



**Mekong River Commission  
For Sustainable Development**

# **IWRM-based Basin Development Strategy for the Lower Mekong Basin**

*Fourth draft*

**29 November 2010**

# Preface

On behalf of the Mekong River Commission (MRC) Council, I am pleased to present this IWRM-based Basin Development Strategy for the Lower Mekong Basin (LMB), jointly prepared by the Member Countries of the MRC (Cambodia, Lao PDR, Thailand and Viet Nam).

The participatory preparation of this Strategy and its approval by the MRC Council is a major achievement in the move towards sustainable Mekong River basin development and management.

The Strategy is fully aligned with the Declaration of the 1<sup>st</sup> MRC Summit held on 5 April 2010, Hua Hin, Thailand, which acknowledges that accelerating the development of water and related resources will make a significant contribution to the socio-economic development of the region, but at the same time recognises there may be negative impacts on the basin environment that need to be fully addressed.

For the first time since the signing of the 1995 Mekong Agreement, the MRC Member Countries have developed shared understandings of the opportunities and risks of the national plans for water resources development in LMB and agreed on a number of Strategic Priorities to optimise the development opportunities and minimize uncertainty and risks associated with them. This provides incentives for the timely implementation of the agreed procedures under the 1995 Mekong Agreement.

The Member Countries recognize the need to further develop water-related opportunities (such as fisheries, navigation, flood and drought risk reduction), as well as opportunities beyond the water sector, which together provide possibilities for poverty reduction and moving towards sustainable basin development.

The Member Countries acknowledge the urgent priority to develop and agree on basin-wide environmental and social objectives and baseline indicators, against which to judge and apply future developments and to guide future updates of this Strategy.

We understand the critical importance of strengthened basin management and in particular, a strong programme of institutional, technical, organisational and human resource capacity building for sustainable basin development.

The successful implementation of this Strategy requires commitment of all Mekong Basin countries, project developers and other concerned stakeholders to make best possible efforts to manage water and related resources activities within the framework detailed in the Strategy.

On behalf of the MRC Council, I encourage your support to work with us in realising this Strategy.

Pham Khoi Nguyen  
Chair of the MRC Council for 2010-2011

# Contents

<b>Acronyms .....</b>	<b>i</b>
<b>Executive Summary .....</b>	<b>ii</b>
<b>1. Introduction .....</b>	<b>1</b>
1.1 Purpose and Scope of the Strategy .....	1
1.2 Objectives and Vision Underpinning the Strategy .....	2
1.3 The Approach to Strategy Development .....	2
<b>2. Development Trends and Plans .....</b>	<b>5</b>
2.1 The Mekong River Basin .....	5
2.2 Water Resources Development and Management .....	5
2.3 Development Trends and Emerging Issues .....	6
<b>3. Development Opportunities and Risks .....</b>	<b>8</b>
3.1 Underlying Assessments .....	8
3.2 Opportunities and Risks of Water Resources Development	<b>Error! Bookmark not defined.</b>
<b>4. Basin Development Strategy .....</b>	<b>12</b>
4.1 Identified Development Opportunity Space .....	12
4.2 Strategic Priorities for Basin Development .....	13
4.3 Strategic Priorities for Basin Management .....	15
4.4 Prioritised Studies and Guidelines .....	18
<b>5. Implementation of the Strategy .....</b>	<b>18</b>
5.1 The Road Map .....	18
5.2 Roles and Responsibilities .....	20
5.3 Monitoring, Evaluation and Reporting .....	21

## Acronyms

ASEAN	: Association of South East Asian Nations
BDP	: Basin Development Plan
CNMC	: Cambodia National Mekong Committee
Danida	: Danish International Development Assistance
DOS	: Development Opportunity Space
EIA	: Environmental Impact Assessment
GMS	: Greater Mekong Sub-region
IPCC	: Intergovernmental Panel on Climate Change
IWRM	: Integrated Water Resources Management
LMB	: Lower Mekong Basin
LNMC	: Lao National Mekong Committee
MDG	: Millennium Development Goal
MNRE	: Ministry of Natural Resources and Environment (of Thailand)
MONRE	: Ministry of Natural Resources and Environment (of Viet Nam)
MOWRAM	: Ministry of Water Resources and Meteorology (of Cambodia)
MRC	: Mekong River Commission
MRCS	: Mekong River Commission Secretariat
MPCC	: Mekong Panel on Climate Change
NGO	: Non Governmental Organization
NMC	: National Mekong Committee
NMCS	: National Mekong Committee Secretariat
NPV	: Net Present Value
PDIES	: Procedures for Data and Information Exchange and Sharing
PNPCA	: Procedures for Notification, Prior Consultation and Agreement
PMFM	: Procedures for Maintenance of Flow on the Mainstream
PWQ	: Procedures for Water Quality
PWUM	: Procedures for Water Use Monitoring
RBC	: River Basin Committee
RBO	: River Basin Organization
SEA	: Strategic Environmental Assessment
SIA	: Social Impact Assessment
TbEIA	: Transboundary Environmental Impact Assessment
TNMC	: Thai National Mekong Committee
US\$	: United States dollar
VNMC	: Viet Nam National Mekong Committee
WREA	: Water Resources and Environment Administration (of Lao PDR)

# Executive Summary

1. **Introduction to the Strategy.** The *IWRM-based Basin Development Strategy* provides initial directions for cooperative and sustainable Lower Mekong Basin (LMB) development and management. The Strategy is:
  - a. The Mekong River Commission's (MRC) central tool for the achievement of the objective of the 1995 *Agreement for the Cooperation for the Sustainable Development of the Mekong River Basin* Agreement in Article 1: "to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin"; and
  - b. The MRC's primary response to Article 2, which calls for "the formulation of a basin development plan...to identify, categorize and prioritize the projects and programs...".The *Strategy* defines an agreed "rolling" basin development planning process that connects regional LMB plans, made possible through transboundary cooperation, with national LMB plans. The *Strategy* is subject to review and updating by MRC every five years.
2. **The Strategy: an Essential and Enabling Response.** The LMB and the Mekong River itself are undergoing significant change. Economic growth and poverty reduction in the LMB require development of water resources for multiple purposes, including power, agriculture and fishery production and navigation. They also require the management of the river and its life- and livelihood-giving ecosystems, for long-term sustainability in times of change – including demographic, economic and climate change. Developments in the Lancang-Upper Mekong Basin in China and in the LMB are now changing the Mekong's flow regime. To meet growing demand for goods and services, the private sector is actively seeking investment opportunities, which the river can provide. The *Strategy* is an essential and enabling response to this reality.
3. **The Strategy on Opportunities and Risks.** There are many LMB development opportunities that could bring significant benefits at national and, through cooperation, at regional levels. These opportunities also have significant risks and costs, which must be managed and mitigated, both at the national level, and where relevant, through cooperation at the transboundary level. The *Strategy* identifies the following opportunities and risks:
  - Considerable potential for further hydropower development in the tributaries, particularly in Lao PDR and Cambodia, requiring social and environmental standards to ensure sustainability;
  - Major potential to expand and intensify irrigated agricultural production and to combat delta saline intrusion, subject to cooperation with China in the operation of the Lancang - Upper Mekong hydropower dams, to ensure increased, regulated and reliable dry season flows;
  - Potential opportunity for some mainstream hydropower development, provided that the many uncertainties and risks are fully addressed and transboundary approval processes followed; although potential benefits are high, so are potential costs, including transboundary impacts; and
  - The need to define other priority water-related opportunities (e.g. fisheries, navigation, flood management, tourism, and environment and ecosystem management), as well as those that go beyond the water sector (e.g. other power generation options).
4. **The Strategy on Basin Development.** The *Strategy* defines a process to move from opportunities to implementation and sustainable development, including the definition of *Strategic Priorities for basin development*:
  - Essential knowledge acquired to address uncertainty and minimize risks of identified development opportunities, including knowledge on: migration and adaptation of fish; trapping and transport of sediments and nutrients; loss of biodiversity; and social and livelihoods impacts;

- Opportunities and risks of current developments (to 2015) addressed, including: cooperation with China to ensure increased low flows; LMB mainstream baseline low-flow agreement; and risks of committed projects managed;
  - Options identified for sharing development benefits and risks;
  - Irrigated agriculture expanded and intensified, for food security and poverty alleviation;
  - Environmental and social sustainability of hydropower development greatly enhanced;
  - Climate change adaptation options identified and implementation initiated; and
  - Basin planning considerations integrated into national planning and regulatory systems.
5. **The Strategy on Basin Management.** The *Strategy* defines *Strategic Priorities for basin management*, an essential companion to basin development to ensure sustainability, as follows:
- Rigorous basin-wide ‘environmental and social objectives’ and ‘baseline indicators’ defined;
  - Clear basin objectives set and management strategies for water-related sectors defined, including fisheries and navigation;
  - National-level basic water resources management processes strengthened, including water resources monitoring, water use licensing, and data and information management;
  - Basin-level water resources and related management processes strengthened, including the implementation of MRC procedures, state of basin monitoring and reporting, project cycle monitoring, and enhancing stakeholder participation; and
  - Water resources management capacity building program implemented, linked to MRC’s overall initiatives and complementary to national capacity building activities.
6. **Implementation of the Strategy.** The *Strategy* defines a clear Roadmap setting out priority actions, timeframes and outcomes. An early action in the Roadmap is the preparation in the first half of 2011 of LMB Regional and National Action Plans, defining activities, responsibilities, deliverables and costs. The preparation of the Regional Action Plan will be led by the MRC and implemented through the MRC Strategic Plan 2011-2015. The National Action Plans will be integrated, to the extent possible, within national long- and short-term economic and sector plans with coordination and facilitation by the NMCSs. The implementation of the *Strategy* will be the core priority of the BDP 2011-2015 Programme. A comprehensive monitoring programme of *Strategy* activities and outcomes will be developed during the first three months of implementation.
7. **The Status of the Strategy.** The *Strategy* is a product of the MRC Member Countries of Cambodia, Lao PDR, Thailand and Vietnam and will be implemented by them with the support and facilitation of the MRC and the financial support of their key development partners. Active and transparent involvement of all Mekong stakeholders is required so that the ambitious goals for the cooperative and sustainable management and development of the LMB are achieved, for the shared benefit of all the LMB population, particularly the poor and needy.

