area. These can be addressed through what is called problem solving based planning whereby coastal problems in the study area are to be solved in order to achieve a management target. On the other hand, it is assumed that other types or new types of problems may occur in the future. It is therefore required that future problems be predicted and measures be taken in advance against them (see Chapter 3). This is called preventive approach. Both of these approaches need to be taken up in the master planning.

(3) Scientific Data Based Approach

It is possible for anybody to point out environmental problems, but at the same time, is unable to show any evidence. Rumors cannot be a basis for planning. To realize both the sustainable utilization of natural resources and the conservation of coral reef, it is indispensable to introduce a management system based on scientific data. Scientific data

provide for effective management in order to minimize futile activities and budget. That is to say, first of all, it is necessary to specify the areas in North Sulawesi's coastal area which are important to be protected and conserved from the viewpoints of preservation of ecosystem, sustainable marine productivity, etc., by conducting a precise assessment research of the target area. This information is important and valuable for appropriate management. Only scientific evidence can realize management planning.

(4) Bottom-up Approach and Top-down Approach

In the master plan, key players for the implementation of coastal management is not only governmental agencies but also the private sector, academic institutions and communities. However, the government initiative, especially of provincial, municipal and regency governments, is imperative to ensure that the overall viewpoints of these entities are reflected. At the same time, complementary efforts from communities to the government initiative are necessary to make more a precise management plan according to the local situation and existing management issues. Therefore, the following approaches should be taken in the formulation of coastal management (see Figure 5.2):

- **Top-down approach**: for integrated government initiative for environmental management; and
- **Bottom-up approach**: for community based coastal management policies including community based resource management, community initiative for coastal environmental programs, etc.

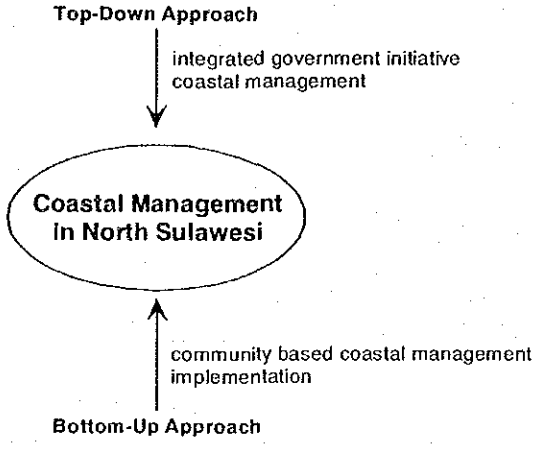


Figure 5.2 Integration of Top-Down Approach and Bottom-Up Approach

5.4 Planning Area

The coastal area is located between the sea and the land so that both offshore and land conditions affect the coastal area. Coastal area is prone to environmental problems for a variety of reasons caused from not only the sea but also the inland. Indonesia has achieved economic development but at the expense of its coasts, which have been harshly affected by intense development pressure. Therefore, the coastal area where includes coastal water and the land should be adopted as a planning area as shown in Figure 5.3.

Where is the planning boundary of seaward? The Indonesian government has adopted a policy of regional autonomy. According to Law No. 22, 1999, coastal waters 4 to 12 miles from shoreline should be managed by provincial governments (Figure 5.4). In terms of coastal water in coastal management, Indonesia's policy of regional autonomy and definition of coastal water should be considered so that planning area of seaward is at 12 miles from shoreline.

However, Law No. 22, 1999, does not prescribe where the shoreline starts – the lowest tide level or the highest level or the mean sea level. The Indonesian government is still formulating a definition of shoreline level so that boundary of shoreline has not yet been defined. It is recommendable that the term "shoreline" in the master plan be defined as high-high-water level (at spring tide), because seawater reaches the inner part of land mostly at this time.

Where is the planning boundary of the inland? For landward, land-based activities have an effect on coastal water. These impacts on coastal water are based on watershed condition. Therefore, planning area should cover land. The Technical Guidelines of the Ministry of Marine Affairs and Fisheries defined coastal water as the area covered landward between the highest tide and that part of land which is influenced by sea water. It is difficult to say at what distance the coastal area is affected, but the distance from shoreline planning boundary is based on impact sources and topographic conditions.

Intensive planning area Hence, planning area is defined in the master plan as coastal water and land area at 12 miles from shoreline (high-high-water level of spring tide) to the boundary of watershed. However, the intensity of planning area is designated for effective management. For coastal water, the designated intensive planning area is where coastal water covers coral reef area and/or within 3 miles from shoreline. The intensive area of coastal water is used very actively by people who are poor and dependent on coastal resources for their livelihood. The land area affected by coastal area is located approximately 50 – 200 or 300 m. In other countries such as Egypt, Sri Lanka, Mexico, the Philippines and Japan, 50 to 300 m is designated as management and/or controlled

areas for coastal conservation and management. In the master plan, land intensive area covers the land 100 m from shoreline based on the "buffer zone" established by Presidential Decree on Protected Areas, No. 32, 1990.

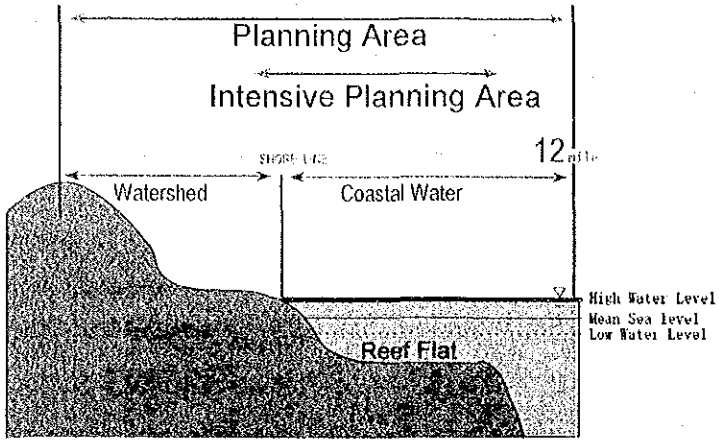


Figure 5.3 Planning Area

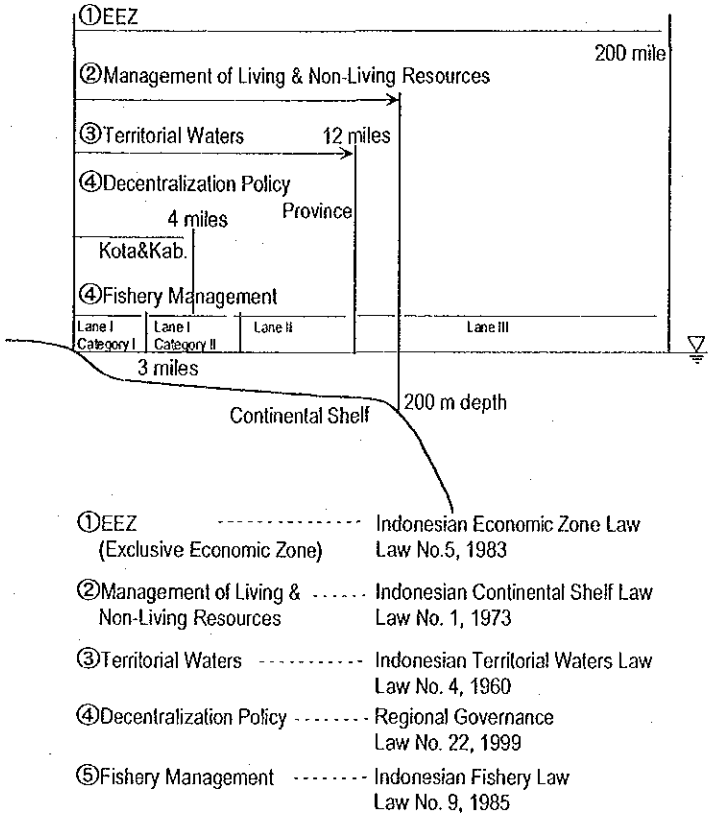


Figure 5.4 Indonesia's Marine and Coastal Water Classification

5.5 Management Strategies

The management issues for master planning are "achievement of appropriate coastal spatial use and sustainable coastal resources use". In order to solve the management issues, the following strategies should be taken in the master plan:

- coastal management zoning;
- unit based management;
- local government initiative; and
- community based coastal management.

(1) Coastal Management Zoning

The Study is taking the scientific approach to analyze the natural environmental condition of the area by taking aerial photos which cover not only coastal water but also inland area, analyzing natural conditions by several scientific surveys, and conveying the data into GIS. This is the first trial in Indonesia to take aerial photos of such wide area and to make a detailed spatial analysis based on the photos.

The Study Team adopted a zoning approach for formulating the master plan as management tool. That is to say, first of all, it is necessary to specify the areas in North Sulawesi's coral reef that are important to be protected and conserved from the viewpoints of preservation of ecosystem, sustainable marine productivity, etc., by conducting a precise assessment research of the target coral reefs. This information is important, valuable and effective for appropriate management.

(2) Unit Based Management

In the master plan, the study would like to propose this concept of "Management Unit", which is corresponding to existing management problems and predicted issues. Management units are units classified by area of problems or by target problems. For example, spatial use management deals with coastal spatial use among users in order to minimize conflict. Coastal resources use management unit deals with all coastal resource use in order to achieve sustainable use of coastal resources and to minimize conflict among resource users.

(3) Local Government Initiative

In the past, North Sulawesi coastal management has suffered more from isolation and ineffective management due to inaccessibility to government administration owing to its centralized form of government. In recent time, a dynamic change in roles and functions

of local governments has been ready to occur in the coastal management in North Sulawesi since the implementation of decentralization policy in January 2001. The government is expected to initiate coastal resources management by setting up new legislation and regulations, also new ideas and strategies. The momentum is now right and right for coastal management in a decentralized context.

In order to implement a comprehensive and integrated coastal management in the area, it would be one of the critical matters to have a unified office at the provincial level which deals with coastal management. The proposed function of different levels of government for coastal management is shown as follows.

Central government agencies	: policy making; formulation of national plan; and formulation of guidelines.
Provincial governments	: formulation of provincial coastal management plan; and coordination among municipal and regency governments.
Municipal and Regency governments	: formulation of action plan; and implementation of coastal management.
Village governments	: planning and implementation of CBCM; and coordination among villagers

(4) Community Based Coastal Management

Complementing government initiated coastal resource management is Community Based Management (CBM), which needs to be encouraged. CBM is an effective way to manage a coastal area because the people who manage the area know better than any others and the effects of management will benefit the people who manage the area directly. Although it should be kept it in mind that CBM is not a panacea for resource management, efforts should still be made to encourage village-level control on coastal resources in North Sulawesi, and also to institutionalize CBM for coastal area in the form of a decentralized government administration. CBM needs a more dynamic partnership evolved between local communities and local government, and also should be complemented by the ability of the local government to provide enabling legislation and other assistance. Responsibilities of coastal management are shared with among government agencies and communities. Conceivable functions of CBM are shown in Table 5.1.

