Transboundary Water Resources Management Issues

in the Sesan and Srepok River Basins of Cambodia and Viet Nam

Sesan and Srepok River Basins
Water Resources Management Project

under

Mekong Integrated Water Resources Management Project

September 2017

Transboundary Fisheries Management Issues

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Abbreviations

2S	Sesan and Srepok Rivers
3S	Sesan, Srepok and Sekong Rivers
ASEAN	Association of South East Asian Nations
BDS	Basin Development Strategy
CNMC	Cambodia National Mekong Committee
EIA	Environmental Impact Assessment
ELC	Economic Land Concessions
Ha	Hectares
IWRM	Integrated Water Resources Management
IUCN	International Union for Conservation of Nature
JC	Joint Committee
JCC	Joint Coordination Committee
Kgs	Kilograms
Kms	Kilometres
LMB	Lower Mekong Basin
M	Metres
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
MW	Megawatts
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
RFMMC	Regional Flood Management and Mitigation Centre
SJCC	Sub-Joint Coordination Committee
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 Sesan and Srepok River Basins (2S) project is one. The objective of the 2S Water Resources Management Project is to: *strengthen cooperation and dialogue between Cambodia and Viet Nam to improve long-term sustainable management and development of the 2S water resources and minimise water impacts.*

Project outcomes are:

1. A Joint Transboundary Issues Paper, supported by the Cambodia National Mekong Committee (CNMC) and the 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 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 drawing from 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 River 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 Sesan and Srepok Rivers

2.1 Water Exploitation and Utilization in the Border Provinces

The Sesan and Srepok Rivers are often studied and managed as part of the 3S River Basins (Sesan, Srepok and Sekong Rivers), which also includes the Sekong River, shared by Cambodia, Lao PDR, and Viet Nam, constituting a significant part of the Lower Mekong River Basin (Watt, 2015). The International Union for the Conservation of Nature (IUCN), for example, has actively worked in the 3S River Basins to build and strengthen water governance capacity, through its BRIDGE project - Building River Dialogue and Governance.

The Asian Development Bank (2010) and the IUCN (Watt, 2015) have also undertaken studies to understand and develop strategic priorities for transboundary water cooperation in the 3S River Basins, including cooperation in water resources monitoring and the exchange of data; flood forecasting and early warning; coordination among cascading hydropower plants and implementation of a Cooperative Regional Assessment; with an emphasis on the balance between development and protection of resources, ensuring mutual benefits for all three countries and equitable sharing of benefits to the people of the 3S River Basins. Similarly, this applies in the context of the 2S River Basins.

The 3S River Basins are important tributaries of the Mekong River and make up a significant area of the Mekong River Basin. It represents 10% of the basin area and has an average annual discharge that represents 20% of the total average annual discharge from the Mekong River.

The Sesan River Basin is 18,800 square kilometres (km^2) and the Srepok River Basin, which lies south of the Sesan River, is 30,940 km^2 (Table 1). The headwaters of the Sesan and Srepok river systems are in the Long-Range Mountains in the Central Highlands of Viet Nam. The Srepok River joins the Sesan River about 7 km upstream of the Lower Sesan II project, and that confluence is 35 km upstream of Sesan River and the Mekong River confluence, which is at Stung Treng city. From its headwaters, the Sesan River flows for 415 km before its confluence with the Srepok River in Cambodia, which is 425 km in length.

The average annual precipitation in the Sesan River Basin is 2,040 millimetres (mm) and in the Srepok River Basin is 1,973 mm, with 80% of the rainfall occurring during the wet season from May to November. The Sesan and Srepok River Basins are both important in terms of their ecosystems, providing important natural resources and ecosystem services in situ and downstream.

There are 2.27 million people living in the Srepok River Basin of which most are located in Viet Nam. In the Sesan River Basin, there are around one million people living in the basin, of which most are located in Viet Nam. Both river systems are characterised by mountain ranges, in the upper regions in Viet Nam, and wide low-lying areas, in the lower regions in Cambodia.

The Sesan River Basin covers parts of Gia Lai and Kon Tum provinces in Viet Nam and Ratanakiri and Stung Treng provinces in Cambodia. The Srepok River Basin covers parts of Dak Lak, Dak Nong, Gia Lai and Lam Dong provinces in Viet Nam and Mondulkiri, Ratanakiri and Stung Treng provinces in Cambodia. **Figure 1** and **2** shows the administrative and river basin boundaries and river systems of the 2S River Basins. In the 2S River Basins, water development is focused on hydropower and irrigation (Table 1, Figure 3). In the upper region of the 2S, small scale irrigation is extensive and supports a wide range of crops but mostly coffee production with irrigation mainly from groundwater resources. Irrigation is less developed in the lower regions of Cambodia.

