Transboundary Water Resources Management Issues

in the Mekong Delta of Cambodia and Viet Nam

Mekong Delta Water Resources Management Project

under

Mekong Integrated Water Resources Management Project

September 2017

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Mekong River Commission
Cambodia, Lao PDR, Thailand, Viet Nam
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Abbreviations

ASEAN	Association of South East Asian Nations
BDS	Basin Development Strategy
CNMC	Cambodia National Mekong Committee
EIA	Environmental Impact Assessment
Ha	Hectares
IWRM	Integrated Water Resources Management
IUCN	International Union for Conservation of Nature
JC	Joint Committee
Kgs	Kilograms
Kms	Kilometres
LMB	Lower Mekong Basin
M	Metres
MCM	Million Cubic Metres
MD	Mekong Delta
MIWRM	World Bank Mekong Integrated Water Resources Management Program
M-IWRMP	MRC Mekong Integrated Water Resources Management Project
MM	Millimetres
MRC	Mekong River Commission
MoU	Memorandum of Understanding
NGOs	Non-Governmental Organisations
NMCs	National Mekong Committees
PDIES	Procedures of Data and Information Exchange and Sharing
PNPCA	Procedures for Notification, Prior Consultation and Agreement
PMFM	Procedures for the Maintenance of Flow on the Mainstream
PWUM	Procedures for Water Use Monitoring
PWQ	Procedures for Water Quality
RBO	River Basin Organisation
RGC	Royal Government of Cambodia
TbEIA	Transboundary Environmental Impact Assessment
VNMC	Viet Nam National Mekong Committee
WUP	Water Utilization Programme

1. Introduction

In November 2009, the Mekong River Commission (MRC) initiated the Mekong Integrated Water Resources Management Project (M-IWMRP) as a follow up to the Water Utilization Programme (WUP). This was in partnership with the World Bank and the Australian Department of Foreign Affairs and Trade. The project comprised three inter-linked components:

- Implementation of an Integrated Water Resources Management (IWRM) regional framework that includes water resources planning and management tools, procedures and guidelines, process and capacity to support the 1995 Mekong Agreement.
- Transboundary initiatives jointly designed and implemented applying IWRM principles and demonstrating mechanisms for joint planning and implementation of projects identified as part of the MRC-led basin development planning process.
- Strengthened policies, institutional arrangements and planning and management capacity for IWRM in the Lower Mekong Basin (LMB) countries.

Commencing in 2012, the 6-year World Bank Mekong IWRM Program (MIWRM) has provided support to implement the transboundary and national initiatives of the MRC M-IWRMP. The objective of the MRC M-IWRM Project is to support LMB governments to establish key examples of IWRM practices at the regional, river basin and local levels. Focus areas are IWRM planning and management, institutional support, and strengthening water resources information, data collection, and modelling.

It has three phases: Phase 1 (MRC and Lao PDR, 2013-2018), Phase 2 (Viet Nam, 2016-2021) and Phase 3 (Cambodia, 2016-2021). The MRC is responsible for managing the bilateral transboundary projects between the Member Countries under the Phase 1 MRC projects.

The M-IWRM Phase 1 (MRC) includes five transboundary projects, which the Mekong Delta (MD) project is one. The objective of the MD Transboundary project is to: *strengthen cooperation and dialogue between Cambodia and Viet Nam to improve long-term sustainable management and development of the MD water resources and minimise water impacts.*

Project outcomes are:

1. A Joint Transboundary Issue Paper, supported by the Cambodia National Mekong Committee (CNMC) and Viet Nam National Mekong Committee (VNMC), that identifies common issues and challenges, and information and data sharing needs, related to transboundary management.
2. Development and agreement on coordination mechanisms for sharing information and improving cooperation between Cambodia and Viet Nam to assist in addressing the joint challenges.
3. A Joint Action Plan to implement coordination mechanisms to help address priority transboundary challenges.

This report represents the key output for Outcome 1.

1.1 MRC IWRM-based Basin Development Strategy

The MRC IWRM-based Basin Development Strategy (BDS) 2016-2020 for the LMB replaces the first Basin Development Strategy (2011-2015), building on this strategy through increasing regional dialogue and cooperation, strengthening basin-wide procedures and guidelines, improving water related monitoring and information management and enhancing national plans and projects to increase national and basin-wide benefits, minimise transboundary impacts, and provide water security. It has been jointly prepared by the Member Countries of the MRC (Cambodia, Lao PDR, Thailand and Viet Nam), and also shaped by input from riparian stakeholders at all levels.

The IWRM-based BDS for 2016-2020 guides water utilization, development and conservation for the MRC Member Countries to address water conflicts in the LMB. More importantly, the IWRM-BDS guides the national governments to develop integrated transboundary water resource management and planning to ensure water, food and energy security for people living along the Mekong River; regional cooperation and integration; national benefits and reduced transboundary impacts.

1.2 MRC Strategic Plan and M-IWRM Project

The MRC Strategic Plan 2016-2020, which replaces the MRC Strategic Plan 2011-2015, was developed based on lessons learned from the previous cycle of planning and the implementation of the BDS 2011-2015. The MRC Strategic Plan 2016-2020 sets the framework to achieve its strategic objectives, including the vision for the Basin and the MRC, the long-term goal, the MRC's mission, and the MRC's Core Functions. The Strategic Plan tackles, both medium and long-term needs and challenges for the Mekong basin, that are at the regional level. The MRC will achieve its strategic objectives through the following seven outcomes identified in the Strategic Plan:

1. Increased common understanding and application of evidence-based knowledge by policy makers and project planners.
2. Environmental management and sustainable water resources development is optimised for basin-wide benefits by national sector planning agencies.
3. Guidance for the development and management of water and related projects and resources, shared and applied by national planning and implementing agencies.
4. Effective and coherent implementation of the MRC Procedures by the Member Countries.
5. Effective dialogue and cooperation between the Member Countries and strategic engagement of regional partners and stakeholders on transboundary water management.
6. Basin-wide monitoring, forecasting, impact assessment and dissemination of results strengthened for better decision-making by the Member Countries.
7. MRC transitioned into a more efficient and effective organisation in line with the Decentralisation Roadmap and related reform plans.

Building on 15 years (2000-2015) of achievements by the MRC, the M-IWRMP has directly supported and assisted the Member Countries with implementing IWRM approaches in national water resources management and related sectors, to support sustainable and equitable regional development on a basin-wide scale.