CBM will, however, need to consider how a community can protect their coastal area and its resources from the other people outside of the community, because the sea is common property with open access to anybody who wishes to use the area. If there will not be a mechanism to protect community people's right to use and manage the coastal area, CBM

will be disturbed by the disorderly fights called " Tragedy of Commons". The master plan would like to look into the possibility of avoiding the issue by introducing "User Right" in a loose sense, which takes cultural aspect into consideration.

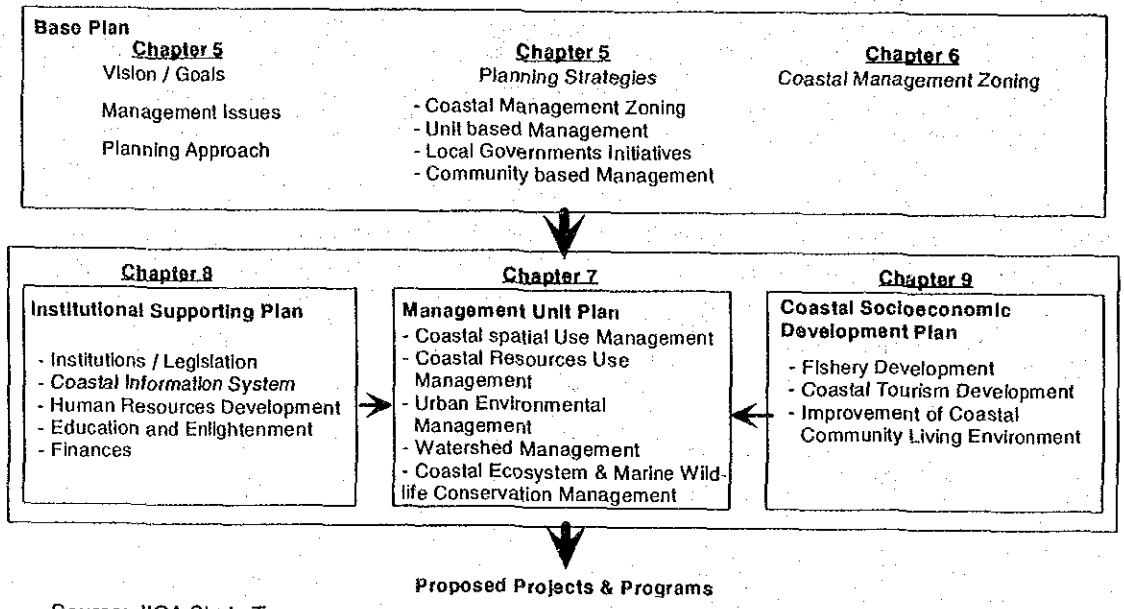
Table 5.1 Community Roles and Activities in each Management Unit Plan

	Coastal Spatial Use Management	Coastal Resources Use Management	Marine Wildlife Conservation Management	Watershed Management	Urban Environment Management
Information Collection	Collect information of spatial use and make a village map	Collect information of their coastal resource, its size, locations, quantity, and quality	Contribute making inventory of rare species such as dugong, turtle, etc in their coastal area		
Planning	①Make a plan on spatial coastal use of coastal area in front of a community by community members ②Establish management groups for spatial use management	①Decide strategies and activities to protect coastal resources such as establishment of DPL, establishment of toilets, decide disposal areas, etc ②Establish management groups for resources use management	①Make a plan for protection of marine wildlife, if the area has such livings ②Establish management group for marine wildlife	①Make a plan for protection of watershed, if the area on a watershed ②Establish management group for watershed protection	
Regulation	Make a spatial use village regulations	Make a regulation on DPL and other destructive activities to protect their coastal resources. (But not sure if they regulate the fishing gears, size, amount of fishes)	Make a regulation on protection of such marine lives.	Make a regulation on protection of watershed	
Activities		①Rehabilitate their natural resources such as mangrove plantation, setting up artificial reefs, etc ②Construct sanitation facilities and DPL ③Clean their villages including coastal area ④information dissemination on their resources conditions, etc	①Management group carry some educational activities and information dissemination to community people ②Exchange information on rare species among neighboring villages and report to the authority	①Clean rivers and river mouths by communities on the watersheds ②Construction Dike	Clean the coastal area
Monitoring	Monitor the spatial use of their village coastal area	Monitor their resources by sampling and observations (fishes, coral reefs, mangroves,)	Monitor the condition of habitats of wildlife and numbers	Monitor the condition of watershed	
Patrolling/ Controlling	Patrol the special use, especially around the boundary area	Patrol destructive activities in their area, and apply their village regulation to those who against.	Patrol the habitat areas	Patrol watershed area	Establish "Coastal Watch Team" to patrol illegal building, constructions, and settlements
Negotiating	Negotiate spatial use of boundary areas between each side of community	Negotiate the use (fishing) right			

Source: JICA Study Team

5.6 Structure of Master Plan

The master plan is composed of four major plans such as General Plan including Coastal Management Zoning, Management Unit Plan, Institutional Supporting Plan and Socioeconomic Development Plan. The structure of master plan is shown in Figure 5.5. The Management Unit Plan is key plan or core plan in the master plan. The Management Unit Plan consists of five unit plans such as coastal resources use management plan, coastal spatial use management plan, urban environmental management plan, watershed management plan, coastal ecosystem and marine wildlife conservation plan based on management area, targets and current administrative structure. The Institutional Supporting Plan is common plan for the Management Unit Plans. These plans show supporting mechanism of the master plan including institutions and legislation, information, human resource development, education and enlightenment, and finances. The Socioeconomic Development Plan intends to fill the gap between coastal communities and inland communities, and aim to contribute to coastal area management by easing socioeconomic constraints of coastal communities.



Source: JICA Study Team

Figure 5.5 Structure of Coastal Management Plan

Chapter 6

Coastal Management Zoning

Chapter 6
Coastal Management Zoning

6.1 General

In the coastal area, rich and various coastal resources are preserved. In terms of spatial use, the coastal area has various purposes such as tourism, amenity, reclamation and solid waste disposal site. There are overlapped areas by each coastal use such as coastal resource use and spatial use at same areas. Different uses are adjacent to other uses, and there is interference by each other. These situations generate user conflict and impacts geographically, ecologically and socially. It is necessary that there be coordination among resource users, and conflict arising from resource utilization should be minimized. Therefore, it is required that use of coastal areas should be reasonable and coordinated with use of neighboring areas based on geographical and ecological conditions. This chapter discusses the guidelines for coastal spatial use plan based on coastal natural environmental conservation.

6.2 Coastal Management Zoning for Environmental Conservation

6.2.1 The Need for Management Zoning

Zoning is one of the most common and effective tools for planning and management. Coastal management zoning is a basis of coastal management planning. Coastal management zoning is required in order to minimize conflicts between coastal resource utilization and coastal environmental conservation. To address the problems arising from these conflicts, coastal natural environment should be considered; at the same time, economic and social demands need to be taken into account. Coastal management zoning delineates areas that should be preserved, conserved and rehabilitated from the viewpoint of coastal natural environment and coastal ecosystem. Therefore, coastal management zoning can be used for setting up guidelines of coastal use planning, infrastructure

development, and environmental impact assessment studies. The objectives of coastal management area classification are more specifically as follows:

- to preserve environmentally important and critical areas, and their unique features;
- to protect critical habitats, ecosystems and ecological processes;
- to separate conflicts of human activities; and
- to minimize effects of human use of the coastal area.

The following coastal management zones are proposed:

- preservation zone;
- conservation zone; and
- rehabilitation zone.

6.2.2 Definition of Coastal Management Zones

Definitions of preservation zone, conservation zone and rehabilitation zone are as follows:

Preservation Zone is an area where utmost efforts are exerted to protect a target environment. Some of Preservation Zone can be established as core zone.

The Preservation zones to be included are:

- area rich in natural resource and are well preserved;
- area with high ecological values including scientific value; and
- area ecologically sensitive especially to human activities.

Conservation Zone is an area surrounding a Preservation Zone to function as buffer and reduce the impacts of human activities on a Preservation Area. Conservation Zone aims to secure environmental conditions and use natural environment and resources sustainably, considering environmental capacity such as ecotourism and traditional use with strict management area. Intense human activities should be restricted.

Conservation Zone intends to provide and contribute to the following effects:

- serving as physical barrier from human activities;
- rehabilitating the natural environment and expanding wildlife habitats; and
- supporting sustainable use of natural resources.

Rehabilitation Zone is an area requiring recovery measures from the viewpoints of ecosystem and natural landscape conservation; it is also an area damaged by natural disasters such as soil erosions and landslides.

Areas to be included in a Rehabilitation Zone are:

- area where deterioration of environment is feared; and
- area which affects coastal environment.

6.2.3 Methodology of Coastal Management Zoning

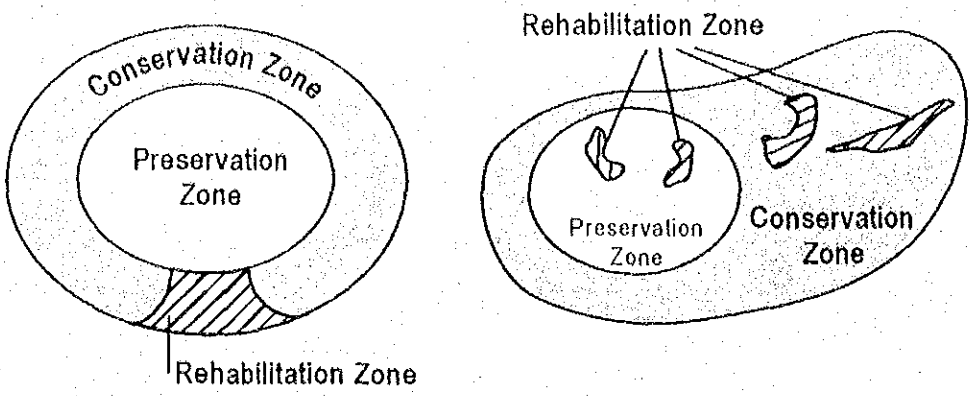
The coastal management zones consist of coral reef and mangrove forest in the coastal area based on ecological unit. In the future, zoning of other ecosystems such as seagrass and habitats of endangered species will be integrated into Coastal Management Zoning when more detailed information is obtained. Because different ecosystems have different levels of vulnerability against impacts caused by human activities, for example, the tolerance of coral reefs and seagrass by physical forces are different. Mangrove forest and coral reefs are distributed in different areas: mangrove forest is located on the coastline and mud bottom, and saline water is a restricted factor for growth, and corals are distributed on coral reef where water is shallow, and require clean saline water. The reason why coastal management zones should be delineated based on ecological units is that different ecosystems require different management approaches and techniques.