# 1. Introduction

## 1.1 Purpose and Scope of the Strategy

**Purpose.** The IWRM-based Basin Development Strategy (the Strategy) is a statement of the Lower Mekong Basin (LMB) countries (Cambodia, Lao PDR, Thailand and Viet Nam) setting out how they will share, utilize, manage and conserve the water and related resources of the Mekong to achieve the goals of the *Agreement for the Cooperation for the Sustainable Development of the Mekong River Basin*, signed on 5 April 1995 (the 1995 Mekong Agreement). The Strategy is part of the MRC's response to Article 2 of the 1995 Mekong Agreement, which calls for '*the formulation of a basin development plan, that would be used to identify, categorize and prioritize the projects and programs to seek assistance for and to implement at the basin level*'. It provides initial directions for sustainable basin development and management that are subject to review and updating by MRC every five years.

**Integrated Water Resources Management (IWRM)** is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize economic and social welfare in a balanced way without compromising the sustainability of the ecosystems.

IWRM is not an end in itself but a means of achieving three key strategic objectives of *Efficiency* (attempt to maximize the economic and social welfare derived not only from the water resources base but also from investments in water service provision); *Equity* (in the allocation of scarce water resources and services across different economic and social groups) and *Sustainability* (as the water resources base and associated ecosystems are finite).

*Global Water Partnership, 2000*

**Scope of Strategy.** The Strategy considers projected development scenarios over a fifty-year period to create a twenty-year view of basin development and management. It provides an integrated basin perspective against which current and future national water resources development plans can be assessed to ensure an acceptable balance between economic, environmental and social outcomes in the LMB, and mutual benefits to the LMB countries, as required by the 1995 Mekong Agreement. This Strategy:

- defines the scope of opportunities for water resources development (hydropower, irrigation, water supply, flood management) and their associated risks and required actions to optimize the opportunities and minimize the risks;
- defines other water-related opportunities (fisheries, navigation, environment and ecosystems, watershed management);
- provides a coordinated, participatory and transparent process that promotes sustainable development.

**Need for Strategy.** This Strategy has been developed during a time of significant change, where rapid, large-scale development of the river is already taking place, and hydropower dams constructed on the Lancang in China (Lancang-Upper Mekong Basin) and on tributaries in the LMB are already changing the Mekong's flow regime. There is increasing demand from riparian countries, project developers and stakeholders for the provision of an integrated basin perspective of national water resources development plans and their cumulative impacts. This is particularly true in a planning environment where private sector operations are a major driver of change. The Strategy has been prepared while recognizing data and knowledge limitations; however, accelerated development pressures demand action. The Strategy is a dynamic framework that will be reviewed and updated every five years to ensure that decision making on water and related resources is based on an updated knowledge of the basin. The next update is expected by 2015.

**A Milestone.** The Strategy presents an important milestone in the history of Mekong cooperation. It has been owned and driven by the LMB countries through a process of analysis of national

development plans and possible impacts and has been informed by wide stakeholder engagement across the basin. For the first time, the countries have arrived - through constructive sharing and consultation - at a common understanding of each other's plans for water resources development, drawing initial conclusions together on likely transboundary impacts, addressing each other's concerns, developing a shared understanding of the opportunities and risks of water resources development and agreeing to a number of Strategic Priorities and actions to guide future decisions on basin development and management.

## 1.2 Objectives and Vision Underpinning the Strategy

**MRC Objectives.** A fundamental objective of the 1995 Mekong Agreement is cooperation to achieve “*the full potential of sustainable benefits to all riparian countries and the prevention of wasteful use of Mekong River Basin waters*”. This aim is complemented with the *Shared Vision for ‘an economically prosperous, socially just and environmentally sound Mekong Basin’*. Basin Development Planning is central to the 1995 Mekong Agreement in achieving this aim and is guided by other fundamental objectives and principles in the Agreement, covering:

- Protection of the environment and ecological balance;
- Sovereign equality and territorial integrity;
- Reasonable and equitable utilization;
- Maintenance of flows on the mainstream;
- Prevention and cessation of harmful effects;
- State responsibility for damages;
- Freedom of navigation; and
- Response to emergency situations

**MRC’s “IWRM Strategic Directions” (2005) -**  
Eight priority IWRM key result areas:

- Economic development and poverty alleviation
- Environmental protection
- Social development and equity
- Dealing with climate variability
- Information based planning and management
- Regional cooperation
- Governance
- Integration through basin planning

**Strategic Directions.** With these objectives and principles underpinning cooperation, the MRC has realized the need for an integrated approach. In 2005 the MRC Council adopted the ‘*Strategic Directions for IWRM in LMB*’ that identifies eight priority areas for IWRM, as key to the goals of sustainable and equitable development in the Mekong Basin.

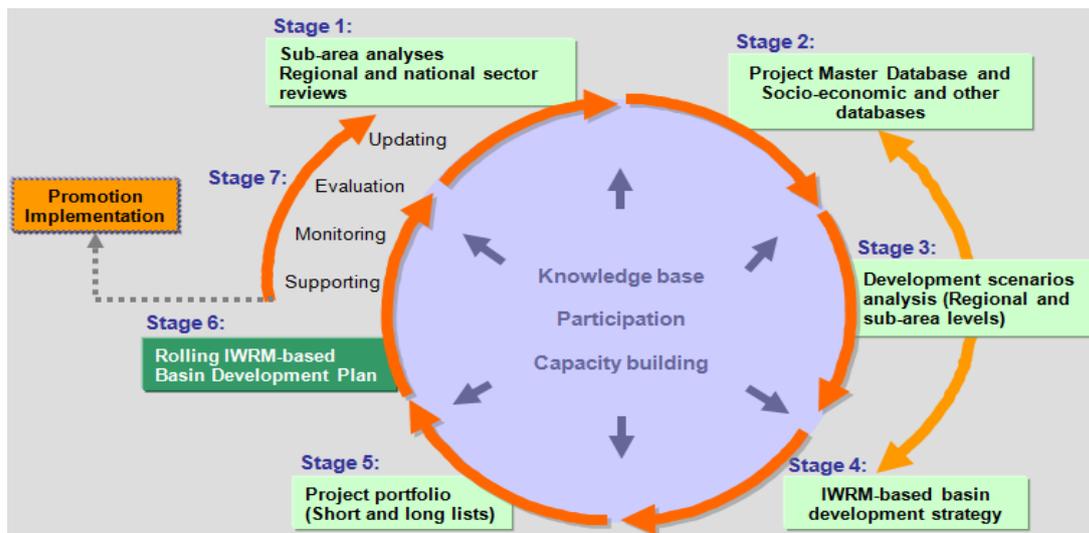
**Summit Declaration.** At the First MRC Summit, Prime Ministers of LMB countries reaffirmed their continued commitment to cooperate in promoting the sustainable development, utilization, conservation and management of the water and related resources (“*Meeting the needs, Keeping the balance: Toward Sustainable Development of the Mekong River Basin*”). The Summit highlighted the need for further cooperation to tackle *critical emerging challenges* in the Mekong Basin including: managing the risks of floods and droughts; integrating sustainability considerations into the development of the Basin’s hydropower potential; minimizing deterioration of water quality, loss of wetlands and deforestation, which present risks to biodiversity and people’s livelihoods; managing the Basin’s unique natural fisheries; and researching and addressing the threat to livelihoods posed by climate change.

## 1.3 The Approach to Strategy Development

**General.** The LMB countries agreed that ‘formulation of a basin plan’, as required under the 1995 Mekong Agreement, would best be achieved by utilizing a rolling basin development planning process that followed seven stages as shown in Figure 1. The key feature of the process is the necessary inter-play between national and sub-national plans with the opportunities at basin-level that are made possible through effective transboundary cooperation. The IWRM-based Basin Development Strategy provides the interconnection between national and basin planning. Its regular updating is key to the rolling basin planning process adopted by the LMB countries (Figure 1). It

brings together water and related resources at the sub-basin and national levels in an integrated assessment of cumulative impacts of basin-wide development scenarios.