2. Profile of the Mekong Delta

2.1 Water Exploitation and Utilization in the Border Provinces

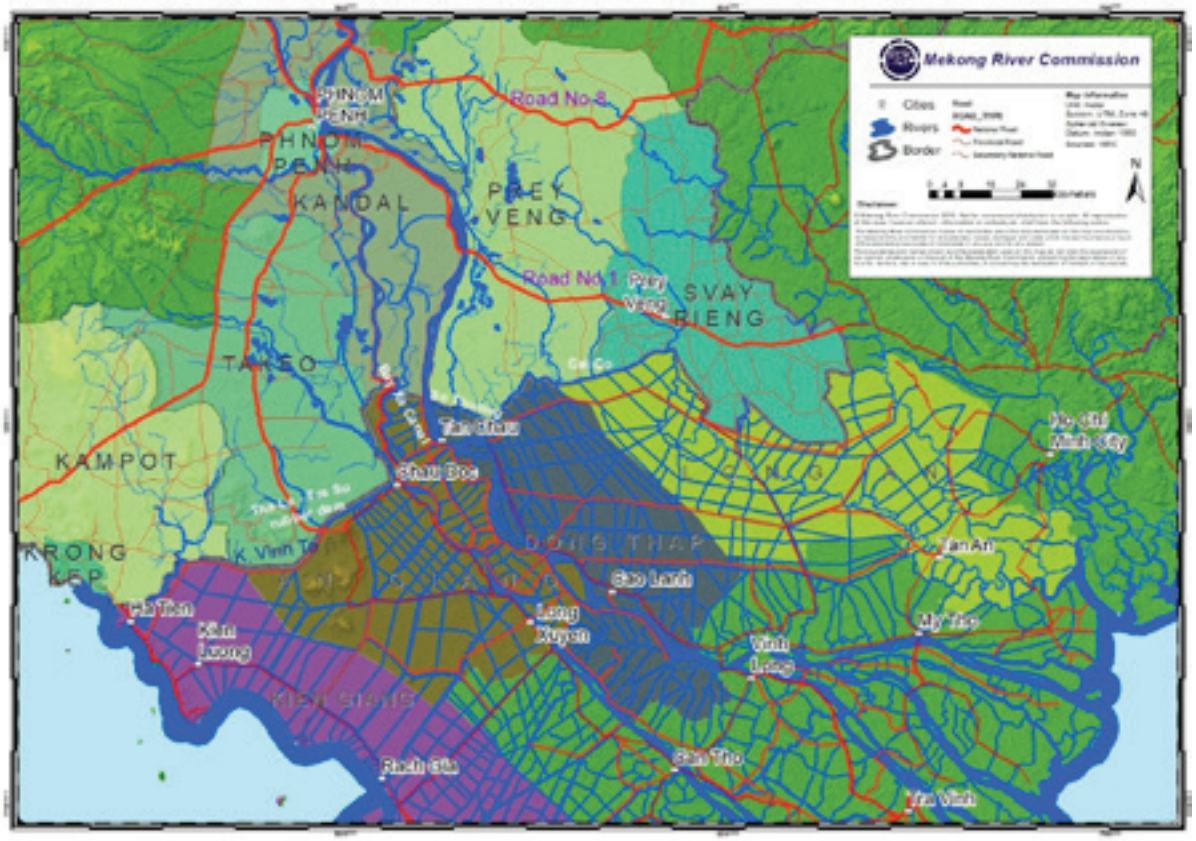
The Mekong Delta (MD) extends from Kratie town, located on the Mekong River in central Cambodia, to the East Sea in Viet Nam. It is comprised of the mainstream Mekong River and its adjacent flood plains and wetlands, including the Tonle Sap Lake, and becomes fan shaped in the lower reach of Viet Nam. In Cambodia, the MD splits into the Mekong and Bassac rivers, which splits further downstream into nine smaller channels that discharge into the East Sea. The total area of the MD represents 8.1% of the Mekong Basin, of which 29,200 square Kilometers (km^2) is within Cambodia and 39,400 km^2 in Viet Nam (Mak et al., 2011). The MD is 545 kilometres (km) long and widens to 750 km at the coast, from Xoai Rap to Mui Nai. Most rivers within the MD are affected by the Mekong River floodwaters.

The MD is home to approximately 24.6 million people, of which approximately 18 million people live in the MD in Viet Nam and 6.6 million people live in Cambodia, making the MD the region of highest population density in the Mekong, as well as in both countries. The MD covers parts of the Cambodian and Vietnamese border: Kien Giang, An Giang, Dong Thap, and Long An provinces in Viet Nam and Takeo, Kandal, Prey Veng and Svay Rieng provinces in Cambodia. **Figure 1** shows the administrative, river basin boundaries and river systems of the MD.

Average annual rainfall ranges between 1,600-2,000 mm of which 90% falls during the wet season from May to October, noting that typhoon conditions of the lower delta raise the mean annual rainfall to above 3,000 mm in the lower MD.

The MD provides a wide range of ecosystem services to support fisheries (including aquaculture), agriculture and local livelihoods, and has important natural assets including lakes, marshes, stream wetlands, flooded forest and shrublands, mangrove forests and grasslands. **Figure 2** shows the location of major aquatic ecological health sites in the MD.

Figure 1: Administrative Boundaries and River Systems of the Mekong Delta



The MD comprises a vast flood plain with an elevation of 0-4 m above mean sea level, it is formed of eroded sediments from the upper basin that are deposited in the lower basin (Fedra, 1991). There is an extensive network of canals that have been constructed in the last 300 years. The structures comprise 7,000 km of main canals, 4,000 km of secondary canals on-farm systems, and more than 20,000 km of protection dykes to prevent early floods (MARD, 2003). There is therefore no potential for hydropower development as the MD is too low-lying a region, however cascading hydropower development upstream of the MD could impact the flow regime within the MD, now and in the future. The MD region has high economic potential due to its fertile soil, abundant water resources, especially during the dry season, and access to major cities and ports.

Water development in the MD is currently focused on agricultural and fisheries production, and domestic demand. Extensive irrigation development and flood control infrastructure has been built on the Viet Nam side of the MD. Rice production in the MD accounts for a large rate of annual production in Viet Nam and most of it is for export. In Cambodia, a large area of arable land is irrigated with irrigation systems built during the Khmer Rouge era, most of which have malfunctioned, with some recently rehabilitated by the Royal Government of Cambodia (RGC). The Vayco Phase I irrigation project is an example of a recent irrigation project in the Cambodian MD, which was completed in 2015, and provides 108,300 ha of supplementary wet season paddy irrigation and 27,100 ha for dry season paddy irrigation (Prey Veng PDWRAM, 2016). Despite these efforts, there is still not enough effective irrigation infrastructure to manage the water resources in the Cambodian MD.

In the MD region of Cambodia, wet season rice crops cover an area of approximately 1.1 million ha.

