

## CHAPTER 4 ACTION PLAN FOR PAFs

### 4.1 Present Condition of Resettlement Villages

#### 4.1.1 General

##### (1) Location and Administration

Ten villages were all located below an elevation of 85 m above mean sea level during the implementation period. Considering the request of PAFs the locations of new villages were selected: i) close to the old village and within the same regency; and ii) close to the reservoir area except PAFs applied PIR-Oil palm pattern. At present, there are 16 resettlement villages, since in some cases one village was divided into more than one resettlement village. Out of the 16 villages, 14 are administratively located in Kampar Regency, Riau Province and two are in Lima Puluh Kota Regency, West Sumatra Province. The location and administration of resettlement villages are shown below:

**Table Location and Administration of Resettlement Village**

No.	Origin Village	Resettlement Location	Current Village	Sub-District
<b>Kampar Regency – Riau Province</b>				
1.	Pulau Gadang	Koto Ranah	1. Pulau Gadang	XIII Koto Kampar
			2. Koto Mesjid	XIII Koto Kampar
2.	Batu Bersurat	Ranah Sungkai	3. Ranah Sungkai	XIII Koto Kampar
			4. Lubuk Agung	XIII Koto Kampar
		Southern Batu Bersurat	5. Batu Bersurat	XIII Koto Kampar
			6. Binamang	XIII Koto Kampar
3.	Pongkai	Southern Siberuang Unit 2 Compensation and Free PIR-Palm Oil Sungai Pagar	7. Pongkai Baru	XIII Koto Kampar
			9. Pongkai Istiqomah	XIII Koto Kampar
			8. Mayang Pongkai	Kampar Kiri
4.	Tanjung Alai	Ranah Koto Talago	10. Tanjung Alai	XIII Koto Kampar
5.	Muara Takus	Southern Muara Takus	11. Muara Takus	XIII Koto Kampar
6.	Koto Tuo	Southern Muara Takus	12. Koto Tuo	XIII Koto Kampar
7.	Muara Mahat	PIR-Palm Oil Bangkinang Blok X/G	13. Muara Mahat Baru	Tapung
8.	Gunung Bungsu	Southern Siberuang Unit 1	14. Gunung Bungsu	XIII Koto Kampar
<b>50 Kota Regency – West Sumatera Province</b>				
9.	Tanjung Pauh	Rimbo Datar	15. Tanjung Pauh	Pangkalan Koto Baru
10.	Tanjung Balit	Rimbo Datar	16. Tanjung Balit	Pangkalan Koto Baru

Source: Study on Koto Panjang Hydroelectric Power Plant and Associated Transmission Project, PT. BITA BINA SEMESTA, May 2001

##### (1) Socio-Economic Condition

According to the 2000 population census, the population of resettlement villages is 22,110 persons consisting of 10,980 male and 11,130 female. The growth rate of

population in the resettlement villages between 1990 and 2000 is not clear since the resettlement program will affect population. The distribution of population and households in each resettlement village is as follows:

Table Population and Households in Resettlement Villages

No.	Origin Village	Current Village	Original Number of PAFs	Population in Year 2000			Household	Persons Per Household
				Male	Female	Total		
<b>Kampar Regency – Riau Province</b>								
1.	Pulau Gadang	1. Pulau Gadang	333	1,251	1,333	2,584	633	4.08
		2. Koto Mesjid	259					
2.	Batu Bersurat	3. Ranah Sungkai	337	2,808	2,969	5,777	1,488	3.88
		4. Lubuk Agung	220					
		5. Batu Bersurat	522					
		6. Binamang	178					
3.	Pongkai	7. Pongkai Baru	72	543	537	1,080	279	3.87
		9. Pongkai Istiqomah	128					
		8. Mayang Pongkai	259	961	942	1,903		
4.	Tanjung Alai	10. Tanjung Alai	313	702	639	1,341	369	3.63
5.	Muara Takus	11. Muara Takus	244	414	441	855	215	3.98
6.	Koto Tuo	12. Koto Tuo	599	1,162	1,167	2,329	541	4.30
7.	Muara Mahat	13. Muara Mahat Baru	447	1,008	956	1,964	437	4.49
8.	Gunung Bungsu	14. Gunung Bungsu	241	544	495	1,039	292	3.56
<b>50 Kota Regency – West Sumatera Province</b>								
9.	Tanjung Pauh	15. Tanjung Pauh	421	705	745	1,450	373	3.89
10.	Tanjung Balit	16. Tanjung Balit	313	885	904	1,789	467	3.83

Source: Dalam Angka (Statistics Book) of XIII Koto Kampar, Kampar Kiri, Tapung and Pangkalan Koto Baru Sub-Districts, 2000

Note: The population data is only available based on the original village before relocation except Mayang Pongkai that was relocated to another sub-district.

The following table shows the statistical data for education status in the resettlement area. It is noted that the drop-out ratio from school (from ages 7-12) of most of the resettlement villages is relatively high compared to the average of XII Koto Kampar sub-district. In addition, the number of teachers for each elementary school is relatively small in the resettlement villages in comparison to the average of both XII Koto Kampar sub-district and Kampar Regency.

**Table Statistical Data for Education in Resettlement Village**

No.	Origin	Current Village	Drop Out Ratio of School (Age 7-12)	No. of School			No. of Teacher for Elementary School
	Village			Kindergarten	Elementary	Junior High	
<b>Kampar Regency – Riau Province</b>							
1.	Pulau Gadang	1. Pulau Gadang	38%	1	4	2	30(15)
		2. Koto Mesjid					
2.	Batu Bersurat	3. Ranah Sungkai	9%	1	5	2	50(12)
		4. Lubuk Agung					
		5. Batu Bersurat					
		6. Binamang					
3.	Pongkai	7. Pongkai Baru	41%	0	2	0	5(3)
		9. Pongkai Istiqomah					
		8. Mayang Pongkai					
4.	Tanjung Alai	10. Tanjung Alai	45%	0	2	0	12
5.	Muara Takus	11. Muara Takus	36%	0	1	0	7
6.	Koto Tuo	12. Koto Tuo	40%	1	3	0	18
7.	Muara Mahat	13. Muara Mahat Baru	n.a.	1	2	1	14
8.	Gunung Bungsu	14. Gunung Bungsu	39%	0	1	0	6
Average of XII Koto Kampar			24%	0.33	3.20	0.53	20.40
Average of Kb. Kampar			n.a.	0.66	2.69	0.33	20.53
<b>50 Kota Regency – West Sumatera Province</b>							
9.	Tanjung Pauh	15. Tanjung Pauh	n.a.	n.a.	n.a.	n.a.	n.a.
10.	Tanjung Balit	16. Tanjung Balit	n.a.	n.a.	n.a.	n.a.	n.a.

Source: Dalam Angka (Statistics Book) of XIII Koto Kampar, Kampar Kiri, Tapung and Pangkalan Koto Baru Sub-Districts, 2000

Note: i) "n.a." means "not available".  
ii) ( ) indicates estimated number per current village.

The following table shows the statistical data for health status in the resettlement area. The number of doctors, nurses and midwives in the resettlement villages is almost at the average level in both XII Koto Kampar sub-district and Kampar Regency.

**Table Statistical Data for Health of Resettlement Villages**

No.	Origin Village	Current Village	No. of Heal Center	No. of Doctor etc.		
				Doctor	Nurse	Midwife
<b>Kampar Regency – Riau Province</b>						
1.	Pulau Gadang	1. Pulau Gadang	1(0.5)	1(0.5)	3(1.5))	2(1)
		2. Koto Mesjid				
2.	Batu Bersurat	3. Ranah Sungkai	3(0.7)	2(0.5)	7 (1.8)	4(1)
		4. Lubuk Agung				
		5. Batu Bersurat				
		6. Binamang				
3.	Pongkai	7. Pongkai Baru	1	0	1(0.5)	1(0.5)
		9. Pongkai Istiqomah				
		8. Mayang Pongkai				
4.	Tanjung Alai	10. Tanjung Alai	1	0	2	0
5.	Muara Takus	11. Muara Takus	1	1	2	1
6.	Koto Tuo	12. Koto Tuo	1	0	1	1
7.	Muara Mahat	13. Muara Mahat Baru	1	0	1	1
8.	Gunung Bungsu	14. Gunung Bungsu	1	1	1	1
		Average of XII Koto Kampar	1.13	0.33	1.67	1.20
		Average of Kb. Kampar	0.44	0.27	2.25	1.81
<b>50 Kota Regency – West Sumatera Province</b>						
9.	Tanjung Pauh	15. Tanjung Pauh	1	n.a.	n.a.	n.a.
10.	Tanjung Balit	16. Tanjung Balit	2	n.a.	n.a.	n.a.

Source: Dalam Angka (Statistics Book) of XIII Koto Kampar, Kampar Kiri, Tapung and Pangkalan Koto Baru Sub-Districts, 2000

Note: i) "n.a." means "not available".

ii) ( ) indicates estimated number per current village.

The following table shows the statistical data for use of radio and TV in the resettlement area. Rate of ownership of TV and radio in the resettlement villages is relatively high compared to the average of both XII Koto Kampar sub-district and Kampar Regency.

**Table Statistical Data for Ownership of TV/Radio in Resettlement Villages**

No.	Origin Village	Current Village	Use Ratio of TV/Radio	
			TV	Radio
Kampar Regency – Riau Province				
1.	Pulau Gadang	1. Pulau Gadang	33%	60%
		2. Koto Mesjid		
2.	Batu Bersurat	3. Ranah Sungkai	33%	44%
		4. Lubuk Agung		
		5. Batu Bersurat		
		6. Binamang		
3.	Pongkai	7. Pongkai Baru	26%	34%
		9. Pongkai Istiqomah		
		8. Mayang Pongkai		
4.	Tanjung Alai	10. Tanjung Alai	30%	72%
5.	Muara Takus	11. Muara Takus	53%	97%
6.	Koto Tuo	12. Koto Tuo	56%	73%
7.	Muara Mahat	13. Muara Mahat Baru	72%	83%
8.	Gunung Bungsu	14. Gunung Bungsu	24%	68%
	Average of XII Koto Kampar		22%	35%
	Average of Kb. Kampar		n.a.	n.a.
50 Kota Regency – West Sumatera Province				
9.	Tanjung Pauh	15. Tanjung Pauh	55%	n.a.
10.	Tanjung Balit	16. Tanjung Balit	9%	n.a.

Source: Dalam Angka (Statistics Book) of XIII Koto Kampar, Kampar Kiri, Tapung and Pangkalan Koto Baru Sub-Districts, 2000

Note: i) "n.a." means "not available".

#### 4.1.2 Water Supply System

A summary of water supply facilities provided to each village is presented in Table 4.1. The information on existing water supply facilities was obtained from previous study reports, visits made to each village by the SAPS team, a statistical household survey and surveys carried out by a locally engaged NGO.

##### (1) Source of water

The main source of water for PAF's is shallow hand dug wells. This water is supplemented in most villages by rainwater catchments, and surface water from streams and springs. In general people find an adequate supply of water from these sources to meet their requirements. There are however 15 villages that experience some degree of trouble due to inadequate quantity in shallow wells during the dry season, one village where quality is the only problem, and ten villages where quality and quantity are a problem (including Tanjung Pauh and Tanjung Balit where water from wells is not potable).

##### 1) Rain water collection

Most households collect rainwater from rooftops into plastic rain barrels about 0.2 m<sup>3</sup> in capacity. The rainwater is used for drinking and cooking. During the

visits villagers indicated that they do not collect more water because quality deteriorates when water is stored for too long.

## 2) Shallow Dug Wells

As part of the original resettlement program, villages were provided with shallow dug wells ranging in depth from 3 m to 9 m depending on the local topography and soil conditions. The shallow wells were excavated by hand, and lined with concrete rings that extend out of the ground to form a parapet wall about 1 m high. A concrete apron protects the area around the well.

Dug wells are still used extensively in all villages except the following:

- In Lubuk Agung villagers use surface water from a nearby stream because there are no shallow wells. It appears that most of the villagers may have been relocated to lower lying areas since the initial resettlement. This would explain why there are no wells.
- The wells in Tanjung Balit and Tanjung Pauh have all been abandoned because water is not potable (high turbidity). People in these villages buy water for drinking, and travel a few kilometres to the former site of Tanjung Balit by the river where there is a good source of water for bathing and washing.
- People in Tanjung Pauh have constructed a small gravity water supply scheme with assistance from Bina Sawadaya (NGO).

In many locations (Batu Bersurat, Binamang, Koto Tuo, Muara Takus, Pongkai Baru) villagers have tried to dig deeper wells but encountered very hard material locally known as "natal" and could not dig deeper by hand. This hard ground could be rock, boulders or consolidated laterite. It will be important in the second part of the assignment to determine the exact nature of the problem since digging deeper wells is likely to be one of the most effective solutions for improving water supply conditions in many villages.

## 3) Piped water supply system

In response to problems encountered with the wells, all villages (except Mayang Pongkai) were provided with a piped water supply system under OECF loan SPL-V/VI. The water source was obtained from deep boreholes or nearby surface streams, in most cases treated through slow sand filters, and pumped to all areas of the village through a piped distribution system to public water hydrants. The pumps were operated by diesel generators.

Although the water supply systems were designed to provide a very good level of service, they were doomed to fail from the start because neither the government nor the villagers were willing or able to take responsibility for operation and maintenance. The Ministry of Transmigration operated piped water supply systems for a few weeks or months then the facilities were handed over to the villagers. The systems proved to be too difficult and expensive to operate and maintain. As a result, all piped water systems have failed.

Most of the diesel generators are missing or in disrepair. The galvanized iron piping is probably in good enough condition to be re-utilized. Some of the piping has been damaged by heavy equipment because it was installed too close to the surface and to the side of the road. In some places sections of piping have been removed. A complete appraisal of the system will be required if it is ever to be put back into operation.

It is doubtful that any of the piped water supply schemes can ever be operated in a sustainable way unless villagers are able (and willing) to afford the operating costs and are trained to operate and maintain the systems properly.

## (2) Description of water supply in each village

Data sheets describing the water supply facilities in each village are presented in Appendix 5.1. These sheets were created to record information gathered during the team's field surveys for future reference. Much of the information required to complete the data sheets is still missing and the team intends to fill in the gaps as the information becomes available.

## (3) Required quality and level of treatment

In previous surveys some villages have reported water quality problems such as objectionable color or taste or staining the wash. These problems are typical in lateritic soils and are usually related to high mineral content (iron or manganese).

The potential to use groundwater and surface water for water supply in each village was evaluated in the engineering assessment that was carried out before resettlement. The reports are not available for all villages but the information that is available indicates that mineral (manganese) levels in groundwater in some locations did exceed the limits set by drinking water guidelines. Discussions with a well drilling contractor in Pekanbaru indicate that high iron content is also a common problem.

The Ministry of Health has produced Regulation No.416/1990 for drinking water

quality. The required levels for various parameters are presented in Table 4.2. Water supply systems in rural areas should meet the regulations. Except for protected sources, most sources of water in rural areas including shallow wells probably have higher coliform counts than allowable, increasing the risk of pathogenic diseases. Pathogens can be removed by sand filtering or by boiling water. Villagers are very aware of the need to boil water and it is common practice in most households. The PU has designed its storage tanks with slow sand filters as an additional precaution to improve the quality of water supplied from catchment dam projects.

#### (4) Required Quantity

The recommended minimum water-quantity requirement for individuals is 15 to 25 liters per day. Dug wells and additional water supply facilities provided by the Ministry of Transmigration were designed to provide a minimum 60 liters per person per day: drinking, 5 liter per person; cooking, 10 liter per person, and washing & bathing, 45 liter per person.

Wells with poor quantity appear to be a problem in the dry season only when lack of rain results in a lower water table. This problem occurs in 13 villages to varying degrees depending on local topography and geology. In hilly villages like Tanjung Alai and Ranah Sungkai, the problem occurs in wells that are located at higher elevations. In villages with flat topography such as Pongkai Baru, the problem of dry wells is more widespread. In most places, during the dry season people use alternative sources of water such as small streams or springs that do not run dry.

The yield and depth of groundwater was measured in test pits during the engineering assessment that was carried out before resettlement. Reports are not available for all villages but the information that is available indicates that the water table in most areas was shallow (1 to 4 m) and that the yield was more than sufficient for domestic water needs. Unfortunately the data is of limited value to the present appraisal because it is not clear if the wells were measured during wet or dry season or where the test pits were located.

Before deciding to dig deeper wells it will be essential to know how deep the water table is during the dry season and how much can be abstracted.

#### (5) Classification of villages:

The statistical household survey included questions on water use and condition of water supply facilities. A summary of the results is presented in Table 4.3. The results tend to correlate with observations in the field made by the team and the



NGO as well as discussions at PRA meetings.

Villages are grouped according to the type of problem encountered and further classified according to the relative severity of the condition. Villages can be ranked into one of four groups depending on the nature and severity of the problem. In ranking severity, quantity is considered more important than quality except where water is not potable. Another factor considered in ranking severity is the number of people affected. This preliminary classification is presented in Table 4.4 and will serve as a guide to determine the priorities for implementing countermeasures.

#### 4.1.3 Plantations

##### (1) General

As part of the resettlement package, each PAF in Riau and West Sumatra has to be provided with approximately 2 hectares of estate crop plantings, which are in due course intended to provide the basis for a sustained livelihood for the persons concerned.

Two perennial estate crop species were selected for this purpose, namely rubber and oil palm. These estate crop species have different agronomic requirements, as well as having widely diverging periods of immaturity, costs and processing and marketing requirements. Whilst these factors are dealt with more fully under Section 4.4 (Issues and Constraints), it will suffice to say here that the inherent differences between these two crop species have, together with the variation in management systems under which they have been developed, led to a very wide divergence in the standards and costs of field development achieved.

In summary, the development of oil palms has been generally more successful in terms of timeliness and technical standards, than has been the case for the development of rubber areas. These conclusions have been drawn from observations during brief field visits during the Phase I Study, and from outline data and observations provided by PAFs and a range of staff and ancillary Study Teams. As will be mentioned later in this Report, all observations, data and resultant implications summarised in this current Report, will require checking/corroboration during routine detailed surveys prior to and during the early stages of the Phase II Study.

Because of the generally more successful development of oil palm areas for PAFs, the majority of effort during the Phase I Study has been directed towards enhancing the condition and ameliorative/rehabilitation activities, which relate to the PAF

rubber plantings.

A summary of the extent, locations and PAF numbers associated with rubber and oil palm plantings is provided in the following Table.

**Table Basic Plantation Information in March 2002**

Village	Number of PAFs	Number of Farmer Groups for Rubber Plantation	Plantation Area (ha)	Distance from Village to Plantation (km)	Remarks
1. Pulau Gadang	333	22	666	0.5 - 6	
2. Koto Mesjid	259	16	518	0.5 - 6	
3. Runah Sungkai	337	13	674	2 - 5	
4. Lubuk Agung	220	11	440	3 - 6	
5. Batu Bersurat	522	21	1,044	10	10km: short cut by boat
6. Binamang	178	7	356	8 - 10	8-10km: short cut by boat
7. Pongkai Baru	200	8	400	1 - 3	
8. Mayang Pongkai	259	-	518	0.5 - 3	Oil Palm
9. Pongkai Istiqomah	-	-	-	-	No plantation by the Project
10. Tanjung Alai	313	22	626	2 - 7	
11. Muara Tukus	244	30	488	3	
12. Koto Tuo	599	21	1,198	1 - 7	
13. Muara Mahat Baru	447	-	894	0.5 - 3	Oil Palm
14. Gunung Bungsu	241	14	482	3 - 8	
Sub-Total	3,446(rubber) 706 (oil palm)	-	6,892(rubber) 1,412 (oil palm)	-	
15. Tanjung Pauh	323	11	646	2 - 6	
16. Tanjung Balit	431	17	862	2 - 6	
Sub-Total	754	28	1,508	-	
TOTAL	4,200(rubber) 706 (oil Palm)	-	8,400(rubber) 1,412 (oil palm)	-	

Source: Interview result to village chiefs and Plantation Service of Riau and West Sumatra Province

## (2) Rubber Plantings in Resettlement Villages

### a) Overall Trends

In general terms, the initial rubber development effort for PAFs was unsatisfactory in both Riau and West Sumatra. In both Provinces, rubber development was initially undertaken utilising short-term contractors (who were sometimes farmers themselves), under the Partial (P2WK) System. As the results were entirely unsatisfactory, it became necessary to completely replant/rehabilitate the PAF rubber plantings in both Provinces.

Such rehabilitation has been undertaken relatively successfully in Riau Province, utilising a longer-term development approach, whereas repeat short-term approaches in West Sumatra have resulted in further failure.

b) Condition of PAF Rubber Plantings in Riau Province.

During the years 1991 to 1996, the Government of Riau Province developed rubber plantings for 3,446 PAF in 11 villages. Contractors were used to undertake planting and maintenance of the rubber plants over an area of 6,892 hectares. The area of rubber plantings developed for each family was 2 ha. However, the majority of plantings were poorly established and therefore died. The main reason for this failure was careless planting and poor initial maintenance by the contractor. Moreover, there was reportedly a lack of communication and suitable coordination between the Local Government and the PAF.

In order to rehabilitate the failed rubber plantings in 1999 and 2000, replanting of the rubber areas was implemented through collaboration between farmers and Local Government. The rehabilitation was undertaken over an area of 6,892 hectares, which had proved to be a failure earlier. During this rehabilitation, the rubber plants were established and maintained by the farmers themselves. The rehabilitation was undertaken over an area of 1,554 hectares in 1999/2000, and over 5,338 hectares in 2000.

Most of the replanted rubber has grown satisfactorily since 1999/2000. However, an area of 163 hectares has proved to be substandard. The causes of this were the flood in 2001 and the unsuitability of the soil for rubber, in some instances. The failed rehabilitation area (163 hectares) was in four villages, namely, Batu Bersurat, Muara Takus, Binamang and Koto Mesjid. Therefore, the rubber areas were re-established in more suitable locations in 2001.

The proportion of PFA rubber plantings that is regarded as being of the requisite standard is 80%, while 20% is said to be sub-standard. A summary of PFA rubber planting condition, together with details of planting areas by village, is provided in the following table, alongside details pertaining to West Sumatra Province.

**Table. The Quality of the Rubber Plantations in 2002**

Village	Plantation Area (ha)	The Proportion of Standard Rubber Plants (%)	The Proportion of Sub-Standard or Dead Rubber Plants (%)
1. Pulau Gadang	666	80%	20%
2. Koto Mesjid	518	90%	10%
3. Runah Sungkai	674	90%	10%
4. Lubuk Agung	440	95%	5%
5. Batu Bersurat	1,044	50%	50%
6. Binamang	356	75%	25%
7. Pongkai Baru	400	95%	5%
10. Tanjung Alai	626	90%	10%
11. Muara Tukus	488	50%	50%
12. Koto Tuo	1,198	95%	5%
14. Gunung Bungsu	482	85%	15%
<b>SUBTOTAL</b>	<b>6,892</b>	<b>80%</b>	<b>20%</b>
15. Tanjung Pauh	646	8%	92%
16. Tanjung Balit	862	0%	100%
<b>SUBTOTAL</b>	<b>1,508</b>	<b>3%</b>	<b>97%</b>
<b>TOTAL</b>	<b>8,400</b>	<b>66%</b>	<b>34%</b>

Source: Interview result to village chiefs and Plantation Service of Riau and West Sumatra Province

c) Condition of PAF Rubber Plantations in West Sumatra Province

From 1993 to 1999, the Agriculture Department and Government of West Sumatra Province used contractors to establish rubber plantings for 754 PAF in two villages over an area of 1,508 hectares. Each PAF was provided with 2 ha of rubber. The Local Government vested responsibility for rubber maintenance with the farmers. However, most of the rubber plants failed to develop well, and ultimately died. Only 50 hectares (3%) of rubber plantings are now successful, and the balance can be said to have failed completely. The main reason for the failure is said to have been careless planting by the contractor. One of the results is that the boundaries of each farmer's land are now not clearly defined, and some 70 percent of farmers are apparently unable to recognise their own land.

In order to rehabilitate the failed rubber areas, replanting was implemented with the collaboration of farmers and Local Government, under a Project Called "KDSA". The rehabilitation was undertaken over an area of 1,022 hectares. During this rehabilitation, the rubber plants were established and maintained by the farmers themselves. However, approximately three months after planting, most of the rubber plants were destroyed by fire. The rehabilitation has thus failed.

The proportion of PFA rubber plantings that is reported to be of the requisite standard is 3%, while 97% is said to be sub-standard. A summary of PFA rubber plantings in West Sumatra Province, together with details of planting area by village,

has been shown in the previous table, alongside the details pertaining to Riau Province.

d) **Costs Involved in Bringing PAF Rubber Plantings to Their Present Condition**

The overall cost of bringing the PAF rubber plantings to their current condition is a function of the original establishment costs, plus those involved in the requisite rehabilitation/replanting. Full records have not been seen in respect of the initial rubber development costs, but details of the costs of rehabilitation/replanting are as shown in the paragraphs which follow:

i) **Riau Province**

In order to establish the rubber plants in the rehabilitation areas, the land clearing, preparation for planting, planting, fertilising, weed control and transportation, were carried out by the farmers. Riau Province subsidised the cost of such operations, and the total related payment to each family was Rp.1,010,000. This income was not adequate to meet their living expenses.

The rubber plants, fertilizers, agricultural tools and pesticides, were also supplied to the farmers by the Government. The cost of these materials was Rp. 550,000 for each family. The total subsidy payment and the cost of supplied materials, was Rp. 1,560,000 for each family. Details are provided in the following Table.

**Table The Subsidy and the Supplied Materials to Each Family for the Planting in Rehabilitation Area in Riau Province.**

<b>1. The subsidy for planting</b>	
1) Land preparing (land clearing)	Rp. 600,000 / family
2) Planting preparation (staking holes, plant holes)	Rp. 150,000 / family
3) Planting of seedlings	Rp. 125,000 / family
4) Manuring	Rp. 40,000 / family
5) Weed control	Rp. 45,000 / family
6) Transportation of plants from the village to the rubber plantation	Rp. 50,000 / family
<b>SUBTOTAL</b>	<b>Rp. 1,010,000 / family</b>
<b>2. The cost of supplied materials</b>	
1) Plants, fertilizers, agricultural tools, pesticides	Rp. 550,000 / family
<b>TOTAL</b>	<b>Rp. 1,560,000 / family</b>

Source: Plantation Service of Riau Province

The farmers maintained the rehabilitated areas themselves. Maintenance included drainage and terraces, supplying of dead plants, weeding, pruning, fertilising, cover crop planting and disease control. Riau Province subsidised maintenance activities for each family during 2000 and 2001. The total payment to each family was not enough to meet their living expenses. Details

were as shown in the following table.

**Table The Subsidy to Each Family for Maintenance in the Rehabilitation Area in Riau Province**

Year	2000	2001
1. Maintenance of drainage and terraces	Rp. 150,000	Rp. 100,000
2. Replacing of dead rubber plants	Rp. 30,000	-
3. Cutting of grasses	Rp. 100,000	Rp. 75,000
4. Cutting of branches	Rp. 50,000	-
5. Manuring	Rp. 100,000	Rp. 100,000
6. Cover crop planting	Rp. 22,500	Rp. 22,500
7. Disease control	Rp. 50,000	Rp. 50,000
8. Weed control	-	Rp. 50,000
<b>TOTALS</b>	<b>Rp. 502,500</b>	<b>Rp. 397,500</b>

Source: Plantation Service of Riau Province

ii) West Sumatra Province

Rubber planting was carried out in the rehabilitation area through the collaborative efforts of the farmers and Local Government. The planting was carried out by the farmers. The Government, Forest Department and Labour Department supplied the plants to the farmers, and paid a subsidy of Rp. 700,000 per family for the planting.

The farmers did not adequately maintain the rehabilitation area, and the majority of the plantings was destroyed by fire. The Government did not therefore subsidise the maintenance of these areas. No details are available in respect of any subsidy payments made.

(3) Oil Palm Plantings in Resettled Villages

a) Overall Trends

As already mentioned, the development of oil palm plantings for PAFs was undertaken in a generally more orderly and satisfactory manner than was utilised for the rubber plantings. The management/development pattern utilised was the PIR TRANS System, whereby smallholder plantings were established and maintained to maturity by a nucleus estate, prior to transfer to farmer settlers. The nucleus estate operators in the oil palm resettlement areas in Riau Province, were PTPNV and PT Sinar Mas.

Overall, the oil palm plantings for PAFs in Riau Province are reported as being 80 percent satisfactory, while 20 percent are reported as being unsatisfactory. The 20 percent of plantings that are reportedly in unsatisfactory condition, are on shallow soil hill crests (5 percent), and in low-lying areas with peat and less than adequate drainage conditions (15 percent).

It is also reported that somewhere in excess of 30 PAF oil palm plots have been illegally taken over by local farmers as they failed to reach an appropriate technical standard and were therefore inappropriate for legal conversion from nucleus estate to smallholder ownership status, and land titling.

The status and condition of all the PAF oil palm plantings requires early and urgent confirmation through survey, including details on planted areas that have been destroyed in some locations as a result of significant lateral erosion of riverbanks.

#### 4.1.4 Income Generating Activities

##### (1) Present Activities for Income Generation

Present activities for income generation in each resettlement village were surveyed through interview of the farmers and government officers concerned. Through the field investigation and interviews, various activities for income generation other than rubber plantation or palm oil plantation are observed in the resettlement villages. There are 12 activities identified and those activities are categorized as follows.

##### 1) Agriculture and Livestock

- Inter-cropping in plantation area (watermelon, rice, corn, chili);
- Food and fruits crop cultivation in farm plot (orange, rice, corn, banana, coconut, papaya, etc.);
- Gambier cultivation; and
- Poultry farming.

##### 2) Fishery

- Fishery in the dam reservoir; and
- Inland fishery using fish ponds.

##### 3) Casual worker

- Plantation worker;
- Wood worker;
- Quarryman; and
- Casual laborer.

##### 4) Other

- Trader; and
- Carpenter.

Detailed information on income generation activities of each village is shown in the following table.

**Table** Income Generation Activities in Each Village in 2002

Village	Inter cropping	Food Crop	Gambier	Fishery	Inland Fishery	Livestock/ Poultry	Trader	Carpenter	Plantation Worker	Wood Worker	Quarry -man	Causal labour
1. Pulau Gadang	○ (50%)	○	×	○ (a few)	○ (60%)	×	○ (6%)	×	○ (60%)	○(5%)	×	○ (5%)
2. Koto Mesjid	○ (50%)	○	×	○ (a few)	○ (60%)	×	○ (8%)	×	○ (70%)	○ (10%)	×	○ (5%)
3. Runah Sungkai	○ (10%)	○ (50%)	×	×	×	×	○ (5%)	×	○ (30%)	○ (30%)	×	○ (a few)
4. Lubuk Agung	○ (10%)	○ (50%)	×	×	×	×	○ (5%)	×	○ (20%)	○ (25%)	×	○ (a few)
5. Batu Bersurat	×	×	×	○ (65%)	×	×	×	×	×	○ (20%)	×	×
6. Binamang	×	○ (a few)	×	○ (95%)	×	×	○ (a few)	○ (a few)	×	○ (a few)	×	×
7. Pongkai Baru	×	○ (10%)	×	×	×	×	×	×	○ (90%)	×	×	×
8. Mayang Pongkai	×	○ (100%)	×	×	×	○(2%)	○ (5%)	○(1%)	○ (20%)	×		×
9. Pongkai Istiqomah	×	×	×	○ (98%)	×	×	○ (a few)	×	×	×	×	○ (a few)
10. Tanjung Alai	×	×	×	○ (a few)	×	×	×	×	×	○	×	×
11. Muara Tukus	×	○ (a few)	×	○	×	×	×	×	×	×	×	×
12. Koto Tuo	○ (15%)	○ (100%)	×	○ (60%)	×	×	○ (5%)	×	×	○ (10%)	×	×
13. Muara Mahat Baru	×	○ (10%)	×	×	×	○(20%)	○ (5%)	○(1%)	○ (15%)	×	×	○ (5%)
14. Gunung Bungsu	×	○ (50%)	○	○	×	×	×	×	○	×	×	○
15. Tanjung Pauh	×	×	○ (15%)	○ (15%)	×	×	○ (10%)	×	○ (50%)	○	○ (15%)	○ (10%)
16. Tanjung Balit	×	×	○ (30%)	○ (10%)	×	×	○ (5%)	×	○* (30%)	○ (20%)	○ (20%)	×

Note : ( ) shows the engaged rate (%) of household in the village.

\* Plantation workers include gambier plantation workers in Tanjung Balit.

Source: Interview results of PAFs

## (2) Income Sources of Villages

Sources of income were surveyed and categorized based on the main and supplemental income sources. The results of the survey are summarized below:



Table Income Sources

Income Type		Village	Main Income Source	Supplementary Income Sources
A	A-1	Binamang, Pongkai Lstiqomah, Muara Takus	Fishery	-
	A-2	Batu Bersurat, Tanjun Alai	Fishery	Wood worker
	A-3	Koto Tuo	Fishery	Wood worker, Inter-cropping of plantation, Food crop cultivation in farmland
B		Pulau Gadang, Koto Mesjid	Inland fishery	Casual labor, Inter-cropping of plantation
C	C-1	Tanjung Pauh, Tanjung Balit	Gambier cultivation	Fishery, Casual labor
	C-2	Gunung Bungsu	Gambier cultivation	Fishery, Casual labor, Food crop in farmland
D		Ranah Sungkai, Lubuk Agung, Pongkai Baru	-	Plantation worker, Wood worker, Food crop cultivation in farmland
E		Muara Mahat Baru, Mayang Pongkai	Palm oil	Poultry farming, Plantation worker

Source: Interview results of PAFs

Income type A shows that the main income source is fishery and five villages are included in this type. Villages under type A are located near dam reservoir and these villages utilize this water potential for income generation. Type A is further divided into three sub-types based on the supplementary income source. Depending the accessibility to the dam reservoir, supplementary income source is diversified. It means that type A-3 indicates poorest accessibility to the dam reservoir.