Establishment of rehabilitation zones for coral reef and mangrove forest strengthens the functions of preservation and conservation zones by ensuring the continuity and size of ecosystem and filling the gaps in and between preservation and conservation zones (Figure 6.1). This step is taken because of the potential threat of these gaps to further expand beyond rehabilitation zones into conservation and preservation zones.

Methodologies of rehabilitation works include the "do nothing" approach, restoration, partial recovery and conversion. Those methodologies of rehabilitation are adopted according to the possibility of application and type of ecosystem. These are briefly explained below:

- **"Do Nothing" approach:** This method is used in case restoration cost would be high, or the ecosystem could recover without rehabilitation works;
- **Restoration:** Damaged areas are restored to its original conditions of ecosystem;
- **Partial recovery**: A part of the whole ecosystem is recovered such as a part of functions and/or inhabitants of its area; and

- **Conversion:** Damaged ecosystem is converted to another type of ecosystem, for example, damaged forest is converted to grass land or pasture land

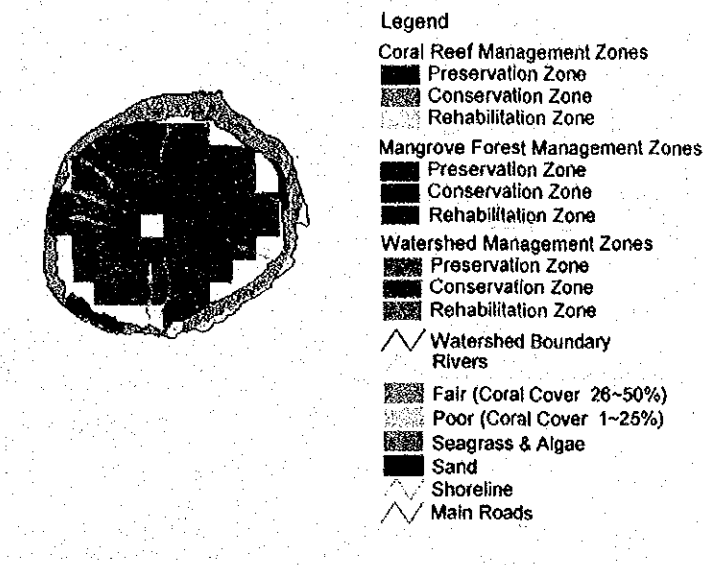


Source: JICA Study Team

Figure 6.1 Concept for Rehabilitation Zone

Terrestrial management zones are delineated from the viewpoint of conservation of coastal environment. The aim of terrestrial management zones is to secure soil stability for protection of soil especially against erosion. Terrestrial management zones are delineated where they face conserved coral reefs from the viewpoint of coastal water conservation. Therefore, terrestrial areas are to be delineated into preservation, conservation and rehabilitation zones, if coastal water areas are to be preserved and conserved as well.

For example, in the case of Manado Tua Island, most of its forested slope area is steep and should be conserved (Figure 6.2). However, the area in blue color is delineated as rehabilitation zone because it is a denuded area with steep slope that could be eroded easily. Moreover, there are coral reef preservation and conservation zones in front of its coastal area.



Source:JICA Study Team

Figure 6.2 Example of a Watershed Management Zone

6.2.4 Guidelines of Management Zones for Coral Reef

In the Study Area, there are but few well-conserved coral reefs so that conserved coral areas should be entirely preserved and conserved. In coral reef management, valuable coral areas can be defined as coral areas in healthy condition, i.e., having high live coral ratio and may include large size of coral areas with little disturbance from the viewpoint of coral reef ecosystem. Even disturbed by destructive activities, large size of coral area has important ecological functions. Therefore, two parameters, live coral ratio and size of area, are considered in order to delineate coral reef management zones. Criteria of coral reef management zoning are shown in Table 6.1. Preservation zone and conservation zone account for 5.5% and 12.5% of the total coral reef area (222.7 km^2) respectively. Damaged coral reef areas which are distributed within and/or surrounding preservation and conservation zones are designated as rehabilitation zone.

Table 6.1 Criteria of Coral Reef Management Zoning

Live Coral Ratio Size of Area	100 – 76%	75 – 51%	50 – 26%	25 – 0%
> 100 ha	Preservation Zone	Preservation Zone	Preservation Zone	Conservation Zone
21 – 100 ha	Preservation Zone	Preservation Zone	Preservation Zone	Rehabilitation Zone
10 – 20 ha	Preservation Zone	Preservation Zone	Conservation Zone	or
> 10 ha	Preservation Zone	Conservation Zone	Conservation Zone	Non-designated area

Source: JICA Study Team
Note:
Preservation Zone : 12.18 km2 (5.5 %)
Conservation Zone : 27.81 km2 (12.5 %)
Rehabilitation Zone : 13.35 km2 (6.0 %)
Non-designated area : 169.33 km2 (76.0 %)

Guidelines for coral reef management zone are shown in Table 6.2. Management policy by each zone is given below:

Preservation Zone

In North Sulawesi, well-preserved coral reefs are very limited, so their ecological value is high. Coral reefs are very sensitive especially to physical forces. Therefore, any activities which directly damage coral reefs are prohibited including fishing, tourism and others in principle in the Preservation Zone.

Conservation Zone

Although the Conservation Zone is already disturbed by human activities, it has still been conserved comparatively. The Conservation Zone should be sustained at least at the same existing conserved level through control of human activities. In Conservation Zones, some activities that do not damage coral reefs directly could be allowed with appropriate control and/or legal permission.

Rehabilitation Zone

In the Rehabilitation Zone, any kind of destructive activity is prohibited. However, fishing and other activities that do not damage coral reefs are accepted in the Rehabilitation Zone. This zone should be monitored regularly. Upon improvement of the Rehabilitation Zone, it could be converted to Conservation Zone and Preservation Zone.

Table 6.2 Guidelines for Coral Reef Management Zones

Preservation Zone	Conservation Zone	Rehabilitation Zone
• any construction of structure and facilities is prohibited • collection of shells for commercial and personal purposes is prohibited • coral boulder is not to be moved and replaced for any purposes • collection of reef materials such as sand and coral is prohibited • collection of aquarium fishes is prohibited • any type of fishing is prohibited • snorkeling and scuba diving are prohibited • natural viewing from boat is allowed • walking on coral reef is prohibited • anchoring is prohibited • research activities are allowed with legal permission	• construction of structure and facilities are prohibited • collection of shells for commercial and personal purposes is prohibited • coral boulder is not to be moved and replaced for any purposes • collection of reef materials such as sand and coral is prohibited • collection of aquarium fishes is prohibited • any type of fishing is prohibited excluding hook & line • snorkeling is prohibited • scuba diving is accepted with a certified dive master • natural viewing from boat is accepted • walking on reef is prohibited • anchoring is prohibited • setting up of mooring buoy is allowed	• construction of structure and facilities is prohibited including fishing, tourist facilities • collection of shells for commercial and personal purposes is prohibited • coral boulder is not to be moved and replaced, excluding rehabilitation works • collection of reef materials such as sand coral is prohibited • fixed-net fishing is prohibited • snorkeling is prohibited • scuba diving is allowed with a certified dive master • walking on reef is prohibited • anchoring is prohibited • setting up of mooring buoy is allowed

Source: JICA Study Team

6.2.5 Guidelines of Management Zones for Mangrove Forest

Delineation of mangrove forest management aims to conserve mangrove forest for ecosystem conservation. Mangrove forest is evaluated from two aspects, namely, generation and density of mangrove forest, in order to delineate mangrove management zones. In this zoning, older forest and higher density mangroves are valuable for stable shoreline and ecosystem, because these conditions of mangrove forest can foster numerous and various fauna and flora, and contribute high biological products. Therefore, height of crown and cover rate are used as parameters for above indicators.

Fragmented mangrove forest areas are connected with other fragmented areas. In mangrove forest conservation zone, continuity of the mangrove forest system should be ensured, and trees of diversified species should be planted.

Based on existing conditions, the mangrove forest is divided into four categories according to intensity of the disturbance received from human activities as follows:

- little disturbed mangrove forest;
- disturbed mangrove forest;

- heavily disturbed mangrove forest; and
- area with few mangroves.

Under this management zoning, 3 management units are proposed, which are preservation zone, conservation zone, and rehabilitation zone. Among the 4 categories of mangrove zoning mentioned above, the "little disturbed mangrove" corresponds to the preservation zone, the "disturbed mangrove" and the "heavily disturbed mangrove" correspond to the conservation zone, and the "area with few mangroves" corresponds to the rehabilitation zone. In these 3 management units, mangrove cutting and conversion to another land use are prohibited in principle. More detailed management guidelines in each management unit are explained below.

Criteria of mangrove forest management are shown in Table. 6.3.

Table 6.3 Criteria of Mangrove Forest Management Zoning

Preservation Zone	Conservation Zone	Rehabilitation Zone
Little Disturbed Mangrove The crown of trees whose height is more than 10m covers the ground at a rate over 70%. The areas receiving little impact of human activities and/or have already recovered enough from damages by human disturbances.	Disturbed Mangrove The crown of trees whose height is more than 10m covers the ground in the range from 30% to 70%. The crown cover rate of trees whose height is around 5m is very high. Heavily Disturbed Mangrove The forest height is 4 to 10m, although its crown cover is generally high enough. There is lack of tall trees because of the heavy disturbance by local people.	Area with Few Mangroves This is an area with few or no mangrove, although there are mangroves surrounding the area. For example, bare land and fishpond fall under this category.
1.1km2 (1.5 %)	70.1 km2 (93.6 %)	3.7 km2 (4.9 %)

Source: JICA Study Team

Guidelines for mangrove forest management zone are shown in Table 6.4. Management policy by each zone is shown below:

Preservation Zone

Preservation Zone is very limited, although its ecological value is high. Therefore, human impacts to this area should be avoided as thoroughly as possible. Not only mangrove cutting, but also the activities of fishing and crab trapping by local people, which disturb the habitat of fauna and flora, are prohibited.

