7. SUMMARY OF FIRST ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

7.1 GENERAL

Within the context of the present Feasibility Study, which started in August 1998, field investigations were carried out in order to establish the information base line by reference to which potential impacts may be estimated. An Initial Environmental Examination (IEE) was produced in October 1998. Preliminary impact assessment and conclusions were presented as an Interim Report in March 1999. Both documents were subject to public presentation and extensive discussions with the Environmental Assessment Committee (EAC) and the Hydropower Office (HPO) of the Ministry of Industry and Handicraft. This section is a summary of the First Environmental Impact Assessment (EIA) Report attached as the Supporting Report (I) to the present document.

The first EIA report has been prepared in accordance with the recommendations of the major international agencies as JICA, ADB and the World Bank. The following chapters have been developed in the first EIA report:

(i) The institutional and legal framework for environmental management in Lao PDR,

(ii) A summary description of the Project components,

(iii) The baseline information on present environmental and social conditions in the region,

(iv) The analysis of impacts and the presentation of mitigation measures,

(v) A summary of the Environmental Management plan,

(vi) A summary of the Preliminary Resettlement plan, and

(vii) A summary of the Public Consultation and Participation implemented during the study.

7.2 INSTITUTIONAL AND LEGAL FRAMEWORK

7.2.1 GOVERNMENT INSTITUTIONS

The GOL has designated the National Office of Science, Technology and Environment (STENO) to serve as the national environmental management agency, reporting directly to the Prime Minister's Office. STENO is presently considered as the body responsible for the enforcement,

control and evaluation of EIA studies related to any infrastructure project developed in Lao PDR.

Several other bodies have a role in environmental management:

(i) The Inter-Ministerial Working Group for Environment and Sustainable Development, with a coordination and policy role,

(ii) The Ministry of Agriculture and Forestry (MAF) which is a key GOL agency for natural resource management,

(iii) The Center for Protected Areas and Watershed Management (CPAWM), under the Department of Forestry is also an important resource management group, with activities in wildlife, watershed management, NBCA management, and wetland conservation,

(iv) The Hydropower Office (HPO) is the focal body for supervision and coordination of studies related to hydropower projects, including environmental and social considerations.

7.2.2 POLICY AND LEGAL CONTEXT

Aside from several major environmental policies developed by the GOL (National Environmental Action Plan, Tropical Forestry Action Plan, Conservation Policy with the creation of more than 20 National Biodiversity Conservation Areas), the Environmental Law endorsed by the Parliament, in February 1999 and declared for enforcement by Presidential decree (Letter 09/President Office of 26/4/99) provides the legal framework for environmental management related to development projects, including obligations regarding EIA. More particularly, it supports STENO's role in environmental management of the hydropower sector.

Because official Lao guidelines on conducting EIAs and planning for involuntary resettlement are currently under preparation, the GOL applies the recommendations and guidelines of the World Bank (WB), which are also recognized by the Asian Development Bank (ADB), to large infrastructures projects.

7.3 BASELINE INFORMATION ON PRESENT CONDITIONS

7.3.1 TYPOLOGY OF PROJECT AREA

Hydropower projects generate several types of impacts affecting several components of the environment in different parts of the Project area and at different periods of the Project life. For that purpose, and to facilitate the understanding of the impact analysis, a typology of the Project area has been established. It is based on the division of the Project area into zones, each zone being subject to typical impacts and subsequent categories of environmental impacts. This typology is presented in Figure 7.3.1.

7.3.2 LANDSCAPE, GEOLOGY, MINERALS AND SOILS

At the confluence with the Mekong, the Nam Ngiep catchment area is 4,510 km². The first 55 km of river stretch are located in a narrow valley, with a steep slope as the river loses about 1,000m in elevation. Then the valley widens for about 70km, with large, partly cultivated alluvial terraces. Then the valley narrows again over a few km before joining the wide alluvial plain where it eventually joins the Mekong River. The proposed dam is located in a narrow gorge just before the river enters this alluvial plain, about 24km upstream from the Nam Ngiep confluence with the Mekong River.

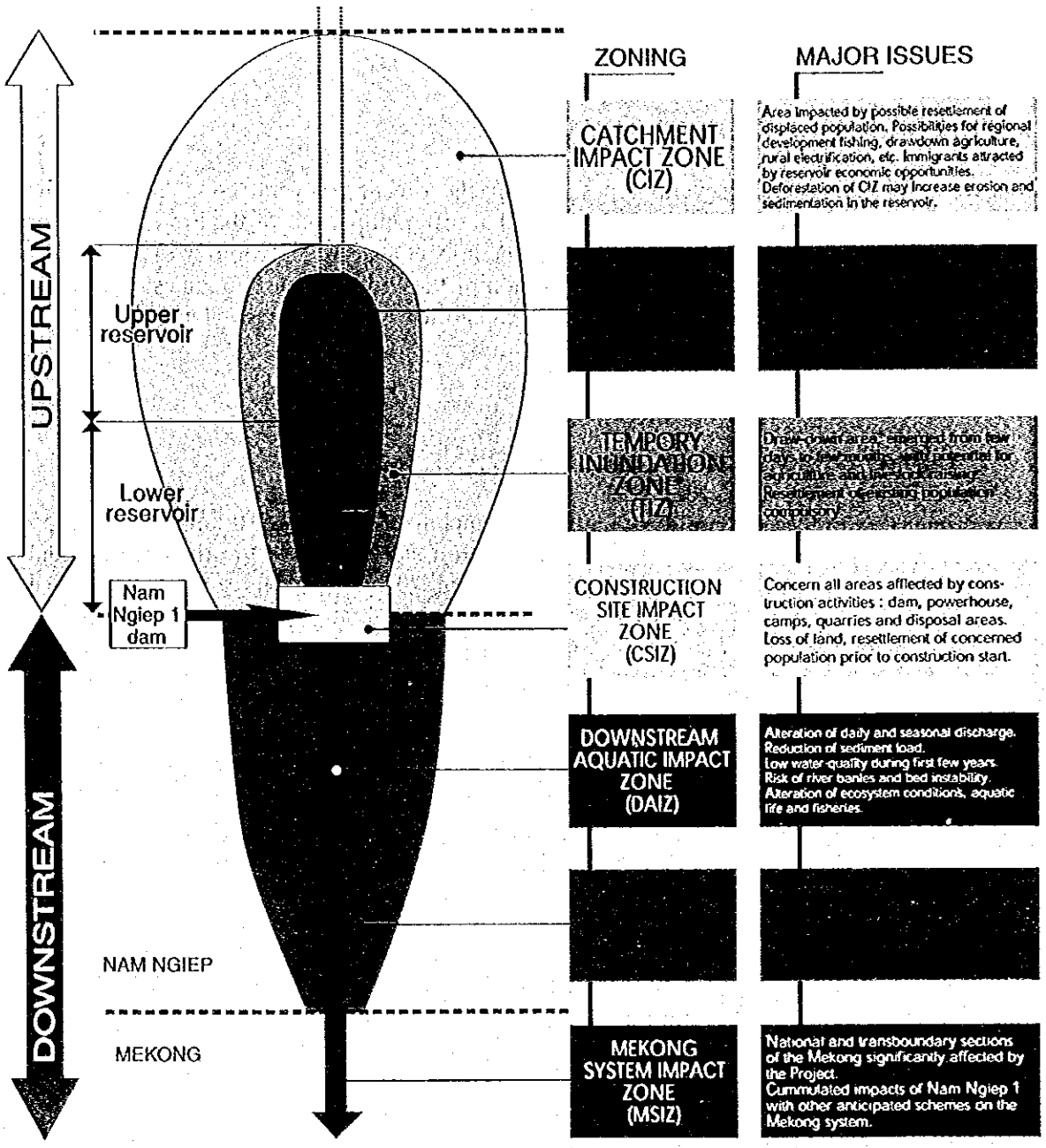
Most of the rocks forming the substratum underlying the future reservoir in its upper and lower parts are sedimentary. The geology of the reservoir falls basically into five (5) types: (i) The Jurassic or Upper Jurassic-Cretaceous types, (ii) Ante-carboniferous granites, (iii) Triassic types including sandstone, siltstones, schist, marls and conglomerates, (iv) Ante-Norian granites and (v) a graven of Jurassic and Cretaceous sandstone and mudstone.

According to the Department of Geology and Mines, no investigation for oil or mineral ore has been, is being, or is anticipated to be conducted, in the reservoir area. Furthermore, due to the geological formations observed along the Nam Ngiep River, important economical sources of mineral resources are unlikely to occur.