**Figure 1 – Basin development planning cycle**



**Scenario Assessment.** This scenario assessment evaluates future development policies, plans and projects against agreed and rigorous environmental and social objectives and criteria. The results, together with other basin-wide assessments (e.g. a sectoral Strategic Environment Assessment - SEA), provide a basis for discussion and negotiation of mutually beneficial levels of water resources development and their associated levels of transboundary environmental and social impacts. This leads to a shared understanding of what could be considered as development opportunities (*Development Opportunity Space*).

**Development Opportunity Space.** The Strategy employs the “Development Opportunity Space” (DOS) to present both *water resources development opportunities* (i.e. how much water can be used for industrial water supply, irrigation and hydropower) and *water-related opportunities* contributing to improved livelihoods (fisheries, flood warning, watershed management, biodiversity conservation, river trade, climate change adaptation) or improving the management of water and related resources (basin monitoring systems, navigation systems, and policy, institutional and capacity development). Together, these two areas of the DOS represent the opportunities for coordinated basin development and management. The boundaries of the DOS are set by the agreed basin environmental and social objectives and indicators and thresholds set out in the MRC procedures, such as the flows framework to be maintained under the PMFM and the water quality standards for human and aquatic health under the PWQ.

**Opportunity, not Project Endorsement.** The Strategy uses the DOS as an intermediate step in the filtering process that moves from considering the full range of development possibilities to a portfolio of projects that achieves the shared vision, within the prevailing regulatory requirements at national and regional levels. It does NOT indicate endorsement of any national plan and project that are brought into the scenarios. It provides a broad picture of the level of basin development to be considered, based on the transboundary environmental and social impacts. For an opportunity to become a project, it will pass through national planning and assessment processes, identification and feasibility, notification and/or prior consultation, and agreement with other countries through the MRC Procedures, where applicable, and national approval as shown in Table 1. This process requires commitment to actions and monitoring to ensure that Strategic Priorities for basin development and management and other processes set out in the Strategy will be applied from the stage when a project is identified (and is included in the Project Master Database to allow early cumulative assessments

and application of the MRC Procedures) to when it is endorsed by the relevant national regulatory processes and MRC Procedures. Initiatives that comply will become part of the Project Portfolio.

**Table 1 – From opportunities to sustainable water and related resources development projects**

Stages	Process	Main Supporting Tools	
1	<b>IWRM-based assessment</b> of needs, combined national water resources development plans, water-related sector plans, and other possible developments	Sharing and/or notification of nationally-identified projects for incorporation in Project Master Database; National and regional discussions to define the basin-wide scenarios and environmental, social and economic assessment objectives and criteria; Expert and participatory assessment process and verification of results;	Project Master Database Basin-wide development scenarios assessment SEA, such as of proposed mainstream dams Other basin-wide assessments
2	<b>DOS:</b> identification of a package of both water resources development and water-related opportunities	National and regional discussions and negotiations on acceptable levels of basin development;  This could include options for benefit and impact sharing that will enhance the DOS	Basin-wide development scenarios assessment; Agreed environmental and social objective statements and baseline indicators; MRC Procedures; Strategic Priorities; Studies.
3	<b>Identification</b> of water resources development and water-related projects, using the DOS	Project identification, also considering alternative options within and outside the water sector; Periodic updates of Project Master Database	Broader (regional and national) sustainability considerations; Strategic Priorities; Option analysis; Project Master Database.
4	<b>Preparation of</b> water resources development and water-related projects	Project preparation, including where applicable feasibility studies, EIAs, etc. Periodic updates of Project Master Database	Broader (regional and national) sustainability considerations; Strategic Priorities; WRM and sector guidelines; Project Master Database.
5	<b>Notification, prior consultation and Agreement.</b> Consideration of projects with transboundary impacts	Implementation of MRC Procedures	MRC Procedures; Strategic Priorities; WRM and sector guidelines; Project Portfolio.
6	<b>National approval</b>	In accordance with national legislative framework	National laws and regulations;
7	<b>Implementation and operation</b> of projects	In accordance with regional and national standards, values and safeguards	National laws and regulations; WRM and sector guidelines

**Enhanced DOS.** The Strategy recognizes that the DOS can also be used as a ‘cooperation space’ or ‘negotiation space’ to explore mutually beneficial options, including benefit and impact sharing agreements that go beyond the specific project level and consider other opportunities (possibly unrelated to water - e.g. trade or transport) to facilitate equitable outcomes. The Strategic Priorities will help enhancing the DOS to move toward sustainable development through a transparent process that: (i) explores joint and mutually beneficial development opportunities that are beyond national plans, within and outside the water sector; and (ii) closes knowledge gap and develops mitigation measures that will facilitate the review and decision making for future development opportunities.

**Strategic Priorities.** The Strategy identifies Strategic Priorities that provide direction and support to optimize opportunities and minimize associated risks as well as to ensure that developments proceed within the established national and regional regulatory framework. When a development opportunity becomes an identified project, Strategic Priorities guide and support project preparation, appraisal/approval and implementation, improve implementation of agreed MRC Procedures, minimize impacts and provide good practice guidelines. Strategic Priorities also guide water-related socio-economic activities, such as improved fisheries management, integration of road and river transport, and addressing the Millennium Development Goal (MDG) 7 relating to improving access to drinking water, biodiversity, wetland and environmental hotspot preservation.

**Stakeholders and Participatory Process.** The Strategy is the outcome of a two-year consultation process with national agencies, provinces, RBOs, community representatives, NGOs, academia, development partners, dialogue partners and others. To ensure transparency, all relevant documents are posted on the MRC web site. The Strategy preparation, including scenario assessment, was overseen by experts from relevant national line agencies, national advisors and the MRC. An independent Panel of Experts has provided an independent expert review of the underlying assessments and the first draft of the Strategy. The approach to developing the Strategy can be found in the supporting document “*Working towards an IWRM-based Basin Development Strategy*”<sup>1</sup>.

## 2. Development Trends and Plans

### 2.1 The Mekong River Basin

**The Mekong River.** The river flows for almost 4,800 km from its source in Tibet through China, Myanmar, Lao PDR, Thailand, Cambodia and Viet Nam via a delta into the East Sea, draining a basin area of 795,000 km<sup>2</sup> and with a mean annual discharge of approximately 475 km<sup>3</sup>. The per capita water resources are high relative to other international river basins. The flow from the Lancang-Upper Mekong Basin contributes 16% of the average annual flow in LMB<sup>2</sup> but up to 30% of dry season flow. There is a very large difference in wet and dry season flow, caused by the Southwest Monsoon, generating wet and dry seasons of about equal length. Inter-annual variability is large in terms of river discharges, flooded areas, and the start and end of the wet and dry seasons. The seasonal cycling of water levels at Phnom Penh causes the large water flow reversal to and from the Great Lake via the Tonle Sap, with the associated flooding and drying creating a rich ecology. The Mekong is the second most bio-diverse river in the world after the Amazon, and supports the world’s largest fresh water capture fishery of about 2.3 million tons per year.

**The Socioeconomic Setting.** The LMB population in 2007 was estimated at 60 million, with about 90% of the populations of Cambodia (13 million), 97% of the population of Lao PDR (5.2 million), 39% of the population of Thailand (23 million), and 20% of the population of Viet Nam (17 million in the Delta and 3 million in the Central Highlands) living within the basin. Population growth in the basin is 1-2% in Thailand and Viet Nam and 2-3% in Cambodia and Lao PDR. Although urbanization is occurring in all LMB countries, about 85% of the basin’s population lives in rural areas. The livelihoods and food security of most of the rural population are closely linked to the river system, with over 60% of the economically-active population having water-related occupations that are vulnerable to water-related shocks and degradation. Millions of poor people depend on capture fisheries for food security and income. While all LMB countries are making good progress towards achieving the MDGs, over 35% of the population of Cambodia and Lao PDR has incomes below the poverty line, with much higher percentages in many rural areas. Food security and malnutrition pose great challenges. About half of all households have no safe water supply and half of all villages are inaccessible by all-weather roads. Throughout the LMB, inequalities are generally increasing between urban and rural groups.

### 2.2 Current Water Resources Development and Management

**Water Resource Withdrawal.** The average annual withdrawals for agricultural, industrial and other consumptive uses in the LMB are about 60 billion m<sup>3</sup>, or 12% of the Mekong’s average annual discharge. There are minor diversions from the mainstream upstream of the Delta in Viet Nam and large-scale diversions are being considered. Existing reservoir storage of water is less than 5% of the mean annual flow, insufficient to redistribute water significantly between seasons. Groundwater use

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<sup>1</sup> The document and other supporting materials can be found at [www.mrcmekong.org](http://www.mrcmekong.org)

<sup>2</sup> This figure is 13% according to China

in the Basin is modest except in Northeast Thailand and Viet Nam where surface water is scarce during the dry season; sustainable groundwater development potential requires careful assessment.

**Water-related Sectors.** Agriculture is the dominant water-related sector, particularly in Thailand and Viet Nam whereas agriculture in Cambodia and Lao PDR is currently less intensively developed. Overall, the dry-season irrigated area of about 1.2 million hectares is less than 10% of the total agricultural area in the LMB (15 million hectares). Expansion of the present levels of irrigation is limited by the availability of dry season flows. The dry season flows reaching the Viet Nam delta are fully used for economic, environmental and social purposes, including combating seawater intrusion. The full hydropower potential of the LMB is estimated at 30,000 megawatt, with 10% developed to date. Navigation is important but largely undeveloped as an integrated transport sector. Efforts to reduce the vulnerability to major floods have primarily been by non-structural measures. Water resources have been developed on a small scale for the improvement of wetlands and aquaculture. River-related tourism is important for national revenue and local income generation.