Income type B is that the main income source is inland fishery, and supplementary income sources are casual labor, and inter-cropping of plantation area. The villages under type B carried out inland fishery, since those villages are located in lower area or have small rivers. Using this water resource potential, villagers developed fish ponds with the assistance of the Fishery Department of the University of Riau.

Income type C is that the main income source is gambier cultivation, and three villages are included in this type. Type C is subdivided into two sub-types based on supplemental income sources. In Tanjung Pauh and Tanjng Balit under type C-1, villagers cultivate *gambir* using community land in the original village before relocation. In Gunung Bungsu under type C-2, on the other hand, villagers cultivated *gambier* in farm plots for food crops.

Income type D does not have any main income source. The supplementary income sources are labor wage based works such as plantation worker and wood worker. In addition, food crop cultivation in farm plot is also important in type D. It is observed that income type D represents villages in the most serious economic condition, since they have no main income source due to limited natural resource during the grace period of rubber plantation.

The main income source of Type E is palm oil plantation and supplementary income

sources are poultry farming, and plantation worker. The palm oil trees are cultivated successfully in most cases and produce a sufficient level of income to the farmers. Using such income, some villagers start chicken raising as new investment with the technical guidance of local private chicken processing company.

### (3) Assessment of income in each income type

The income of rubber plantation was examined through investigation in the other villages of Kampar Regency. According to the age of rubber plants, the annual income of rubber plantation (2 ha) varies from Rp.8.0 million to Rp.17.0 million. This amount is said to be the target income during the grace period of rubber plantation. The income by plant age is shown below:

**Table Income of Rubber Plantation**

Age of Rubber Plants (year)	Rubber Production (kg/day/ha)	Days of tapping (days/month)	Months of tapping (months/year)	Rubber Production (kg/ha/year)	Price of Rubber (Rp./kg)	Income (Rp./ha/year)
6-8	8-13(10)	15	11	1,650	2,500	4,125,000
8-10	13-15(14)	15	11	2,310	2,500	5,775,000
10-12	15-17(16)	15	11	2,640	2,500	6,600,000
12-15	17-19(18)	15	11	2,970	2,500	7,425,000
15-17	19-21(20)	15	11	3,300	2,500	8,250,000
17-25	(21)	15	11	3,465	2,500	8,662,500

Source: Plantation Service of Riau Province

The income per farm household in each income type was estimated through an interview of farmers. The result of income estimation is shown below:

**Table Gross Income of Type A-1 (Fishery only)**

Village: Pongkai Istiqomah

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)
Fishery	N.A.	N.A.	10,860,000

Source: Interview results of PAFs

For estimation of gross income for fishery, interview survey was made in Pongkai Istiqomah near the dam reservoir (0.5-1.0km). Almost all the village households are engaged in the fishery. The farmers catch fish in the reservoir, and sell the yield directly to the local market, or process it to sell it as smoked fish at the local market. The annual income is around Rp.11.0 million, the same as the income from rubber cultivation (2 ha).

**Table Gross Income of Type A-2 (Fishery / Wood Worker)**

Village: Batu Bersurat

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)
Fishery	12,500	240	3,000,000
Wood worker	17,500	240	4,200,000

Source: Interview results of PAFs

In Batu Bersurat, fishery is the main income source, 65% of the households are engaged in the fishery. However, the annual income from the fishery is limited to only Rp.3.0 million, low in comparison to Type A-1. Around 20% of the households receive income as wood workers. The annual income of wood workers is estimated to be Rp.4.0 million. The income of both activities is much smaller than the income of rubber cultivation (2 ha).

**Table Gross Income of Type B (Inland fishery / Casual labor, Inter-cropping)**

Village: Koto Mesjid

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)	Remarks
Inland fishery	N.A.	N.A.	8,200,000 (Net)	
Inter-cropping of plantation	N.A.	N.A.	2,000,000 (Net)	Watermelon is mainly cultivated
Plantation worker / Inland fishery worker	27,500	200	5,500,000	Male case
Plantation worker	15,000	200	3,000,000	Female case
Wood worker	20,000	90	1,800,000	
Temporal city worker	25,000	75	1,875,000	
Seller	N.A.	N.A.	6,000,000	

Source: Interview results of PAFs

In Koto Mesjid, inland fishery is the main income source and 60% of the households are engaged in it. They construct fish ponds in their farm plots. The annual net income is Rp.8.0 million, which is smaller than the income of rubber cultivation (2 ha). Therefore, they also work as casual labor or carry out inter-cropping of the plantation area. However, the income from these supplementary income sources is not very high.

**Table Gross Income of Type C-1 (Gambier cultivation / Casual labor, Food crop cultivation)**

Village: Tanjung Balit

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)
Gambier cultivation	N.A.	N.A.	3,000,000
Fishery	12,500	300	3,750,000
Gambier field worker	25,000	90	2,250,000
Wood worker	30,000	96	2,880,000
Quarryman	25,000	240	6,000,000
Trader	N.A.	N.A.	N.A.

Source: Interview results of PAFs

In Tanjung Balit, the main income source is gambier cultivation, which is cultivated by 30% of the households. Moreover, 20% of the households receive income as farm labor for gambier cultivation. The fishery and casual labor are identified as the other supplementary income sources. The annual income of all activities is much smaller than that of rubber cultivation (2 ha).

**Table Gross Income of Type D (No main income source / Worker, Food crop cultivation)**

Village: Pongkai Baru

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)
Rubber plantation worker	10,000	180	1,800,000
Food crop in farmland	N.A.	N.A.	750,000 – 2,000,000

Source: Interview results of PAFs

In Pongkai Baru, the main income source is farm labor in rubber plantation and 90% of the households are engaged in it. On the other hand only 10% of the households cultivate food crops in their farm plots. The income of rubber plantation workers is only Rp.2.0 million, much smaller than the income of rubber plantation (2 ha). The income of food crop cultivation is also very limited. Therefore, the economical condition is very serious in this village.

**Table Gross Income of Type E (Palm oil / Poultry farming, Plantation worker)**

Village: Mayang Pongkai

	Income / day (Rp. / day)	The possible working days / year	Income / year (Rp. / year)
Palm oil(2ha)	N.A.	N.A.	28,980,000
Food crop	N.A.	N.A.	N.A.
Poultry farming	N.A.	N.A.	18,000,000(Profit)
Plantation worker	25,000	220	5,500,000
Carpenter	30,000	200	6,000,000
Trader	N.A.	N.A.	N.A.

Source: Interview results of PAFs

In Mayang Pongkai, the main income source is palm oil cultivation. Its annual

income is Rp.29.0 million, that is, much better than the income of rubber plantation (2 ha). Out of 259 households in total, 202 households (78%) maintain palm oil plantation. However, 57 households cannot cultivate palm oil because: i) the plantations of 39 households were occupied by the local people, and ii) 18 households have not yet received a plantation area of palm oil by transfer from nuclear estate, since the growth of plants is poor. Only six households are engaged in poultry farming and the annual net income is Rp.18.0 million. This income is better than that of rubber plantations. Around 20% of the households are engaged as plantation workers. However, the income of plantation worker is very small.

Based on the above estimates, the income level by income source type is assessed and the result is summarized below:

**Table Income Level by Type of Income Source**

Income Type	Main Income Source	Supplementary Income Sources	Income Level Comparing Rubber Plantation (2ha)	
<b>A</b>	A-1	Fishery	-	High
	A-2	Fishery	Wood worker	Low
	A-3	Fishery	Wood worker, Inter-cropping of plantation, Food crop cultivation in farmland	Low
<b>B</b>	Inland fishery	Casual labor, Inter-cropping of plantation	Low or slightly low	
<b>C</b>	C-1	Gambier cultivation		Low
	C-2	Gambier cultivation		Very low
<b>D</b>	-	Plantation worker, Wood worker, Food crop cultivation in farmland		Very low
<b>E</b>	Palm oil	Poultry farming, Plantation worker		High

Source: Interview results of PAFs

**(4) Cost and benefit analysis of major income source**

In parallel with the assessment of income level, cost and benefit analysis of major income sources other than rubber and oil palm plantation was carried out. Considering the present income generation activities, labor works are excluded from this analysis, since most of PAFs prefer to carry out their activities using their own sources in their villages. The result of cost and benefit analysis of major income generation is as follows:

**Table Cost and Benefit Analysis of Main Income Generation Activities**

Main Income Source	Village / Crop	Area	Initial cost (Rp.)	Running cost(A) (Rp. / year)	Gross Income(B) (Rp. / year)	Net Income (B) – (A) (Rp. / year)	
Inter-cropping of plantation	Koto Tuo	Rice	1ha	1,900,000		3,000,000	1,100,000
		Corn	1ha	1,900,000		3,000,000	1,100,000
		Watermelon	1ha	1,900,000		3,200,000	1,300,000
		Chili	200 m <sup>2</sup>	250,000		750,000	500,000
Food crop cultivation	Koto Tuo	Orange	0.4ha	6,250,000	1,500,000	9,000,000	7,500,000
		Rice	0.4ha	760,000		1,360,000	600,000
		Corn	0.4ha	760,000		1,360,000	600,000
		Chili	200 m <sup>2</sup>	250,000		850,000	600,000
Gambier cultivation	Tanjung Balit	1ha	2,000,000	100,000	3,000,000	2,900,000	
Inland fishery	Koto Mesjid	375 m <sup>2</sup> (Pond)	13,880,000	6,900,000	15,100,000	8,200,000	
Poultry farming	Mayang Pongkai	3,000 heads	20,000,000	—	18,000,000 (12,600,000 to 24,000,000)	18,000,000 (12,600,000 to 24,000,000)	

Source: Interview results of PAFs

## 4.2 Review of Action Plan

### 4.2.1 Institutional Aspects

#### (1) Background of Action Plan

The meeting to discuss action plan on social and natural environmental issues caused by the Project was organized by BAPPENAS with participants of high-ranking officials of Provincial Governments of Riau and West Sumatra on 21st August 2001. In the meeting, it was concluded among JBIC, BAPPENAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota and relevant agencies that an action plan would be prepared by mid September. Based on the discussion, the Provincial Government of West Sumatra submitted an action plan to BAPPENAS in October 2001 and JBIC received the action plan from BAPPENAS in early November 2001. The Provincial Government of Riau submitted an action plan to BAPPENAS in early December 2001 and JBIC received this action plan from BAPPENAS in early December 2001. PLN submitted an action plan for environmental monitoring and management to BAPPENAS on 3<sup>rd</sup> December 2001 and JBIC also received the action plan from BAPPENAS in early December 2001.

Based on the above action plans, a meeting was held on 4<sup>th</sup> December 2001 attended by JBIC, BAPPENAS, PLN, the Provincial Governments of Riau and West Sumatra, the Regency Governments of Kampar and Lima Puluh Kota, and the Ministry of Forest (MOF). The results of this meeting are summarized below:

- BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota and Ministry of Forest (MOF) agreed to implement the action plans in order to solve the remaining issues related to the Project;
- BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota and MOF agreed to take necessary action to allocate budget in order to implement the action plans;
- BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota and MOF decided, under the strong initiative of BAPPENAS, to set up a task force to monitor progress and implementation of the action plans;
- The task force would consist of BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota, MOF and other members as required.
- It was confirmed that the Provincial Governments of Riau and West Sumatra and the Regency Governments of Kampar and Lima Puluh Kota would consider applying a participatory approach to addressing social and natural environmental issues amongst stakeholders;
- It was confirmed that these three action plans are tentative to be reviewed and modified through further discussions amongst BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota, and MOF.

The Riau and West Sumatra action plans are shown in Tables 4.5 and 4.6, respectively, and are summarized below:

**Table Major Items of Action Plan**

Riau Province	West Sumatra Province
1. Rehabilitation of Rubber Plantation	1. Rehabilitation of Rubber Plantation
2. Clean Water Supply System	2. Clean Water Supply System
3. Legal Procedure of Land	3. Legal Procedure of Land
4. Rural Road Improvement	4. Livestock Development
5. Livestock Development	5. Fishery Development
6. Fishery Development	6. Socialization Program and Training
7. Environment (To be made by PLN)	7. Reforestation (To be Considered)

Source: Riau and West Sumatra action plans, December 2002

## (2) Process of Preparation of Action Plans

### i) Riau Province

In response to the result of the meeting held on 21<sup>st</sup> August 2001, the Provincial Government of Riau, in cooperation with the Regency Government of Kampar, commenced the formulation of an action plan. The provincial Plantation Service had prepared a plan for the rehabilitation of rubber plantations in 1998. Based on this plan, 1,544 ha and 5,338 ha of rubber plantation area have already been rehabilitated in 1999 and 2000, respectively. In addition to rubber plantation, construction of water supply facilities has also been carried out since 1999 when funding was available. A part of legal procedure for land titling, livestock and fishery development were undertaken as normal development work for regency when funding was available. As for road construction of the plantation, the plan was prepared in 1999. Based on the existing activities and plans, each department in-charge prepared an action plan including a budget plan. It is observed to some extent that departments do not clearly understand the purpose of the action plan.

During the resettlement process of villages, a committee was organized for accommodating the requests or comments of PAFs. However, the committee was dissolved in 1998. Considering the requests or comments collected by the committee, each department in charge has prepared the development plan for the resettlement villages. However, people were not involved directly in the process of formulating the existing plans and the action plan. In the rehabilitation program of rubber plantations, villagers were involved at the implementation stage.

### ii) West Sumatra Province

Past efforts for improvement of the resettlement villages in West Sumatra Province are limited. The major effort in the past was the rehabilitation program of rubber plantation and water supply system. However, both programs could not provide desirable results. In response to the result of the meeting held on 21<sup>st</sup> August 2001, the Provincial Government of West Sumatra and Regency Government of Lima Puluh Kota entrusted Andalas University to prepare an action plan for PAFs. Based on the action plan prepared by Andalas University, the relevant provincial government departments estimated the required cost for the implementation of activities proposed in the action plan. However, the cost of some activities proposed in the action plan was not estimated, namely, land improvement, gambir



cultivation, annual crop cultivation, clarification of the promise made by government, increase of the number of teachers, construction of a junior high school, increase of the number of medical workers, etc.

The action plan was explained on 6<sup>th</sup> February 2002 to both Tanjung Balit and Tanjung Pauh. The major contents of the discussion in the public hearing at the village level are as follows:

#### Tanjung Balit

- The villagers had agreed with the action plan that aimed to improve Tanjung Balit villagers. But they did not want the action plan to fail like the last time. So that they requested :
  - a. To maximize their control over the action plan through the involvement of a villagers' representative;
  - b. Asked the Local Government to provide an MOU letter witnessed by the villagers, stating that the action plan would be done honestly and that the villagers would not be exploited for personal interests.
- The compensation case should be clarified.
  - a. In the original Agreement, the rubber plantation was to be tapped seven years after resettlement. Unfortunately, even at nine years since resettlement the rubber plantation could not be tapped. Therefore, the villagers demanded compensation for the rubber planting for 2 years.
  - b. The plants located at higher levels than submerged areas (which were not considered for compensation) could not grow due to the effect of flooded area. So the villagers demanded compensation.
  - c. With respect to reforestation planned by the Local Government in the action plan, the villagers had requested that the program replace tree species previously existing near the dam area and other parts of the catchment. These areas were not only planted with pine trees, but also fruits like durians, rambutan, mangoes and others.

#### Tanjung Pauh

- The villagers did not reject the assistance to be given in the action plan, but stressed the importance of compensation.
- Some of the villagers said that they clearly understood the village needs and so should exercise some authority in making the action plan.

### (3) Organizational Structure for the Action Plans

- i) Overall Structure of Governmental Agencies Concerned

BAPPEANS are taking initiative for formulating the action plans and carrying out the overall coordination of the different government agencies involved. Both provincial and regency governments prepared the action plans and took responsibility for their execution. PLN has responsibility for formulating the action plan on the natural environment and implementation of the monitoring plan. Other ministries would be involved in implementing the action plan and allocating the budget, as required. In addition, the task force will be organized by BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota, MOF and other members in order to implement and monitor its progress in the action plan area. The role of each organization is shown below:

Table Overall Structure of Governmental Agencies Concerned

Name of Organization	Role of Organization
National Development Planning Agency (BAPPENAS)	- Report of overall monitoring and management of consolidated Action Plan to be made by Task Force - Coordination amongst agencies concerned of GOI
Riau Province (PGR) and Kampar Regency (RGK)	- Preparation of Action Plan on PAFs - Rehabilitation of water supply facilities - Rehabilitation of rubber plantation - Development of other income sources - Construction of rural road - Others
West Sumatra Province (PGWS) and Lima Puluh Kota Regency (RGLPK)	- Preparation of Action Plan on PAFs - Rehabilitation of water supply facilities - Rehabilitation of rubber plantation - Development of community - Others
State Owned Electricity Company (PT. PLN)	- Executing Agency of the Project Implementation and Operation - Preparation of Action Plan on water quality of the reservoir, measures to water related disease, fertility of downstream reach, sedimentation in the reservoir - Monitoring on the above environmental items - Implementation of countermeasures on the above environmental items - Preparation and submission of environmental progress report
Ministry of Forest (MOF)	- Implementation of wildlife monitoring and conservation (To be considered)
Other Ministries	- As required for implementation of the Action Plan and allocation of budget
Task Force to be organized by BAPENNAS, PLN, Provincial Governments of Riau and West Sumatra and Regency Governments of Kampar and Lima Puluh Kota, MOF and other members	- Overall monitoring and management of consolidated Action Plan

Source: Minutes of Discussions on Social and Natural Environmental Issues of the Project, December 2001

ii) Organizational Structure at Provincial and Regional Level

Riau Province

In Riau province, the budget source and responsibility for implementation of each action plan is clearly defined as follows:

Table Organizational Structure at Provincial and Regional Level

Items of Action Plan	Budget Source	Executing Agency
1. Rehabilitation of Rubber Plantation	Provincial APBD	Provincial Plantation Service with Plantation Service or Regency
2. Clean Water Supply System	Regional APBD II	Human Settlement Public Work Office of Regency
3. Legal Procedure of Land	Regional APBD II	National Land Affairs Office of Regency
4. Rural Road Improvement	Regional APBD II	Public Works of Regency
5. Livestock Development	Regional APBD II	Animal Husbandry Office of Regency
6. Fishery Development	Regional APBD II	Fishery Office of Regency

Source: Riau action plan, December 2002

The provincial government will take responsibility for the rehabilitation of rubber plantations, including both budget arrangements and implementation, since the total amount of budget is much larger than the other activities. The other activities for the action plan will be the responsibility of the regency government. Each executing agency involved has contributed to the plan, including specifying the necessary budget. The BAPPEDA of both province and regional governments will then prepare a budget plan based on the amounts proposed by the executing agency.

West Sumatra Province

In West Sumatra province, the responsibility for implementation of the action plan comes under Lima Puluh Kota Regency. It is defined as follows:

Table Organizational Structure at Provincial and Regional Level

Items of Action Plan	Executing Agency
1. Rehabilitation of Rubber Plantation	Agriculture and Estate Office of Regency
2. Clean Water Supply System	Human Settlement Public Work Office of Regency
3. Legal Procedure of Land	National Land Affairs Office of Regency
4. Livestock Development	Animal Husbandry Office of Regency
5. Fishery Development	Fishery Office of Regency
6. Socialization Program and Training	Lima Puluh Kota Regency

Source: West Sumatra action plans, December 2002

The above table shows that all the activities are under the responsibility of Lima Puluh Kota Regency. The responsibility of West Sumatra province is limited to coordinating the budget arrangements and implementing the action

plan. On the other hand, the responsibility for providing fund is not clear. In the Feedback Workshop held on 26 March, the BAPPENAS explained that the central government had been asked through respective agencies to allocate the budget to fund the activities relating to the resettlement program. The regency government expressed that they expected to apply the same procedure to arrange budget for implementation of the action plan.

#### (4) Budget for Past Effort and Action Plan

The expenditures or budget for past effort and actions to be taken in FY 2002 are collected from BAPPEDA of both Province and Regency Governments. These expenditures/budgets are related to the resettlement villages and summarized below:

**Table Budget/Expenditures for Past Effort and Action Plan**

(Unit: Thousand Rp.)

	1999	2000	2001	2002
<b>Kampar Regency and Riau Province</b>				
Provincial Budget				
Rehabilitation of Rubber Plantation	9,849,915	11,720,477	9,906,249	10,342,750
Regency Budget				
Water Supply	n.a.	1,856,769	4,629,552	683,324
Road Maintenance & Improvement	n.a.	3,136,383	2,399,043	8,259,063
Housing	-	-	-	11,350,000
Education	-	-	-	1,889,780
Health	-	-	-	626,198
Fishery	-	-	-	2,977,750
Total	9,849,915	16,713,629	16,934,844	36,128,865
Per Village (Estimated)	703,565	1,193,831	1,209,632	2,580,633

	1999	2000	2001	2002
<b>50 Kota Regency and West Sumatra Province</b>				
Provincial Budget				
Rehabilitation of Rubber Plantation	583,987	0	0	0
Preparation of Action Plan	0	0	56,000	0
Reforestation Program	0	0	0	1,100,000
Regency Budget				
Water Supply	n.a.	498,215	0	-
Construction of Terminal	n.a.	0	349,509	-
Others	n.a.	18,275	250,000	700,000
Total	583,987	516,490	655,509	1,800,000
Per Village (Estimated)	291,994	258,245	327,755	900,000

Source: BAPPEDAs of Kampar Regency and Riau Province as well as 50 Kota Regency and West Sumatra Province

The above table indicates that the amount of investment to resettlement villages in Riau Province is much larger than to those in West Sumatra province. The difference varies from 2.4 times in 1999 to 4.6 times in 2000.

The regional development budget of provinces and the budget of regencies are compared as follows:

**Table Regional Development Budget (APBD)**

(Unit: Million Rp.)

	1999	2000	2001
Riau Province	242,788	565,498	827,261
West Sumatra Province	110,733	127,989	137,988

Source: BAPEDAs of Riau Province and West Sumatra Province

**Table Budget of Regency**

(Unit: Million Rp.)

	Items	1999	2000
<b>Kampar Regency</b>			
	Development	45,708	47,850
	Permanent Cost	105,513	110,456
	Total	151,221	158,306
<b>50 Kota Regency</b>			
	Development	32,805	46,447
	Permanent Cost	32,131	100,330
	Total	64,936	146,777

Source: BAPEDAs of Kampar Regency and 50 Kota Regency

The above table shows the large difference of regional development budget (APBD) between Riau and West Sumatra Provinces. APBD of Riau is six times that of West Sumatra province in 2001. On the other hand, only a small difference exists between Kampar Regency and Lima Puluh Kota. It is therefore said that Kampar Regency utilizes other sources for development activities such as provincial funds or national project funds.

#### 4.2.2 Water Supply System

##### (1) Kota Kampar, Riau Province

The BAPPENAS in Kampar Regency has put forward an action plan for improving the water supply. The program identifies a budget of Rp. 750 billion to carry out the following activities:

- Geophysical survey to find groundwater
- Finding new sources of surface water
- Design of transmission and distribution systems
- Operation and maintenance

BAPPENAS referred the team to the Kampar Regency PU office for details of the

program but PU was unaware of all the projects in this program. It did however provide a list of the projects it had recently completed and a list of the projects it proposed for 2002.

In on-going efforts to alleviate hardship during the periods of drought, the PU has implemented a number of small surface water catchment schemes where water can be supplied by gravity to a distribution point in or near to the village. The proposed schemes are all the same and consist of: a small concrete check dam built at the source to capture water, a galvanized iron pipeline to a small concrete storage tank in the village. The storage tank incorporates a slow sand filter to remove pathogens.

PU projects proposed for 2001 are presented in Table 4.7. A total of seven projects were proposed in seven villages with a total budget of Rp. 1,362 million. A total of five projects were completed in 2001. The projects that were not completed in 2001 will be completed in 2002. Only three projects are proposed for 2002 and these are presented in Table 4.8. The total budget is Rp. 898 million.

The PU has put all its efforts in finding a water source that can be delivered to the user by gravity. Because no pumping is required, the costs of developing, operating and maintaining the system are relatively low. The disadvantage is that gravity flow systems usually restrict the source to a specific location and the success of this option is very dependant on local topography. The PU has not identified alternate sources in places where a gravity system does not work.

A number of schemes has already been implemented but the team observed many inconsistencies in the quality and effectiveness of the schemes during the site visits:

- Koto Mesjid (no filter, storage is small and there are no taps for the public, water overflows onto the ground)
- Lubuk Agung new scheme (no filter, storage tank is small, no connection to public hydrant, water pours out of the overflow onto the ground)
- Lubuk Agung old scheme (the check dam has been breached and no water is collected)
- Batu Bersurat (small pond is unprotected, water must be pumped to storage, storage is small and there is no public hydrant in the village or tap at the reservoir)
- Binamang (the check dam provides a large quantity of water directly to the MCK, there is no storage and water is wasted)
- Tanjung Alai (the check dam provides a large quantity of water, the transmission pipeline is not connected to the storage tank, the difference in head between the source and the tank is small < 6m)

- Koto Tuo Block A (the check dam near block A provides a large quantity but there is no storage in block A. The water is piped over 2 km to a storage tank with filter in block C; there is no public hydrant or tap at the storage reservoir; the tank is full).
- Koto Tuo Block C (the check dam leaks and there is not enough water to reach the outlet pipe located at the top of the dam. A second storage reservoir with filter is empty because the difference in elevation between the tank and the source is small < 3m).

A number of factors contribute to the failure or success of each scheme and the quality of the work provided by contractors:

- PU has usually identified the source but there is no detailed technical study to confirm that the quantity of water is sufficient, that water quality is acceptable, or that the available head is sufficient. Details like how much storage should be provided, and how to distribute the water to villagers are not always included in the schemes.
- There is a design standard but there is no quality control in the field and what is actually provided depends on the contractor. The size of reservoirs varies greatly from one site to the next. Filters are specified in the standard design but the contractor does not always provide these.

## (2) 50 Kota, West Sumatra

To address problems in Tanjung Balit and Tanjung Pauh the PU in 50 Kota, West Sumatra has put forward an ambitious action plan for developing a gravity water supply scheme with individual house connection. A cost breakdown for the project is presented in Table 4.9. The program identifies a budget of Rp. 5,765 million to provide the following:

- New check dam with access road
- New transmission pipeline
- A slow sand filter
- New distribution piping with individual connections to each house
- Improved drainage for removing wastewater

The intent is for PDAM (a private rural water supply operator) to operate and maintain the system on a cost recovery basis. The source of raw water is the Bukit Lakuak but technical details of the scheme have not been worked out and a detailed site survey will be required. It appears rather unlikely that there will be a sufficient head to distribute water to every house.

### 4.2.3 Plantations

#### (1) General

An Action Plan for PAF rubber and oil palm plantings in Riau and West Sumatra Provinces was prepared in early 2002, through the collaborative efforts of the Research Institute of Andalas University and the West Sumatra Development and Planning Board.

In broad terms, the action plan and the range of identified problems upon which it is based, lacks the comprehensive data base, analysis and detailed actions which would be required to rectify the past development shortcomings, and foster a more uniform set of conditions for enjoyment by the PAFs in the future.

It would appear that the action plan for PAFs has been confined to rubber plantings, to the exclusion of oil palm. Although the main problems do exist in relation to the rubber plantings, which have been or should have been developed for PAFs in both Riau and West Sumatra Provinces, some significant problems do in fact also exist in relation to the oil palm areas that have been developed.

In the case of PAF rubber plantings, the recommended action plan provides some useful pointers, but lacks detail and appears to be confined to the situation in Riau Province.

#### (2) Specific Aspects of the action plan

Three aspects related to plantation crop development have been specifically mentioned in the action plan to deal with the post-development problems of the Project. The three aspects are as follows: -

- a) Rubber plantation development, which has failed to the extent of 5,392 hectares.
- b) Low fertility status of land in the resettlement areas.
- c) Road access development in resettlement areas.

The action plan points to actions which have already been taken in relation to each of the aspects listed above, and suggests further actions which are required and the time schedule during which these actions should be applied.

In summary, the actions recommended in relation to each aspect, are as follows: -

##### a) Failed Rubber Development

- Proposal that allowance should be made for the requisite standard maintenance to be applied to rubber plantings up to and including Field Year 3 for all plantings, up to calendar year 2006.



- Proposal that there should be a land suitability study of areas that have been or are to be used for PAF plantation crop development.

b) Low Land Fertility Status

- Proposal that agro-forestry and forestry should be undertaken where land fertility demands it.

c) Road Access Development in Resettlement Areas

Proposal that requisite road development should be undertaken, particularly in support of efficient plantation crop development and exploitation.

#### 4.2.4 Income Generation Activities

##### (1) Review of Action Plan in West Sumatra Province

In the action plan formulated by the Government of West Sumatra Province, the following constraints to income generation activities were identified and countermeasures proposed.

**Table Action Plan for Income Generation Activities**

	<b>Constraints</b>	<b>Income Source</b>
<b>Inter-cropping of plantation</b>	The rubbers plantation was not grown as scheduled and accordingly, no inter cropping was made.	Inter crop between the row of the crops should be planted among the rubbers or the gambier plantation
<b>Food crop cultivation in farm plots</b>	The land has not been used properly, Most of them still left, since the land is not fertile. It is also observed that the farm plots are easily attacked by the wild pigs.	The farm plots should be used for the crops such as: chili, beans, lime, <i>jengkol</i> , <i>rumbutan</i> and <i>nangka</i> , if they grow well in this area. However, the cultivation should be maintained properly with the technical guidance. Introduction of wild pig hunting should be considered since that will be incentive for farmers.
<b>Gambier cultivation</b>	Villages opened the new cultivated area of gambier by cutting the trees in the forest area or utilization of sloped area around the original village due to failure of the rubber plantation, the. As a result, the erosion is very easily occurred and the land productivity decreased reapidly.	The technical guidance is required to carry out the proper cultivation of gambier. The gambier should not be cultivated in the land of original village. Soil fertility and conservation as well as crop rotation should be considered correctly. If the gambier is not profitable, it should be replaced by the rubber.
<b>Fishery</b>	1. Low quality of fish fly as well as insufficient knowledge and technical skill on fish production. 2. Insufficient training program on fishery from the relevant institution. 3. Difficulty of capital arrangement	1. Implementation of training program on how to breed the fish fly properly, namely: <i>gurami</i> , <i>lele</i> and <i>patin</i> . 2. Expansion of business of fish fry production in the resettlement village. 3. Development of standard design for the usage of the fish pond. 4. Conservation of fish resource against the ecological change.
<b>Livestock</b>	1. Livestock breeding (cow, buffalo, goat, duck and chicken) is made traditionally. 2. The efficiency of land use is very low 3. Insufficient training program on fishery from the relevant institution. 4. Difficulty of capital arrangement	1. Implementation of training program to improve the knowledge and skill on breeding, arrangement of the feed, and the prevention of the disease. 2. Implementation of trails of chicken breeding, the goat and the plantation of grass such as elephant grass, king grass etc.

Source: West Sumatra action plans, December 2002

At present, no action has been made so far in West Sumatra province. However, PAFs cultivate gambier to get income without any assistance of the government. Through the field investigation of SAPS Team, the countermeasures for gambier cultivation are reasonable and should be taken as soon as possible considering environmental conservation. For other income sources, most of the PAFs have no or limited experience to do it. Therefore, more detailed planning is required prior to the commencement of the action plan. The items to be checked are: i) availability of a source of funding, ii) confirmation of land and water resources, iii) assessment of present technical possibility of village people for livestock, and iv) possibility and content of training program or trial plots.

## (2) Review of Action Plan in Riau Province

In Riau Province, the action plan proposed some activities for strengthening the fishery and livestock sub-sectors as income generation activities. For improvement of crop cultivation or inter cropping in rubber plantation, action was not proposed completely. As for livestock sub-sector, action plan proposed only to provide 275 cows for 75 families. On the other hand, various activities were proposed for the fishery sub-sector. The budget plan and the proposed activities for income generation in the action plan are summarized below:

**Table Action Plan for Income Generation Activities**

<b>Income source</b>	<b>Action Plan</b>	<b>Period</b>	<b>Fund(total) (Rp.million)</b>
<b>Fishery</b>	<b>Fishery development</b> - Floating net (200 units) - Fish seeds(200million)	2002	200
	<b>Fishery business development</b> - 300,000 fishes - Fish breeding basket (300)	2002 to --	230
	<b>Fishery production development</b> - Additional fish seeds (7.7million)	2002 to --	101
<b>Livestock</b>	<b>Livestock development</b> - 275 Cow Breed/Beef Cattle for 75 families	2002 to --	569

Source: Riau action plan, December 2002

For introduction of fishery in resettlement villages, Kampar Regency has carried out various activities of fishery development since 1998. The objective of these activities is to improve the nutritional condition of the local population through expansion of fishery sub-sector. The major activities are: i) training program on

fish fry production, ii) technical guidance on construction of fish ponds, iii) training program on fish culture using floating-nets. Fishery department of Kampar Regency is scheduled to implement the programs for fishery sub-sector until year 2020 considering the potentials of resettlement villages.

For introduction of livestock in the resettlement village, the risk to high initial cost should be examined, even though some PAFs carried out poultry farming successfully in Mayang Pongkai.

#### 4.2.5 Others

##### (1) Compensation

It is understood in the local government of Riau province that there are some people who still complain about land compensation even though land compensation of resettlements have basically already been provided. Therefore, the issue on land compensation should be cleared through the court and funded from Central Government if the court upholds their claim. Based on this consideration, the proposed action plan includes only measurement of land area for land certification and issue of land certification. The National Land Affairs of Kampar has issued land certificates for an area of 5,489 ha for 3,444 PAFs until June 2001. It is scheduled to measure and issue land certification to the remaining PAFs.

