

# ***Appendix-K***

## ***ENVIRONMENT***

**THE STUDY  
ON  
CRITICAL LAND  
AND  
PROTECTION FOREST REHABILITATION  
AT TONDANO WATERSHED  
IN  
THE REPUBLIC OF INDONESIA**

**Volume-III**

**APPENDIX-K  
ENVIRONMENT**

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**ENVIRONMENT**

**CHAPTER 1 INTRODUCTION**

Lake Tondano is very important water source for Central Minahasa. The activities of exploiting the natural resources in Tondano watershed area have not implemented in conformity with the ecological and environmental principles. Ignorance of those principles will cause more environmental components disturbed due to decreasing ecosystem function in Tondano watershed.

Minahasa people are worrying about the water condition of the lake that will be polluted and lead unfavorable problems in the future, such as flood and water shortage. The study aiming the watershed conservation through the sustainable land use intends to prevent such problems and contributes to change the hydrological cycle, ecosystem, and soil fertility.

To minimize the possible impact resulted from the project activities, the regional government, under the environmental policy, decide whether the development activities produce some environmental impacts, through a study on the environmental impact assessment. The EIA was conducted in the Intensive Area to evaluate and to decrease the possible negative environmental impacts, which will be brought about by the implementation of the proposed project in the Intensive Area.

The objectives of the EIA, in the Intensive Area are:

- To identify and explain the initial condition in the Intensive Area and estimate possible components that will affect,
- To predict the possible environmental impacts as a result of the project activities

in the Intensive Area, and

- To provide recommendations to the activities in the Intensive Area.

## **CHAPTER 2    POLICY AND LEGAL FRAMEWORK**

### **2.1    Laws and Regulations in Indonesia**

The laws and regulations of the Indonesian Government for the environmental impact assessment of the Project are listed **Table K.2.1**. These regulations and the standards control the environmental quality, health and safety, protection of sensitive areas, protection of endangered species, silting, land use, etc., at national, regional, and local levels.

The laws and regulations on the Environmental Impact Assessment (EIA) have a hierarchy in their classification, which is shown in the **Table K.2.2**.

### **2.2    AMDAL**

The government of Indonesia enforced the environmental impact assessment (EIA) on 26 August 1996. It is called AMDAL (Jenis Usaha atau Kegiatan Yang Wajib Dilengkapi Dengan Analisis Mengenai Dampak Lingkungan), which demand the EIA for the development activities. The ‘Conclusion’ of AMDAL mentions the kinds of activity that need the environmental impact analysis as listed in **Table K.2.3**.



## CHAPTER 3 ENVIRONMENTAL IMPACT ASSESSMENT

### 3.1 Existing Environment Assessment for the Study Area

The 'North Sulawesi Water Resources Management Plan' presents the result of initial environmental screening of the each proposed initiative in its plan. The environmental screening is based on a field reconnaissance of the study area.

The above report mentioned that many of the original natural habitats on the alluvial plains and in middle watersheds in North Sulawesi have already been converted to agricultural use, urban area, or logged over, due to population pressure around the important and accessible resources (such as along the coast, near lakes, large rivers, and fertile plains). Environmental degradation in the upper watersheds is evident in the high sediment loads and often poor water quality in the rivers and some of the lakes in the province. Many rivers have weirs constructed on them, which impede fish passage along the river. The biophysical impacts of structural water resource management initiatives in those areas which are already converted or stressed will be considerably less severe compared to areas that are still in pristine condition.

The study shows important environment and social aspects on Lake Tondano as below.

**Important Environment and Social Aspects on Lake Tondano**

Lake Tondano:	The biggest lake in the province; a mid-elevation lake with many water demands (agriculture and domestic water supply, hydropower potential, intensive fisheries, and a tourism destination); suffering from sedimentation problems due to adjacent land use; susceptible to increasing population pressure around the lake and competing water demands
The communities living around important water resources and on the coast (Moat, Limboto, Tondano, Manado, Gorontalo in particular):	With the exception of Lake Moat, all show fairly high population density and strong dependence on the water resources to which they are adjacent; competing demands on space and water resources in their areas, and development projects which involve water resources, will increase the level of social disruption and conflict, making these important social components to deal with

The positive social and environmental attributes of the structural initiatives are summarized. Related aspects for the Tondano watershed are shown below.

- Increased opportunities for local labor, due to construction projects;
- Reduced incidence of flooding, leading to more secure river and coastal communities, increased agricultural production, and reduced infrastructure and lost-opportunity cost;
- Trapping sediment in reservoirs and check dams, which will reduce the

- sedimentation rate in irrigation systems, lakes, and coastal areas, and permit natural rehabilitation of some coral reefs;
- Increased human safety associated with lahar flows, from construction of check dams in susceptible volcanic areas; accessible source of commercially valuable sand and gravel;
- Development of hydropower, which in the long term is a sustainable and climate-friendly source of energy.

The negative impacts are shown in followings.

- Construction of structures in watercourses, canals and pipelines:
- Turbidity in watercourses can temporarily stress fish, but many of the fish population in North Sulawesi are already adapted to high turbidity conditions, at least during the rainy season. Dust from construction and noise can be annoyances to communities living near construction sites.
- Sediment disturbance impacts during pre-construction and construction will be relatively short-lived, and can be further reduced with use of silt curtains, dust reduction measures.
- Loss of natural habitat, agricultural land and flooding:
- The areas have already been converted from natural habitat to agricultural land or urban area. Loss of natural habitats associated with these initiatives will therefore be small. Loss of natural habitats or agricultural land occurs with the initial acquisition and land clearing in the early stages of the project.

In the Water Resources Management Plan, the environmental and social sensitivities in the watershed affected by the initiative were identified. Structural initiatives in the water resource management plan was examined in detail and activities in the pre-construction, construction and implementation phases identified. The environmental and social impacts are also described and degree of impact indicated, then various mitigation measures are proposed.

Several initiatives related Lake Tondano and its watershed are summarized as shown in **Table K.3.1 to Table K.3.6.**

Sam Ratulangi University is carrying on study about environmental issues of Lake Tondano. The study will complete end of the year 2000. The study includes biological, physical, and cultural aspects.

### **3.2 Initial Environmental Examination**

Before the Environment Impact Assessment (EIA), Initial Environmental

Examination (IEE) was done to study anticipated environmental impact preliminary and to focus the major issues in the EIA. This IEE was conducted using forms that provided before the IEE. The results of IEE are shown in Table K.3.7 and K.3.8.

### **3.3 Description of Environment**

#### **3.3.1 Land Use**

Lacustrine and volcanic plains are entirely used for rice fields. The hills and the volcanic mountains on the east part of the lake are almost utilized to plant the clove trees (*Eugenia aromatica* BAIL) which recently seem not to be taken a good care. It has given opportunities for a variety of bushes to grow well, which results in the clove plants to dry starting from the young leaves. Nevertheless, some clove plantation areas start to be clean up from the bushes and various kind of grasses, such as in Touliang Oki and Kaweng.

Sloppy volcanic hills or mountains in the west of Lake Tondano is used for the dry land plantation, particularly corns. The steep land (the slope of 60%), such as on the top of Paleloan hill, is usually planted with corn. The land was being unplanted and left for wild grown bushes after second plant in a year. The steep lands along the lake margin of Paleloan, Urongo to Passo are recently opened for corn plants or residences. For instance, in Leleko, the steep lands along the lake with 40% slope are opened for corn plants to the highest. The erosion symptoms were seen in the area and the sediment went to the lake. Therefore, the slope along the road is in a critical status.

#### **3.3.2 Meteorology and Hydrology**

##### **3.3.2.1 Meteorology**

Based on the agro-climate map of North Sulawesi with a scale of 1: 100,000 produced by Oldeman and Darmiyati (1977), Tondano watershed recorded in this is included in type D climate (particularly DI), i.e. 3-4 wet months and smaller than 2 dry months. According to the climate classification of Schmidh - Ferguson, east and south of Tondano watershed possess the Q value of 14.3 – 33.3%. It means that the areas are categorized as type-B climate, and its natural vegetation is tropical rain forest vegetation. In the west of that has the Q value of 60 – 100%, meaning that moderate region with seasonal forest vegetation or categorized as a type-D climate.

From the rainfall data, it can be observed that the climate condition of the southern and eastern parts of the Intensive Area is wet than the western side area. This is

shown by their yearly average rainfall, which are 2363.9 mm/yr in the south and 2028.1 mm/yr in the west, or almost 1000 mm greater than the west side area, where its yearly rainfall is only 1442.4 mm/yr. Thus, it can be concluded that the southern and eastern side receives more amount of water than the west sides. In term of their direct contribution to the lake, those data could also indicate that the southern and eastern side has the potentiality to provide most of the water for the lake.

#### 3.3.2.2 Hydrology

The hydrology of the Lake Tondano may be described and predicted by calculating the change of water volume stored in the lake, which is equal to the sum of the volumes of water entering the Lake Tondano minus the sum of the volumes of water leaving from the lake. Water enters Lake Tondano as precipitation, surface-water inflow, and ground-water inflow. Water leaves the lake as evaporation, surface-water outflow, and ground-water outflow. The discussion in the following part will be dealing with assessment of various aspects that will lead to a clear explanation about the state and change water flow into the Lake Tondano from the catchment area within the Intensive Area. Moreover, the discussion is also directed to assess the impact of planned conservation activities in the Intensive Area.

#### 3.3.2.3 Soil Infiltration

Data collected from soil infiltration rate measurement (Table K.3.9) indicate that soil in the study area has large capability to absorb water from rainfall.

#### 3.3.2.4 Discharge

There are 35 rivers flowing into Lake Tondano directly. However, many of those rivers are seasonal which means the stream occurred only in rainy months and those rivers stay dry during dry months. Rivers having constant flow are found in the Noongan sub-watershed (in the south) and Remboken (in the west).

The yield values of the other rivers surrounding Lake Tondano are less than 50%. Condition in related to the soil infiltration rate shows a strong association with the yield values, in which soils in the study area able to let substantial amount of precipitation to infiltrate.

### 3.3.2.5 Ground Water Quality

#### (1) Physical Quality

Physical quality of ground water is shown in [Table K.3.10](#). The values in the table indicate that the shallow ground water of Tondano watershed is still good. The depth of the well water is not territorially inference from one place to the other. The well water used for cooking and drinking does not smell and has a good taste. However, in the East and West of Lake Tondano, the well water used for washing is turbid, smells, and poor taste.

The physical condition of the well water quality in the watershed of Lake Tondano indicates that the West territory possesses bigger values (color, temperature, turbidity and TSS) than those in the East and South territory. This could result from the presence of the dry land farming/plantation and heavy fertilization in the West compared to the East and the South territory, which has the wet land agriculture (rice field). In the West, quantity of nutrients infiltrated into the soil and poured in the shallow ground water is higher than those in the rice field, where the nutrients go into the runoff directing to some body of water, such as rivers and lake.

#### (2) Chemical Quality

Chemical quality of ground water is shown in [Table K.3.11](#). The results of the chemical quality of the well water show a very small amount of organic and inorganic matters. Nevertheless, with the territory, the West possesses slight higher BOD and COD than other territory. This could be due to the inference in the type of agricultural land use, where the West to be a dry field and the East and the South to the rice field. In addition, the occurrence of intensive fertilization will contribute to a higher input of nutrients into the shallow ground water in the West than in the East and the South.

### 3.3.3 Flora and Fauna

#### 3.3.3.1 Terrestrial Ecology

Spatially, the territories of Kaluta, Tampusu, Kasuratan, and Manimporok forests are four forest territories of the Intensive Area in the Intensive Area of Lake Tondano. Looking at the management concept of the watershed, the forest, the plantation and agricultural areas, the residential and the coastal areas of Lake Tondano are an interdependent ecological system, meaning that the disturbance in one system could disturb the other.

Forest ecosystem located in the ecological boundary of the Intensive Area of Lake Tondano plays important roles as an ecological process control. The establishment of forest as 'key sites' gives big contribution to maintaining the ecological integrity of Lake Tondano ecosystem.

#### 3.3.3.2 Flora

Data of the major community structure of plants in the study area are given in Table K.3.12, Table K.3.13, Table K.3.14, and Table K.3.15. Table K.3.12 shows that the total number of the major plant community in Kaluta forest at the phases of seedlings, saplings, poles and trees are 21 species. Table K.3.13 shows that the total number of the major plant community in Kasuratan forest at the phases of seedlings, saplings, poles and trees are 25 species. Tampusu forest has 21 species of the major plant community structure (Table K.3.14), and Manimporok forest has 22 species of the major plant community structure, both at the phases of seedlings, saplings, poles, and trees (Table K.3.15)

The species of Importance Value Index (IV) > 10 is called the major community. It has a sufficient ecological influence and functions as a community control based on the distribution and the population size. If the major community collapses the impact on the biotic components will be tremendous. In particular, the impact will push the minor community sensitive to the environmental changes, such as the endemic species or endangered species.

#### 3.3.3.3 Fauna

The major bird community structure in the Intensive Area is given in Table K.3.16, in which there are 16 species.

*Myzomela sanguinolenta* occurs only in Manimporok forest, *Ducula forsteni* in Kaluta forest, and *Pachicepala suifurifenter* in Kasuratan forest. *Dicaeum aureolimbatus*, *Dicaeum celebicum*, and *Macropigya amboinensis* occur in two different areas. *Trichastoma celebense* occurs in three different areas. For the threatened species of birds, it appears that they are still existed in spite of small forest area.

#### 3.3.3.4 Floristic and Faunistic Structures

Table K.3.17 shows the species diversity of the flora in the forest of the Intensive Area of Lake Tondano. Based on Table K.3.17, it appears that Manimporok, Kasuratan forests have higher species richness than that in Kaluta, and Tampusu

forests. However, for the species evenness, there is no indication of any species dominance in four forests mentioned above. Although the species diversity of the four forests observed is not high, the vegetation quality could be categorized as good enough. It is indicated that the Shannon Diversity Indexes of the four forests are more than three.

Table K.3.19 shows the species diversity of fauna in the forests of the Intensive Area of Lake Tondano. Table K.3.19 indicates that Tampusu forest possesses the highest fauna richness, 5.18, followed by Kasuratan, Kaluta, and Manimporok forests. For the species diversity, Tampusu forest is the highest, 15.68, followed by Kasuratan, Kaluta, and Manimporok forests. This indicates that the habitat quality of Tampusu forest is better than that of three other forests. Nevertheless, as a whole, the fauna diversity in the four forests studied is good. The Shannon Diversity Index of less than three shows it. In addition, the area and the quality of the four forests highly affect the quality of the fauna.

The condition of the habitat quality for the avifauna could be measured by the number, the similarity, and the diversity of the bird population in certain locations. Based on Table K.3.16, it appears that the bird community in Tampusu forest is relatively better than three other forest observed in this study. This occurs because there are two ecosystems in Tampusu Mountain, i.e. the forest and the lake ecosystem. Thus, the habitat quality of Tampusu forest is better than the three other forests.

#### 3.3.3.5 Threat to Biodiversity Extinction

Evaluation on the threats to the natural vegetation is done based on pressures put on the forest groups. It is found that the biggest threat and pressure on the natural vegetation are to land clearing for estate crops and agriculture, the tree cutting, the non-target forest harvesting, the relative distance between forest and residential areas, and the slope of the steep lands. The easier the access to reach the forest, the worse the threat on the forest. In contrast, the more slanting the slope, despite being adjacent to the estate crops locations, roads and residential areas, the safer the forest from damages. For example, the steep areas of Tampusu forest.

In the forested areas getting heavy fragmentation, the addition of small pressures would cause a fatal problem for the forest, such as the damage of the forest ecosystem. In fact, the forest in the Intensive Area remains at the very steep lands and on the top of the mountain at present.

### 3.3.3.6 Significant Natural Sites

The width and the locality of the protected forests at the Lake Tondano Watershed are given in Table K.3.18. Beside ten forests whose status has been established as the protected forest, there are also other unprotected forest area possessing important roles on Lake Tondano such as Kasuratan Forest. For genetic resources conservation purposes, the forest is too small compare to the minimum area recommended. In this condition, threat to the potential loss biodiversity is due to very small forest area, and much serious effect from surroundings and threat of the exotic plants are dangerous to the forest.

Geographically, the forest in the Intensive Area of Lake Tondano is fragmented. Those forest areas look like islands in the agricultural lands and residential areas, so that the genetic transfer could naturally occur if the flora and fauna could jump quickly from one patch of forests to the other.

Compared to the ideally conserved areas, the forest areas in the Lake Tondano Watershed are very small to support natural flora and wild animals, so the areas become very fragile to changes. Very little change will threat the species lived there. With reference to Table K.3.20 and K.3.21, we can see that most of flora and fauna species are left only to a certain forest areas, and they become specific to these forests. These four forests become very important sites to the species where they support.

### 3.3.3.7 Species of Commercial Importance

A number of flora and fauna species in the Intensive Area of Lake Tondano is threat to extinction. Those are absolutely depend upon the forests, and, the forests are safe places for natural regeneration.

The details of species of commercial importance and the threatened flora and fauna are given in Table K.3.20 and K.3.21. Those tables show that in each forest area occur the preserved flora and fauna species and threatened to extinction. Thus, those forests are the essential places for the biodiversity conservation in the Intensive Area of Lake Tondano.

The management strategy for flora and fauna in the key-sites/significant natural sites of the Intensive Area that can be developed to maintain the ecological integrity in the area. The management methods of the other places, beyond the key-sites, need to follow the ecological need and relationship, and the distribution pattern of the threatened species.



Based on Table K.3.21, the total number of bird species in four Intensive Area are 41 species and 2 species of squirrels, in which there are 8 protected species, 18 rare species, 1 threatened species and 1 nearly threatened species. Based on the threatened status of the fauna, the four Intensive Areas possess *Macropigya amboinensis* of the protected status and almost extinct. Thus, the four forests mentioned above are ecologically important to be conserved.

#### 3.3.3.8 Species with Potential to become Nuisances and Dangerous

Other examples dealing with the invasion of the introduced species dominating several areas in Minahasa are also mentioned here. *Eichhornia crassipes* (water hyacinth) has become a big problem for Lake Tondano. *Imperata cyindrica* (Bushes) also dominates many agricultural area. *Leucaena glauca* dominates an extensive area in Belang and even has invaded the Kotabunan area. In the past, *Leucaena glauca* was used as a plant to eradicate the bushes in the HGU (the right to make the use of the government's land) area of the coconut plantation at the area. *Piper aduncum* directly colonize nearly all forest opened for agricultural activities after the land has been left for a certain period time.

*Lantana camara* dominates in the secondary forest in several areas of Minahasa. *Spathodea campanulata* invades the forest area in Mount Tumpa. Even, in the agricultural area not intensively managed, the colonies of *S. campanulata* are seen as the islands in the estate crops, which will soon cover all the area if it is not well managed. Therefore, those plants need to be taken into account.

#### 3.3.4 Agro-ecosystem

##### 3.3.4.1 Toulimambot District (Makalonsouw)

###### (1) Flora

The types of plant community in Makalonsouw consist of the, cultivated plants, such as clove, vanilla, palawija, rice field, yard vegetation, mix garden and ornamental plant gardens. In addition, the natural vegetation is bushes and grasses.

###### (2) Landscape

Landscape is a description of vegetation in the study area. It is presented in a form of profile diagram vertical to two transect lines selected which could represent the general view of the Intensive Area. Figure K.3.1(1) exhibits the vegetation profiles starting from the high land to the residential area in the west. This area is the secondary forest of clove/vanilla plantation mixed with palawija-field-residence-rice

field. **Figure K.3.1(2)** shows the similar presentation for the transect location on the north. The vegetation consists of the mix plantation, then the palawija across the stony river and the rice field. In the East, there are hills where the steep lands are planted with clove trees. Above the clove plantation or on the top of the hill, the vegetation is the natural vegetation of the secondary forest. According to the local people, this forest is the habitat of various wild animal species. The primates, other mammal, and various birds live in this area.

### (3) Fauna

#### 1) Wild Animals

The interview and the direct observation recorded five mammal species, four reptile species, two amphibia species, and fifteen bird species.

#### 2) Animal Husbandry

The total species are ten consisting of 6 mammal species and 4 other species of bird. Beside that there is a wild bird species hunted in the forest to be kept by the people, 'tekukur.'

#### 3) Pests, Natural Enemies and Diseases of Plants

Pests, natural enemies and plant diseases are observed in the commodities of clove, coconut, coffee, vanilla, paddy rice, corn, red bean, avocado and chilly pepper. The population and the percentage of infection are low. For the pest of *O. rhinoceras* on the coconut trees, the percentage of infection is high enough (30.00%). The population of this pest was not counted in this study due to requiring a specific way, so that only the infection symptoms were observed.

#### 4) Diseases

Diseases infecting the plants in Makalonsouw were only recorded on the clove, vanilla, corn, and red bean plants. Nowadays, no one knows the cause of the clove leaf falls. The percentage of this infection is the highest (25.60%) compared with other diseases on the other commodity plants.

### 3.3.4.2 Eris District (Touliang Oki, Tandengan, Telap and Watumea)

#### (1) Flora

The types of plant community in four villages of Eris District cover the cultivated

plants, i.e. the estate crops, rice field, palawija and the yard vegetation.