Table 1: Attributes of the Sesan and Srepok River Basins

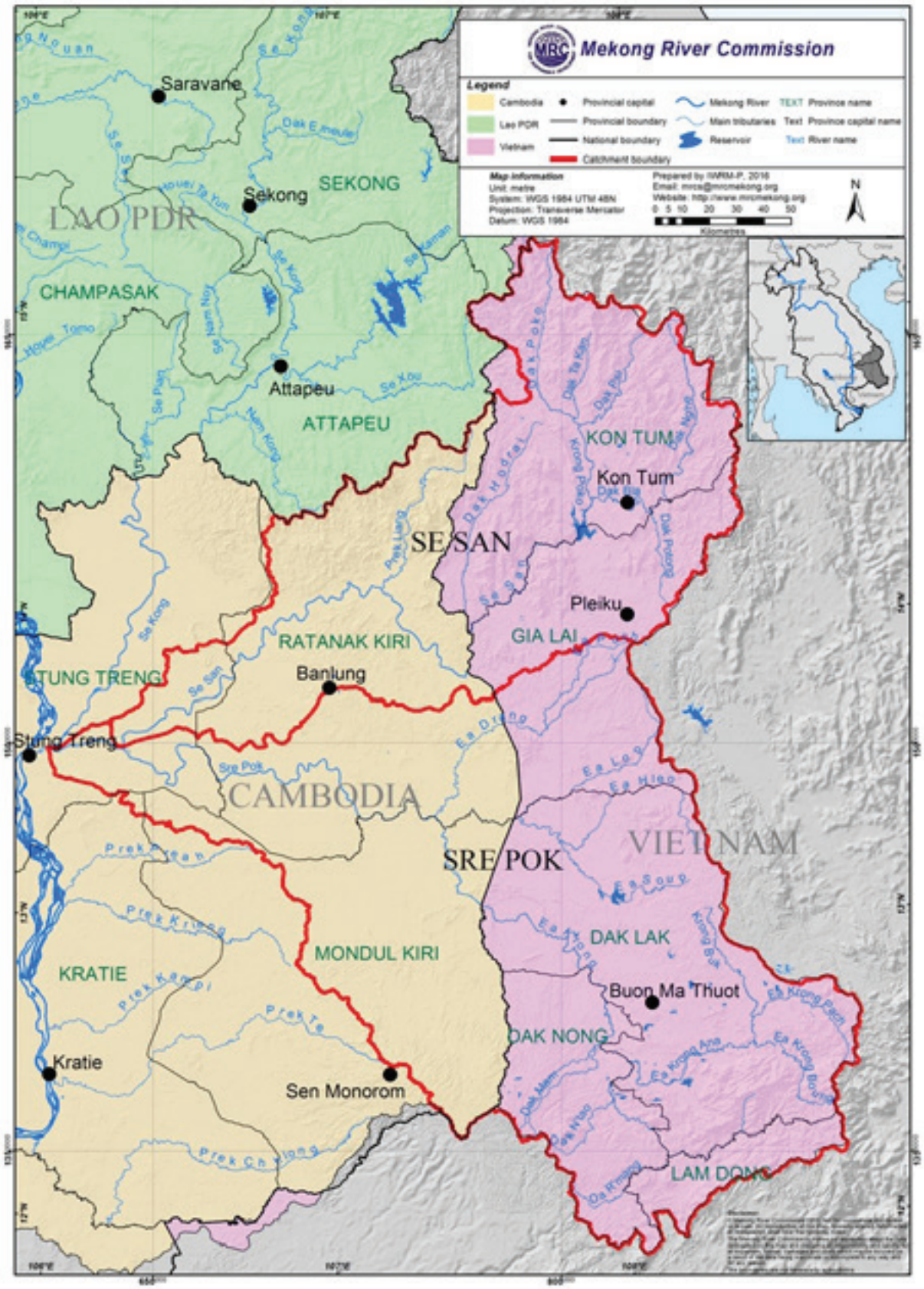
Attribute	Sesan		Srepok	
	Cambodia	Viet Nam	Cambodia	Viet Nam
Basin Area (km^2)	7,630	11,260	12,780	18,160
River Length	225	237	265	160
Elevation Range (m)	50-1,434	129-2,390	45-1,081	140-2,409
Population	95,603	896,812	128,074	2,139,470
Annual Precipitation (mm)	1,965	2,115	1,569	1,575
Irrigation (ha)	520	17,591	6,000	40,200
Number of Hydropower Dams	- 1 existing - 1 under construction - 3 planned	- 6 existing - 1 under construction	- 1 under construction - 3 planned	- 7 existing

Sources: (Constable, 2015 and Watt, 2105), with informaiton verified by CNMC and VNMC, March 2017.

Freshwater capture fisheries are important in the 2S River Basins, in total it is estimated that the 3S capture fisheries generates an annual revenue of US$9.1 million (CNMC, 2011), with the majority from the Sekong River (99 kilograms (kgs) per person per year, and then the Sesan River (12.2 kgs per person

Figure 1: Administrative and Hydrological Boundaries of the Sesan and Srepok Project Area

Figure 2: Sesan and Srepok Catchments



per year), and the Srepok River (16.9 kgs per person per year) (Constable, 2015). In the upper Srepok River in Viet Nam, the income from fisheries has grown significantly due to the introduction of breeding programmes, mainly in reservoirs rather than natural fisheries systems (Someth et al., 2013).

2.2 Significance of Transboundary Water Resources Development and Management

In Cambodia, there is the potential to expand both its hydropower and irrigation capacity in the Sesan and Srepok Rivers. To date, Cambodia has limited development initiatives and funding support for water resources development in the 2S River Basins, aside from the Lower Sesan 2 hydropower dam. Irrigation development in the lower 2S faces many challenges due to topographic conditions and the limited options to store water during the dry season. On the other hand, Viet Nam has almost completely utilised its hydropower potential in the upper 2S and now faces the challenge of how best to operate the dams to benefit all sectors and minimise water shortages and water impacts. **Figure 3** shows the location of existing hydropower and planned projects in the 2S River Basins.

Viet Nam and Cambodia have both gained experience from the adverse impacts of previous water developments, during the construction of the Yali Dam in 2000, the largest dam in the upper Sesan River Basin. The commissioning of the spillway gates during the dry season resulted in sudden flooding downstream, with loss of assets and human lives in Cambodia. As a result of this event, the Government of Viet Nam immediately established a range of mitigation actions including an official apology to Cambodia and the Five Mitigation Solutions' policy (reservoir operation, warning information of water releases and an Environmental Impact Assessment (EIA) for lower Sesan), which was agreed to by Cambodia and adopted by the Viet Nam's Prime Minister in August 2000. Despite implementation of the Five Mitigation Solutions policy, major impacts were still occurring in the lower Sesan River Basin and as a result the Government of Viet Nam responded with a range of new mitigation measures, detailed in Table 2.