In the local government of West Sumatra province, the consideration of compensation is not clear yet. With respect to land title, the proposed action plan includes: i) survey for boundary of plantation area Tanjung Balit (900 ha of 450 lots), ii) measurement of isolated area (196 ha of 67 lots), and iii) survey for village boundary between Tanjung Pauh and Tanjung Balit. The action plan seems to take action on claims of PAFs concerning isolated area. But, it is not yet decided if compensation to the isolated land area will be finalized based on the measurement result.

##### (2) Road Improvement

In Riau Province, the rehabilitation program of rubber plantation roads was made in 11 villages in fiscal year 2000. The total length of the rehabilitated roads is 158.5 km and some wood bridges are also installed. As a result of the rehabilitation program, the access to plantation area and to each plot was improved. In fiscal year 2001, 22.9 km of road (Batu Bersurat – Tanjung) was rehabilitated using funds financed by the World Bank. In addition to this, village roads of 14.4 km were improved in the resettlement villages. In the action plan prepared by the Riau

province and Kampar regency governments, 10 schemes were proposed and the current situation of the proposed schemes is summarized below:

**Table Current Situation of Schemes Proposed in the Action Plan**

No.	Action Plan			Actual Condition in Public Works		
	Proposed Schemes	Schedule	Proposed Budget (Rpx000)	Schemes to be Realized	Schedule	Estimated Cost (Rpx000)
<b>Road development and Bridge Replacement</b>						
1	G. Bungsu Village, Asphalt Road Betterment 1.5 km, Rehabilitation of Environment Road 3 km, culvert 8 unit and drainage.	2002 to ...	533,150	Road Development in G. Bungsu Village (1,8 km), Asphalt works, Drainage, Earth Work	2002	853,836
2	Upgrading of Artery Road 11,9 km: drainage 2,700 m, culverts 23 units located in Mt. Bungsu Villages	2002 to ...	900,000	(To be considered)		
3	Bridge Construction in Ranah Sungkai Village 30 m, P. Gadang Village 50 m, Koto Mesjid Village 14 m	2002 to ...	1,160,000	(To be considered)		
4	Road Upgrading in Batu Bersurat 5 km, Koto Masjid 2 km, T. Alai 6 km & G. Bungsu 6 km.	2002 to ...	3,420,000	(To be considered)		
5	Road Hardening in Koto Masjid Village 2 km & T. Alai Village 5 km	2002 to ...	1,330,000	(To be considered)		
6	Road construction to PLTA Koto Panjang, Batu Bersurat Village 1 km, Koto Tuo 3 km & Binamang 1 km	2002 to ...	550,000	Road Development, Road Graveling Binamang drainage, earth works, drainage, earth works	2002	980,000
<b>Road and Bridge Construction</b>						
7	Ring Road Construction of Koto Tuo Tourist Area	2002 to ...	1,086,384	(To be considered)		
8	Road Construction to K. Panjang HEPP Reservoir in Binamang	2002 to ...	2,200,000	(To be considered)		
9	Construction of Drainage in Koto Mesjid village, 3,000 m and B. Bersurat Village 4,000 m	2002 to ...	4,820,000	(To be considered)		
10	Construction of box culvert in Koto Tuo, Pangkal and Batu Bersurat Villages, 6 unit	2002 to ...	372,000	(To be considered)		

Source: Pubic Works, Kampar Regency

The above Table shows that only two schemes will be realized in fiscal year 2002. In adoption to the proposed scheme, Rp. 6,425 million for road and bridge maintenance in and around resettlement villages is allocated in the budget plan prepared by BAPPEDA of Kampar Regency.

In West Sumatra Province, on the other hand, the road improvement plan in the action plan is not clarified in terms of location, purpose, etc. No budget is proposed for road improvement in both province and regency budgets.

### (3) Training Program

In Riau Province, the training program includes fishery development and animal

husbandry development. Therefore, special training program for PAFs is not proposed in the action plan.

In West Sumatra Province, on the other hand, a training program has been proposed for community development of resettlement villages. In this program, the government proposed to train 20 villagers as core persons during the 3-year implementation period of the action plan. The core villagers (20 persons) will be trained in terms of the natural resource and human resource development mainly at village level. In the implementation of the action plan, the government expects that each core villager will guide and train 40 PAFs in the villages. As a result of the training program, it is expected that the local people could handle their village organization and maintain village resources properly.

### **4.3 Village Assessment**

#### **4.3.1 Mobilization of Local NGO**

Bina Swadaya, a local NGO whose base is in Jakarta, is employed for village assessment, which is to survey the potential for the implementation of the action plan as well as to supplement PRA meetings and statistical household surveys carried out for Impact Survey. The schedule of survey of each village affected by the Project is shown in the Figure 4.1.

Bina Swadaya mobilized four teams of surveyors for village assessment based on the method of holding informal small group meetings in each village. Each team consists of three surveyors. They lived in the assigned villages for a week as is shown in the Figure 4.1. The villages unaffected by the Project but selected for the comparison purposes for the Impact Survey are not included in the village assessment.

Each survey team is assigned to hold very informal interviews at places in each village such as a village grocery store, roadside, market place, farming area, a group of women specifically gathered for a meeting or an occupational group. Depending on the availability of these groups in each village, each survey team selected a group of villagers on an ad-hoc basis as appropriate. The detailed result of the survey is shown in the Appendix 3.

#### **4.3.2 Method of Village Assessment**

##### **(1) Studying on the History of Village**

In Indonesia, a village consists of a number of hamlets, or “dusun” in Riau Province

and “jorong” in West Sumatra Province. Thus in the first hamlet, a small group consisting of 10-15 people was arranged for a primary small group meeting. The topic of the meeting was to discuss the important events related to the the history of the village, notably before, during and after the resettlement as much as they can remember the events. The result is then confirmed in a different hamlet in order to clarify if there were any discrepancies, need to supplement and/or add comments. This is a secondary small group meeting for clarification of the result of the first meeting. The attendance for the secondary meeting is also 10-15 people.

What is clarified in the secondary meeting was further discussed for clarification and confirmation at a different hamlet of the village as tertiary confirmation process. Where only two hamlets existed, the largest is subdivided into two and a small meeting was held in each section in order to carry out at least three separate meetings. Where there were more than three hamlets, a meeting was carried out in each hamlet to avoid creating a feeling among the villagers that one was excluded. The result of the tertiary meeting is then considered as the final result of hearing survey.

#### (2) Transect of Village for Land Use

In order to obtain the conditions and the use of fields in the resettlement village, a team of surveyor makes transect of village, i.e. an ocular survey of the whole of village accompanied by the chief of the village, or the chief of hamlet. Based on the visit, the team then discusses in detail with the community members on the use of land, its potentiality, availability of resources to make better use of land and its status, associated problems, the efforts to cope with the problems and the necessary efforts to transform the community’s hopes into reality. The same discussion takes place in three hamlets.

#### (3) In depth Interview

The team should interview key informants of the cultural leader, opinion leader, entrepreneurs of the village as well as the village officers for supplementary information.

#### (4) Village Map

The Chief of the hamlet is asked to make a village map at the beginning of the survey period, which is between 5-7 days depending on the availability of time. The result is then presented at each meeting for studying the history of the village in order to clarify it. By exposing the map three times, it is confirmed as the village map illustrating the distance and time necessary for carrying out daily activities of

the villagers. (Note: This is not included in Appendix 3.)

#### 4.3.3 Result of the Survey for Village Assessment.

Because the village assessment is still on-going, only preliminary results are shown in Appendix 3. The following is a summary of the results so far.

##### a) Resettlement Process

As for the results of the PRA meeting summarized in Section 3.2, the village assessment exemplifies that the resettled families stated dissatisfaction on the compensation scheme. There are more statements on the forced move than the statement made during PRA meetings. They also stated that the community's proposal was not properly implemented. It is well illustrated in the statement obtained in Koto Tuo that they feared of military in moving to the relocation area. Binamang, Batu Bersurat and Gunung Bungsu, are the villages among others that they compelled to resettle.

Where there was no statement that they were not forced resettlement, the resettled families felt it was compulsory because of the fear of inundation of their villages. Associated with the resettlement process was that there was confusion and dissatisfaction as they arrived at the resettlement village. Statements obtained in Mayang Pongkai and Muara Mahat Baru, both of which chose to grow oil palm, illustrates the un-preparedness of the resettlement program. Because the compensation was not paid prior to resettlement, it appears that the feelings of the resettled families on the resettlement process as a whole became strongly negative.

##### b) Compensation

As is the case for the PRA meeting result, there is a strong resentment among the resettled families against the Government of Indonesia on the compensation issue. The major reasons for this are as follows:

- (i) There was no payment made before resettlement. As a result, resettled families suffered for daily life after resettlement;
- (ii) Assessment of the items of compensation was unjustifiably low;
- (iii) Signature of agreement on compensation was forced as the "security officer" forced them to sign the agreement for compensation;
- (iv) Some received adequate compensation, some received less, and some received nothing;
- (v) There must have been "double standard" of the rate of compensation; and

(vi) What was paid to the resettled families was not the full amount of money that had been made available, i.e. there had to have been embezzlement.

Although there are a number of complaints, Pongkai Istiqomah was the only village that received monetary compensation for resettlement without any new resettlement land and facilities. During the PRA meeting, this village is the only village that stated that life in the resettlement village is better and than before.

c) Rubber Plantation

Dissatisfaction on the provision of rubber plantation is summarized as follows, essentially the same statement as expressed during the PRA meetings:

- (i) Distance to the rubber estate from the resettlement is around 2-7 km;
- (ii) Rubber plantation area was constructed by contractor and no seedling was planted in the first place;
- (iii) There was a lot of disturbances to the seedlings by forest hogs, deer and elephants;
- (iv) The plantation area was not given adequate attention because the resettled families had to take care of the other aspects of daily life while rubber plantation area is very far, has no access road, and is often muddy. It is also difficult to pass swampy area where maintenance works for trail was also important; and
- (v) A lot of plantation area was burnt when the adjoining land was cleared away.

As above, issue of the provision of rubber plantation was mainly responsible for the initial programming of allocation of each plot. This was further negatively affected by the construction and planting program of the plantation not specifically catering for resettled families.

d) Water Supply

Depending on the natural conditions of one resettlement village to the other, the availability of drinking water for the resettlement families is different from one village to another. In Muara Takus, the quality of water from wells was inappropriate to use. Thus the local government built a check dam for water supply. This water source was good and able to meet the needs of the community at Muara Takus. The dam was constructed in two phases: first, developing embankment was carried out; second, placing 3 inch pipes up to the reservoir as long as 800 m. However, the dam did not function properly. It was then damaged when the water gate was closed, as the embankment was



not strong enough. The village lost the expectation of receiving a water supply.

The following is a summary of the result of village survey on water supply issues:

- Wells constructed by the government have not been functioning since resettlement;
- Wells constructed by the government are one for one house in some cases, and one well for three or four houses within a village without specific criteria;
- Most of the wells dry up during the dry season while use of deeper wells is possible only for drinking and cooking during dry season;
- Where wells were dug for more than one house, neighboring families cause troubles to each other on the use of well; and
- Because of the hillside settlement, resettled families moved to lower locations due to difficulties in obtaining water.

The list of complaints is endless. As mentioned above, it appears that the traditional use of river to meet water needs had to undergo a transition to the use of wells and other water supply systems without any understanding of how to provide such a water supply. To some extent, the resettled families did not know what would be the difference between one well to a house and one well to several houses. However, if the water yield is adequate, dissatisfaction among the resettled families and disputes with neighbors over the use of water may not occur.

e) Electricity Supply

As is stated during the PRA meeting, and shown in the result of statistical household survey, both installation and connection of electricity was free of charge in Pulau Gadang. They had enjoyed electricity generated by diesel engines three days after arriving at the village on 3<sup>rd</sup> September 1992. At that time, electricity was switched on even during the night while it was switched off during the daytime. Electricity using PLN line was effective since 1997. In Koto Mesjid, electricity generated by diesel engines was available after six months of resettlement. It was changed to PLN line from diesel engine without the knowledge of the resettled families. The electrical installation was free.

The other villages had to pay for the electricity supply. In general by the time they arrived in the resettlement village, there was no electricity in their house.

In later years, three to five years after the resettlement, they received electricity. Presumably, upon completion of the power generators of Kotapanjang Project, PLN began supplying electricity. The resettled families had to pay the cost of installation, according to the capacity of power supply. In the beginning, it was Rp 150,000-Rp.350,000 per unit for the power supply of 450 watt depending on the year of installation. For 900 watt of electricity supply, it costs Rp 300,000-Rp.750,000 per unit depending on the year of supply.

f) Housing Conditions

For the provision of housing conditions, the following is noted:

- (i) Constructed houses for resettlement were not semi-permanent, contrary to what was promised;
- (ii) In the first stage of relocation, the housing of 241 household are were constructed from timber;
- (iii) The timber was taken from the trees cut during land clearing;
- (iv) The process of construction was done in a hurry; therefore, the foundation hardening was not conducted;
- (v) There were unprepared houses at the time of resettlement;
- (vi) In Mayang Pongkai, 30 houses were flooded during the rainy season;
- (vii) Some had sold their houses and garden at a price of Rp.4.250.000 and moved to other places;
- (viii) Some resettled families had to camp during the initial stage of resettlement in order to keep their possessions from the rain since there was not enough space to keep them in the resettlement house; and
- (ix) A large number of resettled families who began living on the steep hillside at the time of resettlement eventually moved to the roadside.

Complaints on the housing conditions are endless. Essentially the contents of complaint are the same as that of PRA meetings.

g) Road Conditions

The villagers are generally satisfied with the conditions of the main road and roads linking villages. However, the conditions of the village roads are not considered adequate while the plantation roads in the other villages are considered unsatisfactory. Reasons for the dissatisfaction include:

- (i) Unsealed village roads, which are prone to erosion;
- (ii) The village roads are dark at night due to absence of street lighting;
- (iii) Location of the rubber fields is about 1-3 km from the residence and the

condition of the roads is quite good, although it is not asphalt yet.

During the PRA meetings, there have been a number of complaints on the conditions of plantation roads because in some cases they do not exist, are difficult to travel and are inconvenient for harvesting.

#### **4.4 Constraints and Issues**

##### **4.4.1 Institutional Aspects**

###### **(1) Lack of Peoples' Involvement in Formulating Action Plans**

In the process of formulating action plans, the governments considered the PAFs' opinions and tried to realize them. For the rehabilitation of rubber plantations, the government decided to involve people directly in the plantation work without any contractors. As a result, the rehabilitation program achieved much better results than past efforts in Riau province. This experience shows the importance of peoples' involvement in development activities. It is expected to continue it or expand other activities of the rural development. However, the involvement of PAFs in the planning stage is still weak in both Riau and West Sumatra provinces. It is also noted that direct dialogue or exchange of opinions at village level has been limited so far. As a result, unfortunately, the relationship between the government and PAFs has not improved, since the PAFs distrust the government through the history of resettlement program. And, the conflict between the government and PAFs is on the rise.

###### **(2) Expansion of Misinformation Relating to the Compensation**

At present, PAFs cannot confirm the information relating to the compensation is not secured due to i) overall information. It is observed that a lot of misinformation has spread to the PAFs and this has contributed to the conflicts between the government and PAFs and also between groups of PAFs. Moreover, PAFs have no official channel to confirm if the information is correct. Examples of some of the misinformation identified during the field survey of the Team were:

- i) That the Japanese consultant estimated adequate compensation costs but the Government of Indonesia applied a lower unit price with the balance of compensation being given to government officers.
- ii) That the Government of Japan invited some PAFs to Japan to pay additional compensation.
- iii) That the Government of Japan will pay additional compensation to some

villages or PAFs based on the results of surveys or studies made by JBIC. These pieces of misinformation increase peoples' demand and, accordingly, create new compensation issues.

### (3) Unclear Responsibility of Budget Allocation

In Riau province, the responsibility for arranging fund for implementation Action Plan is clearly defined. In West Sumatra province, on the other hand, the responsibility for budget arrangement is not clear yet. In the Feedback Workshop held on 26 March, the BAPPENAS explained that the central government through the sectors had asked for budget to be allocated to solve the issues relating to resettlement program. However, no commitment has been made by the central government for implementation of the action plan. The regency government noted that they expect to apply the same procedure to arrange budget for implementation of the action plan. If responsibility for budget allocation is not cleared, the action plan could not be implemented on time and further delay would be expected in West Sumatra province.

#### 4.4.2 Water Supply System

In response to problems encountered with the wells all villages (except Mayang Pongkai) were provided with a piped water supply system. These systems have all failed because the villagers could not afford to operate and maintain the systems. The problem of poor water quality and dry wells remains to be resolved.

Villagers are dissatisfied with the level of effort and commitment made by the government. Recent efforts to implement gravity schemes are commendable but do not go far enough. Providing solutions that work will require consultation with the villagers and a significant technical effort for proper planning and implementation. Without good planning solutions will continue to be implemented using the same trial and error methods that will most certainly increase the level of discontent.

Physical constraints such as water resources and topography must be taken into account as well as other fundamental factors that will contribute to the success or failure of a scheme. A list of preliminary issues and constraints to sustainable development of water supply systems is presented in Table 4.10.

There are many possible solutions to improve water supply. For every solution proposed the analysis would answer two important questions: can it be achieved?

What are the limitations? The outcome will be a list of technologies and countermeasures that are appropriate given the problems and the constraints.

#### 4.4.3 Plantations

After some ten years of perennial crop development activity, the situation is approximately as follows, although further confirmation is required:

- a) Oil palm development has proceeded in a relatively orderly fashion at two locations, viz. Mayang Pongkai and Muara Mahat Baru, both of which are in Riau Province.
- b) Rubber development has proceeded less than satisfactorily overall at 13 sites (two in West Sumatra and eleven in Riau).
- c) In Riau, all sites are now being developed utilising the PMU (UPP) System, but on a grant basis, after significant failures at many sites, which were initially, developed utilising the P2WK System (again on a grant basis).
- d) In West Sumatra, as far as can be ascertained to date, rubber is being developed for a second time on the P2WK (grant) System. The first time it failed, and the second attempt has been adversely affected by fires.
- e) Oil palm farmers are repaying credit (in many cases successfully), but the overall view of the oil palm development is complicated by;
  - The variability in productive capacity of the areas developed for the crop.
  - General resentment that rubber farmers received inputs on a grant basis.
  - The appropriation of some 39 settler plots by local farmers at one site, prior to the conversion of the said plots.
- f) Rubber farmers have yet to receive any income from their crop, even so far into the development period. Even though they receive a majority of their inputs on a grant basis, they often have to obtain other work to make ends meet. There is also variability among sites.

Based upon and arising out of the underlying concepts and implementation activities to date in the PAF plantation crop development areas, the most relevant issues appear to be as follows:

- a) The absolute necessity of explaining to PAFs, what has gone wrong so far, and seeking their full consensus for future ameliorative actions.
- b) The necessity of providing viable plantation crop areas as soon as possible to PAF settlers who have not yet been provided with or who have not yet been assisted with the development of such plantings.

- c) The necessity or other wise of attempting to compensate PAFs in some appropriate way for the variability in delivery and benefit which has occurred thus far in relation to plantation crop development.
- d) The absolute necessity of promoting the provision to PAFs of Overall Farming Systems that will improve the overall cash flow and viability of the holdings.
- e) The necessity of providing appropriate funding and development assistance to ensure the effective implementation of the proposed measures.

The constraints mitigating against the possibility of dealing constructively and appropriately with the issues noted above, are as follows;

- a) The already perplexed attitudes of PAFs to the action taken so far to deliver the balanced benefits promised in return for their earlier willingness to relocate from the created reservoir area.
- b) The technical difficulty, in some cases, of upgrading plantation crop areas, in view of their stage of development.
- c) The difficulty of providing a truly balanced set of benefits to the resettled PAFs, in the light of the long delays in rectifying past shortcomings.
- d) The difficulty of incorporating balanced farming systems in situations where plantation crop development has already proceeded too far to permit rational intercropping with complementary species.
- e) The difficulty of providing for timely funding of requisite upgrading of plantings, and compensation for existing anomalies.
- f) The difficulty of rapid modeling and structuring of requisite development and management frameworks to facilitate early rehabilitation and replanting activities, as required.

#### 4.4.4 Income Generating Activities

It is confirmed that various activities for income generation are carried out in resettlement villages. However, the distribution of activities varies widely amongst resettlement villages or PAFs within the same village. The SAPS Team assessed the constraints to expanding the range of income generation activities currently practiced. The results of constraint assessment are summarized as follows:

**Table Result of Constraints Assessment**

Income source		Net Income /year (Rp.million)	Assessment				
			Initial cost (Rp.million)	Maintenance Cost/year (Rp.million)	Required technical level	Stability of market	Management risk
Inter-cropping of plantation	Rice	1.1	1.9(High)		Low	N.A.	Low
	Corn	1.1	1.9(High)		Low	N.A.	Low
	Watermelon	1.3	1.9(High)		Low	N.A.	Low
	Chili	0.5	0.25(Low)		Low	N.A.	Low
Food crop cultivation	Orange	7.5	6.25(High)	1.5(High)	High	N.A.	Low
	Rice	0.6	0.76(Low)		Low	N.A.	Low
	Corn	0.6	0.76(Low)		Low	N.A.	Low
	Chili	0.6	0.25(Low)		Low	N.A.	Low
Gambier cultivation		2.9	2.0(High)	0.1(Low)	Low	Stable	Low
Fishery		10.9(Gross)	N.A.	N.A.	Low	Unstable	Low
Inland fishery		8.2	13.9(High)	6.9(High)	High	N.A.	High
Poultry farming		18.0	20.0(High)	0.0(Low)	High	N.A.	High

Note :   Constraints

: In case, total of initial and maintenance costs is more than Rp.1.0million that is 10% of annual income from 2ha of rubber plantation, the cost is assessed as "high".

(1) Inter-cropping of plantation

Cultivation costs of rice, corn, watermelon are relatively high (Rp. 1.9million). It is, therefore, difficult for poor farmers to introduce new inter crops, even though the required technical level and the management risks are low. It is also noted that some PAFs face more difficulty to introduce inter crops, if the plantation area is located at far from their houses. In Batu Bersurat and Binamang, the distance from house to plantation is around 10 km and, accordingly, they cannot maintain inter crops. The extension officers noted that the maximum distance for proper maintenance is within 3 km.

(2) Food crop cultivation

The cultivation costs of rice, corn, and chili are relatively low. Moreover, management and native technical levels are also low.

(3) Gambier cultivation

The most important factor to introduce gambier cultivation is availability of land, since gambier cultivation needs wide area to obtain enough income. In the case of Tanjung Balit, gambier is cultivated at the land of the original village before relocation. Therefore, it is possible to cultivate a large area of gambier. It is noted that the initial cost of Rp. 2.0 million is expensive to some extent for normal farmers. The risks of soil erosion and lowering land productivity are also constraints.

(4) Fishery

The unstable market price is a constraints for engaging in fishery activities. The

price of fresh fish varies from Rp.6,000/kg to Rp.10,000/kg, and the price of smoked fish varies from Rp.20,000/kg to Rp.25,000/kg.

#### (5) Inland fishery

The initial cost and the running cost of inland fishery are very high. The establishment and annual maintenance costs for inland fishery are Rp.14.0 million and Rp.7.0 million, respectively. Therefore, the funding for introducing fisheries is a constraint for farmers. It is reported that the productivity level is still low due to insufficient knowledge, lack of proper maintenance and poor quality of fish fry.

#### (6) Poultry farming

The initial cost of poultry farming is very high (around Rp.20.0 million) and, accordingly, it is impossible for normal farmers to arrange the funds. For introduction, proper technical guidance is also highly required.

### **4.5 Preliminary Formulation of Countermeasures**

#### **4.5.1 Institutional Aspects**

##### (1) Implementation of Workshops

The involvement of PAFs in the preparation of the action plans is still weak and direct dialogue or exchange of opinions at the village level has been limited so far. To improve the relationship between the government and PAFs, it is proposed to organize various workshops such as Universities Workshop, Village Representative Workshop, Village/hamlet Level Workshop (Ref. Section 6.3.2). It is expected that the action plans will contribute more to conflict resolution between the government and PAFs, if people are involved in the planning stage. In fact, the feedback workshops amongst stakeholders resulted in much satisfaction of village leaders.

The objectives of the workshops are to: i) hear the peoples' opinions and ideas for action plan, ii) explain the basic concepts and content of action plan proposed by government, iii) clarify the difference of understanding and contents of the action plan between PAFs and Government, iv) discuss amongst stakeholders how to reduce those differences. It would be difficult to make agreement of all the items to be included in the action plan for a short period. If so, agreeable items should be included and realized in the action plan, while the remaining items should be discussed further.

The most difficult points to achieve consensus in the workshops are: i) compensation issue and ii) difference in the understanding of some promises such



as housing condition, and electric charges. The government insists that the compensation issue has already been settled and the government did not make any promise on providing semi-permanent houses and electricity free of charge. On the other hand, many of the PAFs insist that compensation should be reassessed based on the market value and the government should act as promised. The difference of opinion is large. As for improvement of other items such as water supply system, rubber plantation and income generation activities, the government took or proposed actions in the current action plan considering the history of the resettlement program. Therefore, it will be easier to reach consensus between the government and PAFs, since basic understanding is almost the same.

In the meeting, it is recommended to apply a step-wise approach. As a first step, the scope of the action plan should be discussed. And as a second step, each item should be discussed. If the scope of the action plan is not agreed amongst the stakeholders, the agreeable scope should be clarified and the items within that scope should be discussed and settled. Then, the other items should be further discussed. This procedure will be examined in the workshops in the Phase II of the SAPS Study.

## (2) Establishment of Information Cell

It is observed that a lot of misinformation spread to the PAFs contributing to the conflict between the government and PAFs and amongst groups of PAFs. Therefore, the access of PAFs to the correct information should be ensured. In the feedback workshops of Phase I, BAPPENAS proposed the establishment of an information cell at the regency level. This proposal is quite acceptable to ensure the access of information and settle the present conflict, and immediate action is required.

The proposed function of the information cell is to: i) keep all the documents relevant to the action plan, ii) disclose information relating to implementation of the action plan that will be provided by other relevant agencies, iii) clarify the questions made by PAFs as much as possible through communication with other governmental agencies at both central and local levels. Proposed information cell is a liaison office of information for the action plan and, accordingly, a large number of staff and office space is not required. It is also proposed JBIC should provide correct information through the information cell, since much of the misinformation on compensation is related to Japan.

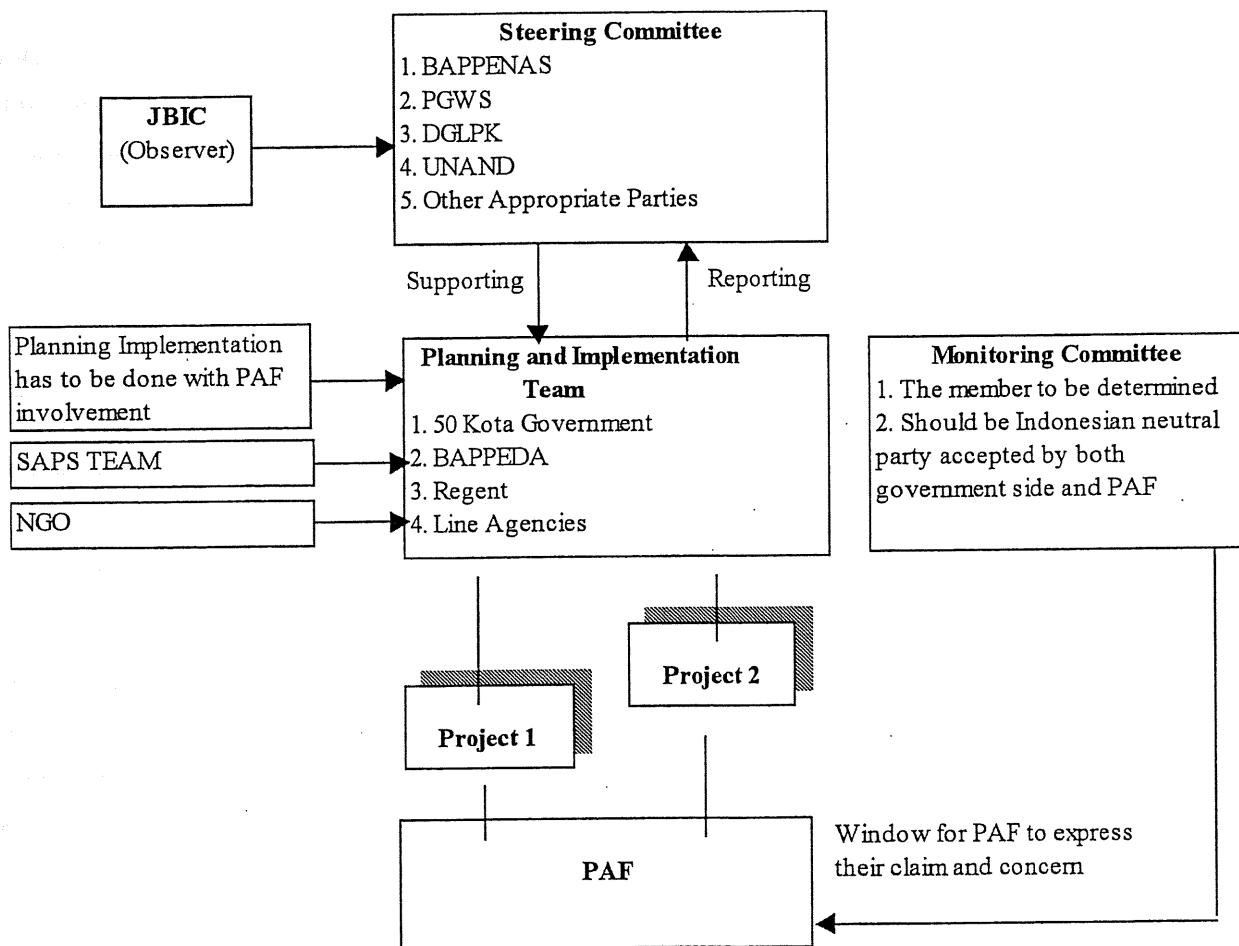
## (3) Role of Task Force to be established at Central Government Level

In West Sumatra province, the responsibility of budget arrangement is not clear yet. In future, a task force should coordinate the budget allocation, since the task force is planned to include representatives of many ministries relating to the action plan.

This matter should be discussed in the initial stage of forming the task force, since the Regency Government of Lima Puluh Kota cannot implement the action plan on time as scheduled. If there are difficulties to allocate budget through the task force, then BAPPENAS should take the initiative to allocate budget for the action plan.

(4) Establishment of Monitoring Committee at Local Government Level

The task force will carry out monitoring and evaluation of activities proposed in the action plan. In addition to the TASK force, a monitoring committee was proposed in the Feedback Workshop of West Sumatra province held on 26 March to monitor the activities at provincial level. The organization charts proposed in the workshop are as follows:



The most important point for monitoring is to increase the transparency to PAFs on how the government prepares and carries out the action plan. Therefore, the monitoring committee proposed in West Sumatra province seems to be useful for transparency to PAFs. The duty of the monitoring committee is to: i) review the actual implementation of the action plan compared to schedule, ii) review annual budget allocation and actual expenditures of the action plan, and iii) prepare the recommendation, if any. To carry out these items, it is expected to hold a committee

on a semi-annual basis at least. The members of the committee should be discussed in the workshop to make consensus between government and PAFs.

In Riau province, on the other hand, the monitoring committee at a provincial level has been not discussed so far. Considering the accountability of the government and the transparency of the action plan, it is required to establish a monitoring committee at the provincial level in Riau Province as well.

#### 4.5.2. Water Supply System

##### (1) General

The objectives for countermeasures on water supply system in order of priority are to:

- i) Improve the quantity available during the dry season;
  - ii) Improve quality;
  - iii) Provide a level of service that meets the usual standard for rural water supply.
- Solutions for improving water supply systems must be simple and inexpensive to operate and maintain, involving little if any use of mechanical/electrical equipment.

##### (2) Strategies for improved water supply

###### 1) Overview

Countermeasures to address water quantity or quality problems in each village will to a large extent depend on site-specific conditions such as topography, availability and location of water sources. The primary source in most villages will continue to be water from shallow wells. The wells should be dug deeper if possible to provide water during the dry season. This primary source of water should be supplemented by rainwater collection. An alternate source will be required where these two options do not provide sufficient quantity or if there is any quality problem with well water that cannot be treated using simple methods. Table 4.11 summarizes how the strategy is applied to each village.

###### 2) Increase the amount of rainwater collected:

The easiest and probably the most effective way to increase the amount of water available during the dry season is to improve the capture and storage of rainfall. Rainfall catchments from rooftops offer a relatively inexpensive method for providing water to individual users.

The study report (TEPSCO, 2000) provides rainfall data obtained from Muara Paiti Rainfall Station and Pangkalan Koto Baru Rainfall Station for the period of 1986-1998. The minimum monthly rainfall in an average year is 82 mm (for the twelve year record).

The absolute minimum water requirement is 15 liters per person per day for drinking and cooking. For a family of 5, that means, 75 liters per day. If a home has a roof area of  $48\text{m}^2$  ( $6\text{m} \times 8\text{m}$ ) and the monthly rainfall is 116mm, the amount of available rainfall is  $82\text{mm} \times 48\text{m}^2 \times 0.8$  (losses) = 3,148 liters per month = 105 liters per day. In an average year, there would be enough rain during the dry season to meet the minimum amount of water required by a family of 5.

If rainfall is evenly distributed throughout the year, the general rule is that a permanent cistern must be large enough to hold a 1-month supply of water. If rainfall is heavy during some months but there is a dry season with little or no rain, the size of the cistern can be increased to store water during the wet season for use in the dry.

In the example used above a cistern with a capacity of  $2.25\text{ m}^3$  would provide enough water for 1 month (75 liter/day  $\times$  30 day). A larger cistern, say  $5\text{m}^3$  would provide water for just over 2 months or allow a family to consume water for bathing and washing.