## (2) Landscape

Figure K3.2(1) shows the vertical vegetation profile in Touliang Oki starting from the high land in the east to the west of Lake Tondano. The vegetation comprises the natural forest, vanilla/clove gardening, palawija- paddy rice- water hyacinth. Figure K.3.2(2) also shows the vegetation profile in Tandengan. In the east of those sampling villages, consist of hills planted by clove trees. The clove plantation covers a large part of the hills. On the flat area, the residences are located directing to Lake Tondano (Watumea). In margin of the lake near the residential area, there are dense water hyacinths (Touliang Oki, Tandengan), and *Matroaylon sagoes* (in Watumea and Telap). Figure K.3.3(1) and K.3.3(2) present the vegetation profiles in Telap and Watumea.

## (3) Fauna

### 1) Wild Animals

There are three species of animals in the rice field, such as rats, herons and sparrows.

### 2) Poultry

The duck farmers in this village take advantages of the rice field as the cultivation site. Other cultivated animals are cow, horse, pig, and local chicken.

### 3) Pests and Diseases

The highest percentage of infection is caused by *O. rhinoceros* (30%) compared with the infection of other plants, except very low number of pest population. The infection is only found on the clove frees. There are two species of disease on the clove trees both in Touliang Oki and Tandengan. The percentage of infection of the leaf falls is very high in Touliang Oki, 80.00% and Tandengan, 85.00%, while the infection of the leaf spot, *C. gloesporiodes* in both villages is low.

### 3.3.4.3 Kakas District (Toulimembet, Kaweng, Tountimomor and Passo)

#### (1) Flora

The vegetation in the four sampling villages could be categorized into 4 types of community, i.e. garden, rice field, yard, and natural vegetation.

#### (2) Landscape

The condition of the landscape in the sampling villages is different. **Figure K.3.5(1)** exhibits the vegetation profile in Toulimembet from the east of Lake Tondano to the west. The coconut plantation, clove plantation, and the residences occur at the margin of the lake. As a boundary, there are growing *Metroxylon sagoes*.

**Figure K.3.4(1)** exhibits the similar way to describe the vegetation profiles in Kaweng. The south of the village is a hilly area. Vegetation profile is from natural vegetation- clove garden- mix garden- rice field and water hyacinths cover the north of Lake Tondano. **Figure K.3.4(2)** is a vegetation profile of Passo. From the west slope, there is the corn garden and toward the east, there is the rice field **Figure K.3.5(2)** presents the vegetation profile in Tountimomor.

#### (3) Fauna

##### 1) Wild Animals

Based on observation and information from the local people, there are 6 bird species, 2 reptile species and 2 mammalian species.

##### 2) Husbandry Animals

The husbandry animals in the Intensive Area consist of cows, pigs, horses, chicken, and ducks.

##### 3) Pests and Diseases of Plants

The villages covered in this study are Tasuka, Kaweng, and Paso. The diseases observed targeted for the commodity are cloves, coconuts, paddy, corns, bananas, and avocado. There are pest species and natural enemies at each commodity of the three villages.

The highest percentage of infection caused by *O. rhinoceros* (30.62%) on the coconut plants in Tasuka, and *C. meinnalis* (30.02%) on the paddy plants in Kaweng. Other pests, both the population and the percentage of infection on all plants are low enough. There are also some diseases on clove trees and

corns in Tasuka and Paso. The percentage of infection of the leaf fall on cloves is the highest (85.00%) in Tasuka, while very low (20.15%) in Passo where other diseases are also low number.

#### 3.3.4.4 Remboken District (Leleko and Tampusu)

##### (1) Flora

The type of plant community in two study villages consist of the palawija garden, plant gardening the rice field and the yard vegetation.

##### (2) Landscape

Leleko is located on the bottom of Tampusu hills. These two villages are closely connecting. **Figure K.3.6(1)** presents the vegetation profiles from Tampusu hills to Lake Tondano. The vegetation profile is the grass field on the top the hill, and toward lower mix vegetation- palawija- rice field (Tampusu)- Residences (Leleko)- mix garden- palawija- natural vegetation rice field (Leleko)- Water hyacinth- Lake.

##### (3) Fauna

###### 1) Wild Animals

Based on the information and field observation, there are seven species of birds and one species of mammal are recorded.

###### 2) Animal Husbandry

Species and number of animal husbandry in Leleko and Tampusu are cow, horse, pig, dog, chicken, and duck.

###### 3) Pests, Natural Enemies and Diseases

The study sites selected are Kaima, Tampusu, and Sendangan. The plants taken as examples for the diseases are clove, coconut, coffee, corn, ground beans, small green bean, green onion, chilly pepper, banana, mango, and avocado. A variety of pest species, population, percentage of infection and natural enemy on each commodity appears that the population and the percentage of infection of all pests in each village are low. The observation on the natural enemies of all commodities indicates that the infection is only found on the ground beans and the green beans in Passo.

Several plant diseases are also found on clove trees, corns, green onions and chilly peppers, while other plants are not infected. The percentage of infection

on various commodities in the study villages is low enough.

#### 3.3.4.5 Tondano District (Urongo and Paleloan)

##### (1) Flora

The type of plant community at these two villages are nearly similar, i.e. (1) cultivated vegetation, such as the estate crops, the palawija, the house yard plants and the rice field and (2) the natural vegetation, such as wild plants and trees.

##### (2) Landscape

The west part where occurs a series of hills is planted with the clove trees. On the higher part, there is a mix garden as trees without care. The corn plants are still planted on the slopes and the road of the regency restricts this slope with the rice fields. The vegetation profile in Urongo and Paleloan could be seen in Figure K.3.6(2) and K.3.7(1).

##### (3) Fauna

###### 1) Wild Animals

There are four species of bird recorded in this study, such as the swallow, the sparrow, weris (local name), and the herons. The habitats of the wild animals are the rice fields, gardens and yards.

###### 2) Animal Husbandry

Pigs have the first priority to be cultured by the local people. The cages are located adjacent to the lake. In addition, the cultivated animals in Urongo and Paleloan are cow, horse, pig, goat, local chicken, and poultry.

###### 3) Pests, Natural Enemies and Diseases

The observation site selected is Paleloan. The coconut and corn plants are examples for the observation of pests and diseases of plants. The pests attacking the coconut plant are *O. rhinoceros* with the percentage of infection of 15.80% and 2.11% by *O. furnacalis*. The main disease of corn plant is albino with the percentage of infection of 1.12%.

#### 3.3.4.6 Tompaso District (Tonsewer and Tember)

##### (1) Flora

The most dominant plant communities in these two villages are the paddy plant in the rice field and the palawija/horticultural plants in the dry land. The estate crops are mainly planted in the yard together with the fruit plants.

##### (2) Landscape

The type of vegetation in Tonsewer and Tember is presented in a profile diagram with a horizontal line in Figure K.3.7(2) and K.3.8(1).

##### (3) Fauna

###### 1) Wild Animals

The wild animals in Tonsewer and Tember consist of bird species, such as sparrow, weris (local name), crow, eagles, cow swallow, rats and phytons.

###### 2) Cultivated Animals

The cultivated animals in Tonsewer and Tember are cow, horse, pig, dog, chicken, and duck.

###### 3) Pests, Natural Enemies and Diseases

The study sites are Tonsewer and Tember. The pests and the diseases of plants are observed on the red beans, tomatoes, and *Brassica rugossa*. The species and the percentage of infection on each commodity indicate the highest population of *Crocidolomia binotalis* with the percentage of infection of 30.12%. Other pests are low. The population *Empoasca* sp. is high enough but the percentage of infection is not known. It results from the very small size of the pest and the way of infecting by sucking the liquid of the plant, so that the infection symptoms are not clearly seen. The infected plants in Tonsewer are found in tomato plants. The disease is the curl virus with the infection of 5.80%, *Alternaria soloni* of 4.20%, and *Pseudomonas solanasearum* of 1.02%.

#### 3.3.4.7 Langowan District (Noongan)

##### (1) Flora

The plant community in Noongan consists of the cultivated vegetation such as field

paddy, palawija, garden plant and yard plant

## (2) Landscape

The vegetation figure from the west to the south will be briefly discussed. The west is dominated by the natural vegetation consisting of the mahogany trees, the gardenia trees, *Ficus septica*, the palm frees, the golden wood, *Pinus merkusil*, and *Ficus minahassae*. On the flat land occurs the rice field. To the south, there are also the clove trees with the boundary of the secondary forest. The landscape in this area is given in Figure K.3.8(2).

## (3) Fauna

### 1) Wild Animals

There are 3 species of mammals, 3 Species of reptiles, 1 species of amphibia, and 1 species of birds.

### 2) Animal Husbandry

The type of animal husbandry is cow, horse, pig, chicken, duck, goose, dog, and cat.

### 3) Pests, Natural Enemies and Diseases

The study site selected is Noongan. The observation of the infection is conducted on the coconut trees, the clove trees, and the rice plants. The pests and diseases found infecting.

## 3.3.5 Aquatic Ecology

### 3.3.5.1 Plankton

Plankton plays an important role in energy transfer of the food chain in the waters. In Lake Tondano, the study found 18 genera of phytoplankton of 4 classes and 12 genera of zooplankton of 3 classes, with a density ranging from 16-221 individuals per liter of water as shown in Table K.3.22. The table shows that all Intensive Area, except Eris, possessed the high diversity indices with a small dominance. These are also supported by the high evenness indices (50 - 92%) which mean that all genera supporting the plankton community are equally common.



#### 3.3.5.2. Benthos

Table K.3.23 shows that in spite of difference in number of individuals of each species, the benthic organisms in all Intensive Area do not show any dominance and possess high diversity indices. This condition is supported with the high evenness indices, except for Toulimembet and Eris. It means that all species supporting the benthic community in Paleloan, Remboken, Kaweng, and Noongan are identical. Moreover, despite a sufficiently large diversity index, the number of individuals of each species supporting the community in Toulimembet is not identical, which is shown by a small evenness index. Eris is categorized as the poorest site in terms of benthic organisms, where only one individual of Oligochaeta group was recorded in this study. It may be caused by the presence of dense fish cages at the area that could put some negative impact on the water quality. In this case, the artificial feed used for the fish cultured in the floating will speed up the fish growth on one hand, but it could also raise the decomposition process in the bottom, as a result of the feed remains falling to the bottom. The attitude of the fish farmers to always leave the broken fish cages in the lake also contributes to the increase in decomposition processes. Consequently, the deleterious water quality at the bottom would drive benthic organisms in this area to extinction.

#### 3.3.5.3 Nekton

Fish living in Lake Tondano comprise the non-cultured fish and cultured fish in the floating net. The non-cultured fish (Table K.3.24) lives in the lake by using the carrying capacity of the lake to support their energy requirement for survival.

These species consist of aboriginal fish and those introduced in order to support the fisheries of Lake Tondano. Data of Fisheries Services of Minahasa Regency shows that in the last 5 years, there was a decrease in the fishery production of the lake, particularly for non-cultured fish.

However, there is also other fish production from the floating net culture contributing to the increase in total fisheries production of Lake Tondano as many as 4,504.2 tons per year (Table K.3.25).

Although the increase in total fisheries production of the lake could be fulfilled, the fish culturing activities, which are operated along the shoreline of the lake, have resulted in a negative impact to the lake fishery. It is associated with the excessive use of the habitat for non-cultured fish, which usually inhabit the margin part of the lake that provides good habitat, shelter, and natural food. This result is supported by Soeroto et al (1975) and Soeroto (1988) who found many fish at the marginal area

of the lake.

The dense aquatic plants in some areas of the lake contribute also to the decline of fisheries production, since this condition will limit the operation of the fishing gear. If the floating net is located in the middle part of the lake and uses floats, the natural carrying capacity of the lake to support the non-cultured fish will be raised.

#### 3.3.5.4 Aquatic Plants

Aquatic plants in this study cover the floating plants and the bottom-rooted plants (Table K.3.26). The water hyacinths, *Echhornia crassipes*, are mainly concentrated around the area of no floating net fish culture, and their distribution is largely influenced by wind that push them to the margin area of the lake. The population of water hyacinth is very small in Paleloan, Eris, Toulimembet, Kaweng, where fish culture activities are prospering, and in Remboken, the center of lake tourism. These areas are often cleaned from the water hyacinths in order to support the fish culture and the tourism. This is conducted by either putting some bamboo poles on the surface or taking them out of the lake.

Nevertheless, the reduction in the water hyacinth population could give opportunities to the bottom-rooted plants to grow, such as Florida Elodea, *Hydrilla verticillata*, which densely grows in the tourism center of Remboken. Similar situation is also seen in Eris, between the fish cages and the shore, in which the water hyacinths and Florida Elodea grow together in a large population.

#### 3.3.6 Social, Economic and Cultural Environment

##### 3.3.6.1 Demography

The number of people reaches 126,953 individuals with the most in Langowan District and followed by Tondano District. The population growth per year reaches an average of 0.54 percent. Districts except Tompaso and Eris have the population growth-below 1 percent per year and even negative. The low population growth or the negative one is associated with the success of the family planning programs and the effect of emigration.

The average people density reaches 355 individuals/km<sup>2</sup>. The villages of the dense population are Passo of Kakas District, Tonsewer of Tompaso District and Touliang Oki of Eris district with their density above 600 individuals/km<sup>2</sup>.

The Study of Waworuntu et.al. (1999) indicated that the value of people pressures have exceeded 1, i.e. Langowan District, 3.66, Tondano District, 3.3, Eris District

2.73 and Remboken District, 2.36. The high value of the people pressures gives an indication of the in-equilibrium between the number of people and the available natural resources. Consequently, the exploitation of the agricultural area at the marginal land and the forest area will affect the ecosystem of Tondano Watershed. In addition, the excessive exploitation will occur in Lake Tondano.

#### 3.3.6.2 Economic Aspect

##### (1) Working and Business Opportunity

Based on the people interview in the sampling villages, more than 70% of the people rely on the agriculture for their living. In the east of Lake Tondano, there are varieties of businesses run by the people. Touliang Oki is typical village whose home industry is growing well. The working and business opportunities are available in agriculture, furniture industry, and freshwater fisheries. Several villages on the margin of Lake Tondano have also the opportunity to run the floating net for fish culture.

For villages in the south of Lake Tondano, the working and business opportunities are limited to the agriculture. This limitation causes that the people of productive age tend to rely on the gold mining in Ratatotok and Tatelu for their living.

##### (2) Income

The income rate of the respondents in the Intensive Area of the east part of Lake Tondano is represented by Makalonsouw, Touliang Oki, Telap, and Toulimembet. In the west of Lake Tondano, it is represented by Paso, Leleko, Tampusu, and Paleloan. For the south of Lake Tondano, Tonsewer, Touure, Noongan, and Manembo (Table K3.27) represent it.

Table K.3.27 shows that the income rate of the respondents ranges from Rp. 300,000 - Rp. 499,000/month. The respondents who have the income less than Rp. 200,000 and more than Rp. 750,000 are in low number. From these incomes, 34 (28.33%) respondents feel not enough to fulfill the family needs. Therefore, they are encouraged to work hard in order to gain the additional incomes, for instance working as farmers, fishermen, craftsman, labor etc.

There are relationships between the activities of the critical land rehabilitation and the protected forest in association with the people income, but it is not clear yet that how big the impact on the income gap. Therefore, this aspect needs detailed study in the future.

### (3) Patterns of Owning Process and Use of Natural Resources

The important components of the natural resources are land, forest, and water. The area beyond the forest generally belongs to the high level of people, known as ‘tanah pasini.’ The land owning process of the respondent in each study sub-area could be seen in **Table K.3.28**.

**Table K.3.28** shows that half of the respondents has the relatively narrow land. If there is an activity of conserving the public land, it could bring about the loss of their land, either partly or entirely, meaning that it would put the negative impact on their family economy. Therefore, a more detail study is needed in association with this problem.

The land is presently available mainly for agricultural activity. The use of the sloped area for the agriculture is generally without the land conservation system. According to the respondents, in several villages the specimen plot were built for the land-conservation implementation, but it did not grow or adopted by the local people. Some reasons for these are the high cost, the effect of farming traditions without any conservation, and the lack of technical knowledge concerning the conservation. Therefore, to support the critical land rehabilitation program, these blocking factors in the society should be considered.

The forest area in the study area, which is categorized as very small, is the state property. The people often use the resources for fire wood, construction wood and hunting animals from there. The present condition is that the construction wood is in very low number, on one hand, but the need is increasing, on the other hand. Therefore, many respondents suggested the gardenia wood, the ‘nantu’ wood, and the mahogany wood to be planted. This suggestion appears in nearly all of sampling villages. The occurrence of the wild animals is also tremendously low. The hunting wild animals are monkeys, bear cuscus, rats, wild pigs and birds.

The river and lake are a public property resource. River water is utilized for irrigation and domestic need. Lake Tondano waters is a source of the freshwater fisheries either fishing or fish culture (floating net). The fish culture has developed in the appropriate locations in the east and west of Lake Tondano. Some respondents stated that the suitable site to put the floating net is the area of low bottom mud. Recently, there is a tendency of excessive utilization of the lake due to providing the sufficiently high income. A decrease in the clove price has encouraged people to use the Lake Tondano as the alternative income. In the west of the lake, most of the owners of the floating nets and houses on the lake surface are the outsiders of the villages possessing big capital. The local people get the salary

for taking care of the business.

Nevertheless, the presence of the floating net houses in Lake Tondano has decreased the aesthetic value of the lake, as one of the main natural tourism in Minahasa. Comprehensive lake management could be accepted by the people with condition of careful study on the future social impacts and implementing the management option.

#### (4) Economic Activities

The main economic activities of the people in the study area are agricultural production. The food production (corns and paddy) is used to fulfil the family needs and as an income source. Besides, there are production activities of the estate crops, particularly clove, for commercial purposes. Other economic activities around Lake Tondano are to produce the freshwater fish in the floating nets. Most of the fish production is for commercial purposes and the fish are generally sold to the city consumers. In the south of Lake Tondano, there are production activities of the horticulture such as tomato and onion, which is marketed as an income source.

In each capital of the district, markets are open 2 to 3 times a week. In these markets occurs transaction between the producers and other merchants including the consumers. There are also middlemen in the villages of agricultural production. In addition, each village has shops selling various main needs of the local people.

Other institutions that take important roles in the economic activities are the banks in the capital of the regency Tondano and several capital of the district. The cooperation also presents in nearly all villages.

Therefore, a further study on how to do the rehabilitation activities of the critical land and the protected forests in Tondano watershed is necessary to be done to support the present economic activities.

#### (5) Territory Accessibility

The interrelationship among the districts in the study area is smooth enough. It also occurs for the other cities, such as Manado and Bitung. This may result from the availability of good infrastructures among the cities. The transportation facilities are also enough to take the people outside the area. Nevertheless, the roads in the area are too narrow, so that any activity around the area could bother the traffic.

### 3.3.6.3 Society and Culture

#### (1) Organization

The public organization is a group of norms coming from a variety of society levels which focus on a principle need in people life (Soekanto, 1987). To fulfil their spiritual needs, the people make religious organizations.

There are three types of religions, i.e. Protestant, Catholic, and Islamic. Based on the village data approximately 90% of the people is Protestant and the rests are Catholic and Moslem. Each religion possesses their own organization and norms or system to guide their followers to behave. The relationship among the religions in the study area is good. In daily life, religion takes a very important role.

Other important organization in the study area is the education institution. It is made as a response on the fulfillment of the public needs for science and technology and the changes in people attitude. The formal one occurs from basic school to high school. The education level of the people is good enough; most of them do the basic school (SD) and the intermediate school (SMP). The informal education of no degree is often conducted, such as the agricultural information, fisheries, health etc.

The government institution is provided to manage the people life as a whole. These institutions particularly in the villages have remarkably changed. Under the new regulation, the head of the village is called "Hukum Tua" as term of a village leader in Minahasa in the Past. It seems that the term "Hukum Tua" is more respectful than "Kepala Desa." There is also a bureau of village representative called Dewan Perwakilan Desa (DPD) which supports the democratic life in the village.

Other social institution in the Intensive Area is the harmony group. Usually, every village has one or two social organizations. If a family has gotten the sorrow, through this organization, all members will give their contribution, such as money, to reduce the family responsibility dealing with the situation. The loyalty of the people to their norms in this group is very high. Beside that, there are also the family harmonies based upon the blood relationship, and there are many of them in the village. In each meeting, they have a pray and an "arisan" (collecting money for a certain purposes). In addition, there are some responsibility to help each other in both good and bad situations, such as party and sorrow.

One of the traditional organizations in Minahasa is Mapalus, i.e. cooperation to do agriculture alternately. It recently has changed and is decreasing the activities in agriculture compared to the previous years.

There is a relationship between various activities of the critical land and the protected

forest rehabilitation in the watershed of Tondano and the present organizations in the rural area. There is possibility that the organizations change and become a working partner in the project. Several respondents have suggested that the local people and organizations need to be involved on the rehabilitation activities to nurture their responsibility to the maintenance.

## (2) Life Style

The life style of a society could be recognized from the consumption pattern, the fashion, and the time management. The people consumption in the study area is adapted to the present economic condition. The previous experience, when the clove price was very high, encouraged people to spend more money and tend to be extravagant.