Figure 2: Aquatic Ecological Monitoring Sites in the Mekong Delta[1]

The dry season rice crops cover an area of approximately 0.19 million ha, and supplement wet season irrigation area of approximately 0.9 hectares (MOWRAM, 2016). In Viet Nam, approximately 1.4 million hectares of the dry season rice crops are irrigated, accounting for 90% of Winter-Spring (dry season) and Summer-Autumn (wet season) crop in the Cuu Long Delta within the MD, with 24,000 km^2 used for agriculture and aquaculture, and 4,000 km^2 for forestry. In the MD of Viet Nam, an increase in industrial, construction and service sectors has also occurred over the last 10 years.

The MD is rich in natural fisheries, and also provides a potential for aquaculture, providing a reliable income and also an important source of protein and food for local communities in both countries. In Cambodia, the average annual fish catch in the Cambodian MD is estimated as more than 36,000 tonnes per year but there are indications that fish catch has declined since 2002 due to clearing of flooded forests and an increase in agricultural activities in the region, affecting the livelihoods of fishing dependent communities and secure access to food (Mak et al., 2011). In Viet Nam (in 2013), approximately 549,300 tonnes per year in fish capture was obtained, accounting for 10.7% of the total

[1]The aquatic ecological health sites in the MD were selected as biomonitoring sites that support the Mekong River Report Card on Aquatic Ecological Health, through measurement of key functional groups of organisms living in rivers. Rich species diversity and high abundance of indicator species reflect good river health, while low diversity and abundances indicate poor health (ratings are Excellent, Good, Moderate and Poor). The maps therefore represent the results of this monitoring at the chosen site. The map for the 2S shows the aquatic health as excellent and good (not moderate or poor) at the monitoring sites.

for the entire country. This high total fish capture for Viet Nam may also be associated with a significant growth of the aquaculture industry of approximately 9% per year.

2.2 Significance of Transboundary Water Resources Development and Management

The MD is affected by upstream development in the Mekong River basin that has impacted on the natural hydrological regime of the MD. Development that has contributed to this impact includes hydropower dams on the mainstream and tributaries, water extraction for irrigation and services, and flood control infrastructure. The cascade of hydropower dam operations have increased the dry season flows and reduced the wet season flows, and when operated at high standard take into account mutual benefits of the downstream countries. The extraction of water for agriculture, industrial, commercial and domestic uses, whilst providing benefits to water users, has contributed to changing the flows in the Mekong River Basin by impacting on water quality, degrading the flood plains, wetlands and their ecosystem services, reducing sediment movement, and causing a decline in fish diversity and catch. Extensive irrigation development in Viet Nam has also changed the hydrological regime of the MD.

Recently, the Vietnamese Government, through the Ministry of Natural Resources and Environment, commissioned a comprehensive study (the MD Study) to assess the consequences of mainstream hydropower development on the Mekong River to build knowledge to address analytical gaps, and assist with planning for the future of the MD. The overall aim of the study is to safeguard the MD, as one of the most vulnerable regions in the Mekong River Basin, from the impact of mainstream hydropower and climate change. The MD study's key findings confirm the complexity of the MD region: a high variation in the flow regime, adverse impacts from water fluctuation, an increase in salinity intrusion, a decrease in sedimentation and nutrients, a reduction of fish migration and production, impacts on navigation passage, and associated impacts on livelihoods in the MD (DHI, 2016). Highlighting the need for immediate actions to fill gaps in available information and to develop a plan to address the potential adverse impacts for the sustainability of the MD.

During the wet season, the water from the Mekong River flows downstream and floods the MD. The Tonle Sap Lake absorbs a larger volume of water and reduces the flooding in the MD. Flood infrastructure development within the MD has also greatly affected the water flow in the MD, although this effect is poorly understood. For example, the flood control dyke systems built in Viet Nam contribute to extensive flooding in the MD region of Cambodia and vice versa. Vulnerable provinces in Cambodia include Takeo, Prey Veng and Svay Rieng with flood damage occurring in six out of ten districts in the Takeo province and in Viet Nam's vulnerable locations include: K. Vinh Te, K Tra Su, K. Bay Xa, and K. Bao Ke. The future construction of flood management infrastructure such as road heightening and embankment or water diversion in Cambodia and Viet Nam may further increase the water levels and prolong the flood period in the flood prone areas in the MD.

In Viet Nam, the extensive irrigation systems in the MD are used to manage floods for economic benefits and minimise flood impacts, and during the dry season, limit shortages of water for irrigation and prevention (or reclamation) of acid sulphate soils (which is naturally occurring). Therefore, the improvement of existing canal systems is a necessity. The shortage of water also causes salinity intrusion in the main rivers affecting agriculture and living conditions (mostly in Viet Nam) will be exacerabated by the impacts of climate change.

The waterway systems in the MD are also very important for navigation in both Cambodia and Viet Nam. In Cambodia the navigation waterways consist of the Mekong River, the Bassac River, connection canals and tributaries, and includes inland and maritime navigation, and in Viet Nam, the Cuu Long Delta provides an important passage for cargo and passengers. The condition of canals are therfore very important to serve for rural transport and river networks in the border areas and rehabilitation programs are necessary to avoid serious bank erosion.

2.3 General Water Development Trends and Potential Impacts

Whilst there is a potential opportunity for expansion of water-based developments in the MD including irrigation, agriculture, and fisheries in each country, there is no strategic plan to address transboundary issues by both countries. The MD has already faced a high level of unpredictability in terms of the future impacts of climate change, which will influence decisions made with regard to water resources development. Flood control and management remains an important aspect of managing both flood and irrigation in the MD.

Viet Nam proposes to implement more flood control and management projects in four sub-areas: the Long Xuyen Quadrangle, an area sandwiched between Tien and Hau rivers, Northern Vinh An sub-area, and the Plain of Reeds. Projects include the construction of dykes, canals, embankments, and sluices to mitigate the anticipated impact of flooding and to store water for irrigation and improvement of channels for rural transport. The Government of Vietnam has identified the MD as a prime area for expanding the production of food, export commodities and consumer goods and is aiming for a 7.1 to 8% per annum growth rate of the region (SIWRP, 2012).

Cambodia, currently have planned 18 integrated flood risk management projects with the main function of: water storage, irrigation, drainage, water conservation/colmatage, flood control, water supply and freshwater aquaculture.

Through the National Indicative Plans (NIPs), a MRC process to implement BDS, a joint project entitled “Integrated flood managmenet in the border area of Cambodia anad Viet Nam in the Mekong Delta for water security and sustinable development” is to be implemented in order to learn good practices, define and experience joint investment, focussing on formulating a joint strategy for water resources development for the Mekong Delta, in both countries, and putting forward immediate measures and actions to address transboundary issues.