For roof catchments to be worthwhile, there must be sufficient rainfall even during the dry season or periods of prolonged drought. The worst case for the 12-year rainfall record occurred in June of 1997 when it did not rain for 34 consecutive days. This period coincided with a very dry year (1,516mm) and a longer than usual dry season that started in May and lasted 6 consecutive months with less than 100 mm of rain per month. Under such drought conditions, rainfall catchments will not provide sufficient water to meet the minimum water requirement unless a larger cistern is provided.

Although rainfall catchments offer a variable yield, they have the potential of providing a viable source of drinking water for most of the season and in average year can even provide families with enough water during an average dry season.

Water from rain catchments requires some treatment because dirt, birds and animal excreta and other contaminants collect on the roofs between rainfalls. To be safe, this water should be filtered and disinfected. Roof catchments differ from other sources of water because they place great responsibility on individual users for operation and maintenance. Water quality will depend on the users' cleaning the pipes and gutters, cleaning and disinfecting the storage tank.

### 3) Dig deeper wells

Many wells are not deep enough, so water is inaccessible in dry weather when the groundwater level is low. One solution could be to deepen the wells so that the bottom reaches the groundwater during dry weather. The practical limit for dug wells is about 10 m and the success of this solution will depend on the depth of the water table and how hard the soil is. Of course if groundwater quality does not meet the criteria for drinking water quality the wells should not be improved.

Digging should be at the end of the dry season, when the groundwater is likely to be at its lowest level. Digging should continue until groundwater is reached. It is often possible to dig two meters or so into the aquifer, although this depends on the rate of recharge. Work has to stop when the water is filling the well faster than it can be removed. An experienced well digger should be chosen to dig into the aquifer, because of the danger of collapse. Where the soil is too hard to dig by hand it will be necessary to use compressed air tools to dig deeper. The walls of the well below the last concrete ring should be lined. The usual practice of using concrete rings will not be possible when upgrading wells because they cannot be pushed down into the hole. Other materials can be used for lining upgraded wells including bricks or stone.

In some cases it may not be possible to upgrade wells. In some areas households are located on high ground and 10m may not be deep enough to reach the water table in the dry season. In most villages, it will usually be possible to find water in shallow wells located in lower lying areas near streams. Providing a number of community wells in strategic locations (1 well per 30 households no more than 250m from users) is a cost effective and sustainable way of alleviating the seasonal drought problem.

### 4) Treat well water at the household level

Where water quality is a problem, one possible option in many villages may be to treat well water at the household level to improve taste, color or remove minerals such as iron or manganese.

Iron can be removed by aeration using aerator trays and some forms of manganese can be removed by aeration followed by filtration. Charcoal filters such as the UNICEF up-flow filter are effective in removing color and improving taste. However, there is evidence that sometimes charcoal, particularly if it is not replaced regularly, can become a breeding ground for some harmful bacteria.

Water quality should be tested before deciding on the need for treatment.

5) Develop alternate sources of water

Every effort should be made to improve rainwater collection and shallow wells before considering other options. An alternate source of water will be required if the quality or quantity of well water cannot be improved and if the quantity from rainwater is insufficient. Alternate sources include groundwater from springs and deep wells, and surface water from streams, rivers and ponds. The availability and capacity of these sources is site specific and in most cases a combination of sources will be required to provide a sufficient quantity of water. Quantity and quality are important factors in selecting an alternate source. Another important factor is that water should be available to the user at the lowest possible cost.

Selecting a suitable source should follow a systematic process of elimination, giving preference to sources that do not need to be pumped and do not need treatment. Figure 4.2 shows the possible type of sources and method of extraction that should be considered in order of preference. If several sources offer adequate quantity a choice must be made among sources. Priorities that should be considered when choosing a source are as follows:

<u>Priority</u>	<u>Pumping required</u>	<u>Treatment Required</u>
First	Not required	Not required
Second	Not required	Required
Third	Required	Not required
Fourth	Required	Required

These priorities are used as guidelines for selecting the most appropriate source among several alternative methods of surface or groundwater development. The priorities are established in order of ease of construction, maintenance and costs of the systems. Where no treatment or pumping is required a system is easier to develop, operate and maintain. Also the development costs should be lower than for systems requiring treatment and pumping. When treatment or pumping is added to a water system, costs rise and a program of operation and maintenance must be established to ensure constant operation. These extra costs will in most villages rule out the use of pumping altogether unless it is with simple hand pumps.

(a) No pumping options

A water source that can be delivered to the user by gravity should be the first

source considered. Because no pumping is required, the costs of developing, operating and maintaining the system are relatively low. Gravity flow systems usually restrict the source to a specific location.

- No pumping - No treatment:

There are only a few places where an uncontaminated source of water can be found. If a spring of sufficient capacity is available in or near the community it could prove to be the best source. Water from a protected spring generally needs no treatment. Protective structures are a very important part of developing spring sources but these have not been used in any of the sites visited. A protective structure (usually a spring box) ensures an increased flow from the spring and protects it from contamination by soil and other materials washed down by surface runoff. Clearing away vegetation from the spring effluent will also improve flow. Seep designs using a system of buried collection pipes are also possible. Care must be taken to ensure that there is adequate head so water will reach the users. Head is the difference in water levels between inflow and outflow ends.

A stream or a river in a highland region with a few inhabitants is another possible source that may not require treatment. Costs should be low but more than for a spring because an intake structure (small dam) will be required.

- No pumping - Simple treatment:

It is always better to find and protect a source of good quality water than to treat water from a contaminated source. However, if a suitable source cannot be located, water can be treated.

If household treatment of well water is not feasible or acceptable to villagers, than the next best alternative will be to provide communal treatment but no pumping. Experience with previous water supply projects in the villages has shown that water treatment requiring mechanical equipment or chemicals is not sustainable because it is expensive and requires special skills for operation and maintenance. Therefore great care is required in selecting a source that can be made fit for consumption with only simple, low-cost treatment such as slow sand filters.

During site visits to each village, the SAPS Team with the help of villagers has identified a number of small spring fed streams and surface water sources that might be used by gravity. These are presented in Table 4.12. These sources will need to be investigated in much greater detail to determine if they are

viable sources of drinking water (water quality testing, measuring the flow or yield) and if they can be used by gravity (elevations at the source, in the village and along the pipeline route).

(b) Options that require pumping

Pump systems provide much more flexibility in locating a source, but the costs of developing, operating and maintaining the system are relatively low.

- Pumping - No treatment:

In rural areas groundwater, cleansed by the soil's natural filters, may be the safest and most reliable source of water that does not require treatment. The disadvantage of groundwater is that it must be extracted from the ground and sometimes at great depths. Wells up to 10 m deep have traditionally been hand dug and villagers use a bucket with rope to extract the water.

In villages or parts of villages where the ground water is too deep for shallow wells one option could be to install a number of deep tube wells. These wells could be drilled at strategic locations throughout the area. Typically a well that has a yield of 10 liter per minute can usually serve about 20 families.

Pumping devices should be as simple and easy to install and maintain as possible. Experience with previous water supply projects in the villages has proven that mechanical pumps using electricity or petroleum are too complicated and expensive to operate and maintain. Pumping, if required, should be limited to the use of suction hand pumps for shallow tube wells and deep well hand pumps for tube wells exceeding 10m.

Unfortunately even simple hand pumps are not always reliable. They break down because they are subjected to rugged conditions and heavy use. They are often left in disrepair when spare parts are hard to obtain. Therefore the use of hand pumps should be limited.

The feasibility of using tube wells depends on finding water of good quality and in sufficient quantity. Locating groundwater can be difficult. The presence of existing wells with good, stable yields and other positive hydrological features can highlight groundwater potential but, following this, extensive field trials are usually required to determine acceptable borehole locations. Therefore the use of deep tube wells should be limited to a few specific cases where other options are not available.



- Pumping - With Treatment:

Of all the alternatives mentioned, the most expensive is that which requires pumping and treatment. Many of the villages are located within close proximity of a stream or small river that could be used for drinking. Direct use of surface water from a river or stream usually requires that water be pumped from the source and treated before the community uses it. Water from rivers and streams in lowland areas is especially likely to be contaminated with sediment and pathogens. Only in mountain streams or where infiltration galleries are used is stream water likely to be usable without treatment.

The treatment process can be a simple sand filter if source water is not too turbid. Sources that have high turbidity or large amounts of organic or suspended matter should not be used because they will require more expensive and complex treatment processes.

(3) Level of service (choosing between community distribution systems and household connections)

Rural water supply projects are normally classified as follows:

Level 1: Water source development or improvement with a distribution point at or near the source. The source is usually a protected spring or well, with a protected outlet. At this level water must be hauled from the source to each house. This level of service is generally suited to rural areas where houses are thinly scattered. The distance water must be carried will vary with the location of the source. Each source is usually designed to provide 30 liter per capita per day. The main advantage of level 1 service is a protected water source.

Level 2: Water source development or improvement with distribution point(s) near population centers. This level of service provides water at one or more points serving several homes. This level of service is generally suitable for rural areas where houses are clustered densely enough to justify a simple piped distribution system. The method of distribution can also be by a tank truck or trailer. Individuals haul water from the distribution point to their homes. The system is typically designed to provide around 60-75 liters per capita per day.

Level 3: A piped water system with individual house connections generally suited to densely populated urban areas. The system is typically designed to provide around 100 liter or more per capita per day.

The community should be involved in deciding on the type of distribution system. This can be accomplished through community meetings and discussion groups. Responsibility for providing resources must be clearly understood along with the cost of and responsibility for operation and maintenance.

The previous system of pumping water and supplying community hydrants failed because the villagers could not afford the cost of operating the system and were not trained to operate & maintain the system. In villages that have a reliable water source the systems could be rehabilitated and put back into operation. However, the constraints to operation and maintenance must be removed or it will not be a sustainable option. This option is selected as one of the possible alternatives for villages that have a reliable source of raw water.

Table 4.11 summarizes the various considerations for selecting a delivery method of water. Methods that require electricity or fuel are technically feasible but will probably not be possible given the cost issues and constraints.

Service level 2 using communal distribution points are considered realistic where individual or shared wells are not meeting the need for water. It should in many cases be possible to utilize some portions of the distribution system that was previously installed. The location and size of the piping must first be identified and then repaired or replaced depending on its condition.

#### (4) Proposed countermeasures:

Water supply improvements should be implemented by following a systematic decision making process. Simple improvements should be implemented before more difficult and costly solutions. Figure 4.3 presents a decision-making flow chart that follows a simple process of elimination. The flow chart indicates the steps that must be followed to determine which options will be the most suitable for each village.

The information gathered so far shows that many options may be available in each village. A preliminary list of potential options is presented in Table 4.14. A thorough examination of the sources and topographical information is required for

determining the feasibility of each option. The final set of countermeasures will depend on selecting a solution that is appropriate given the problems and constraints.

#### 4.5.3 Plantations

In examining the countermeasures for development of plantation crops for PAF farmers, it is convenient to first consider the underlying concepts and implementation achievements to date as a prelude to examining and listing the constraints and issues that need to be addressed. These aspects are dealt with in the paragraphs, which follow:

##### (1) Background Considerations

Essentially, the Project component involving the resettlement of farmers displaced by the Kotapanjang Reservoir involved the following agricultural elements: -

- a) Relocation of farmers and their families to sites that were regarded as being suitable for perennial crop development and the parallel raising of annual crops, livestock and fish. Such activities were assumed to provide living conditions appropriate for the families concerned.
- b) The farmers concerned were settled in areas not too far from their original locations, but even so, were to be provided with patterns and means of livelihood often quite different from those which they enjoyed previously.
- c) All resettled families enjoyed the common attribute of receiving compensation for the land and means of livelihood that they had possessed in their original locations.

##### (2) The Resettlement Process in Practice: its Effect on Farmers

The background considerations listed above are essentially sound in simple terms. In practice, the initial aims were distorted by the incorporation of unfortunate, and in some cases unnecessary, variability in the treatment of farmer participants. The following paragraphs illustrate this point:

- a) The resettled farmers were apparently given an initial choice regarding the perennial crop species that would provide the basis for their livelihood.
- b) However, the choice of crop was in fact limited by land availability and the suitability of that land for the crops under consideration.
- c) This variability, which emanated from basic land suitability and Government

policy, was to a great extent unavoidable, but was compounded by other variability factors, which, while apparently logical at first viewing to the Authorities concerned, have produced a very complicated and inequitable situation. The following aspects are pertinent:

- Two crops (rubber and oil palm) have been selected and are being developed. These crops have different costs, viabilities and periods of gestation. These features are of direct consequence to farmers, GOI and the now autonomous Districts.
- The crops have been developed in two Provinces, which have divergent funding capabilities. This, since decentralization, is leading to differential capability of funding the development of the selected crops at appropriate levels.
- The crop development models have not been identical in all cases. Of the numerous models available for consideration and utilisation, the following appear to have been selected:

West Sumatra- Rubber. The P2WK (Partial Approach), with or without contractors, has been utilised twice.

- Riau- Rubber
  - (i) P2WK (Partial Approach) has been utilised in the first instance at the initially failed sites.
  - (ii) PMU (UPP) model has now been utilised at the failed sites and at the balance of sites.
- Riau- Oil Palm. PIRTRANS model has been utilised, with PT Sinar Mas and PTPN V as the nucleus estate operators.

These crop development models have a number of intrinsic features and outcomes:

- The P2WK model used grant-assisted inputs in years Y0 and FY1 only.
- The PMU (UPP) model for rubber, supported inputs for up to 5-6 years. Normally, this is on a credit basis, but here, a grant approach has been adopted throughout.
- The PIRTRANS model in the case of oil palm, involved credit-based support for Field Years 0, 1, 2 and 3.

We thus have a mix of credit-based and grant-based models, not all of which follow the current Indonesian norms.

- Additionally, there has been repeated failure of the rubber in some areas, and this has led to income starvation and frustration for rubber farmers, even though

the development is on a grant basis.

- An additional factor in the overall consideration of the situation which has developed and which has been allowed to develop, is that the land selected for resettlement is not generally ideal or uniformly suitable for either oil palm or rubber cultivation (because of soil, topography, etc).

### (3) Preliminary Countermeasures

Based on knowledge already available in the Project, and upon data to be collected to add to our knowledge prior to and during Phase II of the Study, the preliminary countermeasures are the following:

- 1) Procedures to bring currently existing plantings to maturity at an appropriate standard.
  - a) Detailed assessments of existing plantation area should be undertaken without delay, to permit commencement of requisite actions.
  - b) The above assessments involve detailing the location, extent and quality of the plantings relative to age, thereby permitting the diagnosis and prescription of appropriate advice.
- 2) Measures and procedures to establish and develop plantings where failures have occurred to date.
  - a) Explanation to PAFs on what has gone wrong and discussions to seek their full consensus with future actions that should be made.
  - b) Re-measuring plot boundaries to avoid future conflict amongst farmers in Tanjung Pauh and Tanjung Balit of West Sumatra Province.
  - c) Establishment of appropriate access to plantation plots including plantation road or boat.
- 3) Mechanisms and procedures to satisfactorily maintain plantings during the productive mature period.
  - a) The PMU (UPP) model for rubber, supported inputs for up to 5-6 years. Normally, this is on a credit basis, but a grant approach has been adopted throughout in Riau province. The same PMU(UPP) model of rubber plantation will be applied to Tanjung Pauh and Tanjung Balit.
- 4) Appropriate mechanisms (subject to in-depth prior discussion), to rectify/reduce anomalies inherent in the ongoing patterns of development under the Project or action plan. Anomalies to be considered include:

- a) Differential credit recovery in relation to the status and condition of plantings in oil Palm plantation.
  - b) Grant payment? Assistance to oil palm settler farmers, where and if warranted.
  - c) Force majeure invocation where justified.
  - d) Compensation where plantings have failed in the past through no fault of the participants.
- 4) Augmented development patterns with appropriate farming system attributes.
- a) Based on the detailed assessment of existing plantations and observation of income generation activities, development patterns with appropriate farming systems should be formulated.
  - b) Those development patterns should be considered from the viewpoints of improving the overall cash flow and viability of the holdings.
- 6) Although particular attention should naturally be paid to the formulation of countermeasures to identified shortcomings in the Project, a number of more wide-ranging actions of general relevance, for incorporation into future resettlement projects, include the following:
- a) Paying attention to the overall concepts, problems and likely solutions for appropriate incorporation in similar future projects.
  - b) Allowing for the utilization of appropriate development and management models aimed at ensuring equitable treatment of settlers, and development of an adequate standard to support farmer livelihoods in a cost-effective manner.
  - c) Providing coherent recommendations to ensure a more equitable treatment of credit and grant provision, recovery procedures and quanta, than hitherto utilized.

#### 4.5.4 Income Generation Activities

The countermeasures for generation activities by income type are formulated on a preliminary basis as follows:

##### (1) Income Type A (Fishery)

Villages under the income type A carry out fishery as the main income generation activity due to their location close to the dam reservoir. Therefore, the present

activities relating to fishery should be improved through maximum use of the dam reservoir as their potential resources. The proposed target of the improvement is; i) introduction of fish culture using floating net considering the limited fish resource in the dam reservoir, and ii) increasing the value of products through fish processing activities such as fish smoking. In case of Type A-3 (Koto Tuo), the income generation activity is not specialized into only fishery, as for the other types. Type A-3 also includes crop or inter-cropping cultivation, since accessibility of Koto Tuo to the reservoir is not as good as for the other villages under type A. Therefore, it is recommended that strengthening of crop cultivation should be considered in Koto Tuo in addition to improvement of fishery.

### (2) Income Type B (Inland fishery)

Villages under the income type B carry out inland fishery as the main income generation activity. Pulau Gadang and Koto Mesjid belong to income type B. In this type B, constraints on expansion of inland fishery are the low technical level and shortage of funds. The net income of inland fishery is still low, since the mortality rate of fish is high. Through improvement of fish fry production, providing sufficient feed and disease control, the mortality rate will be reduced. The processing activities are also considered in order to add value to fish market as proposed in type A.

Only 60 % of the households are engaged in activities of inland fishery in these villages. Other households hesitate to participate in inland fishery due to the shortage of initial funds. Therefore, access to credit scheme should be considered, especially for poor families. Moreover, technical guidance is also important to hedge the risk on loss of initial investment as much as possible.

### (3) Income Type C (Gambier Cultivation)

Villages under the income type C carry out gambier cultivation as the main income generation activity. Tanjung Pauh, Tanjung Balit and Gunung Bungsu belong to income type C. It is reported that cultivation of Gambier in slope area causes soil erosion. Therefore, soil conservation should be considered from the view point of sustainable agriculture as proposed in the action plan prepared by the government of West Sumatra province. The gambier cultivation is not a modernized one, and does not use farm inputs such as fertilizer or pesticides. Accordingly, the net income depends on the extent of cultivation area. Therefore, other income generation activities should be considered if the cultivation area is small and cannot be

expanded.

#### (4) Income Type D (No main income source)

Villages under income type D do not have any main income generation activities. Ranah Sungkai, Lubuk Agung, and Pongkai Baru belong to income type D. It is difficult to develop fishery production or gambier cultivation in these villages, since access to the dam reservoir is almost nil and both water and land resources are limited in those villages. Therefore, the maximum use of existing resources such as farmland or plantation area provided by the Government should be considered. Development of a farm model and improvement of inter-cropping should be considered as the first priority.

Livestock such as poultry should be introduced carefully considering the high risk, lack of experience and high initial investment cost. Therefore, if village people want to participate in the livestock sub-sector, only model farms that have enough funds should be supported with the full technical guidance of the government or private company.

#### (5) Income Type E (Palm oil)

Villages under the income type E carry out oil palm cultivation as the main income generation activity. Muara Mahat Baru and Mayang Pongkai belong to income type E. In those villages, income from the oil palm has been stabilized at a high level compared to all the other resettlement villages. Some village people carried out poultry production under the technical guidance of a private company. Therefore, the development of livestock including poultry might be considered if village people want to invest to enhance their income level.

The above target area by income type is summarized in the following table.



**Table Present and Target Income Generation Activities**

	Income Type	Agriculture			Fishery		Livestock
		Inter-cropping of plantation	Food crop in farmland	Gambier cultivation	Fishery & Fish raising in resevoir	Inland fishery	
1. Pulau Gadang	B	○(50%)	○	×	○(a few)	○(60%)	×
2. Koto Mesjid	B	○(50%)	○	×	○(a few)	○(60%)	×
3. Runah Sungkai	D	○(10%)	○(50%)	×	×	×	×
4. Lubuk Agung	D	○(10%)	○(50%)	×	×	×	×
5. Batu Bersurat	A-2	×	×	×	○(65%)	×	×
6. Binamang	A-1	×	○(a few)	×	○(95%)	×	×
7. Pongkai Baru	D	×	○(10%)	×	×	×	×
8. Mayang Pongkai	E	×	○(100%)	×	×	×	○(2%)
9. Pongkai Istiqomah	A-1	×	×	×	○(98%)	×	×
10. Tanjung Alai	A-2	×	×	×	○(a few)	×	×
11. Muara Tukus	A-1	×	○(a few)	×	○	×	×
12. Koto Tuo	A-3	○(15%)	○(100%)	×	○(60%)	×	×
13. Muara Mahat Baru	E	×	○(10%)	×	×	×	○(20%)
14. Gunung Bungsu	C-2	×	○(50%)	○	○	×	×
15. Tanjung Pauh	C-1	×	×	○(15%)	○(15%)	×	×
16. Tanjung Balit	C-1	×	×	○(30%)	○(10%)	×	×

Note: ○ shows that there is the activity in the village.  
 X shows that there is no activity in the village.  
 ( ) means anticipation rate of household in the village  
 Main target in future as income generation activities

#### 4.6 Conclusions for Phase I

##### (1) Compensation Issue

The government insists that the compensation issue has been settled. On the other hand, many of PAFs insist that compensation should be reassessed based on the market value. It is difficult to achieve consensus of compensation issue for a short period, since the difference of opinions in the argument is quite significant. Therefore, the scope of the action plan should be discussed. Then, the agreed scope should be clarified and items within that scope should be discussed and settled as the initial step. This settlement will provide benefit to both Government and PAFs. The other items that are not agreed, which may include the compensation issue, should be further discussed. In further discussion, mediation or arbitration of the third party, lawsuit, etc., might be considered.

It is observed that a lot of misinformation spread to the PAFs, creating new

compensation issues. To ensure access to information and settle the present conflict, an information cell should be newly established at the regency level. The information cell is a liaison office of information for the action plan and, accordingly, a large number of staff and office space is not required.

## (2) Improvement of Water Supply System as Basic Human Needs for Life Line

The community should be involved in deciding on the type of distribution system, namely: Level 1 (water source development or improvement with a distribution point at or near the source), Level 2 (water source development or improvement with distribution point(s) near population centers) and Level 3 (A piped water system with individual house connections). It should be explained that a high level service requires more responsibility to be placed on beneficiaries for operation and maintenance, including payment of water charges.

Countermeasures to address water quantity or quality problems in each village will to a large extent depend on site-specific conditions such as topography, availability and location of water sources as well as the type of distribution. Therefore, water supply improvements should be implemented by following a systematic decision making process as shown in Figure 4.3. It is recommended that simple improvements should be implemented before more difficult and costly solutions considering the history of the water supply systems in the resettlement villages.

Establishment of a water supply system maintenance group within each village, or groups of villages, should be encouraged. Expertise on the maintenance of a water supply system should be provided by an organization such as government or NGO.

## (3) Rehabilitation of Plantation as Primary Economic Activity

In Riau Province, a program for the rehabilitation of rubber plantations is underway. Detailed assessments of the existing plantation area should be undertaken without delay, to permit the diagnosis and prescription of appropriate advice.

In West Sumatra province, the P2WK model that provides grant-assisted inputs in years Y0 and FY1, was applied twice. The first time it failed, and the second attempt has been adversely affected by fire. Therefore, the viable area of rubber plantation should be developed as soon as possible, considering i) re-measuring of plot

boundaries, and ii) PMU (UPP) model for rubber supporting inputs for up to 5-6 years.

Appropriate mechanisms to rectify/reduce anomalies inherent in the ongoing patterns of development under the Project or action plan should be considered. Anomalies to be considered include: i) differential credit recovery in relation to the status and condition of plantings in oil palm plantation, ii) grant aid assistance to oil palm settler farmers, where and if warranted, iii) force majeure invocation where justified, and v) compensation, where plantings have failed in the past through no fault of the participants.

#### (4) Income Generation Activities as Secondary Economic Source

Various activities for income generation other than rubber plantation or palm oil plantation are observed in the resettlement villages. Those activities depend on the natural potential of villages and availability of funding for each PAF. The following should be considered to introduce or enhance income generation activities as secondary economic source.

- Rubber plantation rehabilitation is the top priority activity for the income generation program;
- In the villages of Type A (fishery) and Type B (inland fishery), the present activities relating to fishery or aquaculture should be improved through maximum use of the water resources considering i) shifting from capture of fish to fishfarming, ii) improvement of present technology, and iii) increasing the value through processing;
- In the villages of Type C (gambier cultivation), soil conservation technology should be introduced and developed from the viewpoint of sustainable agriculture. Income generation activities other than gambier cultivation should be considered if the cultivation area is small and cannot be expanded;
- In the villages of Type D (no main income source at present), it is difficult to develop fishery production or gambier cultivation, since accessibility to the dam reservoir is almost nil and both water and land resources are limited in those villages. Therefore, maximum use of existing resources such as farmland or plantation area should be considered. Farm model and inter-cropping should be improved as the first priority; and
- Exploitation of natural resources such as forest products and construction materials may have to cease in the future as the income level from other income sources is raised.

#### (5) Road Conditions as Basic Rural Infrastructure for Communication

The main road and village roads appear to be in good condition at present. The section of the road south of the reservoir, stretching from Batu Bersurat to Binamang, is under rehabilitation. Regular road maintenance programs should be sufficient for the rehabilitation of roads in the resettlement villages. On the other hand, accessibility to the rubber plantation area is considered still poor in places. Time spent traveling from one place to another should be reduced from the viewpoints of efficient activity for plantation management. In this respect, improvement of accessibility to rubber plantation should be implemented.

#### (6) Rural Electrification and Housing

Rural electrification and housing conditions of the PAFs appear to be, at present, in good condition. Compared to the other villages not affected by the Project, regardless of the villages surveyed or not within the framework of SAPS Study, few appear to be destitute. However, there are some PAFs that are not as successful as other members of the same village. This matter has to be addressed with reference to what was officially promised to all the PAFs prior to the resettlement. Therefore, it is recommended that the same procedure as for the compensation issue should be applied.

#### (7) Institutional Aspects for Formulation and Implementation of Action Plan

##### Implementation of workshops for formulation of the action plan

In the process of formulating action plans, the governments considered the PAFs' opinions and tried to realize them. However, the direct involvement of PAFs in the planning stage is still weak in both Riau and West Sumatra provinces. For improvement of the relationship between the government and PAFs, it is proposed to organize workshops for formulation of the action plan amongst stakeholders including PAFs, local government, local NGOs and local university, etc. It is also expected that the action plan will contribute more to conflict resolution between the government and PAFs if people are involved in the planning stage.

##### Effective utilization of task force for the action plan

A task force is planned to ensure the smooth implementation and effective

monitoring of the action plan. The task force should also coordinate budget allocation since it will include many sector ministries relating to the action plan. This matter should be discussed in the initial stage of establishing the task force, since Regency Government of Lima Puluh Kota cannot implement the action plan on schedule due to difficulty of fund allocation.

Establishment of monitoring committee at provincial level

The monitoring committee was proposed in the Feedback Workshop of West Sumatra province held on 26 March to monitor the activities at provincial level. Considering the accountability of the government and transparency to implement the action plan, it is necessary to establish a monitoring committee at the provincial level in Riau Province as well.

(8) Comparison amongst Existing Action Plan, PAFs' Ideas and Recommendation

The following table shows a summary comparison of the existing action plans and includes the PAFs' needs and ideas and the recommendations of the SAPS Team.

**Table Comparison Table of Existing Action Plan, PAFs' Needs and Recommendation of the SAPS Team**

Issues	Action Plan Prepared by Governments	PAFs' Needs and Ideas	Recommendation of SAPS Team
Compensation	Measurement of land area for land certification and issuance of land certification are implemented or proposed.	Land compensation standard in 1993 need to be adjust based on the market price when payment was made.	The agreeable scope of action plan should be clarified.  The correct information on compensation should be disseminated through information cell.
Water Supply System	Small surface water catchment schemes where water can be supplied by gravity to a distribution point in or near to the village are implemented or proposed.	Water should be supplied to each individual house.  The community does not want communal MCK due to maintenance problem.  The MCK should be provided for each individual house.	Level of water supply service should be decided through discussion with village.  Simple improvements should be implemented before more difficult and costly solutions using decision-making flow chart (Figure 4.3).  Water supply system maintenance group within each village, or a group of villages, should be encouraged to establish.

Plantation	The rehabilitation program is underway.	The government should provide living allowance until rubber plantation is ready to be tapped.	<p>(Riau Province) Detailed assessments of existing plantation area should be undertaken without delay, to permit commencement of requisite actions.</p> <p>(WS Province) Re-measuring of plots boundary should be made to avoid future conflict amongst</p> <p>The PMU (UPP) model for rubber as same Riau province, supporting inputs for up to 5-6 years, should be applied.</p> <p>(Both provinces) Appropriate mechanisms to rectify/reduce anomalies inherent in the ongoing patterns of development under the Project or action plan should be considered.</p>
Income Generation	Fishery development program and livestock development programs are proposed.	The government should provide technical and financial assistance for fish farming.	<p>Rubber plantation rehabilitation is the top priority activity for income generation program</p> <p>Considering existing experience, and village potential, income generation activity by type should be promoted.</p> <p>Exploitation of natural resources such as forest products and construction materials may have to cease in the future as the income level from other income sources is raised.</p>
Road	Road rehabilitation and bridge replacement are proposed.	Plantation road should be improved in places.	Main road and village road appear to be in good condition as present. The improvement of plantation road should be considered.
Electricity	No action is proposed.	The government and PLN should return connection and operation charge for one year.	This matter has to be straightened up according to what was officially promised to all the PAFs before the resettlement. Therefore, it is recommended that same procedure as compensation issue should be applied.
House	No action is proposed.	The government should reconstruct house to keep government's promise.	This matter has to be straightened up according to what was officially promised to all the PAFs before the resettlement. Therefore, it is recommended that same procedure as compensation issue should be applied.
Institutional Aspects	-	-	<p>Implementation of workshops for formulation of action plan.</p> <p>Effective utilization of task force for action plan.</p> <p>Establishment of monitoring committee at provincial level</p>



# Table 4.2 List of Drinking Water Quality Conditions

Attachment I  
 REGULATION OF MINISTER OF HEALTH RI  
 NO. : 416/MENKES/PER/IX/1990  
 DATE : SEPTEMBER 3, 1990

## LIST OF DRINKING WATER QUALITY CONDITIONS

No.	Parameter	Unit	Allowable Maximum Content	Remarks
<b>A. PHYSICS</b>				
1	Smell	-	-	No Smell
2	Total solid substance solution (TDS)	mg/L	1000	-
3	Turbidity	NTU Scale	5	-
4	Taste	-	-	No taste
5	Temperature	°C	Air temperature +/- 3 °C	
6	Color	TCU Scale	15	
<b>B. CHEMICAL</b>				
<b>a. Anorganic Chemical</b>				
1	Mercury (Hg)	mg/L	0.001	
2	Aluminium (Al)	mg/L	0.2	
3	Arsenic (As)	mg/L	0.05	
4	Barium (Ba)	mg/L	1.0	
5	Iron (Fe)	mg/L	0.3	
6	Fluoride (F)	mg/L	1.5	
7	Cadmium (Cd)	mg/L	0.005	
8	Hardness (CaCO3)	mg/L	500	
9	Chloride (Cl)	mg/L	250	
10	Chromium, valence 6 (Cr)	mg/L	0.05	
11	Manganese (Mn)	mg/L	0.05	
12	Sodium (Na)	mg/L	200	
13	Nitrate, as N (NO3)	mg/L	10	
14	Nitrite, as N (NO2)	mg/L	1.0	
15	Silver (Ag)	mg/L	0.05	
16	pH	-	6.5 - 8.5	Minimum and maximum limits
17	Selenium (Se)	mg/L	0.01	
18	Zink (Zn)	mg/L	5.0	
19	Cyanide (SI)	mg/L	0.1	
20	Sulphate (SO4)	mg/L	400	
21	Sulfide (as H2S)	mg/L	0.05	
22	Copper (Cu)	mg/L	1.0	
23	Lead (Pb)	mg/L	0.05	
<b>b. Organic Chemical</b>				
1	Aldrin and dieldrin	mg/L	0.0007	
2	Benzene	mg/L	0.01	
3	Benzoic (a) pyrene	mg/L	0.00001	
4	Chlordane (total isomer)	mg/L	0.003	
5	Chloroform	mg/L	0.03	
6	2,4-D	mg/L	0.1	

**Remarks:**

mg = milligram  
 ml = millimeter  
 L = Liter  
 Bq = Bequerel  
 NTU = Nephelometric Turbidity Units  
 TCU = True Colour Units  
 Heavy metal is metal solution

No.	Parameter	Unit	Allowable Maximum Content	Remarks
7	DDT	mg/L	0.03	
8	Detergent	mg/L	0.05	
9	1,2-Dichloromethane	mg/L	0.01	
10	1,1,1-Dichloromethane	mg/L	0.0003	
11	Heptachlor and heptachlor epoxide	mg/L	0.003	
12	Hexachlorobenzene	mg/L	0.003	
13	Gamma-HCH (Lindane)	mg/L	0.004	
14	Methoxychlor	mg/L	0.03	
15	Pentachlorophenol	mg/L	0.01	
16	Total pesticide	mg/L	0.1	
17	2,4,6-trichlorophenol	mg/L	0.01	
18	Organic Substance (KMnO4)	mg/L	10	
<b>C. MICROBIOLOGY</b>				
1	Sewage Coliform	Total per 100 ml	0	
2	Total Coliform	Total per 100 ml	0	
95 % of tested sample in one year Sometimes 3 samples per 100 ml is allowed, but not in a row				
<b>D. RADIOACTIVE</b>				
1	Alpha Activity (Gross Alpha Activity)	Bq/L	0.1	
2	Beta Activity (Gross Beta Activity)	Bq/L	1.0	

Stipulated in Jakarta  
 On September 3, 1990

MINISTER OF HEALTH OF  
 THE REPUBLIC OF INDONESIA



**Table 4.3 Summary of Statistical Survey for Clean Water**

Group	Name of villages	Shallow well currently used					Alternate Sources				
		Rain season	Dry season	Problem Condition			Surface water/river		From reservoir		
				quantity (insufficient)	quality (is not good)	accessibility (far from house)	Rain season	Dry season	Rain season	Dry season	
A	Muara Mahat Baru	68%	65.7%	1.3%	81.4%	0%	0.2%	0.7%	17.4%	17.6%	
	Gunung Bungsu	88%	68%	78%	2%	0%	3%	13%	0%	1%	
B	Koto Mesjid	31.5%	22.0%	78.4%	1.1%	5.7%	4.8%	15.3%	12.0%	1.6%	
	Koto Tuo	61%	59%	1%	2%	0%	10%	15%	25%	21%	
	Pongkai Istiqomah	68.8%	51.0%	0%	0%	0%	21.2%	41%	8.5%	0%	
	Tanjung Alai	72%	75%	0%	2%	3%	4%	4%	11%	5%	
C	Batu Bersurat	44.8%	8.9%	0%	0%	0%	81%	43.2%	46.1%	18.4%	
	Binamang	10%	0%	0%	0%	0%	10%	75%	74%	0%	
	Lubuk Agung	3%	2%	0%	0%	0%	99%	89%	0%	0%	
	Mayang Pongkai	95%	92%	32%	35%	32%	2%	0%	0%	0%	
	Muara Takus	40.3%	35.8%	41.3%	7.3%	0%	11.6%	2.9%	22.2%	16%	
	Pongkai Baru	95%	68%	1%	9%	0%	4%	29%	1%	3%	
	Pulau Gadang	22%	18%	16.8%	13.6%	10.4%	8%	11%	2.5%	0.8%	
D	Ranah Sungkai	29.1%	25.3%	72.4%	3.9%	5.3%	36.3%	72.0%	30.3%	1.9%	
	Tanjung Balit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Tanjung Pauh	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	

Data Source: Result of Household Survey

**Table 4.4 Classification of Problems by Village**

Severity	Problem with source of water		Name of villages	Number of villages	Remarks
	Quality	Quantity			
A	Yes	No	Muara Mahat Baru	1	Some people report problems with water quality but water is potable and they are still using the well.
B	No	Yes	Gunung Bungsu Koto Mesjid Koto Tuo Pongkai Istiqomah Tanjung Alai	5	Several wells in the village are affected during the dry season.
C	Yes	Yes	Batu Bersurat Binamang Lubuk Agung Mayang Pongkai Muara Takus Pongkai Baru Pulau Gadang Ranah Sungkai	8	Several wells in the village are affected during the dry season.  Some people report problems with water quality but water is potable and they are still using the well. Other sources are available but these are contaminated.  In Batu Bersurat, Binamang and Lubuk Agung most villagers have abandoned wells and are using contaminated surface water as the primary source.
D	Yes	Yes	Tanjung Balit Tanjung Pauh	2	Wells have been abandoned because quality of water is very bad (high turbidity and color). Villagers are using other sources and buying water.