Transboundary water resources management and development in the 2S River Basins is therefore significant in the case of existing and potential water exploitation and utilization. As can be observed in the case of the Yali Hydropower Project, cooperation and coordination remains key to assisting in achieving basin-scale aims at the transboundary level through the provision of shared information, technical guidance and mediation. Whilst each country will implement IWRM based on its national objectives, through national water policies and strategies that aim to strengthen institutional and regulatory frameworks (MRC, 2013a), transboundary water resources management issues will require coordination mechanisms that enhance information exchange to support sustainable water resources development.

2.3 Trends for Development and Potential Impacts

Under the Greater Mekong Sub-region and ASEAN frameworks, the need and aspiration for electricity and regional economic integration has increased in the LMB. Member Countries are looking for opportunities for development particularly with regards to hydropower development, transmission line extension (from one to another country), irrigation development for intensive agriculture, and aquaculture development.

Figure 3: Existing and Planned Hydropower Projects in the Sesan and Srepok Project Area

Hydropower Development in the Sesan and Srepok River Basins

The region is also being shaped by rapid socio-economic change as the riparian countries move towards middle and high-income status (Watt, 2015). Existing infrastructure and future developments such as hydropower, mining, agricultural irrigation, legal or illegal logging, the establishment of Economic Land Concessions (ELC), and leases for industrial agricultural development have accelerated in the 2S region. With regards to water development, more than 20 dams in the 2S Rivers and 200 dams throughout the Mekong system are planned or have already been implemented. These are all medium to large-scale dams.

The Sesan and Srepok River Basins are likely to face many issues and challenges including flood, drought, reduction in the sustainability of fisheries, and sedimentation (MRC, 2014). Likely impacts may include: further alteration of river flow regimes; sediment and nutrient transportation; land use change; soil erosion; deterioration of watershed and an increase of flash floods and drought; water quality degradation and increased pollution; and deterioration of biodiversity and ecology including aquatic ecosystems, and fisheries; and decreased sustainability of the livelihoods of local communities.

2.4 Cooperation in Transboundary Water Resources Development and Management

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. To date, infrastructure development in the 2S has generally been driven by national interests rather than transboundary cooperation considerations (Middleton, 2007).

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. PMFM is not applicable to the tributaries of the Mekong.

- 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 Procedures are important in guiding water use in the Mekong 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. Regarding 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 significant attention when addressing the issues of water resources development and management for the 2S River Basins.

2.4.2 Status of Cooperation between Cambodia and Viet Nam

In 2005, CNMC and VNMC signed a Memorandum of Understanding (MoU) on the Strengthening and Enhancement of Cooperation and Coordination relating to Water Resources Development and Management in the Viet Nam-Cambodia border areas in the Mekong River Basin, with the aim of additional support to the implementation of the 1995 Mekong Agreement, in solving disputes related to social and environmental impacts of water uses in the border areas. However, no activity has been undertaken so far. After the 2000 Yali event, a special mechanism for bilateral dialogue namely, the "Meeting between Cambodia and Vietnam for the management of (Upper) Sesan River", was set up. In Viet Nam, the Advisory Committee of Viet Nam for the Operation of Hydropower Scheme of Sesan River was established, while the Cambodia counterpart was the Cambodian Committee for the Management of the Sesan Water Utilization. The MRC Secretariat attended these bilateral meetings as an observer. Starting in 2001, the dialogue meetings first concerned the Sesan River and then in 2008 also the Srepok River. The two countries officially met in 2001, 2002, 2003 and 2008. The dialogues focussed primarily on the implementation of the mitigation solutions but also discussed future cooperation and other hydropower projects in the lower Sesan River. The MoU should be reactivated to ensure effective cooperation between the two NMCs.

At the national river basin level, a river basin organisation – the Srepok River Basin Council – was established in Viet Nam in 2008, which undertook some activities related to data collection and awareness raising but consequently failed to continue working due to legal implications. For the moment, Viet Nam is implementing an institutional support project (WB support) for establishing the (upper) Sesan-Srepok River Basin Organisation. The institutional study would be developed using the

2012 Law on Water Resources and the IWRM approach for its basis.

Currently in Cambodia, the Ministry of Water Resources and Meteorology is planning to establish a River Basin Management Committee for all River Basins in Cambodia. A Sub-decree on River Basin Management was approved in July 2015 and a decision of the Prime Minister on the composition of the National Committee for River Basin Management and its Secretariat was established in October 2015 (Lim, 2016). Following the establishment of the Water Resources Council, integrated plans will be prepared based on IWRM for better water management in each river basin (CNMC, 2016), including a river basin management plan for Stung Treng in Kampong Thom province.