A further joint project, between Cambodia and Viet Nam, proposes to promote community-based transboundary fisheries management in the border areas of the MD, through the fishermen and local governments in the bordering provinces of Prey Veng in Cambodia and Dong Thap in Viet Nam contributing to better management and sustainable utilization of fisheries resources through cross-border cooperation. The implementation of joint NIPs projects is to occur between 2016-2020 and planning for an appropriate funding source.

The issue of future development upstream and especially the impact of cascading hydropower projects remains a significant concern to the management of the MD. Climate change and saltwater intrusion also pose significant challenges.

2.4 Status of Transboundary Water Resources Management of the Mekong Delta

2.4.1 Overview of MRC Procedures

The 1995 Mekong Agreement is a dynamic "framework agreement" that enables and requires the MRC to adopt and refine rules and procedures to carry out its work in close cooperation and coordination with relevant agencies and member countries. It identifies key activities and mechanisms that support the sustainable and equitable use, utilization and protection of the Mekong water and water related resources. Under the WUP, the MRC and the Member Countries agreed to develop (at least six) sets of rules for water utilization for the LMB. There are five MRC Procedures, and supporting technical guidelines, that have been developed which provide a systematic and uniform process for implementing the 1995 Mekong Agreement, including:

- Procedures for Data and Information Exchange and Sharing (PDIES) was approved by the MRC Council on 1 November 2001 and the Technical Guidelines for the implementation of the PDIES was adopted by the MRC Joint Committee (JC) in July 2002, which provide rules on the sharing and exchange of data and information.
- Procedures for Notification, Prior Consultation and Agreement (PNPCA) was approved by the MRC Council on 13 November 2003 and the Technical Guidelines for implementation of the PNPCA was adopted by the JC on 31 August 2005, which provide rules on the referral of a proposed use of water on the mainstream and tributaries of the Mekong.
- Procedures for Water Use Monitoring (PWUM) was approved by the MRC Council on 13 November 2003 and the Technical Guidelines for the implementation of the PWUM was adopted by the JC on 5 April 2006, which provide rules on water use that may have a significant impact on the flows or water quality.
- Procedures for the Maintenance of Flow on the Mainstream (PMFM) was approved by the MRC Council on 22 June 2006. The intent of the PMFM is to provide guidance on cooperation on the maintenance of a mutually acceptable hydrological flow regime on the mainstream to optimise the multiple uses and mutual benefits of all riparian countries and to minimise the harmful effects.
- Procedures for Water Quality (PWQ) was approved by the MRC Council on 25 January 2011 and the technical guidelines for the implementation of the PWQ was approved by the MRC JC on 22nd November 2016, which provide guidance on water quality parameters and monitoring techniques.

The MRC Procedures are important in guiding water use in the Mekong River Basin and encourage cooperation between the Member Countries. However, successful implementation remains challenging in relation to national institutional capacity and standards for water resources development of each

MRC Member Country. At the national level, different agencies have different mandates, policies and agendas. Implementation of the MRC Procedures therefore requires strong coordination, technical and financial support. With regard to transboundary issues, the implementation of the Procedures requires cooperation between upstream and downstream countries. The lessons learned from the application of the Procedures should be given great attention when addressing the issues of water resources development and management for the MD.

2.4.2 Status of Cooperation between Cambodia and Viet Nam

Transboundary cooperation on water and related resources between Cambodia and Viet Nam has historically been coordinated through the MRC framework under the 1995 Mekong Agreement which provides the overall framework to guide cooperation among riparian countries to share, manage, and use water, focusing on joint water resources management along the international border between Cambodia and Viet Nam. The 1995 Mekong Agreement promotes the "Cooperation for the Sustainable Development of the Mekong River Basin" that stipulates the importance of transboundary water management.

Further, transboundary bilateral cooperation between Cambodia and Viet Nam has been initiated by the two governments at the national and provincial levels through the mechanism of the Joint Committee for Cultural, Socio-economic and Technological Cooperation, with the aim of covering issues in the MD and Central Highlands. This had included the signing of an Agreement on Comprehensive Cooperation between the Ministry of Transport of Viet Nam and Ministry of Transport and Public Works of Cambodia, in which the two parties committed to facilitate the effective implementation of transboundary cooperation with regard to international navigation in order to provide convenience for vehicles, passengers and goods to be able to be transported between (and through) the two countries.

Cambodia and Viet Nam have introduced mitigation measures in the development and management of the flood plain to avoid sub-optimal water regimes and adverse impacts to both teritories, during the flood season. Notably, a Draft Regulation is being considered by the two countries aimed to effectively use and exploit water resources along the border. The Memorandum of Understanding (MoU) between VNMC and CNMC, signed in 2005, aims to support the implementation of the 1995 Mekong Agreement, enhancing capacity to coordinate support between the governments in meeting the requirements of the Joint Committee for Economic, Culture and Technology Cooperation in relation to the water resources development and mitigation of impacts in the border flood plain areas. The draft regulation is still pending, waiting on agreement of terminology.

3. Methodology

An iterative approach was undertaken to identify the priority transboundary challenges based on the following general steps:

1. A review of relevant institutional, legislative, policy and planning documents at the national and regional level (see Annex A).
2. A review of relevant development partner supported documents related to IWRM between Cambodia and Viet Nam.
3. Consultation with central and provincial level government and non-government stakeholders

to clarify key challenges.

4. The undertaking of a questionnaire survey and checklist interviews with key relevant government, NGOs, and Civil Society Organisations, as well as community representatives, to identify key challenges and options to address them.
5. The preparation of a Cambodian and Viet Nam National MD Issues Paper based on literature reviews and findings from stakeholder consultations and questionnaire survey.
6. A review of the general status of the water sector in the MD.
7. The identification of transboundary priority issues, through a number of joint workshops between CNMC and VNMC (late 2015 to mid-2016) to identify the priority transboundary issues for sustainable management and development of the MD based on findings from the national issues papers.
8. The preparation of the Joint Transboundary Issues Paper for Cambodia and the Transboundary Issues Paper for Viet Nam.
9. Finalisation of the Joint Transboundary Issues paper for the MD following discussion and input from CNMC and VNMC.

Figure 3 shows steps taken in developing the National and Joint Transboundary Issues Paper for the project.