A = less severe D = most severe

**Table 4.5 (1/5) Action Plan Proposed By Provincial Government of Riau and Regency Government of Kampar**

No.	Problems according to Bappenas Letter No. 3563/D.V/0a/2001 dated 9/8/2001	2	3	4	5	Fund		8
						Total (Rp. X.000)	Source	
1								
A.	<i>Plantation Sector</i> Rubber Plantation Development in Resettlement of 5,392 ha, failed		<ul style="list-style-type: none"> <li>&gt; Regional Government of Riau Province by Regional Budget (APBD) of Riau Province in F/Y 1999/2000 has given allocation to deal with the failure by planting rubber in the total area of 6,892 ha for 3,446 families in 11 villages</li> <li>&gt; Plantation maintenance (P-1) F.Y 2001 9,688,500,000 covering the area of 6,392 ha (Regional Budget/APBD of Riau Province F/Y 2001)</li> <li>&gt; Substitute of unsuitable land for plantation 163 ha: "Rock 88 ha, Swamp 44 ha, Flooded Area 30 ha" Rp.584,630,000 (APBD of Riau Province ABT F/Y 2001)</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Proposal for maintenance of Plantation P-2 &amp; P3 with total area of 5,338 ha and 1,554 ha respectively in F/Y 2000</li> <li>&gt; Comprehensive study in frame of preparation of land suitability study</li> </ul>	<ul style="list-style-type: none"> <li>2002 to 2006</li> <li>2002/ .....</li> </ul>	<ul style="list-style-type: none"> <li>10,341,750</li> <li>250,000.00</li> </ul>	<ul style="list-style-type: none"> <li>Provincial APBD 2002</li> <li>APBD II (Budget of Level II Region Kampar)</li> </ul>	<ul style="list-style-type: none"> <li>Plantation Service of Riau Province</li> <li>Regional Gov. of Kampar &amp; University</li> </ul>
B.	<i>Clean Water Facilities Development</i> Clean Water Development Problem in Resettlement Area Construction of 25 wells in resettlement area by JBIC Loan IP-500 P3DT Phase II mostly are not in function.	<ul style="list-style-type: none"> <li>&gt; Regional Government of Kabupaten Kampar has tried to rehabilitate clean water facilities by development of raw water source complete with intake, reservoir, transmission and distribution pipe, F.Y 2001.</li> </ul>	<ul style="list-style-type: none"> <li>&gt; By Water Supply and Management Program, the Regional Government of Kampar re-studied the water sources by carrying out the following activities                             <ul style="list-style-type: none"> <li>- Finding of water source by geoelectrical equipment</li> <li>- Finding of new water source</li> <li>- Design of transmission and distribution</li> <li>- Operation and Maintenance</li> </ul> </li> <li>Implementation of F/Y 2002</li> </ul>	<ul style="list-style-type: none"> <li>2001 to 2002</li> </ul>	<ul style="list-style-type: none"> <li>750,000</li> </ul>	<ul style="list-style-type: none"> <li>APBD II (Budget of Level II Region Kampar)</li> </ul>	<ul style="list-style-type: none"> <li>Regional Gov. of Kampar</li> </ul>	
C.	<i>Water Quality in Reservoir</i> Result of IBIC Survey on water quality in the reservoir showed that HZS, BCD5 & CO2 exceeded border line of B class water quality.	<ul style="list-style-type: none"> <li>&gt; Monitoring was conducted by PT. PLN in association with Riau University.                             <ul style="list-style-type: none"> <li>&gt; Trees cutting                                     <ul style="list-style-type: none"> <li>- T. Paut (31 Aug. to 19 Sept. 2001)</li> <li>- T. Balit (20 Sept. to 9 Oct. 2001)</li> </ul> </li> <li>- Pulau Gadang Village (10 Oct. to 25 Nov. 2001)</li> <li>- Mhuara Takus Village (26 Oct. to 11 Nov. 2001)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>&gt; River RPL (Environment Monitoring Plan) &amp; RKL (Environment Management Plan), 2002</li> <li>&gt; Re-monitoring of water quality.</li> <li>&gt; Fish feeding without pellet (factory product fish feeding)</li> </ul>	<ul style="list-style-type: none"> <li>2002</li> </ul>	<ul style="list-style-type: none"> <li>3300,000.00</li> </ul>	<ul style="list-style-type: none"> <li>PLN West Sumatera - Riau</li> </ul>	<ul style="list-style-type: none"> <li>PLN West Sumatera - Riau and the Third Parties:                             <ul style="list-style-type: none"> <li>- (Unclear)</li> <li>- (Unclear)</li> </ul> </li> </ul>	

Source: Riau Province Action Plan, December 2001

**Table 4.5 (2/5) Action Plan Proposed By Provincial Government of Riau and Regency Government of Kampar**

1	2	3	4	5	6	7	8
D. <i>Malaria Disease</i>	<p>JBIC requested report as result of Environmental Management Plan especially prevention of Malaria Disease in Resettlement area.</p>	<p>&gt; Monitoring on the possible development of malaria disease conducted by PT. PLN, Regional Government and Universities. For anticipation, tawes and gold fish were breded according to study recommendation on Environmental Management Plan, with the following schedule:</p> <ul style="list-style-type: none"> <li>&gt; Fish seedling for 2001 consisting of                             <ul style="list-style-type: none"> <li>- 24 July 2001 (40,000 fishes)</li> <li>- 30 August 2001 (40,000 fishes)</li> <li>- September 2001 (40,000 fishes)</li> <li>- October 2001 (40,000 fishes)</li> <li>- November 2001 (40,000 fishes)</li> <li>- December 2001 (40,000 fishes)</li> </ul>                             with total cost of Rp.98,250,000.                         </li> <li>&gt; For preventive measure against malaria disease, the Health office is ready with the following:                             <ul style="list-style-type: none"> <li>- Medical service by Public Health Center (PUSKESMAS), Sub-PUSKESMAS and Midwives.</li> <li>- PUSKESMAS Hospital connection.</li> <li>- Immunizations Service</li> <li>- Pest control to houses against malaria mosquitoes</li> <li>- Medical treatment to patient.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>&gt; Fish seedling for 2002 consisting of:                             <ul style="list-style-type: none"> <li>- January 22 (40,000 fishes)</li> <li>- February 02 (40,000 fishes)</li> <li>- March 20 (40,000 fishes)</li> <li>- April 20 (40,000 fishes)</li> </ul>                             Total cost Rp.84,000,000                         </li> <li>&gt; Follow up necessary measure to prevent malaria disease, the Health Office ready with the following:                             <ul style="list-style-type: none"> <li>- Medical service by Public Health Center (PUSKESMAS), Sub-PUSKESMAS and Midwives</li> <li>- PUSKESMAS Hospital connection.</li> <li>- Immunizations Service</li> <li>- Pest control to houses against malaria mosquitoes</li> <li>- Medical treatment to patient.</li> </ul> </li> </ul>	<p>2001 to 2002</p> <p>2001 to .....</p> <p>2002 to .....</p> <p>2002</p>	<p>182,250</p> <p>32,830 (Combined in the Public Service Enhancement Pjt)</p> <p>200,000 (US\$) (NGO Grant)</p>	<p>PT. PLN</p> <p>Provincial Budget</p> <p>WWF</p>	<p>PT. PLN</p> <p>Heal Office of Riau Province</p> <p>WWF</p>
E. <i>Wildlife Conservation &amp; Monitoring</i>	<p>JBIC requested report from Plant of Study for Protection and Monitoring of Protected Wildlife</p>	<p>&gt; Prevention and control of elephant with potential to disturb resettlement location in F/2001. Combined in the Environmental Project (Provincial Budget of Riau) by Ministry of Forestry in 2001.</p>	<p>&gt; WWF Program of Riau for protection of wildlife (elephant, tiger, bear, etc.)</p>	<p>2002</p>	<p>200,000 (US\$) (NGO Grant)</p>	<p>WWF</p>	<p>WWF</p>

Source: Riau Province Action Plan, December 2001

**Table 4.5 (3/5) Action Plan Proposed By Provincial Government of Riau and Regency Government of Kampar**

1	2	3	4	5	6	7	8
F.	<p><i>Low Fertility Level and Sedimentation in Reservoir</i></p> <p>Lower fertility of land in resettlement area and sedimentation in the reservoir due to deforestation in catchment area and conversion of land use in reservoir area.</p>	<ul style="list-style-type: none"> <li>&gt; Result of monitoring and survey by PT. PLN</li> <li>&gt; Redevelopment of public forest in Riau Province by OECF Loan Imp. 22 Kecamatan XII Koto Kampar 1998/1999 - 2000/2001</li> <li>&gt; Implementation of FLKTI Indragiri-Rokan (13,030 M from Loan, 7,506 M, 116,396 M by GOD).</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Spatial Preparation of PLTA Koto Panjang reservoir area</li> <li>&gt; Preparation of Regional Regulation</li> <li>&gt; Public Forest Conservation Project 2000 ha located in Tanjung Alai and Tanjung.</li> <li>&gt; Agro-Forestry Conservation Project 2,056 ha in Pangkal Istiqomah, Muara Takus, Mt. Bungsu and Tabing Villages</li> <li>&gt; Socialization to the people of reservoir area regarding land utilization and protection of catchment area</li> </ul>	<ul style="list-style-type: none"> <li>2002/2003</li> <li>2002/2003</li> <li>1998/1999 - 2000/2001</li> <li>1998/1999 - 2000/2001</li> <li>2002 to ....</li> </ul>	<ul style="list-style-type: none"> <li>1,000,000.00</li> <li>200,000</li> <li>2,085,000</li> <li>30,000.00</li> </ul>	<ul style="list-style-type: none"> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> </ul>	<ul style="list-style-type: none"> <li>Regional Development of Kampar</li> <li>Forestry Service of Kabupaten Kampar</li> <li>Forestry Service of Kabupaten Kampar</li> <li>Regional Government of Kampar</li> </ul>
G.	<p><i>Legal Process and Land Compensation</i></p> <p>Claim for compensation from 67 fam. from Kimbo Data and only 6 fam. Has won against the claim and at the moment has developed to other region in Muara Takus and Tanjung.</p>	<ul style="list-style-type: none"> <li>&gt; Issuance of Certificate for area of 5,489 ha for 3,444 families in June 2001 (certificate of 2000).</li> <li>&gt; Measurement of land ownership for 1742 families in 2001.</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Preparation of Detailed Spatial Plan of Koto Panjang HEPP special region by the following specifications:                             <ul style="list-style-type: none"> <li>- Land Use</li> <li>- Catchment Area</li> <li>- Intensity of Settlement Area Utilization</li> <li>- Identification of Plantation Area Utilization</li> <li>- Identification of existing Protected Forest (Bukit Sugh, Balang Ujak I, Bukit Bungkok &amp; Bukit Permaisari)</li> <li>- Identification of river flow pattern to the reservoir</li> <li>- Identification of Muara Takus special region.</li> </ul> </li> <li>&gt; Proposal for land certification for the inhabitants of Koto Panjang HEPP, related with the previous problem the owner continuously changed, location at the elevation of 85 meter, activities to be made on                             <ul style="list-style-type: none"> <li>- Re-inventory of 333 land plots.</li> <li>- Re-measurement of 333 land plots (portion) in P. Gadang, Biniang, Tanjung Alai, Mt. Bungsu, Pongkal and Istiqomah Village</li> </ul> </li> <li>&gt; Continuation of measurement for 1742 families up to handing over of Right Certificate.</li> </ul>	<ul style="list-style-type: none"> <li>2002 to ....</li> </ul>	<ul style="list-style-type: none"> <li>1,000,000</li> <li>83,382</li> </ul>	<ul style="list-style-type: none"> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> </ul>	<ul style="list-style-type: none"> <li>Regional Development of Kampar</li> <li>National Land Affairs of Kampar</li> </ul>

Source: Riau Province Action Plan, December 2001

**Table 4.5 (4/5) Action Plan Proposed By Provincial Government of Riau and Regency Government of Kampar**

1	2	3	4	5	6	7	8
H. <i>Submission of Environment Progress Report (EPR)</i>	Submission of Annual EPR during 1 year.	> Report Submission Schedule is as below: - September 2001 - December 2001	> Report Submission Schedule is as below: - March 2002 - June 2002 - September 2002 - December 2002	2001 to 2002		PT. PLN III	PT. PLN III Bappenas
I. <i>Public Economic Empowerment Program</i>	Animal Husbandry Development		> Supply of 275 Cow Breed/Beef Cattle for 75 families in Batu Bersurat, Koto Mesjid and Mt. Maletto Villages.	2002 to .....	569,375	Budget of Level II Region of Kampar	Animal Husbandry Office of Kampar
	Fishery Development		> People Fishery Business Development in Istiqomah, T. Alai, Muara Takus, Mt. Bungsu, Tanjung Batu Bersurat villages, 300,000 fishes, 300 fish breeding basket	2002 to .....	230,080	Budget of Level II Region of Kampar	Fishery Office of Kampar
	Rural and Plantation Road Development		> Fishery Production Development in Kota Tua, P. Gantung, Tanjung, village, additional fish seeds of 77,000.	2002 to .....	100,750	Budget of Level II Region of Kampar	Fishery Office of Kampar
			> Road Development and Bridge Replacement - Mt. Bungsu Village, Asphalt Road Betterment 1.5 km, Rehabilitation of Environment Road 3 km, Culverts 8 units and Drainage 400 m.	2002 to .....	533,150	Budget of Level II Region of Kampar	Public Works of Kampar
			- Upgrading of Artery Road 11.9 km: drainage 2,700 m, culverts 23 units located in Mt. Bungsu Village.	2002 to .....	900,000	Budget of Level II Region of Kampar	Public Works of Kampar
			- Bridge Construction in Ranah Sungkal Village 30 m, P. Gadang Village 50 m, Koto Mesjid Village 14 m	2002 to .....	1,160,000	Budget of Level II Region of Kampar	Public Works of Kampar
			- Road Upgrading in Batu Bersurat 5 km, Koto Mesjid 2 km, T. Alai 6 km & G. Bungsu 6 km.	2002 to .....	3,420,000	Budget of Level II Region of Kampar	Public Works of Kampar
			- Road hardening in Koto Masjid Village 2 km and T. Alai Village 5 km	2002 to .....	1,330,000	Budget of Level II Region of Kampar	Public Works of Kampar

Source: Riau Province Action Plan, December 2001

**Table 4.5 (5/5) Action Plan Proposed By Provincial Government of Riau and Regency Government of Kampar**

1	2	3	4	5	6	7	8
			<ul style="list-style-type: none"> <li>- Road construction to PLTA Koto Panjang, Batu Bersurat Village 1 km, Kota Tua 3 km and Binuang 1 km.</li> <li>&gt; Road and Bridge Construction                             <ul style="list-style-type: none"> <li>- Ring road construction of Koto Tuo Tourist Location</li> <li>- Road Construction to K. Panjang HEPP Reservoir in Binuang</li> <li>- Construction of drainage in Koto Mesjid village 3,000 m and B. Bersurat Village 4,000 m.</li> <li>- Construction of box culvert in KotoTuo, Pangkal and Batu Bersurat villages, 6 units</li> </ul> </li> <li>&gt; Continuation of floating nets assistance.</li> </ul>	<ul style="list-style-type: none"> <li>2002 to ....</li> <li>2002 to ....</li> <li>2002 to ....</li> <li>2002 to ....</li> <li>2002 to ....</li> <li>2002</li> </ul>	<ul style="list-style-type: none"> <li>550,000</li> <li>1,086,384</li> <li>2,200,000</li> <li>4,820,000</li> <li>372,000</li> <li>200,000</li> </ul>	<ul style="list-style-type: none"> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Budget of Level II Region of Kampar</li> <li>Caltex</li> </ul>	<ul style="list-style-type: none"> <li>Public Works of Kampar</li> <li>Public Works of Kampar</li> <li>Public Works of Kampar</li> <li>Public Works of Kampar</li> <li>Public Works of Kampar</li> <li>Fishery Faculty of Riau University</li> </ul>
I.	<i>Fishery Development</i>	<ul style="list-style-type: none"> <li>&gt; Caltex Aid for fishery development                             <ul style="list-style-type: none"> <li>- Floating net 200 units, realization of 300 million fish seeds from total assistance of 500 million per year 1990/2000</li> </ul> </li> </ul>					

Source: Riau Province Action Plan, December 2001





**Table 4.6 (2/2) Action Plan Proposed By Provincial Government of West Sumatra and Regency Government of Lima Puluh Kota**

2002-2004 YEARS

No	The Project/Activity	Present Constraints	First Year (Rp)	Second Year (Rp)	Third Year (Rp)	Total (Rp)	Remarks
3	The Animal Husbandry	1. The knowledge of the society about the cultivation of breeding (cow, buffalo, goat, duck and chicken) is pretty low, thus the breeding is done traditionally.	2,800,000,000	1,800,000,000	800,000,000	5,400,000,000	Department of Animal Husbandry
	3.1 The procurement of livestock seed big/small		2,000,000,000	1,000,000,000	400,000,000		
	3.2 The making efficient use of breeder	2. The usage of the land for husbandry and fishery business is very low.	400,000,000	400,000,000	400,000,000		
	3.3 Supervision	3. The insufficient training and counseling from the relevant institution.	400,000,000	400,000,000	400,000,000		
4	The Fishery		1,200,000,000	125,000,000	125,000,000	1,450,000,000	Department of Fishery a
	4.1 The making efficient use of fisherman	4. The difficulty in getting the capital.	1,000,000,000				
	4.2 The procurement of seed fish	5. The problem in the field of fishery is that the construction of the pools are very too simple, without land managing, it is not given the lime and manure, the quality of fish seed is low.	100,000,000	75,000,000	75,000,000		
	4.3 Research/supervision		100,000,000	50,000,000	50,000,000		
5	The Agreement of Community Land	1. The status of Custom Land of Nagari Tanjung Balit which is now inhabited by the society of Tanjung Pauh.	202,275,000			202,275,000	Department of Land
	a. The Measuring of boundary land of Tanjung Balik; 450 lot / 900 ha		129,275,000				
	b. The measuring of isolated area (67 lot / 196 ha)	2. The ill-definition of the custom land boundary between the two Nagari.	49,000,000				
	c. The measuring of boundary land of community land of Tanjung Pauh & Tanjung Balik (6 km)	3. Unfinished indemnity.	24,000,000				
6	Reforestation	4. The facility promised to the society was not properly realized.	(To be considered)				Department of Forestry of Province
	7 The making efficient use of community	1. The existence of the suspicion of the society to the outsiders, whether it is the government or the private enterprise by the name of government.	1,500,000,000	251,400,000	200,000,000	1,951,400,000	The Regency Government
	a. The training of community		1,320,000,000				
	b. Counterpart, 20 man, 12 months @ Rp. 750.000,00	2. The main living of the society which was previously as the farmers did not give income for their family, because the available land was not properly operated or it failed, and the same thing happened to the lawn farm.	180,000,000				
8	Coordination of Province / Regency		1,013,920,000	650,000,000	650,000,000	2,313,920,000	
	- The coordination of Province		400,000,000	250,000,000	250,000,000		Bappedada of Province
	- The coordination of Regency		613,920,000	400,000,000	400,000,000		Bappedada of 50 Kota Regency
	Total		21,507,195,000	8,476,400,000	5,170,900,000	35,154,495,000	

Source: West Sumatra Province Action Plan, December 2001

**Table 4.7 - Clean Water Project Proposed and Completed in 2001 in Kotopanjang**

Public works                      Riau Province                      XIII Kampar Regency

List of projects

Location	Village	Description	unit/qty	budget Rp.	Reported completed by PU
Koto Ranah	Palau Gadang			0	
Koto Ranah	Koto Mesjid	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	
Ranah Sungkai	Ranah Sungkai			0	
Ranah Sungkai	Lubuk Agung	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	vvv
Batu Bersurat	Batu Bersurat	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	vvv
Batu Bersurat	Binamang	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	vvv
Southern Siberunang U-II	Pongkai Baru	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	xxx
Sungai Pagar	Mayang Pongkai			0	
Sungai Pagar	Pongkai Istiqomah			0	
Ranah Koto Talago	Tanjung Alai	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2500 m	120,743,000	
		filter & storage combined	1	38,810,000	
				198,157,000	vvv
Southern Muara Takus	Muara Takus			0	
Southern Muara Takus	Koto Tuo	concrete check dam	1	38,604,000	
		transmission pipe PVC DN 75mm	2000 m	96,594,000	
		filter & storage combined	1	38,810,000	
				174,008,000	vvv
Bangkinang	Muara Mahat Baru			0	
Southern Siberunang U-I	Gunung Bungsu			0	
total for affected villages				1,362,950,000	

verified during SAPS team site visit                      vvv

SAPS team could not confirm completion of this project during site visits                      xxx

Data Source: BAPPEDA, Kampar Province

Notes

Project for Pongkai Baru not actually implemented and not feasible

Project in Koto Tuo is partly ineffective

cost estimates are all the same because actual conditions in the field are not verified,

solutions are all the same regardless of site specific conditions.

In some cases there is not sufficient difference in elevation between source and village to provide pressure by gravity flow

projects that are not completed are carried over into next years program

cost for constructing filter and storage is much lower than that shown in west Sumatra

**Table 4.8 - Proposed clean water project for 2002 in Kotopanyang**

Public works

Riau Province

XIII Kampar Regency

List of new projects

Location	Village	Description	unit/qty	budget Rp.
Koto Ranah	Palau Gadang			0
Koto Ranah	Koto Mesjid	concrete check dam	1	42,729,000
		transmission pipe PVC DN 75mm	2500 m	132,374,000
		filter & storage combined	1	42,477,000
				217,580,000
Ranah Sungkai	Ranah Sungkai			0
Ranah Sungkai	Lubuk Agung	concrete check dam	2	85,458,000
		transmission pipe PVC DN 75mm	2x2500m	264,748,000
		filter & storage combined	2	84,954,000
				435,160,000
Batu Bersurat	Batu Bersurat			0
Batu Bersurat	Binamang			0
Southern Siberunang U-II	Pongkai Baru			0
Sungai Pagar	Mayang Pongkai			0
Sungai Pagar	Pongkai Istiqomah			0
Ranah Koto Talago	Tanjung Alai			0
Southern Muara Takus	Muara Takus			0
Southern Muara Takus	Koto Tuo			0
Bangkinang	Muara Mahat Baru			0
Southern Siberunang U-I	Gunung Bungsu	new shallow wells	10	27,800,000
		concrete check dam	1	42,729,000
		transmission pipe PVC DN 75mm	2500m	132,374,000
		filter & storage combined	1	42,477,000
				245,380,000
total for new projects				898,120,000

Data Source: BAPPEDA, Kampar Province

Notes

10% increase in unit costs since 2001

reduction in the number of projects proposed

**Table 4.9 - Action Plan for PLTA Kotopanjang 2002 - 2006**

Public works

West Sumatra Province

50 Kota Regency

(Rp.)

Total program budget	95,154,495,000
project administration	2,000,000,000
clean water	5,765,000,000
rubber plantations	21,235,820,000
animal husbandry	3,600,000,000
fish culture	1,450,000,000
land acquisition	202,275,000
re-forestation	60,000,000,000
human resources development	951,400,000

**Details of clean water projects**

Location	Village	Description	unit/qty	budget Rp.
Rimbo Data	Tanjung Pauh	detailed design	1	150,000,000
	Tanjung Balit	road improvements	5000m	550,000,000
		drainage canal	10000m	850,000,000
		rehab MCK	25	25,000,000
		rehabilitate intake dam 30 liter/dt	1	100,000,000
		slow sand filter	1	1,700,000,000
		transmission pipe PVC DN 75mm	7500	300,000,000
		transmission pipe PVC DN 50mm	12500	350,000,000
		transmission pipe PVC DN 200mm	3000	1,305,000,000
		individual house connections	800	280,000,000
		new check dam - design		45,000,000
		new check dam - construct		110,000,000
				<b>5,765,000,000</b>

Source: West Sumatra Provincial Office of PU

**Table 4.10 Water Supply Constraints Analysis for a Typical Village**

<u>Constraint</u>	<u>Effect</u>	<u>Outcome</u>
<i>Social</i> Villagers expect the government to assume responsibility for operating and maintaining the water supply system.	No willingness to pay for operation of systems that use energy.	Need to have inexpensive solutions with as little operation and maintenance input as possible.
<i>Technological</i> Surface water sources are not protected, contaminated with pathogens.	Pathogen removal required	Treatment process requires pathogen removal – using slow sand filtration, boiling or chlorination
Groundwater quality is poor.	Need to check water quality in wells to determine the nature of the problem	May need to have an alternate source of water for drinking and washing clothes or some form of household water treatment
Spare parts are difficult to obtain and technical ability of villagers is low	Extraction and treatment process must be simple and not reliant on power or chemicals	Rules out pumping, coagulation, chlorination and rapid sand filters
Topography is hilly and settlements are often located at elevations higher than water sources	Gravity supply to parts of the village may not be possible.	Piped distribution to all households will not be possible. Must provide community distribution points at lower elevations.
Three phase electrical distribution is not available	Pumps must be powered by fuel engine, which are maintenance intensive.	Must limit the use of pumps to simple hand pumps or small jet pumps with single phase motor.
Villagers are not qualified to operate and maintain water supply schemes	Limited ability to operate and maintain piped pumping and treatment schemes	Must provide adequate period of training
<i>Financial</i> Income levels in village is still low	Ability to pay for operating and maintenance costs is low	Need to have inexpensive solutions Avoid the use of pumps if possible.
<i>Institutional</i> There is no rural water supply authority	No caretaker responsible for operation and maintenance.	Need for villagers to assume responsibility for O & M.
<i>Environmental</i> There is a water deficit during the dry season	Need to check reliability of flow in surface streams during dry season Need to check depth of groundwater during dry season	Increase storage and locate reliable sources that can be used in the dry season.