**State of the Basin.** Monitoring indicates the river's resilience to current human-induced pressures. The flow regime of the mainstream is mostly in its natural state, although tributary dams impact some mainstream locations. Water quality is generally good, except in the Delta and other areas with high development, where high nutrient levels are a cause of concern. The river's annual flood pulse continues to support a rich fishery, although there are reports of declining catches. However, the outlook for the basin's forests is not so positive, with increasing demand for timber and land driving deforestation and soil degradation. Basin fauna, including 14 critically endangered species, 21 endangered species and 29 vulnerable species, is threatened by rapid developments that will alter habitats and mechanisms, essential to sustain high ecosystem productivity.

**Water Resources Management.** Water resources management in the LMB is a mix of a 'cooperative and coordinating model' at the basin-scale, facilitated through the MRC, and four national models, reflecting individual sovereignty, custom and administrative systems. MRC acts as a focal point for cooperation, assisting in achieving basin-scale aims through provision of shared information, technical guidance and mediation. Each country is embracing IWRM adapted to its needs, with clear statements of national water policy and strategy supported by strengthened institutional and regulatory frameworks. This identifies the agency responsible for water resources management, empowered by on-going modernization of water resources legislation. In all LMB countries, river basin organizations/committees are being established for participatory water management at the catchment and local level.

## 2.3 Development Trends and Emerging Issues

**Global Developments.** The region is rapidly growing and integrating into the world's economy. Fluctuating oil and gas prices, an emphasis on renewable and non-fossil fuel generation and the availability of private finance, are making hydropower increasingly attractive and accelerating its development in the LMB. Global food shortages and rising prices can make irrigation more profitable in the LMB, while irrigation development may attract foreign investments seeking intensified and diverse food production. Climate change models predict a wetter wet season and an unaffected dry season in the Basin; the delta is highly vulnerable to sea level rise. Water-related planning must adapt to global economic trends and to climate change in order to ensure sustainability.

**Regional Economic Integration.** Integration is a significant trend in the Greater Mekong Sub-region (GMS). LMB countries are all members of the Association of South East Asian Nations (ASEAN) and signatories to ASEAN agreements for economic integration and promotion of regional approaches to sector development. In the GMS cooperation framework the countries are working together on sector approaches and priority programmes, with energy sector activities promoting regional power trade to develop the sub-region's energy potential, the facilitation of the development of grid interconnection, and private sector investment. The GMS Core Environmental Programme is

improving environmental planning and management capacities for strategic environmental assessment of sector strategies and plans, promotion of pro-poor biodiversity conservation corridors, and environmental management.

**Upper Mekong.** China is completing its hydropower cascade on the Lancang; the Manwan, Dachaoshan, Jinghong and Xiaowan dams are currently operational and the Nuozhadu Dam will be completed in 2014. The Xiaowan and the Nuozhadu dams, with 9,800 and 12,400 million m<sup>3</sup> of active storage, may cause significant seasonal redistribution of flow from the wet season to the dry season and further reduce sediment transport in the Mekong mainstream, providing both opportunities and risks to downstream countries.

**Lower Mekong Basin – Needs.** Economic growth across the LMB is expected to continue, supported by economic diversification, regional economic integration, and investments in infrastructure and human resource development. Lao PDR and Cambodia seek to graduate from least developed country status, while Vietnam seeks middle-income status by 2030. Increasing populations and living standards and growing economies will accelerate food and electricity demand. In overcoming persistent rural poverty, it is essential to address the regular and devastating effects of severe droughts and floods, which claim lives and property and cause substantial economic losses. All LMB countries have poverty reduction strategies that include water supply for drinking and irrigation, flood management, hydropower generation, fisheries and other uses of Mekong water. Hydropower is projected to provide an important source of foreign exchange earnings and revenues for Lao PDR.

**Lower Mekong Basin – Development.** 26 hydropower projects (>10 megawatt) are under construction on tributaries, creating, together with the dams in China, 36 billion m<sup>3</sup> of additional active storage. Over the next 20 years, further LMB dams are planned, including 12 mainstream projects<sup>3</sup> and 30 tributary dams, mostly in Lao PDR. All mainstream dams are classified as 'run-of-river', with limited storage capacity and regulation potential. Many tributary dams include significant reservoirs, adding 21 billion m<sup>3</sup> of storage. There are plans to increase dry season irrigation by 50% (from 1.2 to 1.8 million hectares) in the next 20 years, with Lao PDR planning to expand irrigation from about 100,000 to over 300,000 hectares. Major irrigation expansion is being studied in Cambodia, linked to investments in flood control in the undeveloped Cambodian delta, and elsewhere linked to hydropower development. Mainstream water transfers have long been considered by Thailand, to complement national approaches to alleviate droughts in the Northeast. LMB countries also plan to further develop aquaculture and improve fisheries management, navigation, flood management and tourism. Aquaculture growth is forecasted to double to 4 million tonnes in the next 20 years. Development on this scale will bring both great opportunities and high risks. Cooperation will be needed to minimize and mitigate these risks and to share the benefits across basin population groups.

**New Investments and Development Assistance.** There are increasing opportunities for the private sector and foreign 'state-owned companies' in the development of water and related resources, such as hydropower, navigation, large-scale irrigation, and industry (mining, forestry, and tourism). In many of these areas, private sector investment now exceeds that of the public sector. In comparison with conventional public sector driven developments, private sector developments are more opportunity-driven with relatively short planning cycles and assessment processes. While private sector participation is welcomed, it needs to be open to public scrutiny and sensitive to civil society concerns. This will require effective regulatory systems, including enabling legislation and regulations and enforcement capacity, as well as strong and empowered water resource management agencies.

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<sup>3</sup> Including 10 dams across the river channel (8 in Lao PDR, two of which are on the Lao-Thailand mainstream and 2 in Cambodia), 1 partial damming (Don Sahong) and 1 diversion project (Thakho) in Lao PDR.

## 3. Development Opportunities and Risks

### 3.1 Underlying Assessments

This Strategy is informed by two major assessments: the assessment of basin-wide water resources development scenarios covering a range of national water resources development plans (see section 1.3) and the Strategic Environment Assessment (SEA) of proposed hydropower projects on the Mekong mainstream<sup>4</sup>.

- **Scenario Assessment.** The Scenario Assessment accounted for environmental, social and economic cumulative impacts. Developments in the next 20 and 50 years are assessed with and without the potential influence of climate change. The Scenario Assessment developed a new, participatory approach using 42 criteria to evaluate each scenario in terms of 13 economic, environmental, social and equity objectives. This approach has underscored the need for rigorous basin-wide environmental and social objectives and baseline indicators for future scenario assessment; developing these objectives is a Strategic Priority (Section 4.3 below).
- **SEA of Mainstream Hydropower Dams.** The SEA complements the Scenario Assessment with a more in-depth analysis of power-related and cross-sector development opportunities and risks of the proposed LMB mainstream projects. It provides a basin-wide analysis of the issues to be considered when individual mainstream projects will be discussed by MRC member countries as part of the PNPCA.
- **Data and Assumptions.** The assessments employed various data from the MRC Master Catalogue or supplied by LMB countries. The hydrological assessment uses the MRC-agreed baseline 1986-2000 time-series data. Observed data of mainstream flows during 2001-2009 are used to verify modeled results, which are available as daily values to generate average monthly and seasonal values for comparison, also with historical wet and dry years. The environmental, social and economic impact assessment uses mainly 2008-2009 data. With the limited data and information, assumptions have been made in the Scenario Assessment; most importantly: (i) hydropower projects are operated to maximize power production within the variability of historical inflow data, and proposed LMB mainstream dams are operated as run-off-the-river dams; (ii) the social characteristics of vulnerable people within affected communities in 2030 are assumed to be those of 2008-09; and (iii) impacts of other non-water developments such as roads and urbanization are not included. These data limitations and assumptions are not unusual in “future looking” basin planning studies. Whilst in some cases it may not be possible to quantify the impacts precisely, the directions and orders of magnitude of change are clear enough to enable discussions among sectors and between countries on how resource development and management might proceed.

### 3.2 Opportunities and Risks of Water Resources Development

The LMB countries have consulted extensively, nationally and regionally, on the results of the Scenario Assessment and the SEA to understand the level of cumulative impacts, leading to a shared understanding of the opportunities and risks of various water resources developments and ways to take the opportunities forward to the next stage and to address these risks.

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<sup>4</sup> Detailed information is provided in the supporting document “Working Towards IWRM-based Basin Development Strategy”, the Final Report of the Assessment of Basin-Wide Development Scenarios (September 2010), and the Final Report of the SEA (October 2010) which can be found at [www.mrcmekong.org](http://www.mrcmekong.org)

## **Ongoing Development, especially hydropower development on the Lancang-Upper Mekong Basin and LMB tributaries (by 2015)**

The large storage dams on the Lancang and 28 existing or committed LMB tributary dams, if operated as expected to optimize power generation, would alter mainstream river flows substantially by reducing wet season and increasing dry season flows. The changes compared to the baseline are most evident upstream of Vientiane. This potential redistribution would provide sufficient dry season flows to meet all consumptive water demands of LMB countries as projected in their plans for the next 20 years, without contravening the baseline flow regime. Nevertheless, there will always be some risk that releases from the major storage dams in the basin do not meet expectations. Releases to meet emergency or extreme situations could lead to higher flood peaks and lower dry season flows compared to the baseline condition.