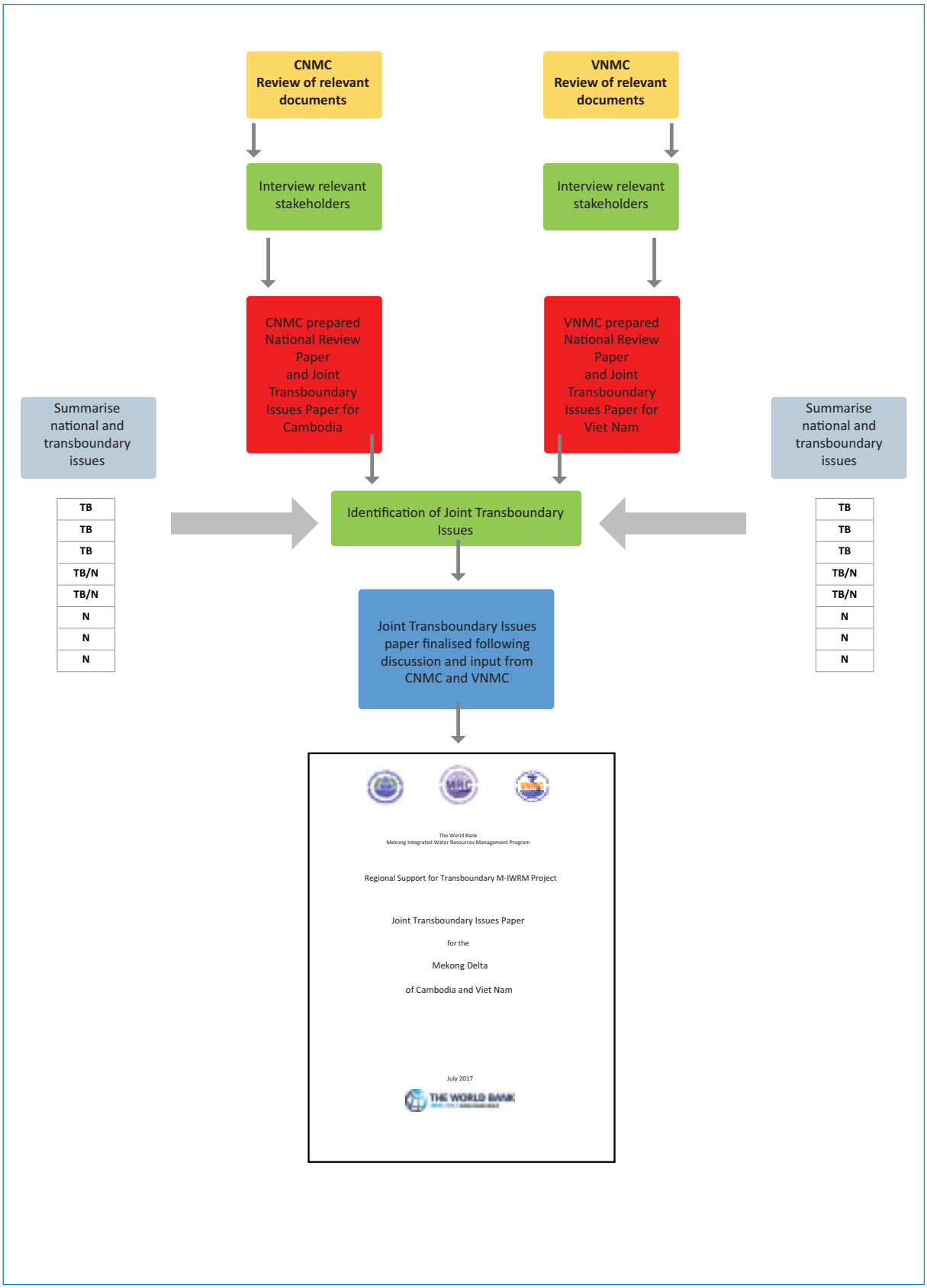
4. Priority Transboundary Water Resources Management Issues in the Mekong Delta

4.1 Flood and Drought Strategic Planning

Background

The MD in Cambodia and Viet Nam is considered to be 'the rice bowl' of both countries. As such, more resources and interventions have been invested into the MD to support rice production than any other regions within Cambodia and Viet Nam. Cambodia and Viet Nam experience heavy annual floods in the wet season and drought in the dry season in the MD, which has implications for not only rice production and agriculture but also livelihoods. Nonetheless, a transboundary water resources management plan or integrated/ master plan for the whole MD has not been established to provide a coordinated approach to ensuring sustainable management and development of the MD. The management of flood and drought in the MD has been constrained and challenged by the political boundaries, national interests, and a sectoral approach. This has led to different development plans for the MD by Viet Nam and Cambodia, and thus water utilization by Viet Nam or Cambodia has implications for their respective neighbour.

Figure 3: Steps Taken in Developing the National and Joint Transboundary Issues Paper for the Mekong Delta Water Resources Management Project



Concern

There is a lack of transboundary strategic planning for the sustainable development of the MD. It is important that efforts are made to address the challenges of managing flood and drought in the MD and to ensure mutual benefits for both Cambodia and Viet Nam. To manage the MD sustainably, it is important for both Viet Nam and Cambodia to agree on a long-term vision for the MD and to develop a transboundary strategic approach with the aim of increasing benefits for both Cambodia and Viet Nam.

Issues that require further consideration in the context of flood and drought management are:

- Improving the understanding of hydrological requirements of the MD (surface water and groundwater);
- Ensuring operation rules for upstream reservoirs and irrigation infrastructure deliver the required water needed for both countries in the MD;
- Identifying and implementing changes to the flow, water level and hydrological regime necessary in the flood season and the drought season;
- Implementing measures to address the shortage of water during the dry season for irrigation, domestic water supply and prevention of salinity intrusion;
- Implementing bilateral cooperation between the two countries such as regulating the use of the water resources along the border, implementation of the Navigation Agreement etc.

If these issues are not addressed through the development of a Transboundary MD Strategy and Management Plan, the MD and its inundated plain in the border provinces will face challenges including: difficulty to achieve socio-economic development objectives, adverse impacts to the livelihood of people, and degradation of water resources and ecosystem, leading to a lack of food and social security.

4.2 Infrastructure Development and Investment

Background

Floods and droughts have affected agriculture production, fisheries sustainability and the livelihoods of people living in the MD. In response to this, Viet Nam has developed extensive flood control through a canal system which aims to prevent Viet Nam from being flooded, and enables Vietnamese farmers to cultivate rice and crops. Consequently, this infrastructure may cause an increase in water levels in Cambodia during the early flood period. The MD region of Cambodia has not been developed to the same extent with infrastructure. However, there is infrastructure and development planned in Cambodia in the near future.