Nowadays, the clove farmers are depressed due to the low clove price. This has become good lesson for the people to have a simple life despite the increase in their income. The similar extravagant consumption is also exhibited in the thanksgiving activities as a part of the religious activities. Regarding this, every family prepares many kinds of food and drink to serve the visitors of various villages and cities. For this, part of the agricultural production is use for instantaneous consumption.

Regarding fashion, the people of the study area is not different from those in the city. The use of new mode is often found in the rural area. It may result from the people attitude with tends to be opened and the effect of good communication, such as television and transportation, and the youth usually catch the new mode very quickly.

Furthermore, looking at the patterns of time management, according to several public figures, there is a tendency that the present young people do not manage their time efficiently. In addition, their desire to work in the field is also decreasing, so that it is necessary to be studied in detail.

The lifestyle and people attitude is closely related to the various rehabilitation activities of the critical land and the protected forest in the watershed of Tondano.

## (3) Social Process

Two important aspects of the social process are the associative processes over the collaboration and the dis-associative process over the conflict.

The people of the study area, like other rural people, have some cooperation among the people and close relationship one and another. The most remarkable cooperation could be seen in the sorrow case. Other form of cooperation is to work together in the party preparation, such as thanksgiving, wedding, birthday, etc.

There is also cooperation in building the public facilities and infrastructures of the village, such as road, village office, church, etc.

The diassociative process or conflict often occurs in the study area as well. The conflict could happen among the people in the village or between the villages. Based on the interview in the sampling villages, most of the conflict is brought about by problems of the young people and becomes bigger and bigger. One of the factors spoiling the situation is the high use of liquor in young people.

The rehabilitation activities of the critical land and forest are potential to produce conflict either among people in the village or between the rural people and the initiator. Thus, a detail study needs to be done in order to anticipate the future possible conflict.

#### (4) Social Structure

Based on the interview and the field observation, the social structure presents in the society, but the strata is not quite clear. Some respondents said that there are people or a group of people respected in the society, and considered as having a higher position than the other people have. They are the leaders of religion, the head of the village, including the village representatives (BPD). There also people of high level education and rich people honored in the village. It is interesting that there is an open system of social structure in the village. It means that its member of the society has the same opportunity to change the position level with their capability.

The present social structure system mentioned above is largely influenced by the historical background in which there has never occurred the kingdom system in the study area. In addition, there is a social value that all people are born to be the same.

#### (5) Gender Aspect

In the agricultural production activities, women are important in the planting, weeding and marketing activities. The working load, such as soil processing, harvesting and product transport, is usually done by men. The decision making in the production activity is reach through the agreement between husbands and wives.

In the social activities, both men and women are actively participating in association with their roles. There is no prohibition for women to participate in the social activity. Even, women lead some social groups. The similar access is also given to control the resources available (abiotic, biotic, culture) that indicates the presence of equilibrium between men and women. In addition, there is no remarkable issue



on gender in the study area.

#### (6) People's Perception

Most of the respondents have similar perspectives about the natural resources conditions, particularly the watershed of Tondano. They think that the condition of Tondano watershed is critical regarding the growth of the water hyacinth in Lake Tondano, the sedimentation and the high fluctuation of riverbed. In rainy season, there is often flooding in several locations around Lake Tondano. In the dry season, part of rice field in Kakas and Remboken cannot be irrigated. Therefore, in general, the respondents have the positive perspectives on the rehabilitation plan of the critical land and the protected forest in Tondano watershed due to contributing a lot of benefit in the future. Nevertheless, some respondents living around the lake worry about the activities that are able to disturb their life, such as the relocation plan that rejected by several respondents. The presence of positive perspectives could be continuously develop by carrying out the programs suitable for public aspiration that encouraged them to actively participate in it. Therefore, the impact of the activities on the public perspectives needs to be carefully studied.

#### (7) Historical and Cultural Inheritance

One of the important historical inheritances in the study area is a small port in Tasuka, Kakas. It was built by the Japanese army in the World War II as a landing area for the amphibian airplanes. However, it is not well kept.

The important cultural inheritance in the study area is the Mangket Dance, which is a characteristic of Minahasan dance, and the Kolintang music instrument made of wood.

In Passo, the District of Kakas there is a rock considered as magic by the local people because the rock is believed to eat people in the legend.

#### (8) Respondent Suggestions

Several suggestions of the respondents addressed in association with the rehabilitation of the critical land and protected forests in Tondano watershed. The following suggestions shown in **Table K.3.29** are public aspiration that could be used as a policy consideration.

### 3.4 Significant Environmental Impacts

#### 3.4.1 Soil and Land

There are eight activities indicated for the management and conservation of the Tondano watershed.

Those activities are:

1. Set-up of monitoring institution for watershed management,
2. Establishing community forest,
3. Extension of agroforestry,
4. Extension of erosion control farming,
5. Reforestation in protection Forest,
6. Green belt along the lake and rivers,
7. Regulation of fishery in the lake, and
8. Construction of erosion control farming.

In term of soil and land in the watershed, the negative impacts of the proposed activities on those components are minor which is denoted by D scores in **Table K.3.30**. If the impact exists it is likely to occur only or at most during initial phase of the activities/projects. This impact will take form of detachment of soil particles from soil mass and transportation of soil particles by running water. Thus, for soil and land components, impacts of the proposed activities will be more on positive sides, such as reducing water erosivity, increasing infiltration, reducing soil loss, and increase ground water storage.

#### 3.4.2 Hydrology

Considering the planned activities mentioned above and the results of assessment on hydrology and water quality components in the Intensive Area, the predicted significant impacts of the activities are shown in **Table K.3.31**.

As shown in those tables, negative impacts of the proposed activities on hydrology and water quality aspects are predicted to be minor. Instead, the positive impacts will be very strong and predominant. This also indicates that, mitigation measure for the negative impacts on the hydrology and water quality side is minor. Monitoring plan, however, still need to be established.

#### 3.4.3 Terrestrial, Agro-ecosystem and Aquatic Ecology

Predicted impacts by the activities are scored mostly D in **Table K.3.32**. Community forest and Extension /Introduction of Agroforestry will generate positive

impact on biodiversity in the area, especially those that have commercial value. Besides using the existing kind, there is possibility that the activities will need to introduce new kind of flora and fauna into the area of community forest and agroforestry. Impact on protected species will not be direct impact of these activities. The establishment of community forest and agroforestry will help the people not to expand their activities into the protection forest, so that the growth of the protected species (fauna and flora) could accelerate. Better condition of the protection forest will improve the availability of food for the wild life such as birds, which in turn will help improving their population growth and distribution.

The plan to establish protection forest will improve (positive impacts) vegetation stand and structure up to the tree levels. This activity will hold the process of genetics erosion in the area, especially indigenous, specific and protected flora. Other activity like creating green belt along the riversides will also help protecting the water resources and hydrology in the area. Establishment of green belt area would also create additional space for the species and the area to find food, and for their nursery. Moreover, this green belt could even function as a bridge (corridor) between areas, so that the flora and fauna could easily move around. Negative impacts of these activities might come when there will actually some new species be introduced into the area.

Agroforestry activities would improve vegetation structure in the area. Combination of forest vegetation and cultured crops would improve the system stability. Improvement will in turn improve the hydrology, water quality and soil fertility of the area. This will then also help local people to increase planting period of their agricultural land situated along the riversides. However, increase in planting intensity indicates increase in application of fertilizer in the area, since the farmer would be able to plant twice or even three times in a year, compare to only once at the existing condition.

For the aquatic life, the planned activities would certainly give impacts on aquatic life. Most impacts, however, are more of mild ones (minor). Negative impacts will only produce by the planned activities at the beginning/ initial state of the activities. This would be in the form of increase in water turbidity, which will influence the condition of water in the lakeshore region where most activities of the wild fish are. Regulation for fish culture in the lake shall get more attention since it would influence a quite broader range of components in the area (physical, biological and socio-cultural).

#### 3.4.4 Socio-Cultural

Impacts of rehabilitation activities of critical land and protection forest on socio-economy and cultural component area as follow (Table K.3.33).

- The set-up monitoring institution for watershed management would give impact on local community. This however will be minor negative impact only. Establishment of strong organization will create more positive impact to the community.
- Establishing community in the state owned land will create impacts on the community that have been using that land to generate income. The negative impacts would be like lost of income which will produce further impacts such as people perception on the planned activities. Negative impacts are expected to occur at the initial state of the project.
- Extension of agroforestry will create positive perception on the community when it properly executed. More positive impacts will be produced if the activities use or include local species with high economic value.
- Extension of erosion control fanning practices will produce fundamental changes in the Intensive Area. Expansion of woodland, prevention of deforestation and green belt along the lake and rivers will produce both negative and positive impacts. Negative impacts, however, will be minor compare to the positive impacts since it will occur at most during the initial state of the activities.

### 3.5 Mitigation Management Plan

Since all the proposed activities will produce impacts but more on the positive side than the negative sides, thus there are little mitigation measures to be considered for. They are discussed below.

#### 3.5.1 Soil, Land, Hydrology, and Water Quality

- By growing grasses on the contour ridges to strengthen them and to grow tree crops along the ridges to protect them from the destruction of surface run off
- By building channels on the upper parts of the ridges to collect running water and let it infiltrate into the soil.
- By growing creeping green manure on both sides of the river to cover that area before the tree crops become well developed.
- Training for extension workers in the area on soil conservation techniques and fertilizer applications. For this, it is necessary to make sure that the message will get through to the farmers and be implemented. This can be conducted in collaboration with university. Training and extension services shall also offer

topics such as domestic wastes handling.

- Establish a demonstration plot and a training center. This setting would be managed by an institution such as BRKLT, help by experts from university.

### 3.5.2 Forest Ecosystem, Agroforestry and Aquatic Ecology

- In order to establish community forest, agroforestry and green belt, it is necessary to have them designed as corridors which will allow high genetics transfer of the flora and fauna within the Intensive Area.
- Species to be used in establishing the planned activities should be chosen from the existing species in the area, since they have already naturally adapted to the ecosystem in the area. Thus, it is considered necessary to ensure some budget for detail studies on aspects such as seed stand, nursery, planting technique, and protection.
- Socialization of the activities to the local people.
- Set up a good institutional system which will be responsible for implementing, monitoring, and maintaining these activities. It is also important to promote participation of local stakeholders, i.e. local people and university in this case.

### 3.5.3 Socio-Economy

In order to increase and maximize positive impacts and to minimize negative impacts, it is necessary to consider below aspects:

- Setting up monitoring institution for watershed management must consider the socio-cultural aspects of the local people. Thus, it is considered important to include leaders of the local communities. Moreover, the institution should also consists of, not only technical organization/institution of the government, but it must include universities, since they have expertise and laboratories which will be needed by the institution being set up. Socialization of these planned activities is required from the very early state of its development process.
- Establishing of community forest should consider some alternative source of income for the local people who receives negative impact produced by this activities. This, however, can be minimized by including local community in establishing this plan.
- Extension, training and workshop should be carried out for farmers and local stake holders in order to create positive perceptions, and to increase capacity building of local people and stake holders. The training should include practical fieldwork in order to provide real experiences to the participants.
- Similar measures with the above could be performed when implementing the

other planned activities such as expansion of woodland, prevention of deforestation, green belt, regulation of fishery and construction of erosion control structures and farming practices.

- It is important to organize a Tondano Watershed Authority Board that is responsible to establish an integrated planning and to manage the watershed.

### **3.6 Monitoring Plan**

#### **3.6.1 General**

Although Lake Tondano have very important role as the largest water source in the region, scientific data on Lake Tondano showing current condition are very limited. For proper management of the lake and its watershed, scientific data is very important. Management of the Tondano Watershed requires time series data on (1) erosion and sedimentation, (2) water quality of the Lake, (3) water balance of the Lake.

#### **3.6.2 Soil and Land**

Measurement of soil loss is necessary for improving estimation of erosion in the area. In parallel to erosion, collection of data to indicate the rate of sedimentation and properties of the bottom materials is indispensable. For erosion observation of soil loss, three monitoring stations are required, and for sedimentation measurement, regular survey in the existing check dams and in the Lake is recommended.

For erosion observation of soil loss, several monitoring stations will be required, and for sedimentation measurement, regular survey in the existing check dams and in the lake is recommended. Proposed site of soil erosion monitoring stations were decided based on the following criteria: different soil type and different type of farming.

For Sediment Analysis, necessary data are annual change of accumulated sediment, and analysis of bottom materials. Sampling and analysis will be done once a year, so that sample will be analyzed at the existing laboratory. Items required analyses are chemical and physical properties to identify the source of origin of the materials.

For water quality, measurement has to be done several times a year. Water samples will be taken from different depths in the water. Necessary measurement items are DO, pH, Ec, N, P, BOD, Suspended solids, Plankton, and Clearness. The regular monitoring sites of the lake are determined considering the criteria: to distribute the sampling points evenly for specifying the major supplier of eutrophication of the lake water.

### 3.6.3 Flora and Fauna

For fauna and flora, their diversity needs to be monitored. This can be done using transect method at several location within the community forest, protection forest, agroforestry, and green belt area, at least once a year. The organizations to be responsible for this include BRKLT Minahasa, PHPA, and BKSDA. Monitoring shall also be made in the agricultural area through direct observation on production and plant pest and disease. This activity could be carried out at every planting season for perennial crops and once a year for annual crops, and it should include institution such as Food Crops and Estate Crops Minahasa offices.

### 3.6.4 Socio-Economy and Culture

For socio-economic components, monitoring activity on socio-economy and cultural components can be implemented concerning of:

- Consulting and socialization of the project to the local people
- Production and development of productive plants
- Providing compensation in the relocation program
- People participation in each stage of the process
- Establishment of monitoring institution

Environmental components that need to be monitored are:

- Potential conflict within the local people
- Lost of source of income
- Level and income distribution
- People perception

The monitoring activities can be conducted through data collection (primary and secondary) at least once every six months.

## **CHAPTER 4 CONCLUSION**

An environmental impact assessment has been carried out in order to assess impacts of the above eight activities on environmental components within the intensive area.

### **4.1 Possible Impacts**

All the proposed activities will produce impacts more on the positive side than the negative sides and negative impacts will occur only at the initial stage. Thus, there are little mitigation measures to be considered for.

In term of soil and land and hydrology, the negative impacts of the proposed activities are minor. Positive impacts will be very strong and predominant, such as improvement of hydrology system, water quality, and soil fertility.

In terms of fauna and flora, positive impacts on biodiversity, accelerated growth in population of the protected species, improvement of vegetation stand and structure are expected. However, precaution should only be made if the activities will include introduction of new species of flora and fauna into the area. Extension of agroforestry will bring about improvement of the ecosystem stability by combination of forest vegetation and cultured crops. However, increase in planting intensity by agroforestry indicates increase in application of fertilizer in the area.

In terms of socio-economy, expected impacts are more positive side. Set up of community forest in protection forest, however, bring negative impacts on the community that have been using that land to generate income for many years. Negative impacts are expected to occur only at the initial state of the project.

### **4.2 Recommendations**

Training and workshop to the local stakeholder are considered important for the benefit of the project and the people. Training and extension services shall also offer topics such as domestic waste handling. Establishing a demonstration plot and a training center would also necessary.

To minimize the negative impacts, following s are considered.

- In order to establish community forest, agroforestry and green belt, it is necessary to have them designed as corridors which will allow high genetics mobility of the flora and fauna to move around in the area.
- Species to be used in establishing the planned activities should be chosen first from the existing species in the area since they have been adapted to the



ecosystem. Thus, it is considered necessary to set aside some funding for detail study on seed stand, nursery, planting techniques, and protection.

- Socialization of the activities to the local people
- Setting up a good institutional system which will be responsible in implementing, monitoring, and maintaining these activities. It is important to include local stakeholders in this case university and local people.

In order to increase and maximize positive impacts and to minimize negative impacts it is necessary to consider aspects as follow:

- Setting up monitoring institution for watershed management must consider the socio-cultural aspects of the local people. Thus, it is considered important to include leaders of the local communities. Moreover, the institution should also consists of, not only technical organization/institution of the government, but it must include universities since they have expertise and laboratories which will be needed by the institution being set up. Socialization of these planned activities is required from the very early state of its development process.
- Establishing of community forest should consider some alternative source of income for the local people who experiences negative impact produced by this activities. This, however, can be minimized by including local community in establishing this plan.
- Extension, training and workshop for farmers and local stake holders should be done in order to create positive perceptions, increase capacity building of local people and stake holders. The training should include practical fieldwork in order to provide real example.
- Similar measures with the above could be performed when implementing the other planned activities such as expansion of woodland, prevention of deforestation, green belt, regulation of fishery and construction of erosion control structures and farming practices.

### **4.3 Monitoring**

In term of monitoring plan, scientific data is very important for proper management of the lake and its watershed. Management of the Tondano Watershed requires data on (1) erosion and sedimentation, (2) water quality of the Lake, (3) water balance of the Lake.

For fauna and flora, their diversity needs to be monitored. This can be done using transect method at several location within the community forest, protection forest, agroforestry, and green belt area, at least once a year. Monitoring shall also be

made in the agricultural area through direct observation on production and plant pest and disease. This activity could be carried out at every planting season for perennial crops and once a year for annual crops

For socio-economic components, the activities are necessary for consulting and socialization of the project to the local people, production and development of productive plants, providing compensation in the relocation program, people participation in each stage of the process, and establishment of monitoring institution. Environmental components that need to be monitored are potential conflict within the local people, lost of source of income, level and income distribution, and people perception. The monitoring activities can be conducted through data collection (primary and secondary) at least once every six months.

## *Tables*

**Table K.2.1 List of the Laws and Regulations (1/7)**

<b>Laws</b>		
1	5/1960	Basic Principles of Agrarian Law
2	5/1967	Basic Principles of Forestry Law
3	5/ 1974	Governmental Principles at the Provincial Level
4	11/1974	Irrigation
5	5/1979	Village's Government
6	4/1982	Environmental Management
7	5/1984	Industrial Affairs
8	9/1985	Fisheries
9	5/1990	Conservation of Biological Resources and Its Ecosystems
10	16/1992	Animal, Fish and Plants Quarantines
11	24/1992	Land Arrangement
12	5/1994	Verification of United Nations Convention on Biological Diversity
13	6/1994	Verification of United Nations Framework Convention on Climate Change
14	23/1997	Living Environmental Management
15	22/1999	Village's Government
16	41/1999	Forestry
<b>Decree of House of Representatives</b>		
17	IV/MPR/1999	National Guidelines for year 1999-2004
<b>Governmental Regulations</b>		
18	33/1970	Forest Planning
19	22/1982	Water Management
20	23/1982	Irrigation
21	28/1985	Forest Protection
22	15/1990	Fisheries
23	20/1990	Water Pollution Control
24	27/1991	Swamp
25	35/1991	River
26	51/1993	Environmental Impact Assessment (Changed by Government Regulation No. 27/1990)
27	13/1994	Wild Animal Hunting
28	19/1994	Dangerous and Toxic Waste Management
29	12/1995	Revision of Government Regulation No. 19/1994 concerning the Management of Dangerous and Toxic Disposals (replaced with the Government Regulation No. 18/1999)
30	69/1996	Right and Responsibility Implementation, and Type and Way of People Participation in the Land Arrangement
31	47/1997	Design of National Territorial Arrangement
32	59/1998	Forest resources Provision
33	62/1998	Permission of Some Government Authorities in the Forestry to the Provincial Level
34	68/1998	Nature Reserves and Natural Preservation Areas
35	6/1999	Forest Entrepreneur-ship and the Forest Product Collection Rights in the Production Forests
36	7/1999	Preservation of Flora and Fauna
37	8/1999	The Usage of Flora and Wild Fauna
38	27/1999	Environmental Impact Assessment
39	25/2000	Authority of Local and Provincial Government as an Autonomic Region