**Table 4.11 Water Supply Improvement Strategy by Village**

Group	Problem with source of water		Name of villages	Number of villages	Water Supply Improvement Strategy	
	Quality	Quantity			Shallow Wells	Other sources
A	Yes	No	Muara Mahat Baru	1	Provide household treatment for drinking water	Use rainwater collection for domestic use
B	No	Yes	Gunung Bungsu Koto Mesjid Koto Tuo Pongkai Istiqomah Tanjung Alai	5	Dig deeper wells if soil conditions permit and use for all domestic purposes.	If deeper wells are not possible: develop alternate sources that can be used during the dry season.
C	Yes	Yes	Batu Bersurat Binamang Lubuk Agung Mayang Pongkai Muara Takus Pongkai Baru Pulau Gadang Ranah Sungkai	8	Dig deeper wells if soil conditions permit.  Provide household treatment for drinking and washing.	Develop alternate sources that can be used all year round for drinking, cooking and washing clothes.
D	Yes	Yes	Tanjung Pauh Tanjung Balit	2	Abandon shallow wells	Develop alternate sources for all domestic water needs

**Table 4.12 - List of rivers and streams near villages**

Location	Village	Sources that can be pumped	Sources for gravity schemes
Koto Ranah	Palau Gadang & Koto Mesjid	Silam (1)	to be confirmed
		Pandan	
		Benih	
		Gunjo	
		Bomban	
		Dusun	
Ranah Sungkai	Ranah Sungkai	Kinari (1)	Tebat Hantu Pinang Mangu
	Lubuk Agung	Kapecong (1)	Bukit Meranti
Batu Bersurat	Batu Bersurat	PLTA reservoir (1)	Ngalau
	Binamang	PLTA reservoir (1)	Makam
Southern Siberunang U-II	Pongkai Baru	Kinawai (1)	to be confirmed
Sungai Pagar	Mayang Pongkai	Win	n.a.
	Pongkai Istiqomah		
Ranah Koto Talago	Tanjung Alai	Silam (1)	Duku
		Bomban (1)	
Southern Muara Takus	Muara Takus	PLTA reservoir	1 spring
	Koto Tuo	none	3 springs
Bangkinang	Muara Mahat Baru	none	none
Southern Siberunang U-I	Gunung Bungsu	Kampar	Kinawai
Rimbo Datar	Tanjung Pauh & Tanjung Balit	Panca (1)	Kelok Balacu Kasing Hulu Gulamo Kelok Tujuh Parmato Bukit Lakuak

Note (1) source of raw water for treatment plant

**Table 4.13 Delivery Method Selection Criteria**

Level of service	Suitability for population size			Construction cost			Relative costs of O&M		
	small (to 100)	medium (100-500)	large (500+)	low	moderate	high	low	moderate	high
Level 1 gravity handpump	X X	X X	X	X X	to X		X X	to X	
Level 2 gravity handpump electric pump fuel pump	X X X	X X X	X	X X	to X		X X	to X	X X
Level 3 gravity handpump electric pump fuel pump	X X X	X X X	X X	X X	to X		X X	to X	X X



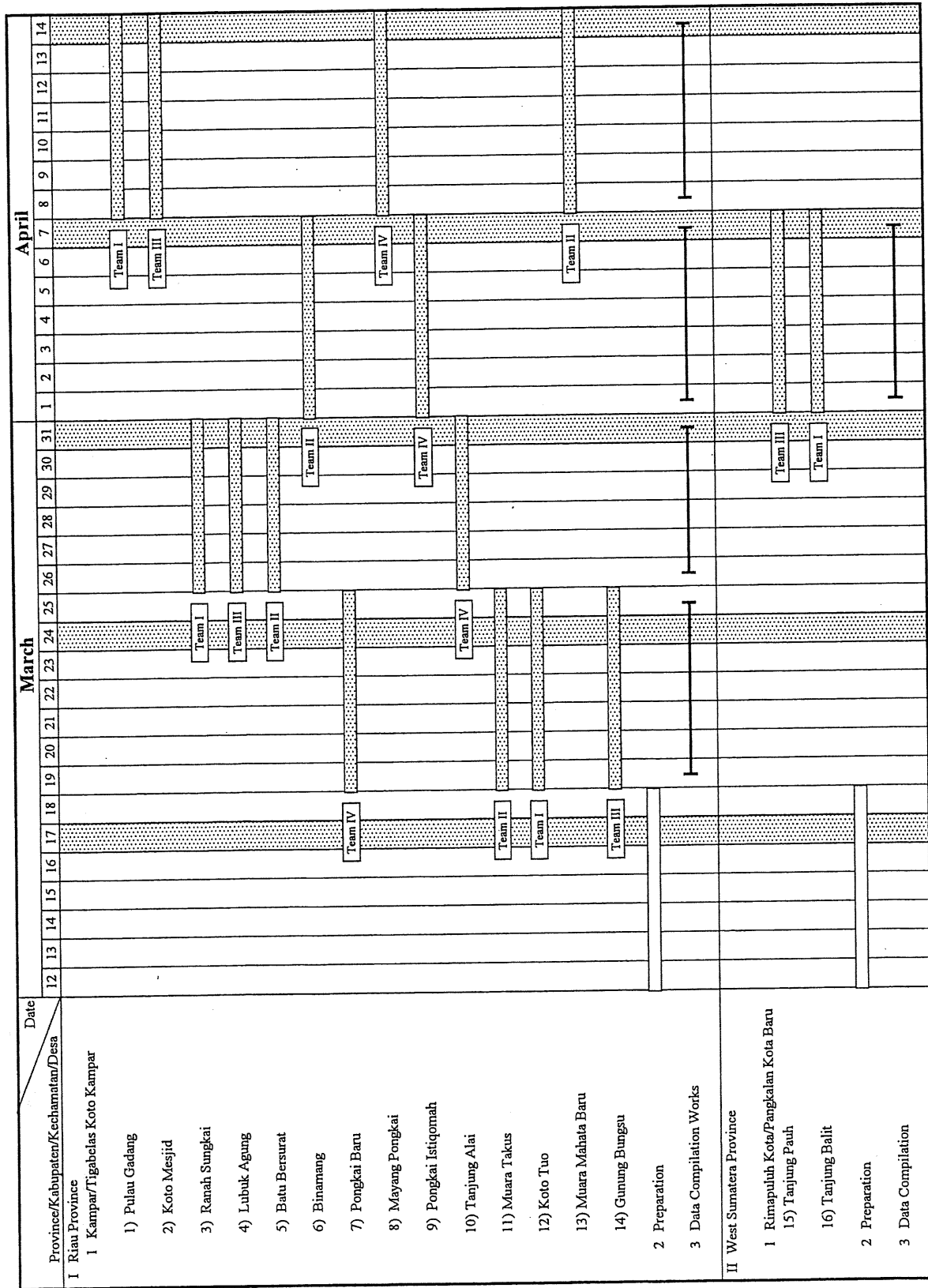
Table 4.14 - Preliminary identification of countermeasures for each village

Village	Group code	Use existing shallow wells	Increase capacity for rainwater storage	Improve shallow wells				Supplied by gravity		Pumped				Distribution method		
				household treatment for drinking	deepen some of the existing wells (1)	provide new wells	new community wells at lower elevations	no treatment	treat with slow sand filter	no treatment	rehab the existing treatment plant	new piping	rehab existing			
Muara Mahat Baru	A	O	O	O												X
Gunung Bungsu	B	O	O		O											X
Koto Mesjid		O	X	X	O	X	X	X	X							X
Koto Tuo		O	O		O											X
Pongkai Istiqomah		O	O		O											X
Tanjung Alai		O	O		X											X
Batu Bersurat	C	O	O		O											
Binamang		O	O		X											
Lubuk Agung		O	X	X												X
Muara Takus		O	O		O											X
Mayang Pongkai		O	X	X	O											
Pongkai Baru		O	O		O											
Pulau Gadang		O	X	X	O	X										X
Ranah Sungkai		O	O		X											X
Tanjung Pauh	D		O													X
Tanjung Balit			O													X

(1) depends on finding water of good quality and quantity  
 (2) use existing boreholes  
 (3) use existing distribution system

X Potential options, to be confirmed by feasibility study.  
 Must resolve constraints before implementing.  
 O preferred options

**Figure 4.1 Schedule of Village Assessment**



**Figure 4.2 - Priorities for selecting a water source for rural water supply**

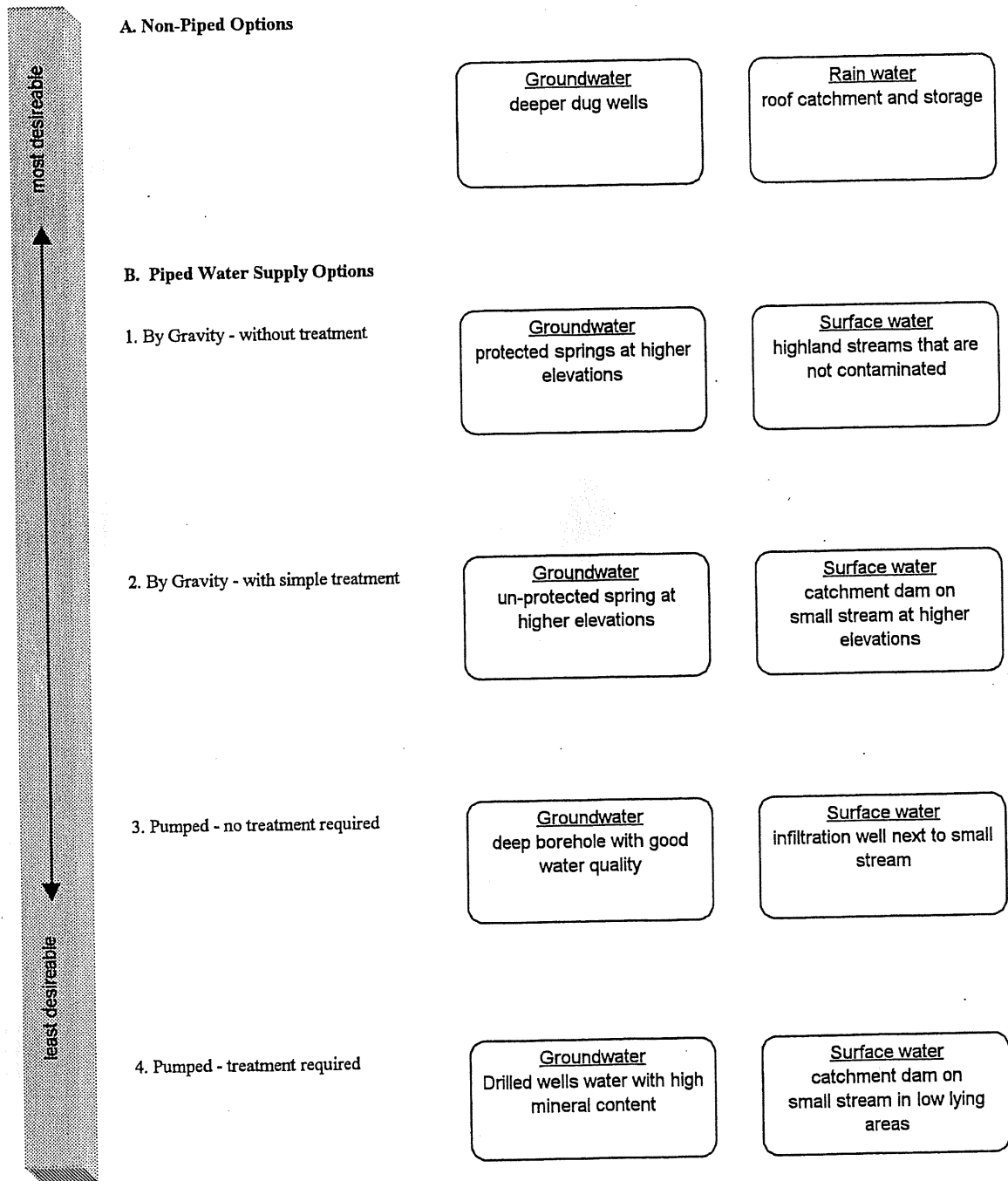
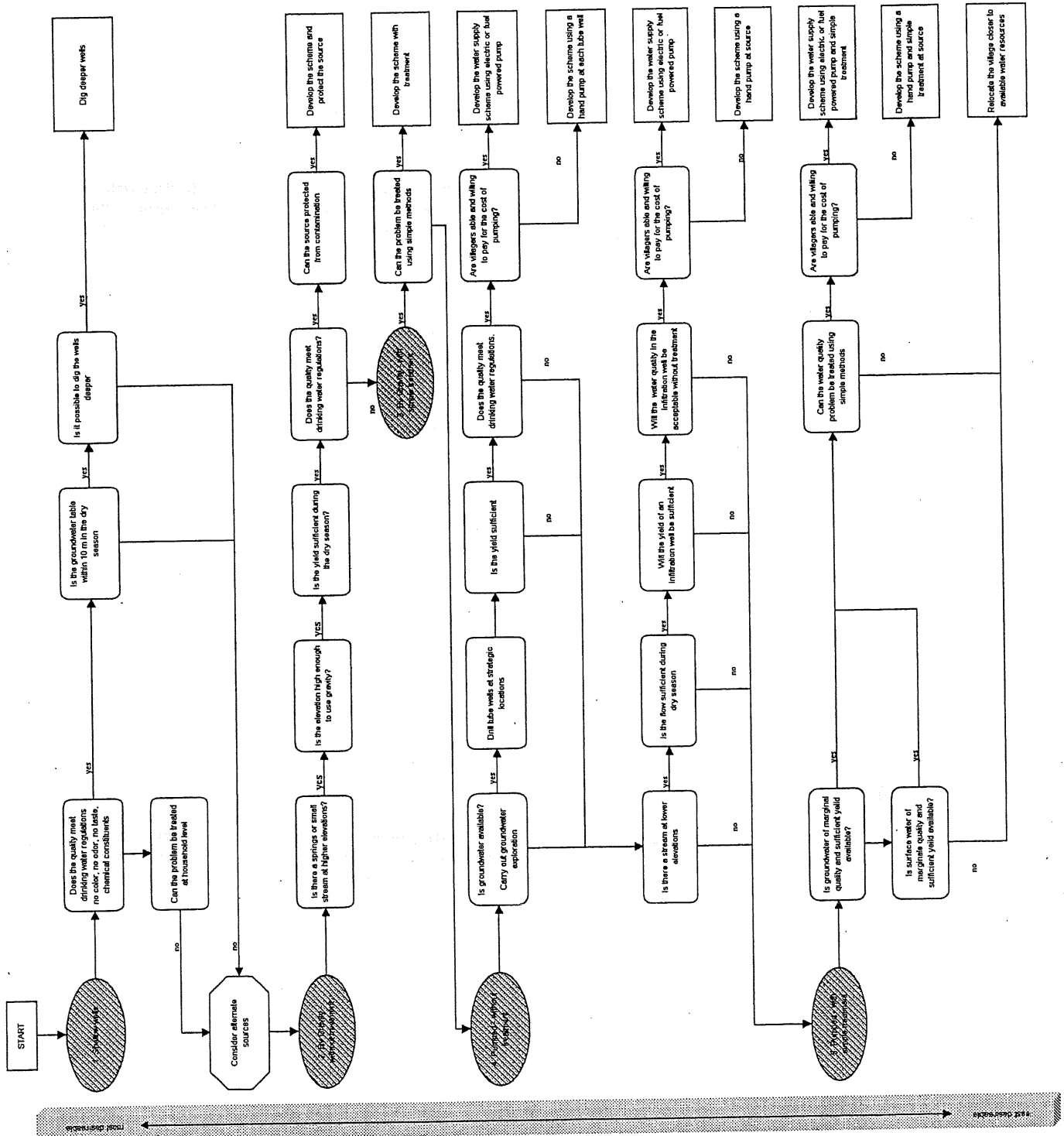


Figure 4.3 - Decision making process for improving water supply conditions



## CHAPTER 5 ENVIRONMENTAL STUDY

### 5.1 Water Quality in the Reservoir

#### 5.1.1 Review of Environmental Management and Monitoring Plans

The 1984 Environmental Management and Monitoring Plans recommended the following actions related to water quality:

- to close the lead mines at Tanjung Balit to prevent water pollution,
- to remove vegetation from the inundated area to protect water quality, and
- to monitor water quality in the reservoir

No report has been received of any action taken on the closure of lead mines.

##### (1) Removal of Vegetation from the Reservoir Area

No report has been received of any action taken to clear vegetation before the reservoir area was inundated. The tops of inundated trees have since been removed at low water level from 25 ha of reservoir near Batu Berserat. The removal of tree tops from a further 100 ha is planned for areas around Tanjung Balit and Muara Takus.

These areas are small compared with the total reservoir area (11,300 ha) and the action will have a negligible impact on water quality. However some benefit for fishing with gill nets, navigation and amenity will be achieved when the water level is high.

##### (2) Water Quality Monitoring

Water quality monitoring was started in 1994 and is planned to continue to 2003. Monitoring was carried out by Padjadjaran University in 1994 and by the Centre for Environment Research, Riau University from 1996 to 2001<sup>1)</sup>.

The monitoring has been carried out to assess the quality of water for domestic purposes, rather than its suitability for fisheries development. However faecal coliform counts have not been routinely made despite their importance for assessing potability. A total of 7 physical and 27 chemical parameters have been measured, some of which were added or dropped during the programme without

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<sup>1)</sup> Pt. Bina Bina Semesta. Study on Koto Panjang Hydroelectric Power Plant and Associated Transmission Project. Final Report. JBIC, Jakarta; 2001  
PLN, 2001a. Report of Realisation of Environmental Management Plan and Environmental Monitoring Plan. PLTA Koto Panjang. Term III, September 2001. PLN, Pekanbaru;  
PLN, 2001b. Pemantauan Rencana Pengelolaan Lingkungan Dan Rencana Pemantauan Lingkungan PLTA Koto Panjang. June 2001. PLN, Pekanbaru;  
PLN, 2001c. Lamporan Pemantuan Pelaksanaan Rencana Pengelolaan Lingkungan (RKL) Dan Rencana Pemantauan Lingkungan (RPL) PLTA Koto Panjang. Periode Triwulan IV. December 2001. PLN, Pekanbaru.

explanation.

Water samples were usually taken from five sites before reservoir impounding began in March 1997 and from five sites afterwards. Three sample sites used after impoundment were the same or close to sites used in the earlier period. In September and December 2001, water samples were also analysed from Gulamo bridge in the reservoir and from S1 (Tanjung). The rationale behind site selection is not explained and the exact location of the sites is not given.

**Table Location of Water Sampling Sites**

Area	Before Impounding		After Impoundment	
	Site	Location	Site	Location
Inflow	S1	Tanjung, Kampar Kanan river	S1	Tanjung
	S2	Tiwi river	-	
Reservoir	S3	Tanjung Pauh, Mahat river	ST1	Tanjung Balit
	S4	Labuk Agung, Kampar Kanan river	ST2	Batu Bersurat
	-		-	Gulamo Bridge
	S5	Dam site	ST3	Dam site
Outflow			ST4	Rantau Berangin bridge, Kampar Kanan river
			ST5	Bankingang bridge, Kampar Kanan river

Source: Pt. Bitu Bina Semesta, 2001

The frequency of sampling has been irregular, varying from no samples in 1995, to one in 1994, 1996, 1998 and 2000, two in 1997 and 1999, and three in 2001.

At each site visit, water samples were collected from the surface, middle and bottom of the water column and mixed to provide a composite sample. The depths from which samples were taken is not known.

The analytical standard used is not stated in the reports, and the analytical methods and detection limits are therefore unknown. The results have been assessed against national water quality standards (Indonesian Government Regulation (PP) No. 20/1990). This regulation recognises four standards:

- Category A: potable without further treatment,
- Category B: suitable for human consumption after boiling,
- Category C: suitable for fisheries and livestock, and
- Category D: suitable for use in agriculture, industry and hydropower or water treatment works.

The reports reviewed contain data and but little interpretation of the results. These data have been reviewed (Appendix 6). Interpretation is limited by the lack of contextual information relating to stage in reservoir level, occurrence of flood inflows; local rainfall, and detail of sampling site and sampling depth. Nevertheless, several conclusions can be drawn:

- a) Most of the water samples from the reservoir have met the quality standards of

Category B (suitable for human consumption after boiling). Standards were breached in some samples for dissolved oxygen in May and November 1999; for hydrogen sulphide in November 1999 and June 2001; for lead from March 1998 to June 2001, and for cadmium in May 1999.

- b) Deterioration of water quality was due to the decomposition of organic matter and mobilization of heavy metals in soil under anaerobic conditions. While dissolved oxygen was present in surface water samples, deoxygenation occurred at depth, causing the production of hydrogen sulphide and nitrite, from sulphates and nitrates respectively, and mobilization of lead, cadmium and copper.
- c) There has been an increase in hardness, chloride and conductivity in the reservoir water since 1999 which may be due to increased sediment inflows, decay of organic matter or the solution of minerals in inundated soils.
- d) Although water quality for domestic purposes was generally satisfactory it cannot be assumed that this was the case for fish, as water samples at depth were not analysed separately.

#### 5.1.2 Present Situation

In general, surface water quality in the reservoir is now better for domestic consumption than either up- or downstream. Inflowing rivers often contains high levels of suspended sediment, while domestic waste including sewage pollute the river downstream. This situation is likely to persist for the foreseeable future.

Although submerged trees may reduce mixing of the water column, their presence in the reservoir presents a greater constraint to navigation, fishing and tourism development than to improved water quality. Based on experience in Lake Kariba in southern Africa, the trees will decay slowly and many may remain standing for over 20 years.

Any pollution from the lead mines at Tanjung Balit, if it occurred, was probably short-lived due to the deposition of sediment over mine workings near the Mahat river mouth.

Despite the considerable body of data on water quality there remains a poor understanding of the limnology of the reservoir, preventing an assessment of the fisheries potential. Important questions remain unanswered. In particular, it is not known whether the reservoir is stratified and if so, whether this is a constraint to production. Nor is it known whether organic matter brought down by floods and deposited in the reservoir headwaters will cause deoxygenation and limit fishing opportunities seasonally in these areas.

### 5.1.3 Assessment of Changes

The temporary deterioration of water quality was predicted by the EIA. There is no evidence that anyone has been adversely affected by poor water quality. The risk of harm was low as most people living in the reservoir area have taken their water from local wells and streams rather than from the reservoir, and the water quality in any event was relatively good.

## 5.2 Sedimentation of the Reservoir

### 5.2.1 Review of Environmental Management and Monitoring Plans

The Summary of the Environmental Impact Study<sup>2)</sup> noted that the life of the reservoir would be shortened by soil erosion due to dryland agriculture and shifting cultivation in the absence of soil conservation measures.

Specific measures to monitor and combat erosion were proposed in the Environmental Management and Monitoring Plans. These were:

- to restore land and stop erosion near resettlement villages,
- to train local farmers in soil conservation techniques,
- to preserve forest areas with slopes > 40%,
- to undertake reforestation, and
- to monitor sedimentation in the reservoir along transects.

No reports of any action taken to combat erosion have been received. The Environment Research Centre at Riau University began monitoring sediment deposition by bathymetric survey along two transects across the reservoir, one near the dam wall and the other at Gulamo Bridge in December 2001. As most sediment will be deposited close to large river mouths, the surveys will underestimate the true rate of sedimentation significantly.

### 5.2.2 Present Conditions

#### (1) Immediate Reservoir Catchment

Soil erosion, caused by construction activities, logging and cultivation is evident in many parts of the immediate reservoir catchment. Erosion along the Pekanbaru - Bukittinggi highway generally, and at the Gulamo bridge in particular, is serious, threatening not only the life of the reservoir but the road itself.

There is no sign of the 50 m wide buffer zone that was planned around the high water level of the reservoir<sup>3)</sup>. Forest has generally been cleared on all slopes down

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<sup>2)</sup> TEPSCO, 1989. Summary of Environmental Impact Study. Kotapanjang Hydroelectric Power Project and Associated Transmission Line System.

<sup>3)</sup> PLN, 2001a. Report of Realisation of Environmental Management Plan and Environmental Monitoring Plan. PLTA Koto Panjang. Term III, September 2001. PLN, Pekanbaru.



to the shoreline. Logging is now reported to be taking place within the Bukit Suligi and Bukit Bugunkuk Forest Reserves, on Tangko Island and in other areas. Slash and burn to create gambier plantations in forest is causing erosion around Tanjung Balit and Tanjung Pauh.

Gambier production also requires large amounts of fuelwood, increasing the rate of deforestation and the risk of erosion. In order to extract the gambier, a constituent of betel, leaves are stripped from the bushes and boiled in water for several hours. In the absence of fuelwood plantations, gambier production in the past has proved unsustainable and environmentally damaging.

Alluvial fans have formed in some areas where seasonal rivers enter the reservoir, suggesting substantial amounts of sediment are now reaching the reservoir in runoff from the local catchment. This impression is reinforced by a change in reservoir water chemistry: an increase in hardness, salinity and conductivity since December 2000 may be due to increasing concentrations of ions washed out of the soil.

There is little evidence of soil erosion due to wave action or high speed boats on the reservoir, a risk foreseen in the EIA.

## (2) Upper Catchment

The rate of soil loss in the Kotapanjang catchment in 1999 was estimated to be between 20.5 - 26 tons/ha/year<sup>4)</sup>, based on land cover assessment from satellite imagery. The fate of this soil is unknown but the river gradient above the reservoir is relatively steep and significant quantities may therefore reach the reservoir. Assuming an average loss of 23 tons/ha/year and a catchment of 333,700 ha, up to  $7.7 \times 10^6$  tons of sediment may be entering the reservoir each year.

Land cover change in the catchment between 1985 and 1999 was estimated by TEPSCO (2000). Land use maps for 1985 were compared with satellite images for 1999 and changes estimated.

Sumatra generally is undergoing rapid land use change with the conversion of primary forest to secondary growth, plantation and bare land, but the rate of change recorded by TEPSCO for the Kotapanjang catchment is the highest on record. However, the rate of deforestation may have been overestimated if TEPSCO assumed that all areas of protected forest shown on maps in 1985 were undisturbed. Their true state in 1985 requires checking from satellite imagery.

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<sup>4)</sup> TEPSCO, 2000. Studi Penanggulangan Dampak Banjir Tahunan Di Pangkalan Koto Baru Kabupaten 50 Kota, Propinsi Sumatera Barat. Laporan Akhir, Vol 2. PLN, Pekanbaru.

**Table Evidence of Rapid Land Use Change in Sumatra**

Area	Land cover	Change	Reference
Mahat and Kampar catchments, West Sumatra	Protected forest	Protected forest area in 1985: 2,142 km <sup>2</sup> ; area classifiable as forest in 1999: 530 km <sup>2</sup> . Annual rate of loss: 10%.	TEPSCO (2000)
Muaratebo, Jambi	Various	58% loss of above-ground carbon stock between 1988 and 1996, mainly due to loss of primary forest	www.icsea.or.id/
Kerinci, Riau	Lowland evergreen dipterocarp forest	“Very high” 3.2% annual rate of deforestation between 1993 and 1998.	www.gvm.sai.it/Forestry/asia/
Riau (coastal)	Evergreen swamp forest	“Very high” 3.3% annual rate of deforestation between 1990 and 1998.	www.gvm.sai.it/Forestry/asia/
Lake Toba, North Sumatra	Evergreen montane dipterocarp forest	“High” 0.7% annual rate of deforestation between 1989 and 1998	www.gvm.sai.it/Forestry/asia/

### 5.2.3 Assessment of Changes

Suspended sediment load and discharge were measured during the Feasibility Study (JICA, 1984) on 12 times in 1982 and 1993 on the Kampar Kanan river at the Rantau Berangin gauging station, some 4 km downstream of the dam site (Project Completion Report, TEPSCO, 1999). The two variables were correlated to provide a sediment rating curve. The rating curve was then used to estimate annual suspended load, based on daily discharge data for 1986. Several floods occurred in this year and the estimated sediment transport was considered conservative.

The annual load at the dam site was estimated as 1,362,536 m<sup>3</sup>/year, equal to 408 m<sup>3</sup>/km<sup>2</sup>/year of catchment area at the dam site (*i.e.* 3,337 km<sup>2</sup>). It was estimated that 95% of this load (*i.e.* 1.3 x 10<sup>6</sup> m<sup>3</sup>/year), would be trapped in the reservoir, based on a general correlation between sediment trap efficiency and the ratio of reservoir gross capacity (1,545 x 10<sup>6</sup> m<sup>3</sup>) to annual inflow (184 m<sup>3</sup>/sec or 5,815 x 10<sup>6</sup> m<sup>3</sup>).

However, in the Project Completion Report (TEPSCO, 1999) the design sedimentation (denudation) rate was adapted as 500 m<sup>3</sup>/km<sup>2</sup>/year (or 0.50 mm/year) for conservative side. This applied design sedimentation rate was also compared with other major rivers/ dam projects in Indonesia or the world and discussed in the Project Completion Report.

The design soil sedimentation level after 100 years was estimated to be El. 64.0 m, some 9.5 below reservoir Low Water Level (LWL).

The following table shows the design denudation rates under various schemes/ dam projects in Sumatra island of Indonesia.

**Table Design Denudation Rates under Various Schemes in the Sumatra (Indonesia)**

No.	Scheme	River	Basin No.	Province	Catchment Area (km <sup>2</sup> )	Denudation Rate (mm/year)	Remarks
<i>Sumatera</i>							
1	Tampur - 1	Kr. Tampur	35	D. I. Aceh	2,025	0.75	5 F/S Projects
2	Teunom - 1	Kr. Teunom	205	D. I. Aceh	900	0.70	21 Pre-F/S Projects
3	Aceh - 2	Kr. Aceh	1	D. I. Aceh	323	0.70	21 Pre-F/S Projects
4	Peusangan - 1	Kr. Peusangan	19	D. I. Aceh	358	0.07	D/D, Lake Tawar u/s
5	Peusangan - 4	Kr. Peusangan	19	D. I. Aceh	945	0.70	21 Pre-F/S Projects
6	Lawe Alas - 4	Lawe Alas	190	D. I. Aceh	5,705	0.70	21 Pre-F/S Projects
7	S. Ular	S. Ular	46	N. Sumatera	1,081	0.77	Pre-F/S
8	Buaya	S. Ular	46	N. Sumatera	428	0.50	Pre-F/S
9	Karai	S. Ular	46	N. Sumatera	500	0.50	Pre-F/S
10	Lausimeme	S. Percut	42	N. Sumatera	105	0.10	Pre-F/S
11	Namobatang	S. Deli	42	N. Sumatera	93	0.10	Pre-F/S
12	Tembengan	S. Belawan	41	N. Sumatera	76	0.30	Pre-F/S
13	Beranti	S. Serdang	43	N. Sumatera	159	0.50	Pre-F/S
14	Sampanan	S. Padang	49	N. Sumatera	370	0.50	Pre-F/S
15	Sibakudu	S. Belutu	49	N. Sumatera	64	0.20	Pre-F/S
16	Asahan	A. Asahan	53	N. Sumatera	3,674	0.25	D/D
17	Renun	A. Renun	53	N. Sumatera	139	0.30	F/S
18	Jambuaye	Kr. Jambuaye	27	N. Sumatera	4,560	0.10	
19	Wampu	S. Wampu	40	N. Sumatera	956	0.44	F/S
20	Sipan Sihaporas	Sipan Sihaporas	181	N. Sumatera	196	0.10	F/S
21	Batang Tonggar	Bt. Tonggar	165	W. Sumatera	320	0.45	
22	Batang Bayang - 1	Bt. Bayang	149	W. Sumatera	84	0.70	21 Pre-F/S Projects
23	Batang Bayang - 2	Bt. Bayang	149	W. Sumatera	36	0.70	21 Pre-F/S Projects
24	Kotapanjang	Bt. Kampar	62	Riau	3,337	0.50	D/D
25	Kampar river basin (all reaches)		62	Jambi	-	0.50	F/S
26	Indragiri river basin (upper reaches)		66	Jambi	-	0.59	F/S
27	Indragiri river basin (middler reaches)		66	Jambi	-	0.53	F/S
28	Merangin - 5	Bt. Merangin	71	Jambi	2,597	0.70	21 Pre-F/S Projects
29	Merangin - 2	Bt. Merangin	71	Jambi	1,309	0.34	D/D, Lake Kerinci u/s
30	Lake Kerinci	Bt. Merangin	71	Jambi	1,053	0.72	F/S (Merangin-2)
31	Ketaun -1	A. Ketaun	129	Bengkulu	449	0.50	D/D
32	Tes -1	A. Ketaun	129	Bengkulu	612	0.50	D/D
33	Musi	A. Musi	74	S. Sumatera	587	0.17	D/D
34	Lematang -4	A. Lematang	74	S. Sumatera	1,321	0.70	21 Pre-F/S Projects
35	Komering	Way Komering	74	S. Sumatera	4,260	1.23	D/D
36	Pigarguruh	Way Sekampung	80	Lampung	2,155	1.00	D/D
37	Batutegi	Way Sekampung	80	Lampung	424	2.60	D/D
38	Way Yurak	Way Sekampung	80	Lampung	682	0.25	M/P
39	Way Pujorohayu	Way Sekampung	80	Lampung	1,743	0.24	M/P
40	Segalaminder	Way Seputih	78	Lampung	175	1.31	D/D
41	Way Banyuwangi	Way Seputih	78	Lampung	67	0.16	M/P
42	Way Tataan	Way Seputih	78	Lampung	75	0.17	M/P
43	Way Rarem	Wat Rarem	77	Lampung	328	0.75	D/D
44	Besai	Way Besai	77	Lampung	415	0.23	D/D
<b>Average in Sumatra Island</b>						<b>0.54</b>	

Source: "Hydro Inventory and Pre-Feasibility Studies", Hydro Inventory Study, Main Report, June 1999, P.T. PLN (Persero), Nippon Koei Co., Ltd. et al. p.T-29.

As seen in the above table, the denudation rates in the Sumatra island vary between 0.07 to 2.60 (average around 0.54). The design denudation rate of 0.50 mm/year for the Project might thus be in the appropriated range at the design stage (1986).

The maximum water level of the reservoir is now two metres lower than planned. At El. 83 m, the reservoir has a volume of  $1,320 \times 10^6 \text{ m}^3$  and surface area of 113 km<sup>2</sup>. As a result, the sediment trap efficiency of the reservoir is marginally lower than design, by perhaps 1-2%, but the area over which sedimentation can occur has fallen by about few percent. The net rate of sedimentation of the reservoir will be therefore higher than design.

Annual sediment inflow (deposit) in the Kotapanjang reservoir is now might be

amounted to  $4.3 - 5.5 \times 10^6 \text{ m}^3/\text{year}$  (TEPSCO, 2000), an around threefold increase from  $1.6 \times 10^6 \text{ m}^3/\text{year}$  in 1985 (TEPSCO, 1999). The detailed is shown below:

**[Land Use Condition: Year 1985]** (studied by TEPSCO, 1999)

- Annual Sedimentation Rate :  $500 \text{ m}^3/\text{km}^2/\text{year}$   
(Denudation Rate) (0.5 mm/year)
- Sediment Trap Efficiency in Reservoir : 95%
- Sediment Bulk Density in Reservoir :  $1,500 \text{ kg/m}^3$  (assumed)  
( $=1.5 \text{ mg/cm}^3 = 1.5 \text{ tons/m}^3$ )
- Specific Soil Sediment Yield (SSS) :  $7.5 \text{ tons/ha/year}$   
( $=500 \times 10^6 \text{ m}^3/\text{km}^2/\text{year} \times 1,500 \text{ kg/m}^3$ )
- Annual Sediment Inflow Deposit :  $2.4 \times 10^6 \text{ tons/year}$   
( $=7.5 \text{ tons/ha/year} \times 3,337 \text{ km}^2 \times 95\%$ )  
**:  $1.6 \times 10^6 \text{ m}^3/\text{year}$**   
( $=500 \text{ m}^3/\text{km}^2/\text{year} \times 3,337 \text{ km}^2 \times 95\%$ )

**[Land Use Condition: Year 1999]** (studied by TEPSCO, 2000)

- Annual Sedimentation Rate : (no updated data)
- Sediment Trap Efficiency in Reservoir : 95% (assumed)
- Sediment Bulk Density in Reservoir :  $1,500 \text{ kg/m}^3$  (assumed)
- Specific Soil Sediment Yield (SSS) :  $20.48 \text{ tons/ha/year}$  (Case-A)  
(by Predictive Model of Universal Soil Loss Equation [USLE] using land use data in 1999)  
:  $26.23 \text{ tons/ha/year}$  (Case-B)  
(by Sediment Discharge Formula [SDF] using sediment sampling data in 2000)
- Annual Sediment Deposit (Case-A) :  $6.5 \times 10^6 \text{ tons/year}$   
( $=20.48 \text{ tons/ha/year} \times 3,337 \text{ km}^2 \times 95\%$ )  
**:  $4.3 \times 10^6 \text{ m}^3/\text{year}$**   
( $=6.5 \times 10^6 \text{ tons/year} / 1,500 \text{ kg/m}^3$ )
- Annual Sediment Deposit (Case-B) :  $8.3 \times 10^6 \text{ tons/year}$   
( $=26.23 \text{ tons/ha/year} \times 3,337 \text{ km}^2 \times 95\%$ )  
**:  $5.5 \times 10^6 \text{ m}^3/\text{year}$**   
( $=8.3 \times 10^6 \text{ tons/year} / 1,500 \text{ kg/m}^3$ )

The potential impact of these possible changes in reservoir life is shown in the following table.

**Table Potential Impact of Sedimentation on Reservoir Life**

Year (landuse or base data)	Study	Estimated Method <sup>1</sup>	Specific Soil Sediment Yield (x tons/ha/year)	Sediment Inflow Deposit <sup>2</sup> (x $10^6 \text{ m}^3/\text{year}$ )	Time to fill Dead Storage <sup>3</sup> (years)
1982-83	Feasibility Study (JICA, 1994) and Completion Report (TEPSCO, 1999)	SSS	7.5 (x 1.0)	1.6 (x 1.0)	316 (x 1.0)
1999 (Case-A)	Mitigation of Annual Flood Impacts Study (TEPSCO, 2000)	USLE	20.48 (x 2.7)	4.3 (x 2.7)	117 (x 0.4)
2000 (Case-B)	Mitigation of Annual Flood Impacts Study (TEPSCO, 2000)	SDF	26.23 (x 3.5)	5.5 (x 3.4)	92 (x 0.3)

Notes) <sup>1</sup> SSS: Specific Soil Sediment (SSS) using sediment sampling data at Rantau Berangin gauging station in 1982-83.