Concern

The development of water infrastructure to control and manage flood may lead to: an increase in water level in the upstream area; prolonged inundation in both upstream and downstream locations; riverbank erosion and instability; risks to safety for local people; a shortage of freshwater; acidic water; retention of sediment and nutrients by embankments; and salinity intrusion.

There is a need to improve the approach to the development of infrastructure in the MD, which is currently implemented under national interest and context, without taking into consideration the transboundary implications and impacts. Decisions on infrastructure development and investment made by one member country will directly affect water flow, and contribute to flooding and drought in neighbouring member countries, especially (but not limited to) where border rivers are shared. The complexity of infrastructure already in place, and the cumulative impact of development make it currently difficult to determine and understand the current situation. Flood control/protection systems can cause the re-distribution of flood to other areas in the floodplain. There is therefore a need to understand possible scenarios for joint water development in the MD. The use of development scenarios would enable a long-term investment and development program to be produced based on anticipated likely future development and impacts.

A lack of joint planning, collaboration and cooperation between border provinces has resulted in inappropriate infrastructure development and investment in the MD. For example, infrastructure for early flood control (Tra Su – Tha La rubber spillway), heightening dykes and embankments for production and residential protection (Bay Xa Canal and So Ha-Cai Co), and canals on the border for irrigation (on both sides) has caused adverse impacts to the people living in the border flood plain areas including: pollution of water and environment, reduction of agricultural production and social security. Viet Nam has introduced flood protection measures in the upper and lower parts of the MD to protect its seasonal rice crops, which has increased threefold in the last decade, and this may have resulted in a reduction in the water retention capacity and higher water levels in Cambodia.

On the other side, a recent development in the Cambodian flood plain (such as the National Road No.8, or National Road No.1) has changed the hydrological regimes and flood characteristics in the delta which has impacts in Viet Nam.

4.3 Coordination and Communication Mechanisms

Background

Information based on well-organised monitoring programmes is key for accurate assessments of the status of water resources and the magnitude of water issues. Moreover, IWRM in transboundary basins shared by two or more countries requires comparable information. There is a need for a common basis for decision-making, which requires harmonised and comparable assessment methods and data management systems, as well as uniform reporting procedures.

The ultimate goal of monitoring is to provide the information needed for planning, decision-making and operational water management at the local, national and transboundary levels. Monitoring programmes are also fundamental to the protection of human health and the environment, in general. The analysis of information needs is the most critical step in developing a successful, tailor-made and cost-effective monitoring programme. To properly design and implement a monitoring and assessment programme, information needs should be specified as precisely as possible.

Cooperation between Viet Nam and Cambodia to address differences in the use of water, flood control and mitigation of impacts caused by water and related resources development will be beneficial for both countries. Currently, this cooperation is implemented through a number of working groups to deal with impacts that have occurred due to the direct operation of infrastructure projects. For example,

Tra Su – Tha La spillway, improvement of border canal projects, water supply for industrial zones and bank erosion. The discussion of impacts and mitigation measures is mainly undertaken between the provinces of two countries, and in some cases, there is participation from the central level.

The sharing of data and information on planning, design and operation is not made regularly. There are some water resources monitoring stations that monitor change in hydrology and water quality near the border. However, it is not sufficient to provide a detailed assessment of impacts as the basis for discussion and developing appropriate mitigation measures. **Figure 4** shows the location of water resources monitoring stations (including monitoring of water quality, surface water, rainfall, and temperature) in the MD.

An existing mechanism of effective coordination for addressing transboundary issues and promoting economic development is the Cooperation of Border Provinces between Viet Nam and Cambodia. VNMC and CNMC are sometimes invited to join the meetings or provide necessary information related to their mandate.

Concern

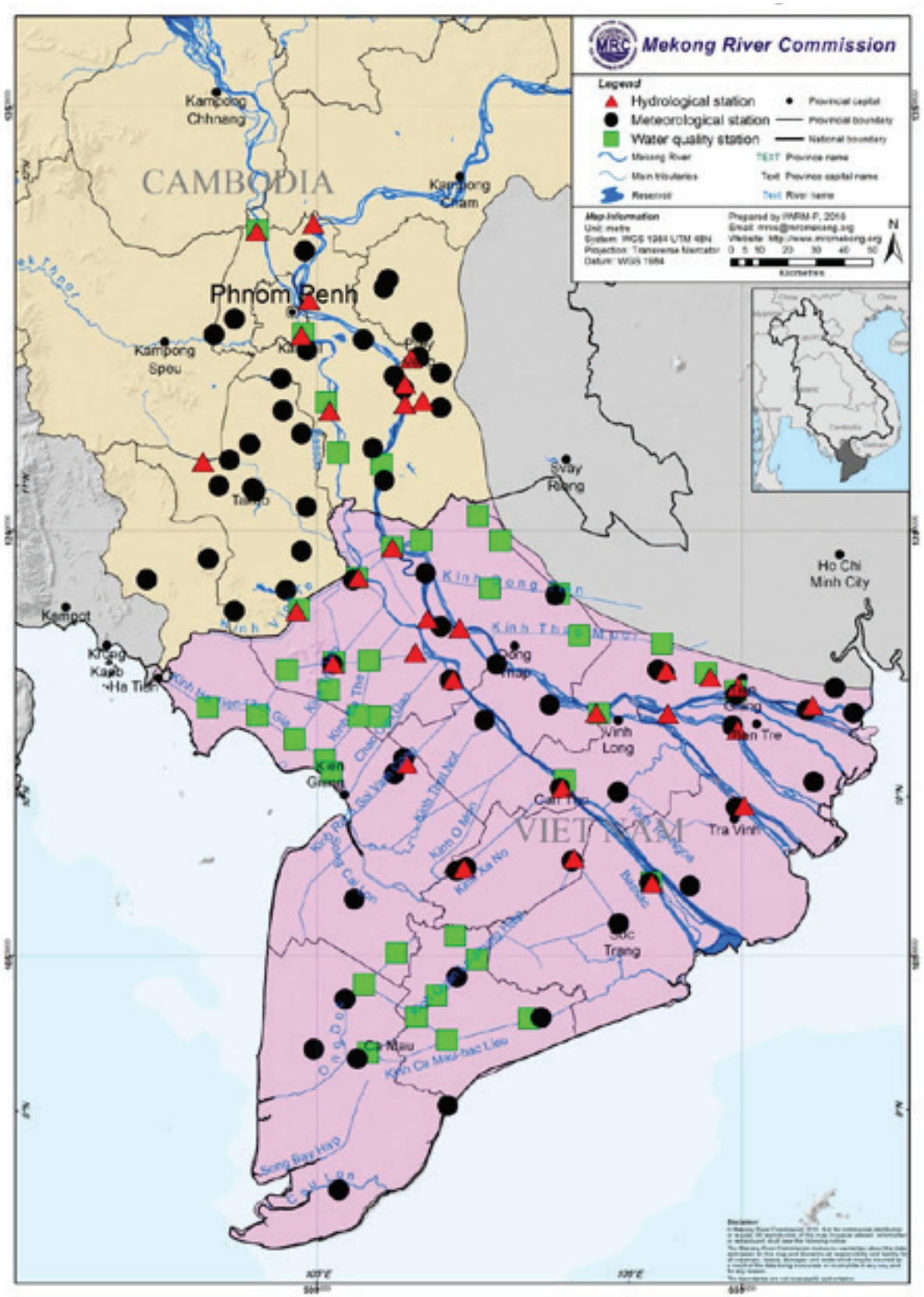
There still remains a lack of clear and sufficient mechanisms, to enable coordination between the countries to address transboundary water resource management issues. As a result, these issues are mainly dealt with through bilateral provincial cooperation. This situation has led to an overlap between the two countries and conflict between the water related sectors, with issues that require resolution such as the need: to establish monitoring of transboundary water use in many locations; the reduction of water pollution impacts (including managing the negative impacts of acidic sulphate soils) and sediment and nutrient rentention due to infrastructure development. Currently, there is not a coordinated approach for harmonising data formats, definitions, or methods of analysis.