**Table K.2.1 List of the Laws and Regulations (2/7)**

<b>Governmental Regulation Plan</b>		
40	.../2000	Controlling Firing Practice, Fire, and Its Impacts
41	.../2000	Act of Controlling Soil Damaging and/or Polluting
<b>Presidential Decree</b>		
42	66/1971	Increase in the Forest Entrepreneur-ship Facilities
43	85/1982	The Use of Shrimp Net
44	23/1990	National Environmental Agency
45	29/1990	Reforestation Fund
46	32/1990	Protected Area Management
47	4/1993	National Fauna and Flora
48	25/1994	Coordination of Transmigration Program and Relocation of Forest Residents
49	77/1994	Environmental Impact Controlling Bureau ('BAPEDAL')
50	21/1995	Selling, Ownership and Usage of Chainsaw
51	196/1998	Environmental Controlling Bureau
52	10/2000	Environmental Controlling Bureau
<b>Presidential Instructions</b>		
53	1/1976	Synchronization of the Agrarian Responsibilities with the Forestry, Mining, Transmigration and General Work
<b>Ministry Decisions</b>		
54	76/Kpts/Um/2/1969	Forest Exploitation Guidance
55	54/Kpts/Um/2/1972	Trees in the Protected Forest
56	178/Kpts/Um/4/1975	General Guidance on the Alteration of the Forest Area Boundary
57	837/Kpts/Um/2/1980	Criteria and Custom of Protection Forest Establishment
58	680/Kpts/Um/8/1981	Guidance of the Consensus Forest Usage
59	683/Kpts/Um/8/1981	Criteria and Custom of Production Forest Establishment
60	20/Kpts-II/1983	Organization and Working System on the Forestry Department
61	34/Kpts-II/1983	Organization and Working System on the Regional Offices of the Forestry Department at the Provincial Level
62	96/Kpts-II/1984	Organization and Working System on the National Park
63	194/Kpts-II/1986	Guidelines for Working at the Other Forests
64	280/Kpts-II/1986	Effort to Prevent and Restrict Destruction of Forest and Forest Product caused by Nature, Pest and Disease Agencies
65	353/Kpts-II/1986	Cutting Tree Prohibitions on the Certain Radius/ Distance from Water Spring, Valley Edges of a Lake, Reservoir, River, and its Streams on Forest, Forest Reserve and the other Forests
66	Mendari No. 48/1989	Identity of the Provincial Flora and Fauna
67	493/Kpts-II/1989	Sanction on Forest Exploiting Violation
68	494/Kpts-II/1989	The Arrangement of Sanction Penalty on Violation in Forest Exploitation and the Cancellation of Forest Concession
69	77/Kpts-II/1990	Order for the Director General of Forest Protection and Natural Preservation and the Head of Territorial Office of Provincial Forest Department to Give permit for Survey on Mining Materials in Forest Area
70	261/Kpts-II/1990	Appendix Addition of Agricultural Ministry Decree No. 54/Kpts/Um/2/1972, concerning the Trees in the Protected Forest Area
71	399/Kpts-II/1990	Guidance of Forest Affirmation
72	815/Kpts/IK.120/11/1990	Permit for Fisheries

**Table K.2.1 List of the Laws and Regulations (3/7)**

<b>Ministry Decisions (continued)</b>		
73	837/Kpts-II/1990	Prohibition of tree Cutting at 100m from Left and Right of the River and 200m from the Radius of Water Spring
74	241/Kpts-II/1991	Revision of Forest Minister No. 494//Kpts/Um/2/1989 concerning the Arrangement of Sanction Penalty on Violations in Forest Exploitation and Cancellation of Forest Concession
75	614/Kpts-II/1992	The Arrangement of Determination, Request, Payment and Equal Distribution of Forest Product Income
76	830/Kpts-II/1992	Forestry Planning System
77	114/Kpts-II/1993	Environmental management and Monitoring of the Forest Concession
78	124/Kpts-II/1993	Organization Structure and Working System on the National Forest Inventory Project
79	251/Kpts-II/1993	Determination of Forest Product Harvesting by Traditional Community (Masyarakat Hukum Adat) or its Members in the Forest Concession Area
80	252/Kpts-II/1993 Junto No. 576/Kpts-II/1993	Criteria and Indicator of Sustainable management of Indonesian natural Forest Production
81	411/Kpts-II/1993	Revision of Decree of Forestry Minister No. 124/Kpts-II/1993 dated 27 February 1993 concerning the Organization Structure and Job Arrangement of National Forest Inventory Project
82	523/Kpts-II/1993	Guidance to Forest Protection in the Forest Concession Area
83	55/Kpts-II/1994	Leasing and Using Guidance of a Forest Area
84	57/Kpts-II/1994	Guidance on Demarcation arranging of Forest Function
85	87/Kpts-II/1994	Establishment of Inventory Team, Instruments and Infrastructures in order to Formulate Forest Service and Land Conservation on the District Level
86	200/Kpts-II/1994	Unproductive Natural Production Forest Criteria
87	260/Kpts-II/1995	Guidance to Preventing and Extinguishing Efforts on the Forest Fire
88	276/Kpts-II/1995	Development of River Current Observation Station in the Forest Concession Area
89	509/Kpts/IK.120/7/1995	Guidance of Fishery Business Partnerships with Central Community Company Pattern (PIR)
90	36/Kpts-II/1996	Assignment of Director General of Forest Protection and Nature Conservation as Management Authority of CITES
91	41/Kpts-II/1996	Revision in Chapter 16 of Decree of Forestry Minister No. 55/Kpts-II/1994 concerning the Guidance of Forest Area Leasing
92	58/Kpts-II/1996	Modification of Agricultural Ministry Decision No. 54/Kpts/Um/2/1972 and Forestry Minister Decision No.261/Kpts-IV/1990 on Trees in the Protected Forest
93	250/Kpts-II/1996	Modification of Forestry Ministry Decision No.418/Kpte-II/1993 on Establishing of Additional Prerequisite on Releasing Forest Area for Agricultural Business Development
94	363/Kpts-II/1996	Experiment and Improved Methodology of Survey on Social Economic of Indonesian Forestry (PPSSEKI)
95	378/Kpts-II/1996	Modification of Forestry Ministry Decision No. 172/Kpts-II/1996 on the Assignment of State Corporation under the Scope of Forestry Department to do Forest Rehabilitation and Community Forest Development
96	413/Kpts-II/1996	Establishment of Standard Cost of Public Forest Development and Protected Forest Rehabilitation under other Governmental Funding Source conducted by BUMN/Third Party

**Table K.2.1 List of the Laws and Regulations (4/7)**

<b>Ministry Decisions (continued)</b>		
97	446/Kpts-II/1996	Guidelines of Proposal, Permit Release and Cancellation of Natural Tourism Entrepreneurship
98	447/Kpts-II/1996	Guidance and Control of Natural Tourism Entrepreneurship
99	603/Kpts-II/1996	Implementation of Forest Services
100	605/Kpts-II/1996	Establishment of Standard Payment of Log Wood Forest Products and Chip Raw Materials in Indonesia for the Period of 1 October 1996 to 31 March 1997
101	606/Kpts-II/1996	Standard Payment of Non-Wood Forest Production in Indonesia for the Period of 1 October 1996 to 31 March 1997
102	616/Kpts-II/1996	Hunting Control of the Hunting Animals
103	617/Kpts-II/1996	Introduction of Wild Animals from Other Areas in Indonesian Country into Hunting Park and Hunting Area
104	618/Kpts-II/1996	Control Techniques of the Unprotected Wild Animal Population Outbreak
105	625/Kpts-II/1996	Field Collaboration of Forest Concession Activities between BUMN and Particular Institution
106	634/Kpts-II/1996	Modification of Forestry Ministry Decision No. 399/Kpts-II/1990 on Guidance of Forest Affirmation
107	635/Kpts-II/1996	Revision of Decree of Forestry Minister No.400/Kpts-II/1996 concerning the Establishment of the Boundary Arrangement Committee
108	658/Kpts-II/1996	Modification of Ministry Decision on Imposition of Levy for Capturing/Taking and Transporting Wild Flora and Fauna which Unprotected by Law and in the Country or to Abroad and for Robbery Levy of Hunting Fauna
109	93/KPTS/OT.210/3 /1997	Guidance for Tutoring Farmer-Fisherman Groups
110	49/Kpts-II/1997	Funding and Public Forest Entrepreneurship
111	76/Kpts-II/1997	Authority Load of Cancellation of Decree of Forestry Minister concerning the Release of Forest Area for Gardening Cultivation on Provincial Governor
112	348/Kpts-II/1997	Revision of Decree of Forestry Minister No.446/Kpts-II/1996 concerning the Guideline of Proposal and Cancellation of Tourism Entrepreneurship Permit
113	364/Kpts-II/1997	Grant Honor of Wana Lestari Satya Nugraha
114	365/Kpts-II/1997	National Mascot of Forest Fire Control
115	519/Kpts-II/1997	Environmental Impact Assessment, Environmental Management and Monitoring of the Forestry Development
116	574/Kpts-II/1997	Appendix Completion of Decree of Forestry Minister No.311/Kpts-II/1995 concerning Wood Type Grouping as a Basis of the Establishment of Forestry Payment
117	602/Kpts-II/1998	Environmental Impact Assessment, Environmental Management and Monitoring of the Forestry and Estate Crops Development
118	677/Kpts-II/1998	Community Forest
119	728/Kpts-II/1998	Maximum Area of Forest Concession and the Releasing Forest Area
120	279/Kpts-II/1999	Organizing Areas at the Forestry Sector
121	104/Kpts-II/2000	Guideline of Wild Flora and Fauna Collection
122	054/Kpts-II/2000	Revision of Decree of Forest and Estate Crops Minister No.704/Kpts-II/1999 concerning the Establishment of Facilitating Team of the Autonomic Area run of Forestry and Estate Crops Department

**Table K.2.1 List of the Laws and Regulations (5/7)**

<b>Ministry Decisions (continued)</b>		
123	084/Kpts-II/2000	Temporary Cancellation of Decree of Forestry Minister No.310/Kpts-II/1999 concerning the Guide to Forest Product Collecting Rights
124	132/Kpts-II/2000	Valid Document of Forest Product (SKSHH) as a Substitute of transport Document of Round Wood (SAKB), Transport Document of Processed Wood (SAKO) and Transport Document of Non-Wood Forest Product (SAHHBK)
125	146/Kpts-II/2000	Evaluation and Further Action of Forest Area Release for the Development of Estate Crops Cultivation Entrepreneurship
126	151/Kpts-II/2000	Establishment of Estate Crops Plant Commodity
127	210/Kpts-II/2000	Revision of Decree of Forestry and Agricultural Minister No.146/Kpts-II/2000 concerning the Evaluation and the Further Action of Forest Area Release for the Development of Estate Crops Cultivation Entrepreneurship
128	213/Kpts-II/2000	Strategic Plan of Forestry and Estate Crops Department for year 2001-2005
<b>Decree of Living Environmental Minister</b>		
129	Kep-03/MenKLH/1987	Mitigation Procedure for the Environmental Pollution and Damage
130	Kep-11/MenLH/3/1994	Type of Business or Activities Compulsorily Requiring the Environmental Impact Assessment (EIA)
131	Kep-12/MenLH/1994	General Guidance for Environmental management and Monitoring
132	Kep-14/MenLH/1994	General Guidance for EIA Compilation
133	Kep-13/MenLH/1994	Standard of Immobile Source Emission
134	2/2000	Guideline of EIA Document Evaluation
135	3/2000	Type of Business and/or Activities Requiring EIA Document
136	4/2000	Guideline of Preparing EIA Document for Integrated Residential Development Activity
137	5/2000	Guideline of Preparing EIA Document for Development Activity in the Wetland Area
138	40/2000	Guideline of Working System of Evaluating Committee of EIA
139	41/2000	Guideline of Establishment of Evaluating Committee of Regency EIA
140	42/2000	Structure of Committee Member and Evaluating Committee on Technical Analysis of Central Environmental Impact
<b>Ministry Regulation</b>		
141	9/1998	Working System of Public Participation in Land Use Designing Process in the Rural Area
<b>Compromised Decision Letter</b>		
142	SKB. Mendari & Menneg. PPLH No.23/1979 – No. KEP-002/MNPPLH/2/1979	Managerial Institutions of natural resources and Living Environment at the Provincial Level
143	KB. Mentrans. & Menhut. No. SKB. 80/Men/1990 – 375/Kpts-II/1990	Working System of Forest Area Release for Transmigration Residences
144	KB. Menhut., Mentan., & Ka.BPN No. 364/Kpts-II/1993 – 519/Kpts/HK.050/7/90 – 23-VIII-1990	The determination of Releasing Forest Area and Awarding Concession for Agricultural Business Development



**Table K.2.1 List of the Laws and Regulations (6/7)**

<b>Compromised Decision Letter (continued)</b>		
145	KB. Menhut., Mendari., & Mentrans. PPH No. 480/Kpts-II/1993 – 74/1993 – SKB.69/MEN/1993	Forest Resident Handling and Shifting Cultivation
146	KB. Mendari. & Menhut. No. 52/1994 – No.230/Kpts-II/ 1994	Implementation of Forestry Services and Soil Conservation on the District Level
147	KB. Menkeu., Menhut., Jagung & Kapolri No. 51/KMK.01/97, No.72/Kpts-II/97, No.Kep.010/JA/2/97 & No.Pol.Kep./01/1/97	Auction of Finding, Seized and Confiscated Woods other than Mixed Forest Wood
148	KB. SekJend Deptan & SekJend Dephutbun No. KP. 150/606/B/VII/2000 & No.57/Kpts/II-Kum/2000	Compilation Team of the Design of Decree of Agricultural and Forestry and gardening Ministers concerning the Policy and the Guide to Crop Plant, Horticultural Plant and Gardening Entrepreneurship
<b>Ministry Instructions</b>		
149	88/Kpts-VI/1988	Controlling Shifting Cultivation
150	3/1997	Coordination of Planning and Development of Protected Area and its Surroundings
<b>Directorate General's Decisions</b>		
151	Dirjen PHH. No.28/Kpts/IV-PHH/1991	Forest Concession Guidance on the Rattan Plantation
152	Dirjen PH No.233/Kpts/IV-set/1996	Guideline of Collecting and Supply of Bamboo Forest Concession Right Payment
153	Dirjen Inventarisasi Tata Guna Hutan dan Kebun No.82/Kpts/VII-1/1998	Technical Guidance on the Forest Establishing Implementation
154	Dirjen Reboisasi dan Rehabilitasi Lahan No.028/Kpts/V/1994	Technical Guidance on Conservation in the Forest Concession Area
155	Dirjen PHPA No.243/Kpts/Dj-VI/1994	Technical Guidance to Prevent and Mitigate Forest Fire at the Forest Concession and at the other Land Use Areas
156	Dirjen PHPA No.244/Kpts/Dj-VI/1994	Technical Guidance to the Forest Fire Extinguishing
157	22/Kpts/II-KUM/2000	Establishment of Smoothing Team of RPP as a Further Action of the Law No.41/1000 concerning Forestry
158	35/Kpts/II-KUM/2000	Establishment of Smoothing Team the laws in Forestry and Gardening unsuitable for Reform Programs
<b>Circular Letters</b>		
159	DirJend.Hut. Letter No.1676/DJ/1976	Policy of Forest Area Trading
160	SE Menhut. No. 088/Menhut/I/1988	Policy on the Protected Forests

**Table K.2.1 List of the Laws and Regulations (7/7)**

<b>Circular Letters (continued)</b>		
161	SE Jaksa Agung No. SE.002/J.A/9.1991	Guideline of Justical Operation of Forest Preserving Coordination Team
162	MenLH No. B-2209/MENLH/11/2000 Head of BAPPENAS	Fund Allocation of EIA Preparation for Government Projects Funded by the National Expenditure (APBN)
163	MenLH No. B-2205/MENLH/11/2000 to Governors and Heads of Regency/Capital of Regency	Fund Allocation of EIA Preparation for Government Projects Funded by Regional (APBD)
164	MenLH No. B-2204/MENLH/11/2000 to Governors and Heads of Regency/Capital of Regency	Authority Order for EIA Evaluation in provincial Level for Temporary Period
<b>Decree of Head of National Environmental Agency</b>		
165	8/2000	People Involvement and Information Exposure on the Analytical Process concerning EIA
166	9/2000	Designing Guidance of the Environmental Impact Assessment

**Table K.2.2 Hierarchy System of the Laws and Regulations**

Priority	English Term	Indonesian Term
1	Laws	Undang-undang
2	Decree of House of Representatives	Ketetapan Majelis Permusyawaratan Rakyat
3	Governmental Regulations	Peraturan Pemerintah
4	Governmental Regulation Plan	Rancangan Peraturan Pwmwrintah
5	Presidential Decree	Keputusan Presiden
6	Presidential Instruction	Instruksi Presiden
7	Ministry Decision	Keputusan Menteri
8	Decree of Living Environmental Minister	Keputusan Menteri Lingkungan Hidup
9	Ministry Regulation	Peraturan menteri
10	Compromised Decision Letter	Surat Keputusan Bersama
11	Ministry Instructions	Instruksi Menteri
12	Directorate General's Decision	Keputusan Direktris Jenderal
13	Secretary General's Decision	Keputusan Sekertaris Jemderal DepHutBun
14	Circular Letter	Surat Edaran
15	Decree of Head of National Environmental Agency	Keputusan Kepala Bapedal

**Table K.2.3                      Activities Needed EIA by AMDAL(1/4)**

NO	ACTIVITIES	Scale/ Area
<b>I. MINING and ENERGY FIELD</b>		
1	Width Area of Public Mining	>= 200 ha and/or
	Production and Exploitation Phases	
	a. Coal	>= 200,000 ton/year
	b. Primary Stone	>= 160,000 ton/year
	c. Secondary Stone	>= 100,000 ton/year
	d. Mined Products other than Metal ( C Group mined Products)	>= 300,000 m/year
	e. Radioactive	all
2	Transmission	>=150 KV
3	PLTD/PITG/PLTU/PLTGU	>= 100 MW
4	Electric Hydro Power with Dam Height	>= 150 m or
	a. Electric Hydro Power with Puddle Area	>= 200 ha
	b. Electric Hydro Power with Direct Electric Current	>= 50 MW
5	Electric Earth Heat Power	>= 55 MW
6	Electric Nuclear Power	All
7	Electricity from other Kind	>= 5 MW
8	Oil, Natural Gas, and Geothermal Exploitation	
	a. Oil and Natural Gas Exploitation and Land Production Improvement	>=BOPD
	b. Oil and Natural Exploitation and Sea Production Improvement	>=5,000 BOPD
	c. Geothermal Exploitation and Production Facility Improvement ( total capacity)	>= 55 MW
9	Oil Refinery	All commercial measures
10	Oil and Nature Gas Transmission (excluded in field piping)	>= 25 km
11	Ground Water Exploitation (either Shallow or Deep Soil Well)	>= 50 lt./day (from 1 well/ or from 5 well arcal < 10 ha)
<b>II. FORESTRY FIELD</b>		
1	Development of Safari Garden	Area > = 250 ha
2	Development of Zoo	Area > = 100 ha
3	Forestry Exertion Authority	All
4	Sago Forest Exertion Authority	All
5	Industrial Plants Forest Exertion Authority	> = 10,000 ha
6	Bamboo Forest Exertion Authority	All
7	Exertion of Natural Tourism in	
	a. National Park	Area > = 100 ha
	b. Natural Tourism Park	Area > = 100 ha
	c. Hunting Park	Area > = 100 ha
	d. Botanical Forest	Area > = 100 ha
All the activities appropriate to the Conclusion of Forestry Department no. 167/Kpts-II/1994		
<b>III. COMMUNICATION FIELD</b>		
1	Train Highway Network	Length > = 25 Km
2	Supporting Infrastructure for Train (Terminal , Station etc)	Area > 5ha
3	Subway	All
4	Train Fly-over	Length > = 5 km
5	River Dredging	Volume > = 50,000 m³

**Table K.2.3                      Activities Needed EIA by AMDAL(2/4)**

(continued)

NO	ACTIVITIES	Scale/ Area
6	Port and its Facilities	
	a. Port (including specific port for fishery, mining, industrial and forestry, etc)	Length > 200 m; or Area > 6,000 m <sup>2</sup> with masive construction
	b. Break Water / Talud (port supporting infrastructure, including terminal, warehouse, container, etc)	Length > = 200 m or Area > = 5 ha
7	Dredging	
	a. Capital Dredging	Volume > = 250,000 m <sup>3</sup>
	b. Maintenance Dredging	Volume > = 500,000 m <sup>3</sup>
8	Reclamation	Area > = 25 ha or Volume > = 500,000 m <sup>3</sup>
9	Dumping Activities	Volume > = 250,000 m <sup>3</sup>
10	Development of New Airport with its Facilities	All dimension (Class I up to IV)
11	Development of Airport with its Facilities	Class I, II, III based on its Developing Plan
12	Airport Expansion with / or its Facilities	
	a. Removal the community	> = 500 family or Area E> = 100 ha
	b. Shore reclamation	Area >=25 ha, or volume > = 10,000 m <sup>3</sup>
<b>IV. TOURISM, POSTAL and TELECOMMUNICATION FIELD</b>		
1	Hotels	> = 200 rooms or Area > 5 ha
2	Golf Area	All
3	Park	Area > = 100 ha
4	Tourism Area	All
<b>V. HEALTH FIELD</b>		
1	Hospital Class A and B	All
2	Pharmacy Industry which producing the raw material for medicine	In commercial scale
<b>VI. NUCLEAR</b>		
1	Development and Operating Reactor Nuclear	
	a. Power Reactor	All the installation
	b. Research Reactor	> = 100 KW
2	Development and Operating Nuclear Installation Non Reactor	
	a. Nuclear Fuel Manufacture	all Installation
	b. Uranium Processing	Production >50 burn elements/year
	c. Radioactive waste Processing	> =100 ton yellow cake/year
	d. Irradiator (Category II up to IV)	all Installation
	e. Radioisotope Production	> 37,000 Tbq (100,000 ci)
	f. Mantle of a pressure Lantern Manufacture	All installation
<b>VII. AGRICULTURE FIELD</b>		
1	Wet rice field on the Forest	Area > = 1,000 ha
2	Food plantation cultivation and holtikultura with or without its exemption units	Area > = 3,000 ha
3	Estate season plant cultivation with or without its exemption unit	Area > = 5,000 ha
4	Estate Plant cultivation with or without its exemption unit	Area > = 10,000 ha
5	Fishpond cultivation	Area > = 50 ha

**Table K.2.3                      Activities Needed EIA by AMDAL(3/4)**

(continued)