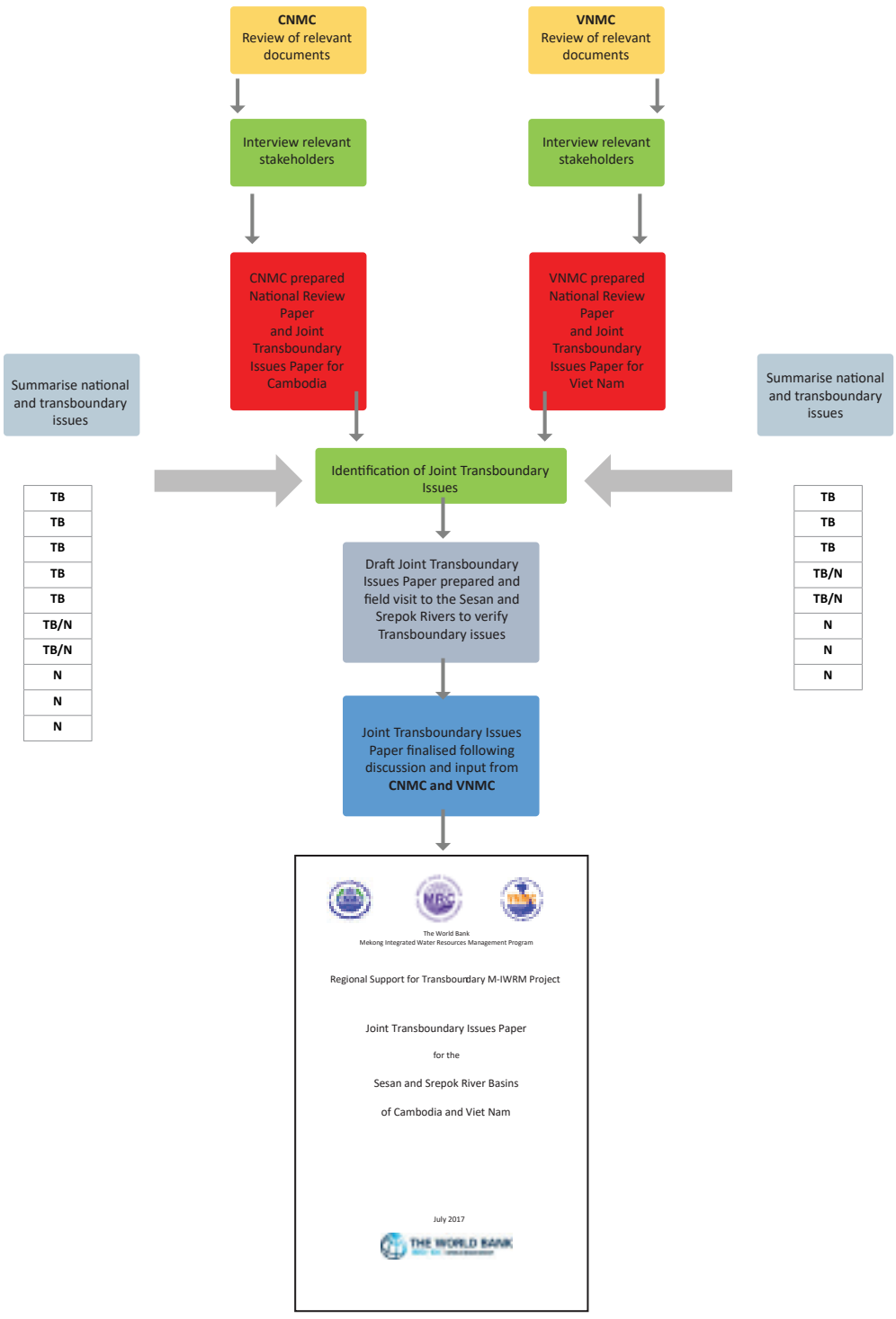
3. Methodology

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 2S 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 2S River Basins.
7. The identification of transboundary priority issues through several joint workshops between CNMC and VNMC (late 2015 to mid-2016) to identify the priority transboundary issues for sustainable management and development of the 2S River Basins, 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. Field visit to the 2S River Basins in Cambodia and Viet Nam to verify the transboundary issues for the 2S IWRM project (refer to Annex B for the field visit report).
10. Finalisation of the Joint Transboundary Issues Paper for the 2S River Basins following discussion and input from CNMC and VNMC.

Figure 4 shows steps taken in developing the National and Joint Transboundary Issues Paper for the project.

Figure 4: Steps Taken in Developing the National and Joint Transboundary Issues Paper for the Sesan and Srepok River Basins Water Resources Management Project



4. Priority Transboundary Water Resources Management Issues

4.1 Monitoring and Assessment of Flow

Background

The upper 2S Rivers in Viet Nam are highly developed river systems, primarily for hydropower production and, thereafter, for also reducing flooding in Cambodia. The upper Sesan River has seven hydropower dams (one under construction), including the Yali Falls dam. The total electricity capacity of these dams is 1,866 Megawatts (MW). The upper Srepok River has seven hydropower dams, with a total electricity capacity of 787 MW. The lower 2S Rivers in Cambodia are currently underdeveloped (aside from the Lower Sesan 2 hydropower dam), but have the potential to expand both their hydropower and irrigation capacity.

Development has significantly modified the natural hydrological regime of both river systems. Large volumes of water are now stored and released upon demand in the upper regions. However, the first attempt of flow regulation led to negative downstream impacts from flooding and diurnal flow variation. In February 2000, major flooding events occurred when the operation of the, almost complete, Yali Falls dam resulted in a large volume of water being released during the dry season, without warning to downstream inhabitants. It resulted in severe social impacts, including deaths. The event led the Government of Viet Nam to establish the immediate Five Mitigation Measures policy to minimise impacts from dry season flow releases (refer to Table 2). Since the full development of the two upper Sesan and Srepok schemes, in 2014, the Decision on Rule of Conjunctive Operation set out specific rules for releasing environmental flows[1] , reducing flood peaks and ensuring dam safety. The implementation of these rules is underway. However, routine monitoring and sharing of storage operational information downstream to local people in Cambodia has yet to be improved.

Concern

Hydro-meteorological networks and monitoring programs have been established by Viet Nam in the upper region of the 2S. Assessment of water resources and scenarios of upper river development have been studied and fully implemented. However, there has been no basin-wide water balance assessment or scenario modelling analysis to better understand the potential impacts of storage operation rules

[1]Environmental flow of 195m^3/s at Sesan 4A and 27m^3/s at Srepok 4 and Srepok 4A

and future management for the entire 2S River Basins. Long-term water resources records (e.g. water levels, discharge, rainfall, water quality) of the entire basins are generally inconsistent and unreliable. The most reliable records start from 2008, even though hydrometeorology monitoring started in mid-1960s in Cambodia and from 1928 in Viet Nam's records. The poor quality of water resources data makes it difficult to establish baseline trends and undertake informative scenario water resources modelling assessments.

