CAMBODIA NATIONAL MEKONG COMMITTEE

Basin Development Plan Programme

Sub-Area Analysis and Development
The Tonle Sap Sub-Area
SA – 9C

October 2004
Phnom Penh, Cambodia

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Acronyms and Abbreviations

ADB	:	Asian Development Bank
AIT	:	Asian Institute of Technology
ASEAN	:	Association of South East Asian Nations
BDP	:	Basin Development Plan (MRC)
CARDI	:	Cambodian Agricultural Research and Development Institute
CARE	:	CARE International in Cambodia
CARERE	:	Cambodia Area Rehabilitation and Regeneration Project
CDC	:	Council for the Development of Cambodia
CIAP	:	The Cambodia- IRRI-Australia Project
CNMC	:	Cambodia National Mekong Committee
DANIDA	:	Danish International Development Agency
DFW	:	Department of Forestry and Wildlife
DIT	:	Department of Industrial Technology
DOF	:	Department of Fisheries
DWSS	:	Department of Water Supply and Sanitation
EIA	:	Environmental Impact Assessment
EU	:	European Union
FAO	:	Food and Agriculture Organization
FWUCs	:	Farmer Water User Communities
GDP	:	Gross Domestic Product
GEF	:	Global Environmental Facility
GMS	:	The Greater Mekong Sub-region
HRD	:	Human Resource Development
HRM	:	Human Resource Management
I & D	:	Irrigation and Drainage
IDE	:	International Development Enterprises
IDRC	:	International Development Research Canada
IFReDI	:	Inland Fisheries Research and Development Institute
ILO	:	International Labour Organization
IOs	:	International Organizations
IRRI	:	International Rice Research Institute
IUCN	:	International Union for the Conservation of Nature
JICA	:	Japan International Cooperation Agency
Lao PDR	:	Lao People’s Democratic Republic
LMB	:	Lower Mekong Basin
MAFF	:	Ministry of Agriculture, Forestry and Fisheries
MIME	:	Ministry of Industry, Mines and Energy
MLMUPC	:	Ministry of Land Management, Urban Planning and Construction
MOE	:	Ministry of Environment
MOH	:	Ministry of Health
MOP	:	Ministry of Planning
MOT	:	Ministry of Tourism
MOWRAM	:	Ministry of Water Resources and Meteorology

MPWT	:	Ministry of Public Works and Transport
MRC	:	Mekong River Commission
MRCS	:	Mekong River Commission Secretariat
MRD	:	Ministry of Rural Development
MW	:	Mega Watt
NCAC	:	National Committee for Assisting the Community
NCHP	:	National Center for Health Promotion
NGOs	:	Non-Governmental Organizations
NRM	:	Natural Resources Management
NTFP	:	Non Timber Forest Products
PADEK	:	Partnership for Development in Kampuchea
PCD	:	Pollution Control Department
PDAFF	:	Provincial Department of Agriculture, Forestry and Fisheries
PDE	:	Provincial Department of Environment
PDIME	:	Provincial Department of Industry, Mines and Energy
PDT	:	Provincial Department of Tourism
PDWRAM	:	Provincial Department of Water Resources and Meteorology
PIPs	:	Public Investment Programs
PRASAC	:	Programme de Rehabilitation et d'Appui au Secteur Agricole du Cambodge
PRDC	:	Provincial Rural Development Committee
RGC	:	Royal Government of Cambodia
RWS	:	Rural Water Supply
SAWG	:	Sub-Area Working Group
SEDP I	:	First Five-Year Socio-Economic Development Plan
SEDP II	:	Second Five-Year Socio-Economic Development Plan
SEDRP	:	Socio-Economic Development Requirements and Proposals
SIDA	:	Swedish International Development Agency
SMEs	:	Small and Medium Enterprises
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UNTAC	:	United Nations Transitional Authority in Cambodia
USAID	:	The United States Agency for International Development
WB	:	World Bank
WHO	:	World Health Organization
WRAM	:	Water Resources and Meteorology
WRM	:	Water Resources Management
WSM	:	Watershed Management
WUG	:	Water User Groups
WUP	:	Water Utilization Programme
WWF	:	World Wide Fund for Nature

Foreword

In partnership with the Mekong River Commission Secretariat (MRCS) Basin-wide initiative, the Cambodia National Mekong Committee (CNMC) is leading the effort in Cambodia on the Basin Development Plan (BDP) Programme. This programme seeks to develop both an *initial plan* as a guiding framework for basin-wide water and water-related resources development in a sustainable manner and a *sustainable planning process*.

It gives me great pleasure to introduce the Tonle Sap Sub-area Analysis and Development. This has been undertaken by the Sub-Area Working Groups of the Tonle Sap Sub-area, with a focus on eight sectors: *irrigated agriculture*; *watershed management*; *fisheries*; *hydropower*; *navigation, transport, river works*; *tourism and recreation*; *water supplies*; and *flood control and management* sub-sectors and four cross cutting themes: *socio-economies, human resource development, environment and participation.*.

The Sub-area Analysis and Development set the context for Basin-wide development strategies and formulation of cross-border sector development, the two first-stages of the five stages of the BDP planning process by defining the macro-issues at the country level. Amongst ten Sub-areas in the Lower Mekong Basin, five Sub-areas have been delineated in the Cambodian part of the Mekong River Basin. The report serves as a vital resource of reference for CNMC-BDP and MRCS-BDP Teams and Local Consultants in developing Basin wide management strategies and cross-border sector development.

This report is the first Cambodia Sub-area Report to be produced within the framework of the BDP planning process. Members of Sub-area Working Groups sourced from the concerned Provincial Departments in the Tonle Sap Sub-area, with overall guidance and coordination by the CNMC Secretariat. This approach ensured full ownership of each stage of production.

On behalf of the Chairman of the Cambodia National Mekong Committee (CNMC), I would like to extend my sincere thanks and profound gratitude to all leadership of the CNMC and Line Ministries for their persistent guidance and constructive recommendations and especially for full participation and support from Ministries concerned that gave rise to the success of this report.

Again, on behalf of the Chairman of the CNMC, I wish to thank and acknowledge the assistance of several local authorities within the Tonle Sap Sub-area and Tonle Sap Sub-Area Working Groups and *Dr. Pichara Leang* , Support Local Consultant, for their full collaboration and support, dedicated endeavors and enthusiasm that contributed greatly to the successful completion of this report.

I would also like to acknowledge and appreciate the efforts of the CNMCS-BDP Team, particularly *Mr. Watt Botkosal*, National BDP Coordinator and *Dr. An Pich Hatda*,

National Specialist for their outstanding coordination, technical assistance and facilitation to the Tonle Sap Sub-area Working Group members in bringing out this valuable report.

Particular thanks are due to *Mr. Jeffrey Himel*, Short-term International Consultant to the CNMC for his technical assistance, valuable advice and guidance, and to *Mr. Yem Dararath*, Local Consolidating Editorial Consultant for his inputs to the successful finalization of the Tonle Sap Sub-area report.

I am of the belief that this report will become an important resource of document for development of Sub-area and Basin-wide management strategies, which will contribute ultimately to the development for the LMB. Additionally, I hope that this report will serve as Sub-area cross-sectoral references, which can be further used by any interested groups such as government agency, private sector and civil society.

Sin Niny
Vice Chairman of CNMC
Chairman of BDP Sub-Committee

Phnom Penh
October 2004

PART I

Executive Summary

CHAPTER 1: INTRODUCTION

1.1. Background

The Basin Development Plan (BDP) formulation started on 1st October 2001, as one of the three core programmes of the Mekong River Commission (MRC). The formulation involves the National Mekong Committees (NMCs) in each country, national planning and line agencies, and a wide range of other government, private sector and civil society actors. The work is supervised by the MRC Joint Committee and by National Sub-Committees.

The BDP seeks to develop both an *initial plan* as a framework for the basin-wide water and water-related resources development and a sustainable *planning process* in the four member states of the MRC, including Cambodia, Lao PDR, Thailand and Vietnam.

The BDP team in each country has been initiating studies and analysis in a number of Sub-areas making up the Lower Mekong Basin (LMB). This is the first stage of the BDP development process. Five Sub-areas have been delineated in the Cambodian part of the Mekong Basin (MB).

In Cambodia, the Cambodia National Mekong Committee (CNMC) is leading the efforts on the BDP. The overall process involves reviewing, collecting, analyzing relevant data and information and conducting forums at regional, national and provincial levels. Background study is being finalized at national level through sub/sectoral reviews by Technical Officials from line agencies involved.

The work in the Sub-areas is being divided into two components as following:

- **Component A: Review and Analysis**
  - Review of provincial and sector plans/data and insight collection; and
  - Analysis.
- **Component B: Scenario and Strategy Development**
  - Scenario development; and
  - Strategy development.

The Sub-area review and analysis will provide the basis for formulating the scenarios and strategies for water use in the sub-areas and subsequently in the region. It will therefore be essential that *the level of detail be tailored and targeted to facilitate macro thinking and analysis and the promotion of suitable oversight and vision in the subsequent stages*. The outcomes for each sub-area analysis will therefore be:

- Summary of present conditions and context for development;
- Summary of water availability, ecological demands and present water uses;

- Identification of opportunities, concerns and risks; and
- Formulation of development objectives.

1.2. Process of Sub-Area Study and Analysis

Sub-area studies involve:

- ***Preliminary review:*** Review of available information at regional, national and sub-area levels to provide overviews of keys issues, review of development plans/programmes (either already prepared or under preparation) and preparation of GIS and related information from MRC data sets;
- ***Identification of key issues and sectors;***
- ***Information collection****:* Identify information gaps, collate or collect required information (particularly from national and provincial agencies);
- ***Analysis:*** Identify sub-area development objectives, formulate scenarios and strategies and identify potential projects/programmes; and
- ***Public consultation:*** Include local knowledge and opinions.

It is proposed that the process of sub-area study and analysis should be orientated around two forums. The process can then be broken down into a number of steps as follows:

- ***Review:*** Mainly through activities coordinated at MRC Secretariat;
- ***Forum 1:*** A multi-stakeholder forum within the sub-area to consider sub-area information, identify key issues and information gaps, and prepare a work plan for further study and analysis;
- ***Implementation of work plan:*** Mainly collection of further information as defined at Forum 1; and
- ***Forum 2:*** A second multi-stakeholder forum to agree on sub-area development objectives, scenarios and strategies and to identify potential projects/programmes.

1.3. Development of Scenarios and Strategies

According to the BDP, scenarios are not about predicting the future; rather they are about perceiving the future in the present. A scenario is a hypothetical combination of events and physical conditions, describing a possible future situation. Development scenarios will be formulated in order to illustrate anticipated limits to the long-term basin development, as well as the significance of external driving forces and uncertainties about applied key assumptions.

Development strategies will be drafted as a tool for identification and assessment of development projects and programmes. Development and management strategies will be

formulated for each sub-area and each relevant water related sector. This will be done in a close dialogue with the stakeholders, and drawing on related MRC programmes.

The strategies need to be justified in terms of: (i) socio-economic implications; (ii) environmental implications; (iii) human resources development implications; and (iv) national priorities, strategies and plans.

1.4. Importance of the Report

The report might also be useful for governmental institutions, external support agencies, project evaluation teams, investors and technical specialists in helping them understand:

- The current condition of various development sectors at provincial levels around the Tonle Sap Sub-area;
- The trends within and future plans of the sectors within the Tonle Sap Sub-area;
- The linkages between one sector and another;
- The cross-cutting themes: socio-economic, environment, public participation and human resources aspects; and
- The Trans-boundary issues within the Tonle Sap Sub-area.

CHAPTER 2: OVERVIEW OF THE TONLE SAP SUB-AREA

2.1. Baseline Description

The Tonle Sap Sub-area covers a total area of approximately 85,620 km^2. Eight provinces and one city share the basin, namely Kampong Chhnang, Battambang, Pursat, Kampong Thom, Siem Reap, Banteay Meanchey, Preah Vihear, Otdor Meanchey, and Pailin City. Main tributaries connecting to the Great Lake include Stung Baribo, Stung Pursat, Stung Dauntry, Stung Sang Kae, Stung Battambang, Stung Mongkul Borei, Stung Sisophon, Stung Sraeng, Stung Siem Reab, Stung Chikraeng, Stung Staung, Stung Saen, and Stung Chinit. Of the total area, about 53% is covered by forest, including deciduous forest, evergreen forest, dense broad-leaved forest, and inundated forest, and 20% is use for agriculture (ADB, 2004). The Tonle Sap contains at least 200 species of fish, 42 species of reptiles, 225 species of birds, and 46 species of mammals. The main groups are cyprinids (48 species), Pangasidae (7 species), Bagridae (5 species), and Siluridae (5 species).

Many sectors rely on water resources for their development. Theses sectors include irrigated agriculture, fisheries, water supply and sanitation, inland navigation, hydropower and tourism. The current trend is shortage of water supply in many areas, including domestic purposes. Serious competition for agricultural water use is intensifying between fast growing population and irrigation development. Pollution of both surface and underground water is extensively provoked by industrialization pressure, urbanization and absence of repressive law against environment destructors.

Hydrological data related to the rivers of the Tonle Sap basin and river are available for only one hydrological year (1962-63). They were collected by Carbonnel in the same period. Currently, with the support of MRC, there have been starting to install some gauging stations in some rivers of the basin. Only fragmentary information has been gathered, thus possibility for serious and comprehensive analysis is limited. According to MRC, water availability, water demand and water use are important elements for analyzing water resources.

An estimate has indicated that the water availability per capita is approximately 6,220m^3/year. The water demand for the Tonle Sap Sub-area has not been known due to lack of data and information. Anyway, the water demand per capita for Cambodians is estimated about 12 m^3 per year (MRC, 2002j).

2.2. The Agenda for Development

After the July 1998 election, the Government of Cambodia adopted the Triangle Strategy in which the promotion of economic and social development composes the third side of the triangle. One of the numerous and urgent priorities identified was an extensive reform of the administrative system. Administration reform includes decentralization, military demobilization, legal and judiciary, gender equity, public financial management, anti-corruption, and natural resource management.

The long term Vision of the Government is *"to have a socially cohesive, educationally advanced, and cultural vibrant Cambodia without poverty, illiteracy, and disease, which will allow each person to be the best that it is in them to be".*

The strategic message of the plan is that Economic growth is a prerequisite for poverty reduction and the key to growth is private sector development, which will be achieved largely through sustained improvement in the government environment. Specific strategies for civil service reform including decentralization, military demobilization, legal and judiciary, gender equity, public financial management, anti-corruption, and natural resource management. In pursuing a higher economic growth path Cambodia will be established as a popular ecological and culture tourism destination.

The Government recognizes that achieving national development objectives relies crucially on creation of a more positive and predictable business environment to facilitate the development of the private sector with a special consideration to the development of small and medium-sized enterprises, as the engine of increased investment, higher incomes and more employment.

Physical infrastructure development is another major area in which the RGC plays an important role. The limited coverage and poor condition of existing infrastructure constrain private sector-led development and access to health and education services, especially by the poor.

A numbers of key development issues have been identified, including irrigated agriculture, irrigation, fisheries, navigation, flood control and management, hydropower, watersheds management, tourism, and water supply.

2.3. Overall Scenarios

High public investment in the improvement of the infrastructure (mainly rural road, and road network to ASEAN and Mekong Region), human resources development (extension service and education), and health care are required. There will be a need to ensure adequate water supply for key sectors and particularly water for irrigation and domestic water supply. The sub-area will need to develop the hydropower to support development, and look for market for the processed agricultural products.

There will be encouragement to high development in agriculture, fisheries, tourism and industrial and agro-industrial sectors. Privatisation will be materialized and high increase in regional trade and other economic cooperation.

The sub-area will challenge with high population growth and migration, problems from droughts and floods incidence, environmental pollution, trans-boundary impacts from upstream *and downstream* development, loss of critical and non-reversible resources such as biodiversities, critical wetland, flooded forest, fish habitats, and environmental degradation, and the competition for water resources between sectors and riparian countries in the Mekong River Region.

Decentralisation *and deconcentration* programme, policy and strategies for water resources management, integrated river basin management of the Tonle Sap River Basin Committee will be established and ongoing, and the results will depend on the law enforcement and application. There will be good support and cooperation from donors and NGOs, but at the same time funding support will be reduced. There will be results from the cooperation in the implementation of the Basin Development Planning of the LMB, and at the same time cooperation from China and Myanmar.

PART II

Sub-Area Study and Analysis (Forum #1)

CHAPTER 3: INTRODUCTION

3.1. General

Literature and studies about the region of the Tonle Sap Great Lakes are abundant and richly documented. However, few adopted a trans-sectoral approach, emphasizing global trends, potentials-opportunities, constraints and threats. Another deficiency that can be noted is the lack of effort to provide a comprehensive reflection on the cross-cutting issues as well as on the trans-boundary issues by putting into evidence the relationships between the different components.

The Tonle Sap Basin is actually being considered as one of the highest bio-diverse habitat by ecologists and environmentalists because of its richness and endemicity of the fauna and flora of the flooded forest ecosystem. The presence of a huge area of wetlands suggests ecological, scientific and economic interests in the Tonle Sap Sub-area. Furthermore, this unique Biota is certainly one of the most heavily occupied by man who exploits natural resources and subtracts food, water, raw materials and energy for sustaining the livelihood and serving economic purposes. As a predictable result of the intensive and abusive exploitation of the natural resources, the Tonle Sap Basin is being facing serious environmental degradation and socio-political challenges in term of management, planning and development.

One of the great dilemmas is actually to know how to develop the region economically and at the same time giving a substantial room for protection of the eco-system. Even though specialists argue that development and conservation are not necessarily contradictory and can support each other, the Tonle Sap Sub-area is the ground of intensive conflict of interests between the stakeholders who- unfortunately - tend to maximize the extraction of natural resources with little concern about negative effects on the environment, and then their consequences on wildlife, flora and human livelihoods.

The purpose of this work is to attempt to provide an in-depth analysis of the development plan of the Tonle Sap Sub-area that has been delimited as the Tonle Sap Sub-area 9C in the Basin Development Plan (BDP) of the Lower Mekong Basin.

This analysis emphasizes the challenges and implications of the mutation occurring in the Tonle Sap Sub-area. It mainly calls upon a critical review of existing documents produced by various relevant stakeholders, e.g. the Mekong River Commission (MRC), the Cambodia National Mekong Committee (CNMC), the Asian Development Bank (ADB), UNDP, the World Bank (WB) and the Provincial Sectoral Departments.

3.2. Objective

The objective of the Sub-area analysis is to provide the basis for formulating scenarios and strategies for water use in the sub-areas and region.

3.3. Tools and Methodology

3.3.1. Tools

A number of documents have been utilized in this in-depth analysis so that a wide and comprehensive view is made possible:

- The first category of documents reviewed is composed of Provincial Sectoral Department Planning and Reviews of nine provinces/town, i.e. Battambang, Banteay Meanchey, Preah Vihear, Oddar Meanchey, Kompong Chhnang, Siem Reap, Kompong Thom, Pursat and Pailin-town.
- The second category of materials includes the National Sector Reviews on Irrigation, Agriculture, Fisheries, Hydropower and Tourism Development. It also accounts the Tonle Sap Sub-Area Study conducted by Dr Neou Bonheur for CNMC that is released in September 2003.
- The third category encompasses MRC and CNMC materials including the Regional Sector Overviews prepared by the MRC-BDP team[1], the Draft Guidelines on Sub-area analysis (MRC, 2002e). A Natural Resources Based Development Strategy for the Tonle Sap Area, Cambodia and the Initial Report of the Tonle Sap Sub-area Analysis prepared for Forum#1 in Battambang are also included as well as additional materials compiled in the BDP Archive CD-ROM.
- The fourth category of materials comprises the 2003 State of the Basin Report (MRC, 2003d) and the Social Atlas of the Lower Mekong Basin (MRC, 2003c). Additional maps and Landsat imageries have been extracted from the People and the Environmental Atlas of the Lower Mekong Basin in order to enrich the analysis of spatial relationships and to assist with visualization of resources, environmental and land use, and connections between sub-areas.
- External Support Agency Overviews and Reports compose the fifth category:
  - A Natural Resources Based Development Strategy for the Tonle Sap Area, Cambodia (MRC, 1999);
  - Fighting Poverty in Cambodia. The Tonle Sap Basin Strategy (ADB, 2003b);
  - Stung Siem Reap Basin, Case study and project ideas (MRC, 2002f);
  - Working for a Cambodia Free of Poverty;
  - Future Solutions Now. The Tonle Sap Initiative (ADB, 2002 & 2003b);
- The sixth category includes various independent research publications such as:
  - Fish Exports from the Great Lake to Thailand: an Analysis of Trade Constraints, Governance and the Climate for Growth. Working Paper #27 (CDRI, 2003); and

[1] These include documents BDP-09a and 09b, BDP-10a and BDP-12a, 12b, 12c, 12d, 12e, 12f, 12g, 12h, 12i, 12j and 17 covering agriculture, forestry, macroeconomics, fisheries, tourism, irrigation, watershed management, hydropower, navigation, domestic water and sanitation, industrial water use, flood management and mitigation and water use for agriculture.

- Cambodian Labor Migration to Thailand: A Preliminary Assessment. Working Paper #11 (Chan, & So, 1999).

As the Sub-area analysis will rely heavily on secondary data (derived and summarized from other sources), an important role of the first forum will be to assess whether the data adequately reflects the real situation, identify information gaps and agree on a work plan to collect missing and needed information.

3.3.2. Methodology

The in-depth analysis is conducted through three complementary tasks:

- Documents review and analysis (see references);
- Stakeholders consultation; and
- Analysis of the outcomes of the Informal Working Group Session in Kompong Chhnang prior the Forum#2.

3.3.2.1.Documents Review and Analysis

Materials are provided by MRC, CNMC and additional documentation (IFReDI, 2000). The in-depth analysis relies heavily on secondary data – derived and summarized from other sources.

3.3.2.2.Stakeholders Consultation

The stakeholder's consultation was conducted following a guide-question check-list designed by the Consultant, emphasizing critical issues to be addressed, trends, constraints, potentials, development plan and relevant projects in the Tonle Sap Sub-area. For this, several key stakeholders - whom we are acknowledgeable for their availability - have been met including:

- MRC: Dr Mak Solieng, Natural Resources Development Planning, Dr Tue Kell Nielson, Consultant and Mr Thim Ly, Jr Riparian Professional.
- CNMC: Dr An Pich Hatda, Dep. Director-BDP National Specialist and Mr Watt Botkosal, Dep. Director-Planning Dept. and National BDP Coordinator.
- IFReDI: Mr Lieng Sopha, Dep. Director-AMCF
- MAFF-DoF: Mr Sam Nuov, Deputy Director, Department of Fisheries
- MAFF: Mr Kith Seng, Director of Planning, Statistics and Intern. Coop. Dept.
- Seila Prog- UNOPS: Mr Scott Leipers, Senior Prog. Advisor
- Min. of Public Works & Transport: Mr Va Sim Soriya, Director of Planning Dept.
- Min. of Water Resources and Meteorology: Mr Pech Veasna
- Siem Reap Planning Dept : Mr Soat Pisak, Planning Director-Member of PRDC
- Kompong Thom Public Work and Transport Dept : Mr Mao Laing, Director
- Kompong Chhnang PDAFF: Mr Tauch Yoeun, Dep. Director
- Pursat PWT: Hom Kimdy, Director

3.3.2.3. Analysis of Outputs of the Informal Working Session prior to Forum 2

This work is based on the proceedings of the informal working session prior to the second stakeholders Forum that is further planned in 2004.

Basically, this analysis aims at assessing the level of understanding on the sub-area development planning and the ability of the working group in identifying development objectives and proposing a scenario formulation at the Forum #2.

CHAPTER 4: BASELINE DESCRIPTION

4.1. Physical Features

4.1.1. Geographical Features

With a total area of 85,620 km², the Tonle Sap Sub-area covers partially or entirely 15 provinces and municipalities. Eight provinces and one city have most of their territories included in the Tonle Sap Sub-area, namely Battambang, Banteay Meanchey, Oddar Meanchey, Preah Vihear, Siemreap, Kompong Thom, Kompong Chhnang, Pursat and Pailin.

The Tonle Sap Sub-area is mainly composed of two physical entities. The first entity is an immense central floodplain bordered by the Cardamom Mountains in the west and south and the Dangrek mountains in the north. The middle of the Sub-area is occupied by the second entity that being the Tonle Sap Great Lake which is connected to the Mekong River by the Tonle Sap River. This river reverses its current in June every year under the pressure of the rising flow of the Mekong River. Tonle Sap is the largest freshwater lake in Southeast Asia, covering an area of 250,000 – 300,000 ha in the dry season and around four to seven times this area in the wet season.

This remarkable hydrological system shapes the richness and diversity of the natural resources by imposing a seasonal flooding system upon the floodplain, which becomes the home for a young, dynamic and entrepreneurial population, diverse flora and endemic wildlife.

The Tonle Sap Great Lake plays in regulating role of the Mekong River floodwaters. So it is crucial and vital fishery that are of critical importance for the national economy, insuring durable livelihoods for more than one third of the country's population. The Tonle Sap Great Lake is the most important inland wetland in Southeast Asia. It supports a huge population through its enormous fisheries productivity and water supply, and provides the last refuge for some of Asia's most globally significant biodiversity.
Given its rich and diverse assets, the sub-area is witnessing a growing population pressure and its fragile eco-biological balance is seriously threatened by over-exploitation of the natural resources.

4.1.2. Wetlands

According to the Glossary of the BDP Inception Report, A wetland can be defined as area that is covered by water at least a part of the year. A wetland can represent a special ecological habitat, sometimes with a high biodiversity, and can serve as a fish breeding ground. The Ramsar Convention defines wetlands quite broadly as "*areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including marine areas with a depth less than 6 meters at low tide*".

This harmonious and natural association between wetlands and abundant aquatic bodies generates an exceptional sanctuary- very likely one of the last – for the survival of many globally significant species of birds, mammals, and reptiles found around the lake during migration.

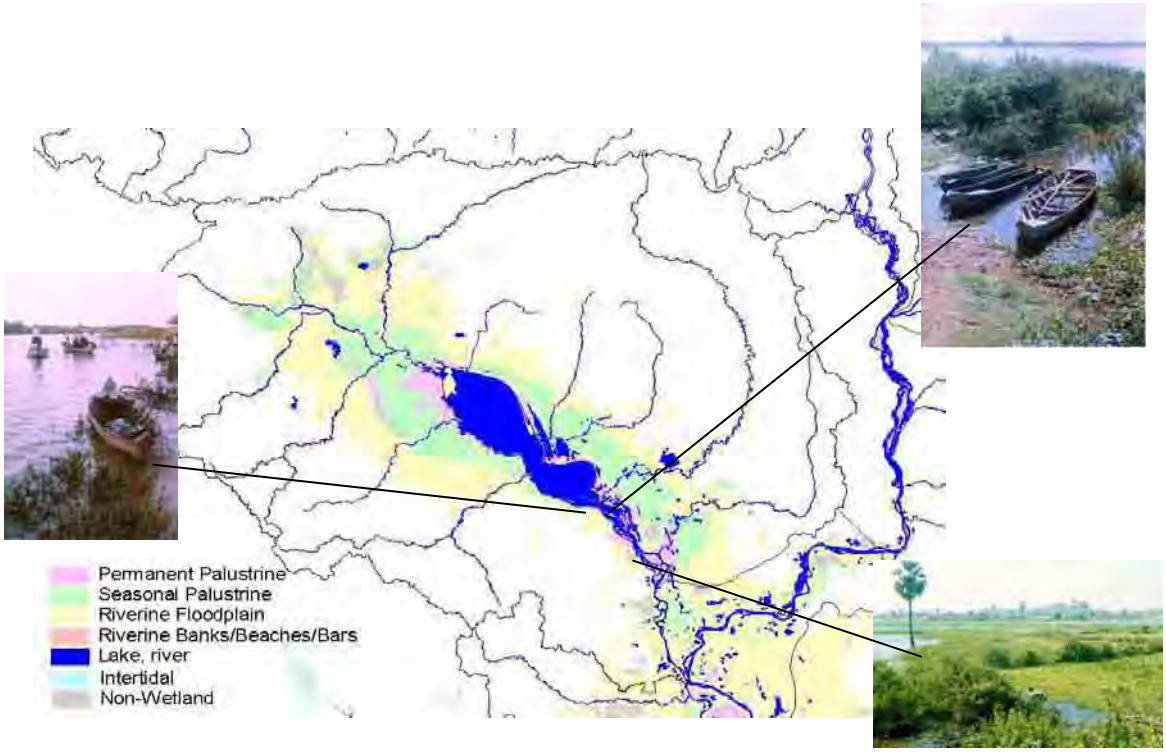


Figure 1: The Tonle Sap Wetland

4.1.3. Biodiversity

4.1.3.1.Fish

According to recent findings the fisheries of the Tonle Sap and the Tonle Sap River account for 15-20% of freshwater capture fisheries in the lower Mekong Basin and represent 50-70% of the catch for Cambodia (ADB, 2003). The fisheries productivity of the lake is known to be one of the highest in the world. This productivity is generally attributed to the flooded forest. A total number of 107 fish species has been recorded for the lake only. New species are regularly discovered and described.

4.1.3.2.Flora

The flooded forest of the Tonle Sap is the largest remaining example of this type of habitat in Southeast Asia. It is a diverse unity of habitats, including shrub lands, stunted swamp forests, gallery forests, and submerged and floating aquatic vegetation. About 200 plant species have been recorded and the flora as a whole is distinct from that of other wetland associated with regard to woody species.

Some restricted-range tree species are endemic to the Tonle Sap and the southern coastal zone of Cambodia and have suffered from exploitation for charcoal production.

4.1.3.3.Invertebrates

Invertebrates are an important component of the Tonle Sap's ecosystem. The available taxonomic information is incomplete but studies so far have identified 46 species of zooplancton. The rich biodiversity of mollusks in the Tonle Sap has been described as striking and 57 species of benthic invertebrates have been identified.

Boeng Tonle Chhmar and the Stung Sen River estuaries are areas with high concentrations of bivalves. Three species of bivalves, two species of prawns, and one species of crab have been confirmed for the Tonle Sap. These freshwater invertebrates are an important source of flood for people and aquatic wildlife.

4.1.3.4.Mammals

Some 46 mammal species are likely to occur in the Tonle Sap region. Some large species such as the Asiatic elephant and tiger used to migrate from upland areas to the Tonle Sap through natural corridors. An agricultural belt, cutting off the floodplain from upland forest areas, now surrounds the floodplain. This isolation has resulted in a decrease in number of mammal species occurring in the Tonle Sap.

The status of the mammal species that directly depend on the Tonle Sap is poorly documented, but they number at least 15 species.

4.1.3.5.Birds

The Tonle sap (mainly at Prek Toal, but also at Boeung Tonle Chhmar), sustains the largest colonies of water birds in Indochina. Its floodplain is an important breeding area for ducks, jacanas, bustards, rails, heron and egrets, cormorants, darters, ibises, pelicans, and storks. Some 225 species of birds have been recorded in the Tonle Sap region since the 1960s.

4.1.3.6.Reptiles and Amphibians

The occurrence and distribution of amphibians and reptiles in Cambodia are not known well and herpetologists still rely on historical literature. There are probably 42 species of reptiles (including 1 endemic water snake, 7 turtles or tortoises, and 1 crocodile).

4.1.3.7.Threatened Species

Rapid human population growth and associated development pressures, as well as demand for natural resources, are affecting biodiversity. Many species found in Cambodian wetlands are on the World Conservation Union (IUCN) Red List, and 12 species are listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1979.

4.1.4. Soils

The most suitable soils are not located in the Tonle Sap Sub-area but in the western part of the country. The floodplain that is usually considered as the country's richest rice producing area is actually made of huge areas of marginally suitable soils for paddy (Acrisols and Plenthisols), and a relatively small area of moderately suitable soils for paddy (Luvisols). But one has to consider that what is "marginally suitable" in FAO parlance is quite good for Cambodia where the vast majority of soils are unsuitable for rice, but on which rice is grown anyway. While the soils are very poor and yields are correspondingly poor, there are likely management techniques that can improve results as people are going to farm on them regardless. This probably needs to be the primary emphasis, that the poor soils in the area require more careful conservation and husbandry techniques.