NO	ACTIVITIES	Scale/ Area
<b>VIII. PUBLIC WORK</b>		
1	Dam construction	Height $\geq$ 15 m, or Reservoir area $\geq$ 200ha
2	Irrigation	
	a. Construction	Area $\geq$ 1,000 ha
	b. Rehabilitation and upgrading of impact	Area $\geq$ 2,000 ha
	c. Extension	Area $\geq$ 1,000 ha
	d. Wet rice field press	Area $\geq$ 500 ha
3	Swamp Developing	
	a. Pasang – surut Swamp reclamation	Area $\geq$ 5,000 ha
	b. Non Pasang – surut Swamp reclamation	Area $\geq$ 2,000 ha
4	Beach Pacification	Length $\geq$ 2 km
5	River normalization	
	a. Big City	Length $\geq$ 3 km or Area $\geq$ 5 ha
	b. Medium city	Length $\geq$ 5 km
	c. Village	Length $\geq$ 10 km
6	Canalization	
	a. Big City	Length = 5 km or Area = 5 ha
	b. Medium city	Length $\geq$ 10 km
	Village	Length $\geq$ 25 km
7	Highway and Fly-over Development	All
8	Highway Development	
	a. Big City	Length $\geq$ 5 km or Area = 5 ha
	b. Medium city	Length $\geq$ 10 km
	c. Village	Length $\geq$ 25 km
9	Upgrading the highway and road widening at the big city/metropolis	Length = 5 km or Area = 5 ha
10	Trash Heap	
	a. Banishment using controlled landfill system/sanitary landfill	Volume $\geq$ 1,000 m <sup>3</sup> /day
	b. TPA at the Pasang-surut Area	Volume $\geq$ 700 m <sup>3</sup> /day
	c. Station Transfer Development	Capacity $\geq$ 2,000 m <sup>3</sup> /day
11	Housing	
	a. Medium and small city	Area $\geq$ 100 ha
	b. Big city	Area $\geq$ 50 ha
	c. Metropolis	Area $\geq$ 25 ha
12	Settlement Rejuvenation	Area $\geq$ 25ha
13	Development of Waste Installation and or installation for waste water preparation	Area $\geq$ 10 ha
14	Waste water piping network	Area $\geq$ 500 ha
15	Sewedge system	
	a. Development at big city/metropolis	Size $\geq$ 5 m or Length $\geq$ 3 km
	b. Development at small city	Size $\geq$ 10 m or Length $\geq$ 5 km
16	Apartment Development/ office complex	Area = 3 ha, or area/building = 50,000 m <sup>2</sup>
17	Clean water at the big city	
	a. Distribution network development	Area $\geq$ 1,500 ha
	b. Transmission network development	Length $\geq$ 5 km
18	Water	Flow rate $\geq$ 500 l/second

**Table K.2.3                      Activities Needed EIA by AMDAL(4/4)**

(continued)

NO	ACTIVITIES	Scale/ Area
<b>IX. COMMERCE AND INDUSTRIAL FIELD</b>		
1	Cement Industry	All
2	Pulp Industry	All
3	Chemical fertilizer Industry	All
4	Petrochemical Industry	All
5	Steel Manufacture	All
6	Lead Manufacture	All
7	Cu Industry	All
8	Aluminum melting industry	All
9	Aluminum manufacture	All
10	Iron making	All
11	Ferro alloy industry	All
12	Industry Area	All
13	Dockyard Industry with graving dock system	> = 3,000 DWY
14	Plane industry	All
15	Plywood industry with logpond	All
16	Weapon industry	All
17	Pesticide Industry	All
18	Dry Cell (battery) Industry	All (using Hg as Raw material)
19	Electricity accumulator Industry	Capacity > 100,000 unit/year
20	Trade center	Area >= 5 ha or building area >= 10,000 m <sup>2</sup>
<b>X. RELOCATION and FOREST CLEARED SETTLEMENT</b>		
1	Settlement and relocation activities	Area >= 1,500 ha
<b>XI. DEFENSE and SECURITY</b>		
1	Construct a Munitions Storehouse, central munitions storehouse, and regional munitions storehouse	All
2	Construct the Navy Base	Class A, B, C
3	Construct the air forced Base	Class A, B, C
4	Center of combat training	Area > = 10,000 ha

**Table K.3.1 Environmental Evaluation for River Engineering Works**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>River engineering will probably occur near populated areas which are subjected to flooding and riverbank erosion; direct interaction with communities possible.</p> <p>Adjacent natural habitats are not likely to be disturbed significantly by river engineering, since these works will mostly occur in areas that are urbanized or converted to agriculture.</p> <p>Hydrology of engineered river will be altered.</p>	<p><u>Pre-construction</u></p> <p>Detailed survey of dyke, gabion, or normalization of site</p> <p>Land acquisition &gt; relocation of families &gt; social disruption (-1)</p> <p>Mobilization &gt; influx of workers &gt; increase in local business (+1)</p> <p>Land clearing &gt; minimal disturbance of farmland and natural habitats (-1)</p> <p>Base-camp setup/operation, sand/quarry operation, access road to riverbank &gt; movement of trucks and heavy equipment &gt; noise (-1); dust (-1); road damage (-1)</p> <p><u>Construction</u></p> <p>Dredging, excavation and construction &gt; temporary disturbance of riverbed and flow &gt; increased turbidity in river (-1); minimal stress on fish (-1); interference with movement of boats (-1)</p> <p>Material placement, disposal &gt; turbidity in river (-1)</p> <p>Re-greening of construction area (+1)</p> <p><u>Operation and maintenance</u></p> <p>Altered hydrology and discharge capacity in normalized river &gt; optimized to reduce bank erosion and flooding &gt; increased farm production and stability of riverbank communities (+3); &gt; possibility of scour upstream and sedimentation downstream with altered hydrology, until stabilized (-1)</p> <p>Ongoing maintenance of dykes, gabions, and revetment &gt; minimal local disruption (-1)</p>	<p>Public consultation and land compensation</p> <p>Site and roadway watering to control dust</p> <p>Silt curtains and dry season construction to reduce erosion/sedimentation during construction</p> <p>Environmental management manual for workers</p> <p>Maintain boat access through construction area</p> <p>Monitor sediment transport in river and riverbank condition: address erosion and sedimentation problems as they occur</p> <p>Local community should be involved in maintaining the local river engineering</p>

**Table K.3.2 Environmental Evaluation for Construction of Sediment Check Dams**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>Sediment check dams are proposed for the Limboto area, where the lake has been suffering from accelerated sedimentation, due to land clearing; this area is fairly heavily populated and has already been converted to agriculture; residual natural habitats are minimal</p> <p>Sediment check dams proposed for Mahawu and Bitung are intended to deal with volcanic lahar flows near communities, to improve the safety of the local communities during the rainy season; specific natural habitats have not been surveyed; sensitivities unknown</p> <p>The size of the check dams and the area covered by small ponds created will define the degree of impact</p>	<p><u>Pre-construction</u></p> <p>Limited land acquisition &gt; some relocation of families possible &gt; social disruption/conflict (-1)</p> <p>Construction of structure</p> <p>Mobilization &gt; small influx of workers &gt; increase in local business (+1)</p> <p>Land clearing &gt; minimal disturbance of farmland and natural habitats (-1)</p> <p>Base-camp setup/operation, sand/quarry operation, access road to riverbank &gt; movement of trucks and heavy equipment &gt; noise (-1); dust (-1); road damage (-1)</p> <p><u>Construction</u></p> <p>River diversion and de-watering &gt; disturbance of river bed and flow &gt; increased turbidity in river (-1) &gt; downstream sedimentation for duration of construction (-2)</p> <p>Material placement, disposal &gt; turbidity in river (-1)</p> <p>Excavation and construction &gt; side-casting and disposal of excavated sediments &gt; flooding of river habitat (-1)</p> <p><u>Operation and maintenance</u></p> <p>Risk of local flooding and wash-around during high flows, in all areas (-1)</p> <p>Reduced sediment transport downstream (+2); but filling up with sediments and local flooding, unless cleaned cut (-2); sediment in check dam can be used for local construction purpose, especially Mahawu and Bitung (+2)</p> <p>Increased safety of communities at Mahawu and Bitung (lahar flow) (+3, but false sense of security can develop at check dam reaches capacity and risk of failure increase (-2)</p>	<p>Public consultation and land compensation</p> <p>Site and roadway watering to control dust</p> <p>Silt curtains and dry season construction to reduce erosion/sedimentation during construction</p> <p>Environmental management manual for workers</p> <p>Proper monitoring and clean out of sediment trap</p> <p>Construction of fish way in a sediment check dam</p> <p>Prevent human settlement around the small reservoirs created by the dams and establish environmental guidelines for local use</p>



**Table K.3.3 Environmental Evaluation for Construction of Embungs**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>Embungs are small field reservoirs constructed with a check dam in small localized catchment with no river inlets.</p> <p>First area specified for embung development is the Gorontalo area, which suffers from water shortages in the dry season</p> <p>Specific location have not been designated; possibility of embung flooding existing farmland, so site selection is critical</p>	<p><u>Pre-construction</u></p> <p>Consultation with communities and ground surveys to identify optimal locations with minimal conflict with existing farming (+3); potential social conflict as communities may compete for government support to build embung (-1)</p> <p>Drainage areas selected for embung might already be under cultivation &gt; loss of agricultural production (-2) &gt; possible relocation of some families, depending on location (-2)</p> <p><u>Construction</u></p> <p>Local community construction of embung &gt; possible no paid labor; in-kind contribution from community in return for provision of materials and water management rights later (perceived +/-?)</p> <p><u>Operation</u></p> <p>Filling in embung in rainy season &gt; creation of fish habitat (+2)</p> <p>Supply of water for livestock, garden watering, and bathing &gt; increased local production (+3), but effective supply area and duration of supply in the dry season will depend on volume of the embung, rainy season drainage to the embung, the rate of extraction, evaporation and seepage/leakage losses</p> <p>Potential creation of mosquito habitat (-2)</p> <p>Inequitable distribution of water from the embung &gt; social conflict (-2)</p> <p>Inferior construction and heavy rains may lead to failure &gt; damage to local housing/crops (-2)</p> <p>Land clearing around the embung &gt; sedimentation &gt; infilling &gt; shortened effective life of embung (-2); requirement for maintenance at end of dry season</p> <p>Entrapment use, and evaporation of water in embung may lead to reduced recharge of aquifers and water sources in the region (-1)</p>	<p>Public consultation required for appropriate selection of embung sites with minimal social conflicts and equitable distribution of embung</p> <p>Compensation for flooded land</p> <p>Clear, effective guidelines on embung construction and quality control</p> <p>Effective distribution system for water from embung, with minimum losses in the system (requires careful calculation of draw-down capacity in the system)</p> <p>Maintenence of embung important; maintain the dam, clear out weeds and excess sediments</p> <p>Keep the area around the embung vegetated to minimize soil loss and filling of embung</p>

**Table K.3.4 Environmental Evaluation for Lake Tondano Irrigation Expansion**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>North Sulawesi's biggest lake, area of about 4,500 ha; in fertile lacustrine/alluvial valley; sedimentation of lake a serious problem, current depth of only 16 meters; storage capacity affected</p> <p>Possible linkage between downstream, hydropower projects and increased flooding of the lake</p> <p>Deteriorating water quality from sedimentation, agricultural runoff, sewage, and fish culture- growth of aquatic plants and water hyacinth accelerating; the lake provides drinking water to Tondano and ultimately to Manado</p> <p>Golf course development planned; increased agriculture/ aquaculture proposed</p> <p>Technical and semi-technical irrigation common In watershed; problem of water supply in dry season; some scope for expansion of irrigated area, but may conflict with existing land use and Tondano urban area; groundwater pumping occurs here</p> <p>Contour and terrace farming of vegetables on the west of the lake; cloves on the east side, but trees being cut due to depressed prices</p> <p>Extensive fish cage culture in the lake, but decreasing production</p> <p>Need for integrated lake management plan</p> <p>Dredging and channel normalization at lake outlet</p>	<p><u>Pre-construction</u></p> <p>Detailed surveys of the lake, calculation of recharge, and estimates of all present and future water demands are required to determine sustainable pumping rates &gt; this is a positive step, but conflict perceived with other water users (hydropower, city water supply, aquaculture along shore) (02)</p> <p>The most suitable locations for pump intakes need to be established &gt; consultation with communities (this is a positive step, but may be very difficult to achieve consensus on a pumping scheme)</p> <p><u>Construction</u></p> <p>Installation of pumping station &gt; localized turbidity in lake (-1)</p> <p>Installation of pipe system, storage tanks, and trickle or sprinkler system &gt; minimal disruption of farmland (no disturbance of natural habitats) (-1); localized turbidity in small water sources (-1)</p> <p><u>Operation</u></p> <p>Water extraction could exceed recharge rate of the lake, especially given all the other water uses, which would lead to a drop in water level during the dry season(-2); needs to be carefully monitored (there is not much scope for increasing the storage capacity of the lake to address dry season water levels, without flooding parts of Tondano , or building an extensive dike system at the downstream end of the lake and flooding the south end of the lake)</p> <p>Drainage of pumped water through fields (drainage needs to be directed away from lake as much as possible, but this may be difficult) &gt; increase in fertilizer and pesticide residue entering the lake and Tondano River (-2)</p> <p>Intake could become fouled with weed &gt; entrainment of small organisms possible (-1)</p> <p>Reduced discharge to Tondano River (evaporation and other losses in the pump system) &gt; conflict with other water demands in the river, such as hydropower and further reduction of fish habitats (-2)</p> <p>Increased water supply &gt; increase in cultivation area and production (+3); reduction of groundwater pumping (+3)</p>	<p>Detailed lake volume and recharge studies required</p> <p>Public consultation on proposed lake pumping scheme; need development of an integrated lake management plan</p> <p>Use of silt curtains around pump installation sites during construction</p> <p>Regular lake level monitoring</p> <p>Regular cleaning of pump intake screens (these should be located in deeper water, but well off the bottom)</p> <p>Direct field drainage to river, rather than back to the lake</p> <p>Keep a maintenance flow in the Tondano River, for fish habitat and eel migration</p> <p>Upper watershed management is critical to reduce soil loss and sedimentation in the lake; reduction of fertilizer and pesticide inputs very important to improve water quality in the lake</p>

**Table K.3.5 Environmental Evaluation for Irrigation Development in Kabupaten Minahasa**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>Area suitable for wetland agriculture (at present, mixed with cropping, with rainfed sawah and palawija, coconuts), but water supply difficult; some of the present water supply off Klabat serves fish ponds</p> <p>Small streams with low dry season flow</p> <p>Gunung Klabat is protection forest and proposed wildlife reserve; some original forest left, but much of the area was logged in the past; some illegal logging and shifting agriculture at present</p> <p>Farmer preference may not include irrigation</p> <p>Possibility of water extraction from Tondano River (combination of pumping and canals), but competing water uses at present</p> <p>Industrial area (KABIMA) also competes for water</p> <p>Water demand and requirements in this area unclear</p>	<p><u>Pre-construction</u></p> <p>Consultation program to determine optimal plan for irrigation in the area and compatibility with other water demands (Tondano and KABIMA) &gt; precondition for implementation of an irrigation scheme at Dimembe (+3)</p> <p>Survey of area; selection of off-take location, pumping site, and canal routes &gt; limited land acquisition for scheme construction &gt; limited relocation of families &gt; social disruption (-1)</p> <p>Mobilization &gt; influx of workers &gt; some social disruption (-1); increased local business (+1)</p> <p>Land clearing &gt; sedimentation &gt; temporary turbidity in watercourses &gt; freshwater fish stressed (-1)</p> <p>Land clearing and access road &gt; temporary loss of agricultural production (-1); noise (-1); dust (-1); road damage (-1)</p> <p><u>Construction</u></p> <p>River diversion and off-take construction &gt; temporary altered hydrology of river &gt; sedimentation in river &gt; freshwater fish stresses (-1)</p> <p>Land clearing, canal construction, and sawah preparation &gt; reduced natural habitat (-1); reduction of farm production (-1); opportunity for local labor (+2)</p> <p><u>Operation</u></p> <p>Operation of diversion and pumping &gt; reduction of Tondano River discharge, conflict with other water uses (-2); further obstruction of fish passage (especially eels); but there may already be many fish pass obstructions (-1)</p> <p>Increase in fertilizer and pesticide application around Klabat &gt; reduced quality of surface water and groundwater in drainage to the north coast (-2)</p> <p>Effect of residual pesticides &gt; mortality of non-target species (spiders, small reptiles, birds, amphibians, fish) (-2)</p> <p>Sawah drainage &gt; reduced quality of coastal mangroves (-1); sediment and nutrient damage to coral reefs (-2)</p> <p>Increased palawija and sawah production &gt; increased nutrition, commerce, and health in the area (+3)</p> <p>Increased access to water (+3)</p>	<p>Public consultation required to determine farmer's interest in sawah, or mixed tree crops, vegetables</p> <p>Dust can be reduced with water spraying of dirt roads</p> <p>Use of sediment fences and small check dams near rivers during construction; drainage channels along roads; culverts under roads; dry season construction as much as possible, to reduce sedimentation in river during construction</p> <p>Terracing of sawah and dryland crops on slope areas and re-greening cleared land to reduce soil loss later</p> <p>For water quality, proper design and location of public latrines; avoid habitation along irrigation canals; proper application and use of fertilizers and pesticides; no garbage disposal in canals or river; locate new wells away from sawah and latrines</p> <p>Coconut plantation along existing roads should be maintained; coconut trees in new sawah area should be maintained where feasible</p> <p>Requirement for a fish pass at the off-take site need to be determined</p> <p>Training and extension on sawah technology, appropriate fertilizer and pesticide use</p> <p>Access to land and credit for inputs; proper maintenance of irrigation system; development of effective P3A</p> <p>Fair compensation for land and trees lost to the irrigation scheme</p> <p>Construction job opportunities available on a preferential basis to local people</p>

**Table K.3.6 Environmental Evaluation for Tondano and Nimanga Flood Control Plan**

Environmental/Social Sensitivities in Watershed Affected by Initiative	Interaction of Initiative and Social Conditions: Degree of Impact	Mitigation Measures
<p>Lake Tondano (at the outlet and in the irrigated areas at the north and south ends of the lake) is subject to flooding; due in part to PLN regulation of lake levels to maximize hydropower outputs</p> <p>Further studies are required to optimize lake operation that deal with flooding and allow sufficient head for power generation; an Integrated Lake Tondano Management Plan is required; specific flood control measures are yet to be specified (however, some outlet normalization is currently underway)</p> <p>The Nimanga River is also subject to flooding and normalization has been proposed in some sections of the river</p>	<p>Tondano flood control cannot be assessed until specific measures are defined</p> <p>Nimanga River flood control is expected to include normalization; this is assessed below</p> <p><u>Pre-construction</u></p> <p>Detailed survey of dyke, gabion, or normalization site</p> <p>Land acquisition &gt; relocation of families &gt; social disruption (-1)</p> <p>Mobilization &gt; influx of workers &gt; increase in local business (+1)</p> <p>Land clearing &gt; minimal disturbance of farmland and natural habitats (-1)</p> <p>Base-camp setup/operation, sand/quarry operation, access road to riverbank &gt; movement of trucks and heavy equipment &gt; noise (-1); dust (-1); road damage (-1)</p> <p><u>Construction</u></p> <p>Dredging, excavation and construction &gt; temporary disturbance of riverbed and flow &gt; increased turbidity in river (-1) &gt; possible stress on fish population (-1) &gt; interference with movement of boats (-1)</p> <p>Re-greening of construction areas (+1)</p> <p><u>Operation and maintenance</u></p> <p>Altered hydrology and discharge capacity in normalized river &gt; optimized to reduce bank erosion and flooding (+3) &gt; possibility of temporary scour upstream and sedimentation downstream with altered hydrology, until riverbed stabilize (-1)</p> <p>Ongoing maintenance of dykes, gabions, and revetments &gt; minimal local disruption (-1)</p>	<p>Public consultation and land compensation</p> <p>Site and roadway watering to control dust</p> <p>Silt curtains and dry season construction to reduce erosion/sedimentation during construction</p> <p>Environmental management manual for workers</p> <p>Maintain boat access through construction area</p> <p>Monitor sediment transport in river and riverbank condition; address erosion and sedimentation problems as they occur</p> <p>Local community should be involved in maintaining the local river engineering works</p>

**Table K.3.7 Initial Environmental Examination - Scoping Check List-1(1/3)**

Issues	Judgement			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/Extension of agroforestry	Introduction/Extension of erosion control farming practices
<b>1. Social Issues</b>				
Scheduled relocation	D	D	D	D
Unwilling relocation	D	D	D	D
Alteration of the right on land tenure, & residence	D	D	D	D
Change of life style	D	B/C	C	C
Conflict between population	C	A	C	C
Effect on indigenous people, minority, & nomads	D	D	D	D
Reform of traditional institution, & custom	C	D	B	C
Obstruction on fishing right, water right, local regulations	C	D	D	D
Alteration of social structure by organization, etc.	C	C	C	C
Radical change of social structure, & population increase	D	D	D	D
Lost opportunity on production, such as loss of land	D	C	C	D
Transfer, conversion of foundation of economic activity, or unemployment	D	C	C	D
Enlarging income gap	D	C	C	C
Impact on existing transportation	D	D	D	D
Impact on schools & hospitals	D	D	D	D
Cutting off the local society by roads	D	D	D	D
People's perception	C	C	A	A
<b>2. Health &amp; Hygiene</b>				
Occurrence of local diseases	D	D	D	D
Spread of malaria/ filaria epidemic	D	D	D	D
Increase of pesticide consumption	D	D	D	D
Accumulation of remained toxic matter	D	D	D	D
Increase of waste and excrement	D	D	D	D
Garbage & trash dump, falling standards of hygiene	D	D	D	D
Spread of vermin	D	D	D	D