Conservation Zone

Conservation Zone is to be established where mangrove forest has already been disturbed and its biomass, reduced. In this area, to recover the mangrove functions, overuses of mangrove are prohibited although moderate uses without decreasing mangrove forest areas are allowed.

The activities of fishing and crab trapping which do not directly damage mangroves are allowed. Also, the exceptional mangrove cutting to make a channel for boat passage and the facilities for ecotourism, environmental education, and research are allowed in this area.

Rehabilitation Zone

In the Rehabilitation Zone, which comprise 3.7 km^2 or 4.9% of the total mangrove forest, mangrove forest is rehabilitated in order to keep the continuity of forests in the preservation and conservation zone, and also to establish the buffer area for the preservation zone. However, all the disturbed mangrove forest is not necessarily recovered to the mangrove forest. The rehabilitation of mangrove is planned considering the actual land use and economic activities there. For example, in the case of fishpens, considering their economic importance for local economy, a feasible rehabilitation plan should be made.

Table 6.4 Guidelines for Mangrove Forest Management Zones

Preservation Zone	Conservation Zone	Rehabilitation Zone
• construction of marina and port is prohibited • construction of dike retaining walls, pier, jetty, causeway is prohibited • dredging of channel is prohibited • reclamation is prohibited • construction of facilities to avoid interfering with tidal flushing of wetlands is allowed • any facilities of fresh water discharging are prohibited • solid waste disposal is prohibited • liquid waste disposal is prohibited • any fishing activities are prohibited	• construction of marina and port is prohibited • construction of dike retaining walls is prohibited • construction of jetty made of wood, causeway is allowed with legal permission • reclamation is prohibited • construction of facilities to avoid interfering with tidal flushing of wetlands is allowed • any facilities of fresh water discharging are prohibited • solid waste disposal is prohibited • liquid waste disposal is prohibited • fishing activities excluding decreasing forest area activities are allowed	• selective logging for restoration is permitted • fishing activities are allowed • walking is allowed excluding at designated areas

Source: JICA Study Team

6.2.6 Guidelines of Management Zones for Watershed

The purpose of the watershed management in the master plan is to decrease the negative impacts caused by land-based activities against the coastal environment. Although there are several factors that affect the coastal environment, water pollution is the biggest concern from the viewpoint of watershed management. Especially eroded soil brought by river water into sea severely affects the coral reef ecosystem. Therefore, the zoning here is carefully conducted, paying attention to the potential occurrence of soil erosion. Delineation of watershed management zones aims to preserve the soil and conserve watersheds from the viewpoint of coastal management.

Watersheds are divided into 3 areas as explained below, based on the result of erosion possibility calculated by this Study using the USLE (Universal Soil Loss Equation) developed by the United States Department of Agriculture, and the criteria shown in the "Technical Guidance, Critical Land Inventory (Forestry Department 1996)." Management zoning areas cover watershed areas fronting conserved coral reefs. The area where the potential of erosion is low because of its gentle slope (0- 8%) is not zoned. On the other hand, the area of low possibility for soil erosion owing to good forest cover is delineated because the area can be eroded easily by the cutting of trees.

Table 6.5 Criteria of Watershed Management Zoning

Preservation Zone	Conservation Zone	Rehabilitation Zone
Area where the potential of erosion is low in spite of a steep slope (above 25%) because of dense forest cover.	Area where moderate amount of erosion (less than 180 tons/ha/year) occurs.	Area where severe erosion (more than 180 tons/ha/year) occurs.
1,875 km^2 (1.9 %)	94,244 km^2 (97.1 %)	926 km^2 (1.0 %)

Source: JICA Study Team

Guidelines for watershed management zone are shown in Table 6.6. Management policy by each zone is given below:

Preservation Zone

Preservation Zone includes a steep area with dense forest (potential of erosion is low). The existing forests are protected in order to maintain the condition of low amount of erosion.

Conservation Zone

Conservation Zone has a moderate amount of erosion (less than 180 tons/ha/year). The existing land use is to be maintained. But in case the land use is converted, it should not cause any drastic increase of erosion. Even in the case where a project with land use conversion is of a scale so small that AMDAL is not required, an environmental assessment especially on soil erosion should be conducted. If the increase of erosion is predicted, the project should be carried out with appropriate measures against the erosion (refer to Management Unit Plan of Watershed Management).

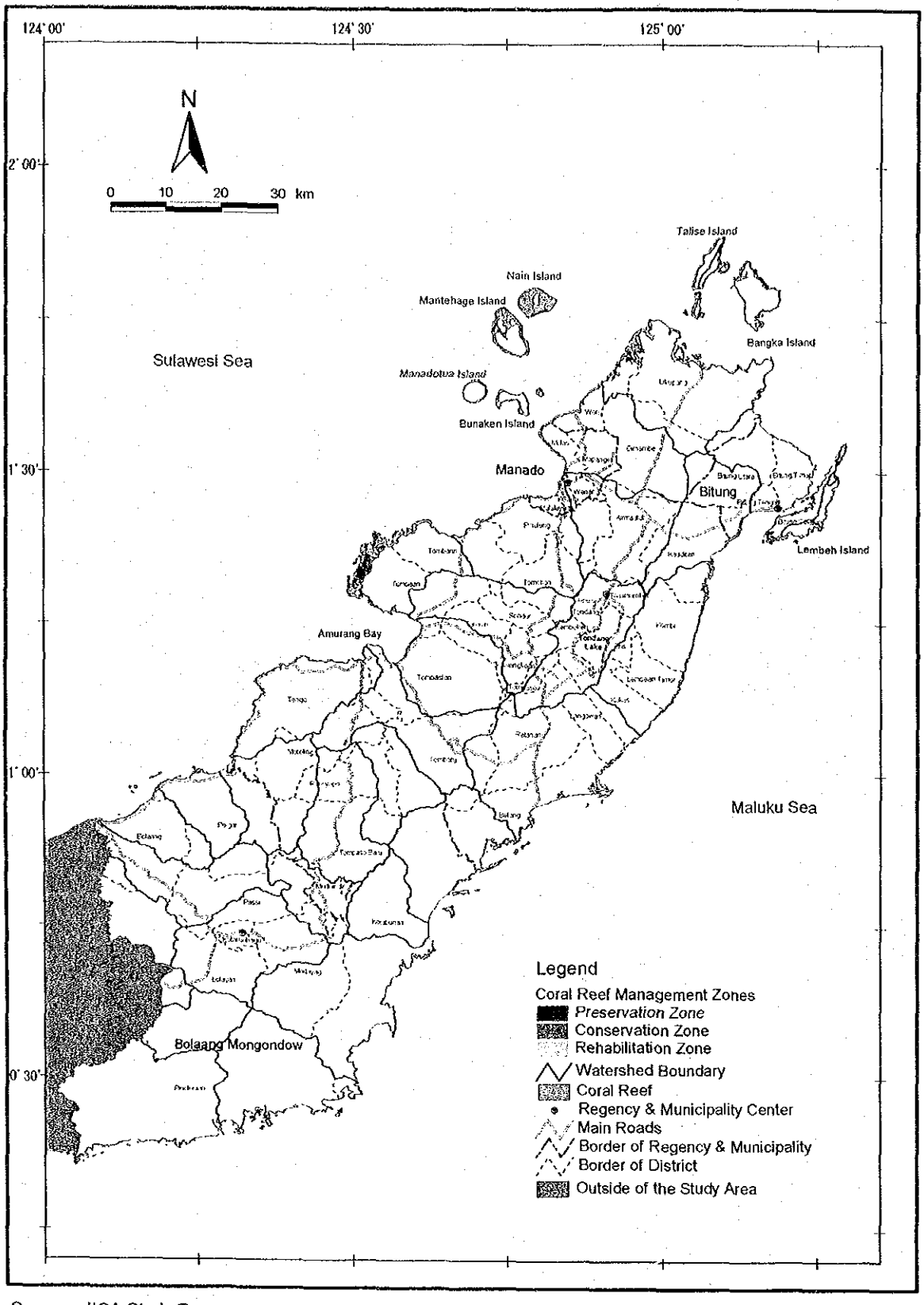
Rehabilitation Zone

The possibility of soil erosion in the Rehabilitation Zone is severe (more than 180 tons/ha/year). In order to decrease the amount of erosion, the existing land use should be improved with some measures, such as increase of land cover by tree planting and establishment of erosion control facilities, such as fences and dams, and their combination (refer to Management Unit Plan of Watershed Management). Several erosion areas without forest cover are priority for rehabilitation works.