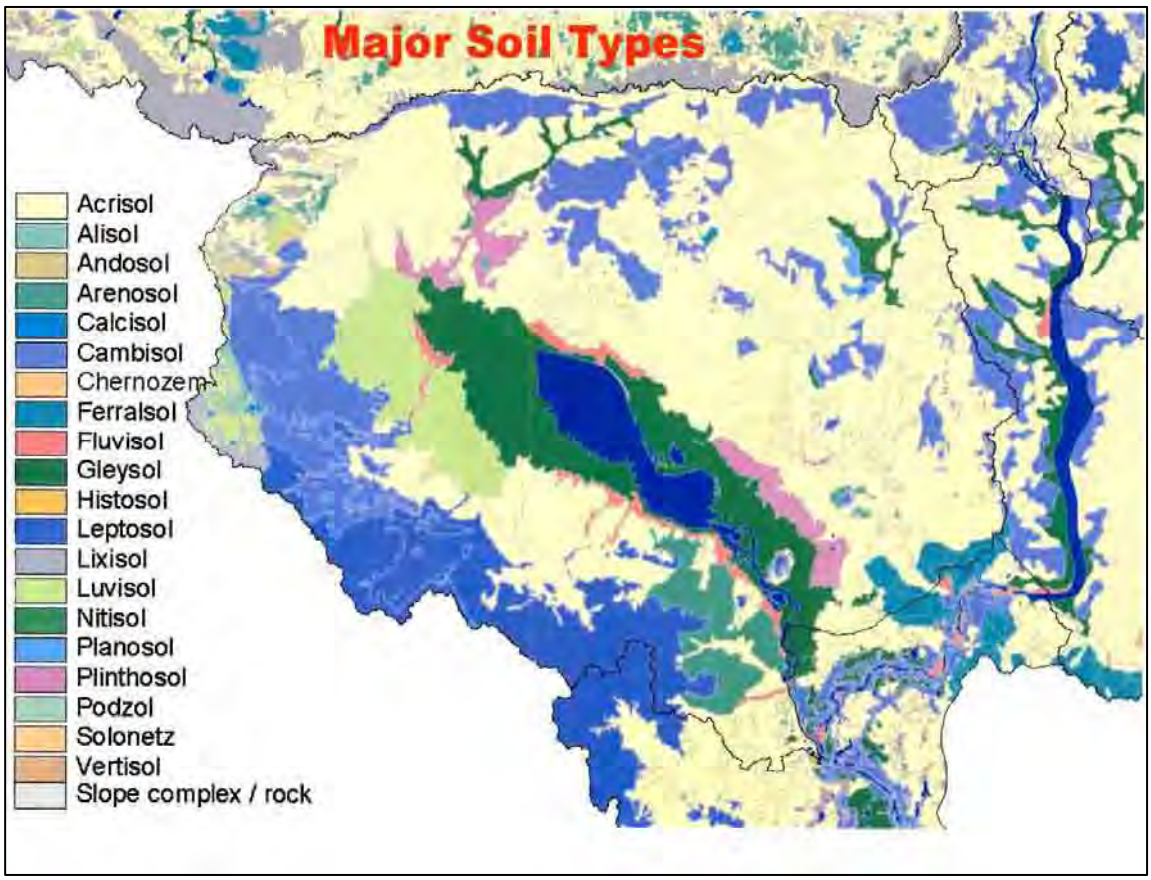


Figure 2: Major Soil Types in the Tonle Sap Sub-Area

Acrisols are described as soils that developed on old land surfaces of undulating topography in seasonally dry and humid tropical and monsoon climates (MRC, 2002). They generally have a very thin layer of top soil and possess low cation exchange capacities, are acidic in the subsoil, and are often saturated in aluminium to toxic levels when aerobic. It is recommended that mechanical clearing of natural forests be avoided at all costs and recurrent inputs of lime and fertilizer are needed for continuous cultivation. Such soils would appear to be unsuited to agriculture except for the cultivation of acid tolerant crops such as cashews and pineapples. Acrisols are the major soil type in terns of area and percentage of the LMB followed by Cambisols. Almost 71% of the irrigable area in the NE Thailand is classified as being occupied by Acrisol soils, 50% in Laos, 59% in Cambodia, 68% in the Central Highlands of Vietnam and 2% in the delta of Vietnam.

200,000 ha each of Leptosol and Ferralsol soils are also found in Cambodia. **Leptosols** are usually associated with hilly and mountainous areas, possessing thin soil layers and are highly susceptible to erosion and, if cropped, drought**. Ferrasols** on the other hand are extremely weathered and possess high percentages of kaolinite clays. They are generally low in CEC and nutrient reserves and inactive applications of phosphorus. If

carefully managed these soils are suitable for cultivation of oil palm, rubber and coffee plus grazing of animals or for tree plantations.

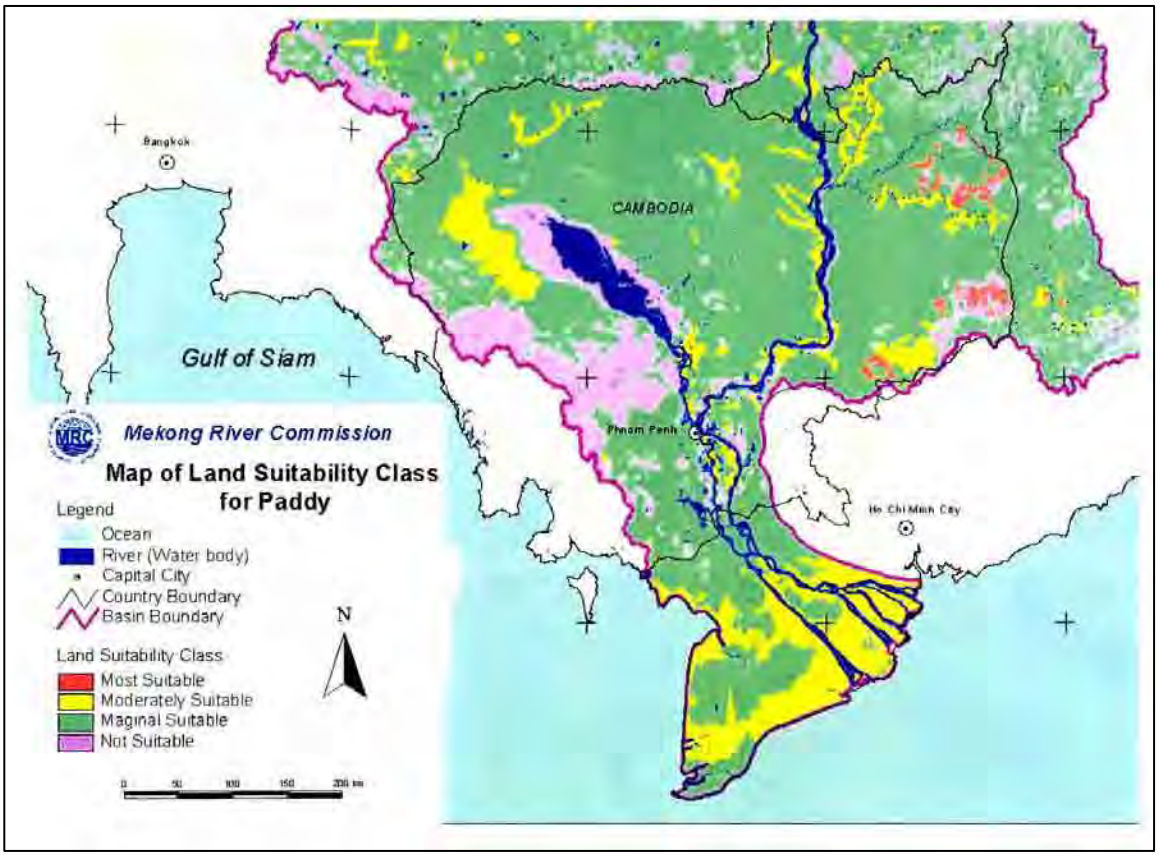


Figure 3: Map of Land Suitability Class for Paddy

4.2. Water and Related Resources

Water resources analysis is a complex work which requires availability of comprehensive, accurate and updated scientific data. As a contrast to neighboring countries of the Lower Mekong Basin, i.e. Thailand and Vietnam, Cambodia is a country that crucially lacks of data. According to Bonheur hydrological data related to the rivers of the Tonle Sap basin and river are available for only one hydrological year (1962-63). They have been collected by Carbonnel in the same period. Currently, with the support of MRC, there have been starting to install some gauging stations in some rivers of the basin. On the below paragraph, attempt is made to provide a state of existing data that have been collected from various sources. Only fragmentary information has been gathered, thus possibility for serious and comprehensive analysis is limited.

According the BDP Inception Report, water resources analysis should comprise three main components:

- Availability of water

- Demand of water
- Use of water

4.2.1. Availability of Water

It can be defined as the flow of water into a sub-area from upstream, plus the (surface and groundwater) resources generated by net rainfall in the sub-area, minus the ecological demand within the area at its downstream boundary. The availability changes slowly, from one decade to the next, due to medium-term climate variations, or due to constructions of reservoirs or diversions. The availability can be measured, and/or determined by numerical modeling, with an accuracy that is conditioned by the coverage and quality of the basic hydrological data.

Data Gathered:

Estimate Water Availability per Capita:
(Bonheur, 2003)

Estimate population in the Tonle Sap Sub-area in 2002: 4,501,833 persons
28 x 109 / 4,501,833 = **6,220 m^3** per person/year

Table 1: Water Balance of the Great Lake Basin: Surface Water Availability

Inputs	Annual volume (109 m^3)
Inputs from the Tonle Sap watershed (67,600 km^2):	
Inflow from the rivers	+24.3
Rainfall on the Lake	+13.9
Evaporation	-10.4
Total inputs from the Lake Basin	+28.0
Inputs from the Mekong River through Tonle Sap river:	
Inflow to Tonle Sap at Prek Kdam to the Lake	-45.0
Outflow from the Lake	+72.9
Net Balance	+27.9

Source: Carbonnel 1962-63, in Bonheur N., Sept.2003.

Table 2: Potential Ground Water Resources by Province

Province	No. of holes	Productive wells	%	Yield (l/m) Range	Productive depth (m)
Kg Thom	404	314	77.7	10-200	4-86
Preah Vihear	64	27	42	18-120	4.9-17
Siemreap	71	62	87	15-1330	7-39
Battambang	4	3	75	0-50	30-57
Kg Chhnang	22	11	50	49-200	18-80
Pursat	1	0	0	-	-
Krong Pailin	No data	No data	-	No data	No data

Source: Rasmussen W.C. et al, 1997, in Bonheur N. Sept. 2003.

Table 3: Estimate Potential Groundwater per Capita and by Province in 1997

Province	Number Productive Wells	Average Yield (liters/m)	Average Productive Depth (m)	Estimate Average Water Volume available (liters)	Estimate population in 2002 in the Tonle Sap S.A	Average Potential Ground Water available per capita (liters)
Kg Thom	314	105	45	1,483,650	672,788	2.2
Preah Vihear	27	69	11	20,493	150,495	0.13
Siemreap	62	672.5	23	958,985	842,979	1.14
Battambang	3	25	43.5	3,262	993,196	0.003
Kg. Chhnang	11	124.5	49	67,105	501,551	0.13
Pursat	0	No data	No data	No data	438,728	No data

Adapted from Rasmussen W.C. et al, 1997, Bonheur N. Sept. 2003

Despite this rough estimation, figures obtained reflect the under-exploitation of the ground water in the majority of provinces of the Tonle Sap Sub-area (No data from Pursat, Banteay Meanchey, Oddar Meanchey and Krong Pailin). Kompong Thom province, with only 2.2 liters per capita of average volume of ground water is the one which dominates the other provinces. The situation in Battambang is critical in 1997, because potential ground water available is non-existent for the population (only 3 productive wells found with extremely low average yield of 25 liters/m). And yet, extensive shallow groundwater reserves are known to exist around the Tonle Sap and beside the Bassac and Mekong Rivers in Cambodia. Water levels in shallow wells and tube wells follow the river height for distances up to 30 km each side of the Bassac river (CIAP, 1999) indicating the aquifers are constantly being recharged. Unfortunately, the recharge rate is slow and in some intensively irrigated areas farmers run short of water during peak periods. Dry season rice production in Prey Veng and Takeo using ground water during 2001 covered an area of between 5,000 and 10,000 ha (CARDI, 2001), up from zero in 1995. JICA (1999) estimated wells in the quaternary aquifers of Svay Rieng, Prey Veng and southern Kandal can yield 500-800 m^3 per day without causing adverse effects on the entire groundwater basin. Such pumps rates would irrigate 4-6 ha of rice per well. The potential for irrigation from groundwater from these aquifers is therefore quite high if properly regulated to ensure minimal drawdown. There is insufficient recharge capacity in the aquifers for large scale irrigation projects.

In Thailand, many towns rely on groundwater. 60% of groundwater abstraction in Thailand is used for domestic supply (World Resources Institute, 2000). In Vietnam, about 2/3 of town water supplies are drawn from surface water with the remainder from ground water (ADB, 2002). Tube wells are increasingly used – for example, in Vietnam, 21% of rural water is supplied from drilled wells and pumps. Rainwater collection is an important supplementary source of domestic water in some areas.

4.2.2. Demand of Water

Demand of water is the amount of water required for a given purpose, for example liters per person per day, or mm per crop. The demand can be consumptive (e.g. domestic use and irrigation), or it can be non-consumptive (e.g. ecological demand, navigation). It can

be present or future. And it can be actual (i.e. related to an available infrastructure) or potential (assuming full infrastructural development and no water shortage). The serviceable (part of the) demand is limited both by infrastructure and water availability. The demand is related to aspects such as consumer lifestyles, topography and land use, crops and cultivation routines, and industrial development and technology. It can be estimated by various techniques, often with a large uncertainty.

Data gathered:

There is no data available for the Tonle Sap Sub-area yet. According to the MRC-BDP Planning-Regional Sector Review 2002 (Domestic Water and Sanitation), per capita use of water for domestic purposes varies widely – estimates quoted by Seager (2002) are from 2 m^3 per year in Cambodia to 47 m^3 in Vietnam. Estimates of demand from MRC-WUP (2002) are displayed in the below table.

Table 4: Estimate of Water Demand

	Population LMB (estimate)	Demand per capita (m^3 per year) MRC-WUP
Cambodia (1998)	9,800,000	**12**
Lao PDR (2000)	4,905,000	20
Thailand (2000)	23,130,000	24
Vietnam (2000)	16,920,000	42
Average	-	24.5

Adapted from Novak, 2002 in MRC-BDP Regional Sector Overview 2002

An alternative measure of likely demand is given by the supply targets set by each country. Lao PDR aims to provide 7 m^3 per year per capita (ADB, 1998) and Vietnam 22 m^3 per year per capita (NSWSS, 2000). Given a total population in the Lower Mekong Basin of approximately 55 million and assuming a demand of between 20 and 100 m^3 per year, current total demand for domestic water is in the order of 1,100 to 5,500 million m^3 per year, or about 0.2% to 1.2% of Mekong annual flow (estimated as 450,000 million m^3 per year from data in MRC 1998).

Table 5: Access to Improved Water Supply and Sanitation, 1999-2000

(Percentage of population)

	Improved Water Supply			Sanitation		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
Cambodia	30%	54%	26%	17%	56%	10%
Lao PDR	37	61	29	30	67	19
Thailand	84	95	81	96	96	96
Vietnam	77	95	72	47	82	38

Source: UNICEF, 2002 in MRC-BDP Planning Regional Sector Overview, 2002.

Excepted in Thailand, the proportion of population who can access to improved water supply and sanitation is higher in the urban areas than in the rural areas. This gap is wide in Cambodia and Lao PDR than in Vietnam. For improved water supply, the gap between urban and rural areas in Cambodia is about 52% at the advantage of the urban.

Regarding sanitation, only 10% of population in the rural areas in Cambodia do actually access to, while it is available for 56% of urban population. This high disparity between rural and urban areas can be explained by imbalanced development policy at the detriment of the countryside where 80% of population is living and producing food.

4.2.3. Access to Safe Water

The quality of water supply varies widely across the LMB. In the majority of Cambodian provinces, the proportion of population having access to safe water is less than 25%. In the Tonle Sap Sub-area provinces, maximum 20% of population has access to safe water, excepted Battambang with 20-40% only.

Also, during the dry season in Cambodia, the number of households with access to safe water declines in both urban and rural areas. In urban areas, piped water systems increase the availability of safe water. Access to safe water is much more common in Phnom-Penh and Vientiane Municipality than in other areas of Cambodia and Lao PDR. Water supplies are also improving in secondary urban centers as a result of government and donor investments.

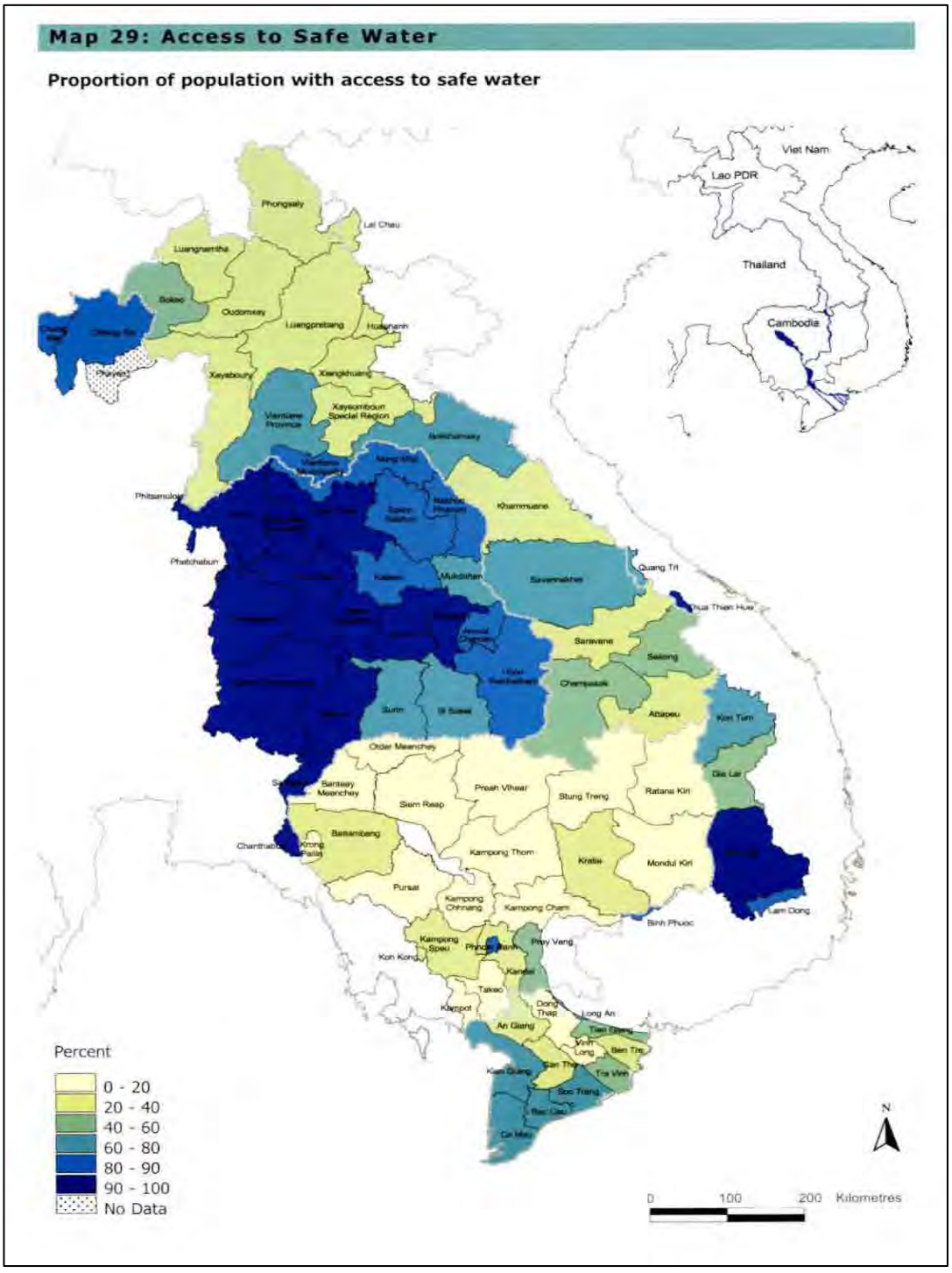
4.2.4. Use of Water

Use of water is the part of the consumptive demand that is actually served at a given time. Many such uses generate a return flow, for example as sewage, or as irrigation tail water. The return flow can occur at a different time or place than the withdrawal, for example in case of a storage reservoir retaining water in a part of the year and releasing it in a different part of the year. The use of water can be increased by infrastructural development and reduced by demand management.

An important part of the water resources analysis is to examine the scope for balancing the availability and demand of water under different assumptions about availability. During this analysis, a clear distinction should be made between water availability (water resources generated), water demand, and actual water uses. This is in order to prevent ends and means being mixed up.

Data Gathered:

Cambodia has 946 operating irrigation systems which can service 256,120 ha of the 2 million ha wet season cultivated area. In the dry season, rice is grown on 225,000 ha and 143,490 ha of this can receive irrigation water from irrigation schemes. Hence, only 12% of the wet season rice is irrigable, the remainder being rain fed and just over half of the dry season crop is irrigated, the remainder being recession rice receiving supplementary irrigation from manually operated and diesel driven pumps. Very few of the irrigation schemes are capable of irrigating all year round. Fully irrigated crops receive approximately 10,000 m^3/ha. Some irrigation engineers in Cambodia consider recession rice receives approximately 4,000 m^3/ha of irrigated water.



Source: Social Atlas of the Lower Mekong Basin, MRC-2003.

Figure 4: Proportion of Population with Access to Safe Water in LMB

4.2.5. Water Consumption by Agriculture in the LMB[2]

Mekong river water is utilized for irrigation, hydropower generation, domestic and industrial purposes. Much of water emerging from hydropower stations is also consumed downstream for irrigation, domestic and industrial purposes. Irrigated agriculture is responsible for 80-90% of water abstractions from the Basin (FAP from MRC, 2002) and is utilized in the form of receding flood water storage, diversion of water from streams and from ground water sources.

On a nationwide basis, the LMB countries do not fully utilize their renewable water resources. Renewable water resources are equal to the total precipitation in the country minus evapo-transpiration. Cambodia and Laos use only 1% of their total renewable water resources for agriculture while Vietnam and Thailand use 5 and 20% respectively. Based on these figures, an average Mekong river flow of 460 km³ each year can service the irrigation requirements of all LMB countries 11 fold. An annual Mekong river flow can also service approximately 64 million ha of fully irrigated rice based on a consumption of 10,000 m³/ha (1 meter of water) per crop. This compares with the 1999/2000 area of 2 million ha of dry season cropping in the LMB watersheds.

Therefore, there is no shortage of water in the Mekong River to service agriculture in it watersheds if all water is captured and redistributed when required. This is of course, not the case, with a majority of water flowing through to the ocean during the wet season when crops receive most of their water requirements directly from rainfall. Water shortages may occur (especially in the Mekong Delta) during the months of February to May when water flows in the Mekong River are at their lowest. Crop irrigation is the major consumer.

4.2.6. Water Consumption by Industry[3]

Water is necessary for all industrial activities, including cooling processing or manufacturing operations, power generation, cleanup and other sanitary purposes, and fire protection. The quality and quantity of industrial water demand varies significantly by country, industry and particularly uses, ranging from high water quality for the beverage industry to brackish water or treated municipal effluent for cooling purposes.
Urban water usage is estimated at about 100 liters per person per day, for a total average annual supply of 36 million m³ for other urban centers in Cambodia. The total water usage represents about 0.01% of the flow in the Mekong River (WUP, 2001).

It is assumed that most Phnom-Penh wastewater transported to the Delta will travel via the Bassac River. However, with a distance from Phnom-Penh to the Vietnam border (about 110 km) and high water temperature (about 29 degree Celsius) in the Bassac River, the rate of decomposition of any organic matter discharged from Phnom-Penh will be rapidly broken down and organic types of pollution are not likely to reach the border of Vietnam (Hart, 2001).

[2] This section is quoted from water used for agriculture in the LMB- MRC, July 2003.
[3] This section is quoted from regional sector overview, 2002.

Some figures on water demand and use

Total water demand/capita = 150 m³ per capita per year
Share agriculture = 94%
Share Municipal and Industrial = 6%
Municipal and Industrial withdrawal 1990 = 78 million m³
Municipal and Industrial withdrawal 2020 = 187 million m³
(Source: Ringler, 2001 in MRC-BDP Planning Regional Sector Overview 2002)

Total water demand = 0.5 Bm³ per year
Internal water supply = 1,004 m³ per person
Water for domestic use = 5%
Water for industrial use = 1%
Water for agricultural use = 94%

These figures will change due to future development in the LMB that bring about changes in the river hydrology.
(Source: MRC-CNMC, 2003, National Sector Review)

4.2.7. Major legal and policy documents pertaining to watershed management in Cambodia

- Land Law (endorsed in August 2001)
- Law on Commune Administration Management (endorsed in August 2000)
- Law in environmental protection and natural resource management (endorsed in November 1996)
- Forestry Law (already submitted to the Council of Ministers in July 2001, but has not yet passed)
- Sub-decree on forest concession management (signed by the Prime Minister in February 2002)
- Law on Water resources management (draft)
- Decentralization and devolution Policy of the Ministry of Interior
- 5 year socio-economic Development Plan (2001-2005); particularly relevant on poverty alleviation
- Interim Poverty Reduction Strategy Paper
- Agricultural Development Plan (2001-2005)
- Action Program for the Development of Agriculture in Cambodia (2001-2010)
- Government Action Plan 2001, which includes a section specifically dealing with natural resources management
- Draft Policy for Ethnic Minority People's Development, also called "Highland Policy" (Sept. 1997, not yet ratified by the Council of Ministers)
- Forest Policy- currently being draft by a national working group.

4.2.8. Analysis

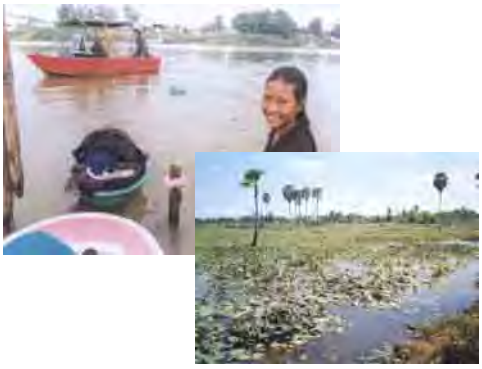
- Data gathered from diverse sources are fragmentary, poorly consistent and vary from one source to another. This low ability of the Cambodian institutions to produce accurate and reliable data on water resources (surface and groundwater) seriously impacts on any possibility to plan, manage and evaluate actions aiming at securing water availability for the population for a better access to water and greater development opportunities, be irrigated agriculture, fisheries, tourism industry and/or navigation.
- Potential of water availability is huge including groundwater, but the effective access of the population to water is limited because of weak management expertise of relevant institutions. Therefore, water is not available at the peak period of water demand.
- Cambodia's challenge related to water is three folds, technological, institutional and social. Technologically, the main challenge is water control including flooding control and warning systems set up. Current high technologies based on satellite imageries and GIS is capable to assist man in forecasting and warning about some natural calamities and thus, to minimize their disastrous impacts on human activities. Institutionally, there is a need to achieve the reforms so that competent human resources are employed and overlapping mandates between rival institutions reduced, for the sake of more efficient and effective water resource management and exploitation. Efforts in capacity building must continue and funds allocated to this task.
- Socially, the challenge is to enable equitable access to water resources to the population, especially the poorest and the rural inhabitants. Access to safe water should be nation-wide and a priority for further policy enforcement.
- The impressive panoply of laws, regulations and policies is conducive to rational and sustainable watersheds resources management at the condition that there is real and sufficient political willingness for enforcement.

4.3. Trends

4.3.1. Fisheries Intensification

Unsustainable fishing is taking place, notably on the Tonle Sap. Although total catch may not be decreasing, the catch per fisher is. Also the share of large and medium-size, higher-value fish has declined. Mangrove forests are being degraded for charcoal extraction and aquaculture. Illegal fishing is increasing. Development of intensive aquaculture may generate destructive environmental effects.

4.3.2. Water Resources Threatened



Many sectors rely on water resources, e.g. agriculture, fish production, biodiversity, water supply, sanitation, transport and hydropower. The current trend is shortage of water supply in many areas, including domestic purposes. Serious competition for water is intensifying between fast growing population and irrigation development. Pollution of both surface and underground water is extensively provoked by industrialization pressure, urbanization and absence of repressive law against environment destructors.

4.3.3. Population Pressure

Migration towards the Tonle Sap Sub-area is of concern due to anarchic resources exploitation and serious environmental degradation. If provinces of Oddar Meanchey, Banteay Meanchey and Pailin are being preferred destination for migrants during these 5 past years, Battambang, Pursat, Kompong Chhnang and Preah Vihear are becoming under pressure also.

Development of tourism, infrastructure improvement and foreign investment are major factors encouraging migration towards urban areas where employment opportunities are created.

4.3.4. Forestry Degradation

Over the last 40 years, forest cover has declined from about 75% to about 55% of total area. Success of Government's effort to control forest exploitation is limited. Rapid degradation of flooded forest will inexorably result in irreversible harm on the fish and wildlife ecosystem due to disappearance of forest cover and water quality degradation.

4.3.5. Tourism Booming

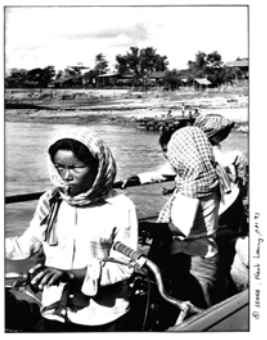
Government policies aiming at encouraging development of tourism in Cambodia, e.g. Open Sky Policy, Airport Modernization, resulted in tourism booming. Presence of numerous archeological sites in Siem Reap, Kg Thom, Preah Vihear, etc. contributes to feed local and national economies with foreign currencies. But a number of side-effects are also generated by increased water use, anarchic waste elimination and rapid social mutation. Development of ecotourism remains embryonic despite unique and valuable biota in the Tonle Sap basin.

4.3.6. Impoverishment of the Vulnerable

Despite the abundance of its natural resources, the Tonle Sap provides an inadequate living for most of the inhabitants of the provinces that adjoin it (Battambang, Kg Chhnang, Kampong Thom, Pursat and Siem Reap). Half of the villages have between 40-60% of the households below the poverty line with a peak of 80% in some areas. Many households have no land holdings and are entirely dependant on fishing and foraging, with access to fishing areas often under dispute. If conflict and instability are major causes of poverty, impoverishment originates from poor access to health and education services, lack of land ownership, women's social deprivation and increasing vulnerability to natural calamities.

Demographic pressure on the environment resulting in degradation is also a mechanism of impoverishment of the vulnerable in terms of limited access to resources. This trend is aggravated by the inadequacies of the governance system.

4.3.7. Navigation and Road Development



Maximization of natural assets consisted of abundant water bodies implies development of navigation serving tourism, transportation, fishery and agricultural trade. Despite serious competition from inland transport via almost rehabilitated NR #5 and #6, navigation remains crucial for shipment between Phnom-Penh and the Tonle Sap region for fish, crop production, agricultural inputs, gasoline and heavy equipment. Tourism in Siem Reap is an economic catalyst for navigation in the Tonle Sap region. Despite its poor network, navigation remains an important opportunity of mobility for the majority of poor rural people in the Tonle Sap Sub-area.

The rehabilitation of Routes 5 and 6 have already reduced the travel times to the major towns in the Tonle Sap Sub-area by several hours. With the expected completion of the route between Ho Chi Minh City in Vietnam and Bangkok in Thailand and ASEAN plans to liberalize cross-border traffic flows, enormous changes will occur in terms of flows of people and goods, access to markets, knowledge and technology and the economy.