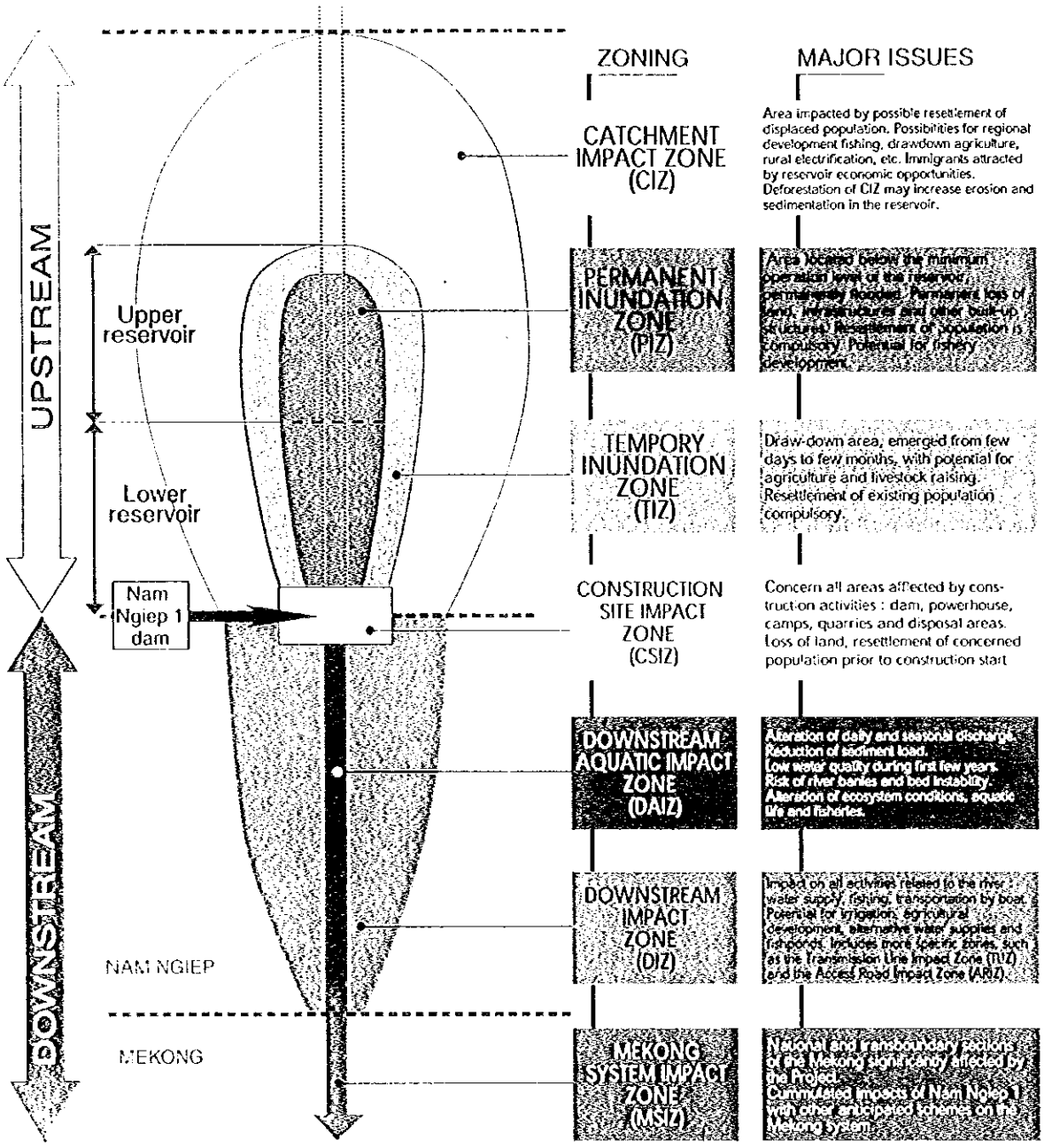
7.3.3 CLIMATE AND HYDROLOGY

The Project area is under the influence of the southwest monsoon, with a wet season from May to October, which yields some 91% of the annual rainfall. The dry season from November to April yields only the remaining 9%. Some of the months may be completely devoid of rainfall.

Hence, rainfall is close to 2,500mm/year in average, as opposed to 2,000mm/year everywhere else in the region. The showers are concentrated into a short summer period, and run-off is particularly high in spite of the vegetation cover.



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	First Environmental Impact Assessment	Figure 7.3.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Typologie of The Study Area	



FEASIBILITY STUDY ON THE NAM NGIEP 1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	First Environmental Impact Assessment	Figure 7.3.1
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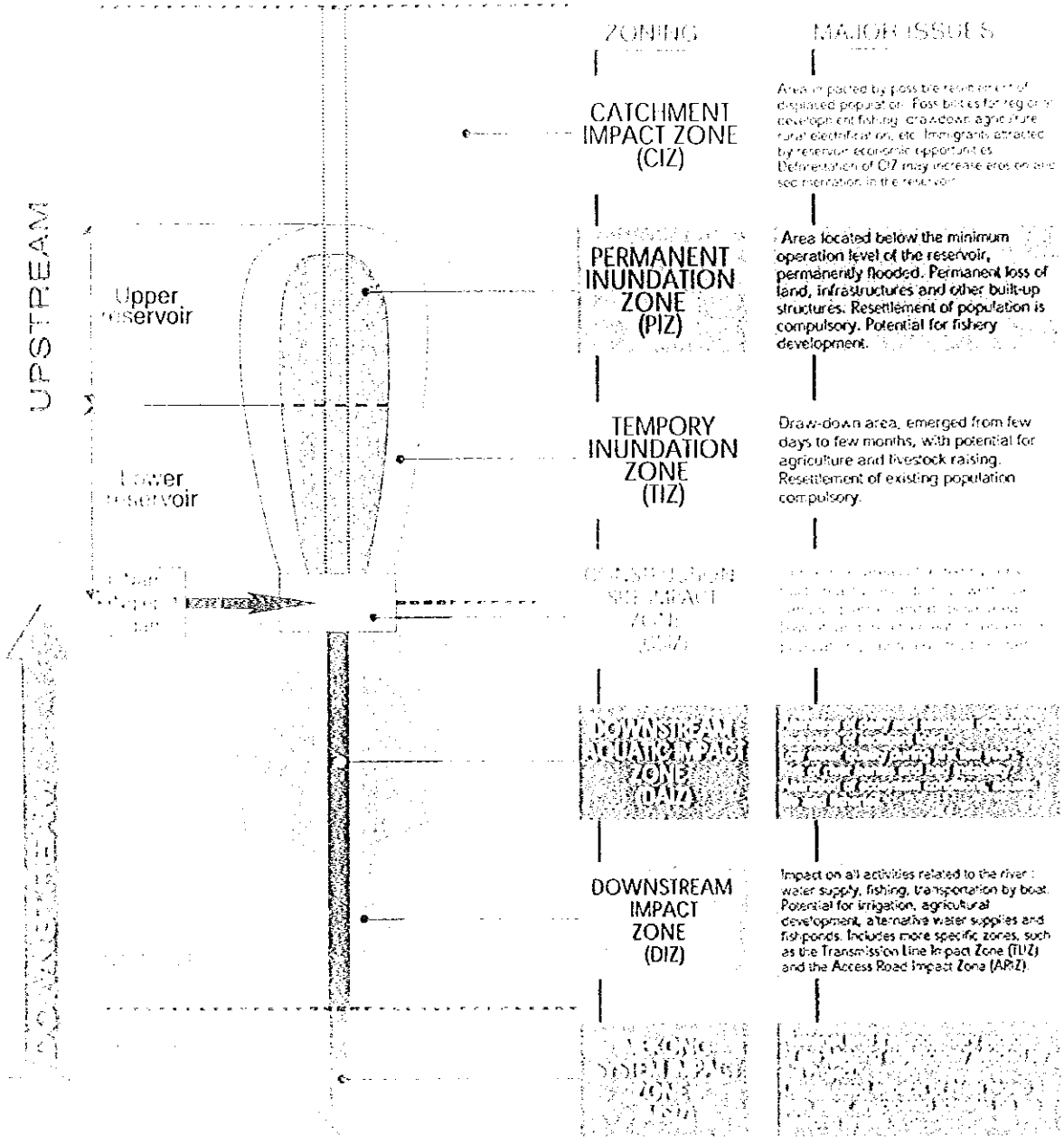

ZONING
MAJOR ISSUES
UPSTREAM
Upper reservoir
CATCHMENT IMPACT ZONE (CIZ)
Area impacted by loss the resettlement of displaced population. Loss basis for regional development fishing, drawdown agriculture rural electrification, etc. Immigrants attracted by reservoir economic opportunities. Delineation of CIZ may increase erosion and sedimentation in the reservoir.
PERMANENT INUNDATION ZONE (PIZ)
Area located below the minimum operation level of the reservoir, permanently flooded. Permanent loss of land, infrastructures and other built-up structures. Resettlement of population is compulsory. Potential for fishery development.
TEMPORY INUNDATION ZONE (TIZ)
Draw-down area, emerged from few days to few months, with potential for agriculture and livestock raising. Resettlement of existing population compulsory.
DOWNSTREAM AQUATIC IMPACT ZONE (DAIZ)
DOWNSTREAM IMPACT ZONE (DIZ)
Impact on all activities related to the river : water supply, fishing, transportation by boat. Potential for irrigation, agricultural development, alternative water supplies and fishponds. Includes more specific zones, such as the Transmission Line Impact Zone (TLIZ) and the Access Road Impact Zone (ARIZ).