Economic benefits expected from hydropower development include reduction of flood damage, reduced salinity intrusion, and increased reservoir fisheries. Employment opportunities (370,000 new jobs estimated) will be generated, primarily in the hydropower and fisheries sectors. However, inevitable and irreversible flow changes will have substantial impacts on the baseline condition, including a reduction of wetlands, reduced flow reversal into Tonle Sap, and reductions in sediment flows causing irreversible river bed incision and bank erosion, with consequent impacts on delta-shaping processes. Reduced sedimentation will happen within a decade, with consequences for reduction of wetland and agricultural productivity and for sediment and associated nutrient discharge to coastal waters, which may affect marine fisheries dependent on the river's nutrient plume. Capture fisheries will reduce by 7%, primarily as a result of LMB tributary dams, two environmental hotspots will be highly impacted, and the livelihoods of almost a million vulnerable people will be at risk.

*The Strategy recognizes that these changes are inevitable as a result of past decisions and that there is an urgent need for collaboration to capture the opportunities and address the impacts of the on-going developments. The Strategy gives immediate attention to detailed identification of impacts and of mitigation and benefit-sharing measures, and to cooperating with China on the operation of the Lancang dams to: ensure certainty and security of LMB dry season flows, reduce flood peaks, and minimize loss of wetland and sediment and nutrient supply.*

## **Expansion of irrigated agriculture and tributary hydropower development in LMB by 2030**

The planned tributary hydropower development and expansion of irrigated agriculture in LMB countries over the next 20 years, including irrigation expansion in the Cambodia delta and current plans for a Northeast Thailand diversion, would add relatively small changes to the flow regime that will result from on-going developments, as large increases in irrigation and other consumptive water demands will mostly offset the potential increases in dry season releases by new tributary hydropower projects. For example, the dry season flows at Kratie will be on average 28% higher than the baseline, but only a 6% increase from changes caused by the on-going developments..

Economic opportunities would be large (estimated US\$ 8 billion NPV added to benefits from on-going development), mainly from tributary hydropower and irrigation. Hydropower construction and operation, irrigation and fisheries would create 650,000 new jobs. Irrigation expansion also provides opportunities for rice-field fisheries. The increase in environmental impacts come principally from the additional 30 tributary dams in Lao PDR and Cambodia, creating barriers to fish migration and increasing sediment trapping which will impact wetland productivity and delta-shaping processes. Impacts include a further reduction of capture fisheries from 7% with on-going developments to 10% over the next 20 years, an increase of highly-impacted environmental hotspots from two to five, and an increase by 400,000 to 1.4 million people exposed to livelihood risks.

*The Strategy recognizes the potential for expansion of irrigated agriculture and other consumptive uses, beyond the on-going development, and the need to protect the present baseline dry season flow to maintain social and environmental objectives. This could be achieved by the implementation of the*

*MRC Procedures for: Maintenance of Flows on the Mainstream (PMFM); Water Use Monitoring (PWUM); maintaining water quality standards (PWQ;) and Notification, Prior Consultation and Agreement (PNPCA), particularly for mainstream diversions.*

*The Strategy also recognizes the potential for further hydropower development in the tributary basins in Lao PDR and Cambodia, beyond ongoing development, which could provide alternative options to mainstream dams in Cambodia for the country's energy security. This requires early notification to allow analysis of mitigation measures, benefit-sharing arrangements, trade-off considerations and application of guideline and tools.*

*The Strategy gives priority to studies and actions that provide guidance and support to sustainable irrigation expansion, sustainable hydropower development in the tributaries, and potential offset arrangements.*

### **Mainstream Dam Development in LMB**

The proposed 12 hydropower projects on the mainstream of LMB have the potential for very large economic benefits but also very large environmental and social impacts. As the projects are run-of-the-river with limited carry-over storage, incremental flow changes over those caused by on-going developments will be insignificant. However, the uncertainty of environmental, social and economic impacts of these dams is high due to insufficient monitored data and analysis in a complex system like the Mekong Basin.

*Economic benefits would be very substantial, with the 11 mainstream dams (excluding Thakho diversion project) generating US\$ 15 billion NPV, 2.5 times the benefits of the planned 30 LMB tributary dams. About 400,000 new jobs would be created during the construction and operation phases of these dams. Furthermore, greenhouse gas emissions could be reduced by 50 million tones CO<sup>2</sup>/yr by 2030. However, the impacts could be very severe: 60% of the ecologically valuable river channel (e.g. biodiverse habitats including deep pools, rapids and sandbars) between Kratie and Houei Xai lost to a series of connected impoundments; 9 environmental hotspots highly impacted, mostly in Cambodia (Tonle Sap, 3S-Basin and the mainstream); 2 out of 4 flagship species at severe risk of extinction (Giant Catfish and Irrawaddy Dolphin); and a near-total barrier to fish migration along most of the mainstream unless new, and as yet untested, fish passage facilities are provided, which will further reduce capture fisheries in the basin by 15%, bringing the overall decline of capture fisheries in the basin to 25% relative to baseline. The dams will also have an impact on sediment and nutrient transport due to sediment trapping behind dams. The impacts increase with both the increased number and also with the location of the dams, with more severe impacts resulting from mainstream dams further downstream in the Basin. Incremental impacts of dams arise from the increased pondage and backwater and barrier effects.*

*The Strategy recognizes the high potential financial and economic returns from proposed mainstream projects in terms of meeting electricity demands and generating revenues for development. At the same time it recognizes that the uncertainty of the 12 proposed mainstream projects in the LMB is large and their cumulative negative impacts would be severe.*

*The Strategy gives priority to the development of this knowledge base, including the scale and distribution of risks and possible avoidance, mitigation and benefit and risk sharing options. Necessary frameworks must be in place to provide assurance that risks can be effectively minimized and transboundary approval through the PNPCA is obtained before investment decisions on the projects are made.*

*The Strategy recognizes that the SEA consultant report recommends deferment of decision on mainstream dams for 10 years with reviews every three years to ensure that essential deferment-period activities are being conducted effectively.*

## Long-term Development (by 2060)

The scenario assessment provides valuable insights on the risks of expanded water resources development in the next 50 years (by 2060). There is sufficient storage potential in the tributaries to meet high-case increases in consumptive water uses, without reducing the baseline dry season flow. However, the assessment also highlights the major impacts these developments would have on the ecosystems and social fabric of the basin, underscoring the need to proceed prudently and at a pace that allows knowledge to stay ahead of actions. The assessments show that while ongoing and planned flood protection measures in the Delta will cause marginal transboundary impacts, these impacts would be severe in the long term if significant areas of the presently flooded areas in the lower basin are given year-round flood protection. This will present major challenges in managing increased flooding and saline water intrusion, as well as further land development within the Cambodian and Viet Nam Delta areas, including the Tonle Sap floodplains. Whilst these issues are beyond the scope of the present planning period, a scoping study of the long term flood management options for the Mekong Delta is needed to inform subsequent basin planning processes.

*The Strategy includes a basin-wide, multi-sector study of the long-term flood management options for the Mekong Delta in response to growing pressures from upstream development plans, land development, morphological change and climate change (especially sea level rise).*

## Climate Change

The assessments of climate change impacts are based on the average value projection (B2 scenario) of the Intergovernmental Panel on Climate Change (IPCC). The predicted sea level rise of 17 cm by 2030 and 30 cm by 2060 is derived from the climate change and sea level rise scenarios for Viet Nam, undertaken by the Ministry of Natural Resource and Environment (MONRE). The assessments point towards more variable conditions within the basin and increasing runoff in the longer term. In the next 20 years, climate change could further increase the already high year-to-year variability of average wet and dry season flows, as well as the frequency and intensity of floods and droughts, reversing the reduction of flooding (and wetlands) caused by the on-going developments. In the longer term, increased average flood flows could be offset by increased tributary storage. However, the uncertainty in current climate change assessments is high. The definition of trends and ranges of climate change, including extreme events and their impacts on ecosystems and agricultural practices, as well as the identification of practical measures to combat droughts and extreme flooding need careful study. Combined with the likelihood of increased flooding, uncertain geomorphological impacts on the delta, and the development pressures in both Cambodia and Viet Nam, the threat of sea level rise needs intensive study before a strategy for the delta can be framed.