This will completely recast all activities and mindsets of the Sub-area, both opening large opportunities and bringing with it many potential threats and dangers. Coping with this change will be a key trend for the foreseeable future.

4.3.8. Ongoing Decentralization Process

Success of decentralization process is strongly conditioned by the effective participation of the grass-roots communities in planning, decision-making and monitoring-evaluation. Resource management in the Tonle Sap basin is a national and regional challenge for the Government in a context of economic and political liberalization, with its unavoidable conflicts of interest among local actors. Capacity building and good governance tend to be key pre-requisite for accountable and equitable resource management to alleviate poverty in the Tonle Sap Sub-area.

Increased awareness is rising of the local communities and authorities about potential and fragility of the ecosystem is another enhancing factor for sustainable and pro-poor exploitation of natural resources.

4.3.9. Land Ownership Conflict

Land use legislation and ownership are critical issues to be addressed to avoid violent conflicts between powerful people who are able to use connections, money and force to take land and the population who are living on the land or who have rights to its use. Land appropriation by the powerful is one of the major factors of impoverishment of the vulnerable in a context of poor local governance and scarcity of natural resources.

4.4. Trans-Boundary Issues

Identification and analysis of trans-boundary issues are crucial for planning and decision-making of the riparian Governments. Below is the key trans-boundary issues identified for the BDP of the Tonle Sap Sub-area.

4.4.1. Environmental Degradation and Contamination

Deforestation impacts on the environment beyond the boundaries of the concerned country. The most direct environment consequences of deforestation are the depredation of the forest biota in the deforested area. Because forests are almost always more biologically diverse than the system with which they are replaced, this usually results in a local loss biodiversity, and potentially a reduction in global species diversity (MRC, 2003d).

An issue of great concern is the Lower Mekong Basin, and thus in the Tonle Sap Sub-area, has been the consequences of forest clearance on hydrology and related processes, i.e. flooding, soil erosion and mass soil movement. When mature forest is cleared, the hydrological consequences depend on the subsequent use of the land.

Deforestation also impacts on society and economy. Progressive disappearance of the flooded forest in the Tonle Sap sub-area is a serious threat for fish reproduction and refuge where large numbers of people draw upon fishery resources for a high proportion of their subsistence and income needs. The agricultural encroachment that follows deforestation often causes the loss of traditional land use rights and traditional conservation mechanisms.

Water pollution by pesticides and chemical fertilizers under the development of intensive agriculture is another great concern. Even through persistent pesticides are banned in the riparian countries, it is clear that residual and illegally imported stocks continue to be used because residues of DDT, Dieldrin, and similar chemicals have been found in fish across the Mekong basin. In the delta of Mekong, there is concern over excessive fertilizer use affecting water quality and damaging integrated aquaculture operations. Pesticides can also cause environmental problems through build-up in the soil, toxicity to human and the development of resistance on the part of pests.

4.4.2. Population Migration



Migration is another concerning trans-boundary issue in terms of social and geo-political implications. The search for employment is a major cause of migration. Seasonal and semi-permanent migration to urban areas provides important income for households in rural areas. Several different types of migration appear to be taking place at the same time, as suggested by national level data from Cambodia and Thailand. The largest movements are between rural areas. People relocated from densely populated rural areas to remote ones to seek new economic opportunities. Economic development in the Lower Mekong Basin, especially in urban canters, creates strong attraction for rural people because jobs are more numerous, better paid and services are more developed.

The Tonle Sap sub-area witnesses the highest population growth of the LMB with 4.84% per year while Cambodia's rate is 2.5%. Migration towards the sub-area comprises internal rural migrants and trans-boundary migrants which demographics and legality remain a controversial issue. Internal migration deals with population of very poor provinces – i.e. Prey Veng, Takeo and Svay Rieng – who are seeking for job opportunities and better livelihoods. Foreigner migrants are motivated by abundant fishery resources and numerous business opportunities. In the northern and western provinces of Cambodia, Cambodian migrants cross the border towards Thailand to seek for employment opportunities. Most of them originate from the poorest provinces of the southeast part of the country.

As a consequence of population migration, the trends in urbanization will increase. By 2002, up to one third of the population in the Lower Mekong Basin will be located in urban areas. This certainly results in loss of valuable agricultural land, increase cost to provide services such as water and sanitation, and, in floodplains, to increase risks and cost associated with flooding.

Human migration also facilitates propagation of diseases which by-pass economic, political, administrative or international boundaries. For instance, the rapid widespread of HIV/AIDS and SARS is enhanced by the population movement all around the world under the effect of migration but also tourism industry development.

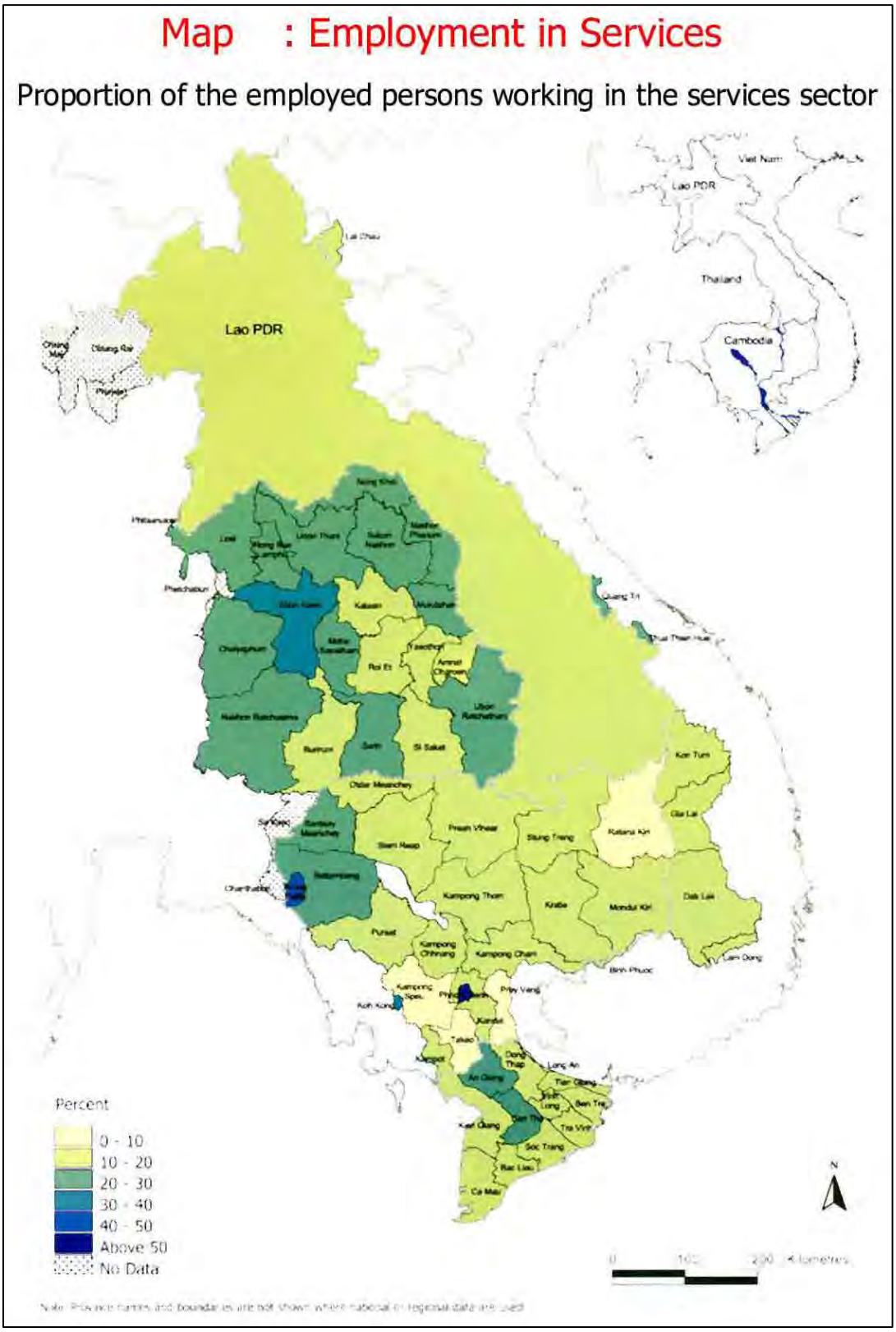


Figure 5: Proportion of the Employed Persons Working in the Service Sector in LMB

4.4.3. Fishery Resources Management



Fishery resources management is the perfect example of trans-boundary issue that challenges every riparian country. Because fish reproduction and associated migration factors go beyond political, administrative and economic frontiers delimiting the States, the fishery issue is exacerbated by growing conflict of interest between the Governments. Rising waters, turbidity and/or the first rains trigger adults of many Mekong fish species to spawn (Poulsen, 2000). Long distance migratory fish species or "White" fish have adapted to spawn at the onset of the monsoon season (May-July), so that their fry and juveniles are ready to enter and feed when the plains become flooded from July to September. Short distance migratory or "black" fish species also migrate to spawn and feed in the inundated floodplains. Deep pools and channels in the mainstream of the Mekong near Kratie in Cambodia, in the Nam Theum and Nam Hinboun in Lao PDR, and in the Se San River in Cambodia are widely acknowledged as dry season refuges for fish, which re-colonise flooded areas during the following monsoon (Poulsen & Valbo, 2001). The long distance fish migrations within main river channels and their main tributaries are referred to as "longitudinal migrations". Such long distance migrations can cover distances of hundreds of km from the Mekong Delta in Vietnam, through Cambodia, to Thailand or Lao PDR through the Mekong River mainstream, Lao PDR through the Se Kong River, or the Central Highlands in Vietnam through the Se San and Sre Pok Rivers (Coates, 2001).

It is obvious that any change of the eco-system occurring in the upstream region will affect and impact on the livelihood of hundred millions of people whose food supply and economic activities heavily rely on fishery resources in the downstream areas. Water quality, water availability, and preservation of the flooded forest are key conditions for the survival and sustainability of fishery resources in Cambodia.

The 1995 Mekong Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, means that attempt is being made to " *Cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin, ...in a manner to optimize the multiple – use and mutual benefits of all riparian and to minimize the harmful effects that might result from natural occurrences and man-made activities*" (Article 1).

However, among the weak-points, the Agreement does not set any strict upper limits to water use, except for trans-basin diversions in the dry season, but this is not where the large potentials are anyway. Cambodia obtained an assurance that the reversed flow of the Tonle Sap River, following the annual flooding would be allowed. Cambodia, as a relatively small country, also benefits from the relative security of such an Agreement. More importantly, Cambodia received an assurance for protection of the water supply to the Tonle Sap Lake. It is perhaps the single most important factor for Cambodia. It will also benefit from improved information flow and a higher concern of overall environmental protection in the Basin. On the other hand, Cambodia is vulnerable vis-a-vis Thailand and Laos when it comes to trans-basin diversions and other large-scale upstream water use, e.g. Hydropower development. But Cambodia can however expect strong support from Vietnam that has similar problems, and both have, consequently, a high interest in regional cooperation around this question. Flood control is an issue that deserves more attention in the Agreement.

To what extent the Agreement represents a move toward a higher degree of regional cooperation or does it mean a move away from it? For instance, large-scale trans-basin diversions, the most unwanted and conflicting scenario for the downstream countries, are allowed as long as the right amount of information is given and/or prior consultation is practiced, and that is done outside the critical dry season period. Even though the Agreement keeps a high profile on environmental sustainability in the Basin, it must be noted that there is yet no credible monitor mechanism in place.

4.4.3.1.Fishery Resources Decline in Figures

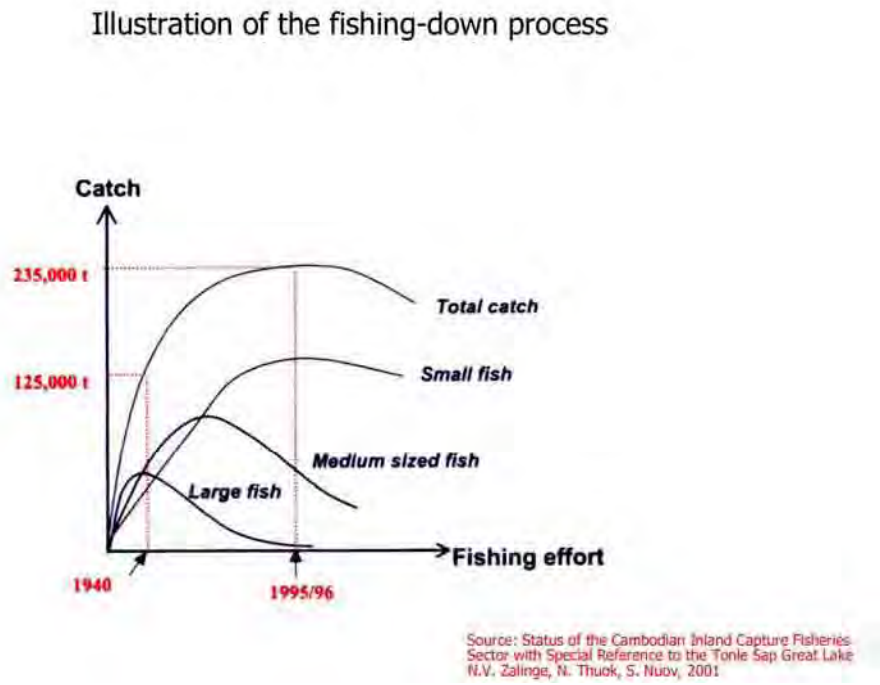


Figure 6: Illustration of the Fishing-Down Process

In 1940 the Tonle Sap Great Lake Region catch of 125,000 tons consisted mainly of large and medium size fish, while the 1995-96 catch of 235,000 tons contained hardly any large fish and was strongly dominated by small fish.

Table 6: Depredation of the Eco-System Supporting Fishery Resources

Type of Land and Water Resources in Cambodia	Area (ha) 1985/87	Area (ha) 1992/93
Permanent water (river, lake, pond, etc.)	567,100	411,1000
Flooded forest	795,400	370,700
Flooded secondary forest	28,200	259,800
Flooded grassland	80,800	84,900
Receding and floating ricefields	17,500	29,300
Seasonally flooded crop fields	366,800	529,900
Swamp	12,200	1,400
Total	**1,868,000**	**5,387,000**

Source: Ahmed et al, 1996.

Note: Beside and overall decline, there were significant changes in the area under different types of land and water resources which support fisheries between 1985/87 and 1992/93. The changes in the area under each type of resource can be attributed to loss of primary flooded forests and timing of the survey between the two periods.

These above figures could be analyzed in term of variation between 1987 and 1993. Results are displayed in the Table 7:

Table 7: Variation of Various Types of Land and Water between 1987 and 1993

Type of land, water resources in Cambodia	Area Variation 1987-1993 (%)	Estimate Average Variation per year (ha)
Permanent water (river, lake, pond etc.)	-27.5	- 26,000
Flooded forest	-53.4	-70,783
Flooded secondary forest	x 9 times	+38,600
Flooded grassland	+5.0	+683
Receding and floating rice fields	+67.5	+1,967
Seasonally flooded crop fields	+44.5	+27,183
Swamp	-88.5	-1,800
Total	**-9.7**	**-30,150**

Every year, between 1987 and 1993, the average area of eco-system which supports freshwater capture fish has declined 9.7% equivalent to 30,150 ha. Flooded forest pays the highest tribute to this depredation: 53.4% of its area disappears between 1985 and 1993, equivalent to 70,783 ha per year. As a result to this destruction, flooded secondary forest occupies the space. Its area has been multiplied by 9 in six years, meaning 38,600 ha increase per year. Receding and floating rice fields gain areas with 67.5% increase in the same period (1,967 ha annually).

Table 8: Fresh Fish Production, 1992-2000

Year	Fish Yield, tons
1992	68,900
1993	67,900
1994	65,000
1995	72,500
1996	63,510
1997	73,000
1998	75,700
1999	231,000*
2000	245,600*

Source: Touch & Bruce, 2000.
Note: (*): Include small-scale fishing.

4.4.3.2. Trans-Boundary Factors Impacting on Fisheries Resources

Development of water resources, particularly dam and weir construction for hydroelectric power, resulting in e.g. increased water levels, increased turbidity and reduction in nutrient levels. Dams also impact in water quality, affecting downstream total suspended solids and nutrient levels, especially total phosphorus and dissolved oxygen levels. Oxygen-consuming decomposition of organic material mainly occurs at the bottom, and the bottom water can become hypoxic or even anoxic if the reservoir is stratified. If oxygen-depleted bottom water is released from a dam, fish kills can occur downstream.

4.4.4. Hydropower

4.4.4.1. Cambodia's Demand of Electrical Power

The country's demand of electrical power is projected to increase from 251 MW to 746 MW between 2000 and 2016. Previous feasibility study reveals potential hydropower in Pursat (3.5 MW) and Stung Sen (38 MW) (Bohneur, 2003).

4.4.4.2. Potential for Hydropower Development in the Mekong Basin

The total potential for feasible hydropower projects in the four Lower Mekong Basin countries is approximately 30,000 MW including 13,000 MW on the Mekong's Mainstream, and the remaining tributaries' potential (13,000 MW in Lao PDR's tributaries, 2,200 MW in Cambodia and 2,000 MW in Vietnam). Only 5% (1,600 MW) of the Lower Mekong's hydropower potential have been developed, and all projects are on the tributaries, not on the mainstream. There is also huge hydro potential in the Upper Mekong Basin. In Yunnan Province of the People's Republic of China, total hydro potential is an estimated 23,000 MW, and two projects, totalizing 2,850 MW, have already begun operating.

Figure 7: Completed Hydropower Projects in the Mekong Basin

Table 9: List of Completed Hydropower Projects (10MW<)

Country	Name	Location	Capacity (MW)	Output (GWh/year)	Commissioning
China	Manwan	M	1,500	7,870	1993
	Dachaoshan	M	1,350	5,930	2001
Lao PDR	Nam Ngum	TR	150	900	1971-85
	Xeset	TR	45	150	1991
	Theun Hinboun	TR	210	1,645	1998
	Houay Ho	TR			
	Nam Leuk	TR	60	184	2000
Thailand	Sirindhorn	TR	36	115	1968
	Chulabhorn	TR	15	62	1971
	Ubolratana	TR	25	75	1966
	Pak Mun	TR	136	462	1997
Viet Nam	Dray Ling	TR	13	70	1995
	Yaly	TR	720	3,642	2000

Note: TR = Tributary, and M = Mainstream
Source: MRC, 2001

4.4.4.3. Analysis of Trans-boundary Implications of Hydropower Projects

Obligation of consultation between countries:

In signing the 1995 Agreement that established the MRC, member countries all agreed that before any hydro project can be built on the mainstream of the Mekong, all four members must agree. Furthermore, the 1995 Agreement obligates members to ensure that no harmful effects will occur downstream in neighboring countries. The problem is that China and Myanmar are not signatories to the MRC-Agreement. China is probably building dams with high storing capacity, which puts Thailand and Laos in a position where they have to compensate for water capture carried out upstream.

Risks for riparian countries:

The first risk of hydropower projects development in the upstream area of the Mekong River is the negative impact on the environment and society. Those risks have been duly identified as:

- Adverse impacts on the ecosystem (aquatic life, animals, birds, vegetation);
- Blocking of the flow of sediment;
- Negative impacts due to changing a river's flow pattern;
- Negative social impacts (resettlement, loss of livelihood);
- Loss of scenic landscapes (tourism potential);
- Negative impacts on water quality due to storage of water (eutrophication, lower temperatures for discharged water);
- Negative impacts to other users of water (navigation, fisheries);
- Problems during the construction period (noise, vibration, dust, traffic problems); and

– When associated with irrigation, land salinization and water logging.

The second type of risk is geo-political, i.e. the inevitable dependence of countries who do not possess hydropower upon those who develop hydropower projects. Cambodia is particularly vulnerable because it will depend on Thailand, Laos and Vietnam for power supply. A cut-off of power supply by power producers would seriously impede any possibility for Cambodia to achieve its development goal and strategies, to alleviate poverty, to improve the population livelihood, etc.

Geo-hydraulic conflicts:

Hydropower involves dam building which requires water diversions. Conflict may arise between upstream countries and downstream countries because of water scarcity and/or unequal allocation. The most crucial is perhaps where a basically agricultural country risks loosing the access to the water sources and thereby being robbed of the chance of achieving food security, poverty alleviation, and possible economic growth (Öjendal, 2000). Furthermore, aggressive and hostile capture could lead to tensions and conflicts through population movements, group identity conflicts, economic deprivation and/or civil strife (Ibid).

Progress generated by Hydropower projects:

Quite a number of positive impacts of hydro projects deserve to be highlighted:

– Harnessing of a renewable natural resource;
– Reducing of the negative impacts that power generation has on the global environment (e.g. use of fossil fuels reduced, thus will lessen air and water pollution);
– Increasing the river's flow in the dry season, and reducing peak flow during the flood season;
– Increasing the availability of electrical power will stimulate economic development and improve people's living standards; and
– Revenues will be earned from the sale of power.

4.4.5. Soil and Water Conservation

The tenuous situation of most rural people stems from their difficult situation as subsistence rice farmers dependent on making a living from poor quality soils and uncertain and inconsistent rainfall. This is clearly identified usually by requests to solve the water problem with “irrigation”. Yet often the problem is not just water shortage but flooding due to poor drainage or pests associated with a drought period or low yields that prevent farmers from escaping the debt cycle caused by a failed crop.

A more holistic approach to these problems is to examine the situation within the framework of soil and water management and conservation. Cambodia was previously able to produce large surpluses of rice without major investments in irrigation reservoirs

by utilizing local knowledge and resources and smaller investments to improve the rice cropping situation[4]. Many traditional techniques of soil and water control have been developed over the course of centuries of rice farming that involve flood spreading, water harvesting, storage, drainage, soil conservation through bunding and field leveling and improved crop management.

Numerous small-scale improvements in infrastructure are proven to work and contribute to the catchment's response to rainfall thereby contributing to the reduction of downstream flooding and sedimentation. In addition, the better soil and water conservation improves the viability and performance of larger investments in the watershed and reduces pressure for populations to migrate from tenuous economic situations to put more pressure on important areas like the Tonle Sap flooded forest.

The overall water balance within the sub-basins can be greatly improved through widespread application of these techniques that have the corollary effect of increasing the absorption of rainfall and runoff into the soils and thereby increasing the quantity of groundwater available. The groundwater provides the base flow in the rivers during the dry season, and thereby contributes the necessary volume to maintain the situation in the Mekong Delta area downstream from increasing encroachment of seawater.

Through careful management of the watersheds to maintain and conserve local resources, the environmental situation throughout the basin is improved and the local people's ability to respond to natural disasters is strengthened.

[4] For example, during the "Sangkum Reastr Niyum" period of 1953-1969, a rural engineering department mobilized local people and leadership to work together on small-scale water resource projects appropriate to the village that gained good success for a relatively small investment.

CHAPTER 5: THE AGENDA FOR DEVELOPMENT

5.1. National Development Policy and Plans

5.1.1. National Development Objectives, Plan and Policies

5.1.1.1.Development Vision, Goals and Objectives

After the July 1998 election, the Government of Cambodia adopted the Triangle Strategy in which the promotion of economic and social development composes the third side of the triangle. One of the numerous and urgent priorities identified was an extensive reform of the administrative system. The concretization of the social and economic vision of the government is the second five-year Socio-economic Development Plan that derives from the review of SEDP I. Through SEDP II, the Royal Government of Cambodia is given a development framework that enables the articulation of the national economic growth with poverty reduction strategy.

The long-term vision of the Government is stated as "*to have a socially cohesive, educationally advanced, and cultural vibrant Cambodia without poverty, illiteracy and disease, which will allow each person to be the best that it is in them to be*".

The strategic feature of the plan is to put Economic growth as a prerequisite for poverty reduction and the key to growth is private sector development which achievement is conditioned by sustained improvement of the government environment. Administration reform includes decentralization, military demobilization, legal and judiciary, gender equity, public financial management, anti-corruption, and natural resource management. It is highly assumed that a higher economic growth path will make Cambodia become an attractive ecological and cultural tourism destination.

5.1.1.2. Plans to Achieve Vision and Objectives

National economic growth and poverty reduction strategy:

The strategy recognizes that previous growth has largely been concentrated in urban areas and has tended to bypass rural where the majority of the poor live and agriculture that feed the entire population.

High expectation for poverty reduction:

Rural economy growth would result in the most tangible reduction of poverty due to its highest incidence there and its lowest inequalities, because so far economic growth mostly benefits to the urban population.

Importance of growth and private sector development:

The projected increase in output growth over the medium term is based on agricultural and rural development and further growth in industrial production and tourism. The Government recognizes that achieving national development objectives relies crucially on creation of a more positive and predictable business environment to facilitate the development of the private sector with a special consideration to the development of small and medium-sized enterprises, as the engine of increased investment, higher incomes and more employment.

Decentralization:

Through Decentralization it is expected to create new possibilities to bring about a broader-based economic growth and to implement a more effective and efficient strategy for poverty alleviation. Government accountability is one of the key mechanisms of economic growth and poverty reduction. Decentralization is expected to offer new opportunities for political representation and facilitate direct participation of the poor in the local public decision-making process. Government recognizes that decentralization reforms are bound to have an impact on the national planning system itself.

Special focus on agriculture and rural development:

Poverty reduction calls for a sustained focus on the rural poor and development of the potential of agriculture, as well as an improved effort to reduce gender inequalities. The rural population from whom agriculture is the primary source of income account for 90% of the poor, women comprise 65% of the rural population and 80% of them are actually engaged in agriculture and the sector accounts for about 40% of GDP.

The Government recognizes (MRC, 2002n) that agriculture constitutes one of the major mechanisms of poverty alleviation because:

- Agriculture provides the primary direct source of income in the rural economy;
- Its multiplier effects can potentially have a strong effect on the expansion of the rest of the economy and on the development of off-farm sources of income; and
- It is associated with strong seasonal variations in the welfare of the rural poor. Agricultural improvement is key therefore to broad economic growth and poverty reduction and there is little doubt that there is much potential for improvement.

Encouraging reduced fertility and slower population growth:

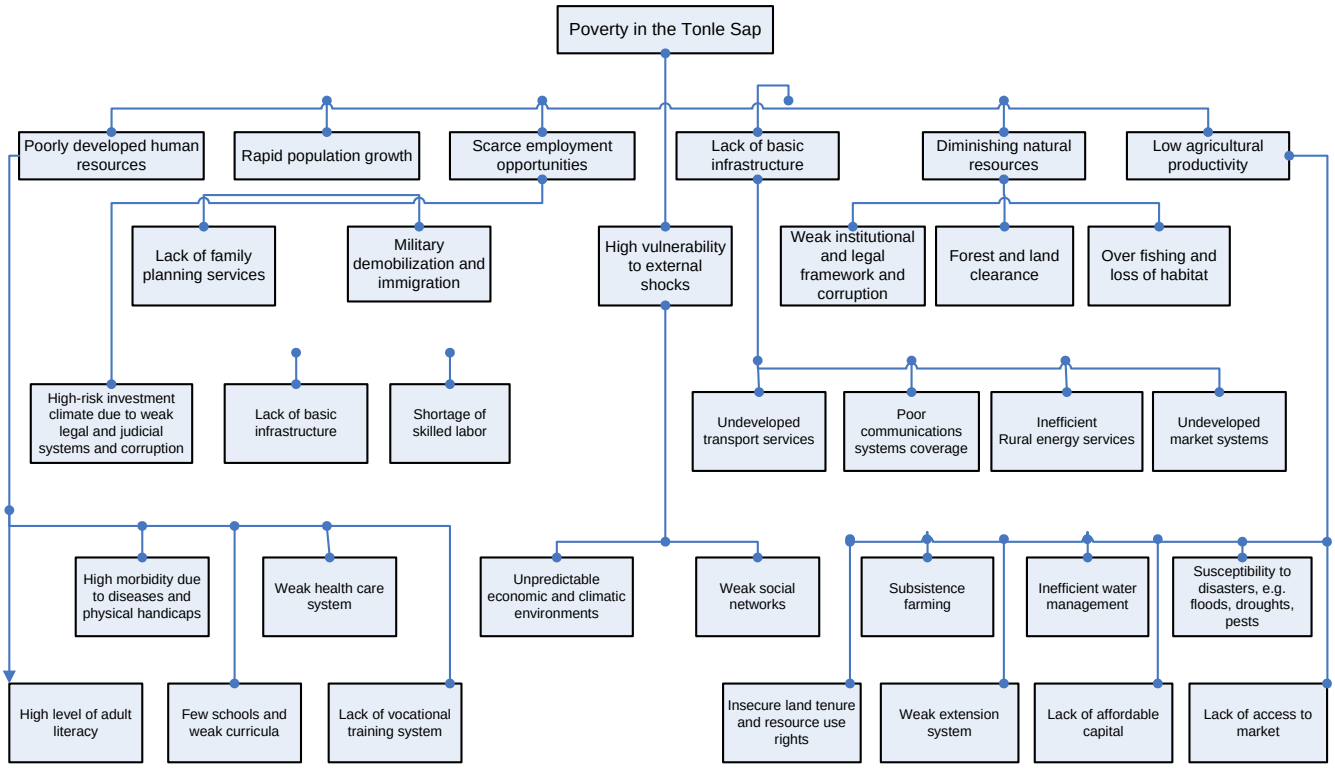
The relatively high population growth rate of 2.5% per year suggests the need for the wider birth spacing in poor families, allowing better health for mothers and their children, ad reduced maternal and child mortality. The expected result of this is the improvement of livelihood of the rural population with increased human assets needed to improve welfare, as well enabling family spacing and fully participation in a developing society.

Reducing gender based poverty:

Concern for women empowerment is clearly expressed in the Government development vision, through initiatives that support women and girls particularly in the areas of laws and culture. This political willingness is translated into raising the level of skills and productivity of both rural and urban women through greater investment in basic education, literacy, skills programs and vocational training, and health and nutrition.

Another supportive mechanism is to creating security for women through legal measures and public education, particularly of men, to reduce trafficking of women and other violence against women.

A pro-poor education and health program:



Source: ADB

Figure 8: Poverty in Tonle Sap Region

According to the Second Socio-Economic Development Plan 2001-2005, improving access of the poor to education and health services encompasses:

- Promoting financial transparency and addressing corruption issues particularly in health, nutrition and education sectors;
- Addressing the HIV/AIDS threat through more awareness raising and multi-disciplinary programmes devoted to target women and children in rural areas.

Prevention strategy is developed in parallel. Health services will benefit from greater investment; and

- Increasing education investment to enable the poor to increase their access and improving school quality and deploying educational inputs.

Expanding village level infrastructure and services:

Water, roads and electricity are priorities identified. Along with the policy environments are promoted to increase investment of private sector in rural infrastructure services.

Disaster prevention and management:

By living in an environment conditioned by wet-dry seasonality, most of the rural poor are under the treat of natural calamities that affect all aspects of their lives. Plans in natural disaster prevention, preparedness, relief, mitigation and rehabilitation are crucial poverty reduction measures.

The key challenge of Government's efforts is to find effective ways to minimize the vulnerabilities of the rural poor to adverse weather, in particular flooding and drought.

Targeted special programmes:

Special programmes will be necessary for those groups of the poor who are unable to participate effectively in the economic growth process. Contribution of NGOs and aid agencies, and Government commitment are of importance to achieve the goal.

5.1.2. Water Related Basin Concern and Policy

The review confirms that despite great concern about water issue in the Tonle Sap region there is no specific water resources management policy related to the basin, but a national water resources policy to be adjusted to each province and locality. In other words, the legal framework for national water resources management is not yet fully in place. In consequence, there are no national operational strategies or plans for water resources and management.

Due to the rich but fragile biodiversity and to respond to emergency, the management of the Tonle Sap floodplain and freshwater resources has been devoted to the Ministry of Environment through a Coordinating Unit for the Tonle Sap. According to a Royal Decree on the Protection of the Tonle Sap Biosphere Reserve had been enacted in March 2001. A Tonle Sap Inter-Ministerial Task Force was created to formulate and coordinate the implementation of a multi-sectoral management plan for the sustainable development of the Tonle Sap region.