**Table K.3.7 Initial Environmental Examination - Scoping Check List-1(2/3)**

(continued)

Issues	Judgement			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/Extension of agroforestry	Introduction/Extension of erosion control farming practices
<b>2. Health &amp; Hygiene (continued)</b>				
Dump of construction waste, excavated soil, sludge, trash, etc.	D	D	D	D
<b>3. Historical remains, Cultural legacy, superb panorama, etc.</b>				
Destruction or damage of historical remains and cultural legacy	D	D	D	D
Loss of precious scenery	D	C	D	D
Effects on underground resources	D	C	D	D
Change of ground features by construction of the structures	D	D	D	D
Disturbance of harmonic scenery by construction of the structures	D	D	D	D
<b>4. Area of precious fauna and flora, and eco-system</b>				
Alteration of vegetation	A	D	B	D
Invasion and propagation of harmful fauna and flora	C	B	B	B
Extermination or decrease of precious or specific fauna and flora	A	B	B	D
Disappeared wetland or peat bog	D	D	D	C
Loss of bio-diversity	B	B	B	D
Loss of rain forest/ wild lands	A	C	B	D
<b>5. Soils and Lands</b>				
Land devastation (incl. Desertification)	D	D	D	D
Loss of soil fertility	D	D	D	D
Soil pollution by discharge or diffusion of toxic waste water	D	D	D	D
Soil loss	D	D	D	D
Loss of top-soil after forest cutting	D	D	D	D
Loss of top-soil after land consolidation	D	D	D	D
Modified important ground feature and loss of important geology by cut and bank	D	D	D	D

**Table K.3.7 Initial Environmental Examination - Scoping Check List-1 (3/3)**

(continued)

Issues	Judgement			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/Extension of agroforestry	Introduction/Extension of erosion control farming practices
<b>6. Hydrology &amp; Water quality</b>				
Change of flow/water surface	D	B	B	B
Occurrence of inundation and floods	D	D	D	D
Change of groundwater flow and groundwater table	D	B	B	C
Pollution or deterioration of water quality	D	D	D	D
Turbid water by soil erosion / reduced discharge	D	D	D	D
Exhausted groundwater by excess extraction or lowered recharge	D	D	D	D
Seeped toxic water of buried materials	D	D	D	D
Eutrophication	D	D	D	D
Water temperature change	D	D	D	D
<b>7. Lake and River</b>				
Sedimentation in lake	D	C	C	C
Sedimentation in rivers	D	C	C	C
Riverbed degradation	D	C	C	C
<b>8. Others</b>				
Increased opportunity of slope failure, accidents	D	D	D	D
Pollution by exhaust or toxic gas of vehicles and plants	D	D	D	D
Noise and vibration caused traffic, pumps, etc.	D	D	D	D
Change of temperature and wind by large scale development	D	D	D	D

*Judgement scores*

*A : Serious impact anticipated, need careful assessment in the site,*

*B : Anticipated impact*

*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*

*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.8 Initial Environmental Examination - Scoping Check List-2 (1/3)**

Issues	Judgement			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
<b>1. Social Issues</b>				
Scheduled relocation	D	A	C	D
Unwilling relocation	D	A	C	D
Alteration of the right on land tenure, & residence	D	A	D	C
Change of life style	D	A	D	C
Conflict between population	D	A	A	C
Effect on indigenous people, minority, & nomads	D	C	D	D
Reform of traditional institution, & custom	D	B	C	D
Obstruction on fishing right, water right, local regulations	D	C	A	D
Alteration of social structure by organization, etc.	D	C	C	D
Radical change of social structure, & population increase	D	D	D	D
Lost opportunity on production, such as loss of land	C	A	C	C
Transfer, conversion of foundation of economic activity, or unemployment	D	C	D	C
Enlarging income gap	D	C	D	D
Impact on existing transportation	D	D	D	C
Impact on schools & hospitals	D	C	D	D
Cutting off the local society by roads	D	D	D	D
People's perception	C	C	C	C
<b>2. Health &amp; Hygiene</b>				
Occurrence of local diseases	C	C	D	D
Spread of malaria/ filaria epidemic	C	D	D	D
Increase of pesticide consumption	C	D	D	D
Accumulation of remained toxic matter	D	D	D	D
Increase of waste and excrement	D	D	D	D
Garbage & trash dump, falling standards of hygiene	D	D	D	D
Spread of vermin	C	D	D	D



**Table K.3.8 Initial Environmental Examination - Scoping Check List-2 (2/3)**

(continued)

Issues	Judgement			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
<b>2. Health &amp; Hygiene (continued)</b>				
Dump of construction waste, excavated soil, sludge, trash, etc.	C	C	D	C
<b>3. Historical remains, Cultural legacy, superb panorama, etc.</b>				
Destruction or damage of historical remains and cultural legacy	C	C	D	C
Loss of precious scenery	C	C	D	C
Effects on underground resources	C	C	D	C
Change of ground features by construction of the structures	C	C	D	C
Disturbance of harmonic scenery by construction of the structures	C	C	D	C
<b>4. Area of precious fauna and flora, and eco-system</b>				
Alteration of vegetation	D	D	D	D
Invasion and propagation of harmful fauna and flora	C	C	D	D
Extermination or decrease of precious or specific fauna and flora	D	D	D	D
Disappeared wetland or peat bog	D	D	D	D
Loss of bio-diversity	D	D	D	D
Loss of rain forest/ wild lands	D	D	D	D
<b>5. Soils and Lands</b>				
Land devastation (incl. Desertification)	D	D	D	D
Loss of soil fertility	D	D	D	D
Soil pollution by discharge or diffusion of toxic waste water	D	D	D	D
Soil loss	D	D	D	D
Loss of top-soil after forest cutting	D	D	D	D
Loss of top-soil after land consolidation	D	D	D	D
Modified important ground feature and loss of important geology by cut and bank	D	D	D	C

**Table K.3.8 Initial Environmental Examination - Scoping Check List-2 11(3/3)**

(continued)

Issues	Judgement			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
<b>6. Hydrology &amp; Water quality</b>				
Change of flow/water surface	C	A	D	B
Occurrence of inundation and floods	D	D	D	D
Change of groundwater flow and groundwater table	D	D	A	D
Pollution or deterioration of water quality	D	D	D	A
Turbid water by soil erosion / reduced discharge	D	D	D	A
Exhausted groundwater by excess extraction or lowered recharge	D	D	D	D
Seeped toxic water of buried materials	D	D	D	D
Eutrophication	D	D	B	D
Water temperature change	D	C	D	D
<b>7. Lake and River</b>				
Sedimentation in lake	A	A	D	A
Sedimentation in rivers	A	A	D	A
Riverbed degradation	D	D	D	C
<b>8. Others</b>				
Increased opportunity of slope failure, accidents	D	D	D	D
Pollution by exhaust or toxic gas of vehicles and plants	D	D	D	D
Noise and vibration caused traffic, pumps, etc.	D	D	D	D
Change of temperature and wind by large scale development	D	D	D	D

Judgement scores    *A : Serious impact anticipated, need careful assessment in the site,*  
                               *B : Anticipated impact*  
                               *C : Unknown (necessary to assess, detail could be clarified in a further assessment),*  
                               *D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.9 Infiltration Rate in the Intensive Area**

South		East		West	
Location	Infiltration Rate (cm.hr)	Location	Infiltration Rate (cm.hr)	Location	Infiltration Rate (cm.hr)
Tonsewer	23.62	Kakas	16.02	Tataaran	19.38
Tumaratas I	48.00	Tumpaang Kaweng	103.44	Parepei	22.68
Tumaratas II	27.60	Eris	79.44	Leleko	6.42
Tumaratas III	53.28	Tandengan	18.36	Tampusu	2.45
Raringis	84.51	Touliang Oki	21.66	Paleloan	37.50
Noongan	99.17	Makalonsouw	14.35	Pulutan	37.74
Kaayuran Atas	37.85			Kasuratan	10.70

**Table K.3.10 Physical Quality of Ground Water in Intensive Area**

No	Physical Parameter	Intensive Area		
		East	South	West
1	Range of Ground Water Surface (m)	2.00-12.70	3.10-22.50	2.10-6.60
	Average	5.77	9.48	4.11
2	Depth of Well Water (m)	1.60-4.08	1.70-7.40	1.56-5.55
	Average	2.67	3.79	3.45
3	Smell of Well Water for cooking and drinking	Odorless	Odorless	Odorless
4	Taste of Well Water for cooking and drinking	Tasteless	Tasteless	Tasteless
5	Smell of Well Water for was	Smelly	Smelly	Smelly
6	Taste of Well Water for washing	Tasty	Tasty	Tasty
7	Water color for washing	Turbid	Turbid	Turbid
8	Color of Well Water(Pt-Cu)	0-37	0-5	0-58
	Average	13	0.32	14.7
9	Temperature of Well Water(C)	23.1-25.3	23.1-28.1	23.0-26.7
	Average	24.58	24.75	24.88
10	Conductivity (mhos)	64.6-526.0	137.3-553.0	152.2-690.0
	Average	291.78	269.66	313.86
11	Turbidity(NTU)	1.0-20.7	0.7-2.7	2.2-33.8
	Average	7.17	1.25	10.71
12	Suspended Solid (mg/l)	1-34	1-5	2-38
	Average	9.32	2.37	11.6

**Table K.3.11 Chemical Quality of Ground Water in Intensive Area**

No	Chemical Parameters	Intensive Area		
		East	South	West
1	Water pH	5.03-6.77	5.83-7.32	5.51-7.07
	Average	6.12	6.34	6.35
2	N-Total (mg/l)	0.028-0.434	0.012-0.43	0.048-0.477
	Average	0.176	0.263	0.214
3	Salinity(%)	0.0-0.3	0.1-0.3	0.1-0.3-
	Average	0.16	0.13	0.15
4	Dissolved Oxygen (mg/l)	3.00-5.33	3.03-6.32	2.00-5.24
	Average	4.28	4.91	3.66
5	BOD(mg/l)	0.56-1.21	0.48-1.24	0.58-1.46
	Average	0.88	0.86	0.93
6	COD	1.15-1.43	0.92-1.46	0.77-2.31
	Average	1.22	1.23	1.37

**Table K.3.12 Major Species of Plant Community Structure in Kaluta Forest**

No	Species	Seedling	Sapling	Pole	Tree
1	<i>Carsanum vulgare</i>				10.20
2	<i>Cadsura</i> sp				13.13
3	<i>Gasuarina .selebica</i>				10.41
4	<i>Diospyros</i> sp		13.38		
5	<i>Eleocarpus</i> sp				39.66
6	<i>Eugenia</i> sp			16.30	
7	<i>Ficus microkarpa</i> sp				13.53
8	<i>Ficus selebensis</i>				74.14
9	<i>Ficus.septica</i>		10.88		
10	<i>Fzcus</i> sp2			14.96	
11	<i>Gutiferse</i>			25.47	
12	<i>Leea rubra</i>			14.99	
13	<i>Macarangagtantea</i>			34.59	22.56
14	<i>Mwzgtfera</i> sp				15.74
15	<i>Roma</i> sp		10.88		
16	<i>Pharasananthes mznahasae</i>	10.87			
17	<i>Piper aduncun</i>			26.64	
18	<i>Sarcocephallus cadamba</i>		13.38	23.54	10.61
19	<i>Saurauia pendula</i>			18.14	
20	<i>Terrninalia bellirica</i>				16.34

Note: table shown species of Importance Value Index (IV) larger than 10.

**Table K.3.13 Major Species of Plant Community Structure in Kasuratan Forest**

No	Species	Seedling	Sapling	Pole	Tree
1	<i>Actinodaphne</i> sp			33.47	21.90
2	<i>Alstonia</i> sp			10.47	
3	<i>Aralia</i> sp			20.99	
4	<i>Areca vestiaria</i>		15.11		
5	<i>Arenga pinnata</i>				16.76
6	<i>Calophyllum</i> sp				12.76
7	<i>Canarium</i> sp			12.74	13.40
8	<i>Caryota</i> sp			18.07	
9	<i>Dendrochne</i> sp			13.12	
10	<i>Dillenia celebica</i>			20.64	
11	<i>Elatostema</i> sp	39.58			
12	<i>Ficus celebensis</i>				11.22
13	<i>Ficus microcarpa</i>				44.19
14	<i>Macaranga</i> sp			12.39	
15	<i>Manglietia glauca</i>			22.17	
16	<i>Mynstzca fatua</i>				12.61
17	<i>Palacium</i> sp				10.69
18	<i>Panandus dubius</i>			12.22	
19	<i>Pigaffeta filans</i>				10.84
20	<i>Pznanga</i> sp			16.82	
21	<i>Polyalthia</i> sp			12.04	
22	<i>Polyalthia macrophylla</i>				14.66
23	<i>Radermachera</i> ?			18.40	
24	<i>Saurauia cauhi</i>			12.77	
25	<i>Compositae</i>	22.02			

Note: table shown species of Importance Value Index (IV) larger than 10.

**Table K.3.14 Major Species of Plant Community Structure in Tampusu Forest**

No	Species	Seedling	Sapling	Pole	Tree
1	<i>Amomum coccinaum</i>		36.35		
2	<i>Aralia</i> sp				11.30
3	<i>Areca vestiaria</i>			16.95	
4	<i>Canarium</i> sp				19.83
5	<i>Cyathea</i> sp			12.45	
6	<i>Elatostema</i> sp	26.70			
7	<i>Elmerilia ovalis</i>				10.73
8	<i>Lauraceae l</i>		12.82		
9	<i>Magnolia paulantha</i>		11.60		
10	<i>Makopi</i>				18.13
11	<i>Manglietia glauca</i>			18.27	
12	<i>Nauclea</i> sp				12.85
13	<i>Nephrolepis</i> sp	10.49			
14	<i>Ochrosia salubris</i>				10.60
15	<i>Panandus dubius</i>		27.36	29.94	11.50
16	<i>Pinanga (hitam)</i>			107.59	
17	<i>Pouzolzia</i> sp			11.65	17.00
18	<i>Sarcocephalus cadamba</i>				17.12
19	<i>Compositae</i>	37.62			
20	<i>Talauma celebica</i>			11.60	
21	<i>Terminalia</i> sp				61.58

Note: table shown species of Importance Value Index (IV) larger than 10.

**Table K.3.15 Major Species of Plant Community Structure in Manimporok Forest**

No	Species	Seedling	Sapling	Pole	Tree
1	<i>Areca vestiana</i>	22.32	13.47		
2	Danoan		10.76	55.05	
3	<i>Diospyros</i> sp			14.16	14.09
4	<i>Elatostema</i> sp	31.20			
5	<i>Eugenia</i> sp 1			16.93	
6	<i>Eugenia</i> sp 2				14.25
7	<i>Ficus microcarpa</i>				13.60
8	<i>Ficus</i> sp. (daong gaga)			11.31	
9	<i>Lithocarpus</i> sp			18.80	
10	<i>Mallotus</i> sp				11.86
11	Malvaceae (fruit berbulu)			10.95	
12	Malvaceae (kulit ba serat/merak)				20.53
13	<i>Manglzetia glauca</i>			12.67	27.20
14	<i>Neohitsea</i> sp			21.52	
15	Paku (dairn bawah kecil)	29.37			
16	<i>Pigaffetafilans</i>			13.04	19.38
17	<i>Pznanga</i> sp			25.34	
18	<i>Polyclthia</i> sp. (seandg)				71.13
19	<i>Pouzolza</i> sp			14.14	
20	Sama deng in Sanger (fruit merah)				14.02
21	<i>Saurauia</i>		10.76		
22	<i>Sterculia</i> sp			11.63	

Note: table shown species of Importance Value Index (IV) larger than 10.

**Table K.3.16 Major Species of Bird Community Structure in the Study Sites**

No	Species	Kalula	Tampusu	Kasuratan	Manimporok
1	<i>Cocoinantis mendinus</i>			12.57	14.65
2	<i>Culicicapa helianthea</i>			14.61	
3	<i>Cyomis nifigastm</i>		23.33		34.43
4	<u><i>Dicaeum aureolimbatuin</i></u>		12.86	14.61	
5	<u><i>Dicaeum celebicwn</i></u>	10.83		17.84	
6	<i>Ducada aenea</i>	19.13	11.43		
7	<u><i>Ducula forsteni</i></u>	10.83			
8	<u><i>Macropigaya amboinensis</i></u>	29.91		10.53	
9	<u><i>Myzomela sanguinolonta</i></u>				12.45
10	<u><i>Pachicepala ndfurifenter</i></u>			10.53	
11	<i>Ptilinopusmelanoqila</i>	35.63			29.67
12	<i>Ptilinopus superbus</i>			10.53	
13	<u><i>Trichastoma celebense</i></u>	16.55	26.19	17.84	
15	<i>Zosterops atrifrons</i>		23.81	30.09	32.60
16	<i>Zosterops mont anus</i>				17.58

Note: Underlined = Threatened Species

Note: table shown species of Importance Value Index (IV) larger than 10.

**Table K.3.17 Species Diversity of Fauna in Intensive Area**

Index	Kaluta	Tampusu	Kasuratan	Manlmporok
<b>Richness</b>				
No of Species (S)	21	23	19	14
No. of Individuals (NO)	79	70	49	39
Margalef Index(RI)	4.58	5.18	4.63	3.55
<b>Diversity</b>				
Simpson Index ( $\lambda$ )	0.08	0.06	0.07	0.10
Shannon Index (H')	2.72	2.91	2.60	2.63
Hill II Index (N2)	12.08	15.68	15.08	9.86
<b>Evenness</b>				
Pielou Index (EI)	0.89	0.93	0.88	1.00
Peet Index (E4)	0.79	0.86	1.12	0.71
Hill Ratio Modification (E5)	0.78	0.85	1.13	0.68

**Table K.3.18 Area and Locality of Protection Forest in Intensive Area**

No	Protection Forest	Area (ha)	Locality	Regulation
1	Mt. Mahawu	550	West of Tondano Lake	GB. No. 17; July 15, 1933
2	Mt. Masarang	207.23	West of Tondano Lake	Decision of Forestry Minister No.250/Kpts-IIIUM/1 984, Dated on February 20, 1984
3	Mt. Tampusu	309	West of Tondano Lake	GB.No. 17; July 15, 1933
4	Mt. Lengkoan	351	West of Tondano Lake	GB. No. 3; Nov 22, 1932
5	Mt. Lembean	2,700	East of Tondano Lake	GB. No. 3; January 5, 1932
6	Mt. Kaweng	417.86	East of Tondano Lake	Decision of Forestry Minister No.250/Kpts-II/UM/1984, Dated on February 20, 1984
7	Mt. Kaluta		East of Tondano Lake	Overlayered Map, 23 October 1996
8	Mt. Kawatak		South of Tondano Lake	GB. No. 3 July 5, 1930
9	Mt. Soputan		South of Tondano Lake	GB. No. 8; Jul 5, 1930
10	Mt. Maniniporok		South of Tondano Lake	Overlayered Ma 23 October 1996

**Table K.3.19 Species Diversity of Plants in Intensive Area**

Index	Kaluta	Tampusu	Kasuratan	Manlmporok
<b>Richness</b>				
No of Species (S)				
Seedling	30	60	60	62
Sapling	26	38	55	40
Pole	27	22	22	25
Tree	21	28	38	22
No. of Individuals (NO)				
Seedling	78	612	539	522
Sapling	80	183	178	74
Pole	93	64	40	54
Tree	73	48	84	35
Margalef Index(RI)				
Seedling	6.66	9.19	9.38	9.75
Sapling	5.71	7.10	10.42	9.06
Pole	5.74	5.05	5.69	6.02
Tree	4.66	6.97	8.35	5.91
<b>Diversity</b>				
Simpson Index ( $\lambda$ )				
Seedling	0.05	0.66	0.06	0.06
Sapling	0.04	0.07	0.02	0.03
Pole	0.05	0.15	0.05	0.07
Tree	0.10	0.07	0.05	0.09
Shannon Index (H')				
Seedling	3.19	3.39	3.48	3.39
Sapling	3.21	3.15	3.77	3.56
Pole	3.08	2.50	2.99	2.95
Tree	2.68	2.99	3.34	2.78
Hill II Index (N2)				
Seedling	21.75	15.90	16.91	15.98
Sapling	26.52	15.00	42.26	36.42
Pole	18.93	6.50	19.13	14.90
Tree	9.98	14.43	21.37	11.33
<b>Evenness</b>				
Pielou Index (EI)				
Seedling	0.94	0.83	0.85	0.82
Sapling	0.98	0.86	0.94	0.97
Pole	0.93	0.81	0.97	0.92
Tree	0.88	0.90	0.92	0.90
Peet Index (E4)				
Seedling	0.89	0.53	0.52	0.54
Sapling	1.07	0.65	0.97	1.03
Pole	0.87	0.53	0.96	0.78
Tree	0.69	0.72	0.76	0.70
Hill Ratio Modification (E5)				
Seedling	0.89	0.52	0.50	0.52
Sapling	1.08	0.63	0.97	1.03
Pole	0.86	0.49	0.96	0.76
Tree	0.66	0.71	0.75	0.68