Table 6.6 Guidelines for Watershed Management Zones

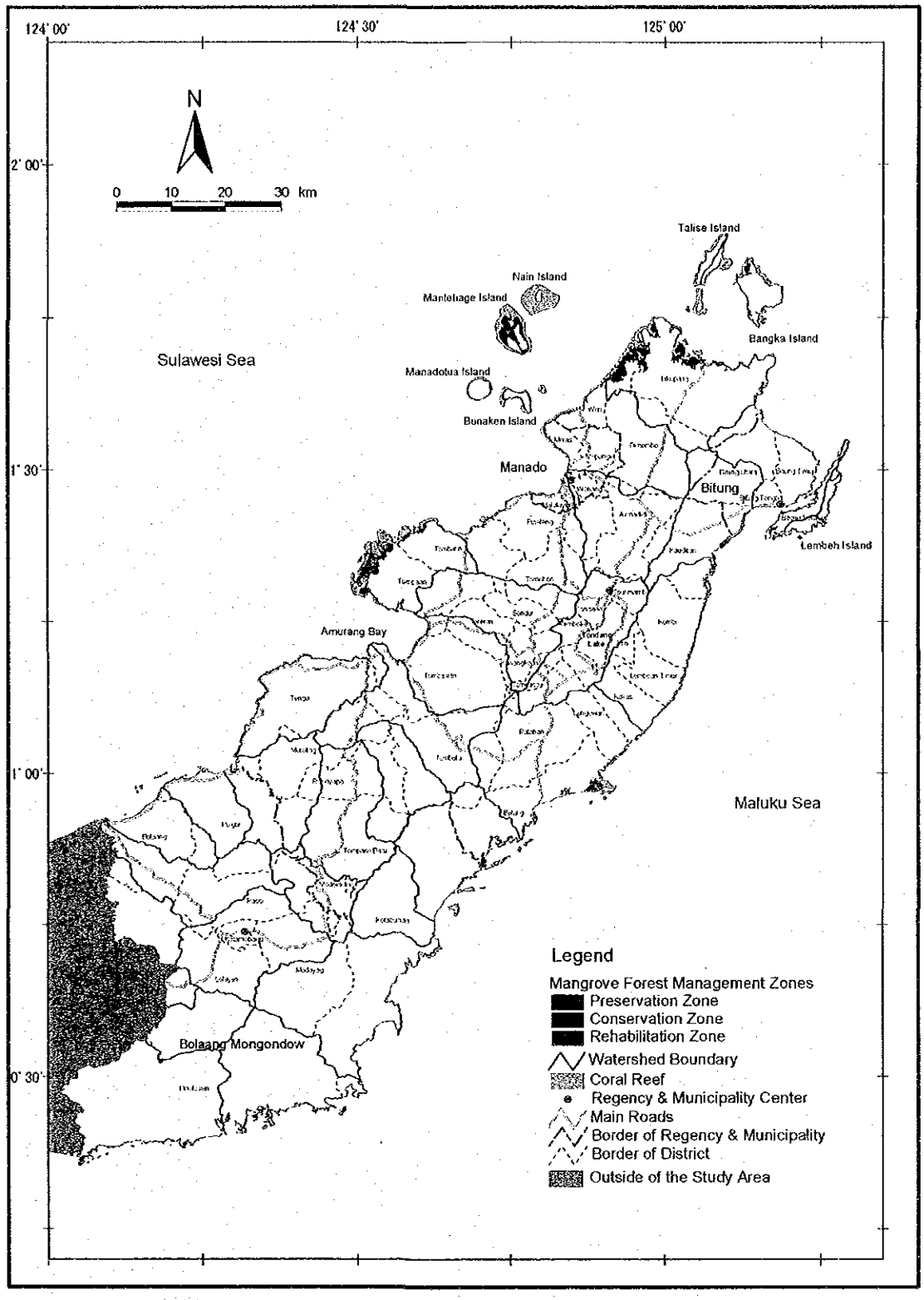
Preservation Zone	Conservation Zone	Rehabilitation Zone
• any spatial development is prohibited • any construction of roads is prohibited without legal permission and stable works • construction of building is prohibited without legal permission • logging, agriculture and any other activities which cause decrease of forest area are prohibited • cutting of trees for significant cultural, religious, anthropological purposes, and ceremonies and practices for traditional culture are allowed	• any spatial development is prohibited • any construction of roads is prohibited without legal permission and stable works • construction of individual houses and small buildings is prohibited without permission • small-scale facilities for tourism, environmental education purposes are allowed with legal permission • recreation and environmentally friendly tourism are allowed	• variety of indigenous tree species is planted • selective logging for restoration is allowed • slope stability works including fence grass planted are implemented • soil erosion control works including wire net gabion box, masonry retaining wall are implemented