Below is the description of the National Water Resources and Meteorology Development:

5.1.2.1. Policy of Water Resources and Meteorology Development

To implement the programme of the Cambodia Royal Government and accelerate economic development, the Ministry of Water Resources and Meteorology has set four policies for social development and in particular poverty reduction, which are as follows:

- To increase the irrigated area of rice production from 16.62% to 20%, which means from 374,603 ha to 450,600 ha in addition to the existing 407,000 ha irrigated area, through water storage during the wet season for double crop production, with a view to increase job opportunities and income of the population in the rural areas.

- To take a leading role with regard to drainage, water conservation, water resources development to the benefit of the population by developing drainage systems and protection dikes

- To study surface water and groundwater to insure water quantity and quality management in an integrated manner and determine the balance between demand and water availability.

To improve weather forecasts, hydrological forecasts and ensure the timely warning of natural disasters such as typhoons, floods and drought to the population in the whole country.

5.1.2.2. Government's Goals in the Water Resources Sector

- To implement viable irrigation systems based on local cost recovery;
- To develop hydropower, focusing on multipurpose projects; and
- To increase the domestic technical capacity and databases needed for effective water resource management capacity.

Water resources management is addressed in section 11.9 in the current 5-year socio-economic development plan (2001-2005). Details are found in the separate policies and activity plans for each ministry, as presented in their respective 5-years plans and 3-years Public Investment Programs (PIPs).

The national targets for access to safe water are as follows:

- Rural population: from 29% in 2000 to 40% in 2005; and
- Urban population: from 48% in 2000 to 87% in 2005.

5.1.2.3. Water issues in the Case of the Stung Siem Reap Basin

Background:

With a financial support granted by the United Kingdom’s Department for International Development (DID), a case study of the Stung Siem Reap Basin was carried out in May-

July 2002 by the MRC and the CNMC in association with Siem Reap Provincial Department of Water Resources and Meteorology. With its management under the MRC Environment Programme, the aims were as follows:

- To improve the knowledge of tools, concepts, options and challenges in integrated management of water resources and the environment;

- To apply concepts and tools for drafting a pilot plan with outlines of development strategies for the selected river basin; and
- To identify one or several project proposals, for possible subsequent implementation.

Approximately 86% of Cambodia's territory is located within the Lower Mekong Basin. Part of the country, including much of the most valuable rice cropping area, is flood-prone. The extreme flood in 2000 (estimated to be a one in seventy-five year flood by the MOWRAM) affected some 3.5 million people and caused damage estimated at $145,000,000 USD. In Cambodia, like elsewhere, there are potential ecological impacts related to flood protection measures. Today, most water utilization is based on surface water, except for certain industrial groundwater supplies, and small-scale domestic (urban and rural) withdrawals from shallow tube wells. Groundwater resources are expected to be large, and groundwater irrigation is in a state of initial implementation. Access to water can be difficult in rural areas, and the hygienic standard of drinking water is generally law. In 2000 it was estimated that safe water was available to 29% of the rural population and 48% of the urban population.

Siem Reap Water Supply:

The Stung Siem Reap Basin's population is estimated as 424,621 inhabitants and its area cover 3,619 Km^2 (National Institute of Statistics, 2000). The lower part of the basin forms a part of the flood plain of the Great Lake of Tonle Sap. The floating fisher village of Chong Khneas is located in this area.

Siem Reap town is supplied via a 12,057 m network of main line, built in the 60-ies. There are 480 domestic water meters and 36 restaurants, hotels and guest houses. The water fee is 1,200 riels/m^3 for domestic uses and 1,400 riels/m^3 for hotels. Several large hotels operate their own water supplies (and do not actually pay a water fee). All supplies are based on groundwater. The withdrawal is 1500-1600 m^3 per day, of which 1000-1400 m^3 per day are registered as supplies. The present capacity is adequate to serve the connected users. A plan for a network expansion by 600 m main line has been prepared and is waiting for Japanese funding.

Surface Water and Wastewater Quality:

Water pollution by human activities may occur due to lack of wastewater treatment facilities within the town and due to fish processing during the rainy season. The most polluted area in the catchment area is Chong Khneas, which is located at the mouth of

Stung Siem Reap. Water pollution by industries does not take place as no medium-and large scale industry is located in the catchment area. No data and information related to pollution load is available.

Water related concerns and priorities:

Imminent, general concerns comprise occasional droughts, as well as extreme floods. These effects can be enhanced by El Niño events, and/or other meso-scale climate fluctuations. Between them, it is possible that droughts represent the large risk of adverse socio-economic and environmental effects.

Table 10: Irrigated Areas in Siem Reap Province, 2001-2005

No.	Project Name	Irritation, ha			
		Without Project		With Project	
		Wet	Dry	Wet	Dry
1	Spean Sreng	1,750		10,000	500
2	Baray	4,000	1,000	10,000	5,000
3	Makak	1,500		3,500	500
4	Thnol Tateung	2,400		3,500	100
5	Trapeang Veng	200		800	200
6	Cheay Russey				186
7	Chong Kal			1,200	50
8	Kro Peu	400	800	8,000	1,500
9	Tumnup 78		1,050		1,500
10	Trapeang Snor	40		80	150
11	Kork Chan	500		2,000	2,000
12	Tumnup Sourng				500
13	Thnung Kanchos			400	
Total		**10,790**	**2,850**	**39,480**	**12,186**

Source: MOWRAM, 2000.

Both raw water and agricultural lands are finite, and development should aim at quality and value, as much as quantity. Water allocation should be managed with a view to the value generated by the raw water, within different sectors, and in terms of selection of crops, particularly secondary crops.

Due consideration should be given to preservation of the groundwater quality and quality, considering the long time required for natural restoration (if once polluted), and the scope for continued utilization for domestic and industrial supplies.

5.1.2.4. The Dilemma of Chong Khneas (Siem Reap Province)

The problematic:

Chong Kheas is certainly the best illustration of the interaction between environmental and livelihoods issues in Cambodia. Port facilities do not exist in the traditional sense of the term at Chong Khneas due in large part to the seasonal water level variation and corresponding movement of the shoreline by some 5-8 km. The present facility for

unloading passengers, fish and cargo comprise an earthen road embankment extending south from Phnom Kraom of about 6 km that runs alongside the road and connects to the small inlet on the lake's perimeter. When the lake is at its highest level, Phnom Kraom is accessible by passenger, fishing and cargo boats, even though the road is mostly submerged. In the dry season, the channel is un-navigable for almost its complete length. At such times, a wooden landing site is constructed at the point where the road ends.

The site is hazardous for passengers, unhygienic for fish handling and susceptible to oil and fuel spills. The air is fetid with rotting organic debris. Non-biodegradable solid wastes litter the shoreline and shallow waters. Liquid and solid wastes of all nature are disposed of in the water alongside the road and become trapped within the channel. This situation poses an increasingly severe health risk for the villages of Chong Khneas, limits opportunities for value added fish-based activities, and is not conducive to tourism development.

The ADB's Tonle Sap Initiative at Chong Kneas:

The objective of a project preparatory Technical Assistance grant, scheduled in 2002, is to improve the social and natural environment at Chong Kneas. The TA will produce a feasibility study of investment interventions. The project will consist of improving environmental conditions for the community at Chong Kneas and reducing its poverty, which are interrelated and strongly linked with improving the living conditions of the dependent community members. The community has requested that upgrading of the port facilities be accompanied by the provision of a permanent living area for the commune of Chong Kneas.

5.1.3. Analysis of Water Policy and Basin Concerns

There is coherence between the long-term vision and the development objectives which clearly reflect real concern for poverty reduction through the economic development. One can note how strong the challenge of the Government long-term vision is because it comprises both economic and social dimension of development of a country which re-starts from zero after many decades of war and under a tragic legacy from the Khmer Rouge era.

By putting administration reform among key priorities, the Government wants to make sure that this process is conducive to substantial change of attitude in the governing bodies to make them fully receptive to key requirements, e.g. decentralization, legal and judiciary reform, gender equity, good governance, etc.

In a current context of local style of governance, decentralization could appear as a demagoguery approach of delegation of decision-making power to local governance. However, properly designed and implemented local participatory processes will certainly contribute to better understand the coping strategies of the poor and to channel local governments' resources to their support and diversification of results.

The Government recognizes poverty as an undermining factor of social development due to the growing gap created by unbalanced economic development. Political willingness and more time are needed to cut down poverty since it is a complex consequence of political, social, cultural and economic interactions. Balance between assistance to the poor and dependence vis-a-vis aid services remains to be found for the sake of human dignity and socio-economic development sustainability.

The lack of specific water resources management policy for the Tonle Sap Basin is partly addressed by the Royal Decree of March 2001, but this remains to be concretized by a regulatory framework and clear management-development strategies to restore balance between biodiversity protection and resources development.

The case study of Stung Siem Reap Basin pertinently shows how huge are challenges faced by the Tonle Sap Basin in terms of potentials and constraints related to water resources management. It also remind us that sustainable development of water resources heavily relies on sound and urgent management and planning policies given the fact that over-exploitation and pollution are main serious threats.

The Chong Kneas' dilemma is a current proof that environmental issue related to quality water cannot be dissociated from quality and sustainable livelihoods requirements, and that this harmonious relationship could be rapidly damaged because the balance has been broken down by both tourism industry development and population pressure.

5.2. Key Development Issues and Objectives

5.2.1. Key Development Issues

Nine key development issues have been identified by the participants:

- Irrigated agriculture
- Irrigation
- Fisheries
- Navigation
- Flood control-management
- Hydropower
- Watersheds management
- Tourism
- Water supply

5.2.2. Identification of Assets

Assets:

- Forests: flooded forests and animal habitats
- Sources of water resources: rivers, river branches, streams, etc.
- Tonle Sap lake
- Agricultural land

- Irrigation system
- Human resources: labor, brain
- Fishes, wild animals, and biodiversities
- Cultural tourism regions: temples and eco-tourism regions
- Infrastructure: roads

Needs and priorities:

- Food security by developing agricultural sector and irrigation
- Regular family income being assured
- Enough water supply and safe water being assured
- Human resources strengthened: new technologies available for all sectors and more understanding about involved laws and natural resources management
- Determine boundaries of flood plains (land)
- Rehabilitate the irrigation systems and build the new ones
- Build hydropower along the river branches
- Expand eco-tourism and cultural tourism
- Improve waterways for navigation
- Ensure political stability
- Enough budget
- Markets
- Safe water and health education
- Control the siltation in Tonle Sap Lake
- Mechanism of flood mitigation
- Ensure the fish migration route and waterway
- Strengthen institutional cooperation

Opportunities/potential:

- Increase irrigation system
- Increase rice and other crop yields
- Use the surface water and the ground water
- Develop hydropower: e.g. Battambang, Stung Sen, Stung Chinit, Stung Pursat, Stung Russey
- There are regions for eco-tourism and cultural tourism
- Ports construction
- Agricultural land
- Mines
- Human resources
- Infrastructure
- Navigation network
- Internal and external investors
- Mekong River Commission
- Community and local NGOs

Constraints/risks:

- High concerns on environmental impacts
- Lack of data and information
- Limited effect of law implementation and application
- Limited human resources
- Lack of budget
- Inappropriate trading framework
- Lack access to electricity
- Lack of technologies
- Limited public participation
- Many political parties
- Do not have clear sectors plan and roles are overlap
- Environmental degradation and pollution
- Continuous environmental degradation and pollution: the natural resources and biodiversities are declined
- Market competition in the region is still weak
- Migration and labor market competition

Trends:

- Population growth: increase water and natural resources demands, so impacts will be unavoidable
- The economy will be improved, particularly industrial sectors
- Expansion of agriculture will demand more water
- Expand irrigation system: water storage will block the fish migration
- Development of urban infrastructure
- Increase of tourism, will lead to increasing wastes and water pollution
- Increase agricultural production through the use of inorganic fertilizer and pesticides
- There will be increasing gaps between the rich and the poor, therefore social conflicts emerge
- Cooperation between people upper stream and down stream will not be complete

5.2.3. Identification of development objectives

5-10 year objectives:

- Adult literacy increase up to 80% and 100% of 6-years children go to school and people have enough food
- 15 to 25% of the population have access to electricity
- 75% of the population know/understand on how to protect and use the natural resources in sustainable way
- Food security will be assured for 100%

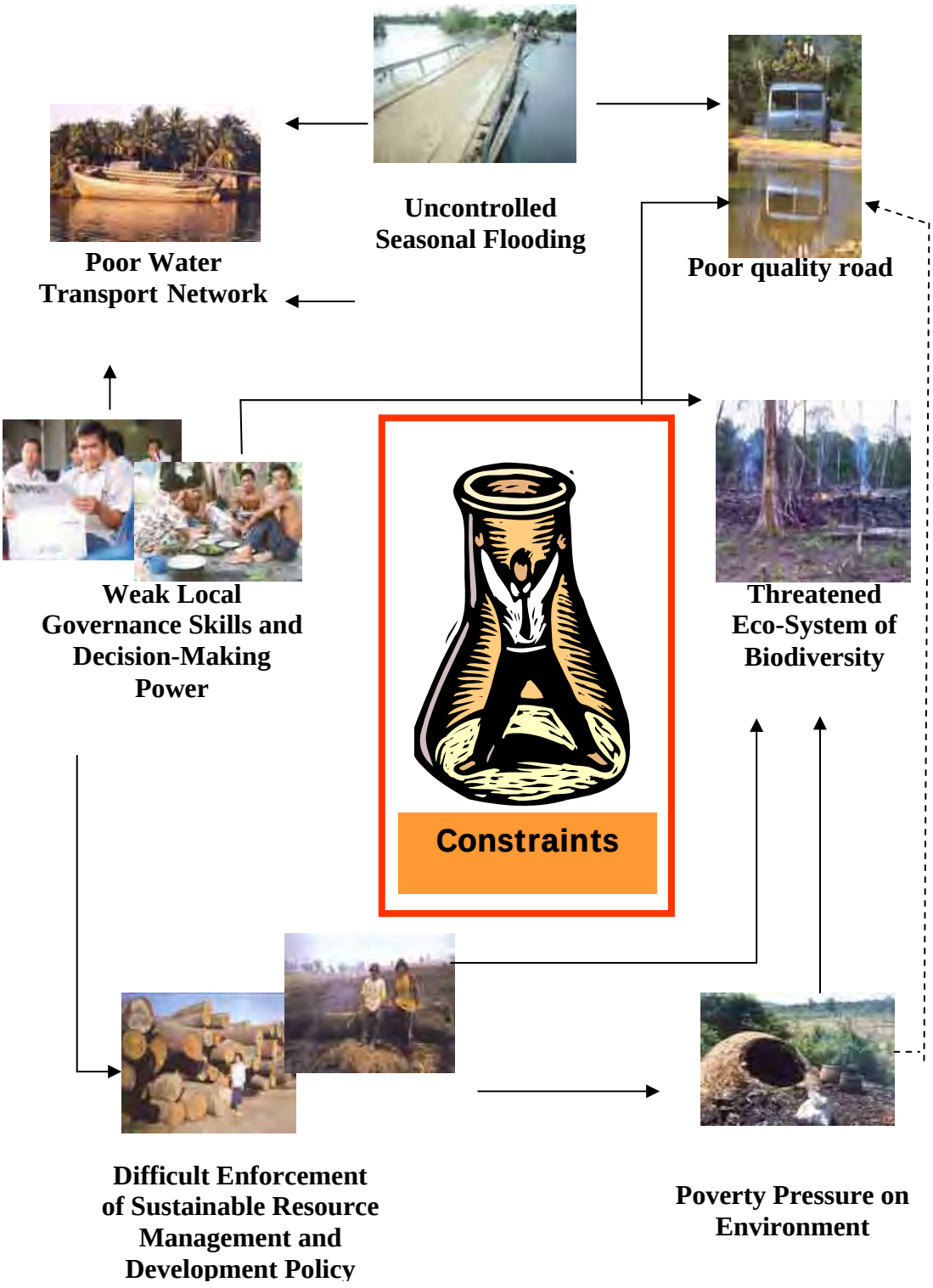
- 20% of irrigation system will be rehabilitated and built
- Increase rice production to 2.5t/ha
- Hydropower improved by 10% for Steung Sangke and Steung Chinit
- Improve tourism to 2.5 million tourists
- Improve access to safe drinking water by 40%
- Manage the watershed by 50%
- Reduce the population growth to 2.5%
- Increase the GDP to USD 400-500
- Human resource development
- Institutional development
- Expand irrigation system (large and medium scale)
- Expand and strengthen the agricultural sector (increase yield and secure food)
- Expand aquaculture
- Water way transport ensure prosperous economy
- People get enough access to safe water
- Tourism destination expanded and improved
- Yield of rice and other crops increased from 20 to 30% compared to the present yield
- Increase irrigation capacity from present time to 10 – 15% through rehabilitation of old irrigations schemes and newly built
- Increase 10-15 well (tube well or normal well) more from the present number
- Increase tourist number up to 15-20% in the Sub-area particularly in Siem Reap province through improvement of tourism destination, road network and services
- Ensure a balance development by reducing negative impacts through strengthening application of law, community participation and use of adequate technologies.

20 year objectives:

- Living standard of the sub-are population stabilized with integrated income generation by using local resources and sustainable environment
- Establish a permanent mechanism for the central and local level to plan and implement the sub-area development plan with transparency
- Establish legal process of the sub-area planning for the Tonle Sap Sub-area with all stakeholders involved
- 35% of irrigation system will be rehabilitated and built
- Increase rice production up to 3.5t/ha
- Hydropower improved by 20% for Stung Sangke and Stung Chinit
- Improve tourism to 3.5 million tourists
- Improve access to safe drinking water by 70%
- Manage the watershed by 70%
- Reduce the population growth to 1.5%
- Increase the GDP to US$ 500-700

- Develop the hydropower sector
- Rice quality improved for exportation (also quantity)
- Aquaculture expanded and strengthened in quantity and quality
- Hydrology modernized
- Navigation ports developed according to adequate modern technologies
- Food security achievement through the best use of natural resources and high irrigation efficiency
- Up to year 2023, 80% of sub-area population will get access to the safe water and every industries services will be assured with water supplies
- 50% of the hydropower potential will be developed with a maximum reduction of negative impacts
- Tourism industry will be developed to its available potential through different services support (water supplies and waste management).

5.3. Constraints



5.4. Risks of Intervention

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
Deforestation impacts on economy and society. Progressive disappearance of the flooded forest in the Tonle Sap Sub-Area is a serious threat for fish reproduction and refuge where large numbers of people draw upon fishery resources for a high proportion of their subsistence and income needs. Flooded forest pays the highest tribute to this depredation: 54% of area disappears between 1985 and 1993 (70,783 ha per year).	Presence of biodiversity ecosystem is of interest for funding agencies. The unique eco-system able to provide substantial and diverse resources to insure quality livelihoods. Strong conflict of interests. Weak local governance.	To prepare feasibility studies and project proposals for funding and submit to interested donors. To map and delineate which areas are to be preserved and which are allowed to be developed and to demarcate and patrol those areas designated for preservation. To develop alternative sources of income and employment for people responsible for degrading flooded forest. To what extent is this deforestation caused by outsiders (i.e. industrial interests who co-opt local people to develop the area, and those who live above the road coming down to farm in the flooded forest in the dry season? If the latter, then development/ improvement of the upper areas will contribute to reducing pressure. To appeal to the highest powers to prevail upon them to reduce these activities and support the preservation of the remaining area. Another option is to publicize the problem so that public support is gained and pressure placed on these interests.	Dependence upon aid agencies and banking institutions Over-exploitation of natural resources at the expense of the environment. Long process

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Enforcement of regulatory framework is challenged by impunity and highly profitable practices.	Capacity building and awareness rising on the issue.	Long process
Decline of fishery resources is of great concern. Current captures contain hardly any large fish and was strongly dominated by small fish. Every year, between 1987 and 1993, the average area of eco-system which support fresh water capture fish has declined 9.7% equivalent to 30,150 ha.	Weak legal framework in Fishery Resources management and development. Weak local governance. Lack of government resources to conduct research and recommend measures.	To strengthen legal framework in fisheries resource management. To build capacity through "learning by doing", thus this intervention could best be combined with the intervention requesting assistance from the outside aid agencies as a means of addressing the core issues in a capacity-building and participatory manner. Capacity building and awareness rising on the issue. Others who might be targeted include those who are damaging the resources as a whole, such as China (dam building on the upper Lancang/Mekong), those engaging in destructive fishing practices such as using illegal gears and explosive/electrical fishing. It is best to formulate the problem and idea to solve it prior to approaching aid agencies in order to maintain more input and control of the solution.	The long process does not fit with immediate individual interest. Dependence on aid agencies

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Overlapping mandate of acting institutions	To clarify respective mandates. Political appeals and campaigning: appealing to the highest authorities appears to have an impact on returning control of some resources to the local people. This is often brought about through a campaign both through the media and other methods to raise public awareness and bring pressure on the authorities for change.	Conflict of interests.
There is an immediate need for poverty alleviation so that pressure on environment and fishery resources can be regulated and relieved. Siemreap, Pursat and Kampong Chhnang provinces have the highest rates of poverty in the Kingdom with 50-60% and 40-50% respectively.	Tourism industry development will create a number of job opportunities. However how many of those opportunities are provided to the poorest people is the real question, because the poorest don't live where tourists tend to go for the most part. They are in a subsistence economy so don't produce things that tourists are interested in buying. They are the least trained and adapted to enter the service industry so are least likely to gain jobs from the tourist sector. The most concerning matter is the harm provoked by sex tourism industry on the most vulnerable people, especially young rural girls.	To strategize tourism development plan to attract investment so that job opportunities are effectively enhanced.	Pressure on environment and social side-effects.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Road infrastructure improvements facilitate investments. Impacts on the poor remain to be assessed, but the expected results are to bring opportunities for the poor to access education and health services markets for their produce and to get to places where they can find seasonal jobs, knowledge and information.		
	Abundant fishery resources insure food security.	To enforce fishery management and development policy.	Conflict of interests.
	Even though rice is not very productive as yields are among the lowest in the region, there is certainly room for improvement. But other things should be considered such as using higher value rice varieties which, while bringing low yields, bring 2-3 times the price to farmers. The Tonle Sap Sub-area is suited to the "Somali" fragrant rice in many locations, and twice the price is the equivalent of twice the yield.	To develop irrigation system and infrastructure and fertilization programme. Despite the fact that there is no evidence of correlation between the potential for irrigation system and poverty, the farmers certainly contribute to smaller scale and less discrete methods of soil and water management, improved agricultural techniques, diversification and markets development.	No insurance for rice price due to competition of neighbor countries. Trained skills do not fit with labor market.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	It is true that subsistence farmers are reluctant to diversify cropping until they have secured their main grain crop and so there needs to be serious efforts towards improving the main wet season rainfed crop that most farmers rely upon. Diversification will unevitably increase now through with the rehabilitation of the road network and connection to Thailand and Vietnam.		
	A number of unqualified migrants.	To train and educate young people through non-formal education programme.	
	Weak provincial development policy and strategies.	To promote private sector investment through transparency, incentives and access to cheap and sufficient credit.	
	Difficulty in land law enforcement. Low salary/income.	To protect women from sex industry through law enforcement.	Long process
Water pollution and solid waste disposal	No data available to know the state of water quality.	To set up database on water quality and pollution.	Weak capacity pre-requires costly training of staff. Overlapping mandates leads to "laissez-faire".

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Lack of resources of relevant institutions to tackle this issue. But the most pressing issue than institutions (that exist) are the facilities for solid and liquid waste disposal. Disposal of waste is a difficult issue requiring a choice of technology all of which have some negative impacts and overcoming local opposition to disposal sites (the "NIMBY" syndrome - "Not In My Back Yard"). This is particularly acute and difficult with respect to toxic waste. Both those used in industries like agriculture (toxic pesticides) and illegal disposal of toxic industrial and solid waste from other countries which require enforcement of importation rules to prevent their entering the country.	To clarify relevant government policy and strategies so that financial resources are mobilized	
	Increasing population pressure. Tourism development aggravates the problem.	To enforce immigration law. To find balance between conservation needs and development policies.	Costs for waste are high especially in comparison to dumping improperly. Corruption develops where opportunity to reduce costs or gain profit exists.
	No waste recycling system to limit effects on environment.	To enforce relevant government policy and strategies relevant to environment protection.	

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Lack of local understanding of pollution problem and impacts and widespread practice of littering.	To promote proper waste disposal and stopping littering through public information campaign.	
Wildlife sanctuary endangered by animal trafficking: demand rising from neighboring and western countries increase pressure on local wildlife trade.	Attractive bio-diversity and endemicity of fauna for research on preservation of endangered species.	To design appropriate research programme in partnership with funding agencies.	Low absorption capacity and scientific skills of local researchers.
Traditional medicine market encourages traders to capture wild animals in the reserve zone.	High potential in funding opportunities for preservation of fauna and environmental /ecological research. Impunity and collusion of powerful actors.	To develop research programme that fit with international concern. To enforce relevant government policy and strategies relevant to core zone protection. To continue ongoing campaigns against trafficking in wildlife and cultural property.	Idem. Conflicts of interests.
Vulnerability to drought and flooding and crop failures.	Current production levels are low and could improve significantly without tremendous efforts.	Studies and research on traditional techniques and pilot projects to demonstrate their utility.	Small-scale efforts are less visible to donors and government so are lower priority.
	Irrigation infrastructure and land development have been handicapped by poor development of Khmer Rouge.	Proper engineering and rehabilitation of Khmer Rouge and other existing irrigation and drainage infrastructure.	Economic analysis of works is difficult.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	Flooding events are common both locally and basin wide and appear to be increasing.	Examination of successful techniques in other countries such as "controlled drainage" and improved water management.	Many Khmer Rouge works are not economically viable or require significant investment when available funds are low. Low capacity and salaries of government staff.
	Understanding of traditional soil and water management techniques is limited due to losses of people and culture.	Promotion of small-scale techniques and improvement of agricultural extension services.	
	History of area is famous and proud legacy that could motivate restoration efforts.	Collection of required hydrological, meteorological economic and soils data required to improve designs. Working closely with local farmers to improve their situation and preparedness for disasters.	Lack of understanding of the value of data. Difficult and long process required to work with farmers on management entities. Lack of experience in these techniques.

5.5. Cross-Cutting Issues

5.5.1. Environment

– The commercial logging sector is characterized by active logging, often carried out on a cross-border basis. The demand for wood in Thailand and Vietnam is a major factor driving logging in Cambodia.

Figure 9: Forests in Lower Mekong Basin in 1997

- Commercial forestry activity is often carried out on an unsustainable scale, with government regulatory controls sometime unable to prevent overexploitation.
- Increasing run off in logged areas can result in erosion, turbidity and sedimentation.

Table 11: Deforestation Rate in Lower Mekong Countries

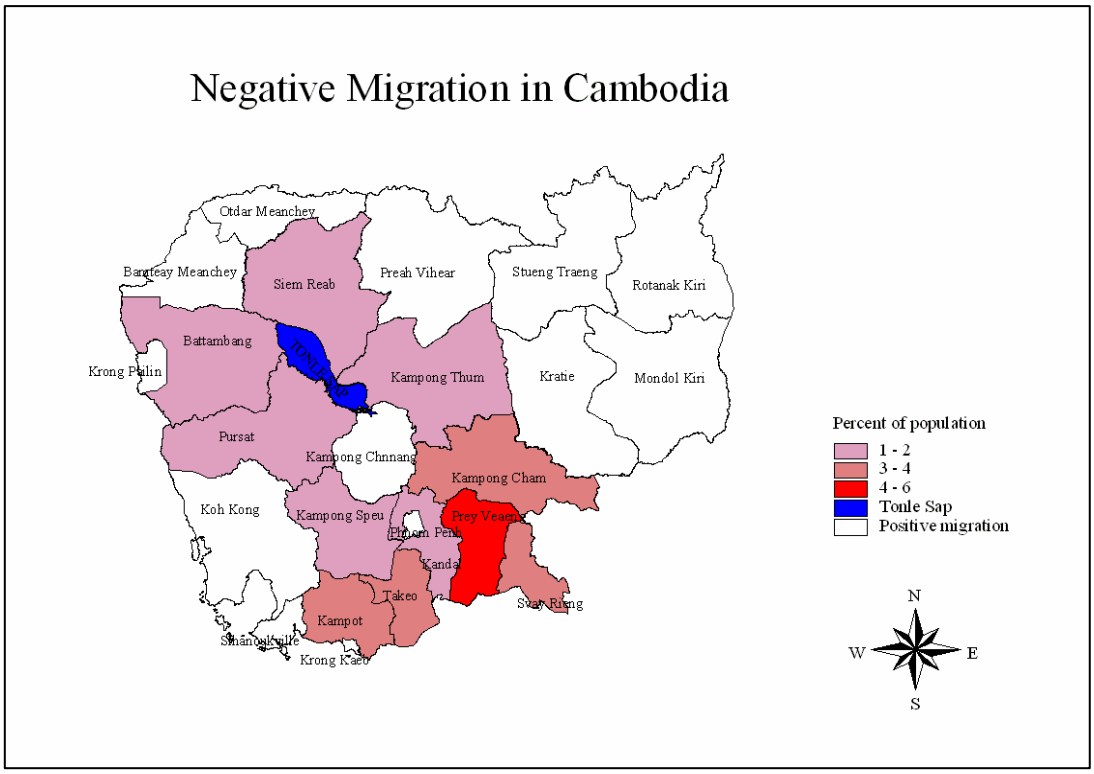
Area	Deforestation Rate, %
Cambodia	0.50
Lao PDR	0.58
Thailand	0.40
Viet Nam	0.73
LMB	0.53

5.5.2. Population Pressure

Demographic pressure seriously impacts on resources exploitation which destructive practices impede equitable sharing of benefits. The demographic pressure on environment is a major factor of aggravation of poverty for future generation.

5.5.3. Gender

- Women are vulnerable to deficient health care, HIV/AIDS, human trafficking and domestic violence.
- Women compose 65.9% of the economically active population and 54% of skilled agricultural actors and fishery workers.
- Literacy rate for women is 61.1% compared to 82.9% for men. Women have limited employment opportunities.