**Table K.3.20 Locality, Species of Commercial Importance, Dangerous Species and Threatened Status of Plants in Intensive Area (1/7)**

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	<i>Acalypha</i> sp				+	Fire wood			
2	<i>Actinodaphne</i> sp 2			+		Fire wood			
3	<i>Actinodaphne</i> sp 1		+	+		Fire wood			
4	<i>Actinodaphne</i> sp 3			+		Fire wood			
5	<i>Ainnucleafagifolia</i>		+			Commercial wood			
6	<i>Ailanthus integrifolia</i>		+	+	+	Commercial wood			R
7	<i>Alocasia</i> sp		+						
8	<i>Alseodaphne</i> sp		+			Fire wood			
9	<i>Alstonia scholans</i>	+				Commercial wood and medicinal plants			
10	<i>Alstonia</i> sp			+		Fire wood			
11	<i>Amomum coccineum</i>		+	+	+				
12	<i>Anacardiacaceae</i>		+			Fire wood			
13	<i>Angiopteris avecta</i>		+						
14	<i>Anonaceae (liana)</i>		+		+				
15	<i>Araceae</i>				+				
16	<i>Arinsia</i> sp		+						
17	<i>Areca vestiaria</i>		+	+	+	Ornamental plant			R
18	<i>Arengapinnata</i>			+	+	Multi-useful plant			
19	<i>Arenga undulatifolia</i>		+						
20	<i>Artrofilum diversifolium</i>	+							
21	<i>Asplenium nidus</i>		+		+				
22	<i>Asplenium</i> sp				+				
23	<i>Astronia</i> sp	+			+	Fire wood			
24	<i>Axonopus</i> sp		+	+					
25	<i>Baccaurea brachyateata</i>	+				Fire wood			
26	<i>Baccaurea</i> sp 1	+	+	+		Fire wood			
27	<i>Baccaurea</i> sp 2	+				Fire wood			
28	<i>Baccaurea</i> sp 3			+		Fire wood			
29	<i>Bambusa</i> sp			+		Fire wood			
30	<i>Barringtonia</i> sp 1			+		Fire wood			
31	<i>Barringtonia</i> sp 2			+		Fire wood			
32	<i>Begonia</i> sp		+			Ornamental plant			
33	<i>Bhischoffia javanica</i>	+				Ornamental plant			
34	<i>Bignoniaceae</i>		+			Fire wood			
35	<i>Blumea</i> sp		+	+					
36	<i>Borreria</i> sp			+					
37	<i>Cadusira</i> sp	+							
38	<i>Calamus</i> sp 2		+	+	+	Industrial materials			
39	<i>Calamus</i> sp 2		+		+	Industrial materials			
40	<i>Calamus zollingeri</i>	+				Industrial materials			R
41	<i>Calathea</i> sp		+			Ornamental plant			
42	<i>Calophyllum</i> sp 1	+	+	+		Ornamental plant			
43	<i>Calophyllum soulattii</i>	+			+	Ornamental plant			

Note: Kal = Kaluta forest, Tam = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,  
1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (2/7)

(Continued)

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
44	<i>Calophyllum</i> sp 2		+			Ornamental plant			
45	<i>Calopogonium</i> sp		+						
46	<i>Cananum hirsutum</i>		+	+		Commercial wood			
47	<i>Canarium</i> sp 1		+	+		Commercial wood			
48	<i>Canarium</i> sp 3			+	+	Commercial wood			
49	<i>Canarium</i> sp 4				+	Commercial wood			
50	<i>Canarium</i> sp 5		+			Commercial wood			
51	<i>Canarium</i> sp 2	+				Commercial wood			R
52	<i>Cananum vulgare</i>	+		+		Commercial wood			
53	<i>Cappans micracantha</i>	+							
54	<i>Carex</i> sp		+						
55	<i>Caryota mitis</i>	+		+		Ornamental plant		Pr	
56	<i>Garyota urens</i>				+	Ornamental plant		Pr	
57	<i>Casuanna selebica</i>	+				Commercial wood/ Ornamental wood			R
58	<i>Chisocheton warburgii</i>		+	+	+	Fire wood			R
59	<i>Cinamomum culilawan</i>				+	Medicinal plant			
60	<i>Compositae</i>		+	+	+				
61	<i>Corina</i> sp		+		+	Fire wood			
62	<i>Cratoxylum</i> sp				+	Fire wood			
63	<i>Cucurbitaceae</i>			+					
64	<i>Cyathea contaminans</i>				+				
65	<i>Cyathea</i> sp		+	+					
66	<i>Cypenus</i> sp			+					
67	<i>Dendrochne</i> sp			+	+				
68	<i>Desmoinum</i> sp			+	+				
69	<i>Dillenia celebica</i>	+		+		Fire wood			R
70	<i>Diinochloa</i> sp		+	+	+	Fire wood			
71	<i>Dioscorea sagitata</i>		+						
72	<i>Dioscorea</i> sp 1		+	+					
73	<i>Dioscorea</i> sp 2			+					
74	<i>Diospyros</i> sp 1			+		Fire wood			
75	<i>Diospyros</i> sp 2		+			Fire wood			
76	<i>Diospyros</i> sp 3	+			+	Fire wood			
77	<i>Diospyros</i> sp 4				+	Fire wood			
78	<i>Diospyros</i> sp 5				+	Fire wood			
79	<i>Inplazium</i> sp		+	+		Vegetables			
80	<i>Dracaena</i> sp			+		Ornamental plant			
81	<i>Dracontomelon dao</i>			+		Commercial wood			
82	<i>Elatostepna repens</i>		+	+	+				
83	<i>Eleocarpus</i> sp	+							
84	<i>Elmenilia ovalis</i>	+	+	+		Commercial wood			
85	<i>Erythrina</i> sp				+	Commercial wood			
86	<i>Eugenia</i> sp 3				+	Fire wood			

Note: Kal = Kaluta forest, Tam = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (3/7)

(Continued)

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
87	<i>Eugenia</i> sp 1				+	Fire wood			
88	<i>Eugenia</i> sp 2				+	Fire wood			
89	<i>Eugenia</i> sp 5			++	+	Fire wood			
90	<i>Eugenia</i> sp 6				+	Fire wood			
91	<i>Eugenia</i> sp 7				+	Fire wood			
92	<i>Eugenia</i> sp 8				+	Fire wood			
93	<i>Eugenia</i> sp 4				+	Fire wood			
94	<i>Euoina</i> sp 1			+		Fire wood			
95	<i>Euoina</i> sp 1		+	+	+				
96	<i>Ficus</i> sp 5	+							
97	<i>Ficus</i> 10			+	+				
98	<i>Ficus benyamina</i>	+				Ornamental plant			
99	<i>Ficus celebensis</i>	+	+	+		Ornamental plant			
100	<i>Ficus deltoidea</i>	+	+						
101	<i>Ficus microcarpa</i>	+		+	+				
102	<i>Ficus obliqua</i>	+		+					
103	<i>Ficus spetica</i>	+							
104	<i>Ficus</i> sp 1	+	+						
105	<i>Ficus</i> sp 11			+					
106	<i>Ficus</i> sp 12		+						
107	<i>Ficus</i> sp 13				+				
108	<i>Ficus</i> sp 14				+				
109	<i>Ficus</i> sp 15				+				
110	<i>Ficus</i> sp 16				+				
111	<i>Ficus</i> sp 17				+				
112	<i>Ficus</i> sp 18				+				
113	<i>Ficus</i> sp 2	+							
114	<i>Ficus</i> sp 3	+							
115	<i>Ficus</i> sp 4			+					
116	<i>Ficus</i> sp 6		+						
117	<i>Ficus</i> sp 7			+					
118	<i>Ficus</i> sp 8			+					
119	<i>Ficus</i> sp 9		+						
120	<i>Flagellaria indica</i>				+	Ornamental plant			
121	<i>Freycitenia insignis</i>		+	+					
122	<i>Garctinia dulcis</i>	+							
123	<i>Garctinia macrophylla</i>			+		Commercial wood			
124	<i>Garctinia</i> sp		+		+				
125	<i>Garctinia tetandra</i>	+	+	+					
126	<i>Geophylla</i> sp			+					
127	<i>Gesneriaceae</i>			+					
128	<i>Gigantochloa</i> sp		+	+					
129	<i>Grewia tiliifolia</i>	+		+					
130	<i>Guttiferae</i>	+							
131	<i>Gyronniera .sp</i>	+							
132	<i>Homalium celebicum</i>	+				Commercial wood			R

Note: Kal = Kaluta forest, Tarn = Tarnpusu forest, Kas = Kasuratan forest, Man = Manimporok forest,

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (4/7)

Continued)

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
133	<i>Homalium</i> sp		+	+		Commercial wood			
134	<i>Hydnophytum formicarum</i>			+				Pr	
135	<i>Ilex</i> sp			+					
136	<i>Ipomea triloba</i>		+						
137	<i>Kibara corriacea</i>		+	+	+				LR/lc
138	<i>Knema</i> sp				+	Commercial wood			
139	<i>Lantana camara</i>			+		Medicinal plant			
140	<i>Lauraceae 1</i>		+		+				
141	<i>Lauraceae 1</i>		+						
142	<i>Lauraceae 1</i>				+				
143	<i>Leea ininca</i>				+				
144	<i>Leea rubra</i>	+	+	+	+				
145	<i>Leguminoceae</i>				+				
146	<i>Lindsaea</i> sp				+				
147	<i>Lithocarpus celebicus</i>	+				Commercial wood			R
148	<i>Lithocarpus</i> sp		+	+	+	Commercial wood			
149	<i>Litsea</i> sp	+							
150	<i>Lyndzaea</i> sp		+						
151	<i>Macaranga gigantea</i>	+				Commercial wood			
152	<i>Macaranga</i> sp		+	+					
153	<i>Magnolia paulantha</i>		+			Commercial wood			R
154	<i>Mallotus</i> sp	+		+	+	Commercial wood			
155	<i>Malvaceae 1</i>				+				
156	<i>Malvaceae 2</i>				+				
157	<i>Malvaceae 3</i>	+			+				
158	<i>Mangifera minor</i>	+				Commercial wood			
159	<i>Mangifera</i> sp	+							
160	<i>Manglietia glauca</i>	+	+	+	+				R
161	<i>Marantha edulis</i>		+	+		Vegetables			
162	<i>Meliaceae 1</i>				+				
163	<i>Meliaceae 2</i>				+				
164	<i>Muranina</i> sp		+	+					
165	<i>Musa sapientum</i>	+			+				
166	<i>Myristica fatua</i>			+		Commercial wood			LR/lc
167	<i>Nauclea 1</i>		+	+					
168	<i>Nauclea 2</i>			+					
169	<i>Nauclea</i> sp				+				
170	<i>Neolitsea</i> sp				+				
171	<i>Neonauclea</i> sp				+				
172	<i>Nephelium</i> sp				+				
173	<i>Nephrolepis biserata</i>		+			Ornamental plant			
174	<i>Nephrolepis</i> sp		+	+	+				
175	<i>Ochrosia salubris</i>		+	+					
176	<i>Oplismenus</i> sp		+	+	+	Ornamental plant			
177	<i>Palaquium</i> sp 2	+				Commercial wood			

Note: Kal = Kaluta forest, Tarn = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,  
 1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (5/7)

(Continued)

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
178	<i>Palaquium obovatum</i>	+		+		Commercial wood			
179	<i>Palaquium obtusifolium</i>			+	+	Commercial wood			
180	<i>Palaquium</i> sp 1			+		Commercial wood			
181	<i>Palaquium</i> sp 3				+	Commercial wood			
182	<i>Panandus dubius</i>		+	+	+				
183	<i>Panandus</i> sp	+							
184	<i>Pharaserianthes minahasae</i>	+				Commercial wood			R
185	<i>Phylodendron</i> sp		+						
186	<i>Pigaffeta flaris</i>			+	+	Ornamental plant		Pr	
187	<i>Pinanga caesia</i>	+	+	+	+	Ornamental plant			R
188	<i>Pinanga celebica</i>			+		Ornamental plant			R
189	<i>Pinanga</i> sp		+	+	+	Ornamental plant			
190	<i>Piper aduncum</i>	+		+			Dangerous		
191	<i>Piper</i> sp 2		+	+					
192	<i>Piper</i> sp 3				+				
193	<i>Piper</i> sp 4	+	+	+	+				
194	<i>Piper</i> sp 1				+				
195	<i>Polyalthia macrophylla</i>				+	Commercial wood			
196	<i>Polyalthia</i> sp 1	+							
197	<i>Polyalthia</i> sp 2		+	+	+				
198	<i>Pathos</i> sp	+				Commercial wood			
199	<i>Pouzolzia</i> sp		+						
200	<i>Pterocarpus indicus</i>	+				Commercial wood			AU Ald
201	<i>Rubiaceae</i> 1		+	+					
202	<i>Rubiaceae</i> 2		+						
203	<i>Rubiaceae</i> 3	+		+	+				
204	<i>Sapindaceae</i> 1				+				
205	<i>Sapindaceae</i> 2				+				
206	<i>Sapindaceae</i> 3	+			+				
207	<i>Sapindus</i> sp	+							
208	<i>Sarcocephallus cadamba</i>	+				Commercial wood			
209	<i>Saurauia bracteosa</i>	+	+	+	+				
210	<i>Saurauia caudiflora</i>		+	+					
211	<i>Saurauia minahasae</i>				+				R
212	<i>Saurauia pendula</i>				+				
213	<i>Sauropus</i> sp		+	+					
214	<i>Schefflera</i> sp	+			+	Ornamental plant			
215	<i>Schimattogictis</i> sp			+		Ornamental plant			
216	<i>Scindapsus</i> sp		+	+		Ornamental plant			
217	<i>Selaginella intermedia</i>			+		Ornamental plant			
218	<i>Setaria palmifolia</i>				+				
219	<i>Shorea</i> sp				+	Commercial wood			

Note: Kal = Kaluta forest, Tam = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (6/7)

(Continued)

No	Species	Kal*	Tam*	Kas*	Man*	Commercial Value	Dangerous Species	Threatened Status	
								Protected by I.G. <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
220	<i>Solanaceac</i>				+				
221	<i>Spathoglottis</i> sp				+	Ornamental plant			
222	<i>Sterculia</i> sp		+						
223	<i>Syngonium</i> sp		+	+	+	Ornamental plant			
224	<i>Talauma celebica</i>		+	+		Commercial wood			R
225	<i>Terminalia bellinca</i>		+	+	+	Commercial wood			R
226	<i>Terminalia</i> sp 1	+							
227	<i>Terminalia</i> sp 2	+		+					
228	<i>Terminalia</i> sp 3			+	+				
229	<i>Tiliaceac</i>			+					
230	<i>Trema orinentalis</i>				+	Commercial wood			
231	<i>Unknown 1</i>		+	+	+				
232	<i>Unknown 10</i>	+							
233	<i>Unknown 11</i>	+				Commercial wood			
234	<i>Unknown 12</i>		+						
235	<i>Unknown 13</i>			+	+	Ornamental plant		Pr	
236	<i>Unknown 14</i>	+	+	+	+	Ornamental plant			
237	<i>Unknown 15</i>			+		Ornamental plant			
238	<i>Unknown 16</i>		+	+	+	Ornamental plant			
239	<i>Unknown 2</i>	+		+			Dangerous		
240	<i>Unknown 3</i>		+	+					
241	<i>Unknown 4</i>				+				
242	<i>Euoina</i> sp 1				+				
243	<i>Ficus</i> sp 5			+					
244	<i>Ficus 10</i>				+				
245	<i>Ficus benyamina</i>				+				
246	<i>Ficus celebensis</i>				+				
247	<i>Ficus deltoidea</i>				+				
248	<i>Ficus microcarpa</i>		+			Ornamental plant			
249	<i>Ficus obliqua</i>			+					
250	<i>Ficus spetica</i>				+				
251	<i>Ficus</i> sp 1			+		Ornamental plant			
252	<i>Ficus</i> sp 11		+						
253	<i>Ficus</i> sp 12	+							
254	<i>Ficus</i> sp 13		+	+					

Note: Kal = Kaluta forest, Tarn = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Table K.3.20 (7/7)

(Continued)

	Commercial Value	Dangerous Species	Threatened Status	
			Pro .By Ind.Gov	IUCN Categories
Kaluta Forest	32 Species			
Kasuratan Forest	38 Species			
Manimporok Forest	59 Species			
Tampusu Forest	36 Species			
Kaluta and Kasuratan Forests	8 Species			
Kaluta and Manimporok Forests	6 Species			
Kaluta and Tampusu Forests	4 Species			
Kasuratan and Manimporok Forests	8 Species			
Tampusu and Kasuratan Forests	24 Species			
Tampusu and Manimporok Forests	9 Species			
Kaluta, Kasuratan and Manimporok Forests	3 Species			
Kaluta, Tampusu and Kasuratan Forests	5 Species			
Kaluta, Tampusu and Manimporok Forests	1 Species			
Tampusu, Kasuratan and Manimporok Forests	17 Species			
Kaluta, Tampusu, Kasuratan and Manimporok Forests	4 Species			
Fire Wood	36 Species			
Commercial woods	42 Species			
Medicinal plant	3 Species			
Ornamental plant	26 Species			
Multipurpose plant	1 Species			
Steam as media for orchids	2 Species			
Toxic plant		2 Species		
Protected Species in Manimporok forest			1 Species	
Protected Species in Kasuratan forest			1 Species	
Protected Species in Kasuratan and Manimporok forests			1 Species	
Protected Species in Kaluta and Kasuratan forests			1 Species	
Rare Species in Kasuratan forest				1 Species
Rare Species in Tampusu forest	Commercial wood			1 Species
Rare Species in Kaluta forest	Medicinal plant			6 Species
Rare Species in Kaluta and Manimporok forests				1 Species
Rare Species in Kaluta and Kasuratan forests				1 Species
Rare Species in Tampusu, Kasuratan and Manimporok forests				3 Species
Rare Species in Kaluta, Tampusu, Kasuratan and Manimporok forests				3 Species
LR/lc Species in Kasuratan forest				1 Species
LR/lc Species in Tampusu, Kasuratan and Manimporok forests				1 Species
VU A1d Species in Kaluta forest				1 Species

Note: Pr: Protected by PP No. 7/1999 Concerning the protection of plants and animals.

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

R: Population is characterized by an acute restriction in its area of occupancy (typically less than 100 km<sup>2</sup>) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.