Table 7.3.1 Average Monthly Rainfall Average (mm) in the Project Area

January	59	July	431
February	50	August	591
March	44	September	480
April	41	October	225
May	82	November	119
June	228	December	73
Total : 2,423 mm/year			

Concerning the river system, at the proposed dam site the controlled catchment area is 3,700km² or 82% of the total catchment. Downstream of the dam site, the largest tributary of the Nam Ngiep River on its left bank is the Nam Xao River, with a catchment area of 310km². The remaining 500km² catchment consists of a smaller tributary, the Nam Tak River, and the drainage of the plain near Pakxan as shown in Figure 7.3.2.

Mean annual discharge at the proposed dam site is estimated at 161m³/s, based on a run-off coefficient of 0.56. Series of flow at the dam site have been generated over a 30-year period. Average for 30 years and typical values for mean, wet and dry years are summarized in the following table:

Table 7.3.2 River Flow at Dam Site (m³/s)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Average 30 yrs	47	40	35	33	65	182	345	472	384	180	95	58	161
Mean year	59	50	43	40	68	185	236	581	358	168	106	65	163
Wet year	37	33	36	40	91	339	442	850	564	223	122	64	237
Dry year	46	35	30	24	28	71	219	251	173	92	50	40	88

7.3.4 WATER QUALITY

During the present Feasibility Study, 4 sampling missions were scheduled in January, March, June and late August 1999.

Sampling surveys were carried out in 4 stations, from upstream to downstream as shown in Figure 7.3.3:

(i) The Nam Siam River at B.Xiengkhong, the major tributary of the Nam Ngiep River in the upper catchment,

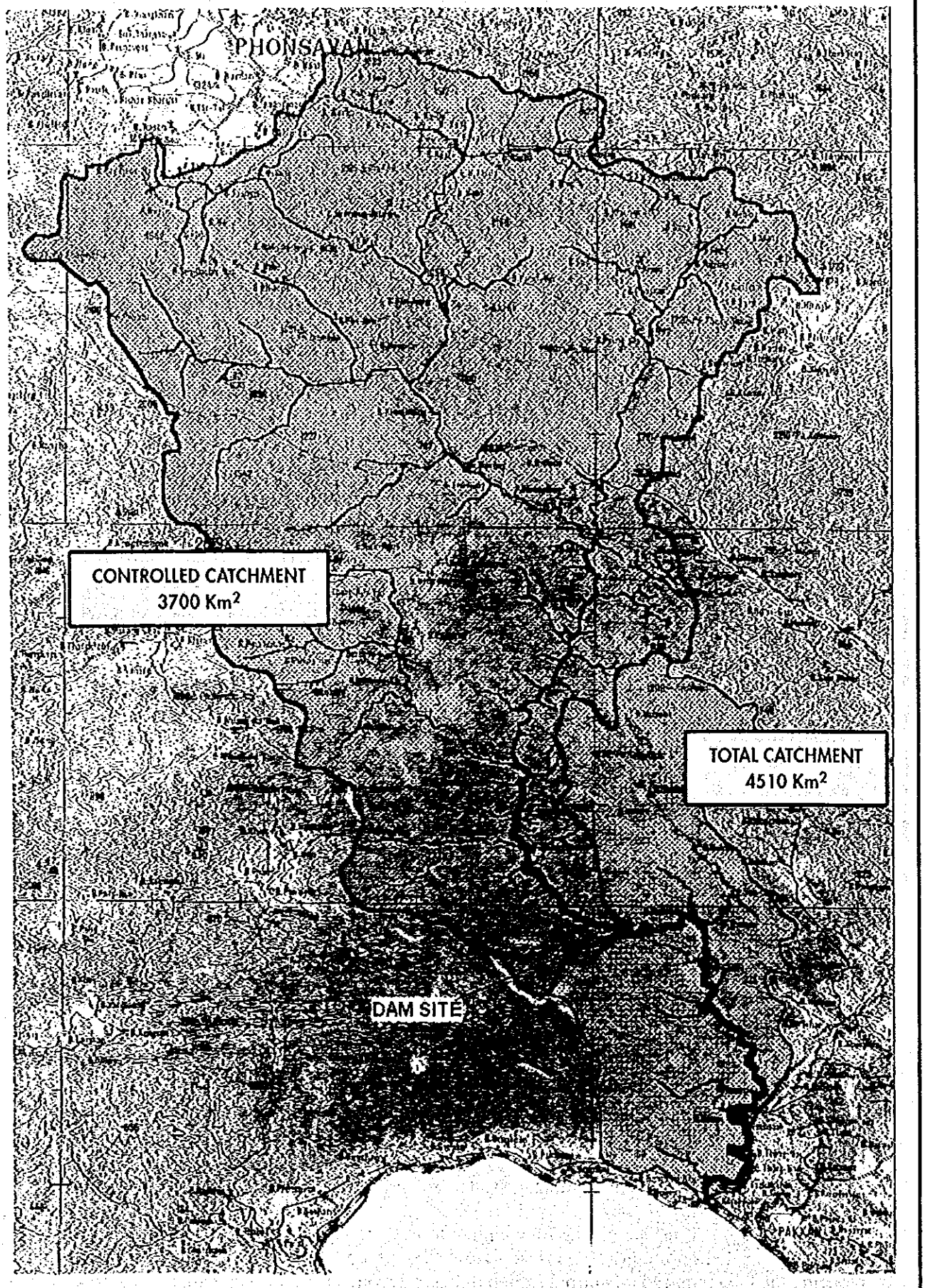
(ii) The Nam Ngiep River at Thavieng Sub-District (B.Dong)

(iii) The Nam Ngiep River at B.Hat Kham (gauging station)

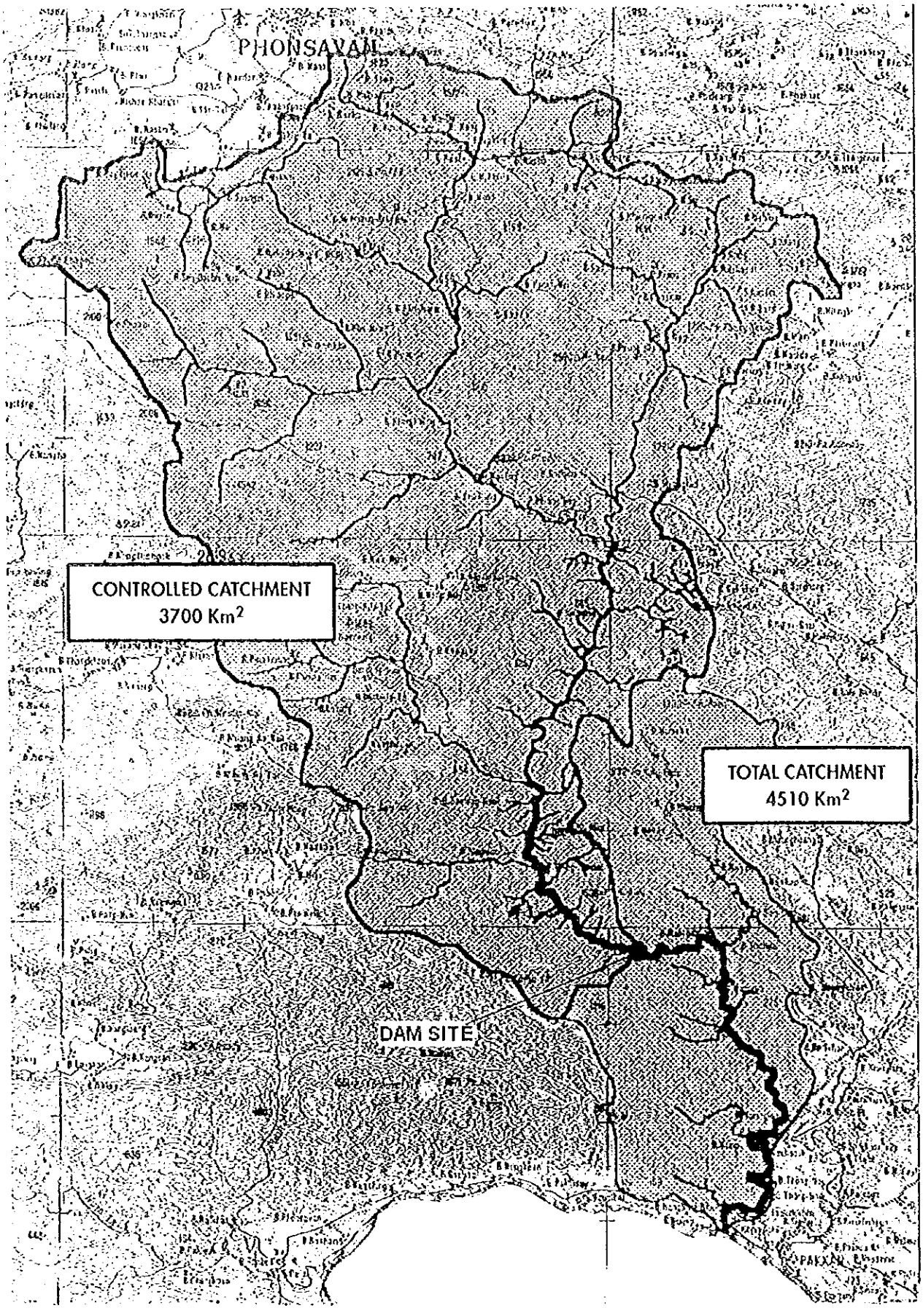
(iv) The Nam Ngiep River at B.Munagmai (gauging station)