Source: JICA Study Team



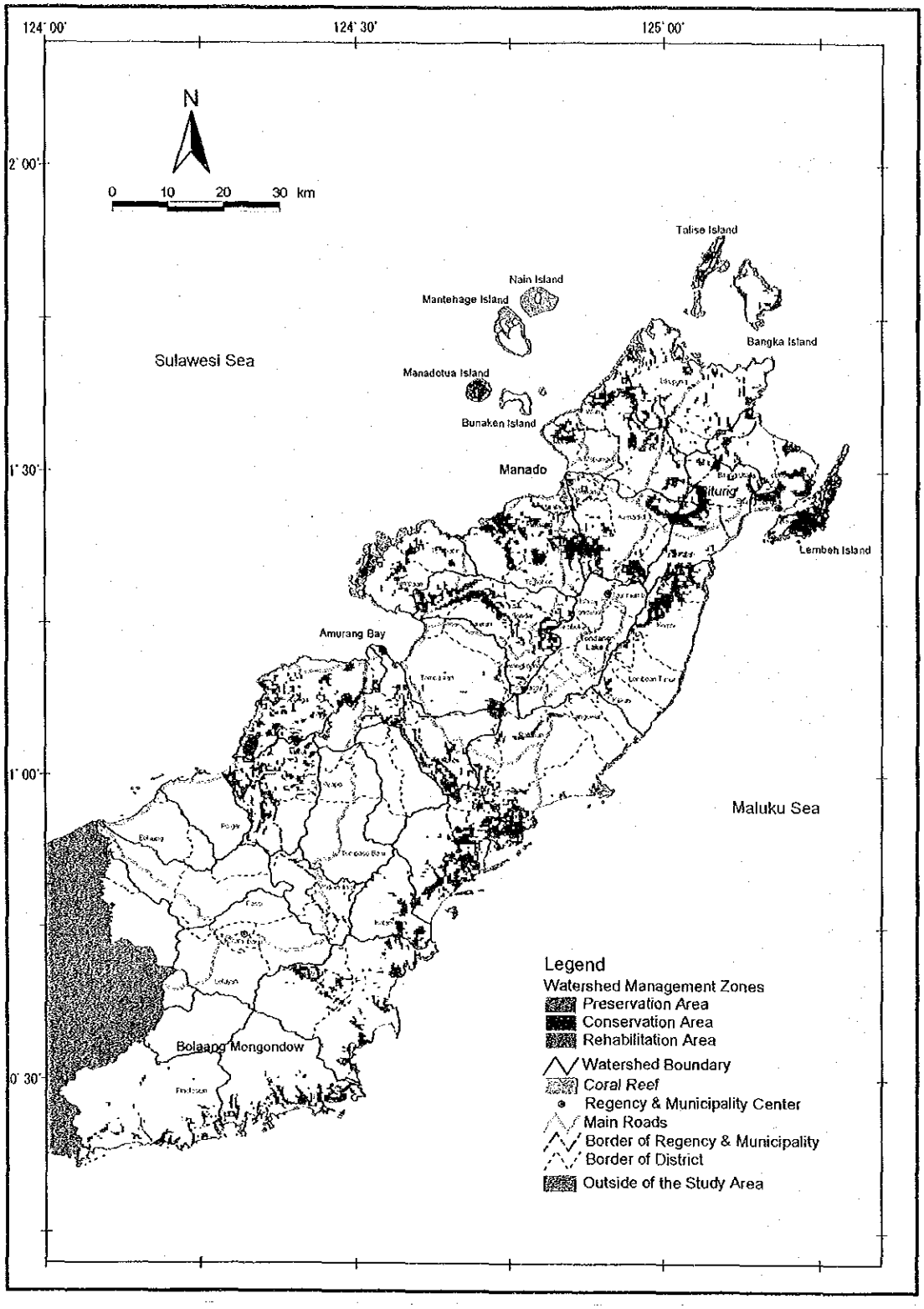
Source : JICA Study Team

Figure 6.3 Coral Reef Management Zoning Map



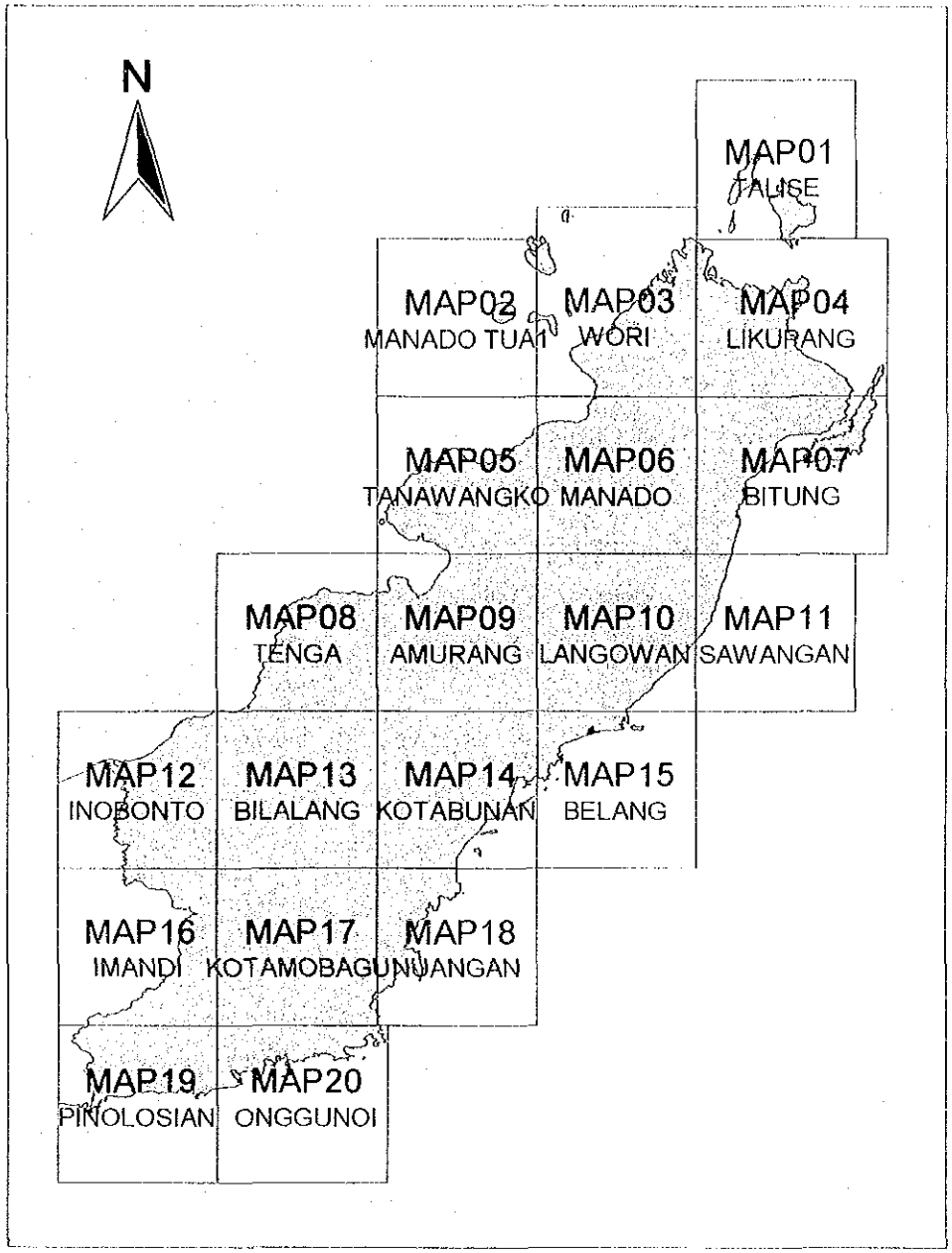
Source : JICA Study Team

Figure 6.4 Mangrove Forest Management Zoning Map



Source : JICA Study Team

Figure 6.5 Watershed Management Zoning Map



Source : JICA Study Team

Figure 6.6 Index Map of JICA GIS Database

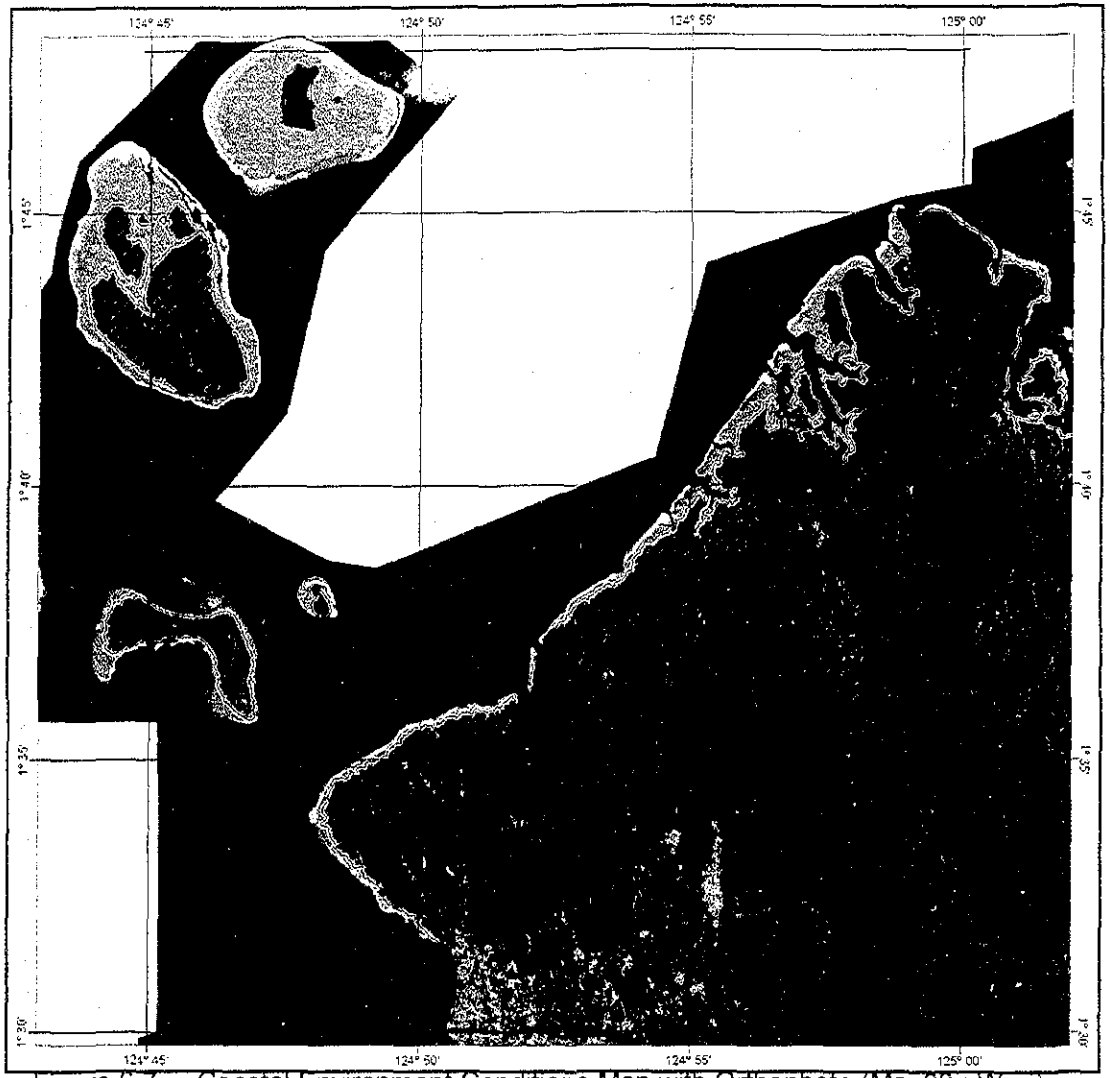


Figure 6.7 Coastal Environment Conditions Map with Orthophoto (Map03 : Wori)

Source : JICA Study Team

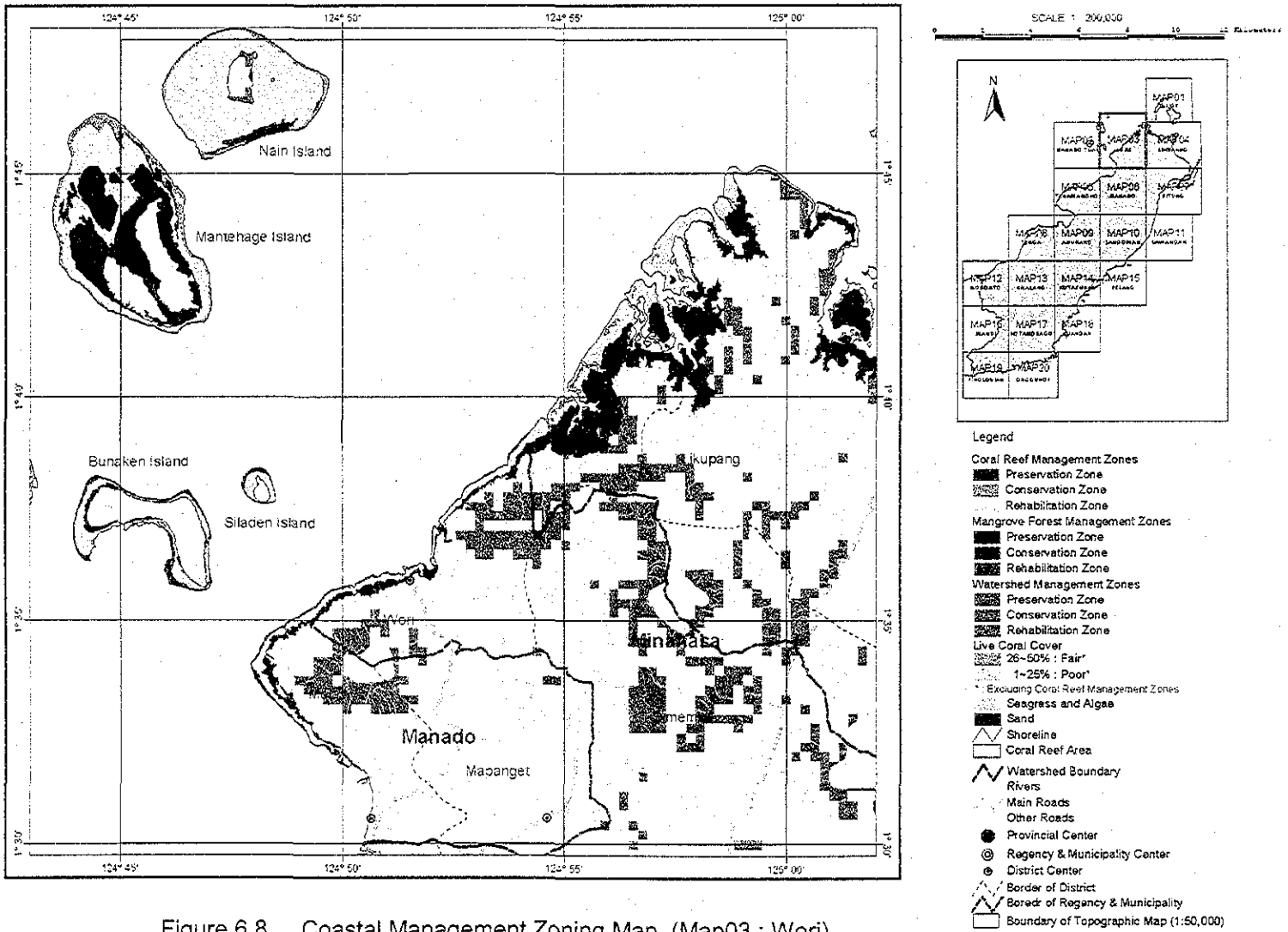


Figure 6.8 Coastal Management Zoning Map (Map03 : Wori)

Source : JICA Study Team

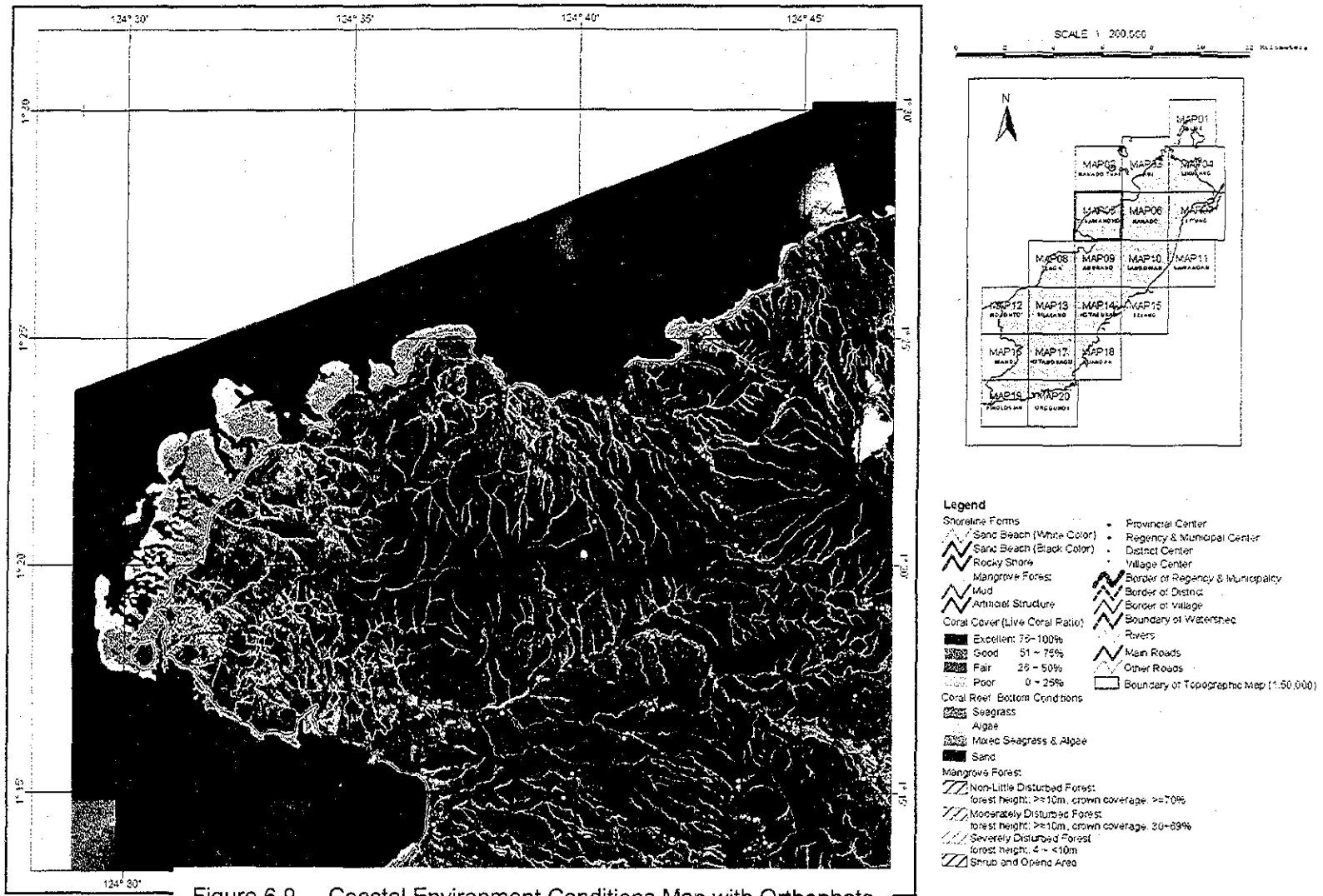


Figure 6.9 Coastal Environment Conditions Map with Orthophoto (Map05 : Tanamangko)