Source: WUP-FIN

Figure 10: Negative Migration in Cambodia

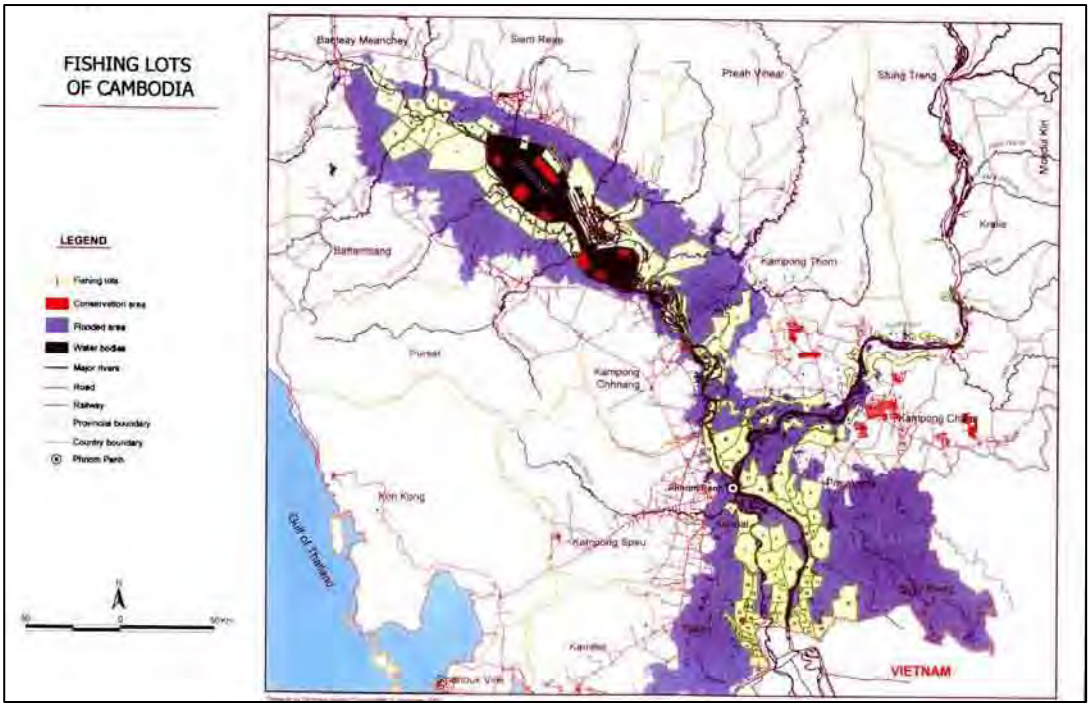


Figure 11: Fishing Lots in Cambodia

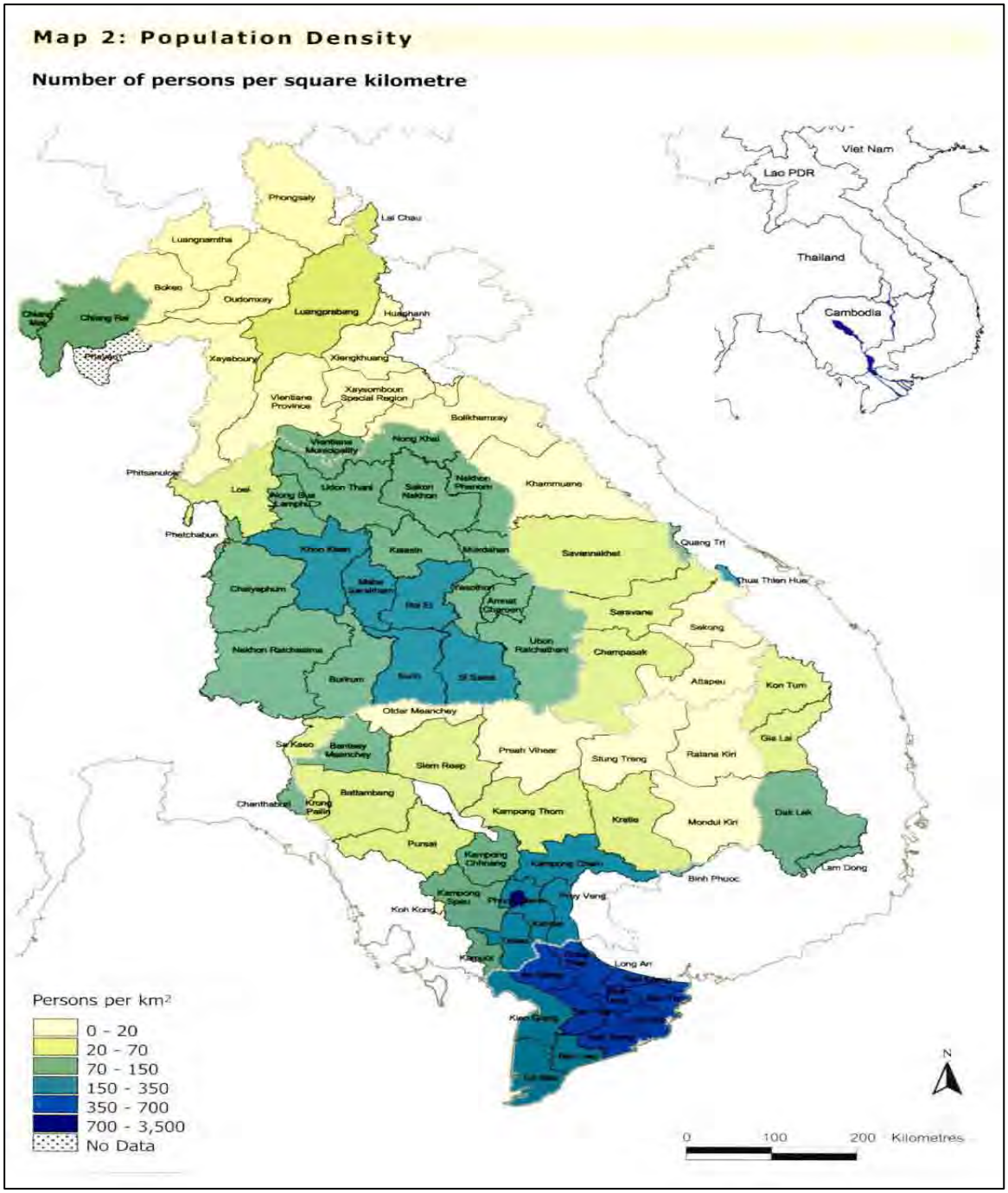


Figure 12: Population Density in LMB

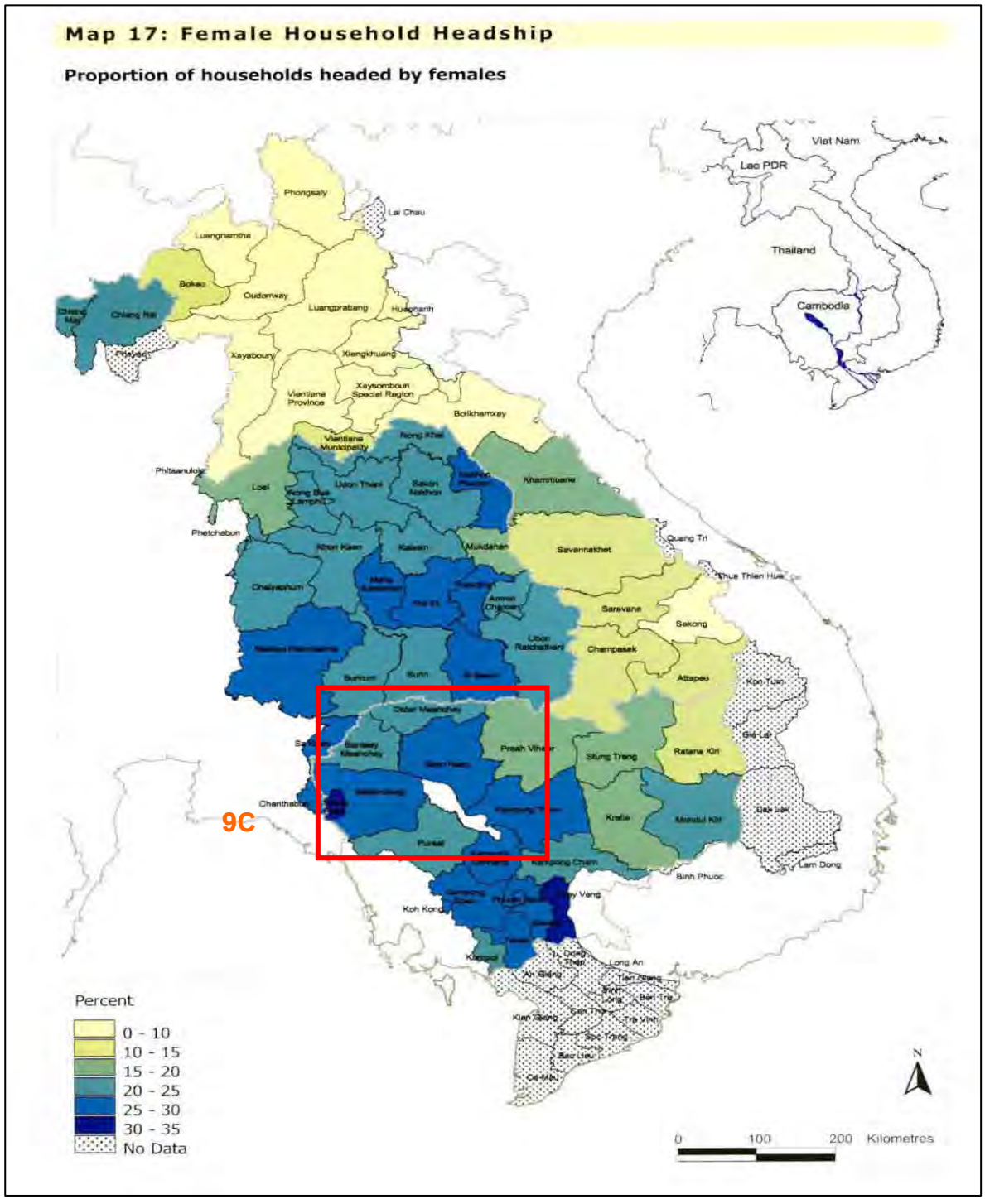


Figure 13: Proportion Households Headed by Female in LMB

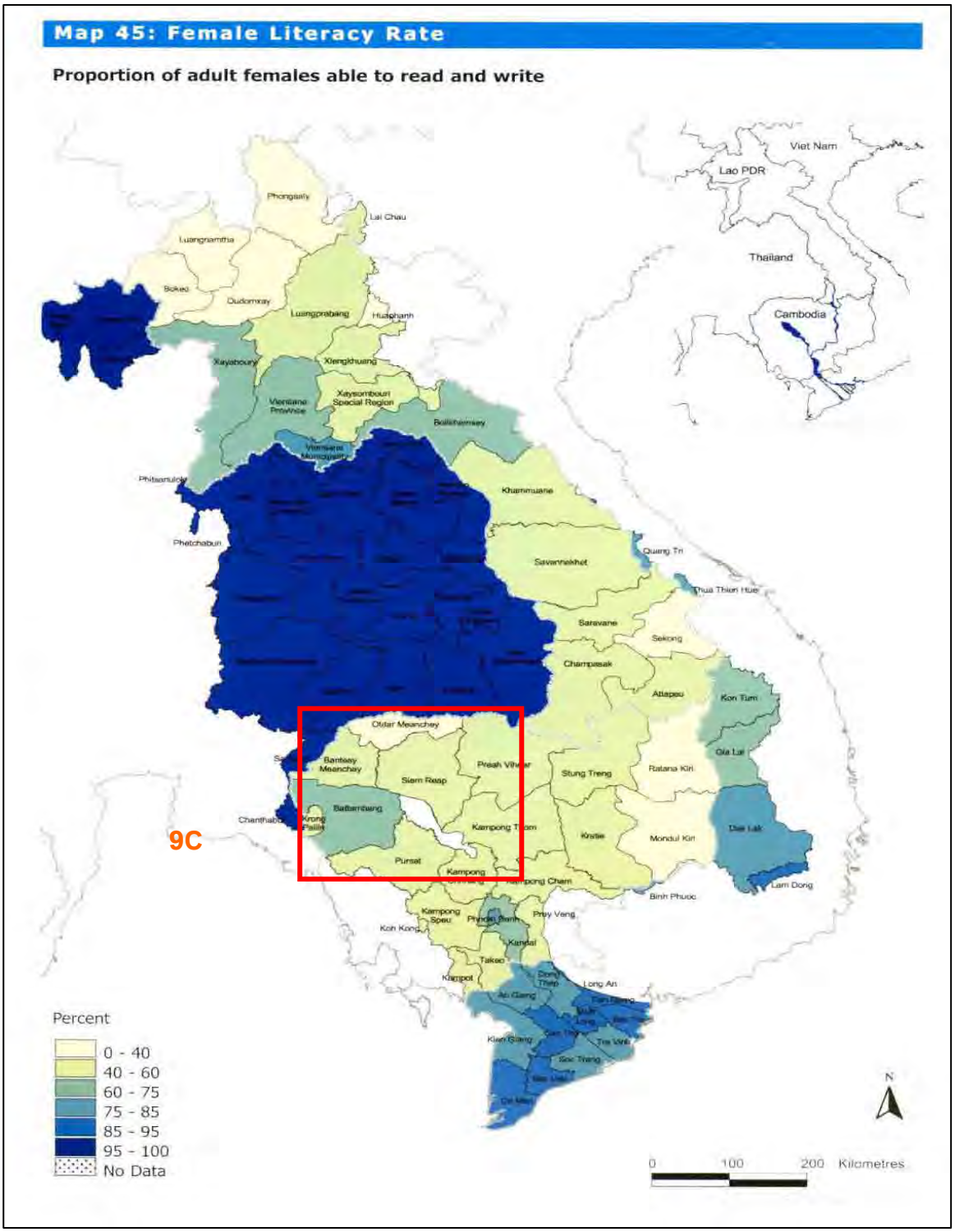


Figure 14: Female Literacy Rate in LMB

5.5.4. Access to Health Services

Actually, pollution of water sources is not a big problem yet. Proper sanitation practice is more the real issue. Water use education in concert with provision of hygienic sources of year-round water supply is the answer.

There is a strong correlation between the prevalence of malaria and other serious diseases and poverty, as poorer people are less able to prevent the spread of the disease or to seek cures. The cost of health care when serious illness strikes in terms of treatment and effects of poor quality treatment severely damages the household savings and places people in the poverty cycle.

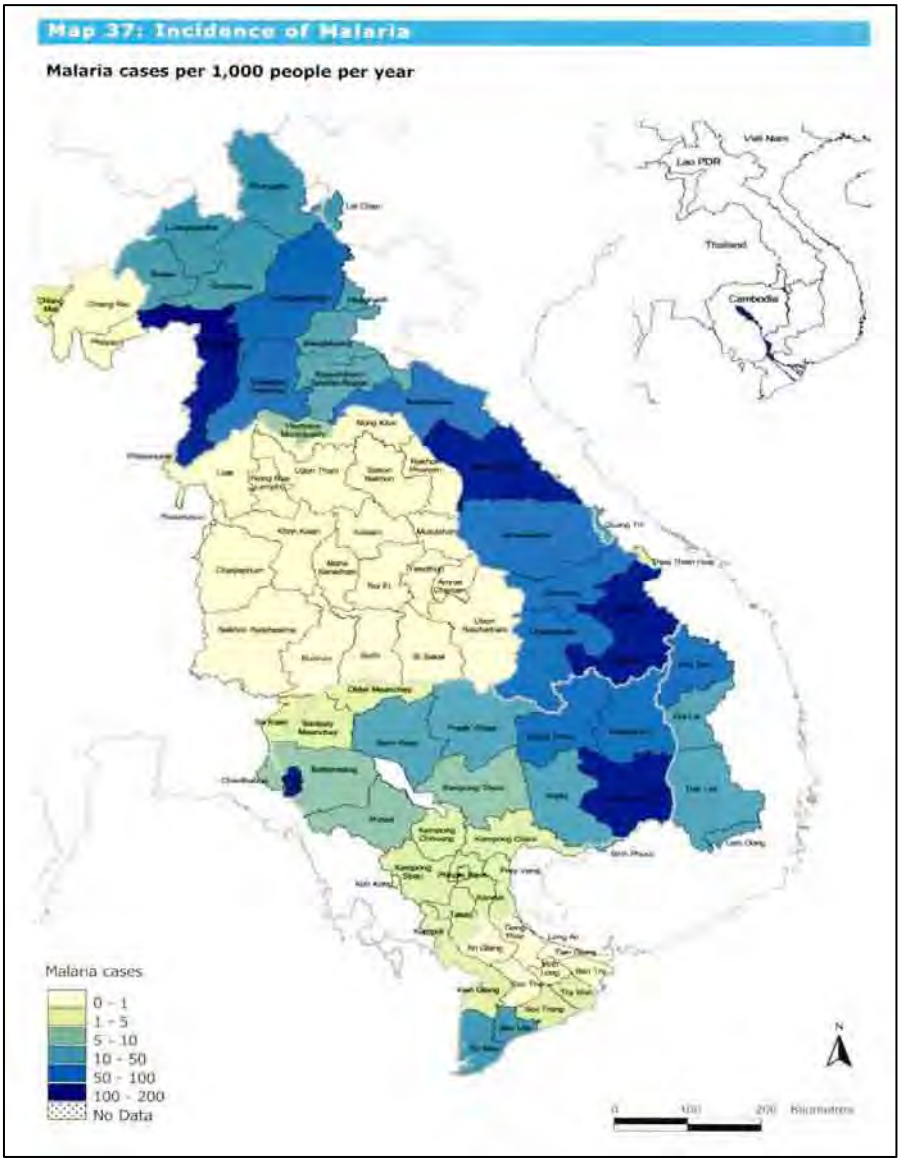


Figure 15: Incidence of Malaria in LMB

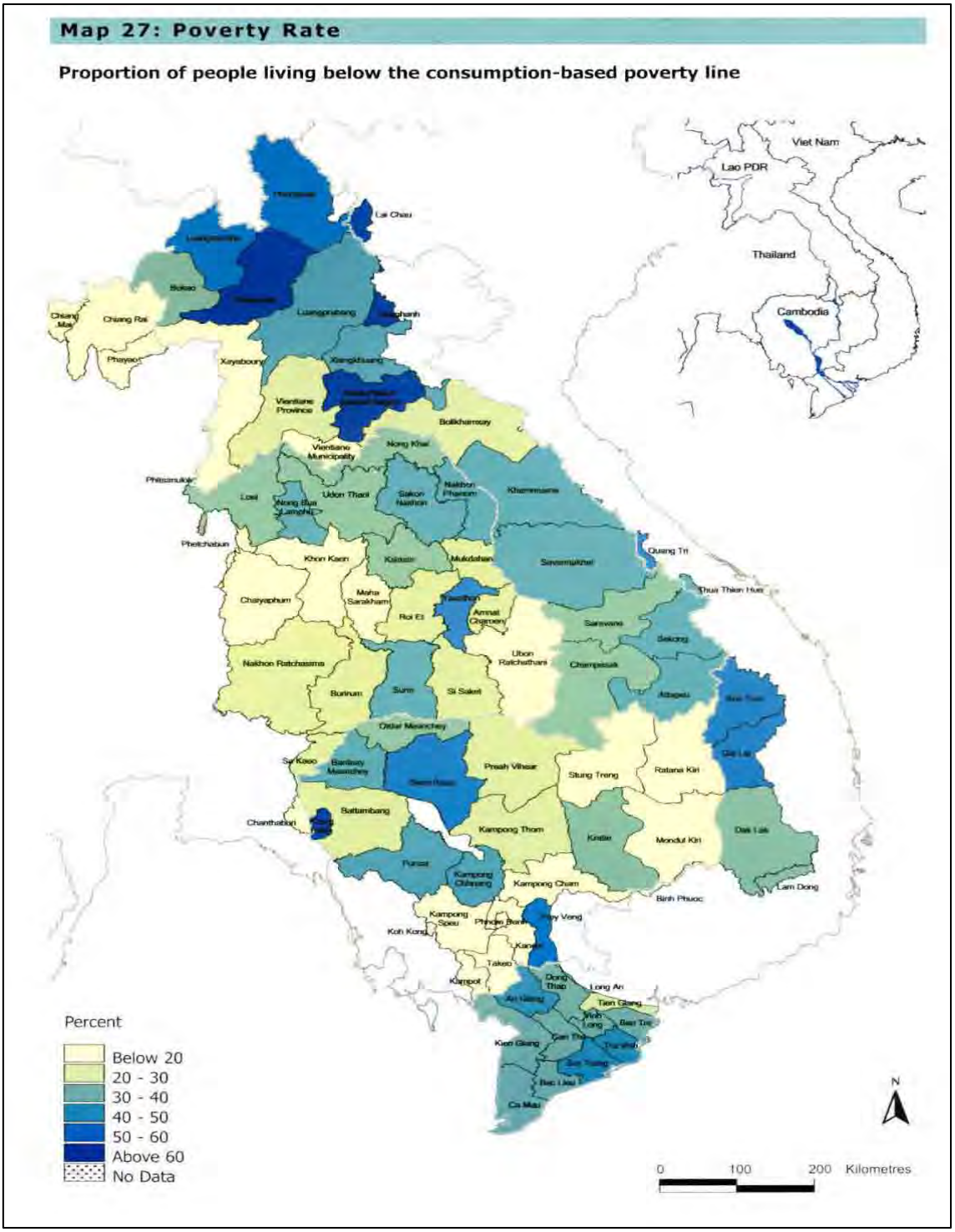


Figure 15: Poverty Rate in LMB

5.5.5. Human Resource Development

Human resource development is one of the fundamental of the country's development. The creation of employment opportunities needs to be strongly supported by availability of well-trained people able to provide quality services.
Outside of Phnom-Penh, fewer than 20 percent of people of secondary school are enrolled in school. Most young people are working by this age, and the network of secondary school age is very sparse throughout much of the country. The average distance from a village to the nearest lower secondary school is estimated at 27 km, too far for daily travel (MOP, 1999).

Educated people often find that there are no jobs available for their skills due to the slow development of the private sector economy. This leads to frustration and loss of the resource as the people are not able to gain the experience needed to provide the benefit from their education.

The education system is not geared towards the needs of the employers. The rote learning method employed does not engender the analytical skills looked for by outside investors.

Post-secondary educational institutions of international standard and recognition do not exist within Cambodia. Students graduating from these institutions are too few to fill the large need for their quality of services.

Governmental staffs with ability and training are often overworked; many leave for the private sector once trained resulting in a “brain drain”. There is often no clear delineation between the public and private sector jobs of these staff with resultant confusion of roles, conflict of interest and lack of continuity in both sectors.

5.5.6. Public Participation

Public participation at all the levels, central, provincial, district and commune are a key factor of success in the context of decentralization. The many different aspects of civil society including the private sector need to be encouraged to join within the processes that are currently dominated by development agencies and government.

As previously outlined in section 4.5.3, gender is a major factor in public participation –, women's voices are seldom heard, particularly in comparison to their proportion of the population and workforce.

Participation is a key element in the success of all development – it allows design to incorporate local knowledge and concerns, people to gain ownership and makes long-term management and maintenance sustainable.

5.6. Factor for Change

Balance between Centralism and Localism in managing resources is conducive to interactive, accountable and sustainable governance is made possible: Real delegation of decision-making power is crucial.

Equitable access to local resources: The fundamental challenge is to reduce the vulnerability of the poorest through fair sharing of the benefits of the national resources exploitation.

Better access for the population to health, education, sanitary services and employment opportunities. The Gender dimension of this social welfare should be a focus point.

Innovative, responsive and participatory development strategies taking into account key issues: poverty, migration, shortage of water supply, fragility of eco-system, land grabbing, local governance. Multi-sectoral planning and inter-ministerial measures should be prioritized instead of separate approach.

Modernization of infrastructure including inland and water transportation network, flood control system: this will significantly contribute to encourage economic and industrial investment needed for stimulating for instance tourism and creating employment opportunities.

5.7. External Assistance to Environment and Natural Resources Sector in the Tonle Sap Sub-Area

Non-Exhaustive Inventory of External Assistance to the Environment and Natural Resources Sector relevant to the Tonle Sap Sub-Area

Project	Duration	Source	Objective	US$ million	Area of Operation
Management of the Freshwater Capture Fisheries of Cambodia	Ongoing	MRC, Denmark	To study socioeconomic and community organization for improved management	2.30	national
Strengthening Inland Fisheries Management Systems	2001-2004	MRC	To establish database for national Mekong Basin capture and culture fisheries; and regional capture and culture fisheries and strengthening national capacity for data collection, storage, processing, analysis, interpretation and dissemination.		Tonle Sap
Participatory Natural Resource Management in the Tonle Sap Region	1995-1998 1998-2001 2001-2003	FAO Belgium	To conduct research and data collection on the flora and fauna of the flooded forest ecosystem and the socio-economy of fisheries and border zone agricultural communities; and to develop natural resource management by local communities.		Siem Reap

Project	Duration	Source	Objective	US$ million	Area of Operation
Natural Resource and Environment Program	2001-2006	DANIDA	To sustain environmental resource management based on environment-friendly, technologically, and socio-economically sound use of natural resource by the communities, the private sector and government; mitigate against the detrimental effects of urban and industrial development and support environmental education, particularly among the younger generation.		National
Protection and Management of Critical Wetlands in the Lower Mekong Basin	1998-2001	ADB	To prepare proposals for investment to develop & support community-based integrated management systems.	1.65	Cambodia Lao PDR
Agricultural Productivity Improvement	1999-2003	WB	To strengthen agronomy, animal health, fisheries and agricultural hydraulics, all of which have capacity building responsibilities.	3.40	North and northeast, including Kg Thom and Siem Reap.
Community-based Rural Development	2001-2005	IFAD	To sustain increased food production and farm incomes from intensified and diversified crop and livestock production; and increase the capacity of the poor to use services available from the Gov. and other sources for their social and economic development.	22.80	Kampong Thom and Kampot

Project	Duration	Source	Objective	US$ million	Area of Operation
North East Village Development	2002	WB	To promote rural development through direct productive activities training in agriculture, fisheries and vegetable cultivation, micro-enterprise development, small-scale rural infrastructure and harbor improvement.	6.0	Kampong Cham, Kampong Thom and Stung Treng
Cambodia Land Management and Administration	2002-2007	WB	To improve land tenure security and promote the development of efficient land market	33.40	National
Support Program for the Agricultural Sector in Cambodia	1995-1998 1999-2003	EU	To increase the income of the farming communities and to nourish a prosperous life in the rural vill.	39.0	Kg. Chhnang, Kg. Speu Kg. Cham, Prey Veng Svay Rieng, and Takeo
Stung Chinit Irrigation and Rural Infrastructure	2001-2006	ADB AFD	To increase income and improve quality of life by providing sustainable irrigation, agricultural extension and rural infrastructure, such as road and markets.	23.80	Kampong Thom
Northwestern Rural Development	2002-2007	ADB	To reduce poverty through accelerated rural development	35.30	Battambang, Oddar Meanchey, Banteay Meanchey, Siem Reap
Tonle Sap Environmental Management	2002-2007	ADB GEF UNDP	To enhance systems and develop the capacity for natural resource management coordination and planning, community-based natural resource management, and biodiversity conservation in the Tonle Sap biosphere reserve.	19.40	Tonle Sap

Project	Duration	Source	Objective	US$ million	Area of Operation
Improving the Regulatory and Management Framework for Inland Fisheries	2003-2004	ADB	To improve the regulatory and management framework for inland fisheries, with special attention to the sub-decree on community fisheries.	0.50	Tonle Sap
Chong Kneas Environmental Improvement	2003-2004	ADB Finland	To prepare an investment project to improve the social and natural environment at Chong Kneas	0.90	Siem Reap
Capacity Building of the Inland Fisheries Research and Development Institute	2003-2004	ADB	To develop the inland fisheries research and development institute as an efficient, effective and relevant research and development institute.	0.90	Tonle Sap

Source: ADB, 2003.

Analysis of External Assistance:

- Considerable financial resources are devoted to – directly or indirectly – develop economy, human capacity and institutions in the Tonle Sap Sub-Area. Environment and agriculture sectors are the main beneficiaries, but also legislation and community organization. Civil society strengthening is crucial and deserves more attention from external assistance, given the significant role it occupies in advocacy and decision-making process.

- Several key institutions are involved, including the Ministry of Agriculture, Forestry and Fisheries (MAFF), the Ministry of Public Works and Transport (MPWT), Ministry of Tourism, Ministry of Planning, Ministry of Environment and the Ministry of Water Resources and Meteorology (MOWRAM). Dispersion of resources often occurs due to overlapping operations because of lack of clear mandate and inter-agency cooperation.

- Cambodia seriously suffers from poor absorption capacity of foreign aid due to lack of human resources, particularly in the provinces. Lack of proper training, experiences and critical skills and little opportunity to apply their skills are key factors of de-motivation. Indeed, this situation is aggravated by the low salary of its civil servant. The implication of this is a strong dependency on external technical assistance and funds for complementing salary of government staff.

- Therefore, foreign aid agencies tend to take the lead role in the projects rather than the local staff or institutions.

- Experience demonstrates that participation-oriented planning remains difficult to achieve because of the need for much time and patience. Often the agenda and short timeframes of outside development agencies drives the process resulting in top-down and non-integrative approaches that are less effective.

CHAPTER 6: STAKEHOLDERS AND DIALOGUE

Institutional capacity throughout the Royal Government of Cambodia (especially at sub-national levels) is limited, because of the loss of an entire cohort of people during the civil war, low salaries in the public service, run-down infrastructure, etc. To address this problem, the Government is implementing a variety of measures in administrative and governance reform. Capacity building is another concern with physical facilities, ongoing funding for operational purposes and human resources development will continue to be required in MOWRAM, other water-related institutions, and the public services as a whole. The RGC seeks a greater level of private sector and/or beneficiary involvement in water services provision (water supply, sanitation, hydropower, irrigation).

Given the difficult situation with respect to human resources and the identified widespread weakness in the concerned government agencies, a number of different efforts are required to gradually address these deficiencies. A key factor in overcoming the constraints is identifying them clearly. Some of these issues are discussed below.

6.1. The Draft Water Sector Roadmap for Cambodia

Interesting initiatives to address the various water sector issues exist. For instance, a Draft Water Sector Roadmap for Cambodia has been presented by the Government to ADB and discussed in a consultation meeting in April 7th 2003. The roadmap summarizes the RGC's goals for the water sector in Cambodia and provides a basis for setting priorities and planning investment and development assistance. It also reviews the context provided by national goals for poverty reduction and socio-economic development. It provides an overview of the sector, and considers the issues and constraints that are faced. Finally it summarizes recent, current and planned activities and investment by international funding agencies. The road map does not actually define a single direction to go, but indicates the possible routes to many destinations, and the obstacles that must be overcome.

6.1.1. Sector Issues and Constraints

The key issues and constraints in the water sector have been classified in various ways by recent analyses, such as the National Water Sector Profile (MOWRAM, 2001). In this roadmap, issues are grouped into the following topics:

- Legislation and policy
- Institutional arrangements
- Institutional capacity
- Providing data and information
- Managing irrigation and drainage systems and other water-related infrastructure
- Mitigating the impacts of water-related hazards
- Managing competition for water and deteriorating water quality
- Conserving aquatic ecosystems and fisheries
- Managing international water resources

- Managing the coastal zone
- Financing water resources development and management

6.1.2. Summary of issues and constraints[5]

Legislation and policy

There is not at present a coherent body of water-related law, regulatory instruments, or policy. A draft Law on Water resources Management (WRM) is before the National Assembly, and a draft National Water Resources Policy is before the Council of Ministers. Several sub-sectoral policies are at various stages of development or approval. Implementation of laws is generally weak, although advances are being made, e.g. in administering water pollution-related provisions of the Law on Environmental Protection and Natural Resources Management. The MOWRAM needs to develop the institutional capacity to administer the Law on WRM if/when it is passed.

Institutional arrangements

Several RGC line ministries have responsibilities for different aspects of water resources exploitation, while the CNMC deals with Cambodia's responsibilities under the Mekong Agreement. The MOWRAM was established in 1999 with a mandate to manage the Nation's water resources, but has directed its attention primarily towards irrigation and drainage (I&D). Inter-agency relationships tend to be competitive and uncooperative, although MOWRAM has reached formal agreements with several other ministries to delineate responsibilities. The RGC is devolving responsibilities to provincial and more local levels, which will require allocation of increased financial and trained human resources, to lessen reliance on non-governmental support. Institutional arrangements for managing I&D works are reasonably well-defined, with some lack of clarity regarding relative responsibilities of MOWRAM, MRD and MAFF for water management for agriculture. However, water management cannot be sustained because of limited government resources.

Institutional-Community capacity

Institutional capacity throughout the RGC (especially at sub-national levels) is limited, because of the loss of an entire cohort of people during the civil war, low salaries in the public service, run-down infrastructure, etc. The RGC is implementing a variety of measures in civil service and governance reform. Capacity building, in terms of physical facilities, ongoing funding for operational purposes and human resources development will continue to be required in MOWRAM, other water-related institution, and the public service as a whole. The successful development of PPWSA as a public corporation is a good example of what is possible, and the RGC seeks a greater level of private sector and/or recruitment programme will be required, at both central and provincial/district levels, in areas such as water resources management, law enforcement, support for

[5] Excerpt from: the Draft ADB "Roadmap" for the Cambodian Water Sector. Draft report on MRC participation in the ADB meeting on the Water Sector "Roadmap" for Cambodia, April 7th 2003.

community groups, etc. This will assist the Ministry to evolve from a primarily construction and operation agency, to one that is able fully to carry out its mandate in water resources planning, management and regulation.