*The Strategy includes the analysis of climate change impacts, response to increasing risks of floods and droughts, and addressing the potential impacts of sea-level rise on the delta as part of long-term delta management options.*

## Distribution of Benefit and Risks

The potential benefits and risks of on-going developments are largely “shaped” by the flow changes caused by hydropower developments in the Upper Lancang-Mekong Basin. All LMB countries are both benefitting and impacted. In the next 20 years, excluding the proposed LMB mainstream dams, all countries would benefit economically, but Lao PDR, being the largest investor, would benefit most. The incremental impacts compared to those of on-going developments are mainly associated with the additional 30 tributary dams in Lao PDR and Cambodia, and these impacts are mostly felt in these countries. With mainstream hydropower dams, Lao PDR would gain two-thirds of the economic benefits, while Thailand and Viet Nam would benefit from hydro-electricity sharing. Cambodia’s economic benefits would be low compared to its investments, due to adverse impacts on its capture fisheries and a less attractive mainstream hydropower project. The incremental impacts relative to those caused by on-going development are distributed unevenly. Cambodia and Viet Nam

would be hardest hit by the risks from the proposed mainstream dams in Cambodia and southern Lao PDR. The uneven distribution of both benefits and risks across the four countries highlights the need for transboundary cooperation in benefit and risk sharing, to reach mutually acceptable decisions.

*The Strategy recognizes that the uneven distribution of benefits and risks of both on-going and future water resources development requires the countries to develop benefit and cost sharing options for basin development to be mutually beneficial.*

## 4. Basin Development Strategy

The Strategy for development sets out: i) the initial identification of the Development Opportunity Space (Section 4.1); ii) the Strategic Priorities for *both* Basin Development and Basin Management (Sections 4.2 and 4.3); and iii) prioritised studies of strategic importance and water resources management and sector guidelines that have been identified to support the implementation of the Strategic Priorities (Section 4.4).

The Strategic Priorities for basin management will guide and support the basin development process and future updates of the Strategy through the protection of the natural resource base, the strengthening of basin management processes, and related institutional development and capacity building. The DOS and initial Strategic Priorities need to be implemented to optimize the opportunities and minimize their associated risks, to ensure that developments will not stretch the boundaries of the DOS as well as to explore ways to enhance it. They will be updated by 2015.

### 4.1 Identified Development Opportunity Space

**Additional tributary hydropower development.** There is considerable potential for this in the LMB, especially in Lao PDR and Cambodia. Utilising this opportunity requires a focus on both transboundary and project level sustainability, and that any potential transboundary impacts are collaboratively identified and mitigated using the MRC Transboundary Environmental Impact Assessment (TbEIA) Framework.

**Expansion of irrigated agriculture.** Subject to coordinated operation of the hydropower dams in the Lancang-Upper Mekong Basin and in LMB, there is an opportunity for increased dry season flows to be used, without affecting the baseline flow, for irrigation expansion, including in the Cambodia delta and a possible diversion into Northeast Thailand, and to combat saline intrusion in the Delta. This requires effective cooperation with China and rigorous implementation of agreed MRC Procedures to monitor water use (PWUM), maintain baseline flows (PMFM), maintain water quality standards (PWQ), and ensure transboundary approval of certain uses (through PNPCA as applicable).

**Mainstream hydropower development.** There is a potential opportunity to consider some mainstream hydropower, provided the major uncertainties and risks associated with mainstream dams are fully addressed and transboundary approval for any project is obtained (through the PNPCA).

**Other opportunities.** Water-related opportunities, such as fisheries, navigation, flood management, watershed management, tourism and environment and ecosystem management, as well as opportunities beyond the water sector (e.g. alternative power generation options) have considerable potential and will be identified, facilitating the move towards sustainable basin development. The MRC Navigation Programme has previously prepared a sector strategy document 'Incorporation of Navigation into the Integrated Water Resources Management and Development Strategy', which proposes opportunities that will be assessed for entry into the DOS. The Strategy emphasizes the need for water-related sectors to prepare basin-wide strategies and for further identification of alternative opportunities beyond the water sector.

## 4.2 Strategic Priorities for Basin Development

### 1. Acquire essential knowledge to address uncertainty and minimize risk of the identified development opportunities

The uncertainties and risks associated with basin development opportunities, including uncertainties of climate change, require early implementation of a range of studies of strategic importance to fill knowledge gaps and to develop risk mitigation measures, necessary for the opportunities to move to the next stage of study or transboundary appraisal, as required. The list of these studies is provided in Section 4.4 below. Immediate analysis will be undertaken of:

- ***Sediment and nutrient trapping and their consequent risks.*** Predict changes in sediment transport arising from both on-going and planned water resources developments. Analyze the impacts of these changes on: river incision; bank erosion; water quality; floodplain sedimentation; productivity of fisheries, agricultural land and wetlands; and delta-shaping processes and sediment movement to marine water. Identify avoidance, mitigation and enhancement measures.
- ***Reduction of capture fisheries and social implications.*** Identify: fish migration routes; the impact of existing natural and man-made barriers and evidence of adaptation; fish productivity and health under development stresses and associated social implications; fish passage technology options; and the potential role of fisheries production (paddy, ponds, aquaculture, reservoirs) in offsetting loss of capture fisheries (including flagship species) due to water developments.
- ***Biodiversity loss.*** Identify the biodiversity consequences of development and suitable indicators and their baseline for monitoring biodiversity loss. One key approach is to consider flagship species, but a broader view is needed to protect species that are an integrated part of wetland functions and services, requiring the mapping of ecosystem units and habitats and the roles of water, sediment and nutrient flows.
- ***Social and livelihood impacts in the mainstream corridor, Tonle Sap, and 3S system.*** Investigate the impacts and risks of ongoing and planned development on the lives of women and men in these areas and identify solutions to minimize/mitigate them.

### 2. Address the opportunities and consequences of the on-going developments, especially development in the Lancang-Upper Mekong Basin.

Actions will be carried out in 3 areas to optimize benefits and manage risks of committed projects:

- ***Strengthen cooperation with China for coordinated operations of Lancang hydropower dams to secure benefits of increased dry season flow, address the issue of sediment transport and provide early warning.*** Future LMB water use will be a function of dry season flows from the Lancang dams. Annual and multi-year information on the releases and China's longer-term Lancang development plans and dam operating rules are essential inputs to LMB planning. This requires a new agreement, drawing on the experience of the existing Memorandum of Understanding between China and the MRC. This would affirm mutual commitment to sustainable Basin development, promote benefit sharing and facilitate information exchange, while recognising sovereign rights.
- ***Reach agreement to protect the baseline dry season flows on the Mekong mainstream.*** The baseline flow regime of 1986-2000, as represented in the MRC Decision Support Framework, is considered to be close to its natural state. Protection of this flow regime is necessary to meet essential social and environmental needs. The PMFM provides both mechanisms to ensure that baseline flows are maintained at 12 key points along the mainstream and the

foundation to agree on further use of water. Together with maintaining water quality standards through PWQ, this will assist in maintaining the natural functions of the river,

- ***Manage the risks of committed projects.*** National agencies, RBOs, communities and project developers need to work together on the design and operation of tributary dams, to minimize sediment and nutrient trapping and blocking of fish migration, and on reaching agreement on management measures for valuable wetlands (both from ecosystem and livelihoods perspectives). Opportunities will be explored to address the social implications of ongoing water resources development through national poverty reduction and other socio-economic development activities.

### **3. Seek options for sharing the potential benefits and costs of development opportunities**

The potential benefits from identified development opportunities (e.g. from additional dry season water for water supply, navigation, irrigation and other beneficial uses and from hydropower development) could be shared to provide compensation and/or address risks to the environment, other water related sectors and people's livelihoods. Options will be identified and the MRCS will support and facilitate negotiated solutions for sharing benefits and risks that are sensitive to the region, in compliance with MRC Procedures, and respectful of the development strategies and aspirations for regional cooperation of the parties.

### **4. Expand and intensify irrigated agriculture for food security and poverty alleviation**

The expansion of irrigation, currently under consideration, and its intensification will significantly increase agricultural production, food security, farm incomes and employment. Sound project identification will be essential to attract investments. In many areas there is scope for increasing agricultural yields and generating higher farm incomes through improved varieties and farming practices. Agricultural yields vary by 200-400% across the basin, indicating considerable potential for agricultural intensification. However, irrigation expansion will not be a solution to the possible increased frequency and intensity of droughts, given the small percentage of rainfed land that is potentially irrigable. Drought mitigation strategies are needed for rainfed areas; in some areas groundwater will be a solution. Guidelines will be prepared for fish-friendly development of irrigation schemes (river-canal-rice field-pond fisheries to support capture fisheries and boost farmer incomes), for promoting integrated pest management to reduce risks to water quality, and for improved irrigation management.

### **5. Improve the sustainability of hydropower development**

The Strategy emphasizes the need for evaluating options for development of sustainable hydropower on tributaries, addressing the risks of mainstream hydropower, and assessing alternative energy options to mainstream hydropower.

- ***Move towards sustainable development of hydropower on tributaries.*** This includes:
  - Identifying sub-basins with high ecological value to be protected and those where hydropower can be developed with limited social and environmental impacts.
  - Evaluating hydropower projects from a multi-purpose perspective to increase overall economic benefits and decrease adverse effects on other water uses.
  - Mitigating negative impacts of hydropower, such as through: re-regulation reservoirs downstream of peaking projects; multi-level water intakes or aeration facilities to manage water quality and temperature; and minimizing sediment entrapment.
  - Developing management plans for environmental hotspots impacted by changed flow regimes.