Source : JICA Study Team

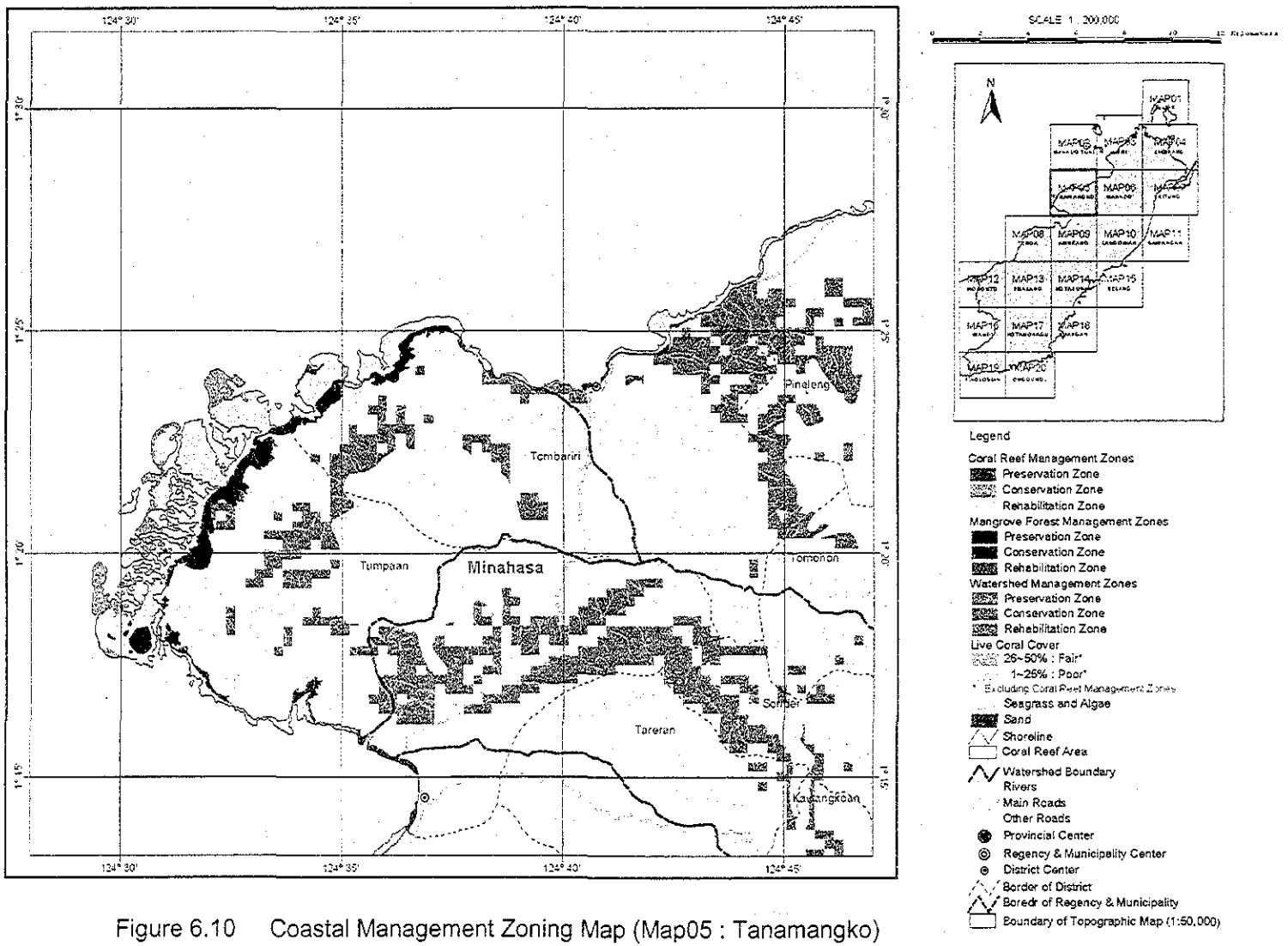


Figure 6.10 Coastal Management Zoning Map (Map05 : Tanamangko)

Source : JICA Study Team

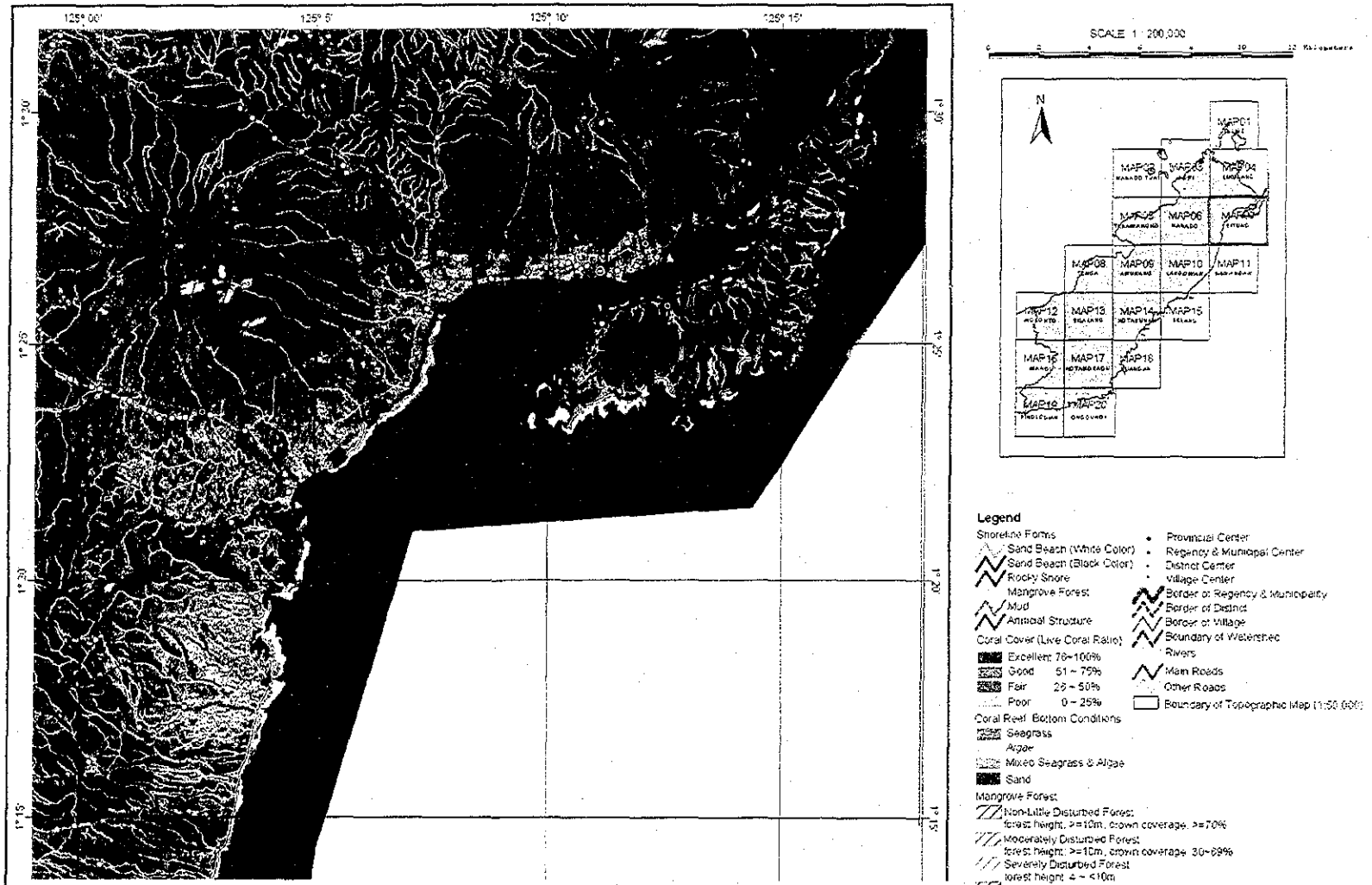


Figure 6.11 Coastal Environment Conditions Map with Orthophoto (Map07 : Bitung)