The water quality of the Nam Ngiep River is good. Close to neutral pH, low nutrients content and dissolved solids in the low to medium range. The nutrient content remains very low, partly because the whole catchment has a limited population, and partly because during dry season, water flowing in the river is often drainage water from the basement aquifer.

During the rainy season, these values are higher because of the run-off collecting organic matter and dust deposited on the ground surface. However, these values remain on the low side, thus reducing the long term risk of eutrophication in the reservoir.



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.2
	NAM NGIEP CATCHMENT	



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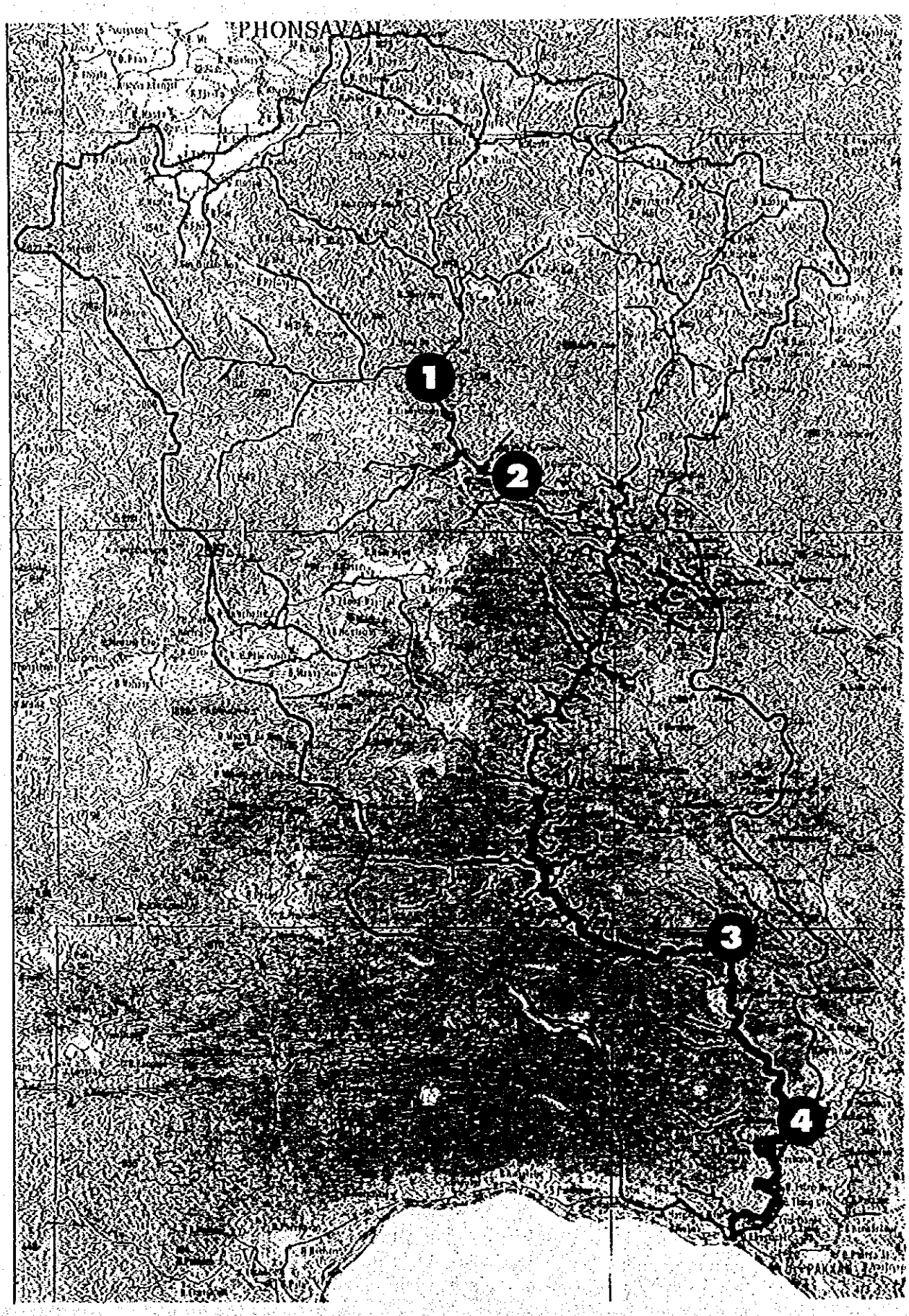
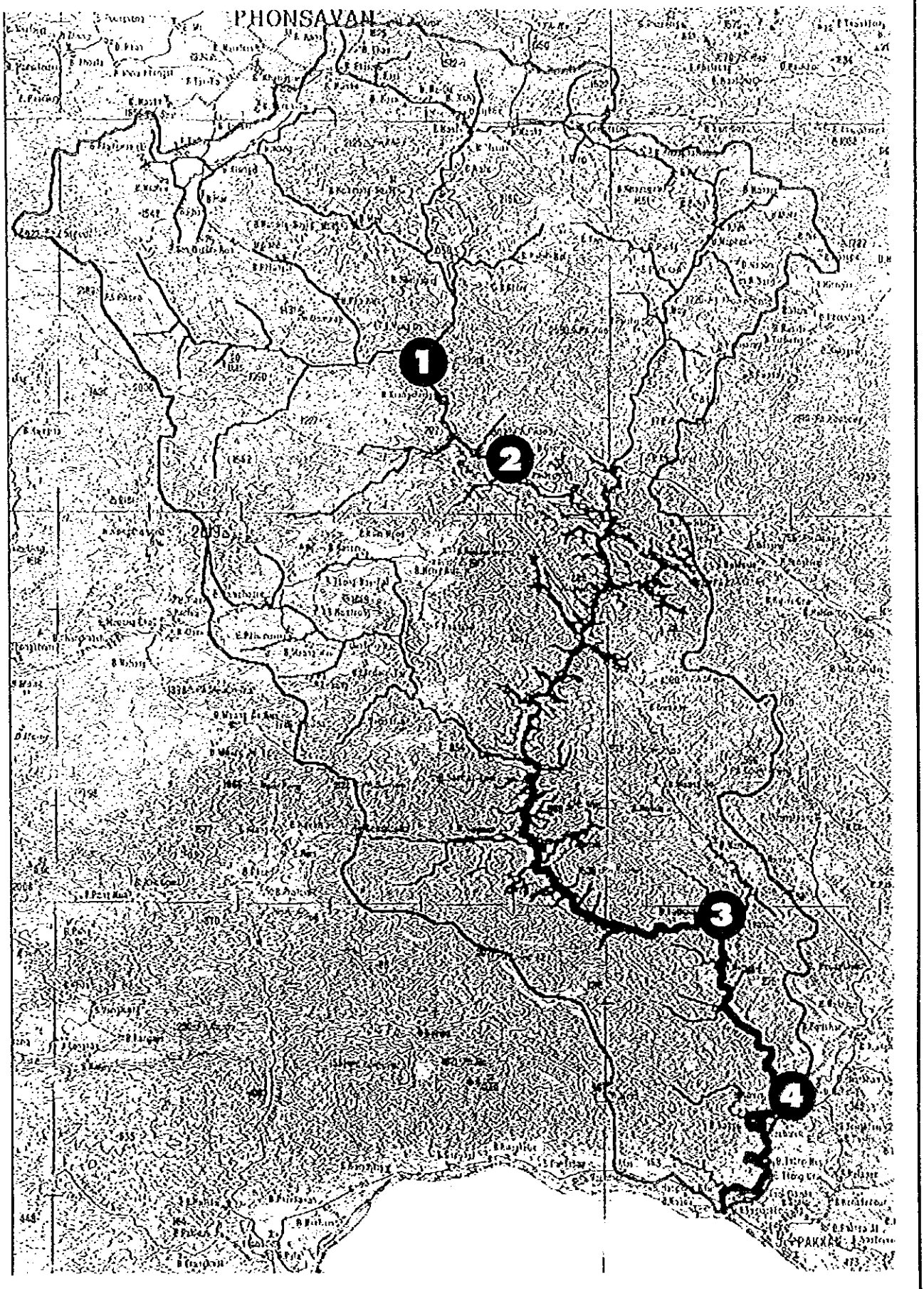


FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.3
	LOCATION OF WATER MONITORING STATIONS	



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.3
	LOCATION OF WATER MONITORING STATIONS	

Some coliform pollution from fecal origin is observed downstream, resulting from the presence of villages and the slow flow of the river.