Nor an agreement on the frequency of data collection, and the density of monitoring networks and data processing or consultation of related plan

The lack of a monitoring network and a strong coordination mechanism leads to misunderstandings by both countries with regards to the current status of water-use at the border. This may affect provincial economic development and the livelihoods of people living in the border flood plains. The study of transboundary impacts in the MD caused by the mainstream upstream development will also be challenged by the lack of data in the absence of an extensive monitoring system.

Monitoring is critical for supporting decision-making and water management operations. In critical hydrological situations, such as floods and droughts, timely and reliable hydro-meteorological data in the MD is needed, which often requires telemetric systems to transmit data continuously. When pollution events occur, reliable data is needed, which may require early warning systems to signal when critical pollution levels are exceeded or toxic effects occur. In these cases, hydrological, prediction

Figure 4: Water Resources Monitoring Stations in the Mekong Delta



of water quality models can often support decision-making. Cambodia and Viet Nam should develop agreements/protocols for harmonisation of data formats, definitions, methods of analysis, the frequency of data collection, the density of monitoring networks and the processing of data.

4.4 Human and Institutional Capacity Building at the Managerial and Technical Levels

Background

The matrix of uncertainties in transboundary river basin management requires evolving capacity enhancement and development activities at a national and regional level. There should be a focus on educating and training a new generation of 'local water leaders' having the skills needed to tackle the challenges in this field. Managing transboundary waters requires a portfolio of skills that cut across disciplines (political, economic, social and environmental) and covers a range of scales (from user level to the global level). In such a context, the need for ongoing and targeted capacity enhancement and development is evident. Effective transboundary cooperation depends upon national capacity to give effect to the obligations of international law and the agreements between riparian countries. Processes to facilitate cooperation between riparian countries must therefore involve targeted national institutional capacity building initiatives to 'level the playing field' and ensure national alignment with the prerequisites for effective transboundary cooperation (Handbook for IWRM in TSB Basins of Rivers, Lakes and Aquifers, 2012).

Due to the lack of capacity in terms of technical and institutional arrangement, the inaccurate assessment of transboundary impacts has led to difficulties in agreeing on proposed mitigation measures, especially in the application of tools for assessment and implementation of the MRC Procedures. Recognising this issue, during the implementation of the MoU signed between VNMC and CNMC in 2005, the VNMC organised training for CNMC staff in using the MRC Decision Support Framework and its modelling tool, as an example. In addition to this, in order to deal with all transboundary water resources development and management issues, capacity building in all fields of water management is required.

Concern

A limited capacity in the institutional arrangements and human resources, among sectoral agencies and national governments, currently contributes to weak coordination and application of international rules and procedures in addressing the transboundary water issues, as well as applying tools for impact assessment and monitoring, to mitigate risks caused by transboundary impacts in the MD.

The difficulty in agreeing with the results of an assessment and measures to mitigate impacts, and also understanding implementation of the MRC Procedures for addressing transboundary issues is a challenge for the MRC countries, including Viet Nam and Cambodia. Institutional capacity is important to achieve a common understanding, and thus, the effective implementation of the MA and the five procedures. The decentralisation of the MRC places emphasis on the National governments and the need to obtain the necessary institutional capacity in this context.

4.5 Environmental, Social and Economic Impacts of Development and Climate Change

Background

The impacts of development, such as hydropower dams and the flood control system, on the MD has been evident through many scientific studies and these have an impact on the MD, as well as its people (DHI, 2015). With the cascading hydropower development in the Mekong it is expected that the MD region, with an expected high variation in the flow regime, and fluctuating flows and water level, will experience adverse impacts, including: an increase in salinity intrusion, decrease in sedimentation and nutrients, and a reduction of fish migration and production, impacts of navigation passage, and the associated impacts on livelihoods in the MD (DHI, 2016). This demonstrates the immediate need to fill strategic gaps in information and hydrological modeling, so that the potential adverse impacts are able to be planned for and mitigated. Climate change has exacerbated these impacts recently and also further complicates the likely impacts of cascading hydropower dams in the Mekong Basin. Despite the increased concerns over the impacts of climate change within the MD, the impacts will be gradual and cumulative, while the dams and the flooded control dykes will bring more immediate impacts.

Concern

The environmental, social, and economic impact of development and climate change may not be fully understood by government agencies, the experts and the community. This is due to a lack of data and information being readily available, and an absence of strategic planning of water resources in the MD. This lack of data and information and a strategic approach makes reaching an agreement on the issues, through cooperation at the transboundary level, difficult to achieve. Furthermore, there is a lack of stakeholder participation which leads to different points of view of the likely impacts of development and climate change.

Impacts of high concern that require further understanding include:

- Limited or no access to fresh water
- Sea level rise and saltwater intrusion, reducing the availability of freshwater and the viability of crops
- Severe weather patterns due to climate change
- Poor communities that are most vulnerable to flood and droughts
- Change in demographics and shift from agricultural to urban living
- Food shortages and exorbitant food prices
- Poor management of water storages, eg. canals, wells, dykes causing siltation and erosion,
- Impact of drought and flood causing a loss of lives and a loss of income from impacts on agriculture and fisheries.
- Increased risk of infectious diseases and malnutrition.