Providing data and information

The capacity of MOWRAM and other RGC agencies to provide the data and information required for design of water-related infrastructure, development and management of water resources, and management of extreme events (droughts and floods) is limited, although participation in international programmes in the dissemination of data and information about water resources and use (quantity and quality; surface water and groundwater), river basin characteristics, weather and climate is needed, in terms of a coordinate water and climate information strategy. Exchange of existing information among RGC institutions is not always efficient, because of a lack of awareness of what is available, a lack of formal mechanisms for obtaining access, and possessiveness regarding information assets. As a result, the heavy investment by international funding agencies in natural resources information has not been fully effective. The draft National Water Resources Policy includes policies on exchange of data and information. Mechanisms and willingness to implement these policies will be required.

6.2. Overlaps in Managing Natural Resources (Example of Costal Zone Management in Cambodia)

One of the features of the Cambodia's institutional management is a large degree of overlapping roles, rules and responsibilities. For instance in costal zone management, it is seen that the nine institutions are involved – be they departments or offices – and have overlapping activities and legal provisions. Current overlaps/conflict between institutions account for 62% while potential overlaps/conflict represent 38%.

Table 12: Existing and Potential Institutional Overlaps in Coastal Zone Management in Cambodia

Responsible Department/Office	In	Fo	Fi	Ag	To	Tr	Lu	Rd	En
Industry (In)		P	CP	P	P	P	CP		CP
Forestry (Fo)	P		CP	CP	P	P	CP	P	CP
Fisheries (Fi)	CP	CP		CP	P	CP	CP	P	CP
Agriculture (Ag)	P	CP	CP		CP		CP		P
Tourism (To)	P	P	P	CP		P	CP		P
Transportation (Tr)	P	P	CP		P				CP
Land Use (Lu)	CP	CP	CP	CP	CP			CP	CP
Rural Development (Rd)		P	P				CP		CP
Environment (En)	CP	CP	CP	CP	P	CP	CP	CP	CP

Note:

- C: Current overlap/conflict
- CP: Potential overlap/conflict

Source: RGC, 1998.

Table 13: Current and Potential Overlaps among Legal Provision in Cambodia's Coastal Zone Management

Legal Provision	FL	FIL	LEPNRM	LL	LLM	PA
Forest Law (FL)	CP	CP			CP	
Fisheries Law (FIL)	CP		CP			CP
LEPNRM	CP	CP				
Land Law (LL)	P				CP	CP
Law on Land Management Utilization and Construction (LLM)				CP		
Protection Areas Decree (PA)	CP	CP		CP		

LEPNRM: Law on Environmental Protection and Natural Resources Management
Source: RGC, 1998.

With respect to legal provisions which include six key laws, nearly 47% of current overlaps/conflicts have been identified, 3% of potential overlaps/conflict (Land Law – Forest Law). These overlapping rates have been calculated based on the below tables. Overlaps and conflicts are factors limiting possibility to enforce laws and regulations in a consistent and coherent manner.

6.3. The Fisheries Sub-Sector (Difficult Implementation of Regulatory Framework for Fish Exports)

As described in Fish Exports from the Great Lake to Thailand: an Analysis of the trade Constraints, Governance and the Climate for Growth. Working Paper #27 (CDRI, 2003), there are numerous constraints to export fish as a result of actual practices rather than strict implementation of the official regulatory system.

For instance, the study pointed out that only one-fourth to one-tenth of the actual shipment amount is declared in fisheries statistics and that exporting fish from Snok Trou to Thailand involves 27 different fee payments to 15 institutions in 16 different places. Institutions with no direct role in fisheries management actually collect 80 percent of fees (CDRI, 2003). Among the numerous recommendations raised by the study, it is suggested that fees collected by checkpoints and institutions that have no clear legal basis for collecting fees should be eliminated. To decrease the impact of these checkpoints on fish trade, regular monitoring of roads is needed to identify and remove unauthorized checkpoints, and to ensure that authorized checkpoints are operating in accordance with legal mandate. In addition, it is also recommended to establish a "non-stop" fee payment service with transparent procedures and clearly defined fee levels.

6.4. Analysis

The above examples suggest that, if lack of human resource in terms of quantity and quality is recognized as the major factor of the institutional capacity weakness, a number of socio-political factors also impede national institutions from properly enforce existing law and regulations. In this context, there are a lot of limitations in the improvement of data accuracy and reliability, since statistics and figures generated by various institutions

lack of consistency and comprehensiveness. Time, political willingness and success of public reform are prerequisites for change of mindset and behavior.

PART III

Sub-Area Scenarios and Development Strategies (Forum #2)

CHAPTER 7: KEY ISSUES

This chapter introduces economic and environmental development needs, opportunities and concerns for the Tonle Sap Sub-area. All main issues raised below resulted from the sub-area report, group discussions during the working sessions, Forum 1 and Forum 2.

7.1. Needs (20 year timeframe)

Socio-economic issues

1. Security and social welfare
2. Food security for rural families and surplus for market
3. Sufficient and safe water supply
4. Access to health service, medicines, and knowledge
5. Ease to travel and transport
6. Enough access to electricity
7. Technical and financial assistance
8. Access to credit services
9. Gender balance
10. Demining

Environment and natural resources issues

11. Environmental security
12. Equal rule and natural resource management
13. Structure to manage the Tonle Sap Sub-area through decentralization and deconcentration
14. Protect and use the available resources adequately
15. Trans-boundary policy for country, province, district, commune, village and community

Capacity building

16. Improved knowledge and capacity

Public participation

17. Participation in basin development planning and its implementation

Institution

18. Good governance
19. Reform in micro-credit system

Sectors

Agriculture

20. Increase rice and other crop yields, and livestock production
21. Market for agricultural products
22. Processing development and agro-industry
23. Information and extension system

Fisheries

24. Increase fish production

Tourism

25. Tourism physical infrastructure development
26. Tourism human resources development and job opportunities

Industry

27. Investment encouragement in small and medium scale enterprises for more income

Flood controls

28. Protection against the natural disaster

7.2. Opportunities (20 year timeframe)

Agriculture

1. Agriculture intensification and crop diversification (increase cropping season and increase yield) for rice & other crops
2. Agro-industry
3. Irrigation system rehabilitation and development
4. One village one product development
5. Improve soil and water management for wet season crops
6. Smallholder livestock development

Fisheries

7. Develop non-capture fisheries – aquaculture, cage culture
8. Regional network in fisheries research and development

Water supply for domestic and industry

9. Develop water supply and sanitation
10. Improve the use of surface water and groundwater

Tourism

11. Develop regions for eco-tourism and cultural tourism
12. Develop agro-tourism
13. Emerald Triangle Tourism Development (9C and 6C)

Industry

14. Increase in internal and external private sector investment
15. Value-added processing of agricultural products by SMEs
16. Development of garment industry and other basic industries
17. Development of cottage industry

Hydropower

18. Hydropower potential
19. Minerals development

Navigation and transport

20. Port construction
21. Navigation network improvement
22. Develop international airport within the sub-area for safety of the Angkor Watt temple

Institution

23. Project implementation through International Development Organizations
24. Project implementation through community and NGOs
25. Increasing HRD from development project work
26. Demining is being supported

Regional cooperation

27. Railroad from Phnom Penh to Thailand and Vietnam
28. National Road development between Bangkok, Phnom Penh and Ho Chi Minh City
29. ASEAN Open Border Policy
30. Regional Airline Network and Carriers
31. Cargo Terminal in Kampong Chhnang

7.3. Concerns (20 year timeframe)

Socio-economic issues

1. Population growth: increase water and natural resources demands so impacts will be unavoidable
2. There will be increasing gaps between the rich and the poor, therefore social conflicts emerge
3. Increased illegal resettlement and labor market competition
4. Lack of budget
5. Limited human resources
6. Lack of electricity

Institution

7. Lack of data and information (no consensus)
8. Do not have clear sector plans and roles overlap
9. Limited efficiency of credit use and management
10. Limited effect of rule of law and its application

Public participation

11. Limited public participation

Environment issues

12. Water resources threatened
13. Droughts and floods
14. Environmental degradation and pollution – decline of natural resources and biodiversity
15. Fisheries and forest violation
16. Habitat degradation: forests, flooded forests, wetlands
17. Irreversible impact from conversion of flooded forest
18. Siltation and erosion of key tributaries of Tonle Sap River
19. Large concerns regarding environmental impact
20. Expansion of agriculture will demand more water and affect the water quality
21. Development of urban infrastructure impacts on the environment
22. Trans-boundary issues:
    - Upstream Mekong River development
    - Water resources, fish seeds, rice seeds, biodiversity
    - Trans-boundary policy (for country, province, district, commune, village, community)
    - Cooperation between people upstream and downstream will not be complete
    - Low international cooperation in the (Mekong) region

Agriculture

23. Increased agricultural production through the use of inorganic fertilizer and pesticides
24. Lack of technologies
25. Unwillingness to change laggard traditional practices
26. Market competition in the region is still weak
27. Inappropriate trading framework

Fisheries

28. Loss of local fish species
29. Introduction of fish species which harm the local fish
30. Expansion of irrigation systems: water storage will block fish

Tourism

31. Increase of tourism will lead to increasing solid waste and water pollution

Industry

32. Development in industrial sectors

7.4. Development options for analysis

The agenda

- Economic growth
- Food security (and surplus for market)
- Improved rural and urban livelihoods
- Changed lifestyles
- Land use management
- Water and soil management
- Habitats degradation: wetlands, inundated forests, forests
- Addressing the problem of loss of fish species
- Transboundary issues
- Careful introduction of new technology
- Strengthen and increase human resources
- Regional development cooperation

Opportunities ... and concerns

Opportunities:

- Agriculture
- Fisheries
- Watershed management
- Tourism
- Water supply
- Hydropower
- Navigation and transport

Concerns:

- Water resources threatened
- Droughts and floods
- Change of flow regime due to upstream development
- Natural capture fisheries and aquaculture intensification
- Habitat degradation: forests, flooded forests, wetlands
- Loss of fish species
- Ecological change of the Tonle Sap Lake
- Loss of biodiversity
- Construction (that impacts on river system and wetlands)
- Population growth
- Excessive people migration
- Lost of traditional livelihoods

CHAPTER 8: SCENARIOS AND ELEMENTS BY SECTOR

This chapter introduces scenarios and element of scenarios by sector and by cross-cutting issues for the Tonle Sap Sub-area. The chapter resulted from group discussions during working sessions and Forum 2. The chapter was prepared for the formulation of scenarios and strategies for the Tonle Sap sub-area.

8.1. Scenarios and Elements by Sector

8.1.1. Irrigated Agriculture

Trends	Risks	Interventions
– Food security 100% and surplus for market – New type of food demand – Maximum increase in rice (3.5 t/ha) and other crops – Agriculture intensification, diversification and agro-industry through modern technology 2-3 crops/year – Increased irrigated areas: 200,000 ha – Increase quality of agricultural products – Expansion of agricultural areas into new locations further away and formerly mined or insecure areas – Introduction and extension of food processing from crops without using fertilizers and pesticides – High value-added for agricultural products for high income by SMEs – Lack of market for agricultural products – Market for agricultural products – More capacity for marketing competition – Livestock development: heads/family? – Agricultural land ownership – Increased use of chemicals – Decreased soil nutrients – Improved and increased	– Floods and droughts incidence – Climate change – Continued pressure resulting in environmental degradation – Flow regime change from upstream development – Pollution problems (chemical uses) – High competition for water resources use between sectors and riparian countries – Epidemics of human and animal diseases – Rice and other commodities market fluctuations – Private sector development fails to materialize – Increased foreign ownership/control	– Water Strategies (MOWRAM-ADB) – Eco-Zone Project (irrigation, livestock, extension, water supply) (RGC-EU) – Stung Chinit Integrated Rural Infrastructure Project (MOWRAM-ADB/AFD) – Cambodia-Australia Agricultural Extension Project (MAFF-AusAID) – Agricultural Quality Improvement Project (MAFF-AusAID) – Integrated Food Security Project (RGC-IFAD) – Sustainable Agriculture Project (RGC-IFAD) – Trapeang Thmar Irrigation Rehabilitation Project (MOWRAM-Japan) – Northwest Irrigation Sector Project (MOWRAM-ADB) – Greater Mekong Sub-region Programmes for tourism, navigation, agriculture and watershed management (RGC-ADB) – Preparation of land master plan – Preparation of market price policy – Supportive policy for local agricultural products – Demining is being

service delivery in term of agricultural extension, credit, banking and processing technology		supported

8.1.2. Fisheries/Aquaculture

Trends	Risks	Interventions
– Natural capture fisheries intensification: sustain average catch of last 5 years – Reformation of fisheries management policy – Aquaculture intensification: 100,000 t – Development of fish processing – Degradation of fish habitats and fish migration routes – Loss of local fish species	– Flood and drought Disaster – Fishing and forest violation – Water resources threatened – Flow regime change from upstream development – Loss of non-renewable and critical resources – Loss of biodiversity – Continued pressure resulting in environmental degradation – Lost of critical wetland – Siltation and erosion of key Tonle Sap tributaries are affecting fisheries – Pollution problems – Climate change – Increased foreign ownership/control – Epidemics of human and animal diseases – High competition for water resources use between sectors and between riparian countries – Flooded forest degradation – Land clearing for farming and settlement	– New Fisheries Law (MAFF-ADB) – Fisheries programme (MRC) – Improvement on Regulation and Management Framework of the Freshwater Fisheries (MAFF-ADB) – The Tonle Sap Environmental Management Project – Fishery Sector (ADB-DoF)

8.1.3. Watershed Management

Trends	Risks	Interventions
– Forestry degradation – Reforestation – Rehabilitate and protect wetlands and flooded forests – Expansion of settlement and farming areas – Uncontrollable concession forests and small-scale illegal lodging – Increased protected areas and wildlife sanctuary	– Floods and droughts incidence – Fishing and forest violation – Loss of non-renewable and critical resources – Continued pressure resulting in environmental degradation – Flow regime change from upstream development – Climate change – Continued migration and population increase – Increased foreign ownership/control	– Greater Mekong Sub-region Programmes for tourism, navigation, agriculture and watershed management (RGC-ADB) – Wetlands Classification Project (MRC-DANIDA) – Watershed Management Pilot Project in Siem Reap Province (MRC-GTZ) – Forest Crime Monitoring Project (MAFF-WB) – Community Forestry Project (RGC-Concern) – Action plan for watershed management

8.1.4. Tourism

Trends	Risks	Interventions
– Tourism booming: 1 million tourists/year – Development and increase in eco-tourism and cultural tourism: 10 major eco-tourist sites developed – Development of agro-tourism: 5 major eco-tourist sites developed – Increased demand in tourist infrastructure – Increased demand of electricity and water supply – Increased regional collaboration in tourist development – Increased sex tourism – Introduction of foreign culture – Improved and increased service delivery – Increased regional and international links via Airs, roads and railways – Increased the role and benefits of the local community in the sector	– Floods and droughts disaster – Epidemics of human and animal diseases – Loss of non-renewable and critical resources – Loss of biodiversity – Pollution problems – Climate change – Political instability – Increase in sex trade and sexually transmitted diseases – Problem of illegal migration – Drug uses and trafficking	– ASEAN Open Border Policy and Free Trade (RGC-ASEAN) – First and Second East-West Economic Corridor (RGC-ASEAN) – Greater Mekong Sub-region Programmes for tourism, navigation, agriculture and watershed management (RGC-ADB) – Emerald Triangle Tourism Development (Cambodia, Lao PDR and Thailand) – Economic Cooperation Strategy between Cambodia, Lao, Myanmar and Thailand, namely (RGC): ▪ Trade and investment facilitation ▪ Agricultural and industrial cooperation ▪ Transport linkages ▪ Tourism cooperation – human resources development

8.1.5. Water Supply for Domestic and Industry

Trends	Risks	Interventions
– Need access to sufficient rural (90%) and urban water supply (100%) – Tourism booming will demand more water – Increased Private Sector investment, mobilization of funds and credit, development of SMEs – Increase processing development and agro-industry – Water resources threatened – Increasing need to manage the waste water and solid waste – Increased urbanization and urban expansion	– Floods and droughts disaster – Continued pressure resulting in environmental degradation – Flow regime change from upstream development – Pollution problems – Climate change – Continued migration and population increase – Private sector development fails to materialize – Increased foreign ownership/control – High competition for water resources use between sectors and riparian countries – Lack of electricity – Water contamination and high arsenic substance	– Water Strategies (MOWRAM-ADB) – Cambodia Roadmap for Water Sector (MOWRAM-ADB) – Seila Programme (RGC-UNOPS, WB) – Sustainable Livelihoods Project (RGC-ADB) – Fighting Poverty in Cambodia, Tonle Sap Basin Project (MEF-ADB) – Northwest Rural Development Project (MRD-ADB) – Provincial and Peri-Urban Water Supply Project (MIME-ADB – Eco-Zone Project (irrigation, livestock, extension, water supply) (RGC-EU)

8.1.6. Hydropower

Trends	Risks	Interventions
– Higher electricity demand? KW? – Development of hydropower projects: 5 (Battambang I&II, Stung Pursat, Stung Siem Reap, and Stung Sen) – Competition for water resources between sectors and between Mekong Countries – Generation of electricity by using fuel decreased and increased use of solar energy – Increased power availability in the region through ASEAN Power Grid	– Water resources threatened – Flow regime change from upstream development – Climate change – Dependence on foreign aid and reduction of foreign aid – Resettlement problems – Environmental and ecological threats	– Technical study on hydropower by MRC – Electricity project Cambodia-Thailand – Private sector investment (studies and construction) – Republic of Korea

8.1.7. Navigation and Transportation

Trends	Risks	Interventions
– Demand for navigation and waterway transport: to what level? – Navigation will be needed for tourism, fisheries and some people nearby the river and lake: to what level? – There will be potential development of eco-tourism and navigation: to what level? – Increased modern port construction – Communications and transportation development – Development of rural road and regional road – Railroad from Phnom Penh to Vietnam – Potential development of the railroad to Thailand, and Kampong Chhnang Airport – Higher demand of navigation for medium and large scale of bulky goods	– Floods and droughts incidence – Change of water flow regime due to upstream development – Siltation of the lake and rivers and erosion of key river tributaries – Impacts of communication development on forestry – Impact on biodiversities – Environmental pollution – Increased sedimentation in the lake and tributaries	– Navigation programme (MRC) – Greater Mekong Sub-region Programmes for tourism, navigation, agriculture and watershed management (RGC-ADB) – Provincial Road Improvement Project (MPWT/MRD-WB) – National Road No. 5 and 6 Rehabilitation Projects (MPWT-ADB/WB)

8.1.8. Flood Control

Trends	Risks	Interventions
– Floods and droughts incidence is more frequent – Flow regime change from upstream and downstream development – Increased development of flood protection structures – Increased development of water infrastructure for irrigation	– Climate change – Continued pressure resulting in environmental degradation – Continued migration and population increase – Construction – Damage to agricultural crops	– Flood Management and Mitigation Programme (MRC) – Emergency Flood and Flood Emergency Rehabilitation Projects (RGC-ADB/WB)

8.2. Scenarios and Elements by Cross-Cutting Issues

8.2.1. Socio-Economic Issues

Trends	Risks	Interventions
– Demographic pressure: growth rate up to 2.5% – Impoverishment of the vulnerable – Increasing no. of people below the poverty line – Increase migration – Increased illegal resettlement and labor market competition – Increase unemployment – Need to have gender balance – Ongoing decentralisation and deconcentration – Need access to sufficient rural and urban water supply – Urban expansion and urbanization	– Continued migration and population increase – Increase in sex trade and sexually transmitted diseases – Epidemics of human and animal diseases – Lack of transparency and governance continues – Dependence on foreign aid – Increased foreign ownership/control – Lack of good governance – Continuity of weak counter-measures against corruption – Continued poor law/regulation reinforcement – Continued rising of land ownership conflict	– Seila Programme (RGC-UNOPS, WB) – Sustainable Livelihoods Project (RGC-ADB) – Fighting Poverty in Cambodia, Tonle Sap Basin Project (MEF-ADB) – Northwest Rural Development Project (MRD-ADB) – Provincial and Peri-Urban Water Supply Project (MIME-ADB – Land Registration and Commune Delineation in Tonle Sap Region (LMAP, Commune Council Development Program, MLMUPC-ADB, WB) – Archaeology Projects (RGC-FEO/India/Japan)

8.2.2. Private Sector/Markets

Trends	Risks	Interventions
– Increased Private Sector investment, mobilization of funds and credit, development of SMEs (Industry development) – Increasing need to strengthen the private sector development – Increasing need to strengthen capacity in market competition – Increased foreign ownership/control – Need market for agricultural products – Development of agricultural industry – Problem of illegal resettlement and labor market competition – Increasing needs to have reliable information and network development for marketing	– High taxation – Inappropriate trading framework – lack of technology – lack of credit – Private sector development fails to materialize	– MPDF Development Program – Cambodia small scale enterprise – Cambodia Trading Parliamentary – Public Bank and NGOs and IO's Bank – IMF assists in improving Investment Regulation.

8.2.3. Environmental Issues

Trends	Risks	Interventions
– Improve the use of surface water and groundwater – Tonle Sap River Basin Organization established and ongoing (all level) – Water resources threatened – Land ownership conflict – Forestry degradation (turned into home village or productive land): ha? – Loss of biodiversity – Use of agricultural pesticides	– Droughts and floods incidence – Flow regime change from upstream development – Impacts caused by flow regime change from upstream development (China dams) – Water resources threatened – Siltation and degradation of Tonle Sap Lake, rivers and its tributaries – Loss of non-renewable and critical resources – Continued pressure resulting in environmental degradation – Pollution problems – Climate change	– Water Strategies (MOWRAM-ADB) – Cambodia Roadmap for Water Sector (MOWRAM-ADB) – Tonle Sap River Basin Organization, (CNMC-ADB) – Tonle Sap Modeling (MRC WUP- FIN) – Basin Development Plan (MRC) – Environmental Management of Tonle Sap Lake (MAFF-ADB) – Environmental Improvement in Chong Khneas (MPWT-ADB-Finland) – Protected Area and Development (MoE-IUCN, MRC) – Tonle Sap Biosphere (MOE-ADB, UNESCO) – Wildlife and Conservation Projects (MoE-WWF/WCS/FFI) – Western Battambang Wildlife Preservation Project (MoE-Angelina Jolie) – Natural Resources and Environmental Management Programme (RGC-DANIDA) – Participatory Natural Resource Management in the Tonle Sap Region (MoE/MAFF-Belgium)

8.2.4. Capacity Building

Trends	Risks	Interventions
– Limited human resources – Lack of technology – Lack of data and information (no consensus) – Need to protect and use the available resources adequately – Need protection from natural disasters – Need information and extension system – Need to have gender balance – Increasing HRD from development of project work – Need to learn experience from developed countries	– Pollution problems (from agriculture, tourism, industry) – Lack of participation – Inadequate human resources management – Fisheries and forest violation – Unwillingness to change laggard traditional practices	– Basin Development Plan (MRC) – Natural Resources and Environmental Management Programme (RGC-DANIDA) – Participatory Natural Resource Management in the Tonle Sap Region (MoE/MAFF-Belgium)

8.2.5. Participation

Trends	Risks	Interventions
– Participation – Need to have gender balance – There will be increasing gaps between the rich and the poor, therefore social conflicts emerge – Ongoing decentralization and deconcentration process – Cooperation between people upstream and downstream will not be complete – Structure to manage the Tonle Sap Sub-area through decentralization and deconcentration – Trans-boundary impacts	– Lack of budget – Dependence on foreign aid – Reduction of foreign aid – Lack of information provision	– Tonle Sap River Basin Organization, (CNMC-ADB) – Seila Programme (RGC-UNOPS, WB) – Basin Development Plan (MRC)

8.2.6. Institutional and Legal Issues

Trends	Risks	Interventions
– Need structure to manage the Tonle Sap Sub-area through decentralization and deconcentration – No clear plans and roles overlap – Fisheries and forest violation – Limited effect of rule of law and its application – Limited human resources – Problems of rules and institutions	– Lack of transparency and governance continues – Lack of budget and inadequate use of available budget – Depend on foreign aid – Reduction of foreign aid	– Tonle Sap River Basin Organization, (CNMC-ADB) – Seila Programme (RGC-UNOPS, WB) – Basin Development Plan (MRC) – National Committee for Assisting the Community (NCAC)

CHAPTER 9: OVERALL SCENARIOS

This chapter introduces overall scenarios for the Tonle Sap sub-area. The formulation of scenarios resulted from the scenario elements in chapter 8.

Scenario 1: High Growth

There will be supported by high public investment in the improvement of the infrastructure (mainly rural road, *and road network to ASEAN and Mekong Region*), human resources development (Extension service and education), and health care. There will be need to ensure adequate water supply for key sectors and particularly domestic water supply. The sub-area will need to develop hydropower and look for market for the processed agricultural products for supporting development in the sub-area.

There will be high increase of regional trade and other economic cooperation that will lead to high development. There will be high value generated from agriculture, very high from fisheries, much higher from tourism and very high from industry and agro-industry.

The sub-area will have to challenge with high population growth and migration; droughts and floods incidence; high pollution; loss of critical and non-reversible resources such as biodiversities, *critical wetland, flooded forest, fish habitats*, and environmental degradation; impacts from the upstream development; and great competition for water resources between sectors as well as between the riparian countries of the Mekong River Basin. The national policy and governance will be more focused on economic development despite efforts to balance it with the social and environmental issues.

Scenario 2: Optimal Growth

There will be supported by high public investment in the improvement of the infrastructure (mainly rural road, and road network to ASEAN and Mekong Region), human resources development (extension service and education), and health care. There will be need to ensure adequate water supply for key sectors and particularly domestic water supply. The sub-area will need to develop hydropower and look for market for the processed agricultural products for supporting development in the sub-area.

The ASEAN Open Border Policy and other cooperation and development policies of the Mekong Region and high growth in private sectors will provide opportunities for sustainable development. There will be high income from agriculture, very high from fisheries, much higher from tourism and very high from industry and agro-industry.

The sub-area will challenge with high population growth and migration; droughts and floods incidence; loss of critical and non-reversible resources such as biodiversities, critical wetland, flooded forest, fish habitats and environmental degradation; the impacts from the upstream development; and competition for water resources between sectors as well as between the riparian countries of the Mekong River Basin. Good national policy

and governance will be established and ongoing well. There will be good result from the integrated management from the Tonle Sap River Basin Committee, successful decentralization programme, good support and cooperation from donors and NGOs, good cooperation in the implementation of the Basin Development Planning of the LMB and better cooperation from China & Myanmar. The economic growth will be in balance with social & environment issues.

Scenario 3: Low Growth

There will be supported by low public investment in the improvement of the infrastructure (mainly rural road, and road network to ASEAN and Mekong Region), human resources development (extension service and education), and health care.

There will be need to ensure adequate water supply for key sectors and particularly domestic water supply. The sub-area will need to develop hydropower and look for market for the processed agricultural products for supporting development in the sub-area.

There will be increase of regional trade and other economic cooperation but the process will be slow and low economic increase. There will be low income from agriculture, high from fisheries and tourism and low development.

The sub-area will challenge with high population growth and migration, serious problems with droughts and floods incidence and trans-boundary impacts from upstream development, loss of critical and non-reversible resources such as biodiversities, critical wetland, flooded forest, fish habitats, and environmental degradation. There will be low cooperation in the implementation of the Basin Development Planning of the LMB, less funding support from international agencies, and limited benefits from the Economic Cooperation Strategies. The private sectors will not be materialized and there will be high foreign ownership and control.

Scenario 4: Likely Happen Scenario

There will be high public investment in the improvement of the infrastructure (mainly rural road, and road network to ASEAN and Mekong Region), human resources development (extension service and education), and health care. There will be need to ensure adequate water supply for key sectors and particularly *water for irrigation* domestic water supply. The sub-area will need to develop the hydropower to support development, and look for market for the processed agricultural products.

There will be encouragement to high development in agriculture, fisheries, tourism and industrial and agro-industrial sectors. Privatisation will be materialized and high increase in regional trade and other economic cooperation.

The sub-area will challenge with high population growth and migration, problems from droughts and floods incidence, environmental pollution, trans-boundary impacts from

upstream *and downstream* development, loss of critical and non-reversible resources such as biodiversities, critical wetland, flooded forest, fish habitats, and environmental degradation, and the competition for water resources between sectors and riparian countries in the Mekong River Region.

Decentralisation *and deconcentration* programme, policy and strategies for water resources management, integrated river basin management of the Tonle Sap River Basin Committee will be established and ongoing, and the results will depend on the law enforcement and application. There will be good support and cooperation from donors and NGOs, but at the same time funding support will be reduced. There will be results from the cooperation in the implementation of the Basin Development Planning of the LMB, and at the same time cooperation from China and Myanmar.

CHAPTER 10: SUB-AREA DEVELOPMENT OBJECTIVES

10.1. Introduction

This chapter presents the results of the process to develop and refine the development objectives as undertaken by the Tonle Sap Sub-Area (9C) Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter was prepared for the participants of the *2nd Stakeholder Forum* for the Tonle Sap Sub-Area in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan.

The chapter takes as its starting point the preliminary development objectives as developed and presented in chapter 7 and chapter 8: ***Key Issues and Scenario Elements, Tonle Sap Sub-Area***. A two-step process is then presented whereby the preliminary development objectives are categorized and then reorganized in related groups. These groups provide an overall development objective with some sub-objectives and specific targets to be achieved within the 5- to 10-year and 20-year timeframes.

The results are then used as the basis for preparing strategies to achieve the development objectives as presented in chapter 11: ***Strategies, Tonle Sap Sub-Area***.

Finally, the objectives were consolidated, refined and subsequently improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Tonle Sap Sub-Area, which was held on 29th – 30th June 2004, as presented in this chapter.

10.2. Categorization of Preliminary Development Objectives

The preliminary development objectives were then examined by categorizing them within their sector and any cross-cutting themes, as well as by sub-categories related to their issue. The categories are:

1. Irrigated Agriculture
2. Fisheries/Aquaculture
3. Watershed Management
4. Tourism and Recreation
5. Water Supply and Sanitation
6. Hydropower
7. Navigation and Transportation
8. Flood Control and Management
9. Cross-cutting Issues

The sub-categories are:

A. Economic
B. Social
C. Environment

Preliminary Sub-Area Objectives	Category	Sub-Category
1. Food security and safety for all people	1	A/B
2. Improved water supply and sanitation	5	A
3. Large increase in human resource development for all sectors	9	A
4. Increase in data collection and analysis	9	A
5. Increased community participation	9	A
6. Increase of rice and other crop production and quality	1	A
7. Diversification, modernization and improvement of agriculture	1	A
8. Increase aquaculture quantity and quality including export	2	A
9. Increasing analytical skills and numbers of technical staff	9	B
10. Rehabilitation and expansion of irrigation systems, increased efficiency in their use	1	A
11. Better human resource management – identifying needs and training people to fill them	9	B
12. Develop export markets for agricultural products and increase competitiveness in region	1	A
13. Improved environmental awareness	9	C
14. Improved watershed management	3	C
15. Reduced population growth rate	9	B
16. Improved institutional development	9	B
17. Increased tourism including eco-tourism and expansion to new areas	4	A/B
18. Increase agro-processing and SMEs	1	A
19. Increasing and improved household livestock production	1	A
20. Reduction of flood damage and drought	8	B
21. Increased electrification including generation capacity within Sub-area	6	A/B
22. Improved navigation and waterways transport including modern ports	7	A/B
23. Management, protection and conservation of natural resources	3	B/C

10.3. Organization and Grouping of Development Objectives

Development Objective 1: Address Short-Term and Long-Term Food Security for the Poor

Sub-Objective 1.1: Increased rice and other crop production for poor farmers meet their basic grain security requirements and they move into the market economy.

Sub-Objective 1.2: Improved and increased smallholder livestock, aquaculture, handicrafts and other income-generating and smallholder savings activities.

Sub-Objective 1.3: Critical resources for natural capture fisheries are conserved.