- Evaluating benefit-sharing options, such as watershed development and management benefitting hydropower generation and funded from hydropower revenues.
- ***Address the uncertainty and risk of possible mainstream dams.*** This includes: acquiring essential knowledge to minimize uncertainty; identifying risk mitigation options; strengthening the PNPCA process; applying the Design Guidance for Mainstream Dams; and developing specific guidance for existing and new wetlands, river flow variations and related erosion impacts, and improvement of social conditions, all to complement project-specific studies such as feasibility studies, EIAs and SIAs.
- ***Assess power options.*** Promote evaluation of the benefits of mainstream hydropower dams along with their substantial impacts, within the broader context of power options assessments and national and regional power strategies.

## 6. Adapt to Climate Change

Climate change mitigation is primarily about energy whereas adaption is primarily about water; the future can only be predicted with great uncertainty but the threat is very serious. Efforts will be made to develop a much better understanding of the potential impacts of climate change on the river ecosystem and population groups. Adaptation measures will be piloted to seek successes worthy of scaling up. Priority will be given to measures for coping with increased floods and droughts, including improved forecasting and early warning systems and damage mitigation.

## 7. Integrate basin development planning considerations into national systems

This Strategy will be successful if it is mainstreamed in national planning and decision-making processes, with each country developing country-specific principles, processes and actions. Rapidly growing private investments in water-related sectors underscore the importance of the role of the national water resources management agencies (MOWRAM in Cambodia, WREA in Lao PDR, MNRE in Thailand and MONRE in Viet Nam) in coordinating an integrated approach to sector planning, both across national sectors and between national and regional planning. The Strategy emphasizes the critical importance of strengthening the implementation of MRC Procedures. Implementation of this Strategy requires the following integration actions:

- ***Align national water resources development planning and project identification*** with identified development opportunities to ensure the move toward sustainable development.
- ***Address identified risks early in project identification and preparation***, which will provide an opportunity for the project to be more responsive to national regulations and to the requirements of transboundary appraisal and approval (PNPCA), as applicable.
- ***Maintain a register of existing, ongoing and planned water resources development and water-related projects at NMCSs and MRCS*** to facilitate national and regional monitoring of LMB water development and to provide early advice on addressing transboundary risks. This will enable the development and promotion of the Project Portfolio to support coordinated basin management.

## 4.3 Strategic Priorities for Basin Management

### 1. Develop environmental and social objectives and “baseline indicators”

The Strategy places importance on the facilitated development of agreed basin-wide objectives or “baseline indicators” that will cover economic, environmental and social factors, reflecting and respecting national sovereignty, policies and processes. This is needed to guide Strategy implementation and updating and to provide a basis upon which to assess the impacts of development options. Some objectives are being developed as part of the Technical Guidelines

for implementation of MRC Procedures, such as the flow thresholds framework on the mainstream (PMFM), and the water quality parameters for human health, aquatic life and water quality emergency situations (PWQ). Others are anchored in the commitment to achieve the Millennium Development Goal 7 on environmental sustainability, aimed at reducing biodiversity loss.

## **2. Establish clear basin objectives and management strategies for water-related sectors**

Basin objectives and management strategies for fisheries, navigation, flood and drought risk management, tourism, ecosystem, wetland and watershed management are critical for basin planning. Initial priority will be given to:

- **Fisheries management.** This requires studies to improve fisheries knowledge (Strategic Priority 1 in Section 4.2) and development of a comprehensive, basin-wide fish management strategy that builds on national strategies and plans, recent MRC basin-wide studies, and international best practice. This is needed to influence and guide basin development and management planning over the next five years.
- **Navigation.** The MRC Navigation Programme will prepare a master plan for regional waterborne transport and development of rural water transport, a master plan for navigation in Cambodia and a navigation improvement plan, which will further define the development opportunities for navigation (see Section 4.1). These plans will also identify strategies to manage the risks of increased navigation, such as accidents and environmental damage.
- **Flood risk management.** The flow regime of the mainstream and many tributaries is changing and climate change is predicted to increase the frequency and intensity of flood events. Detailed analysis will be undertaken of flow and flood changes along the mainstream from northern Thailand to the Delta, as an input to integrated spatial planning.
- **Wetland management.** Changes in the flow regime will result in profound changes in wetlands, altering their annual variability and increasing their fragmentation. Wetlands play a vital role in the livelihoods of many poor people. Priority attention will be given to those wetlands with ecologically important areas and where people are depending on their services, like the Tonle Sap. Actions will include monitoring biodiversity loss, promoting integrated wetland management, and supporting implementation of the Ramsar Convention.

## **3. Strengthen national level water resources management processes**

The Strategy depends on the effective implementation in all countries of the basic processes of surface water and groundwater monitoring, water use permitting (of withdrawals and pollution discharges), compliance assurance of permit conditions and regulations, and maintaining a computerized water information system. This will provide a strong foundation for managing and developing water resources in the Basin. Improving and sustaining these essential tasks will require additional financing.

## **4. Strengthen basin management processes**

- **Implementation of MRC Procedures** (Table 2). The Strategy reasserts the relevance and importance of MRC Procedures and associated guidelines, and reinforces their implementation and effectiveness as enabling conditions for sustainable basin development.
- **Harmonized methods and tools.** Strengthen and harmonize methods, standards, tools and quality assurance systems relating to water resources management. If there are large differences between LMB countries, then it is difficult to exchange reliable data and information, negotiate rational agreements, and sustain effective cooperation.

- **State of Basin monitoring and reporting.** Strengthen the national to basin scale monitoring systems, extended to include different aspects of water and related resources and the monitoring of climate change impacts by the Mekong Panel on Climate Change (being established by MRC). This will culminate in ‘State of the Basin’ reporting every five years.

**Table 2 – MRC Procedures and associated guidelines**

Procedures/Technical Guidelines	Status
Procedures for Data and Information Exchange and Sharing (PDIES)	Approved by MRC Council on 1 November 2001
Technical Guidelines for the implementation of the procedures for data and information exchange and sharing (PDIES)	Adopted by MRC Joint Committee on July 2002
Procedures for Notification, Prior Consultation and Agreement (PNPCA)	Approved by Council on 13 November 2003
Technical Guidelines for the implementation of the procedures for notification, prior consultation and agreement (PNPCA)	Adopted by Joint Committee on 31 August 2005
Procedures for Water Use Monitoring (PWUM)	Approved by Council on 13 November 2003
Technical Guidelines for the implementation of procedures for water use monitoring (PWUM)	Adopted by Joint Committee on 5 April 2006
Procedures for the Maintenance of Flows on the Mainstream (PMFM)	Approved by Council on 22 June 2006
Technical Guidelines for the implementation of the procedures for maintenance of flows on the mainstream (PMFM)	In preparation
Procedures for Water Quality (PWQ)	Adopted by Joint Committee December 2006
Technical Guidelines for the implementation of the procedures for water quality (PWQ)	In preparation

- **Project cycle monitoring to support basin planning.** Develop and implement a system of comprehensive monitoring of project development in the basin, using MRC Procedures (such as Procedures for Data, Information Exchange and Sharing – PDIES and PWUM) and other tools. This will allow early registration of nationally-identified projects with transboundary implications in the Project Master Database and tracking of their status and main characteristics to: conduct basin-wide cumulative assessments; monitor the use of the DOS; initiate dialogues on controversial projects; and add projects that are approved at the national and transboundary regional levels to the Project Portfolio for promotion and implementation as part of the Strategy implementation.
- **A network of national WRM agencies and RBOs.** The national WRM agency, the primary authority for water resources in each country, together with the four NMC’s and emerging RBOs, is the focal points for Strategy implementation. These bodies will interact regularly through a network, facilitated by MRCS, with the aims of strengthening their IWRM planning, coordination and monitoring role and developing basin wide synergies.
- **Enhanced stakeholder participation.** Enhanced regional and national stakeholder participation will build upon processes developed in Strategy preparation, respecting community and wider popular participation approaches in each country. Increased stakeholder access to information is assured through implementation of the MRC Communication Strategy and Information Disclosure Policy.
- **Managing differences.** The 1995 Mekong Agreement (Article 34 and 35) has provisions for dispute resolution. However, there might be particular issues relating to basin development, such as accelerating hydropower development that may lead to disputes between sectors or countries. Whilst it would be appropriate for unresolved disputes to follow the specific procedures in the Agreement, it should be seen as a “process of last resort”. Consideration will be given to the development of guidelines or mechanisms that will help the parties to discuss and negotiate at various technical levels, and as needed, at higher policy levels.

## 5. Implement a targeted IWRM capacity building programme

The implementation of this Strategy will require: robust institutional arrangements; competent male and female riparian professionals in all water-related fields; sound basin and national planning and decision making processes; and effective communications and participation to ensure inputs from all basin stakeholder groups. The Strategy includes the implementation of a targeted capacity building programme, linked to the MRC’s overall initiatives and complementary to national capacity building activities.

## 4.4 Studies and Guidelines

**Studies.** The Strategy (section 4.2.1) outlines the urgent studies to provide information required for decision making on planned water resources development. Table 3 includes other studies of strategic importance to fill the current knowledge gap and support implementation of the Strategic Priorities.