USLE: Predictive model of Universal Soil Loss Equation (USLE) using land use data in 1999 (Landsat data).

SDF: Sediment Discharge Formula using sediment sampling data Batu Dukung in 2000.

<sup>2</sup> assumes the sediment bulk density (deposited sediment in the bed of reservoir) is  $1,500 \text{ kg/m}^3$  and 95% trap efficiency.

<sup>3</sup> dead storage volume equals  $505 \times 10^6 \text{ m}^3$  (= Gross  $1,545 \times 10^6$  - Active  $1,040 \times 10^6 \text{ m}^3$ )

It is concluded that the estimated sediment rates were extremely high of 20.48 to 26.23 tons/ha/year (or 4.3 to 5.5 m<sup>3</sup>/year). Those values are equal to denudation rate of 1,290 to 1,650 m<sup>3</sup>/km<sup>2</sup>/year (or 1.29 to 1.65 mm/year). Comparing to 1984 value of 7.5 tons/ha/year (or 0.5 mm/year), the increased rate reached 2.7 to 3.5 times. In the last 15 years, the significant decreased of the watershed quality have existed, and it will seriously cause negative impacts to the existence of the Mahat River watershed and the Kotapanjang reservoir. However, above values are estimated based on insufficient data such as land use data from LANDSAT images or few water sampling data.

### **5.3 Forest and Wildlife Conservation**

#### **5.3.1 Review of Environmental Management and Monitoring Plans**

A wide range of activities were proposed in the Environmental Management and Monitoring Plans to protect wildlife, either directly or indirectly. These were

- substitute forest area lost to the project with new reserves (1:1),
- preserve forest areas where slope > 40%,
- regulate against settlement of forest areas,
- monitor encroachment of forests,
- enforce regulations against encroachment,
- relocate elephants from the project area,
- restock rivers with fry of fish prevented by the dam from migrating,
- monitor changes to plankton, fish and vegetation, and
- monitor changes to mammals and birds (PLN, September 2001)

Implementation of activities related to plankton and fish are reviewed in Section 5.4.1.

##### **(1) Forest Conservation**

The consultant is unaware of any management action taken on forest substitution or forest protection. It should be noted that the primary design aims of forest conservation in the project area were to prevent sedimentation of the dam and protect streams for domestic water supply rather than conserve wildlife or provide access for local people to non-timber forest products.

##### **(2) Elephant Translocation**

The Environmental Management Plan proposed that the Federal Directorates for Forest Protection and Nature Conservation should plan the relocation of elephants and tigers from the area and that local government should implement the plan.

Two sites were considered for elephant relocation: the Protected Forest of Bukit

Suligi, near the reservoir, and the Giam Siak Kecil Forest Wildlife Reserve<sup>5)</sup>. Giam Siak Kecil was the preferred choice as it offered better elephant habitat and stronger conservation status than Bukit Suligi. It was estimated that there was room for about 50 more elephants in the 50,000 ha reserve at Giam Siak Kecil, assuming one elephant requires 400 ha of forest.

Giam Siak Kecil was declared a Forest Wildlife Reserve by means of Governor Decree No. 342/XI/1983 dated 3 November 1983. The Director of Forests and Nature Protection, Jakarta, recommended confirmation of this decree, and expansion of the reserve to 160,000 ha, to the Minister of Forestry in 1984 (Ref No: 156/VI-Sek/Perk/1984).

On 6 June 1986, the Minister of Forestry confirmed the protection of forest areas in Riau Province, although Giam Siak Kecil was not mentioned by name in the order (No: 173/Kpts-11/1986). Ten years later, PLN (1996)<sup>6)</sup> reported that "the establishment of the status of Giam Siak Kecil as Game Reserve is being processed by the Central Government"

Thirty elephants were moved to the reserve in 1993 and a further five in 1995. One other elephant died during translocation. No monitoring of the fate of these animals was carried out.

Following the removal of elephants from the project area, the Forest Department recommended a 6 km long electric fence should be constructed north of Tanjung Alai to prevent other elephants from entering the area. No action was taken and elephants reappeared near the villages of Tanjung Alai and Silam in June 2001.

No action was implemented to conserve tigers or other terrestrial wildlife. Four or five tigers were probably present in the reservoir area at the time of the EIA and the Forestry Department considered immediately adjacent were adequate for the displaced population. Generally, the reasons given for restricting wildlife conservation measures to the elephant were:

- other species are more abundant and breed faster,
- other species require less space, and
- other species can move more readily during impounding and can save themselves<sup>7)</sup>.

Such a simplistic rationale should have been rejected at appraisal as it ignores broader conservation values, the particular conservation requirements of valued species, and the needs of local communities for non-timber forest products.

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<sup>5)</sup> PLN, 1991. Report of Wildlife (Elephant) Handling Study in the Inundation Area of Kotapanjang HPP Kampar Regency, Riau Province.

<sup>6)</sup> PLN, 1996. Twenty Fourth Quarterly Progress Report on Environmental Aspects of the Kotapanjang Hydroelectric Power and Associated Transmission Line Project (Phase 1). Period: October 1, 1996 - December 31, 1996. PLN, Jakarta.

<sup>7)</sup> Anon. 1990. Answers of Questionnaire on Environmental Aspect of Kotapanjang Hydroelectric Power Project.

### (3) Monitoring Changes in Plants and Animals

The baseline description of habitats, flora and fauna in the project area in the EIA is brief. There are no species lists for specific sites, or population estimates which can be used as a basis for monitoring.

The consultant is unaware of any monitoring data on changes to the vegetation.

### (4) Plankton

See Section 5.4

### (5) Birds and Mammals

The Forestry Department monitored mammals and birds at 12 sites adjacent to the reservoir in 1992, 1993 and 1997 (*i.e.* before, during and after project construction).

The Centre for Environment Research at the University of Riau has a programme to monitor mammals and birds three times a year at five sites near the reservoir from 1999 to 2003. An additional site was added near Tanjung Alai when elephants appeared in the area in 2001.

Neither programme had nor has management objectives that are stated in the Environmental Monitoring or Management Plans. It is obvious that inundation of the valley and clear-felling of the forest will have devastated wildlife populations and the purpose of this work is therefore unclear.

Neither programme has reported a baseline from which to assess and interpret population changes due to the project. The sampling areas have not been described nor located on a map. Mammals and birds are counted in a strip census at each site and local people are asked to provide an estimate of numbers from a prescribed list of species.

Relatively few species are recorded and the numbers noted are very low. There may be insufficient data for statistical treatment to separate species population changes from sampling error. There is a remarkable constancy in both species occurrence and numbers recorded at each visit. This is highly unusual data, and a fuller understanding of the sampling methodology is required before the work can be fully assessed. However the conclusion, that species populations and species diversity have stayed more or less constant is invalid given the methodology used. And given the significant change in land cover that has occurred in the project area in recent years it is simply not credible.

Examples of the data for two sites, one for mammals and the other for birds are shown below.

**Table Mammals Recorded on Bukit Tangko Island**

Species	12/99	12/00	6/01	9/01	12/01 (month/year)
<i>Petaurus elegans</i>	2	2	2	2	2
<i>Helarctos malayanus</i>	1	1	1	1	1
<i>Tragulus javanicus</i>	4	4	4	4	4
<i>Panthera tigris</i>	3	0	0	0	0
<i>Muntiacus muntjac</i>	2	2	2	2	2
<i>Felis bengalensis</i>	5	5	5	5	5
<i>Tragulus napu</i>	6	6	6	6	6
<i>Cervus unicolor</i>	4	4	4	4	4
<i>Tapirus indicus</i>	3	3	3	3	3
<i>Hylobates agilis</i>	3	3	3	3	3
<i>Sus scropus</i>	3	3	3	3	3
<i>Macaca nemestrana</i>	8	8	8	8	8
<i>Macaca fascicularis</i>	4	4	4	4	4
<i>Paracoxurus hermaproditus</i>	2	2	2	2	2
<i>Callusciurus notalus</i>	4	4	4	4	4

Source: The Center for Environment Research at University Riau

**Table Number of Birds Recorded at Binamang River (Batu Bersurat)**

Species	English Name	6/99	12/99	12/00	6/01	9/01	12/01 (month/year)
<i>Gallus gallus</i>	Red Junglefowl	4	4	4	3	2	3
<i>Lonchura leucogastroides</i>	Javan Munia	10	9	9	9	5	9
<i>Centropus sinensis</i>	Greater Coucal	2	2	2	2	2	2
<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul	0	0	0	0	6	0
<i>Pycnonotus zeylanicus</i>	Straw-headed Bulbul	0	0	0	0	1	0
<i>Spizaetus bartelsi</i>	Hawk Eagle sp.	1	1	1	1	1	1
<i>Buceros rhinoceros</i>	Rhinoceros Hornbill	2	2	2	2	2	2
<i>Cervun enca</i>	?	2	2	2	2	1	2
<i>Ducula lacermulata</i>	Imperial Pigeon	0	0	0	0	2	0
<i>Treron sp.</i>	Green Pigeon species	0	0	0	0	1	0
<i>Dicrurus annectans</i>	Crow-billed Drongo	0	0	0	0	2	0
<i>Picus pycatau</i>	Woodpecker species.	0	0	0	0	2	0
<i>Phylloscopus trivirgatus</i>	Mountain Leaf Warbler	2	2	2	2	0	2
<i>Halcyon capensis</i>	Stork-billed Kingfisher	2	2	2	2	0	2

Note: *Cervun enca* and *Picus pycatau* are not listed in Robson, C. (2000) and their identity is uncertain  
 Source: The Center for Environment Research at University Riau

### 5.3.2 Present Conditions

#### (1) Forest Conservation

In 1985, 3,331 km<sup>2</sup> of the PLTA Kotapanjang catchment area was classified as forest, of which 2,142 km<sup>2</sup> (64%) was protected forest and 1,189 km<sup>2</sup> (36%) as exploitation forest. Interpretation of satellite imagery in 1999, found that only 424 km<sup>2</sup> of the protected forest survived with a dense or moderately dense canopy. The remainder was classified as open forest, secondary growth, plantation or bare ground<sup>8)</sup>. Assuming the protected forest had been intact in 1985, the annual rate of deforestation of the protected area exceeded 10% per annum, higher than in any

<sup>8)</sup> TEPSCO, 2000. Studi Penanggulangan Dampak Banjir Tahunan Di Pangkalan Koto Baru Kabupaten 50 Kota, Propinsi Sumatera Barat. Laporan Akhir, Vol 2. PLN, Pekanbaru.



other case study known for Sumatra.

Forest cover has been removed from almost all of the land in the immediate vicinity of the reservoir, from land outside the resettlement areas, from steep slopes, the reservoir shoreline and drainage lines. Large blocks of forest are now apparently restricted to the Bukit Suligi and Bukit Bungkuk forest reserves, and to Tangko island, but it is reported by staff of the Environment Research Centre, Riau University that these areas are now being encroached. A boat towing 54 logs under the Kampar Kanan bridge traveling from the direction of Bukit Bungkuk towards Batu Berserat was seen by the consultant on 20 March 2002.

#### (2) Elephant Conservation

The fate of elephants translocated to the Giam Siak Kecil Reserve is unknown. Indeed, the relocation site is uncertain. The chief of Tasik Serai (N 01° 07'17", E 101° 34'25") the main village on the edge of the reserve, was unaware of elephants being relocated to the area. Elephants are uncommon in the area, with the last one recorded in December 2001. The reserve has little suitable habitat left as it mainly comprises peat swamp and the drier parts of the reserve have been intensively logged.

#### (3) Plants and Animals

Based on the implications of forest clearance for forest plant and animal species, biologically they cannot survive in higher densities in smaller areas of forest, or in other habitats, since the area of forest has greatly reduced following the project. It is, therefore, clear that the populations of many species are very much less now than they would have been before the project.

### 5.3.3 Assessment of Changes

#### (1) Forest Conservation

It has been predicted that all remaining large lowland forest tracts will be cleared from Sumatra by 2005 unless the remaining reserves are protected. Given the scale and speed of this change, it is probable that much of the forest cover in the project area would have been lost in the absence of the project. However it should be noted:

- a) the intensity of forest clearance within the reservoir area is much greater than in adjacent areas immediately upstream,
- b) the construction of new roads and creation of the reservoir have facilitated access to areas of primary forest, while the failure of the rubber plantations may have encouraged some local people to cut and sell timber instead of tapping rubber, and
- c) the project has clearly failed to protect forest areas as planned.

The specific causes of deforestation have not been studied but include road construction, logging, shifting cultivation, clearance for plantations and settlement. In the absence of baseline and recent data on land use cover, the impact of the project on forest conservation cannot be quantified.

## (2) Wildlife Species Protection

Recent research has found that the lowland forests of Riau contain the highest biodiversity of any forests on Earth (WWF) and had proper surveys of the biodiversity been conducted during the Feasibility Study there can be little doubt that a number of species of conservation concern other than elephant and tiger would have been found.

In the absence of baseline and recent data on wildlife populations, the impact of the project cannot be quantified at present. Estimated losses could be derived by sampling present wildlife populations in representative land cover types, such as closed forest, open forest, plantation etc., and estimating changes by comparing land cover change on satellite images from the present with land cover in the mid 1980's. Wildlife population sampling would involve a considerable amount of work by a range of specialists.

The fate of the translocated elephants is unknown, but it is doubtful they can have survived in the Giam Siak Kecil area due to logging and conversion of natural forest areas to plantation *Acacia* production forest and oil palm plantation.

## 5.4 Plankton, Fish and Fisheries Development

### 5.4.1 Review of Environmental Monitoring and Management Plans

Four actions were planned in the original Environmental Monitoring and Management Plans, namely to:

- monitor changes to fish populations,
- restock the river with migratory species adversely affected by the dam,
- prepare project proposals for fishery development, and
- introduce fish to the reservoir to control mosquito larvae and bilharzia snails.

The monitoring of plankton was included in the Environmental Management Plan as a wildlife monitoring component but is reviewed here because of the importance of plankton to fish and fishery development.

#### (1) Plankton

Plankton has been monitored in surface waters since May 1999 at the same time and in the same places as water quality monitoring. The results reveal no serious perturbations since May 1999 and a gradual evolution of the plankton community that indicates the reservoir, while still oligotrophic (nutrient poor), is becoming

more mesotrophic (moderately nutrient enriched) due to the release of plant nutrients from submerged vegetation.

#### (2) Monitoring Changes to Fish Populations

There is confusion over the identity of fish in the Kampar river system in terms of the taxonomy of local and scientific names (compare EIA Annex 4, Table RD-4 with B. Abdul Malik, H.B. *et al.*, 1998<sup>9)</sup>).

The EIA lists 27 species of fish found in the reservoir area. The list does not provide a basis for monitoring as there is no information on either presence/absence at particular sites, and/or estimates of abundance. No population monitoring has been carried out.

#### (3) Restocking the River with Adversely Affected Species

The EIA predicted that the dam would stop the migration of *Pangasius pangasius*, *Wallago leeri* and other fish species along the river. It proposed that the Provincial Fisheries Department and Riau University should monitor the situation and implement conservation measures, including the introduction of fry to the river.

No monitoring of migratory fish stocks has been carried out, but fry of *Pangasius pangasius* (Patin) have been introduced to the reservoir (see below).

#### (4) Fishery Development Action Plan

The EIA predicted that the reservoir could be developed as a fishery to benefit the community living around the lake. It proposed that the Provincial Fisheries Department and Riau University should make a development plan, involving fisheries research and construction of fish hatcheries.

The plan, agreed by PLN, the Provincial Fisheries Department (Dinas Perikanan) and Riau University in August 2001 has three objectives:

- to stock the reservoir with fish to support an artisanal fishery,
- to set up a pilot aquaculture project in two resettlement villages, and
- to stock the reservoir with fish that will control mosquito larvae.

Stocking involves the release of 400,000 fish of five species at ten sites around the reservoir before April 2002. The species composition is based on discussion between Riau University, Provincial Fisheries Department and local people as shown below.

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<sup>9)</sup> B. Abdul Malik, H.B., Achmadi, F., Syahmiral, A.P. and Trynaldo, L.A.P. 1998. Determinasi Jenis-Jenis Ikan Perairan Umum Riau. Bagian I. Ikan-Ikan Sungai Utama Riau. Dinas Perikanan Propinsi, Pekanbaru, Riau.

**Table Composition of the Fish Stock Released in Kotapanjang Reservoir**

Local Name	Scientific Name	Frequency in Total Stock	Note
Tawes	<i>Puntius goniotus</i>	50%	Selected by Riau University for mosquito control
Mas	<i>Cyprinio carpio</i>	20%	Selected by Riau University for commercial exploitation
Patin	<i>Pangasius pangasius</i>	10%	Preferred by local people and Fisheries Department
Gurame	<i>Osphronemus gourami</i>	10%	Preferred by local people and Fisheries Department
Nila	<i>Oreochromis nilotica</i>	10%	Recommended by Riau University for rapid growth.

Source: Riau University / Provincial Fisheries Department

Stocking is on course for completion in April 2002. No monitoring to assess the survival and growth of fish released into the reservoir has been carried out.

Riau University operated an experimental fish farm in the reservoir at Tanjung Alai in 1998, funded by the Caltex Foundation, Twenty cages were constructed in the lake and stocked with *Osphronemus gourami*, *Cyprinio carpio*, *Pangasius pangasius* and *Oreochromis nilotica*. Although the site was located in a sheltered inlet, the water quality remained good and the scheme was apparently profitable.

Two more experimental farms have now been built in the reservoir by the Fisheries Department, at Batu Berserat (10 cages) and Gunung Bungsu (20 cages).

Fish mortality at both farms is relatively high. The cause is unknown but may be linked to poor water quality and disease. The Kampar river enters the reservoir at Gunung Bungsu and heavy mortality on one occasion there was related to a flood of muddy water and subsequent disease.

#### (5) Introduction of Fish to Control Mosquito Larvae

The species *Puntius goniotus* (Tawes) has been introduced to control mosquito larvae (see Table). No need assessment was carried out before the release programme, and no check has been made so far to see whether the fry have survived.

The snails that carry the bilharzia parasite eat aquatic vegetation. The absence of aquatic plants in the littoral zone of the reservoir at present make the risk of contracting bilharzia very low.

#### 5.4.2 Present Conditions

During this study informal discussions on fish and fishing were held with both fishermen and staff of the Fisheries Department in the project area.

### (1) Changes in Fish Populations

Changes in fish populations in the reservoir area, and up- and downstream were reported to have taken place since the dam was built.

Fish have declined in the Mahat and Kampar rivers upstream of the reservoir. On the Mahat, few people now fish at either Kotapanjang Mudik or Gunung Malintang villages whereas catches at Gunung Malintang, before the dam was built, often produced a surplus for sale.

Within the reservoir, the composition of fish catches has changed, although species caught before the dam was built can still be found. Even *Pangasius pangasius* (Patin), which was rare at the time of the EIA, still occurs. *Ophiocephalus* sp. (Toman), *Micrones nemurus* (Baung), *Osphronemus gourami* (Gurami) and *Rasbora* sp. (Pantau) have become relatively common, but *Mastacembalus perakensis* (Tilan) has declined. *Rasbora* and *Ophiocephalus* spp. now grow larger than they did before the dam was completed.

Downstream of the dam, fish populations have declined within living memory. The decline started in the 1960s and 1970s. There has also been a change in species composition. For example, *Osteochillus hasseleti* (Paweh) and *Ophiocephalus striatus* (Gabus) were once restricted to smaller tributaries but are now caught in the main river.

Table Occurrence of fish species before and after project completion.

Family	Species	Local Name	Before		After		
			1	2	3	4	5
<i>Cyprinidae</i>							
	<i>Labeo pleurotaenia</i>	Lelan	✓	✓	✗		✓
	<i>Labiobarbus</i> sp.	Gariang	✓		✗		
	<i>Dangilla sumatrana</i>	Mali	✓	✓			
	<i>Leptobarbus hoeveni</i>	Ikan Lamak	✓				
	<i>Rasbora</i> sp.	Pantau		✓	✓	✓	
	<i>Rasbora</i> sp.	Kapara	✓				
	<i>Thymichthys thynnoides</i>	Motan		✓		✓	✓
	<i>Osteochillus hasseleti</i>	Paweh	✓	✓			✓
	<i>Hampala (macro)lepidota</i>	Barau	✓		✗		✓
	<i>Cosmochillus falciper</i> or <i>Barbichthys leavis</i>	Pitulu	✓				
	<i>Puntius schwanefeldi</i>	KapieK	✓			✓	✓
	<i>Puntius</i> sp.	Ngalan		✓			
	<i>Puntius</i> sp.	Siban	✓	✓			
<i>Clariidae</i>							
	<i>Clarias batrachus</i>	Ikan Kalang, Keli	✓	✓			
<i>Siluridae</i>							
	<i>Wallago leeri</i>	Tapah	✓	✓		✓	✓
<i>Pangasidae</i>							
	<i>Pangasius pangasius</i>	Patin	✓				
<i>Bagridae</i>							
	<i>Macrones nemurus</i>	Baung	✓	✓	✗	✓	✓
	<i>Macrones nigriceps</i>	Geso	✓				
<i>Anabantidae</i>							
	<i>Anabas testudineus</i>	Puyu	✓				
	<i>Anabas</i> sp.	Katung		✓			
	<i>Osphronemus gourami</i>	Gurami	✓			✓	
	<i>Trichogaster pectoralis</i>	Sapek Siam	✓				
	<i>Trichogaster trichopterus</i>	Sapek Rawa	✓				
<i>Ophiocephalidae</i>							
	<i>Ophiocephalus</i> sp.	Ruan	✓				
	<i>Ophiocephalus</i> sp.	Lulo	✓				
	<i>Ophiocephalus</i> sp. or <i>Channa micropeltes</i>	Toman	✓	✓		✓	
	<i>Ophiocephalus striatus</i>	Rutiang/Gabus	✓				✓
<i>Mastacembalidae</i>							
	<i>Mastacembalus perakensis</i>	Tilan	✓				
<i>Nandidae</i>							
	<i>Pristolepis fasciatus</i>	Kataung	✓				
<i>Cichlidae</i>							
	<i>Oreochromis nilotica</i>	Nila					✓
Uncertain affinity							
	? <i>Lucioma stigerum</i>	Gual			✗		
	<i>Tylognathus</i> sp.	Sikam	✓				
	<i>Tylognathus bopapta</i>	Silimang	✓				

Key: ✓ - present; ✗ - disappeared

Sources: EIA Report; 2: This study; 3: Mahat river, upstream of reservoir (this study); 4: Reservoir area (this study); 5: Downstream (Palaubeng, near Bangkinang) (this study)

## (2) Fish Production

Fish production in the area is based both on aquaculture and on fishing in the reservoir and rivers.

### Aquaculture

Fish ponds are common in the resettlement villages as well as both up- and downstream of the reservoir and are an important component in the farming system<sup>10)</sup>.

Many of the fish ponds are privately owned and newly constructed. At Merangin near Bangkinang for example, local residents have just constructed 23 ponds in the disused PLTA Kotapanjang gravel pits. The ponds are usually stocked with *Cyprinio carpio*, *Pangasius pangasius* or *Oreochromis niloticus* fry which, like the food pellets, are obtained commercially.

The development of fish ponds on a large scale may cause nitrate enrichment of groundwater and the pollution of wells in some areas.

Floating fish farms using cages have also been built in the reservoir. Two commercial farms, one with 45 cages, are now either under construction or operational. These are additional to the two farms run by the Fisheries Department.

The failure to clear vegetation from the reservoir, as prescribed in the Environmental Management Plan, now restricts the choice of sites for fish farming.

### Fishing

The potential yield of fish from a reservoir is related to drawdown magnitude, conductivity and water depth<sup>11)</sup>. Although data are few, annual drawdowns of 2.5 - 4.0 m are optimal. The rule curve for Kotapanjang specifies an annual drawdown of 6.5 m, rather more than is optimal for fish production.

A morphoedaphic index (MEI = conductivity divided by mean depth) has been used to predict yield in African reservoirs<sup>12)</sup>. Assuming this relationship holds for Kotapanjang, the predicted yield is c. 30 kg/ha/y, or c. 340 tonnes/y, given that conductivity in the order of 35  $\lambda$ S/cm and the mean depth is 11.7 m.

The actual yield of fish from Kotapanjang is unknown. There is no information on

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<sup>10)</sup> Bandamas Konsulindo, 1993. Report on Land Use Study of Reservoir Area. Kotapanjang Hydroelectric Power Project, Riau Province. Tepsco, Tokyo.

<sup>11)</sup> Bernacsek, G.M. 1984. Dam design and operation fish production in impounded river basins. CIFA Technical Paper, 11. FAO, Rome

<sup>12)</sup> Bernacsek, G.M. 1984. Dam design and operation fish production in impounded river basins. CIFA Technical Paper, 11. FAO, Rome

the number of fishermen, number of canoes or catch size (Fisheries Department).

The Fisheries Department monitors quantities of fish bought by traders rather than quantities of fish caught by fishermen. Agricultural extension workers based in villages close to the reservoir and adjacent rivers record amounts traded each week and report totals annually to the Fisheries Department. No validation of this work has been carried out by the Fisheries Department.

In 1999 and 2000, some 212 and 227 tonnes of fish caught in the reservoir and local rivers of Kampar XIII district respectively were sold to traders. The proportion caught in the reservoir is unknown but may be in the order of 75%. (Fisheries Department, Bangkinang). The amount of fish caught in the reservoir and sold to traders in West Sumatra is unknown.

Fishing to meet household needs or for commercial gain is important for many local residents following the inundation of rice farms in the reservoir area and the subsequent problems of rubber tapping. About three in four households at Gunung Bungsu for example now fish for subsistence needs and to sell any surplus caught.

Fish in the reservoir are caught in gill nets set from canoes. Cast nets, hooks, and traps are used on in-flowing rivers. In addition, children at Tabing on the Kampar river upstream of the reservoir, were seen using simple harpoon guns successfully.

Fishing success varies with time and space. Fishermen at both Tanjung Balit and Muara Takus reported fishing as poor during the survey. Catches at Muara Takus had been low (< 0.5 kg/day) since January 2002; in better times, up to 50 kg/day could be caught.

#### 5.4.3 Assessment of Changes

##### (1) Plankton

Changes in the abundance and composition of plankton indicate the reservoir is becoming enriched and, while still relatively infertile, is changing from oligotrophic to mesotrophic.

##### (2) Fish Populations

Changes in fish populations may be due to a range of factors, including dam construction, river regulation, change in catchment runoff, change in sediment transport, pollution and overfishing.

The EIA noted overfishing, and perhaps sedimentation of the gravel river bed, had caused a general decline in fish populations and a specific decline of *Pangasius pangasius* (Patin) at the time of the study. More recently, a general decline in fish production in the Kampar river south of Pekanbaru since 1994/1995 has been



linked to pollution from the PT Riau Andalas Pulp and Paper factory<sup>13)</sup>.

On the basis of experience elsewhere (e.g. Pak Mun, Thailand) there can be little doubt that the impact of the Project on fish populations up- and downstream has been - and remains - negative. However the impact cannot be quantified due to a lack of monitoring and the presence of other confounding variables. As a result, the project is not bearing the true cost of reduced fish populations and loss of fishing opportunities.

The benefits of stocking the reservoir for fishing and control of mosquito larvae are unclear as the survival and growth of introduced fish have not been monitored.

### (3) Fish Production

#### Aquaculture

Fish ponds in the resettlement area have developed through private initiative rather than project intervention. The commercial fish farms in the reservoir, on the other hand, are the direct result of the project. However it is too early to assess the benefits of fish farming in the reservoir as the farms are new.

#### Fishing

The impact of the Project on fish production from fishing is unknown as detailed information on production before and after reservoir construction is unavailable.

The weight of fish sold to traders caught in the rivers of Kampar XIII district was 284 tonnes in 1981 (EIA). This compares with 212 and 227 tonnes caught in the reservoir and rivers in 1999 and 2000 respectively (Fisheries Department, Bangkinang). Given that the surface area of water has increased significantly in the district, fish production reaching market from fishing has declined both relative to the surface area of water and in absolute terms since the project was completed.

## **5.5 Impacts of Flood Attenuation by the Dam**

### **5.5.1 Review of Environmental Monitoring and Management Plans**

The Summary of the Environmental Impact Study (1989) found that the project would benefit areas downstream by controlling floods and permitting irrigation development.

The Environmental Management and Monitoring plans predicted that the project would mitigate the yearly flood impacts in the downstream area, which cause loss of life and property. Flood control would also allow increased food production through irrigation development.

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<sup>13)</sup> Kafil Yaman, 1998. River Dying as Paper Production Thrives. Interpress Services, 24/3/98

No actions were proposed in the Environmental Management and Monitoring plans but, as a separate activity, BAPPEDA (Agency for Development Planning) would make a development plan for the area downstream.

### 5.5.2 Present Conditions

The project provides flood protection immediately downstream in two ways: firstly, the dam allows flood storage in the reservoir, where the maximum water level is two metres below design; and secondly, a siren alerts villagers to imminent flood and permanent notices on the river bank tell them what to do. The siren at Bankinang was tested on 26 March 2002. There has been no major flood since 1996.

Large floods damaged property, livestock and cropland and people near Bankinang recognise the benefit of flood protection. Interviews with local farmers found that crop production in this area is mainly rain fed or irrigated by streams flowing the main river; flood recession farming was unimportant before construction of. However, regulation is causing bank erosion and damage to farmland at Palaubeng village. The river level fluctuates by up to a metre each day resulting in undercutting and slumping of the gravel bank. Simple erosion prevention measures have been installed in one area, with some success.

Wells are reported to be drying up at several villages downstream of the dam, but the cause is unclear. Sand and gravel extraction from the river bed has become a significant activity in the Bankinang area in recent years, reducing the elevation of the river bed in some places. Deepening of the river channel will reduce the height of the water table in wells close to the river bank.

Fish pond aquaculture has grown in popularity in recent years downstream of the reservoir. At Merangin, 24 ponds have been created recently by local residents in the gravel pits formerly used to supply the Kotapanjang project. They are stocked with *Oreochromis nilotica*, *Cyprinio carpio* and *Pangasius pangasius*, which are fed on commercially available food pellets.

### 5.5.3 Assessment of Changes

The cause of falling groundwater levels downstream of the dam is unknown, but it is unlikely to be due to the project. Floods have been attenuated, but base flows have increased, and the mean flow - and mean water level - would be unchanged in the absence of on-going sand and gravel extraction from the river bed.

Erosion of the river bank will have increased as water leaving the reservoir contains little suspended sediment to replace any picked up by the river downstream. However the impact of clearwater erosion due to river regulation is also

confounded by the effects of gravel extraction, which has reconfigured the river channel in some areas. Assessing the relative importance of the two factors would be technically difficult and further study by PLN alone is not recommended.

## 5.6 Water Related Disease

### 5.6.1 Review of Monitoring System

The Environmental and Monitoring Plans identified the possibility of increased malaria incidence. The following steps were recommended to be taken in connection with water related diseases:

- the introduction of fish such as *Puntius Goniouotus* which feed on mosquito larva, and
- the monitoring of vector borne disease incidence.

However, no action was taken until 2001 to implement these recommendations.

#### (1) Introduction of fish into the dam reservoir

There was no report of fish being introduced into the dam reservoir in order to control vector borne diseases before 2001. Fish introduction started in 2001 but there is no system to monitor mosquito larva numbers.

#### (2) Monitoring of vector borne diseases

No systematic monitoring was initiated by PLN or related institutions until 2001. In the absence of any monitoring action taken by the PLN, no observations can be made on changes in vector borne disease incidence. However, since the Ministry of Health and Social Welfare requires health centers to report data on the incidence of selected diseases, limited data is accumulated at certain levels of the Ministry of Health and Social Welfare.

### 5.6.2 Present Situation

#### (1) Health profile in general

From an epidemiological perspective, the health status in the target area is a key concern since it affects the susceptibility of the hosts.

In the two provinces of the target area, the health profile is no worse than Indonesia as a whole in relation to the infant mortality rate and nutritional status. Regarding the nutritional status, protein-calorie malnutrition in infants at the regency level is at a level better even than that of the provinces and the country as a whole. Therefore, it can be said that Riau Province is in a considerably better situation in terms of health when compared with the Indonesian standard, while West Sumatra is more or less at the national level.

Data on the infant mortality rate and nutritional status at the sub-district level and

the health center level is not available. The political territory in relation to the health centers is as shown in the Table. There used to be a XIII Koto Kampar IV health center; however, this became a sub-health center and is now under XIII Koto Kampar II.

**Table Political Territory of Health Centers**

	Area near the dam and PAF			Area not near the dam		
	Name of Health Center	Covering villages	Location	Name of Health Center	Covering villages	Location
West Sumatra Province, 50 Kota Regency	Rimbo Datar	- Tnajung Balit	- Tnajung Balit	Pangkalan	- Pangkalan	- Pangkinan
		- Tnajung Pauh		Mangginang	- Pasar Manggilang	- Manggilang
Riau Province, Kampar Regency	XIII Koto Kampar I	- Batu Bersurat - Balung - Tanjung Alai - Binamang	- Batu Bersurat	Bangkinan I	- Bangkinang - Langgini - Kumantan - Ridan Permai - Salo - Salo Timur	- Bangkinang
	XIII Koto Kampar II	- Gunung Bungsu - Tanjung - Pongkai - Tabing - Gunung Malelo - Sibervang - Bandar Picak - Muara Takus - Koto Tuo - Pongkai Istiqomak	- Gunung Bungsu	Bangkinan II	- Laboi Jaya - Bukit Payung - Muara Uwai - Suka Mulya - Bukit Sembilan - Pasir Sialang - Pulau - Pulau Lawas	- Muara Uwai
	XIII Koto Kampar III	- Koto Mesjid - Pulau Gadang - Lubuk Agung - Ranah Sungkai	- Pulau Gadang	West Bangkinan	- Merangin - Silam - Sei Durian - Empat Balai - Pulau Jambu - Ganting - Sipungguk - Siabu - Aliantan - Kabun - Tandun	- Merangin

Data source: Ministry of Health and Social Welfare

## (2) Main health problems

The health workers in the provinces consider that communicable diseases are still prevalent and constitute the main health problems, as is the case in other developing countries. At the national level, meanwhile, circulatory diseases were the main causes of death in 1990-1995.