Table 2: Mitigation Measures to Minimise Hydropower Operation Impacts in the Sesan and Srepok Rivers in Viet Nam

Measures	Description
Construction of the Sesan 4A re-regulating dam-reservoir	The Sesan 4A re-regulating dam-reservoir was built according to the EIA recommendation made by SWECO-GRONER which recommended that "the most important mitigation measure for existing and future developments is establishing a re-regulating reservoir downstream the last power station of Sesan in Viet Nam; this measure will level out the diurnal flow variations. The flow out of the re-regulating reservoir should be as equal to the natural flow as possible".
Establishment on the Rule of Conjunctive Operation of Reservoirs of the Upper Sesan scheme and Upper Sre Pok scheme	The two decisions of the Prime Minister on Rule of Conjunctive Operation of Reservoirs of the Upper Sesan scheme and Upper Srepok scheme were issued in July 2014. The Rules were set with the principles of: • Ensuring dam safety. • Reducing the flooding, minimising flood damages to downstream and avoiding sudden flows at Cambodia - Viet Nam border areas. • Ensuring the effectiveness of energy generation. • Ensuring a continuing flow of not less than 195 m^3/s at Sesan 4A downstream and 27 m^3/s at Srepok 4 downstream.
	In implementing these new rules, the 2 hydropower schemes suffer deficits to some extent of annual energy, but are required to comply.
Establishment of a transboundary water resources monitoring network in Viet Nam	The World Bank MIWRM national projects (Cambodia and Viet Nam) are strengthening water resources monitoring networks across the 2S River Basins.

Table 3 and Figure 5 shows the water resources monitoring stations in both countries and rivers, however most monitoring stations in Cambodia are non-operational and detailed information on water quantity and quality, including river flow, sediment (suspended and bed load) is lacking, as is monitoring stations on the border to provide early warning prior to flooding. **Figure 6** shows the MRC hycos stations sending data on water levels and rainfall located in the 2S River Basins.

Table 3: Water Resources Monitoring Stations in the Sesan and Srepok River Basins

Monitoring Station	Sesan		Srepok	
	Cambodia	Viet Nam	Cambodia	Viet Nam
Hydrological	3	2	1	4
Meteorological	4	3	3	2
Water Quality	1	1	0	1

National and trans-national water resources monitoring and assessment processes need to be urgently strengthened. As a highly regulated system with issues around daily flow fluctuation, risks from flash flooding, and impacts of severe drought, comprehensive basin-wide monitoring and assessment of flow is essential to support decision-making and long-term sustainable development of the 2S. This information will also assist in: building on mutual benefits between the countries; ensuring emergency response and preparedness; reviewing rules on regulation to ensure a satisfactory situation upstream and downstream; understanding implications of the changed hydrological environment for ecological systems, and the impacts of climate change; and opportunities to access water downstream (due to an increase in average low flow).

With five large reservoirs are now operating, the average low flow has increased. Viet Nam is using these favorable conditions for hydropower purposes. Agriculture is unable to utilise this due to the mountainous relief of the basin, irrigated agriculture is therefore exploiting waters from minor tributaries streams and creeks. In another aspect, this average low flow increase consequently creates potential opportunities for downstream irrigated agriculture in Cambodia, if a plan is made for that purpose.

The permanent issue during dry season (including a short dry period during rainy season), that affects the downstream from upstream development is the diurnal fluctuation of water level. The issue has been addressed primarily by the construction and operation of re-regulating dams at both rivers and the release of the minimum flow, 195 m^3/second at upper Sesan River since July 2011, and 27 m^3/second at upper Srepok River, since August 2015. The diurnal fluctuation is therefore minimised as much as possible, and impacts caused to the river ecology are also minimised. However, the diurnal fluctuation does still exist to some extent meaning that the river downstream will need to adapt, somehow, through mitigation measures (refer to 4.4).

In some specific drought conditions, for example the recent 2015-2016 dry season, no reservoirs could fill to the full supply level, therefore the release of the minimum flow, as agreed, became impossible. Cambodia was warned about the situation and showed full understanding: a good example of cooperation and trust.

Figure 5: Location of Water Resources Monitoring Stations in the Sesan and Srepok Project Area