4.6 The implementation of the Navigation Agreement between Cambodia and Viet Nam

Background

In Cambodia, the navigation waterway system in the MD consists of the Mekong River, the Bassac River, connection canals and tributaries, and includes inland and maritime navigation. In Viet Nam, the Cuu Long Delta carries 73% of the region's cargo tonnage and 27% of passengers are transported by inland waterway. For the areas far from the administration or business centres, such as border communes, the inland waterway becomes more important, especially during the monsoon season when roads become impassable for months at a time. Therefore, there is a common target to combine improvement and development of rural navigation with the irrigation and flood control projects. The condition of canal and river networks in the border areas are very important and rehabilitation programs are necessary to avoid serious bank erosion. In the Cuu Long Delta, the main rivers are the Tien and Hau, in which the Hau River has a shared border of approximately 10 km between Cambodia and Viet Nam.

Inland waterways in these rivers play a key role for transportation of goods from other countries and between Viet Nam and Cambodia. Therefore, Viet Nam and Cambodia have signed an Agreement on Navigation, which aims to contribute to increased trading between the two countries. The accord also links to the Agreement on Commercial Navigation in the upper part (China, Myanmar, Thailand and Lao PDR) of the Mekong Basin.

Concern

Between Cambodia and Viet Nam, international navigation continues to be restricted by a delay in realising an agreement on protocol terms. As mentioned above, the effective implementation of the Agreement on Navigation depends on many factors such as channel conditions that may frequently change due to flood, a change of flow caused by development, and the implementation of certain policies and national regulations. All of these factors must be considered as challenges in transboundary cooperation in the field of navigation.

For example, the Mekong River is current underutilised for domestic and international navigation due to physical and non-physical barriers. The physical barriers are related to the shallow (impassable) sections of the river (particularly during low tide) and non-physical barriers are related to a delay in Cambodia and Viet Nam reaching agreement on a protocol to enable international navigation. Other non-physical constraints include operational and administrative shortcomings (lack of common navigation rules and safety standards, lack of training, inefficient customs and immigration procedures, etc.), channel obstructions (shoals and sedimentation, insufficient waterway maintenance, lack of aids to navigation, etc.), poor port and related facilities, and a lack of transport promotion capacity (marketing strategy, hinterland facilities, acquisition of cargo, etc.).

5. Conclusion

The transboundary integrated water resources management of the border rivers of the MD is very complex due to extreme variations in natural conditions (including flood, drought, acid sulphate soils, and saltwater intrusion), the impact of upstream development, a myriad of flood infrastructure, and the implications of climate change. This complexity is further exacerabated by the strong need to meet economic development objectives for both Viet Nam and Cambodia. Understanding and effectively coordinating transboundary impacts is therefore essential. Due to the importance of the MD, the Governments of Viet Nam and Cambodia have given attention to cooperation in all aspects of the water use and utilization.

To have proper planning and solutions with regards to the transboundary issues of the MD, the priority should be on the collection of data, monitoring of hydro-meteorology, water requirements, related development plans, and evaluation of cooperation in water use of international border rivers. The sharing of information and data between countries depends on the type of information and data used for different purposes, as defined by the countries.

It is necessary to scientifically assess and analyse the upper development and its impact to the border areas in order to express the inter-relationship of the border area with the wider Mekong Basin.

The water resources development and management of the MD flood plain is very complicated. Therefore studies are needed first (e.g. on joint integrated planning), and secondly, the selection of a parallel case study, for application in future projects. The technical support for such activities could be made through the establishment of an expert group of the two countries to make a joint plan, followed by a specialist/working group to prepare the case study.

Because cooperation with regard to transboundary water resources development is of significance, several mechanisms with different targets / purposes should be established, under the direction of a high level mechansim between the two countries.

The cooperation between Viet Nam and Cambodia in transboundary water resources development also needs to be suppored by other initiatives of multilateral cooperation, especially the MRC and ASEAN to make the best use of legal, technical capacity and political support aimed to create the basis for seeking funds for implementation from relevant financial institutions and development partners.

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Annex A - Plans and Policies Reviewed

Plans and policies reviewed in developing this Joint Transboundary Issues Paper include:

- Cambodian National Water Resources Policy of the RGC approval by council ministers on 16 January 2004
- Cambodian Law on Water Resource Management of the RGC was adopted in 2007
- National Strategic Development Plan 2009-2013 on planned action to implement the prioritised policies
- Cambodian National Strategic Development Plan 2014-2018 on Sustainable Development of the Mekong River Basin
- Vietnam National Water Resources Strategy towards the year 2020
- Vietnam Direction Strategy for the development hydraulic works systems 2020 and vision for the year 2050
- Vietnam National Strategy for prevention, control and mitigation of natural disaster towards the year 2020
- Vietnam National Strategy for Climate Change
- Law on Water Resources (Vietnam, June 2012)
- Master Plan for Social and Economic Development for Cuu Long Delta
- Master Plan for the Cuu Long Delta to respond to climate change and sea water level rise
- Restructuring agriculture sector towards the increase of value and sustainable development
- Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin" signed on 5th April 1995 by the four lower Mekong countries – Thailand, Lao PDR, Cambodia, and Viet Nam
- The Declaration of the First MRC Summit held on 5 April 2010 in Hua Hin, Thailand highlighted about the cooperation commitment of the 4 countries on the development of water and related resources in the Mekong basin will make a significant contribution to the socio-economic development of the region, but at the same time recognises the negative impacts on the basin environment that need to be fully addressed
- MRC Strategic Plan 2011-2015 and 2016-2020 focused on providing direction to the MRC Secretariat and MRC programmes (and related projects) over a five-year period
- MRC Basin Development Strategy (BDS) 2011–2015 and 2016-2020 focused on 4 Specific Goals for basin development and management together with one further MRC Organisational Goal and In 2016-2020, BDS was agreed by the council to consider on i) impact and experience of implementation; ii) any additional or recent information and knowledge; iii) Review of national policies and plans; iv) review of scenario assessment and other studies; v) emerging regional trends in cooperation and integration (GMS, ASEAN, etc.); vi) the transition of the MRC towards focusing on core river basin management functions and re-structuring of the MRC secretariat
- MRC Basin Development Plan (BDP) 2011-2015 and 2016-20120: facilitates joint planning and management for water and related resources in effective, sustainable, and equitable ways in order to help reduce poverty in the Basin
- Basin Action Plan (BAP) is the national and Regional Action Plan (RAP) for the implementation of the IWRM-based Basin Development Strategy (IWRM BD-Strategy)

- Regional Action Plan is the MRC strategic plan
- National Indicative Plan (NIP) (2011-2015) is the country plan to demonstrate how it will respond to the IWRM-Strategy and explain mutual and national benefits that can be created through the implementation of the Strategy

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