Sub-Objective 1.4 Vulnerability to flooding and drought is significantly reduced.

Specific Targets:

5-10 Years	20 Years
90% food security	100% food security
2.5-3.0 tons/ha average	3.5 tons/ha average
2 cattle, 10 poultry/family	5 cattle, 10 poultry/family
20% of farmers will access to mechanization	40% of farmers will access to mechanization
30-50,000 tons local aquaculture production	100,000 tons local aquaculture production
Sustain average natural catch of last 5 years	Sustain average natural catch of last 5 years
Market number and size doubles	Bank branch facilities at Commune level
One emergency aid event/province/year	One emergency aid event/sub-area/year

Development Objective 2: Increase Agricultural Production, Quality and Diversity for Markets

Sub-Objective 2.1: Improved agricultural production quantity, quality and diversity for domestic markets including tourism.

Sub-Objective 2.2: Improved agricultural production quantity and quality for regional and international export markets.

Specific Targets:

5-10 Years	20 Years
25% increase in grain production	50% increase in agricultural production
Domestic markets contain all locally produced vegetables	International hotels using all locally produced vegetables and meats
20 millions foreign exports (esp. Thailand and Vietnam)	$40 millions foreign exports (esp. Thailand and Vietnam)
10,000 tons high value culture (esp. cage)	50,000 tons high value culture (esp. cage)
25% increase in industrial crop production	50% increase in industrial crop production
$50 million investment in agro-industry	$100 million investment in agro-industry

Development Objective 3: Improve the Use and Management of Water Resources

Sub-Objective 3.1: Secured domestic water supply for rural and urban areas.

Sub-Objective 3.2: Ensured and sufficient water supply for industry and wastewater treatment.

Sub-Objective 3.3: Large increased area covered by more efficient irrigation systems.

Sub-Objective 3.4: Potential multi purposes hydropower projects in association with irrigation development will be developed through studies and construction with substantial participations of private sector and community.

Sub-Objective 3.5: Improve institutions for management and utilization of water resources.

Specific Targets:

5-10 Years	20 Years
62% access to safe water in rural areas	90% access to safe water in rural areas
80% access to safe water in urban areas	100% access to safe water in urban areas
54% improved sanitation in rural areas	80% improved sanitation in rural areas
74% improved sanitation in urban areas	95% improved sanitation in urban areas
All industry sufficiently supplied	All industry sufficiently supplied
70% urban wastewater treatment	100% urban wastewater treatment
2 feasibility studies for hydropower projects	1 feasibility study and 1 construction project

100,000 ha irrigation areas increased	200,000 ha irrigation area increased
25% increase in irrigation efficiency	50% increase in irrigation efficiency
50% sub-basin management committees established and functioning	80% sub-basin management committees established and functioning

Development Objective 4: Promote Tourism Development as an Engine for Growth

Sub-Objective 4.1: Cultural tourism is promoted and developed, and tourist interest is expanded to wider areas with more benefit to local economy.

Sub-Objective 4.2: Increased and improved eco-tourism, especially around the Tonle Sap, as a means of promoting conservation and livelihoods for local communities.

Sub-Objective 4.3: Improve management of revenue and expenditure and protection of monuments and national heritage.

Sub-Objective 4.4: Navigation and transports will be further developed through rehabilitation and construction of new infrastructure networks that will serve for both goods and travellers, especially tourists.

Specific Targets:

5-10 Years	20 Years
5 major ancient tourism sites developed	Overall regional network developed
2.5 million tourists/year	3 million tourists/year
Average stay 3-7 days	Average stay 7-10 days
7 major eco-tourism sites developed	10 major eco-tourism sites developed
2 agro-tourism pilot areas developed	5 major agro-tourism sites developed
1 modern river port will be constructed and 3 river ports and 50% of road networks will be rehabilitated	1 international airport will be built and 90% of road network will be rehabilitated and newly constructed

Development Objective 5: Strengthen Human Resources Development and Management

Sub-Objective 5.1: Increased awareness of natural resource use and management and participation by local communities.

Sub-Objective 5.2: Improved practical technical staff ability available at national and provincial levels for natural resources and environmental monitoring, management, conservation and planning.

Sub-Objective 5.3: Strengthened local research capacity and skills for natural resource management available including established regional linkages.

Specific Targets:

These are cross-cutting issues that are difficult to measure and monitor. They will be addressed by integrating human resources development and management into all project activities.

Development Objective 6: Sound Natural Resource and Environmental Management Practices Established and Strengthened at All Levels

Sub-Objective 6.1: Tonle Sap biosphere reserve conservation and protection promoted and strengthen.

Sub-Objective 6.2: Integrated watershed management established and ensuring adequate base flows, maintaining the seasonal flow regime and equitable resource sharing and conservation.

Sub-Objective 6.3: Effective legal and regulatory framework for environmental management.

Sub-Objective 6.4: Support community in the utilization and management of natural resources and environmental protection.

Specific Targets:

5-10 Years	20 Years
World Heritage Site established and accepted	World Heritage Site maintaining necessary standards and management
Tonle Sap Basin Management entity established	Tonle Sap Basin Management entity effective
50% of sub-catchments have management committees established	70% of sub-catchments have management committees established and 50% are functioning effectively
Hydro-meteorological data collection, mapping and studies completed in 50% of catchments	Hydro-meteorological database established and regularly operated, catchments studies and mapping completed for all catchments
Successful conservation pilot projects for uplands, soil and water management and floodplain protection implemented	Pilot approaches implemented over 50% of catchments

CHAPTER 11: SUB-AREA DEVELOPMENT STRATEGIES BY SECTOR

11.1. Introduction

This chapter presents the results of the process to develop and refine the strategies for achieving the development objectives as undertaken by the Tonle Sap Sub-Area (9C) Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter was prepared for the participants of the *2nd Stakeholder Forum* for the Tonle Sap Sub-Area in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan.

This chapter takes as its starting point the development objectives as presented in the chapter 10: ***Development Objectives, Tonle Sap Sub-Area***. A three-step process was undertaken. First, the individual sub-objectives were examined as the basis for preparing "brainstormed" strategies that would address the goals. Next, these strategies were grouped together on the basis of sectors and cross-cutting issues. The results of these first two processes are contained in the tables in the chapter 7 and chapter 8: ***Key Issues and Scenario Elements, Tonle Sap Sub-Area***. Finally, the strategies were consolidated, refined and subsequently improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Tonle Sap Sub-area, which was held on 29th – 30th June 2004, as presented in this chapter.

The sectors and cross-cutting issues are as follows:

A. Agriculture
B. Fisheries/Aquaculture
C. Irrigation, Flood Control and Hydropower
D. Watershed Management
E. Tourism
F. Water Supply, Waste Management and Sanitation
G. Navigation and Transport
H. Private Sector/Markets
I. Capacity Building
J. Participation
K. Institutional and Legal Issues

The results are then used as the basis for preparing interventions and project ideas as presented in the chapter 12***: Project Interventions and Ideas, Tonle Sap Sub-Area***.

11.2. Development of Strategies by Sector and Cross-Cutting Issues

A. Agriculture

Intensify and diversify agriculture to achieve food security and to supply domestic, regional and international markets:

- Improve situation of poor farmers through agricultural extension, rural credit/banking, production and distribution of better quality seed and inputs, water control and irrigation management, improved technique and technology, post-harvest processing, marketing and training.
- Focus support efforts in the areas of cropping (grain, vegetable, industrial, organic), smallholder animal health and production, aquaculture, integrated farming, irrigated agriculture, post-harvest processing and handicrafts.
- Improve soil and water conservation and management for wet season rice cropping through infrastructure development, land leveling and bunding, small-scale and medium-scale surface water diversion and storage, and improved on-farm soil, crop and water management supported through government budget, loan and grant funds, Food-For-Work and community association efforts.

B. Fisheries/Aquaculture

Conserve natural capture fisheries through habitat protection, policy, law enforcement, consensus building among stakeholders and preservation of genetic resources both aquatic plants and animals:

- Improve natural resource and environmental management of the floodplain and flooded forest including zoning, preservation of fisheries migration routes and sanctuaries, protection of fisheries habitat and flooded forest, conservation of local species genetic resources, careful management of alien species aquaculture and development of alternative livelihoods for the people affecting these areas.
- Address the key political and legal issues including gaining high level support for critical fisheries issues such as fish lot management and upstream dams, improving regulations and enforcement of laws, studying the impacts of large dams on fisheries and encouraging different stakeholders to participate in the process of fisheries conservation through awareness raising, education and promotion of good practices.
- Increase training and extension for family aquaculture promotion through local private and public sector fingerling production and the uses of agricultural byproducts and byproducts of slaughters houses in combination with trash fish and corns, etc.

C. Irrigation, Flood Control and Hydropower

Prepare overall plan for water resources development and implement prioritized irrigation, flood control and hydropower projects with strong participation from affected communities and people:

- Improve hydro-meteorological network and inventory surface water, groundwater, irrigation and flood control infrastructure and potential sites for hydropower, evaluate water demand and investment potential and prioritize.
- Implement selected priority irrigation and flood control projects with full participation and management by benefiting farmer water user communities to expand wet and dry season cropping, reduce vulnerability to flooding and to use as a nexus to introduce new technologies and techniques.
- Select hydropower project with best potential for feasibility study and identify interested donors and private sector investors.
- Development of local capacity in early flood and natural calamity, i.e., drought warning systems, management and response.

D. Watershed Management

Implement integrated watershed management to improve soil and water conservation, preserve biological resources, allocate water resources between competing uses, coordinate involved organizations and assist in conflict resolution and planning:

- Establish a pilot project in a watershed to develop and demonstrate a framework for cooperation among concerned agencies that incorporates bottom-up, participatory processes through the decentralization policy of the government in order to address critical resource problems of water demand and protection of important natural resources.
- Utilize watershed management to address key natural resource and environmental management issues of flooded forest and forest protection, land use and conservation area zoning, fisheries management, study and allocation of groundwater resources, conservation of local genetic resources and equitable water allocation through pricing and privatization.
- Work with UNESCO, ADB and MRCS, Ministry of Environment and Cambodian National Mekong Committee to go through process of strengthening biosphere reserve and to gather high level and public support for research and conservation to protect the Tonle Sap World Heritage Site.

E. Tourism

Expand cultural and develop eco-tourism and increase the benefits to and role of local communities in the business:

- Increase the market and quality of tourism through international and regional promotion, restoration and development of sites, and improved infrastructure and services.
- Work with communities on site preservation and conservation, development of agro-tourism and production of handicrafts, food and services for tourist market.
- Awareness raising for communities to understand the importance of tourism and to protect the environment from pollution and contamination (i.e., water, sexually transmitted diseases, etc.).

F. Water Supply, Waste Management and Sanitation

Improve rural and urban water supply and sanitation and solid and liquid waste management through increased investment in rural areas and privatization and cost recovery in urban areas:

- Increase investment in rural water supply including water use education and sanitation to efficiently use rainwater, surface water and groundwater to improve public health.
- Develop urban water supply through private sector financing and cost recovery by users.
- Develop a Master Plan for Solid and Liquid Waste Management including technical and zoning considerations, a legal framework for water quality and waste disposal, and an enforcement mechanism.
- Choose appropriate location and technology for management of liquid and solid waste containing hazardous substances.

G. Navigation and Transportation

Promote and encourage private sector investment in navigation and transportation in both urban and rural areas though studies on potential river transports and improve and expand river ports in order to serve an increased demand:

- Expansion and maintenance of highway, waterway and airport facilities.
- Improve riverbank protection and soil erosion reduction for rivers and streams.
- Increase and develop ports through construction and dredging.
- Develop alternative airport site for Siem Reap to ensure protection of monuments.

H. Private Sector/Markets

Promote and encourage increased private sector involvement in the rural economy and support farmers to gain best advantage from the investment, and to curtail to a lager extent of impeding factors for rural trade:

- Provide incentives and an enabling environment to agro-industry and small and medium enterprises (SMEs) to work with farmers in rural areas and develop markets for agricultural produce and value-added products.

- Support farmers through farmer associations, providing information and technology, identification and promotion of comparative advantages and niche markets and regulation/mediation of private sector.

I. Capacity Building

Increase capacity throughout public and private sector at all levels of society:

- Improve quality and long-term impact of all project implementation through adoption of standards and appropriate technologies, increasing capacity by integrating "learning-by-doing" and on-the-job training in all project activities, incorporating research into regular project work and selecting consultants with demonstrated ability to work closely with national staff.
- Improve human resources development and management including identifying training needs, roles and responsibilities of staff, providing incentives, improving job placement and decentralizing trained and capable staff to provinces.
- Encourage students to focus on natural science and technology.
- Develop agreements and methods for data sharing and analysis to support management.

J. Participation

Broaden and deepen participation in all project activities particularly among less represented people:

- Increase level of participation in all project work through adoption of community-based natural resource management, ensuring local ownership and rights for common resources, encouraging local leadership and responsibility, awareness raising, education and promotion of good practices.
- Actively promote better participation of women and involvement of women in leadership roles throughout project activity.

K. Institutional and Legal Issues

Address foundation for development through improving institutions, legal framework, awareness raising, and reinforcement of the laws and regulations:

- Review current rules, standards and regulations, roles and responsibilities and eliminate overlap and conflicts.

- Promote good management and conservation practice through media, education and training at local and national level, publicizing laws, exchanging experience with other countries and encouraging students to focus on natural science and technology.
- Identify key research issues and prioritize, with an emphasis on building upon local knowledge and link with regional and international institutions for knowledge sharing, training and funding including academic exchanges.
- Identify donors and key funding opportunities for support of activities including strengthening of biosphere reserve.
- Ensure local usufruct rights are included in laws and management plans through bottom-up participatory mechanisms.

CHAPTER 12: PROJECT IDEAS/INTERVENTION

12.1. Introduction

This chapter presents the results of the process to develop and refine the project interventions and ideas as undertaken by the Tonle Sap Sub-Area (9C) Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter is prepared for the participants of the *2nd Stakeholder Forum* for the Tonle Sap Sub-Area in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan. This chapter takes as its starting point the strategies as presented in the chapter 11: ***Strategies, Tonle Sap Sub-Area***. A two-step process follows where the first step examined the grouped strategies by sector and possible general project ideas were prepared as preliminary project ideas and interventions. In order to maximize the number of ideas, individual provinces are also going to submit additional ideas to form a Long-list from which to work.

The last step is to form a Short-list by taking out the project ideas that are not within the mandate of the BDP (i.e., trans-boundary, water-related and of regional significance) and better detail the remaining ideas to make them viable and unique in the context of the sub-area. In the prepared project ideas and interventions, sometimes a project will include elements from other groups, such as agriculture and irrigation while cross-cutting issues should be generally addressed within all project ideas.

The Project Ideas and Interventions presented are suggestions from the CNMC Development Plan Team that could form a basis for discussion during the *2nd Stakeholder Forum*. Finally, the Project Ideas and Interventions have been improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Tonle Sap Sub-area, which was held on 29th – 30th June 2004, as presented in this chapter.

12.2. Preliminary Project Ideas/Interventions

A. Agriculture

A.1. Integrated Food Security for Poor Farmers Project including agricultural extension and demonstration, smallholder and commercial livestock improvement, integrated farming promotion and piloting, domestication of forest vegetables and other non-timber forest products, rural roads, land leveling and small-scale water conservation works with food-for-work support, soil and water management improvement, handicrafts and non-farm employment and micro-credit.

A.2. Agricultural Market Production Project including rehabilitation of irrigation systems following the participatory process, improved quality seed and inputs, cash cropping of high value vegetable, fruit, grain and industrial crops, farmer cooperatives, organic farming training, certification and marketing, post-harvest processing, linking to private sector and high-value livestock production.

B. Fisheries/Aquaculture

B.1. Wild Fisheries Conservation Project including community-based natural resource management of floodplain and flooded forest, mapping of flooded forest and floodplain land use, preservation of fisheries migration routes and sanctuaries, awareness raising and promotion of good practice, preparation of policy and legal alternatives for consideration by senior government officials and support for enforcement of rules and improved regulations.

B.2. Aquaculture Promotion Project including private sector fingerling production and outreach, conservation of local species through germ plasms and pilot fish-farming, organization of fishery communities, promotion of cage culture for high-value markets and development and promotion of methods to reduce introduction of alien species into the natural environment.

C. Irrigation, Flood Control and Hydropower

C.1. Exploration and geographical examination, study and data collection of hydropower potential sites such as Stung **Battambang**, **Stung Pursat**, **Stung Sen** and **Stung Siem Reap**.

C.2. Prioritization of potential hydropower projects including construction and connection of distribution network to the regional power grid for private sector or loan investment.

D. Watershed Management

D.1. Pilot Integrated Watershed Management Project in Tonle Sap Tributaries, including for example:

D.1.1. Stung Siem Reap Watershed with broad government agency cooperation including mapping of land use change, trends and resources, inventory of infrastructure and proposed/implemented projects (including hotels, etc.), groundwater mapping, a focus on floodplain and flooded forest management, and study on hydropower dam project potential.

D.1.2. Pilot Integrated Watershed Management Project in Stung Pursat Watershed focusing on hydro-meteorological and soils data collection, analysis and database management, inventory of irrigation and surface water systems, prioritization of

investment and water availability, study on hydropower dam project potential, implementation of some irrigation projects with participatory methods.

D.1.3. Pilot Integrated Watershed Management Project in Stung Sen Watershed to examine potential for hydropower and large-scale diversion of upper Stung Sen, development of floodplain areas in the lower Stung Sen.

D.1.4. Pilot Integrated Watershed Management Project in Stung Battambang Watershed with broad government agency cooperation including mapping of land use change, trends and resources uses, a focus on floodplain and flooded forest management, and study on hydropower dam project potential.

D.2. Applied Research Project into Historical and Modern Techniques of Soil and Water Management and their feasibility including pilot water conservation works, land suitability mapping and groundwater availability and use study.

D.3. Sub-Area 9C Water Map Project to inventory all water-related infrastructure including existing surface water (rivers, lakes, ponds, canals), infrastructure (dykes, weirs, bridges, wells, pumping stations, control structures), provision of equipment for measurement stations and potential hydropower sites to evaluate water resources, demand and investment potential and to prioritize investment.

E. Tourism

E.1. Cultural, Agricultural and Eco-Tourism Project to link the lesser known monuments outside of the Angkor complex and provide investment and infrastructure to improve the lives of the local communities and provide opportunities for community-based critical habitat and culture protection and handicraft, food and service income serving tourists.

E.2. ***Project on mapping of different locations for natural, cultural and agro-tourisms and establishment of appropriate accommodation for visitors*** who are interested in natural tourisms.

F. Water Supply, Waste Management and Sanitation

F.1. Rural Water Supply, Use and Sanitation Project to increase availability of safe water sources in rural areas using groundwater, surface water and rainwater, improve facility maintenance, increase awareness of sanitation issues, install toilets with appropriate technology and improve waste (both liquid and solid) disposal and management.

F.2. Urban Water Supply and Waste Disposal Privatization Project to rehabilitate the water treatment and distribution systems in the major urban areas and contract out sewage and solid waste treatment to private interests paid for by urban users.

G. Navigation and Transportation

G.1. Studies and Research on Improvement of River Transports and Port Location in order to rehabilitate and construct transport networks, and prioritize projects for implementation.

H. Private Sector/Markets

H.1. Foundation for market support and development project including research and market study to identify comparative advantage, international and regional marketing promotion of local products, promotional material development, and study on appropriate credit and tax incentives and encouragement for domestic private sector targeted to Small and Medium Enterprises (SMEs).

I. Participation and Capacity Building

I.1. Mekong River Basin Key Issues awareness raising, training and educational project including media campaign to target specific practices or issues of importance, education campaign in schools, training and advocacy for senior officials on water management, ecology and gender, conferences and workshops on basinwide issues and participatory research for community-based natural resource management.

I.2. Human Resource Development and Management (HRD/HRM) Project including training and active promotion of women in leadership roles, preparation of HRD/HRM strategy and plan, links to regional and international institutes, internship programme for students, and roundtable forum for interagency cooperation to work towards rationalization of roles and responsibilities.

12.3. Project Ideas and Interventions

The project ideas and interventions take the basic and general project ideas and distill from them specific project or programme possibilities that would fit the final criteria for the Basin Development Plan and which have a compelling reason to be included within the Tonle Sap Sub-Area.

12.3.1. Sub-Area Specific Projects

These are projects that would occur entirely within the Tonle Sap Sub-Area and which would meet the BDP criteria by virtue of providing direction and approaches that would be replicable elsewhere in the region or because they are of great importance for the basin because of the unique conditions within the Tonle Sap Sub-Area.

12.3.1.1. Watershed Management of the Stung Siem Reap Sub-Basin

This Sub-basin is the most visible in Cambodia and one of the “jewels” of the Mekong River Basin with its temples and monuments forming one of the wonders of the world. The basin includes upland forest, flooded forest, wildlife sanctuaries (Kulen Promtep) and multiple use areas (Tonle Sap) with habitats for wildlife and fisheries. There are ancient and modern irrigation systems using the limited surface water resources while

land is being rapidly converted from agriculture to residential use to serve the tourism industry and expanding urban area, with corresponding increases in solid and liquid waste volumes. The groundwater resources are being pumped out by a quickly growing tourism industry without full understanding of the resource capacity or any monitoring or licensing of the extraction.

This sub-basin is thus undergoing the greatest amount of stress in the Mekong River Basin due to the enormously increasing but poorly managed development that threaten its unique characteristics. The proposed project would take advantage of the great interest in the area and the many different initiatives and projects that are ongoing here but which are not coordinated or sharing data and knowledge. Much is already collected and known by various university groups and others but is only used for their specific projects. Other key data is missing or not being collected. The project would address the critical resource issues in this most important sub-basin in Cambodia while developing understanding and tools that could be widely applied throughout Cambodia, Northeast Thailand and Laos for watershed management.

The watershed management project would provide a nexus for natural resources management in the context of the rapid growth. It would include mapping the area to high detail including analysis of change over time to provide context and a base for examining natural resource and cultural management issues. It would include research on ground and surface water availability and use and a forum for managing demand and cost issues. It would seek to develop a universal zoning plan for the watershed that would provide the much-needed framework for managing development and maintaining the natural resources that underpin the area's growth.

12.3.1.2. Birds and Man (Finding the Balance between Irrigation, Eco-Tourism and Biodiversity in Trapeang Thmar Reservoir)

Trapeang Thmar Reservoir in Banteay Meanchey is a large Khmer Rouge reservoir built along the ancient road from Siem Reap to Banteay Chhmar. Extensive irrigation works were intended, but with the insecurity in the area, they were never repaired or completed. In the meantime, the area has become a habitat for the Eastern Sarus Crane, a globally important and high profile bird. The area was declared a wildlife preserve by the Ministry of Environment, yet is slated for full development as an irrigation system by the Ministry of Water Resources and Meteorology. Already resource conflicts are causing problems between conservationists and local people.

Finding a balance to maintain the habitat while enabling the local people to gain benefits from eco-tourism and irrigation could generate a "win-win" situation and many lessons on resource management and development in situations where conservation is also paramount. This could provide a model for finding the balance between conservation and development and creating participatory local management.

12.3.1.3. Surface Water Management and Planning Project for the Stung Pursat Basin

This would address the large amount of infrastructure that exists in this basin for which there is insufficient water resources. It would include a feasibility study for a multi-purpose hydro-electric dam in the upper watershed to provide electricity and store water for addressing the downstream needs for irrigation.

12.3.1.4. Integrated Watershed Management Project in Stung Sen Kampong Thom

This would include a feasibility study for a large-scale hydropower project in the upper Stung Sen River basin and conservation efforts for the wildlife sanctuaries and temples in the hinterland. It would research and piloting of ancient techniques of soil and water conservation found in Kampong Thom for their potential to increase and diversify farming and store more water for release downstream in the dry season.

12.3.1.5. Integrated Watershed Management Project in Stung Battambang

This would include feasibility studies for a multi-purpose large-scale hydropower projects (Battambang I and Battambang II). The watershed management project would provide a nexus for natural resources management in the context of the rapid growth. It would include mapping the area to high detail including analysis of change over time to provide context and a base for examining natural resource management issues of flooded forest and floodplain land use. It would include research on ground and surface water availability and use. It would seek to develop a universal zoning plan for the watershed that would provide the much-needed framework for managing development and maintaining the natural resources that underpin the area's growth.

12.3.1.6. Tonle Sap Wild Fisheries Conservation Project

The Tonle Sap is a critical habitat for the maintenance of fisheries throughout the Mekong River Basin, and its flooded forest in particular is vital to maintaining the unique and rich biodiversity of fish and other aquatic species that provide the majority of protein to the basin's people. To protect this resource, a community-based natural resource management project focusing on the floodplain and flooded forest for wild fisheries conservation is proposed. This would include mapping of flooded forest and floodplain land use, preservation of fisheries migration routes and sanctuaries, awareness raising and promotion of good practice, preparation of policy and legal alternatives for consideration by senior government officials and support for enforcement of rules and improved regulations for fisheries.

12.3.1.7. Tonle Sap Sub-Area Water Mapping Project

There is a large amount of surface and groundwater resources and infrastructure in the Tonle Sap Sub-area, but comparatively little of it has been inventoried and mapped such that it could form the basis for planning and design efforts. This project would inventory all water-related infrastructure including existing surface water (rivers, lakes, ponds, and canals), infrastructure (dykes, weirs, bridges, wells, pumping stations, control structures), measurement stations and potential hydropower sites to evaluate water resources, demand and investment potential and to prioritize investment.

12.3.1.8. Tonle Sap Basin Management Committee Project

The Tonle Sap basin attracts a great deal of attention from government agencies, donors, academic institutions, non-governmental organizations, the private sector and, of course, the many people living there. In order to provide a framework and forum for management of the natural resources in the entire basin, it is proposed to create a Tonle Sap Basin Management Committee that would provide overall direction, coordination, support and planning for the region.

12.3.2. Regional Projects

These programmes/projects would address issues that extend beyond individual Sub-areas in Cambodia.

12.3.2.1. Mekong Fisheries Migratory Pathways and Refuge Preservation Program

This would include examination and delineation of the critical habitats and pathways for the flagship species and locations, namely the Irrawaddy Dolphin and Mekong Catfish and the Tonle Sap. It would include recommendations on physical, legal, economic and social conservation measures to protect these species and areas. It would examine the potential links to eco-tourism and how to maximize the benefits from this to assist in funding local people to cooperate in the protection of the resource.

In addition, it would examine the issues of how fish are able to migrate during the flood and the impacts of different infrastructure development on blocking or enabling that migration. There would be research on the design and operation of structures to allow fish to migrate and spawn, and identification and protection of refuges. Pilot projects could examine how to allow the natural capture fisheries to thrive while managing infrastructure works like irrigation systems and roads and combining this with ways of increasing the yields from the fisheries in water bodies blocked by the structures.

12.3.2.2. Technology Dissemination for Development – Hooking Up with the Modern World

This would include development of a low-tech and widespread information and market system to allow farmers to produce goods and access the more open and reachable markets in Thailand and Vietnam. This would include low-cost internet services such as those developed in India and organization of cooperatives and promotion of linkages with the private sector so that farmers are supported and trained to produce the quality necessary. It would include use of new technologies such as high-efficiency drip irrigation and development of niche high-quality agriculture and aquaculture products for those markets.

It would also examine constraints to development of small and medium enterprises and pilot projects to promote their participation in working with farmers to develop business opportunities. It could look into the issues of livestock, plant and fish traffic, disease control, marketing, tariff barriers and response to epidemics.

12.3.2.3. Reaching Out to the Vulnerable – Bringing the Poor Along for the Economic Ride

There is a clear link between poverty and vulnerability, and poverty and environmental degradation. The causes of poverty are many and are known, but not sufficiently analyzed and addressed in aid project work.

This project would focus closely on issues of particular benefit to the vulnerable including women, the disabled and the chronically poor. It would include poverty analysis and identification of ways to address their real needs in the time of rapid economic development and change. It would include research into women's under-representation in leadership positions and development of practical pilot projects and recommendations for increasing their voice and direct involvement. It would address the specific needs of the many disabled to access and use water. It would include aid coordination and advocacy on these issues. It would include training and promotion of employment opportunities.

Another aspect to be included would be to link the more developed integrated sustainable farming activities undertaken in neighboring countries such as Northeast Thailand to poor farmers in Cambodia so that they could see the benefits and learn from the many years of experience developed in similar conditions there.

12.3.2.4. The Tourist Trail Project

Tourism is concentrated in the Angkor area, yet there are ancient monuments and sites throughout the Tonle Sap basin. However ancient roads ran from Wat Phu in Southern Laos through sites such as Koh Ker, Beng Mealea, Kampong Svay, Banteay Chhmar and Sambor Prei Kuk. These interesting monuments provide potential attractions for tourists looking to get off of the beaten track and discover other areas and epochs of ancient history. These areas are relatively poorer with difficult infrastructure and few markets.

Repairing the ancient roads and linking the monuments would provide a critical mass sufficient of attracting many tourists who would extend their stay and spend time and money in these poorer areas. The "Tourist Trail" could link the monuments to the local people with home stays and agricultural tourism giving people an authentic rural experience. The trail could pass through national parks, wildlife sanctuaries and other scenic spots so that eco-tourism increases and business is generated for conservation efforts.

CHAPTER 13: PROPOSED PROJECT IDEAS

The following is the list of projects ideas proposed by the Tonle Sab sub-area working group and other external stakeholders as the results of the Second Stakeholder Forum, which need to be included in the long list of the MRC-BDP program of the 4 countries (Cambodia, Laos, Thailand and Vietnam).

This list still opens and waits for other development projects, which will be proposed by sub-area working group and other stakeholders after completion of Forum 2. To propose these development projects, requesters have to prepare their own projects using Pro-forma (PIN) prepared by MRC-BDP Team for preparing the long list.