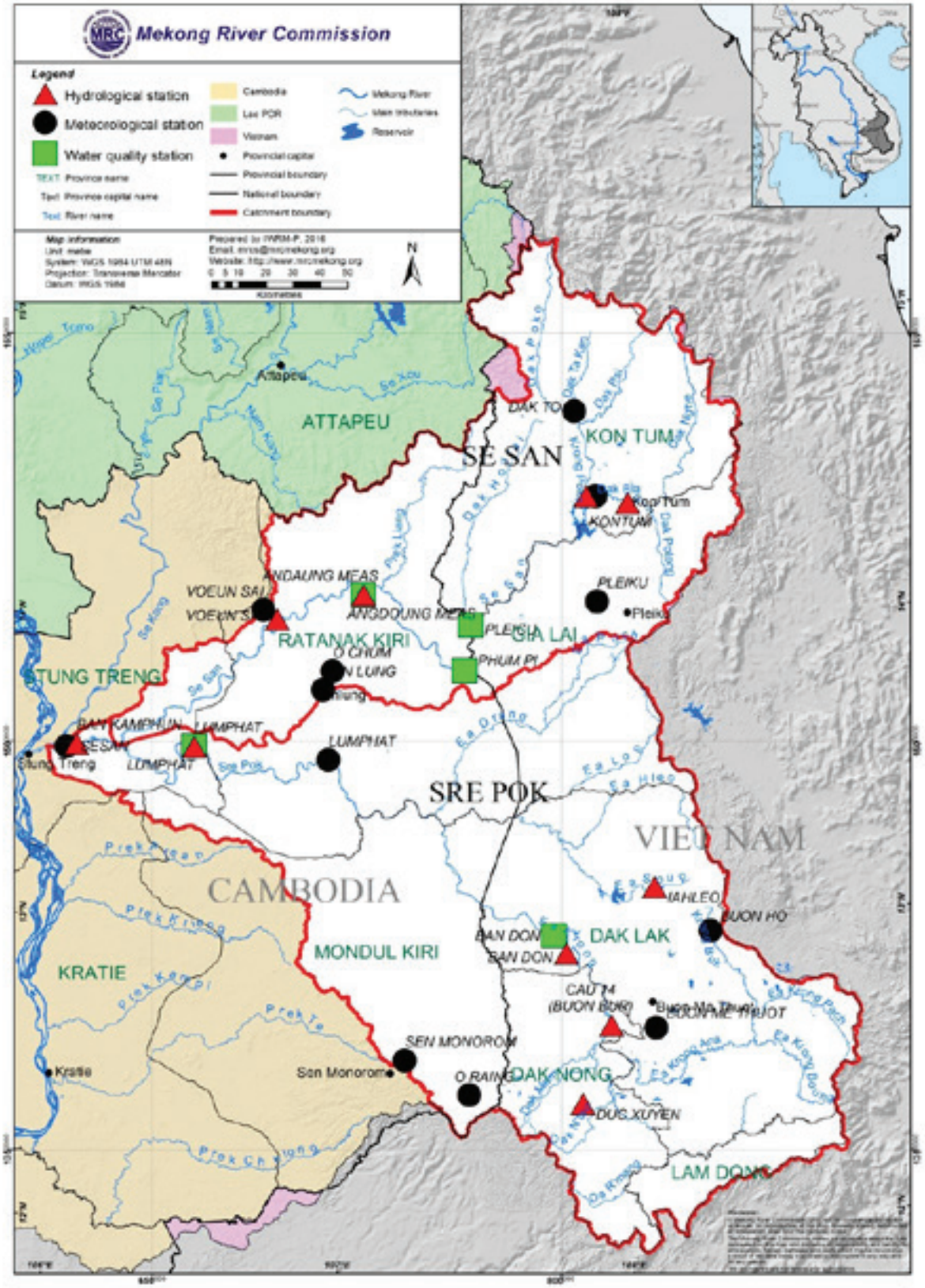
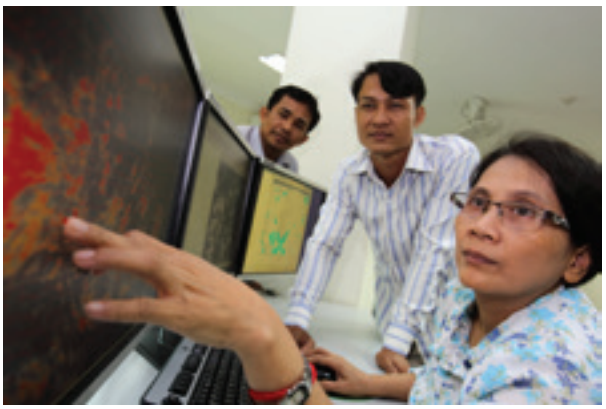


Figure 6: MRC Hycos Stations in the Sesan and Srepok River Basins

4.2 Flood Forecasting, Flood Control and Flood Warning Mechanisms

Background

Flood plays an important role in the 2S River Basins and contributes to its abiotic character. On the 2S mainstream, flood season usually lasts from August to November and even to December in some years (MRC, 2015a). The flood load in Cambodia, within the 2S River Basins, depends on the hydro-meteorological events in the upper catchment area situated within the territory of Viet Nam. Flood forecasting and early warnings for the river basin are mainly dealt with at the national level, even though it is recognised as a transboundary issue. Regional flood forecasting is implemented via the MRC Regional Flood Management and Mitigation Centre (RFMMC) located in Phnom Penh (Cambodia), but is restricted to the Mekong mainstream, and does not provide forecasts for the 2S River Basins.



Cambodia and Viet Nam have already undertaken efforts to optimise the situation. A mechanism has been established to exchange and share information on both flood and hydropower dam operations, in normal and emergency cases. The results obtained by this mechanism, however, have been limited due to the unknown impacts of emerging developments in the River Basins. For instance, water levels in the Sesan River in 2010 fell to the lowest conditions compared with the historical records (noting that the Re-regulating Upper Sesan 4A started operation in 2011). A severe flood in 2009 strongly affected people in the whole basin, especially people living in the downstream areas. Whilst the regulation function in the upper Sesan and upper Srepok[2] has reduced annual flooding, the impact of flood still needs to be managed, especially due to changing land uses and, the likely impacts of climate change.

The Vietnamese Government's Rule of Conjunctive Operation of Reservoirs, in its second objective, reflects a spirit of upstream responsibility. From the original function of power generation, two tasks were identified: (i) Flood reduction for minimising flood damages to downstream and (ii) avoiding sudden changes of flows at Viet Nam - Cambodia border areas. Flood reduction requires proactive operation by keeping the active volume of the reservoir semi-empty during the early flood period. This commissioning requires accurate forecasting of rainfall and incoming flows; otherwise by the end of the flood, the reservoir may not be filled up to its full supply level, and as a result a loss of energy will occur in the next dry season.

The effectiveness of implementing such rules depends on the skill of the hydro-meteorological forecasting agency and hydropower scheme operators, and also the effective coordination between upstream and downstream agencies to improve the mechanism for communicating warnings with regards to water releases.

[2] The 2009 high flood season witnessed their effects: Pleikrong reservoir (Upper Sesan) regulated up to 51.7% of flood peak; Sesan 4 reservoir diminished 12.6% of the peak flood; Buon Tua Srah reservoir (Upper Sre Ppok) decreased flood peak of 37.8%.

Concern

Currently, there is an absence of information and coordination in flood forecasting, flood control and flood warning within the 2S River Basins at the national and transboundary levels. This is further exacerbated by the uncertain impact of new water development projects and the impacts of climate change. Appropriate information, coordination mechanisms, policies and strategies are needed to address flood-related issues, especially to reduce casual ties of downstream communities from flash floods. Cambodia has noted unexplained changes in flood and drought following water developments upstream, further information and transboundary collaboration will enable deeper understanding of the changes, along with other measures addressed under different sections of this issues paper.

Transboundary cooperation is therefore needed between Cambodia and Viet Nam in the Sesan and Srepok River Basins regarding the set-up of both: (i) an effective flood forecasting system and (ii) a sufficient data exchange mechanism to enable early warning, as well as the timely dissemination of respective information to the community level.