**Table 3 – List of other prioritized studies**

No.	Study
1	Identification of priority habitat areas and environmental hotspots and development of management plans for those that would be highly or moderately impacted by potential changes in flow conditions and the proposed LMB mainstream dams
2	Mitigation of the impacts of converting much of the mainstream to a series of slow moving waters between proposed LMB mainstream dams
3	Assessment of mainstream and tributary hydropower potential and alternative power options, including innovative hydropower schemes that do not affect connectivity in the lower basin
4	Detailed modelling of flood-related impacts upstream of Kratie to understand the impacts of flow changes on different river reaches, and how mainstream dams will affect these
5	Basin-wide and multi-sector study of long-term flood management options for the Mekong Delta to respond to growing pressures from land development, sea level rise, climate change, and upstream development plans
6	Climate change adaptation studies of sub-basins, to define climate change trends, including extreme events, to incorporate in water-related sector plans, including hydropower
7	Monitoring and assessment programme to analyze the implications of climate change on: the basin’s long-term hydrology; on agriculture and food security; and on ecological conditions and bio-diversity
8	Updating of groundwater inventories throughout the Basin to set priorities for development and management

**Water resources management and sector guidelines.** Essential basin-wide water resources management guidelines and guidelines needed for addressing basin-wide issues in sector development and management have been identified. Some of the guidelines have been or are being prepared by MRC, such as the TbeIA framework, Preliminary Design Guidance for Mainstream Hydropower, and Guidelines for Integrated Flood Risk Management. This list is provided in the supporting document “*Working towards an IWRM-based Basin Development Strategy*” and will be prioritized by the concerned national line agencies and MRC sector programmes so as to meet immediate needs in the broader water and related resources development context in the basin.

## 5. Implementation of the Strategy

### 5.1 The Roadmap

**Actions, targets, outcomes.** Priority actions needed to implement the Strategy are outlined by the Roadmap in Table 4. Other actions of lower priority are contained within the supporting document “*Working Towards an IWRM-based Basin Development strategy*”. The Roadmap provides the *priority actions needed with suggested timeframes and outcomes*, particularly for the new or strengthened processes for moving projects from “development opportunities” to the more definite stage where projects are included in the Project Portfolio that supports the implementation of this Strategy. The Notification, Prior Consultation and Agreement for the first mainstream dam (the

Xayaburi) that will take place by March 2011 will provide insights into the practical implementation of some of the Strategic Priorities.

**Action plans.** Regional and National Action Plans for the implementation of the Strategy will be prepared during the first half of 2011. Each of the five Action Plans will include a description of the activities, methodologies, implementation and management responsibilities, milestones, deliverables, and costs and coordination requirements. The preparation of the Regional Action Plan will be led by the MRC and implemented through the MRC Strategic Plan 2011-2015. The preparation of the National Action Plans will be led by the responsible national agencies, with coordination and facilitation by the NMCSs. The National Action Plans will seek to incorporate the Strategy's basin perspectives into national planning, decision-making and governance processes, integrating to the extent possible with five-year socio-economic and sector planning and annual work planning of relevant national agencies. This process of integration will result in growing networks with wide understanding and ownership of the regional perspectives of the Strategy. This will increase the effectiveness of Strategy implementation and bring national perspectives into future updates of the Strategy, creating a 'loop of ownership' between MRC and its Member Countries. The MRC/BDP 2011-2015 provides overall guidance, coordination and support to the implementation of the Strategy.

**Table 4 - Road map outline**

Priority action	Targets	Outcome
<b>Regional and National Action Plans to implement the Strategy</b>		
1) Regional Action Plan	Prepared and endorsed by MRC JC in 2011	Clear objective, outcomes and activities at regional level, to be implemented mainly through the MRC Strategic Plan but also in partnership with regional organizations and programmes Regional monitoring and evaluation system, led by MRCS
2) National Action Plans	Prepared and endorsed by NMC/relevant national authorities in 2011	Clear national objective, principles and activities for integrating and implementing Strategic Priorities and basin management in national systems National monitoring and evaluation systems, coordinated by natural resource management agencies/NMCSs
<b>Strategic Priorities for Basin Development</b>		
1) Acquire knowledge to address uncertainty and risk	Most urgent information available by 2013 and continuously	Monitoring systems (for sediment, fisheries and social issues) operational and data available for necessary analyses and decision making
2) Address consequences of on-going developments	Agreed measures in place by 2012	Regional cooperation supports mitigation actions by member countries
3) Seek benefit and cost sharing options	Prepared by 2013 and applied/updated continuously	More sustainable options for water resources development that leverage cooperation among countries
4) Increase irrigated agriculture	Guidelines prepared by 2013	Increase food security and opportunities for economic growth and poverty reduction in LMB countries and the region
5) Enhance sustainability focus of hydropower	Prepared by 2013 and applied continuously	Guidelines and "code of conduct" applied by project developers, regulators and national agencies
6) Adapt to climate change	Prepared by 2015 and applied/updated continuously	Improved flood and drought management Results of study feed to discussion on long term delta strategy
7) Integrate basin consideration in national systems	Continuously	National water resources development and plans and project proceed within the identified opportunities and applying basin Guidelines and processes
<b>Strategic Priorities for Basin Management</b>		
1) Develop Basin environment and social baseline indicators	Prepared by 2015	Agreed set of basin biophysical and social indicators to be used to assess future developments
2) Develop basin objectives and strategies of water related sectors	Prepared by 2015	Agreed basin strategies for the development and management of water related sectors (fisheries, navigation, flood management, tourism, environment and ecosystem management, watershed management)
3) Improve implementation of basic water resources	Continuously	Basic data regarding the status and use of water resources available and accessible for everyone

Priority action	Targets	Outcome
management tasks		
4) Basin management processes		
• Implementation MRC Procedures	Continuously	Improved transboundary cooperation and data and information exchange for planning and decision-making
• Enabling methods and tools	Continuously	Enhanced MRC IS and Toolbox and effective use in basin assessments
• State-of-Basin monitoring and reporting	Continuous monitoring Reporting every 5 years	Operational monitoring systems at national and basin levels across all aspects of water and related resources Periodic comprehensive check of the condition and trends of the basin's water and related resources
• Monitoring project cycle to support basin planning	Continuously	Transparent sharing and use of project information for basin planning
✓ Project Master Database	Prepared by 2012 Operational by 2013 and continuously updated	Register of existing, planned and proposed water development and utilization in the basin for planning and management
✓ Project Portfolio	Project Portfolio fully prepared by 2012 and updated continuously	Compliant projects promoted for implementation of the Strategy and enhancement of the DOS
• Networking of national resource management agencies and RBOs	Continuously	Increased practical capacity for IWRM and increased synergies between policies and practices of the 4 countries
• Enhancing stakeholder engagement	Continuously	Cost-effective mechanisms for wider stakeholder participation, especially of communities with national ownership
• Managing differences	Continuously	Practical mechanisms on trade-off discussions are preventing significant transboundary disputes
5) Institutional development and capacity building	Continuously	Improved coordination and data and information exchange between national line agencies
<b>Prioritised studies and guidelines</b>		
6) Prioritised studies	Completed by 2015	Important knowledge gaps for decision-making on future development are 'filled' with required information
7) Guidelines	10 guidelines by 2015 All guidelines by 2020	Helping hands for planning, using and managing water resources
<b>Monitoring and evaluation</b>		
8) Monitoring	Developed by 2011 Operational 2012	Planners and decision-makers have at all times the information about the status and impacts of their plans
9) Evaluation	In 2015	Information whether and how the Basin Development Strategy needs to be adjusted
10) Updating	In 2015	Basin Development Strategy updated based on new information regarding needs, opportunities and constraints

## 5.2 Roles and Responsibilities

**Country ownership and wide partnerships.** This Strategy is *owned and implemented by the LMB countries* with support and monitoring by MRCS. It will require the input and direct involvement of many stakeholders throughout the basin, as well as international financial institutions and donor agencies. It will need partnerships to be developed, networks to be created, and transparent and meaningful consultation and participation. Private developers and investors will benefit by following the guidelines arising from the Strategy and civil society and NGO's will be able to work more closely with the MRC and national agencies. Establishing networks between the resource management agencies of the riparian countries, and the various River Basin Organizations within the countries, will be important ways for managing the Strategy process.

**Extensive participation.** During the preparation of the Regional and National Action Plans, wide consultations will be organized with basin stakeholders, donors and other institutions to agree approaches to Strategy implementation and review at local, national and regional levels and to determine the roles and responsibilities of all groups. During the implementation of the Strategy, forums will be organized at the national and regional levels to undertake regular stakeholder reviews of the implementation of the Strategy. Only by the *active, open and transparent involvement of all*

*Mekong stakeholders* can the ambitious scope of the Strategy and the difficult tasks it prescribes be realized, leading towards sustainable development, poverty alleviation and livelihood improvements.

### **5.3 Monitoring, Evaluation and Reporting**

**Comprehensive monitoring of activities and outcomes.** A comprehensive monitoring programme of Strategy implementation, including activities and outcomes, will be developed in the first three months of the implementation phase. Monitoring and reporting will provide planners and decision-takers with the information necessary to determine whether the plans and processes in the Strategy are being implemented effectively and whether outcomes are being achieved. This monitoring programme will also feed into the MRC State of the Basin monitoring and reporting and the MPCC climate change monitoring (see Section 4.3.4 above), which will ultimately monitor the Strategy's relevance and outcomes in terms of the basin's resources and climate change.