Table 7.3.3 Results of Water Quality Monitoring

Items		STATIONS														Drin-king Stan-dard
Parameter	Unit	Station 1				Station 2				Station 3			Station 4			
Date in 1999		8/01	16/03	22/06	24/08	8/01	16/03	22/06	25/08	12/01	19/03	24/06	12/01	19/03	24/06	
Temp	°c	NA	23.1	27.0	25	NA	22.9	30.0	24	NA	27.4	24.6	NA	27.1	25.0	-
PH	-	8.10	7.39	7.79	8.18	7.61	7.91	7.58	7.68	7.84	8.56	7.75	7.81	8.26	7.52	5.8-8.5
TDS	mg/l	NA	39	44	40	NA	63	33	40	NA	56	36	NA	57	36	-
DO	mg/l	NA	7.8	7.56	6.75	NA	8.0	7.50	6.84	NA	7.3	7.98	NA	8.0	7.62	-
Conduct	ms/m	13.5	7.2	8.03	8.07	9.8	11.2	6.30	8.02	9.9	9.87	6.64	9.4	10.2	6.64	-
Ca	mg/l	15.16	7.76	0.592	14.4	11.28	13.96	0.421	11.6	11.60	12.18	0.446	13.94	12.54	0.455	-
Mg	mg/l	8.78	2.00	0.220	3.89	3.91	4.09	0.206	2.7	5.56	3.12	0.193	4.88	2.98	0.202	-
Na	mg/l	NA	0.03	0.074	1.40	NA	0.035	0.049	2.6	NA	0.042	0.052	NA	0.043	0.077	-
K	mg/l	NA	0.01	0.036	0.312	Na	0.009	0.031	0.273	NA	0.012	0.045	NA	0.012	0.033	-
Cl	mg/l	0.42	2.00	0.007	0.014	0.28	0.70	0.018	0.011	0.35	1.54	0.016	1.19	0.84	0.018	<250
SO_4	mg/l	1.92	3.74	0.074	0.011	1.06	6.00	0.064	0.019	2.88	2.40	0.078	2.40	2.98	0.066	<400
NO_3-N	mg/l	0.001	0.002	0.127	0.068	0.001	0.001	0.126	0.086	0.023	0.018	0.147	0.314	0.110	0.134	<10
PO_4-P	mg/l	0.014	0.020	0.088	0.011	0.011	0.008	0.059	0.019	0.01	0.003	0.018	0.009	0.003	0.019	-
Hardness	mg/l	64.9	27.8	40.60	52.2	44.5	52.0	31.35	40.4	42.9	43.5	31.95	47.1	43.9	32.85	<300
$CaCO_3$	mg/l	67.9	34.4	37.6	43.4	48.2	53.6	27.1	16.3	43.1	42.6	28.9	44	44.0	28.2	<350
TSS	mg/l	1	87	6.58	38	1	20	486	53	2	12	140	1	14	88	-
Tot-Fe	mg/l	0.152	0.68	0.256	0.143	0.146	0.36	0.359	0.499	0.171	0.45	0.307	0.244	0.39	0.606	<0.3
Si	mg/l	7.3	9.0	4	4	8.8	8	2	5	8.9	8.0	6	8.6	8.0	6	-
COD_{Mn}	mg/l	0.458	3.8	3.20	0.589	0.866	1.2	5.55	0.568	0.517	1.2	0.95	0.521	0.9	0.78	-
Fecal Coliform	nb/ 100ml	NA	3	2	2	-	5	0	1	46	25	5	10	40	12	0

7.3.5 AQUATIC ECOLOGY AND FISHERIES

Fish samples were collected, observed and identified from 21 stations along the Nam Ngiep River and its tributaries, including 9 stations of the Upper Reservoir, 5 stations in the Lower Reservoir area and 7 stations in the Downstream Area. Additional information on fish species was obtained from observation at B.Phonyeng market and also from the fishermen's catches in the villages of the Upper and Lower Reservoir.

The first fish survey was carried out around the end of December 1998 until mid January 1999 for Upper and Lower Reservoirs and at the beginning of April 1999 in the Downstream Area.

The second fish survey was carried out at the end of July and beginning of August 1999, mainly in the tributaries of the Nam Ngiep River and in the floodplain, rice fields and ponds along the river.

During the first survey, 115 species were collected and identified. During the second survey, 19 additional species were collected, raising the biodiversity of the basin to 134 species. 57 species are observed in the Upper Reservoir, out of which 8 species are not observed in lower river sections. 78 species were observed in the Lower Reservoir, out of which 16 species are not observed in upper reservoir and downstream areas. In the downstream area, 91 species were observed, out of which 45 species are not observed in the upper and lower reservoirs. These species are typical of the Mekong system. This distribution is summarized in the following table 7.3.4:

Table 7.3.4 Distribution of Biodiversity

NUMBER OF SPECIES OBSERVED	DISTRIBUTION OF FISH BIODIVERSITY		
	Upper Reservoir	Lower Reservoir	Downstream Area
Only in upper reservoir area	9		
Only in lower reservoir area		16	
In upper and lower areas	18		
In lower reservoir and downstream		16	
Only in downstream area			46
In upper, lower and downstream areas	29		
Total species observed	56	79	91

This total of 134 fish species observed during the surveys compares well with some basins which have already been investigated also for hydropower development purposes.

In the Nam Leuk basin, 122 species were reported. Several surveys in the Nam Theun - Xe Bang Fay basins came with a fish biodiversity of 165. In Thailand, investigations on the Pak Mun River gave 125 species.

Most of the species found are widely distributed in the region. However, some species not identified at species level (only genus level) may have more restricted distribution. Additional investigations on that matter are recommended for the next stage of the study.

At present, information on fish species behavior and migrations is still very limited.

However, some species observed in the Upper or Lower reservoir have already been reported from other rivers in the Mekong basin where they are considered as migratory. This is the case of *Cirrhinus molitorella ; Labeo erythopterus; Bangana behri; Bangana sinkleri; Kreptopterus cryptopterus; Mystus nemurus; Hemibagrus wyckoides.* (Roberts & Baird, 1995). But even the exact timing, location and distance of the migration is still uncertain. During the first survey in December 1998 to January 1999, while fish migration for spawning was reported by the villagers, the exact timing of the migrations, location and distance of the migrations are also still not known.

In coordination with the socio-economic survey, a specific questionnaire on the fisheries was developed in order to get a clear picture of the subsistence fisheries as an economic activity of the local communities.

Fishing activities are present in all of the 31 surveyed villages (Upper reservoir 13 villages, Lower reservoir 4 villages and Downstream area 14 villages). The number of persons fishing in each household in the Upper Reservoir is about 1.1, whereas in the lower reservoir it is 1.5, and 1.3 in the Downstream, and the average of all areas is 1.3. The survey indicates that up to 68% of the households that were interviewed fish all year long. It also appears that the percentage of villagers fishing all year long in the Lower Reservoir (80%) is higher if compared to the Upper Reservoir (67%) and in Downstream Area (56 %).

Most of the villagers fish about 2-3 days a week and reported that in the Nam Ngiep River, fish catches are at peak in November-December. May-June is also a good period for fish catches. Gillnet with hook and lines represent the most popular fishing gears. The average gillnet per household is 2.8, but in the downstream area, an average of 4.3 per household is observed. The cast net is the third most represented fishing gear, with about 1 per household.

The boat is an important tool for fishing. Less than 33% of the investigated households have a boat. It is observed that in the downstream area, more households have a boat (44%) than in the reservoir area. Only 28% of those having a boat report also a motor, the other ones having only paddle boats. However, in the downstream area those reporting a motor boat raise to 61%. This is quite understandable as the river downstream allows boat use and transportation, a practice more limited by the rapids and the flow in the reservoir area.

Preferred fishing areas vary according to season. During the wet season, the water depth and the strong flow limit the practice in the river. During this period, fishing occurs also in the smaller tributaries and in the paddy fields. The peak season for river fishing is in May-June when the discharge increases and the fish move upwards the river.