The capacity of the forecasting, monitoring and hydropower dam operations also needs to be improved to enhance the quality of this information and the effectiveness of coordination. For hydropower developers, the operation of reservoirs for flood reduction purpose is a challenging task to implement properly in order to meet national obligations as well as their upstream responsibility, and also to minimise their energy losses.

4.3 Communication and Coordination Mechanisms on Information/Data Sharing

Background

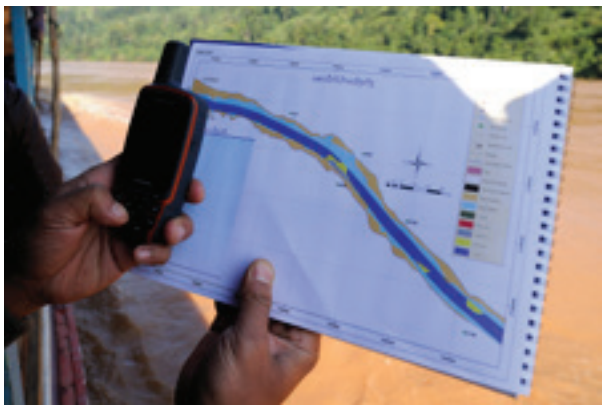
Managing the 2S River Basins through IWRM principles will require riparian countries to address transboundary issues together and demand strong coordination and cooperation among neighbouring countries (MRC, 2013a) in order to ensure sustainable utilization of the same river. Meaningful and effective cooperation on river data and information sharing can assist with the political or economic development of both countries in the region. However, there is still limited communication and coordination related to data and information sharing between the upstream and downstream countries. For example, there currently exists an early warning system which provides notification of water releases from hydropower dams in the Sesan River, under the National Mekong Committee (NMC) structure. However, the downstream community are still confronted with delay in the scheduled water release from upstream, which affects their income generation, livelihoods and sense of security.

The Procedures for Data and Information Exchange and Sharing (PDIES)[3] and the Guidelines on Disclosure of Data, Information and Knowledge[4] were prepared to govern access to information. The Procedures and Guideline's aim to facilitate and operationalise data, information and knowledge exchange between Member States and with the Secretariat under three main categories: ***Unrestricted*** (available to the general public), ***Restricted*** (may be released to a specific audience following the appropriate approvals), and ***Confidential*** (not for release beyond the author and addresses nor to the public) (MRC, 2015b).

[3]Adopted by the MRC Council on 1 November 2001 at the 8th MRC Council Meeting in Bangkok, Thailand.
[4]Approved in the MRC Council meeting in 2006.

Real time data on river flows, and historic hydrological and water quality data, is classified as unrestricted and can be shared publicly on the MRC website. Following the Yali Dam event, in the Sesan River, Viet Nam and Cambodia implemented its first mitigation action of communication/information of water release. As a consequence, water information was sent by Viet Nam to the Cambodian Water Resources and Meteorology provincial office in Ratanakiri and the CNMC in Phnom Penh. Communication and information sharing, however, is usually delivered to the community too slowly due to many factors including: no internet access; technical information is not easy for local people to understand; there is a delay in the delivery of information to remote areas (such as riverine villages located in Ratanakiri and Mondulkiri provinces); and there is a limited budget and capacity of local authorities to share data and information and provide the necessary facilities to do so. Further attempts have been made to improve communications and broaden the Provincial contacts, as well as, adding the Srepok River to the communication systems.

Attempts to improve communication exchange, resulted in the main channel of information being between Hanoi and Phnom Penh through the NMCs, however, similar issues with delay and coordination with local people have arisen. Other communication channels have been set up, for example, email communication between the Upper Sesan 4 Hydropower Scheme and the Ratanakiri Director, Department of the Water Resources and Meteorology (DWRM). So far water information from the Upper Srepok 4 and Srepok 4A was also communicated via the two NMCs, however there has been no feedback from Cambodia at the Mondulkiri provincial level on this (as reported to the Team by the Director of Upper Srepok 4).



Concern

Attempts have been made to establish and improve communication and coordination mechanisms for information and data sharing, however, this still needs to be improved to ensure live and relevant information is provided to the locally affected communities using systems that distribute information and data quickly, efficiently, in an accessible way (noting that internet is not always available), and in the local language. Hydropower operators in Viet Nam routinely provide information to Cambodia (15-day bulletin) and in the case of an emergency. However, in some instances there is not enough time or resources (staff and financial) for Cambodia to implement emergency measures, and also there may be a lack of capacity to do so. It is therefore important that bilateral communication continues and that this is strengthened for the most effective information exchange and coordination mechanism. In Cambodia, flood forecasting and water level information that can provide an early warning system is only currently delivered manually, with the DWRM provincial office located in Ratanakiri province far away from the affected river and riverine communities.

The establishment of a Joint Coordination Committee (JCC) at the Central Government level and a Sub-Joint Coordination Committee (SJCC) between Cambodia and Viet Nam for the regulation of “Water Resources Utilization along the Common Border” should be a priority. This is especially important due to the development of the cascade of hydropower plants on the 2S Rivers, including the Lower Sesan 2

Hydropower Plant in Cambodia, soon under operation.

Experiences from the past decade have shown that the cooperation must go beyond institutional focus, alone. Realistic measures are required to solve the issues, and this will be studied further under Outcomes 2 and 3 of this project, where joint coordination mechanisms will be agreed upon and an action plan developed to implement these mechanisms. It is considered that this approach would be useful for both countries. Viet Nam's national approach, in other river basins, is to use 'water level' information as the means to communicate (in addition to discharge information), so that everyone can easily understand. In emergency cases, a siren alarm is activated.

4.4 Mitigation Measures to Address Social and Environmental Impacts

Background

Historically, the 2S River Basins have faced hydropower development which did not consider transboundary impacts, both social and environmental. In the case of the Yali dam in Viet Nam, there was no official transboundary impact assessment for downstream communities in Cambodia (Wyatt & Baird, 2007), as well as no consultation with the Cambodian Government and dam affected communities before the construction commenced. This removed the opportunity for the Cambodian Government to have input into ensuring that the development prevented harm through the implementation of appropriate mitigation measures. The result was the violation of the rights of the downstream communities along the Sesan River (RCC, 2005).