Source : JICA Study Team

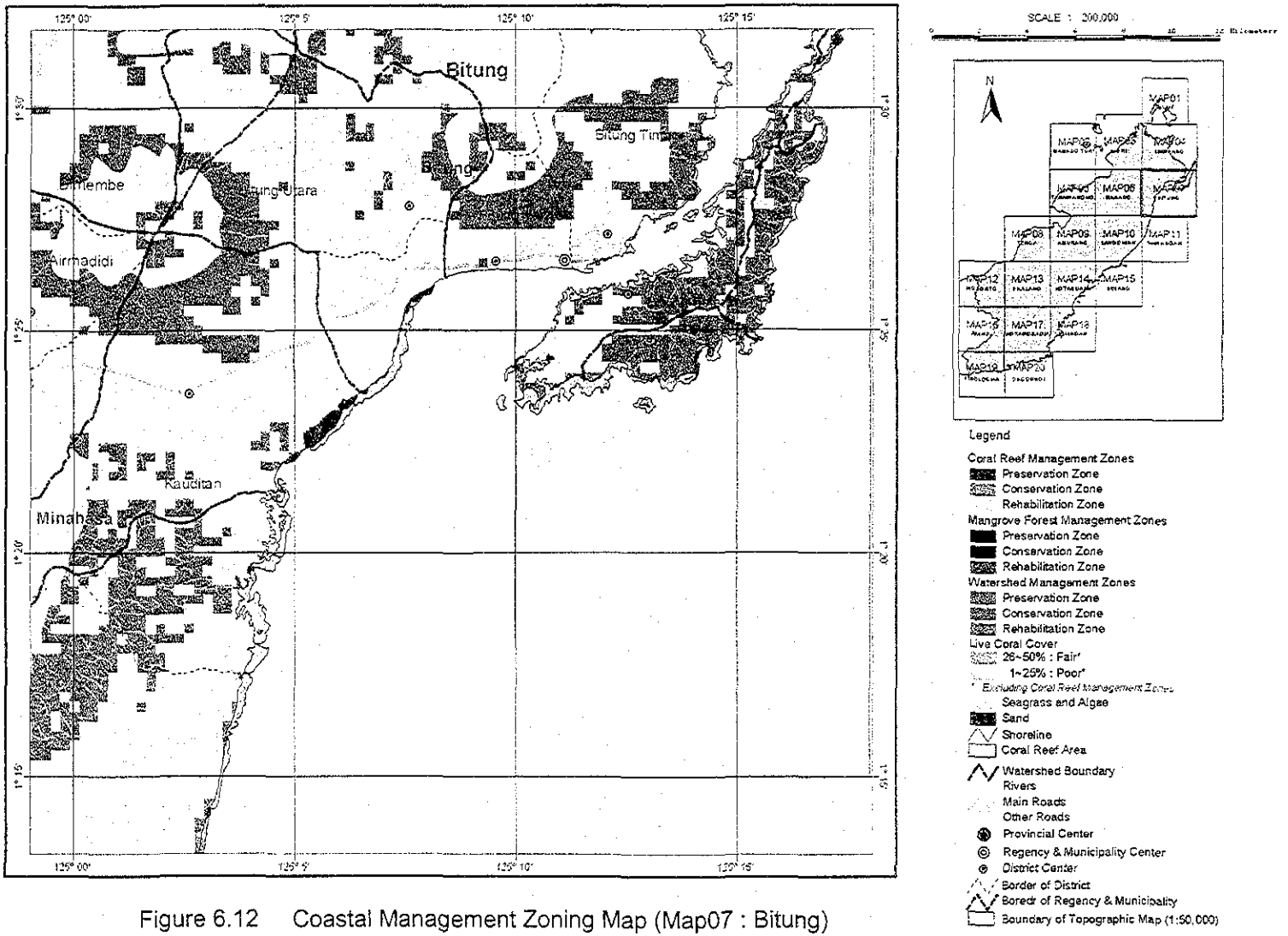


Figure 6.12 Coastal Management Zoning Map (Map07 : Bitung)

Source : JICA Study Team

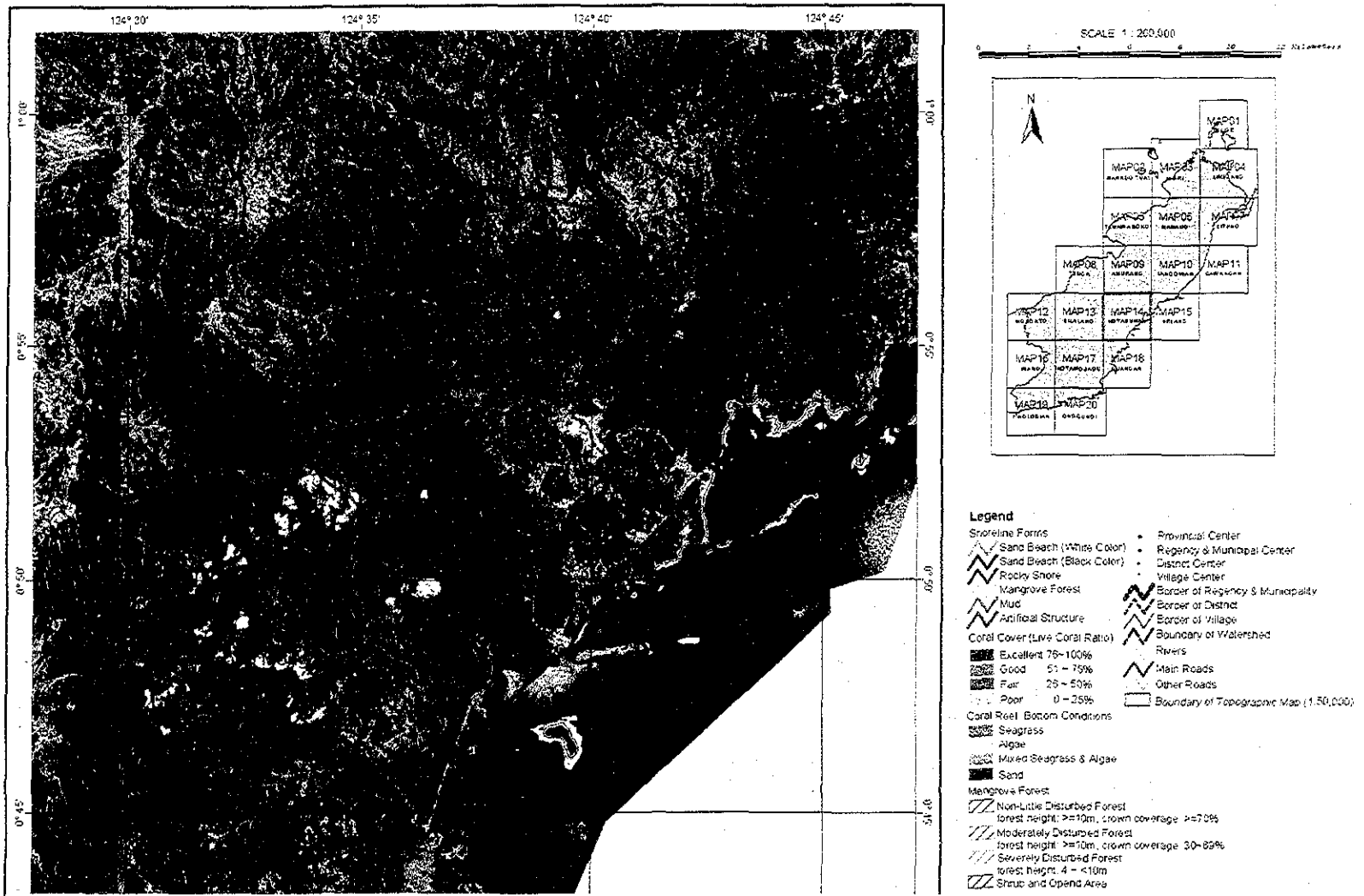


Figure 6.13 Coastal Environment Conditions Map with Orthophoto (Map14 Kotabunan)

Source : JICA Study Team

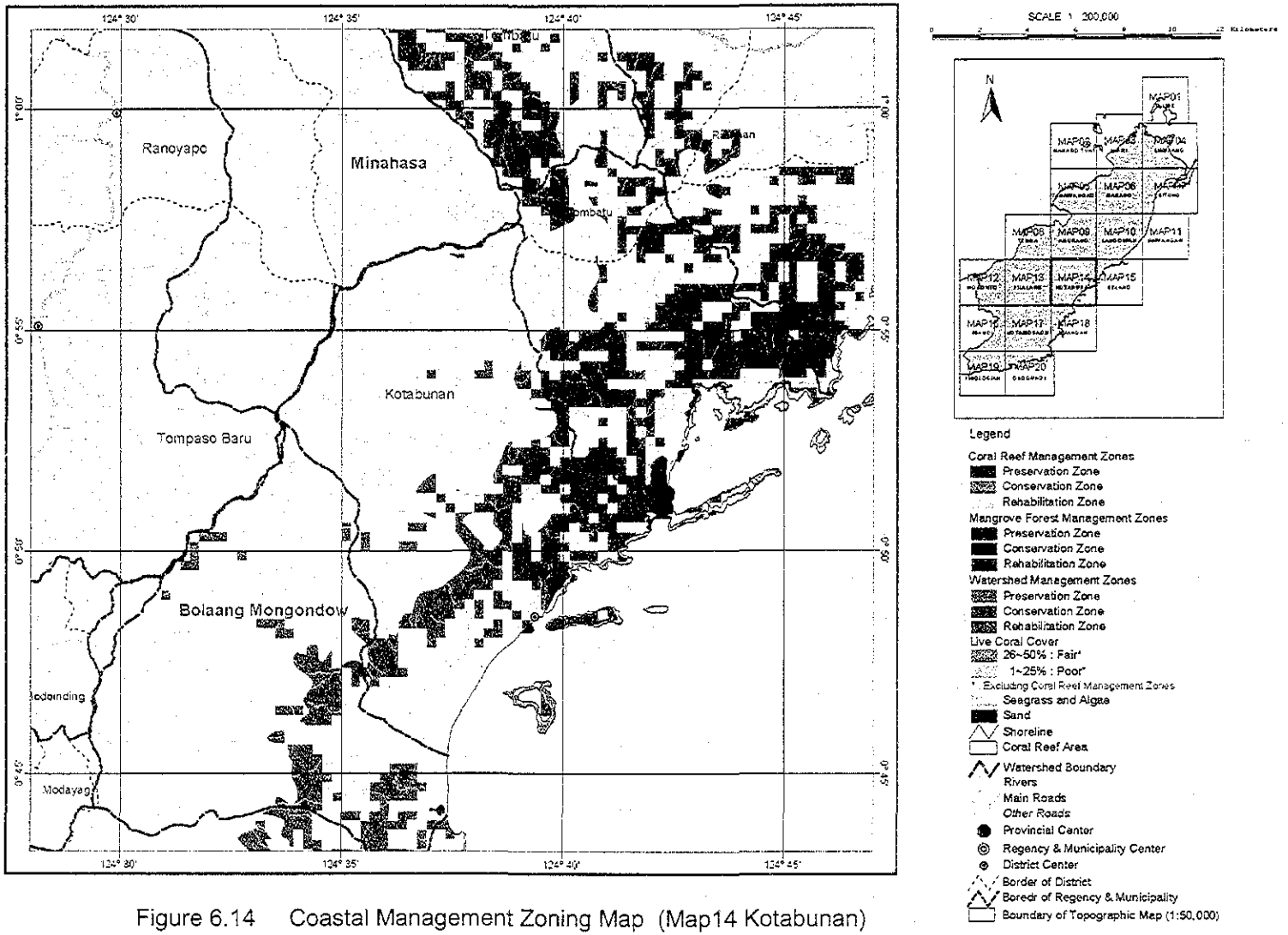


Figure 6.14 Coastal Management Zoning Map (Map14 Kotabunan)

Source : JICA Study Team