The average quantity of fish catches reported is 0.7kg/fishing-time/HH. The average fish consumption per household and per year has been established at 137kg/HH/year in the downstream area. No consistent information was gathered from the upstream area to assess the consumption. Anyway, it should not be much different than from the downstream area. This figure is particularly close to the result of a 3-year fishery monitoring for the Nam Leuk HEPP, which comes to an average of 133kg/hh/year (or 50-60 grs/capita/day).

The average fish price in the area varies from 2,200 kips/kg (Upper reservoir), to 7,100 kips/kg (downstream area). This may be explained by a more autarkic economy in the upper reservoir than in the downstream area, more open to the national market and which reflects more rapidly the high inflation rate which prevails in the country (at the time of survey, US$1.00 was equivalent to about 9,000 Kips).

There is limited fish culture practices in the project area. This is still new for the villagers, mainly in the upper and lower reservoir areas. In the absence of a market and the river being able to satisfy requirements, there is no perceived need for the development of such practice. In the downstream area, the road connection to Vientiane and a higher urban population has raised more interest for fish culture among villagers.

7.3.6 VEGETATION AND WILDLIFE

The work related to the terrestrial ecology had two major objectives:

(i) to provide a preliminary information on the present condition of wildlife and habitats in the project area (including the whole catchment), and

(ii) to provide a preliminary information on the vegetation biomass and commercial timber volumes available in the reservoir area.

A first field work campaign was carried out from January 22 to February 20, 1999 by a team of 7 persons followed by a second field work campaign from April 1 to 12, 1999.

(1) Land Systems and Vegetation

The catchment was analyzed using 1:50,000 and 1:100,000 scale maps and divided into 40 land systems which are shown in previous Figure 7.3.2. A further catchment analysis has been made to describe the sub-catchments of the Nam Ngiep River. The results are presented in a

reconnaissance level description of each land system unit has been made from all sources available to the Study Team. The 40 land systems identified are shown in Figure 7.3.4.

The lower reservoir has small areas of secondary woodland (LS5) all seriously degraded, with extensive areas of land cleared, cultivated and logged. The middle and upper reservoir (LS14 and LS21) though less degraded (least degraded between B.Houaypamon and the Nam Mang River confluence) is still mainly covered with secondary woodland (with large areas of woodland) interspersed with areas of hill rice cultivation. In the upper reservoir the Nam Mang River (tributary upon which B.Nakang is located) most of the valley floor has been cleared for paddy rice cultivation in the last few years. Small scale logging operations are currently working in the lower, middle, and upper reservoir.

In the small areas of LS2, LS3, LS9, LS10, LS16, and LS20 surveyed the steepest slopes and ridge tops tended to have the oldest and most diverse stands of trees. Particular patches of LS2 and LS3 had the most mature stands of trees observed.

The riverbanks of the Nam Ngiep River in LS1 are heavily cultivated (mainly sugar cane and rainfed rice) and further from the river large areas have been subject to swidden agriculture, logging and the impacts of small to moderate numbers of elephant.

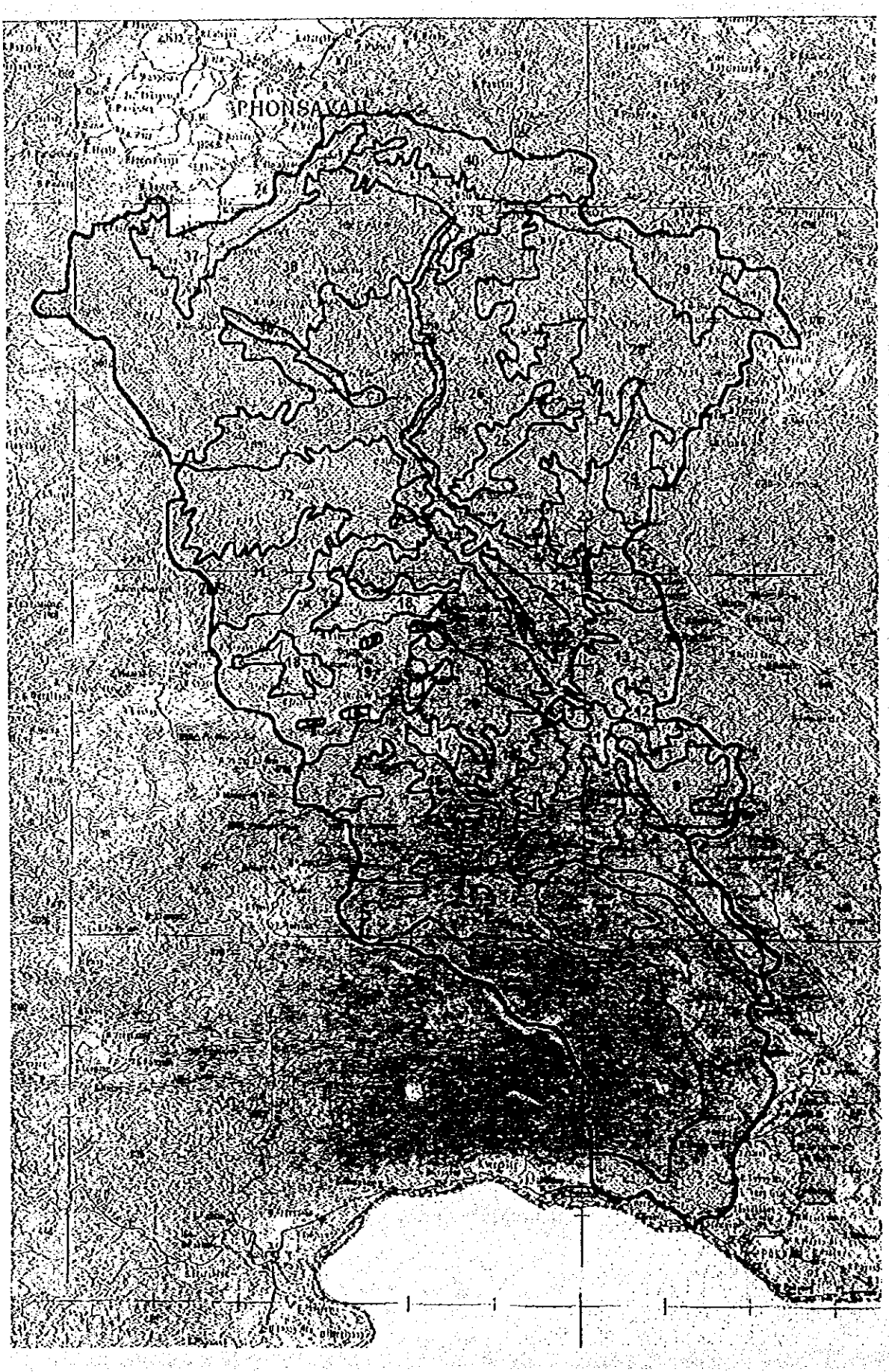
Interestingly most of the bamboo flowered and seeded more or less simultaneously in LS1 and LS2 four years ago. The large quantities of dead bamboo which built up then burned in a series of severe forest fires that burnt through the areas in the following two years. Hence the degraded secondary woodland in LS1 and LS2 is characterized by a grassy rather than bamboo understorey.

The northern end of the Nam Xao Valley (LS7) has recently been almost totally cleared for a large irrigation/resettlement development project. The southern end has a mosaic of young secondary woodland interspersed with late stage regeneration on crop fields. Two (2) old village sites were present in the southern end of the valley. In addition logging over the past 6 years has extracted all of the valuable trees in the valley and on adjacent slopes. The hills overlooking the Nam Xao Valley have all been used by shifting cultivators in the past 10-20 years, and are covered by large areas of bamboo.