LR/nt: A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. **Near Threatened (nt)**. Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

Vu C1+2a: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future. C. Population estimated to number less than 10,000 mature individuals and either: 1. An estimated continuing decline of at least 10 % within 10 years or 3 generations, whichever is longer; or 2. A continuing decline, observed, projected or inferred, in numbers of mature individuals and population structure in the form of a severely fragmented (i.e. no sub-population estimated to contain more than 1000 mature individuals)

**Table K.3.21 Threatened Status of Animals in Intensive Area(1/2)**

No	Scientific Name	Family	Location	Threatened Status	
				Protected .By I.G <sup>1)</sup>	IUCN <sup>2)</sup> Categories
(1)	(2)	(3)	(4)	(5)	(6)
1	<i>Accipiter</i> sp	Accipitridae	Kas	Pr	
2	<i>Aetopigia siparaja</i>	Nectariniidae	Kas	Pr	
3	<i>Centropus celebensis</i>	Centropoindae	Tam		R
4	<i>Cisticola exilis</i>	Silviidae	Kal		
5	<i>Cacomantis merulinus</i>	Cuculidae	Kal, Kas, Man		
6	<i>Corvus enca</i>	Corvidae	Tam, Kas		
7	<i>Cuculus merulinus</i>	Cuculidae	Kal, Tam		
8	<i>Culicicapa helianthea</i>	Muscicapidae	Tam, Kas		
9	<i>Cyornis rufigastra</i>	Muscicapidae	Kal, Tam, Ku, Man		
10	<i>Dendrocopos temminckii</i>	Picidae	Tam		R
11	<i>Dicaeum auralimbatus</i>	Dicasidae	Tam, Kas		R
12	<i>Dicaeum celebicum</i>	Dicacidac	Kai, Tm, Kas		R
13	<i>Dicaeum nehrkorni</i>	Dicacidac	Tam, Man		R
14	<i>Ducula aenea</i>	Columbidae	Kal, Tam, Man		
15	<i>Ducula forsteni</i>	Columbidae	Kal, Tm		R
16	<i>Enodes erythrophris</i>	Stumidae	Kal		R
17	<i>Eudynamis melanorkynca</i>	Cuculidae	Kal		R
18	<i>Eumyas panayensis</i>	Muscicapidae	Tam, Ku		
19	<i>Ficedula rufigula</i>	Muscicapidae	Kal, Ku		R/LR/nt
20	<i>Gallirallus torquatus</i>	Rallidae	Tam		
21	<i>Hypothymis azurea</i>	Muscicapidae	Man		
22	<i>Lonchura molluca</i>	Estrilindae	Tam		
23	<i>Macropigya amboinensis</i>	Columbidae	Kal, Tm, Kas, Man	Pr	VU Cl+2a
24	<i>Mulleripicus fulvus</i>	Picidae	Man		R
25	<i>Myzomela sanguinolenta</i>	Meliphagidae	Ku, Man	Pr	
26	<i>Nectarinia aspasia</i>	Nectariniidae	Kal	Pr	
27	<i>Nectarinia jugularis</i>	Nectariniidae	Tm	Pr	
28	<i>Pachycephala sulfuriventer</i>	Pachycephalidae	Tam, Ku, Man		R
29	<i>Penelopides exarhatus</i>	Bucerotidae	Kal	Pr	R
30	<i>Phaenicophaeus calyborhincus</i>	Cuculidae	Kal, Tm, Kas		R
31	<i>Phylloscopus borealis</i>	Silviidae	Man		
32	<i>Pitta erythrogaster</i>	Pittidae	Tam, Kas	Pr	
33	<i>Prioniturus platturus</i>	Psittacidae	Kal		R
34	<i>Prosciurillus leucomus</i> (Tupai)		Kal		R
35	<i>Prosciurillus munnus</i> (Tupai)		Kal		
36	<i>Ptilinopus melanospila</i>	Columbidae	Kal, Ku, Man		
37	<i>Ptilinopus superbus</i>	Columbidae	Ku, Man		
38	<i>Treron griseicauda</i>	Coluinbidae	Kal		
39	<i>Treron vernans</i>	Columbidae	Tam		R
40	<i>Trichastoma celebense</i>	Timaijidae	Kal, Tam, Ku		R
41	<i>Zoothera erythronota</i>	Turindae	Tm		
42	<i>Zosterops montanus</i>	Zosteropidae	Man		
43	<i>Zosterosp atrifrons</i>	Zosteropidae	Kal, Tam, Ku, Man		
44	<i>Otus manadens</i>	Strigidae	Tam		

Note: Kal = Kaluta forest, Tarn = Tampusu forest, Kas = Kasuratan forest, Man = Manimporok forest,

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources



**Table K.3.21 Threatened Status of Animals in Intensive Area (2/2)**

(Continued)

No	Number of species	Threatened Status	
		Protected .By I.G <sup>1)</sup> .	IUCN <sup>2)</sup> Categories
Kaluta forest	9 Species		
Kasusatan forest	2 Species		
Manimporok forest	4 Species		
Tampusu forest	8 Species		
Kaluta and Kasuratan forests	1 Species		
Kaluta and Tampusu forests	2 Species		
Kasuratan and Manimporok forests	2 Species		
Tampusu and Kasuratan forests	5 Species		
Tampusu and Manimporok forests	1 Species		
Kaluta, Kasuratan and Manimporok forests	2 Species		
Kaluta, Tampusu and Kasuratan forests	3 Species		
Kaluta, Tampusu and Manimporok forests	1 Species		
Tampusu, Kasuratan and Manimporok forests	1 Species		
Kaluta, Tampusu, Kasuratan and Manimporok forests	3 Species		
Protected Species in Kaluta forest		1 Species	
Protected Species in Kasuratan forest		2 Species	
Protected Species in Tampusu forest		1 Species	
Protected Species in Kasuratan and Manimporok forests		1 Species	
Protected Species in Tampusu and Kasuratan forests		1 Species	
Rare Species in Kaluta forests			5 Species
Rare Species in Tampusu forests			3 Species
Rare Species in Manimporok forests			1 Species
Rare Species in Kaluta and Tampusu forests			1 Species
Rare Species in Tampusu and Kasuratan forests			1 Species
Rare Species in Tampusu and Manimporok forests			1 Species
Rare Species in Kaluta, Tampusu and Kasuratan forests			3 Species
Rare Species in Tampusu, Kasuratan and Manimporok forests			1 Species
Protected/Rare in Kaluta forest			1 Species
Protected/Rare in Tampusu forest			1 Species
R/LR/nt Species in Kaluta and Kasuratan forests			1 Species
Pr/VU C1+2a Species in Kaluta, Tampusu, Kasuratan and Manimporok Forests			1 Species

Note: Pr: Protected by PP No. 7/1999 Concerning the protection of plants and animals.

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

R: Population is characterized by an acute restriction in its area of occupancy (typically less than 100 km<sup>2</sup>) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.

LR/nt: A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. **Near Threatened (nt)**. Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

Vu C1+2a: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future. C. Population estimated to number less than 10,000 mature individuals and either: 1. An estimated continuing decline of at least 10 % within 10 years or 3 generations, whichever is longer, or 2. A continuing decline, observed, projected or inferred, in numbers of mature individuals and population structure in the form of a severely fragmented (i.e. no sub-population estimated to contain more than 1000 mature individuals)

**Table K.3.22 Biological Index of Plankton in Lake Tondano and Noongan**

No	Study Site	Ecosystem	S	N	H'	J	D
1	Paleloan	Lake	13	392	1.67	0.65	0.28
2	Remboken	Lake	12	135	1.51	0.61	0.48
3	Eris	Lake	7	199	0.93	0.48	0.57
4	Toulimembet	Lake	15	194	1.73	0.64	0.23
5	Kaweng	Lake	12	241	1.36	0.51	0.42
6	Noongan	Watershed	9	29	2.02	0.92	0.15

**Table K.3.23 Biological Index of Benthos in Lake Tondano and Noongan**

No	Study Site	Ecosystem	S	N	H'	J	D
1	Paleloan	Lake	6	23	1.48	0.83	0.28
2	Remboken	Lake	6	171	1.44	0.80	0.27
3	Eris	Lake	1	1	0	0	0
4	Toulimembet	Lake	5	62	1.04	0.041	0.47
5	Kaweng	Lake	8	111	1.29	0.621	0.44
6	Noongan	Watershed	11	165	1.65	0.716	0.263

Note: *S* = Number of species, *N* = Number of Individuals, *H'* = Diversity Index, *J* = Evenness Index, *D* = Dominance Index

**Table K.3.24 Non-cultured Fish in Lake Tondano**

No	Name	Occurrence
1	Sleeper ( <i>Ophieleotras aporos</i> )	++++
2	Nike (anak payangka)	++++
3	Threespot Gourami ( <i>Trichogaster trichopterus</i> )	+++
4	Tilapia ( <i>Oreochromas mossambicus</i> )	++
5	Tilapia ( <i>O. niloticus</i> )	+
6	Snakehead ( <i>Cha,ma strima</i> )	+
7	Carp ( <i>Osteochilus hasselti</i> )	+
8	Walking Catfish ( <i>Clarias batrachus</i> )	+
9	Carp ( <i>Cypru'ws carpia</i> )	+
10	Climbing Perch ( <i>4nabas testudMeus</i> )	+

Note: ++++ = very high number, +++ = high number, ++ = medium, + = few

**Table K.3.25 Number of Floating Nets, Seeds Needed, Production and Number of Owners around Lake Tondano**

No	District	No. of fish cage (unit)	No. of seeds needed (thousand inds.)	Production (ton)	No. of owner (family)
1	Tondano	278	621	147.8	46
2	Eris	2166	9.747	3,889.0	182
3	Kakas	337	505	426.7	117
4	Remboken	68	102	40.7	58
Total		2.849	10.975	4,504.2	403

\* Source: Fisheries Services of Minahasa

**Table K.3.26 Aquatic Plants (macrophytes) in Lake Tondano**

No.	Common Name	Scientific Name
1: Emergent Plants		
A	Water hyacinth	<i>Eichornia crassipes</i>
B	Water lettuce	<i>Pistia stratiotes</i>
2: Bottom-rooted submergent plants		
A	Florida Elodea	<i>Hydrilla verticillata</i>
B	Coontail	<i>Ceratophyllum demersum</i>
C	Pondweed	<i>Potamogeton malaianus</i>

**Table K.3.27 Income Rate of the Respondents in Intensive Area**

No	Income Rate	East	West	South	Total	%
1	<100	-	-	-	-	-
2	100-99	1	3	1	5	4.17
3	200-299	10	11	8	29	24.17
4	300-499	14	19	20	53	44.17
5	500-749	11	5	8	24	20.00
6	750-999	2	1	1	4	3.33
7	1,000-1,500	1	1	1	3	2.50
8	>1,500	1	-	1	2	1.67
<b>Total</b>		40	40	40	120	100

Sources: Primary Data, 2000

**Table K.3.28 Land Property of the Respondents in Intensive Area**

No	Area (ha)	East	West	South	Total	%
1	<0.5	4	11	9	24	20.00
2	0.5-1	13	13	15	41	34.17
3	1.1-2	15	10	12	37	30.83
4	>2	8	6	4	18	15.00

Sources: Primary Data, 2000

**Table K.3.29                      Suggestions of Respondent in Social Survey**

<b>East of Lake Tondano</b>	
Makalonsow	<ul style="list-style-type: none"> <li>-To develop the gardenia, mahogani and palm trees.</li> <li>-To develop the fruit trees, such as jackfruits, rambutans, and dunans.</li> <li>-To provide some public training and to involve the local people directly on the project.</li> </ul>
Touliang Oki	<ul style="list-style-type: none"> <li>-To eliminate the water hyacinths to carry out the lake dredging and to build the dyke.</li> <li>-To plant the green belt with fruit trees.</li> <li>-To develop the gardenia and "nantu" wood.</li> </ul>
Telap	<ul style="list-style-type: none"> <li>-To plant the gardenia, "nantu", mahogani and palm trees</li> <li>-To replant the productive plants such as durians, manggoes, and oculated rambutans.</li> <li>-Training for the farmers about growing fruit trees.</li> <li>-To destroy the water hyacinths.</li> <li>-The relocation plan should be carefully studied that benefits the local people.</li> </ul>
Toulimembet	<ul style="list-style-type: none"> <li>-To build the dyke and destroy the water hyacinths</li> <li>-To arrange the floating nets in the lake</li> <li>-To involve the local people in the project activities and the bureaucracy should be simplified.</li> <li>-Careful relocation.</li> <li>-To plant the cinnamon and the gardenia trees.</li> </ul>
<b>West of Lake Tondano</b>	
Passo	<ul style="list-style-type: none"> <li>-To destroy the water hyacinths in Tondano Lake.</li> <li>-The use of Tondano Lake needs to be well arranged</li> <li>-To plant the fruit, the gardenia and "nantu" trees.</li> <li>-Relocation plan should be well studied; some people do not agree with it.</li> </ul>
Leleko	<ul style="list-style-type: none"> <li>-To destroy the water cyacinths and to build the dyke on the margin of Tondano Lake.</li> <li>-Replanting with fruit trees (such as durians and rambutans), and to plant the gardenia and niahogani woods.</li> <li>-To involve the local people in the project activities.</li> <li>-The relocation must guarantee the people survivorship.</li> </ul>
Paleloan	<ul style="list-style-type: none"> <li>-To destroy the water hyacinths and build the dyke</li> <li>-Reforestation with productive plants, such as durian, rambutan, gardenia and nantu.</li> <li>-Technical information for building the terraces in the hilly land</li> </ul>
Tampusu	<ul style="list-style-type: none"> <li>-Reforestation with the gardenia, mahogani and nantu woods and the fruit trees.</li> <li>-Funding support for soil conservation.</li> </ul>
<b>The South of Lake Tondano:</b>	
Tonsewer	<ul style="list-style-type: none"> <li>-To build a check dam, impoundment and reforestation.</li> <li>-To develop the coffee plants, the fruit trees, the gardenia and the "nantu" wood.</li> <li>-Water source needs to be maintained which requires the people participation.</li> <li>-Agricultural equipment support.</li> </ul>
Touure	<ul style="list-style-type: none"> <li>-To plant coffee and fruit trees.</li> <li>-To plant the gardenia, "nantu" and mahogani woods, palm tree and 'keniiri' (<i>Aleurites maluccana</i>).</li> <li>-The conservation technique should be suitable for the sandy land condition.</li> <li>-To involve the local people in the project.</li> </ul>
Noongan	<ul style="list-style-type: none"> <li>-To develop the coffee plants and avocado.</li> <li>-To develop the gardenia, the mahogani, and the nantu wood.</li> <li>-Technical information on conservation.</li> <li>-Funding support for conservation</li> <li>-Organization in the implementation of the conservation project should be rearranged by involving the local people or the local government under the BPD and the independent organization control so that it could be successful and there is some responsibility of the local people.</li> </ul>
Manembo	<ul style="list-style-type: none"> <li>-To develop the gardenia, the palm, the cinnamon and the fruit trees.</li> <li>-Capital support to the local people.</li> <li>-Train the local people.</li> </ul>

**Table K.3.30 Impact Assessment for Planned Activity on Soil and Land (1/2)**

Issues	Activities			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/ Extension of agroforestry	Introduction/Extension of erosion control farming practices
Land devastation (incl. Desertification)	D	D	D	D
Loss of soil fertility	D	D	D	D
Soil pollution by discharge or diffusion of toxic waste water	D	D	D	D
Soil loss	D	D	D	D
Loss of top-soil after forest cutting	D	D	D	D
Loss of top-soil after land consolidation	D	D	D	D
Modified important ground feature and loss of important geology by cut and bank	D	D	D	D

*Judgement scores*      *A : Serious impact anticipated, need careful assessment in the site,*  
*B : Anticipated impact*  
*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*  
*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.30 Impact Assessment for Planned Activity on Soil and Land(2/2)**

Issues	Activities			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
Land devastation (incl. Desertification)	D	D	D	D
Loss of soil fertility	D	D	D	D
Soil pollution by discharge or diffusion of toxic waste water	D	D	D	D
Soil loss	D	D	D	D
Loss of top-soil after forest cutting	D	D	D	D
Loss of top-soil after land consolidation	D	D	D	D
Modified important ground feature and loss of important geology by cut and bank	D	D	D	C

*Judgement scores*      *A : Serious impact anticipated, need careful assessment in the site,*  
*B : Anticipated impact*  
*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*  
*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.31 Impact Assessment for Planned Activity on Hydrology (1/2)**

Issues	Activities			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
Change of flow/water surface	D	D	D	D
Occurrence of inundation and floods	D	D	D	D
Change of groundwater flow and groundwater table	D	D	D	D
Pollution or deterioration of water quality	D	D	D	D
Turbid water by soil erosion / reduced discharge	D	D	D	D
Exhausted groundwater by excess extraction or lowered recharge	D	D	D	D
Seeped toxic water of buried materials	D	D	D	D
Eutrophication	D	D	D	D
Water temperature change	D	D	D	D

*Judgement scores*      *A : Serious impact anticipated, need careful assessment in the site,*  
*B : Anticipated impact*  
*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*  
*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.31 Impact Assessment for Planned Activity on Hydrology (2/2)**

Issues	Activities			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
Change of flow/water surface	D	D	D	D
Occurrence of inundation and floods	D	D	D	D
Change of groundwater flow and groundwater table	D	D	D	D
Pollution or deterioration of water quality	D	D	D	D
Turbid water by soil erosion / reduced discharge	D	D	D	D
Exhausted groundwater by excess extraction or lowered recharge	D	D	D	D
Seeped toxic water of buried materials	D	D	D	D
Eutrophication	D	D	D	D
Water temperature change	D	D	D	D

*Judgement scores*      *A : Serious impact anticipated, need careful assessment in the site,*  
*B : Anticipated impact*  
*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*  
*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.32 Impact Assessment for Planned Activity on Fauna and Flora (1/2)**

Issues	Activities			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/Extension of agroforestry	Introduction/Extension of erosion control farming practices
Occurrence of local diseases	D	C	C	D
Spread of malaria/ filaria epidemic	D	C	C	D
Increase of pesticide consumption	D	C	C	D
Accumulation of remained toxic matter	D	D	D	D
Increase of waste and excrement	D	D	D	D
Garbage and trash dump, falling standards of hygiene	D	D	D	D
Spread of vermin	D	D	D	D
Dump of construction waste, excavated soil, sludgw, trash, etc.	D	D	C	D
Alteration of vegetation	D	D	D	D
Invasion and propagation of harmful fauna and flora	C	D	D	D
Extermination or decrease of precious or specific fauna and flora	D	D	D	D
Disappeared wetland or peat bog	D	D	D	C
Loss of bio-diversity	D	D	D	D
Loss of rain forest/ wild lands	D	D	D	D

**Table K.3.32 Impact Assessment for Planned Activity on Fauna and Flora (2/2)**

Issues	Activities			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
Occurrence of local diseases	D	D	D	D
Spread of malaria/ filaria epidemic	D	D	D	D
Increase of pesticide consumption	D	D	D	D
Accumulation of remained toxic matter	D	D	D	D
Increase of waste and excrement	D	D	D	D
Garbage and trash dump, falling standards of hygiene	D	D	D	D
Spread of vermin	D	D	D	D
Dump of construction waste, excavated soil, sludgw, trash, etc.	D	D	D	D
Alteration of vegetation	D	D	D	D
Invasion and propagation of harmful fauna and flora	D	D	D	D
Extermination or decrease of precious or specific fauna and flora	D	D	D	D
Disappeared wetland or peat bog	D	D	D	D
Loss of bio-diversity	D	D	D	D
Loss of rain forest/ wild lands	D	D	D	D

*Judgement scores*

*A : Serious impact anticipated, need careful assessment in the site,*

*B : Anticipated impact*

*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*

*D : No impact anticipated, not necessary IEE and/or EIA*

**Table K.3.33 Impact Assessment for Planned Activity on Socio-economy (1/2)**

Issues	Activities			
	Set-up of monitoring institution for watershed management	Establishing community forest	Introduction/Extension of agroforestry	Introduction/Extension of erosion control farming practices
Scheduled relocation	D	D	D	D
Unwilling relocation	D	D	D	D
Alteration of the right on land tenure, & residence	D	D	D	D
Change of life style	D	B/C	C	C
Conflict between population	D	D	C	C
Effect on indigenous people, minority, & nomads	D	D	D	D
Reform of traditional institution, & custom	D	D	D	D
Obstruction on fishing right, water right, local regulations	D	D	D	D
Alteration of social structure by organization, etc.	D	D	D	D
Radical change of social structure, & population increase	D	D	D	D
Lost opportunity on production, such as loss of land	D	D	D	D
Transfer, conversion of foundation of economic activity, or unemployment	D	D	D	D
Enlarging income gap	D	D	D	D
Impact on existing transportation	D	D	D	D
Impact on schools & hospitals	D	D	D	D
Cutting off the local society by roads	D	D	D	D
People's perception	D	D	D	D
Destruction or damage of historical remains and cultural legacy	D	D	D	D
Loss of precious scenery	D	D	D	D
Effects on underground resources	D	D	D	D
Change of ground features by construction of the structures	D	D	D	D
Disturbance of harmonic scenery by construction of the structures	D	D	D	D
Increased opportunity of slope failure, accidents	D	D	D	D
Pollution by exhaust or toxic gas of vehicles and plants	D	D	D	D
Noise and vibration caused traffic, pumps, etc.	D	D	D	D
Change of temperature and wind by large scale development	D	D	D	D

*Judgement scores*

*A : Serious impact anticipated, need careful assessment in the site,*

*B : Anticipated impact*

*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*

*D : No impact anticipated, not necessary IEE and/or EIA*



**Table K.3.33 Impact Assessment for Planned Activity on Socio-economy (2/2)**

Issues	Activities			
	Expansion of woodland, Prevention of deforestation	Green belt along the lake and rivers	Regulation of fishery in the lake	Construction of erosion control structures
Scheduled relocation	D	D	D	D
Unwilling relocation	D	D	D	D
Alteration of the right on land tenure, & residence	D	D	D	D
Change of life style	D	D	D	D
Conflict between population	D	D	D	D
Effect on indigenous people, minority, & nomads	D	D	D	D
Reform of traditional institution, & custom	D	D	D	D
Obstruction on fishing right, water right, local regulations	D	D	D	D
Alteration of social structure by organization, etc.	D	D	D	D
Radical change of social structure, & population increase	D	D	D	D
Lost opportunity on production, such as loss of land	D	D	D	D
Transfer, conversion of foundation of economic activity, or unemployment	D	D	D	D
Enlarging income gap	D	D	D	D
Impact on existing transportation	D	D	D	D
Impact on schools & hospitals	D	D	D	D
Cutting off the local society by roads	D	D	D	D
People's perception	D	D	D	D
Destruction or damage of historical remains and cultural legacy	D	D	D	D
Loss of precious scenery	D	D	D	D
Effects on underground resources	D	D	D	D
Change of ground features by construction of the structures	D	D	D	D
Disturbance of harmonic scenery by construction of the structures	D	D	D	D
Increased opportunity of slope failure, accidents	D	D	D	D
Pollution by exhaust or toxic gas of vehicles and plants	D	D	D	D
Noise and vibration caused traffic, pumps, etc.	D	D	D	D
Change of temperature and wind by large scale development	D	D	D	D

*Judgement scores*

*A : Serious impact anticipated, need careful assessment in the site,*

*B : Anticipated impact*

*C : Unknown (necessary to assess, detail could be clarified in a further assessment),*

*D : No impact anticipated, not necessary IEE and/or EIA*