Among communicable diseases, TB, acute respiratory infections and diarrhea are the most prevalent diseases in the two provinces. TB is still the second main disease at the national level. At the regency level and the sub-district level as well, the health workers claim that communicable diseases continue to constitute the principal health problems.

The diseases considered as the most prevalent problems at the health center level in the two sub-districts are as shown in the table below. In the table, two sub-districts (the area near the dam and the area distant from the dam) are distinguished in order to illustrate differences between them. The health centers which cover the resettlement village and the villages by the reservoir are categorized as "Area near the dam and PAF", while the health centers which cover the villages without resettlement and not located near the dam reservoir are defined as "Area not near the dam".

In fact, however, no particular difference can be identified in terms of disease between the two categories, other than malaria which was mentioned in Rimbo Data in Kampar Regency in West Sumatra Province.

**Table Prevalent Diseases at the Health Centers (2000)**

Area near the dam and PAF		Area distant from the dam	
Rimbo Datar	- Malaria - Diarrhea - ARI	Manggilan	- Asthma - Bronchitis - Diarrhea
XIII Koto Kampar I	- Accident - TB - Asthma	Pangkalan	- ARI - Diarrhea and dysentery - TB
XIII Koto Kampar II	- ARI - Allergic dermatitis - Rheumatism	Bangkinan I	- ARI - Diarrhea - Dermatitis
XIII Koto Kampar III	- ARI - Rheumatism - Diarrhea	Bangkinan II	- ARI - Diarrhea - Rheumatism
		West Bangkinan	- ARI - Diarrhea - Rheumatism

Data source: Health Centers

From the above table, the main diseases occurring in the area near the dam can be listed as i) respiratory diseases, ii) water related diseases, iii) skin diseases, and iv) rheumatism. In the context of the construction of the dam, the primary focus in this study will be on water related diseases, especially malaria, diarrhea and scabies.

### Malaria

Malaria is a communicable disease which needs to be tackled at the national level. Annually about 1.5 million cases of malaria are reported in Indonesia. Malaria incidence is actually on the increase by number. In the case of Java and Bali islands, the morbidity rate of malaria was 12 per 100,000 in 1997 and 38 per 100,000 in 1999. In the case of the outside two islands, the morbidity rate of malaria also increased, from 1600 in 1997 to 2500 in 1999. The morbidity rate grew 65% for Java-Bali and 56% for the rest of Indonesia.

At the province and regency level, malaria, especially malaria incidence in the project area, is not much recognized by the health workers. According to the health workers in the project area, malaria is considered to constitute a serious problem only in the health center of Rimbo Datar. The health workers at the health centers of XIII Kota Kampar I and III consider malaria to be an endemic disease and do not deal seriously with it. Despite this, the morbidity rate of malaria in XIII Koto Kampar I Health Center is actually high.

The annual morbidity rate of malaria is as shown in Table. Since the data available was limited, this table is not complete. The colored data is from the area near the dam reservoir and the rest is from the area distant from the dam reservoir.

**Table Annual Morbidity Rate of Malaria (per 1000)**

	1997	1998	1999	2000	2001
Pangkalan Puskesmas	NA	NA	0.05	0.28	NA
Rimbo Datar Puskesmas	16.71	NA	11.14	13.78	NA
XIII Koto Kampar I	NA	NA	NA	NA	25.69
XIII Koto Kampar II	NA	NA	NA	NA	8.49
XIII Koto Kampar III	0.33	0.00	NA	NA	NA
Bangkinan I	NA	NA	0.00	0.00	0.20
Bangkinan II	8.21	NA	10.03	12.85	11.39
West Bangkinan	NA	2.65781	1.44	1.79	2.64

Data source: Health Centers

### Diarrhea

At the national level, diarrhea incidence declined in numerical terms between 1990 and 1998. The morbidity rate of diarrhea dropped from 27.2 to 20.7 per 1000. However, diarrhea is still the third most common cause of infant mortality at the national level and health education regarding drinking water is still important in order to prevent diarrhea.

At the provincial level in both the provinces of Riau and West Sumatra, among communicable diseases diarrhea is the second most problematic disease after Acute Respiratory Infections. In 2000, the morbidity rate of diarrhea was recorded at 14.48 per 1000 in Riau Province and 18.34 per 1000 in West Sumatra Province. At the regency level, the situation is the same. However, the morbidity rates of diarrhea were even lower. In 1999 the morbidity rate was 3.66 in 50 Kota Regency of West Sumatra Province and 13.7 in Kampar Regency of Riau Province. These readings are below the national average and the regency average.

At the health center level, diarrhea morbidity rate readings in the areas near the dam and distant from the dam are generally high, especially in Rimbo Datar, as shown in the Table.

**Table Annual Morbidity Rate of Diarrhea (per 1000)**

	1997	1998	1999	2000	2001
Pangkalan Puskesmas	NA	NA	21.3	16.1	NA
Rimbo Datar Puskesmas	NA	NA	NA	94.7	NA
XIII Koto Kampar I	NA	11.9	NA	NA	17.2
XIII Koto Kampar II	NA	NA	NA	NA	24.4
XIII Koto Kampar III	10.7	NA	NA	NA	31.3
Bangkinan I	NA	NA	15.6	19.8	32.0
Bangkinan II	27.3	NA	24.1	27.4	31.9
West Bangkinan	NA	7.8	11.1	14.4	21.7

Data source: Health Centers

In general, Indonesians think that water in their country is not drinkable because of its poor quality, since they receive health education informing them of this. As a result, people tend to boil water to drink. However, boiling is not necessarily carried out in an appropriate manner or other relevant habit such as brushing teeth or using finger bowl at table is carried out with not clean water. Consequently, diarrhea is still problematic all over the country.

#### Scabies

In general, scabies is viewed as a disease which can be caused by water shortage. A shortage of water means a hygienically inadequate environment for human health and a lack of basic human needs.

Data regarding scabies was not available at the national, provincial or regency level. At the health center level, the data from Rimbo Datar and XIII Koto Kampar I show generally increasing readings.

**Table Annual Morbidity Rate of scabies (per 1000)**

	1997	1998	1999	2000	2001
Pangkalan Puskesmas	NA	NA	6.6	6.1	NA
Rimbo Datar Puskesmas	16.7	NA	11.1	13.8	NA
XIII Koto Kampar I	NA	14.7	NA	NA	15.5
XIII Koto Kampar II	NA	NA	NA	NA	9.5
XIII Koto Kampar III	0.0	0.0	NA	NA	5.5
Bangkinan I	NA	NA	0.2	0.0	0.8
Bangkinan II	3.8	NA	5.2	5.5	2.0
West Bangkinan	NA	3.5	1.4	1.2	2.3

Data source: Health Centers

### 5.6.3 Assessment of Changes

#### (1) Malaria

The proximity comparison between the areas near the dam and distant from the dam suggests that, in general, the dam area features a higher malaria morbidity rate. In addition, the periodical change analysis suggests a higher malaria morbidity rate following the construction of the dam. From this data it therefore seems possible to conclude that the dam reservoir has had a negative impact on malaria incidence.

Generally speaking, it is recognized that the construction of a dam has a negative impact on mosquito occurrence. Therefore, technically the following applications are recommended as basic measures:

- selecting a reservoir site far from human settlement,
- adopting antimalarial measures on sections of shoreline within 2km of villages and towns, and
- clearing vegetation from as much as possible of the area which is to be submerged. Where the area is too large for this, the clearing should at least include a belt extending above and below the shoreline, where mosquitoes are most likely to breed.

In the case of Kotapanjang Dam, these measures have not been implemented: the reservoir site is close to some villages, antimalarial measures were not taken near the dam and the vegetation was not cleared from the dam reservoir area. An increase of anopheles mosquitoes in the area is a likely result of this.

In addition, in some villages the villagers started to farm fish around the village. As a consequence, a number of health workers report greater numbers of mosquitoes near the fish farms close to the houses and believe that may be another cause of increased malaria incidence.

The analysis above shows an increased potential for mosquito occurrence. However, with malaria incidence it cannot be concluded for certain that this is a direct impact of the dam reservoir, since the behavior and action of the host is of central importance in connection with malaria infection. The detailed relevant data is analyzed in the proximity comparison, periodical changes and further relevant analysis.

#### Proximity comparison (near the dam and distant from the dam)

A comparison of the malaria morbidity rate for areas near the dam and distant from the dam is set out above in Table Annual Morbidity Rate of Malaria (per 1000). Ignoring other potentially relevant factors, the relative risk of the area near the dam in Riau in 2001 was 3.4. This means that by living near the dam the risk of contracting malaria increased by a factor of 3.4. The attributable risk is 8.2 – this



means that, by living in this area, morbidity incidence mounted by 8.2. The attributable risk percent, which shows what percentage of morbidity incidence was caused by living in the area, is 70.6%. Therefore, living in the area near the dam entails a high risk of getting malaria.

Periodical changes (before and after construction of the dam)

In relation to periodical changes, impounding of the reservoir took place in March 1997. To analyze the changes related to the construction of the dam, periodical data is needed.

However, periodical data from before the dam construction is only available in Rimbo Datar out of four health centers both covering the resettlement villages and located near the dam. As a result, there will be a greater focus here in connection with the construction of the dam on the case of Rimbo Datar between 1994 and 2001.

**Table Monthly Morbidity Incidence Number of Malaria in Rimbo Datar 1994-2001 (Unit: No.)**

	Jan	Feb	Mar	April	May	June	July	Aug.	Sep	Oct	Nov	Dec
<b>1994</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.29	0.00	0.29
<b>1995</b>	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.59	0.29	0.00	0.59	NA
<b>1996</b>	0.29	0.29	0.59	0.00	0.29	0.29	0.29	0.29	0.00	NA	NA	0.29
<b>1997</b>	0.88	1.76	0.59	7.92	0.00	3.52	0.00	0.00	0.00	0.88	0.59	0.59
<b>1998</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>1999</b>	1.17	1.47	1.17	1.17	1.17	0.88	0.59	1.17	1.76	0.00	0.59	0.00
<b>2000</b>	0.88	2.05	2.05	1.17	0.00	2.05	0.59	1.47	0.88	0.00	1.47	1.17
<b>2001</b>	1.17	0.88	1.17	NA	1.17	NA	0.88	0.88	1.47	0.00	1.47	0.00

Data source: Rimbo Datar Health Center

The relative risk or the attributable risk cannot be calculated on an annual level because of limited data availability. However, generally, each month the data before 1997 show lower readings than the data after 1998.

In the Rimbo Datar case, the local population was resettled in July 1994. According to the health workers in the Rimbo Datar area, at that time malaria incidence was high and, as a result, insecticide was sprayed in the houses in 1994.

However, from the data above, it is not possible to detect whether malaria had been endemic in the new resettlement area when they moved in, or whether the dam reservoir was the direct cause of the explosion of anopheles and the indirect cause of the malaria incidence.

### Further relevant analysis

A number of factors need to be considered in relation to malaria contamination.

Firstly, as discussed in the preceding analysis, the environment is a key concern. The drastic changes caused by the construction of a dam are of primary importance. No clear conclusions, however, can be drawn in this connection from the data available.

The second concern is the balance between the strength of the plasmodia and individual resistance. The nutritional status of the people in the target area is better than the average for the country as a whole. However, there is no information either on individual resistance to plasmodia in the target area or on the strength of the plasmodia. Even so, from the morbidity rate of malaria in the target area in comparison with the morbidity rate of malaria in the country as a whole, it is possible to conclude that the host in the target area is not particularly susceptible.

The third concern is the activity and behavior of the hosts in the target area. Even if malaria is highly prevalent, it is preventable and can be reduced through human intervention such as the use of mosquito nets and insecticide. However, in two areas, adults do not generally use mosquito nets to sleep under. The Ministry does not carry out treatment with insecticide unless a given village has high malaria incidence. The villages in these areas do not generally have high malaria incidence compared with other villages in the regency or province.

In addition, according to the health workers, most malaria patients are gambier farmers, who sleep in the islands in the dam reservoir, and fishermen, who fish at the dam lake and their family members. Other patients who are infected by malaria live near the lake or have fishponds near their houses. These data are not, however, recorded officially since malaria incidence in the area is not regarded as of epidemic proportions.

However, these observations by the health workers lead us to conclude that malaria patients tend to spend their lives right by the dam, but their activity or behavior is not affected by concerns of malaria. In fact, only in Rimbo Datar health center was it considered that malaria is a central problem which needs to be dealt with. In other health centers, the perspective on malaria was that it was 'endemic' but not worthy of serious thought.

### (2) Diarrhea

Faecal-oral diseases such as diarrhea are generally thought of with reference to water quality in connection with applicable water supply and sanitation conditions. The morbidity rate of diarrhea is generally high in the area near the dam and the area distant from the dam. In addition, the population in the area near the dam do not use the water from the dam reservoir for daily use, therefore, the impact of the

dam on diarrhea is not direct. However, resettlement may have resulted in water supply problems.

According to the health workers in the area of the dam, diarrhea in the area near the dam is recognized as a problem. The water supply is also considered to be problematic, in terms of both quantity and quality. Based on the interviews with the health workers, problems in connection with the water supply are set out in the Table.

**Table Water related problems claimed by the health workers**

	Quantity of water available	Quality of water available
Pangkalan	No good (brown colored and infusion)	Not a big problem
Rimbo Datar	No water, except water supply built recently	Shortage
XIII Koto Kampar I	Problem	Problem
XIII Koto Kampar II	Problem	Partially problem
XIII Koto Kampar III	Problem	Partially problem
Bangkinan I	No problem	No problem
Bangkinan II	No problem	No problem
West Bangkinang	No problem	No problem

Data source: Health Centers

The following relevant problems can be observed in the target area with respect to diarrhea: 1) certain sanitation facilities are not built in the right place in view of the distance to the well for drinking water, 2) certain wells are not well maintained, and 3) people do not use boiled water for daily use such as in finger bowls at table, brushing their teeth and so on.

These various problems are the responsibility of the local population. However, instruction in relation to problems 1) and 2) was supposed to have been carried out at the time of the relocation.

### (3) Scabies

In the same way as diarrhea, scabies is closely related to water supply, particularly in terms of the water quantity available. Although the difference is not clearly marked, the areas near the dam and PAF in general have higher readings in Table Annual Morbidity Rate of Scabies (per 1000). It may therefore be considered that water availability may be even worse in the area near the dam than in the area distant from the dam.

From this, it can be concluded that the scabies situation is worse for the population in the area near the dam. This may be caused by worse living conditions in terms of water supply in the resettlement area and the area near the dam.

## **5.7 Conclusions and Recommendations**

### **5.7.1 General**

The Environmental Monitoring and Management Plans have substantially failed. With the exception of water quality monitoring by the Environment Research Centre, Riau University, and establishment of two experimental fish farms by Fisheries Department, no significant action has taken place since 1995.

Since then, and contrary to the Plans, large areas of primary lowland forest have been cleared, resulting in loss of wildlife, soil erosion, sedimentation of the reservoir, and reduced rainwater infiltration and increased risk to groundwater supplies, as well as impoverishment of local communities who formerly benefited from non-timber forest products. The process of environmental degradation is apparently continuing with encroachment and logging of the last forest areas.

The political will to implement the Environmental Monitoring and Management Plans is evidently lacking, as is a clear chain of management command.

### **5.7.2 Water Quality**

The quality of water in the reservoir for domestic consumption is no longer an issue as it now meets Category B standards. Water quality should be maintained or improve over the next few years.

The quality of water for fisheries development is uncertain as monitoring to date has examined composite samples from shallow inshore areas. The limnology of the reservoir has not been studied, but an understanding of this is fundamental to any fisheries development programme. It is therefore recommended that the water quality monitoring programme is re-designed to support a limnological survey and assessment of the fisheries potential of the area.

### **5.7.3 Sedimentation**

The sustainability of the Project at risk from a 2.7 to 3.5 times increase in soil erosion rate between 1985 and 1999 due to rapid land cover change in the catchment. In these 15 years, the life of the project may have been reduced from over 300 years to around 100 years.

It is recommended that PLN obtain improved data on sediment transport to the reservoir and estimate the economic cost of increased erosion to the project.

New sediment rating curves should be derived for the automatic water level recording stations now operated by PLN immediately upstream of the reservoir at Taging, on the Kampar Kanan river, and at Lubuk Sipopay on the Mahat river. The curves should then be used to estimate the total amount of sediment reaching the

reservoir annually from the upper catchment, based on daily discharge records over the hydrological record for these two station. Sediment discharge observations should be made over at least one full flood season and should employ the same sampling methods as were used in the feasibility study.

The Department of Forestry is responsible for catchment protection and PLN should take appropriate steps at a political level to protect its interests by insisting that the Department meets its commitments under the Environmental Management Plan.

#### 5.7.4 Forest and Wildlife Conservation

Forest and wildlife resources in the project area continue to be lost through encroachment for cultivation and logging. It is recommended that both Government and local communities act immediately to stop further forest destruction as an indication of their political support for sustainable development of the Project.

Monitoring of forest encroachment has not been done. Monitoring of changes in wildlife populations has used inappropriate methods. It is recommended that retrospective studies should be undertaken to assess the impact of the project in these areas. The impact of the project on land cover change should be studied by comparison of Landsat images from the mid 1980s and recent past. Changes should be interpreted by ground truthing and interview with land holders.

Assessment of the impact of the project on wildlife populations would link land cover change to change in wildlife populations. Wildlife surveys should be carried at representative sample sites in all major land cover types recognisable on the satellite images, including closed forest, open forest, secondary scrub, plantation, settlement and reservoir, to estimate the relative abundance of important species in each habitat.

JBIC SAPS Team will assist PLN in strengthening monitoring design and methodology, data analysis and report preparation.

#### 5.7.5 Plankton, Fish and Fisheries Development

##### (1) Plankton

Changes in the diversity and abundance of plankton indicate the reservoir is becoming more fertile. It is recommended monitoring should continue to support a limnological study and fish stock assessment.

##### (2) Fish Populations

Fish populations in the Kampar river catchment have changed in the last forty years

or so. These changes have arisen for a variety of reasons which are not fully understood, but include the effects of the Kotapanjang dam and river regulation.

It is therefore recommended that government increases institutional capacity to monitor fish biodiversity and better understand the factors affecting changes in the fishery resource.

### (3) Fish Production

The Governor of Riau Province has recently called for an increase in fish production from the project area.

#### Aquaculture

The Fisheries Department pilot project has experienced some production problems and work should continue to better understand the causes and how these may be overcome. The project may benefit from stronger technical support, particularly in terms of water quality analysis, and it is recommended a need assessment is carried out.

#### Fishing

The reservoir fishery is an open access resource and therefore potentially important for income generation and poverty reduction amongst local people. However the Agricultural Extension Service is unable to offer advice to fishermen on where or how to fish, or what to catch. There is a lack of information on the limnology of the water body, the stock of fish over space and time, and production potential - the knowledge needed for informed extension advice. In addition, the benefits of stocking the reservoir with fish, carried out under the current Environmental Management Plan, are unknown.

It is therefore recommended that a fish stock assessment and limnological investigation should be carried out to provide relevant information to extension officers. The benefits of the stocking programme should also be assessed. The present programme of water quality monitoring should be discontinued in favour of providing analytical support to the limnological study.

#### 5.7.6 Impacts of Flood Attenuation by the Dam

River bank erosion downstream of the dam has increased with the loss of agricultural land. It is recommended that a survey of the scale of the problem is carried out.

### 5.7.7 Water Related Disease

Although the recent morbidity rate of malaria tends to be higher in the area near the dam than in the area distant from the dam, and also higher since the dam was constructed, malaria incidence should not be thought of as caused only by the construction of the dam. Human behavior and actions play a major role in the process of malaria infection. The majority of the hosts in the area near the dam exhibit the following characteristics:

- gambier farmers, congregating in the islands of the dam reservoir,
- fishermen, fishing in the dam reservoir or cultivating fish in fish ponds near their houses,
- family members of gambier farmers or fishermen,
- living in houses by the dam reservoir area, or
- living in houses surrounded by a pond or bushes.

It is recommended that malaria infection should be controlled through health education. In addition, indirect vector control should be attempted through the introduction of appropriate fish into the dam reservoir. Direct vector control using insecticide also needs to be considered.

There are generally high morbidity rates also for diarrhea and scabies. These result predominantly from the poor water supply in the area near the dam. The water supply should be improved, in terms of both quantity and quality, to address these problems.





## CHAPTER 6 WORK PLAN FOR PHASE II

### 6.1 General

Phase II of the SAPS Study will be implemented from mid June to mid October 2002. The major work items to be undertaken in Phase II are: i) explanation and discussion of the Interim Report to GOI; ii) formulation of the countermeasures for water supply system, plantation, and income generation activities; iii) conducting various workshops with various stakeholders to reach consensus on an action plan to assist PAFs; iv) assisting GOI to finalize the action plan; v) formulation of countermeasures for negative impacts on the environment; vi) revision of the environmental monitoring and management plan; and vii) preparation of the final report. The details of each item are explained in the following sub-chapters.

### 6.2 Explanation and Discussion of Interim Report to GOI

Prior to the commencement of Phase II, the SAPS Team will explain and discuss the content of the Interim Report to the central, provincial and regency governments. Based on the results of discussion, the work plan will be modified, if necessary. In addition, the duty and role of those governments in formulation and implementation of the action plan will be confirmed in the meeting.

### 6.3 Action Plan for PAFs

#### 6.3.1 Formulation of Countermeasures

##### (1) Water Supply System

Developing an action plan with specific countermeasures for each village cannot proceed without a thorough field survey and examination of the potential water sources. A thorough and conscientious field survey is time consuming but it is one of the most important phases in the whole process of developing a water supply system.

To make the best use of the time available, the SAPS Team recommends conducting a field survey of three villages that represent conditions in the other villages together with Regency office of PU. Each of the three villages will become a model for how to approach the problem solving in the other villages. It is also noted that cooperation work with PU will contribute to the formulation of plan on water supply system in other villages.

An action plan with specific countermeasures for each of the three villages will be developed using a selection process proposed by the SAPS Team. For this matter, the major works are to:

- i) Confirm the feasibility of using shallow wells (depth of the water table, location of hard strata, and water quality);
- ii) Confirm the feasibility of using surface water sources (location of potential sources, yield of springs, flows of streams, water quality, elevation of sources, selection of routes for pipelines);
- iii) Examine the existing distribution system (location, size of pipes and storage reservoirs, length, and elevation); and
- iv) Identify the preferred solution and prepare a preliminary plan for each village.

The selection of three villages for field surveys is based on the information gathered during phase 1. Villages have been classified into groups based on the nature and severity of the problems observed and reported by the house-to-house survey. This classification is presented in following Table. Ideally one village should be selected from each category.

**Table Classification of Villages Based on Water Source Problems**

Severity	Problem with source of water		Name of villages	Number of villages	Remarks
	Quality	Quantity			
A	Yes	No	Muara Mahat Baru	1	Some people report problems with water quality but water is potable and they are still using the well.
B	No	Yes	Gunung Bungsu Koto Mesjid Koto Tuo Pongkai Istiqomah Tanjung Alai	5	Several wells in the village are affected during the dry season.
C	Yes	Yes	Batu Bersurat Binamang Lubuk Agung Mayang Pongkai Muara Takus Pongkai Baru Pulau Gadang Ranah Sungkai	8	Several wells in the village are affected during the dry season.  Some people report problems with water quality but water is potable and they are still using the well. Other sources are available but these are contaminated.  In Batu Bersurat, Binamang and Lubuk Agung most villagers have abandoned wells and are using contaminated surface water as the primary source.
D	Yes	Yes	Tanjung Balit Tanjung Pauh	2	Wells have been abandoned because quality of water is very bad (high turbidity and color). Villagers are using other sources and buying water.

Group A only has one village, Muara Mahat Baru, and the water supply conditions are not very severe. It is not included so that time can be spent on another more severe case instead. In the Group B, Koto Tuo is selected because it offers a number of different water source alternatives so we can test the proposed source selection decision-making process and make adjustments if necessary. In the Group D, Tanjung Pauh and Tanjung Balit are selected because they represent the only villages from West Sumatra Province. They are both selected because they occupy

the same geographical location therefore solutions for one village will be the same as for the other. In the Group C, Batu Bersurat is selected to establish some measure of public participation in the problem solving process. The other selected villages are in close proximity of Batu Bersurat and this will minimize the amount of time wasted in traveling.

In addition to a more thorough field survey in three villages, the SAPS Team will visit each of the other villages to examine the condition of the shallow wells in the dry season. The quantity of water provided by PU gravity water supply schemes will also be evaluated. A random survey of the shallow wells will provide an estimate of how many wells are affected and which parts of the village are most affected (e.g. top of hill).

## (2) Plantation

Detailed surveys of all rubber and oil palm plantings will be made in terms of the numbers of plants per hectare, growth measurements and yield statistics (where already available). Site descriptions should also be provided. This information is also required on a plot-by-plot basis. This survey, which is of major importance, should be undertaken as a joint exercise involving farmers, consultant experts, government staff, during the three weeks prior to Phase II commencement and during the first week of Phase II activities.

In addition, the following information will be collected through the governments: i) maps of the location of each settler plot; ii) location of each development area relative to land suitability units; iii) history of each development area; iv) component quantities and costs (materials and services) and labour inputs; v) physical one-hectare models utilized in the past, or being utilized at present, at all development sites; vi) family labor statistics need to be obtained for all rubber and oil palm areas.

Based upon data and information collected prior to and during the early stages of the Phase II period, the countermeasures should be formulated considering the following main components:

- Careful assessment of the current physical status of plantation crop plantings of all PAFs;
- Prescription of early and timely activation of remedial/rehabilitation/replanting/maintenance activities designed to bring plantings to a satisfactory standard;

- Consultation with PAFs to describe, discuss and agree on an appropriate range of actions;
- Phased costing of the measures and activities prescribed;
- Selection of appropriate development models to achieve the requisite standards;
- Assessment of the scope for early incorporation of the appropriate supplementary farm activities to bolster farm cash flow; and
- Assessment of the workable scope for compensatory measures to rectify the imbalance of cash flow, and grant and credit aspects enjoyed by PAFs to date.

### (3) Income Generation Activities

The following surveys will be conducted in Phase II for the formulation of countermeasures of income generation activities.

- Additional survey for confirmation of income generation activities in the resettlement villages;
- Clarification of the present condition (crop yield, production and cultivated area), cultivation method, crop budget and marketability of food crops and inter crops in the plantation;
- Clarification of the present condition (crop yield, production and cultivated area), cultivation method, crop budget, marketability and erosion condition of gambier cultivation,
- Assessment of the potential for livestock, including poultry, farming;
- Assessment of present support service for agricultural extension, training program, cooperatives and credit scheme;
- Formulation of the appropriate development models to achieve the requisite standards; and
- Consultation with PAFs to describe, discuss and agree on an appropriate range of actions.

In phase I, the high potential of fish farming, including inland fish farming, was confirmed in some resettlement villages. Therefore, a more extensive survey will be carried out in the fishery sector as follows:

- Additional survey for the present condition of the fishery that is based on the dam reservoir as well as the inland fish farming;
- Assessment of capture fisheries and aquaculture potential in the resettlement villages in terms of water resources, present experience and accessibility to the dam reservoir;
- Assessment of yields, production, aquaculture technology, production cost and

- income, processing, and marketability in the fishery sector;
- Assessment of constraints on the fishery sector;
- Assessment of present support service for extensions, training program, cooperatives, supply of fish fry and credit scheme;
- Formulation of appropriate development models to achieve the requisite standards; and
- Consultation with PAFs to describe, discuss and agree on an appropriate range of actions.

### 6.3.2 Implementation of Workshops

The following workshops will be organized to formulate an action plan and reach consensus amongst stakeholders including PAFs, governments, local universities and local NGOs.

#### 1) Universities Workshop (2 times)

The University of Riau and Andalas University both studied the issues related to the Project since 1991, or even before, and should be invited to the one-day workshop. In addition, new issues such as fishery development in the reservoir should be dealt with, i.e. Fishery Department of the University of Riau should be invited. The staff of provincial and regional government will also be invited as much as possible. The workshop will be held in mid June. The major topics of the workshops are: i) the present situation of PAFs based on the results of the impact survey; ii) present action plan, preliminary recommendations of the SAPS Team and needs of PAFs; iii) suggestions and comments for formulation of the action plan; and iv) role of the universities in the action plan.

#### 2) Initial Village Representative Workshop (3 times)

Head of villages and the village assembly members should be invited to the one-day conference at Kechamatan Office in Batu Bersurat. Results should be conveyed to each village member via head of village and the member of village assembly. Representatives of BAPPEDA Kabupaten and local NGOs are invited. In West Sumatera, head of the village and assembly members of Tanjung Pauh and Tanjung Balit should be held separately. Those workshops will be held at the end of June. The major topics of the workshops are: i) result of the impact survey; ii) present action plan, recommendations of SAPS Team and needs of PAFs; iii) scope of the action plan; and iv) role and duty of government and PAFs in the action plan.

3) Field trip to Koto Mesjid (once)

Koto Mesjid in Riau Province is a village that has taken necessary action in order to supplement the adverse conditions they faced during the past years. Representatives of the Villagers in Riau should be invited to examine the development of Koto Mesjid. Representatives from Tnajung Pauh and Tanjung Balit are invited. After the observation of development activities made in Koto Mesjid, a meeting will be held to discuss how other villages realize the development. The field trip will be made at the middle July.

4) Village/Hamlet Level Workshop

An NGO will carry out a survey after the village representative workshop to confirm that the village representatives have informed the discussion and outcomes of the initial Village Representative Workshop. After the survey, a village/hamlet level workshop will be organized. In each village, NGO teams will hold village, hamlet level, or "dusun" level in Riau Province and "jogong" level in West Sumatra, PRA meetings to confirm and/or elaborate the Action Plan. It should take three weeks to complete the village/hamlet level workshop (end of June to mid July).

5) Second Village Representative Workshop (2 times)

In middle to late July, the second workshop will be held to confirm the findings of the SAPS Team and various suggestions on formulation of countermeasures and forming maintenance organizations. Representatives of Provincial and Kabupaten governments, and Local NGOs will be invited to discuss the finalization of the action plans.

### 6.3.3 Assisting GOI to Finalizing the Action Plan

Based on proposed countermeasures and the result of various workshops, the action plans will be revised. The SAPS Team will assist the finalization from the following points.

1) Institutional Aspects

Institutional aspects will cover: i) scope of the action plan, ii) organizational plan of governmental agencies, and iii) duty and responsibilities of governmental agencies concerned as well as PAFs.

2) Technical and Financial Aspects

Technical and financial aspects will cover: i) countermeasures for water supply system, ii) countermeasures for rubber plantation, iii) countermeasures

for income generation activities, iv) other countermeasures considering people's opinion, v) budget plan, vi) priority of each measure and implementation plan, and vi) monitoring and evaluation plan.

## **6.4 Environmental Study**

### **6.4.1 Collection of Additional Information**

Additional information on the environmental condition will be collected based on the comments of the Interim Report. In addition to the collection of information in and around the project area, the best practice for environmental protection measures will be studied in the other project or area. It is scheduled that the examination of the best practice will be made for sedimentation of the dam reservoir and wildlife species protection, since those are the most serious issues in the Project.

### **6.4.2 Formulation of Countermeasures**

The past efforts made and the action plan proposed by the Government will be reviewed in terms of institutional, financial and technical aspects. Based on the review results, the feasibility and effectiveness of each item will be examined. The results of the environmental assessment made in Phase I indicate that the Project has had the following impacts: i) sedimentation of dam reservoir, ii) forest conservation, iii) wildlife species protection, iv) plankton and fish in the reservoir, v) river bank erosion in the downstream, and vi) increased malaria incidence. For those impacts, it will be checked whether the government has taken proper efforts in the past, or plans to in the proposed action plan. Based on the results, additional countermeasures will be formulated, if necessary. In some cases, further detailed study or monitoring activity may be proposed to formulate countermeasures in future.

### **6.4.3 Revision of Environmental Monitoring and Management Plan**

Based on the survey results in Phase I and II, the environmental and management plan will be revised. The items of the overall environmental monitoring and management plan should be narrowed down, considering the necessity and importance of each item. Then, other necessary items will be added. To enhance the transparency of the Project, it is important that the final proposed environmental monitoring and management plan is made public. The SAPS Team will discuss this matter with the governmental agencies concerned and formulate recommendations.

## **6.5 Preparation of Monitoring Sheet Format**

The format of the monitoring sheet will be prepared based on the study result. The monitoring items will include the progress of action plan for PAFs families and environmental aspects. The monitoring sheet will be submitted to JBIC on a semi-annual basis by the GOI in future and attached to the Draft Final Report. The responsible agencies for each monitoring item are also considered through discussion with the GOI.

## **6.6 Preparation of Draft Final Report**

Based on the results of the study carried out in the field work in Indonesia, the Draft Final Report will be prepared and submitted to JBIC. The Draft Final Report will be finalized reflecting the comments of JBIC.

## **6.7 Discussion of Draft Final Report and Action Plan**

### **6.7.1 Discussion with Government**

The Draft Final Report will be submitted and explained to the GOI and the contents discussed with both the central government and local governments. The opinions and comments from the GOI will be reflected in preparation of the Final Report.

### **6.7.2 Third Village Representative Workshop (2 times)**

The third workshop with village representatives will be held for final confirmation on the Action Plan including the implementation plan. For the third workshops, local governments will be requested to organize the workshop with the assistance of the SAPS Team.

## **6.8 Preparation of Final Report**

Based on opinions/requests from JBIC and GOI as well as the result of the workshop, the Draft Final Report will be revised and the Final Report will be prepared. The Final Report will be submitted to JBIC in mid October 2002.