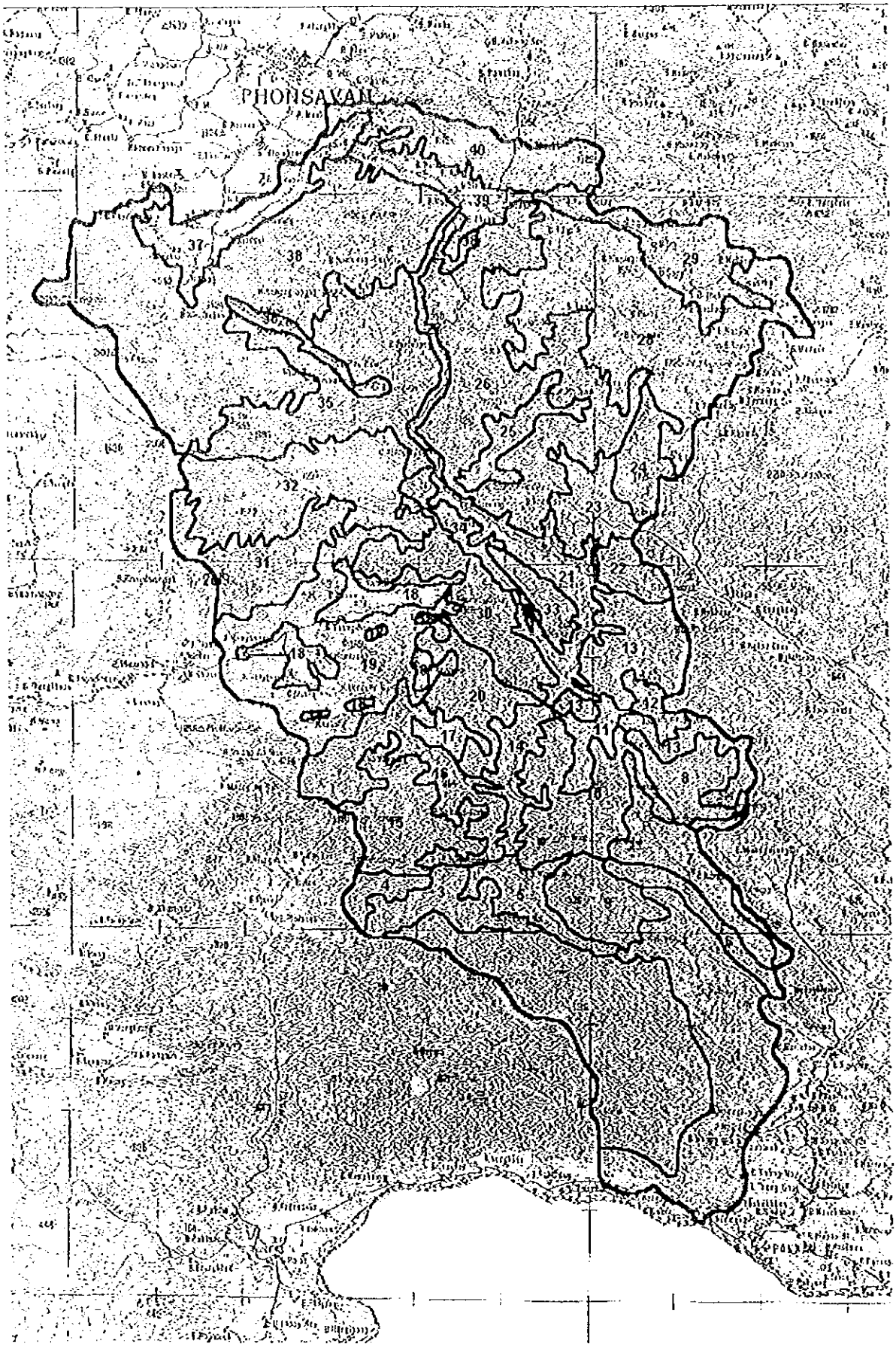
The identifications of the trees observed indicate that the areas of catchment surveyed have low species diversity in comparison to other woodlands surveyed in Lao PDR (surveys in Xaignabouli (SFE6), Vientiane (SFE9) and Attapu (Xe Kaman basin). The level of diversity is comparable to the degraded woodlands of the Nam Leuk catchment. However the forests of the Nam Ngiep catchment surveyed are generally older than those found in the Nam Leuk Catchment.

The land cover of the catchment area is presented in Figure 7.3.5.

The severity and age of degradation of the land systems is presented in Table 7.3.5, and a list of trees identified in the respective habitat types is shown in Table 7.3.5.



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.4
	LAND SYSTEMS IN THE NAM NGIEP CATCHMENT	



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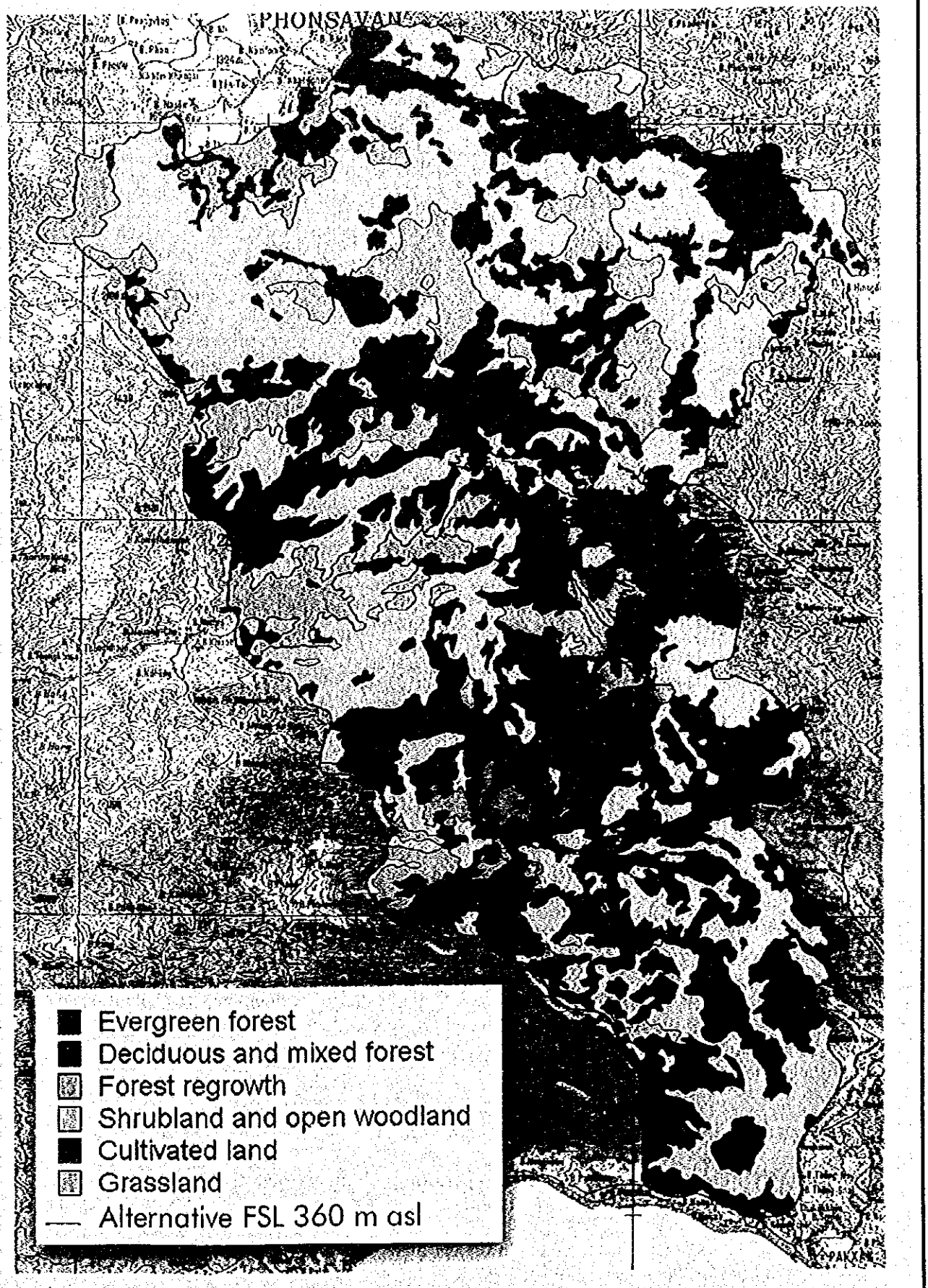
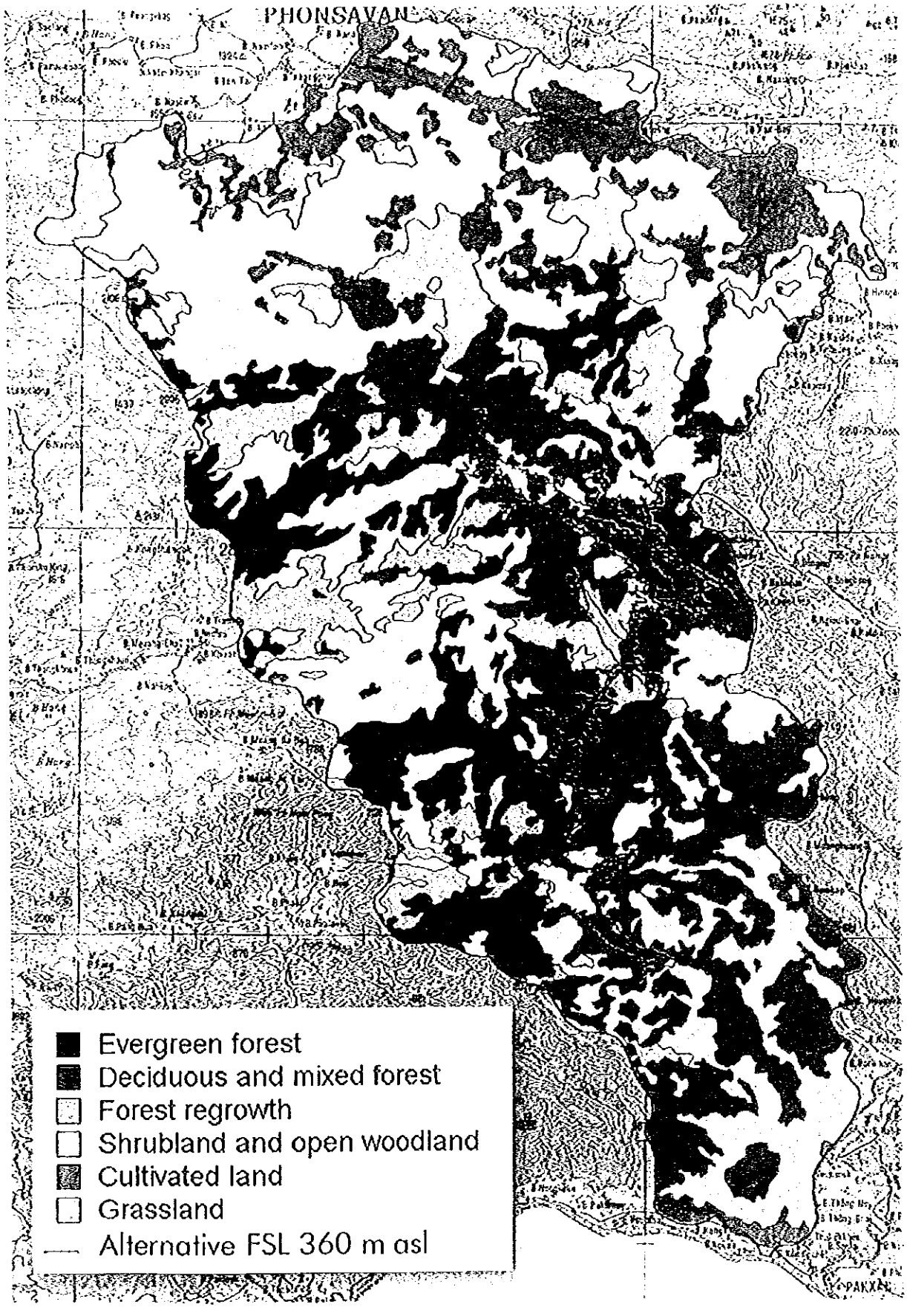
	LAND SYSTEMS IN THE NAM NGIEP CATCHMENT	