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
Pailin						
1. Human Resource Development and Watershed Management	– Manage erosion – Support irrigation development – Beneficiaries: 20,500 persons	Strengthen staff capacity of PDWRAM in the management of irrigation	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by CNMC and Sub-Area Working Group of Tonle Sap and implemented by PDWRAM and Communities	4	20,000
2. Development of Integrated Agriculture	– Improve farmer living standard – Reduce poverty	Train farmers and provide financial support to the farmers to implement the project (400 families/year within 8 districts)	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by CNMC and Sub-Area Working Group of Tonle Sap Sub-area and implemented by PDAFF	4	40,000
3. Watershed Management	– Manage forest – Reforestation	The project will train people living in the vicinity of protected natural resources and develop 4 communities.	Environment Programme of MRC	Coordinated by CNMC and Sub-Area Working Group of Tonle Sap Sub-area and implemented by PDE and PDWRAM	4	40,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
Banteay Mean Chey						
1. Protection and management of flood from Thai border and Irrigated Agriculture.	This project assists the management and protection of the West and the North border regions where affect by flood flow from Thailand and support the irrigated agriculture development. Beneficiaries: 46,149 persons.	This project includes rehabilitation of four irrigation systems, and the feasibility study of ground water use in O Chrov district.	Agriculture, Irrigation and Forestry Programme; and Water Resources Management Programme of MRC	Coordinated by MRC, PRDC, and Tonle Sap SAWG. Implemented by PDWRAM & Communities	4	2,153,720
2. Management of Flood from Tonle Sab and Irrigation.	This project will protect the flood from Tonle Sab and support the development of agriculture in order to assure food security and poverty reduction.	This project includes the repairing of Komborsras dam located in Phreah Nethpreah district and reparairing of Thmor dob dam located in Mongkolborei district.	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by MRC, PRDC, and Tonle Sap SAWG. Implemented by PDWRAM & Communities	3	574,297
3. Management of Rainfall and Irrigation.	This project will protect the flood that was caused by annual rainfall and the flooded flow from Battambang province. It can store enough water to irrigate cultivated land in both dry and rainy seasons.	This project includes preparing of Porpideum dam and Kokbalang basin system. The both places located in Mongkoulborei district.	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by MRC, PRDC, and Tonle Sap SAWG. Implemented by PDWRAM & Communities	3	1,907,400

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
4. Establishment and Capacity Strengthening of Provincial Committee on Tonle Sab Sub-Region Works.	This project will strengthen the capacity of commune officers to lead the process of the Tonle Sab sub-area development program in Bantey Meachey province through establishment managerial structure development activities in the province.	Establishing the provincial committee on Tonle Sab sub-region works. Establishing the managerial committee of Tonle Sab sub-region at the district and commune level and train them.	This project relates with the project of establishment of Tonle Sab Management Organization of ADB-CNMC.	Coordinated by CNMC and PRDC.	5	1,528,300
Battambang						
1. Management and Flooded Forest Conservation.	Protection of Tonle Sab flooded forest and to keep water depth in Tonle Sab so that it can remain it function of taking water from area around Tonle Sap, preservation of biodiversity, especially fish and water bird.	This project includes determination of flooded forest area situation, forest type, forest cover and advantage of each fish type. Establishment of efficient managerial structure. Study and analysis the causes of flooded deforestation, the environmental impacts and the relationship between wild animal type and fish type.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC, PDAFF, PDE, Local Authorities and Communities.	4	6,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
2. Management and Conservation of Provincial Reserved Fishing Territory.	Reserved fishing lots are very important for protected place and genetic fish conservation in order to increase fish production.	Studying genetic fish type, stock products and biological character. Protection system and prepare efficient mechanism for reserved fishing territory protection.	Fishery Programme of MRC.	Coordinated by CNMC, PDAFF, PDE, Local Authorities and Communities.	5	6,000,000
3. Development of Provincial Aquaculture.	To meet protein demand and improve living standards of the people, and reducing over-fishing	This project includes the determination of geographical situation where has the aquaculture development potential. Preparing the baby fish produced station. Studying fish breeding technique. Preparing media system on aquaculture.	Fishery Programme of MRC.	Coordinated by CNMC and implemented by PDAFF	5	5,000,000
4. Collection of Provincial Fishery Data.	Fisheries statistic is very important in terms of sustainable management of fish resource and to develop appropriated fishery policy and plan.	This project includes the training on fisheries statistic collection methodologies. And fisheries statistic collection.	Fishery Programme of MRC.	Coordinated by CNMC and implemented by PDAFF	5	5,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
5. Chemical Waste Reduction by Using the Appropriated Agricultural Technique (Organic Agriculture).	This project will provide with non-chemical substance agricultural products to domestic and international markets. Help in keeping natural balance and bio-diversity.	Establishing training center and educate on organic agriculture and agricultural intensification by using natural fertilizer.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and implemented by PDAFF	5	5,000,000
6. Establishment of Animal Breeding and Feeding Technique Center for Farmers.	Increase livestock production through feeding of non- chemical substance, natural fodder to meet domestic demand and export.	Establish animal breeding center for providing the genetic animal to the farmers, train the farmers on family animal feeding and farm.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and implemented by PDAFF	3	5,000,000
7. Rehabilitation of Sangker River Irrigation System.	This project will supply water for domestic and agricultural uses in both dry and rainy season. The project help also to protect soil erosion and landslide of river slope have been happening at present.	This rehabilitation includes five irrigation systems a long the Sangker river located in Banan, Koskralor, Sangker, Battambang and Ekphnom districts.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and implemented by PDWRAM, Line Agencies Involved and Communities	5	25,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
8. Rehabilitation of Bovel Irrigation System.	This project diverts water from Bovel river for domestic and agricultural uses both in dry and rainy seasons.	This project includes the repairing of cross-river water gate. Construction and rehabilitation of canal systems and development of meteorological data system and farmer water use communities.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and MOWRAM Implemented by PDWRAM	3	2,100,000
9. Rehabilitation of Mong Ressey River Irrigation System.	This project diverts water from Mong Ressey river for domestic and agricultural uses both in dry and rainy seasons.	This project includes water basin preparation, repairing of the construction of cross-river water obstruction. Build and rehabilitate canal system, build the system of water canal and water distribution, build released water basin, and prepare meteorological system and organize farmer water use communities.	Agriculture, Irrigation and Forestry Programme & Water Resources Management Programme of MRC	Coordinated by CNMC and MOWRAM Implemented by PDAFF	4	3,000,000
10. Forest Management and Reforestation	– Mitigate erosion by deforestation – Reduce poverty and ensure food security		Agriculture, Irrigation and Forestry Programme & Environment Programme of MRC	Coordinated by MRC and implemented by PDAFF and Stakeholders involved	5	7,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
11. Forest Conservation participated by Local Communities	– Reforestation – Forest seed development	The project consists of such activities as reforestation, forest community development and capacity building.	Agriculture, Irrigation and Forestry & Environment Programme of MRC	Coordinated by CNMC and implemented by stakeholders involved	5	4,000,000
Kampong Chhnang						
1. Integrated Agricultural Production Project	Improving living standards of farmers and improve farmers' knowledge in using and adopting integrated agricultural technology.	This project includes the working model shows and trains the farmers.	Agriculture, Irrigation and Forestry Programme & Water Resources Management Programme of MRC	Coordinated by MRC and implemented by PDAFF	4	590,800
2. Construction and Rehabilitation of 3 Floating Ports	Facilitate transportation of agricultural products for farmers.	One port locates in Chhnok Trou and another two locate in Kompong Tralach district. These floating ports can move to different positions according to seasonal water level.	Navigation Programme of MRC.	PDPWT	3	200,000
3. Improve River bank stability and Embankment.	Protect from bank erosion and improve management and aesthetic of Siem Reap ports.	This project locates in Phsar Chhnang commune where is the capital of Kampong Chhnang province	Navigation Programme of MRC.	PDPWT	2	750,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
4. Wastewater Treatment Plant Construction.	Store and treat wastewater before discharge into the river.	This project is located in Phsar Chhnang commune	Navigation Programme of MRC.	PDPWT	2	200,000
5. Construction and Rehabilitation of Water Disposal System in Kampong Chhnang Capital and Roleaphear District.	Drain water from the town and Roleaphear district, and protect the province from flooding.	This project will construct 2,000 meters of sewage pipe a long and crossing the national road # 5.	Navigation Programme of MRC.	PDPWT	2	400,000
6. Flooded Protection Dike.	Construction of reservoir for irrigation and flood protection, and increase agricultural land.	This project locates 4,000 meters a long Tonle Sab riverside in capital of province.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and MOWRAM Implemented by PDWRAM	3	1008,000
7. Watershed Management.	– Protect and conserve forest – Reforestation	3 communities will be developed to protect forest	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	Coordinated by CNMC and MOWRAM Implemented by PDWRAM	5	30,000
8. Restoration of Tonle Sap Bed	Facilitate movement of fish and navigation	Location of the project is along the Tonle Sap in Chol Kiri and Kampong Leng district, with a lenth of 10,000 m	Navigation Programme of MRC	PDPWT	5	2,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
9. Ecotourism	Preserve natural resources in a sustainable manner through participation of communities aiming at attracting tourists and generating jobs and income for farmers	The project consists of 4 location within Samaki Meanchey and Toek Phos district	Tourism Programme of MRC	PDWRAM, PDE, PDT	4	40,000
10. Restoration of Irrigation Systems (6 areas)	- Reduce water flow - Increase and restore cultivated area - Increase agricultural productivity - Ensure food security	Location of the project: Tamrek, Salong, Tasek, Banteay Thlok, O Trav, and Chan Kiek	Agriculture, Irrigation and Forestry & Fisheries Programme of MRC	Coordinated by CNMC and MOWRAM Implemented by PDWRAM	3	764,000
Kampong Thom						
1. Strengthening of Fishing Lots	The project will assist the management of fishing lots in an effective manner. Fish habitats will be protected. Illegal fishing activities will not be carried out.	Location of the project: Phat Sanday Commune (Kampong Svay district) & Peambang commune (Staung district)	Agriculture, Irrigation and Forestry & Fisheries Programme of MRC	Implemented by PDAFF	3	58,800
2. Restoration of Stung Sen and Ta Som Stream		Location of the project: Phat Sanday Commune (Kampong Svay district)	Agriculture, Irrigation and Forestry & Fisheries Programme of MRC	Implemented by PDAFF		25,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
3. Fish Seed Management		400 lakes will be selected to implement. The size of each lake is approximately 10,000 m^2. Main activities include: plant flooded forest around each lake, restore lakes (as necessary), and develop fishery community.	Agriculture, Irrigation and Forestry & Fisheries Programme of MRC	Implemented by PDAFF		90,000
4. Protection of Stung Sen's Bank	Protect Stung Sen's bank from erosion		MRC	PDPWT	3	360,000
5. Construction of Floating Port, Stung Sen district	Mitigate inland water traffic jam	Location of the project: Stung Sen district	MRC	PDPWT	1	18,000
6. Wastewater Treatment Facility	Treat urban wastewater	Location of the project: Kampong Thom town	MRC	PDPWT	1	8,000
Odor Meanchey						
1. Restoration of Boeung Snor Irrigation System	– Irrigate 400 ha of dry season rice – Be a bird shelter – Be a place for celebrating such ceremony as water festival			PDWRAM and Communities	2	3,500,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
2. Rehabilitation and Construction of Trapeang Veng Irrigation System	The project can irrigate 2,000 ha of dry season rice	– Repair 150 m of irrigation damaged by flood – Construct 2 water culverts – Construct 3 water gates – Dig 3 canals consisting of 3 km			3	65,000,000
3. Rehabilitation and Construction of Chong Kal Irrigation System	The project can irrigate 1,800 ha of dry season rice	Construction of water culverts, water gates and main canals			3	35,000,000
Pursat						
1. Fishing Species Management and Aquaculture Development	Fish habitats will be protected and conserved. The project will build and strengthen capacity for conservation of fish species.	Location of the project will be Krakor, Kandieng, Bakan and Phnom Kravagn district. Preserved fish habitat, flooded forest and aquaculture will be prioritized by the project.	Fisheries Programme of MRC	PDAFF & Fisheries Communities	5	588,501
2. Training and Practice of Farmers at Research Center of Fruit Trees and Rice	Farmers will gain knowledge and technique on how to grow fruit trees and rice	The project will be carried out in Bakan and Sampov Meas district	No interface with any programme	PDAFF & Fisheries Communities	5	144,250

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
3. Reduction of Pesticide Use	– Farmer awareness on the use of pesticide will be improved – Use of pesticide will be mitigated – Natural methods for destroying pests will be promoted	The project will help farmers living in Kandieng, Bakan, Krakor, Sampov Meas, Kravagn and Viel Veng district.	No interface with any programme	PDAFF & Fisheries Communities	5	116,875
4. Strategy for Land Management in accordance with Crop Patterns	– Farmers will gain knowledge on how to prepare land for growing crops – Natural fertilizer utilization will be improved	The project will be carried out in Kandieng, Bakan, Krakor, Sampov Meas and Kravagn district	No interface with any programme	PDAFF & Fisheries Communities	5	150,000
5. Integrated Agricultural System for Plateau and Floodplain	The project will help farmers use integrated agricultural technique aiming at mitigating soil erosion and protecting soil quality	The project will be undertaken at 30 places on plateau and 20 places on floodplain	No interface with any programme	PDAFF & Fisheries Communities	5	150,000
6. Establishment of Fruit Tree and Vegetable Community	– Communities will be developed – Communities will gain proper knowledge on how to grow fruit trees – Import of fruits from neighboring countries will be decreased	The project will be carried out in 23 communes	No interface with any programme	PDAFF & Fisheries Communities	3	150,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
7. Development of Agricultural Diversification Community facing Flood and Drought		30 communities with 900 ha of cultivated area will grow new kind of paddy rice	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	PDAFF & Fisheries Communities	3	170,000
8. Livestock and Forage	– Quality and quantity of animals within 12 communities will be increased – Forage quality will be improved – Communities will have ability and capacity to manage the communities themselves	The project will be carried out in any villages or communes located along Stung Pursat	No interface with any programme	PDAFF & Fisheries Communities	5	395,091
9. Rehabilitation of Kbal Hong Irrigation	– Provide sufficient water to farmers living in Veal commune for growing wet and dry season rice – Mitigate disaster by flood during rainy season	The project can irrigate 17,610 ha of wet season rice and 130 ha of dry season rice.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	PDWRAM	1	486,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
10. Development of Hydropower at Anlong Kroch, O Som and Tang Lourch	Electricity supply for Pursat and some communes will be sufficiently provided	Location of the project will be at Anlong Kroch, O Som and Tang Lourch	No interface with any programme	PDIME & MIME		2,110,000
11. Restoration of Stung Pursat Drainage	– Provide sufficient water to farmers living in 2 districts and Veal commune for growing wet and dry season rice – Mitigate disaster by flood during rainy season	The project can irrigate 2,000 ha of wet season rice and 130 ha of dry season rice.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	PDWRAM	1	400,000
12. Rehabilitation of Chheu Tauk Irrigation	– Provide sufficient water to farmers living in Sra Gne commune for growing wet and dry season rice – Mitigate disaster by flood during rainy season	The project can irrigate 16,780 ha of wet season rice and 60 ha of dry season rice.	Agriculture, Irrigation and Forestry Programme & Fisheries Programme of MRC	PDWRAM	2	5,000,000
13. Solid Waste Management in Kampong Lourng Recreation	– Reduce pollution that can affect on public health – Serve as a practical model for other place surrounding Tonle Sap Sub-area		Environment Programme of MRC	PDT & PDE	3	181,134

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
14. Bird Conservation in Kampong Thkaul	– Stop destroy of birds – Protect bird habitats – Prevent destroy of flood forest		Environment Programme of MRC	PDT & PDE	3	68,124
Siem Reap						
1. Conservation and Management of Flooded Forest and Reserved Fishing Lots	Protect flooded forest, soil erosion, biodiversity, fish habitat.	To understand clearly ecosystems and relationship and interaction between its components, manage properly reserved areas, create natural tourist sites and research centers, demonstrate legal way of fish catches,	Fisheries & Environment Programme of MRC	Coordinated by CNMC Implemented by PDAFF and Communities	5	5,000,000
2. Use Appropriated Techniques for Agriculture to Reduce Chemical Fertilizer Use and Livestock Development.	Agricultural products for domestic use and export were assured in both quantity and quality.	Improve Tekvil research center in Tonle Sap area, use of appropriate technique to produce natural fertilizers, form communities, and promote livestock, agricultural extension.	Fisheries & Environment Programme of MRC	Coordinated by CNMC Implemented by PDAFF and Communities	5	7,000,000
3. Conservation and Diversion of Water Resources for Irrigated Agriculture Use and Forest.	Store and divert water to irrigate 8,000 ha of rainy season rice and dry season rice of 300 ha for 5,000 families.	Rehabilitation of 15,000 m dam, 6 water gates, construction of 3 diversion dam and 11 water gates, and 80 km of irrigation systems.	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by CNMC Implemented by PDWRAM and Communities	5	2,500,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
4. Conservation of Water Resources for Irrigated Agriculture	Store water during rainy season to irrigate dry season rice of 2,000 ha for 1,150 families.	Rehabilitation of 3,000 m dam, 3 water gates, 2 concrete pipes, construction 4 water gates, 1 diversion dam, and 30 km of irrigation system.	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by CNMC Implemented by PDWRAM and Communities	4	1,200,000
5. Conservation of Water Resources for Use in the Province	– Protect 1,500 families in the area from flood – Assure water supply during dry season – Irrigate dry season rice of 300 ha and rainy season rice 1,500 ha – Improve road condition	Rehabilitation of BekTap 2,000 m dam and two water gates, and construction of 1 water diversion gate and 1 water retention basin.	Agriculture, Irrigation and Forestry Programme of MRC	Coordinated by CNMC Implemented by PDWRAM and Communities	3	2,500,000
6. Chong Kneas Environmental Improvement through Construction of Port	Improve waterway transport for tourist, passengers and goods; provide water supply, electricity, school, health center for people in 2 communes with total population of 11,500.	Construction of port in Chong Kneas and development of tourism sites.	Environment Program of MRC.	Coordinated by CNMC Implemented by PDE, PDPWT, Apsara Authority, and Communities	3	20,000,000
7. Sewage and Wastewater Treatment Plants	Assure well-being of the people, good services for tourists, improve natural environment. Benefits for people in Siem Raep of 140,000 and hotel 7,000 rooms.	Construction of water treatment plants, road and sewage systems.	Environment Program of MRC.	Coordinated by CNMC Implemented by PDE, PDPWT, Apsara Authority, and Communities	4	15,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
8.Establishment of Solid Waste Community in Chong Khneas, Siem Reap Commune	Reduce waste disposal and pollution, improve natural environment and public health and biodiversity, attract tourist, and provide employment opportunity and increase income.	Conduct survey, establish communities, temporary disposal places, recycling center, provide equipments, provides education to communities.	Environment Program of MRC.	Coordinated by CNMC Implemented by PDE, and Communities	2	330,000
Preah Vihear						
1. Rehabilitation of OuKdol Irrigation system	This project will provide water to irrigate rice at the beginning and at the end of rainy seasons, for other crop and other uses of water.	Rehabilitation of Okdol diversion dam, irrigation and drainage systems in Phnom Penh commune, Kulen district.	Agriculture, Irrigation and Forestry & Flood Control and Management Programme of MRC	Coordinated by CNMC Implemented by PDWRAM, SAWG, and Communities	2	550,000
2. Rehabilitation of water basin 95	This project will provide water to irrigate rice at the beginning and at the end of rainy season and other crops. Provide advantage for fishery and tourism.	Construction of earth fill dam irrigation system in Palharl and Kampng Pronak communes, Tbeng Meanchey district, and establish farmer water user group	Agriculture, Irrigation and Forestry & Flood Control and Management Programme of MRC	Coordinated by CNMC Implemented by PDWRAM, SAWG, and Communities	3	7,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
3. Rehabilitation of Meun Reach irrigation system	This project will provide water to irrigate rice at the beginning and at the end of rainy seasons, for other crop and other uses of water.	Construction of earth fill dam, diversion dam, irrigation and drainage system in Sa Ang, Tor Su and Kyorng communes, Chey Sen district, and establish farmer water user group	Agriculture, Irrigation and Forestry & Flood Control and Management Programme of MRC	Coordinated by CNMC Implemented by PDWRAM, SAWG, and Communities	3	1,500,000
4. Rehabilitation of O Sro Em irrigation system	This project will provide water to irrigate rice at the beginning and at the end of rainy seasons, for other crop and other uses of water.	Construction of earth fill dam, diversion dam, irrigation and drainage system in Kantout communes, Cham Ksan district, and establish farmer water user group	Agriculture, Irrigation and Forestry & Flood Control and Management Programme of MRC	Coordinated by CNMC Implemented by PDWRAM, SAWG, and Communities	3	1,000,000
5. Protection of natural resources along Sen river	Protect from illegal fishing, to conserve fish and other biodiversity and water birds.	Study the impacts on human and animal, and establishment of fishery communities.	Fisheries Programme of MRC	Coordinated by Department of Fisheries Implemented by PDAFF and Communities	5	1,000,000
6. Aquaculture development for all districts in the province	Improve people livelihood and well-being, to meet the demand for food.	Establishment of breeding centres and provides fish raising technique to local communities.	Fisheries Programme of MRC	Coordinated by Department of Fisheries Implemented by PDAFF and Communities	5	5,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
7. Collection of fish data in Sen river	By surveying many times can collect information about fish breeding by season.	Provide training through lecture and field visits in order to plan, implement and monitoring properly any project.	Fisheries Programme of MRC	Coordinated by Department of Fisheries Implemented by PDAFF and Communities	5	5,000,000
8. Reduce the use of chemical fertilizers and pesticides	This project can reduce health hazard caused by chemical substance and can assure long term soil quality.	Construction of pollution control training center to provide training and collection of data.	Fisheries Programme of MRC	Coordinated by Department of Agronomy Implemented by PDAFF and Communities	5	5,000,000
9. Agriculture Land Improvement	Farmers gain more new knowledge and change their way of planting and can use new method to improve their products.	Construction of experimental center, provide training through lecture and field visit to farmers.	No interface with any programme of MRC	Coordinated by Department of Agronomy Implemented by PDAFF and Communities	5	3,500,000
10. Establishment of Animal Breeding Center	Farmers have more animals to use for plowing and transportation.	Establishment of breeding center to provide training.	No interface with any programme of MRC	Coordinated by Department of Veterinarian Implemented by PDAFF and Communities	5	4,000,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
11. Construction of Sewage System in Provincial Town	To drain waste water from the town to keep the town clean and protect the town from flooding	Construction of two sewage systems, 8,000 m long, along the roads in provincial town.	Navigation Programme of MRC	PDPWT	3	1,600,000
12. Construction of Wastewater Treatment Plants	To treat wastewater before drain it into natural water body	Construction of waste water treatment plants in provincial town.	Navigation Programme of MRC	PDE	2	250,000
13. Construction of Wastewater Treatment Plants and Management of Natural Resources and Watershed	To treat and drain wastewater from Preash Vihear Temple area and can protect soil erosion and illegal logging and trans-boundary impacts.	Construction of two sewage systems in hillside areas and construction of waste water treatment plants. This project also can protect overexploitation of natural resources.	Environment & Tourism Programme of MRC	PDE	2	200,000
14. Establishment of Protected Area Communities	Promote natural resources products for people to use, reduce deforestation and can protect soil erosion, conserve soil quality and environment.	Establishment of communities and providing awareness on natural resources management, develop community statute, making plan for short and medium term.	Environment Programme of MRC	PDE	20	350,000
15. Protection and Conservation of Grass Area in Protected Areas	Protect grass field, forest, soil erosion and fodder.	Survey on biodiversity data, identify priority areas and develop efficient management systems	Agriculture, Irrigation and Forestry Programme of MRC	PDE, PDAFF, Local Authorities, and Communities	20	500,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
16. Human Resources Development	Improve capacity of officer and community members in order to manage development programme properly.	Establishment of working group and provide training through short, medium and long training courses.		PDE	10	200,000
17.Construction of National Road No.64	Promote tourism development as well as transportation mean for people in the area.	Construction of asphalted roads with 210 km long and 9 m wide, 21 concrete bridge with 346 m long, 29 sewage systems with 116 m long, diameter 0,8 m, 4 Bale bridge 174 m long.		PDPWT	10	35,627,000
18. Construction of National Road No.66	Promote tourism development as well as transportation mean for people in the area.	Construction of asphalted roads 50 km long and 9 m wide, Bale bridge 135 m at Krasang river, sewage systems 140 m, diameter 0.8 m.		PDPWT	3	9,121,000
19. Construction of National Road No.211 and 212	Promote tourism development as well as transportation mean for people in the area. Also promote relationship with Laos and Thailand.	Construction of asphalted roads 126 km long and 9 m wide, 34 concrete bridge 680 m, 50 sewage systems 200 m, diameter 0.8 m.		PDPWT	7	24,358,000

Project Name	Project Beneficiary	Project Description	Interface with MRC	Project Implementing	Time Frame (year)	Budget, US$
20. Pipe Water Supply	To meet water demand in the provincial town	Install two pumping machines capacity 25-120 HP, pipe 150 m, water tank capacity 20 m3, main pipe 7,000 m and distribution pipe 12,000 m.		Coordinated by MIME Implemented by PDIME & Private Investors	3	12,016
21. Development of Natural-Cultural Tourism Sites (Beung Brodak Prasat Preash Khan-Kampong Svay)	Protect and conserve natural resources, promote community participation and attract tourism in order to increase income for farmers.	Establish 4 tourism sites in Village Ta Seng, Ranakse commune, Sangkum Thmey district, near Kra Saing river.		PDT	3	350,000
22. Eco-tourism Development at Stung Ksach	Protect and conserve natural resources, promote community participation and attract tourism in order to increase income for farmers.	Establish 1 tourism sites along 1,500m Sen river in Village Thmey, Kamong Pronak commune, Tbeng Meanchey district.		PDT	1	30,000

CHAPTER 14: GLOSSARY

Acid soils (or sulphur acid soils): Soils that have been rendered acid due to formation of sulphuric acid by oxygenation of pyrite (natural iron sulphide, FeS_2), often due to human interference (lowering of the groundwater table by drainage, or excavation of ponds for aquaculture). Such soils are unsuited for cultivation, effluents leaking from such areas can be poisonous to fish (because acid can dissolve aluminium), and the process can be practically irreversible.

Alluvial: Formed by river sediments. An alluvial river flows in a landscape formed by its own sediments.

Analysis (of hydrological data): Processing, involving a sometimes comprehensive transformation and interpretation, in order to arrive at some desired knowledge. Data analysis is often carried out stage-wise and in different contexts: On-line processing in the field, off-line processing, further synthesisation for model input, etc. In general, data analysis involves both hidden and explicit assumptions about the relation between primary data and final results. (As one example, a flow rate in a river can be calculated assuming that the current measurements were made simultaneously, even if they took a whole day). Such assumptions can affect both the accuracy and the validity of the results. A suitable quality is supported by an adequate transparency of the analysis.

Aquaculture: Cultivation, aiming at commercial production, of aquatic plants or animals, such as fish, prawns, shellfish, etc.

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Basic minimum needs: These can comprise food and water, shelter, primary education, vital health care, and personal integrity.

Biodiversity: The number of species (of plant and animals) that actually live in an area (or biotope) where they belong. Agenda 21 (Chapter 17.7) states about coastal biodiversity: 'Coastal States, with the support of international organizations, upon request, should undertake measures to maintain biological diversity and productivity of marine species and habitats under national jurisdiction. Inter alia, these measures might include: surveys of marine biodiversity, inventories of endangered species and critical coastal and marine habitats; establishment and management of protected areas; and support of scientific research and dissemination of its results'.

Brackish water: A mixture of sea water and freshwater, found at places where inland waters discharge into the sea: River mouths, fjords, estuaries, lagoons, inland seas, etc. The salinity will be higher than nil, but lower than the ocean salinity of 35 PPT. Stratification is common in brackish areas, and the salinity will often vary highly, both in time and place.

Catchment (or drainage area): An area (delineated by a watershed) that drains through a specific river cross-section.

Development objective (or overall objective, or development goal, or mission): A desired future situation, which is supported by a plan (or programme or project) that is targeted towards it. The plan (or programme or project) cannot in itself assure achievement of the development objective - this is subject to a number of assumptions on related developments that are outside the control of the plan (or programme or project). Some authors recommend that only one development objective be applied from case to case, and that it be specified in time, space and quantity. See also immediate objective.

Discharge: Net flow or net sediment transport through a fixed cross-section of a river.

Dispersion: Mass transport determined by the transverse current velocity gradient and the concentration gradient (and always in the direction of the concentration gradient).

Driving force: A circumstance that has a major (positive or negative) influence on pursuance of a set of planning goals. It can be physical, climatic, economic, social or political, and can appear as a trend, a cycle, or an event. A driving force cannot be fully controlled by the participants in the planning process. It can be unpredictable, or not well understood, or even unknown.

Dublin Principles (from International Conference of Water and the Environment, Dublin 1992): (1) Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment; (2) water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels; (3) women play a central role in the provision, management and safeguarding of water; (4) water has an economic value in all its competing uses and should be recognized as an economic good.

Ecological demand of stream flow: The minimum stream flow required for prevention of irreversible ecological degradation. This value varies over the year and from one place to another. To maintain a healthy environment, the flow must be higher in the wet season than in the dry season, because many aquatic species have annual cycles that reflect their natural habitat. Sometimes, the water-level is critical, rather that the flow rate.

Endemic: Occurring only in one specific geographical area (for example one country, one river basin, or one island).

Eutrophication: Excessive supply of nutrients, resulting in a high primary production. Eutrophication can have negative ecological effects, such as large fluctuations of dissolved oxygen between night and day, or damage to benthic vegetation due to shading by algae.

Flow: Volume transport per time unit (for example through a cross-section of a river).

Frequency: Number of cycles (or units or events) per unit time.

Gauging: Measuring at a fixed point; a gauge is a measuring device (e.g. for water-level or pressure).

Gross domestic product (GDP): the total output of goods and services for final use produced by an economy, by both residents and non-residents, regardless of the allocation to domestic and foreign claims. It does not include deductions for depreciation of physical capital or depletion and degradation of natural resources.

Immediate objective: The intended situation that is achieved as the direct result of orderly implementation of a plan (or programme or project). The immediate objective is the result of a number of outputs, which, between them, are necessary and adequate for achieving the immediate objective. Some authors recommend a maximum of 3 immediate objectives, and that these are specified in time, space, quantity, quality and target group. See also development objective.

Integrated farming: An area-intensive and labor-intensive combination of different parallel productions, like a fish pond, paddy, fruit trees, livestock, cash crops and vegetables. Integrated farming can give yields that highly exceed monoculture yields.

Integrated Water Resources Management (as defined by Global Water Partnership): A process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

Opportunity costs: The cost difference between one course of action and another (better) course of action. In a wider sense, the implications of one course of action relative to alternative strategies. In development projects, the opportunity costs can reflect the time lag from when a new technology emerges and until it becomes available to the target group. There is often an opportunity cost related to doing nothing.

Photosynthesis: The primary production (by plants, algae and some bacteria) of simple carbohydrates (such as sugar), normally from (inorganic) carbon dioxide, and using energy supplied by the sun.

Phytoplankton: Photosynthetic aquatic microorganisms (algae).

Pollutant: A compound that is harmful or otherwise undesired in the environment, either absolutely, or at an elevated concentration level. See also contaminant and xenobiotic compound.

Pollution: Release to the environment of a substance that can harm it.

Salinity (of sea water): Relative mass of the salt contents, given in PPT (parts per thousand) (kg per 1,000 kg), or in PSU (practical salinity units) (which is very nearly the same as PPT).

Scenario: A hypothetical combination of events and physical conditions, describing a possible future situation.

Sector planning: Planning for a specific source of income, like agriculture, fisheries, hydropower, industry, service, tourism, etc.

Seepage: Slow movement of water in the ground, or from the ground to the surface.

Stakeholder: A person, group or institution that has a particular interest in an activity, project, programme or policy. This includes both intended beneficiaries and intermediaries, winners and losers, and those involved in, or excluded from the decision-making process. A key stakeholder is one who can significantly influence or who is otherwise important to the success of the activity, project, programme or policy.

Strategy: (1) A conceptual plan for how to reach a goal; (2) a plan, method or series of actions designed to achieve a specific goal or objective.

Subsistence economy: An economy in which agricultural, hunting and other activities are undertaken primarily to meet household consumption requirements.

Transparency (of a procedure): The insight conveyed to the data user about how the data were produced, for example for assessing the validity of the data for a given, possibly unforeseen, purpose. An acceptable transparency is obtained by documentation and can be supported by using standard procedures.

Vector-borne disease: A disease transmitted by an organism (for example malaria).

Water availability: The flow into an area from upstream, plus the (surface and groundwater) resources generated by net rainfall in the sub-area, minus the ecological demand within the area and at its downstream boundary. The availability changes slowly, from one decade to the next, due to medium-term climate variations, or due construction of reservoirs or diversions. The availability can be measured, and/or determined by numerical modelling, often with a high accuracy (subject to the coverage and quality of the basic hydrological data).

Water demand: The amount of water required for a given purpose, for example litre per person per day, or mm per crop. The demand can be present or future, and it can be actual (i.e. related to an available infrastructure) or potential (assuming full infrastructural development and no water shortage). The serviceable (part of the) demand is limited both by infrastructure and water availability.

Water pricing: A tool for management of water allocation between areas, sectors and individual users, assuming that an 'optimal' allocation (or just a sustainable allocation) can be determined on the basis of a water price that reflects the full costs (and hereby the full value) of water (for example, in economic theory, by charging the full costs and relying on free market mechanisms for allocation). Such a strategy can improve water efficiencies and reduce waste of water. It will often give preference to industrial allocations rather than irrigation. See valuation and cost of water.

Watershed: A line in the landscape (e.g. a ridge) that delineates a catchment. The surface runoff on each side of the watershed will proceed towards different locations.

Wetland: An area that is covered by water in at least a part of the year. A wetland can represent a special ecological habitat, sometimes with a high biodiversity, and can serve as a fish breeding ground. The Ramsar convention defines wetlands quite broadly as 'areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including marine areas with a depth less than 6 m at low tide'.

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