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.5
	LAND COVER IN THE NAM NGIEP CATCHMENT	



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.5
	LAND COVER IN THE NAM NGIEP CATCHMENT	

Table 7.3.5 Degradation of Land systems

Land System	Type of degradation	Severity of degradation	Age of degradation
LS01	Shifting and paddy cultivation Elephant induced Fire Catastrophe Logging	Very Severe Severe Severe Very Severe	50 - 100 years to present 50 years to present 3 years ago ?
LS02	Shifting cultivation Elephant induced Fire Catastrophe Logging	Moderate Severe Severe Moderate	20 years to present 50 years to present 2 years ago 20 years to present
LS03	Shifting cultivation Logging	Severe Severe	40 years to present 20 years to present
LS05	Shifting and paddy cultivation Logging	Very Severe Very Severe	20 years to present 20 years to present
LS07	Shifting and paddy cultivation Logging	Very Severe Very Severe	20 years to present 6 years to present
LS09	Shifting cultivation Logging?	Severe Severe	20 years to present ?
LS10	Shifting cultivation Logging	Severe Moderate	20 years to present 6 years to present
LS14	Shifting cultivation Logging	Very Severe Severe	10 years to present 10 years to present
LS16	Shifting cultivation Logging	Severe Severe	20 years to present 4 years to present
LS20	Shifting cultivation Logging	Severe Moderate	40 years to present ?
LS21	Shifting and paddy cultivation Logging	Very Severe Severe	20 years to present ?

All land systems experience (and have experienced in the past) hunter-gatherer degradation pressures, which can be significant. All ecotypes have probably suffered moderate to severe degradation pressures from large populations of wild elephant until about 60 years ago.

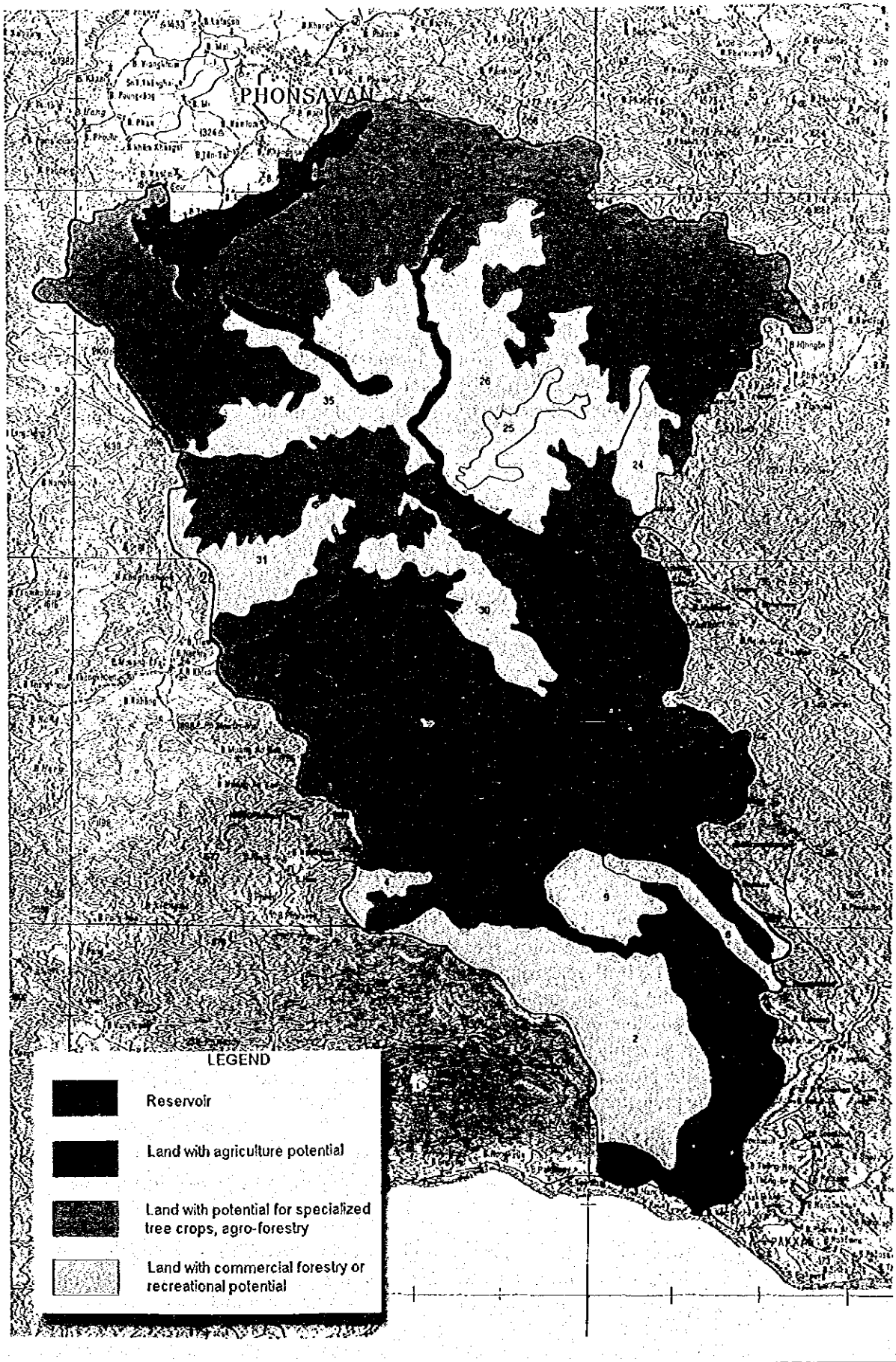
However, as mentioned in the land system description, the potential for development in the catchment is varies according to the system considered, taking into consideration the local vegetation, geology, soils and topography. A synthesis of this potential is shown in Figure 7.3.6. This may provide a preliminary basis for the identification of suitable areas for resettlement or regional development.

During the preliminary vegetation survey carried out in the catchment, 167 plant species belonging to 40 families have been identified and 68 were collected but not identified. The forest area visited within the limits of the future reservoir consists mostly of secondary degraded forest, with sometimes a dense bamboo cover.

(2) Commercial Timber and Vegetation Biomass Study

Three (3) forest plots have been identified to perform preliminary investigations on commercial timber and vegetation biomass in the reservoir area.

The results to date suggest that there could be approximately 40 stems/ha to be extracted with a maximum of 30-35m^3/ha to be removed.



FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 7.3.6
	POTENTIAL FOR DEVELOPMENT IN THE CATCHMENT AREA	