Over the last 15 years, water development and land use practices have changed the natural environment, the natural hydrological flow, and the water quality within the 2S Basins. The aquatic ecosystems of the Lower Sesan and Lower Srepok Rivers have been adversely impacted on including fish, their ability to migrate and their habitat. **Figure 7** shows the health of aquatic ecological sites in the 2S River Basins.

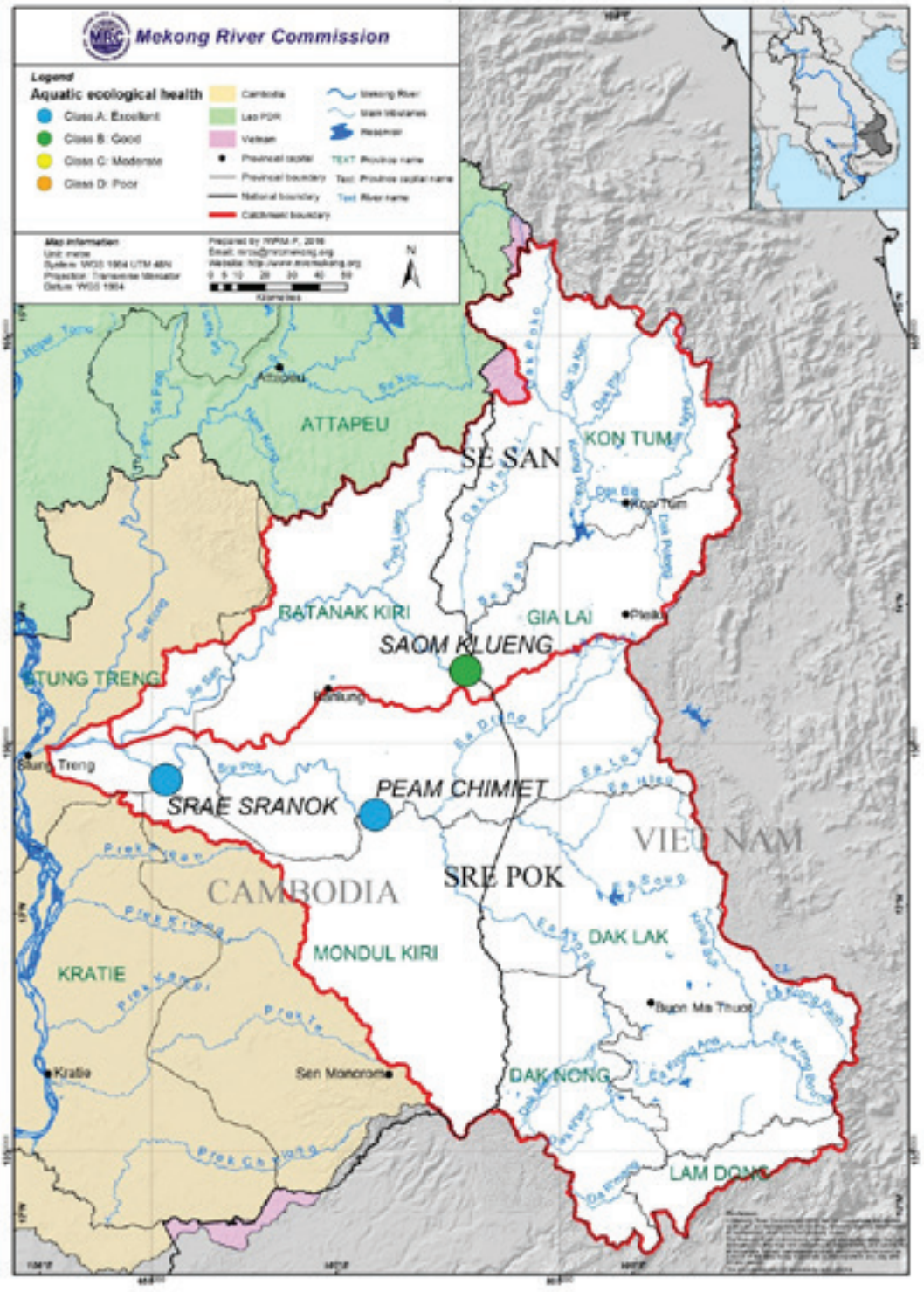
Riverside communities have been impacted significantly with changes to their living conditions, including: sustainability of their livelihoods through a reduction in fisheries productivity - a principal source of protein; access to safe and clean water for drinking and domestic uses such as bathing and washing; access to local river transportation, and adverse impacts on eco-tourism. River bank erosion has also threatened economic activities and housing safety, and there have been adverse impacts on riverbank agriculture, a key income earning activity of riverine people.

The water quality of the 2S Rivers is also likely to decline due to pollution by mining, intensive agricultural activities, and urban drainage, if there are not proper mitigation measures to protect and sustain water quality.

Concern

Currently, the cumulative negative impacts on biodiversity, river ecosystems, and water quality, as a result of: the upper Sesan and Srepok cascade hydropower development, intensive agriculture, and other activities upstream have not been assessed. This makes it impossible to introduce mitigation measures to prevent negative impacts. There is a clear need for such an assessment to be undertaken to effectively understand the current situation and the likely future development scenarios so that these impacts can be mitigated.

Figure 7: Aquatic Ecological Health Sites in the Sesan and Srepok River Basins[5]



[5]The aquatic ecological health sites for the 2S River Basins were selected as biomonitoring sites that supported 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.

In Viet Nam and Cambodia, National Indicative Plans have been developed for the 2S River Basins, of the Central Highlands, that aims for the: "Enhancement of the sustainability of tributaries' hydropower development through mitigation of negative impacts of the construction and operation of hydropower dams in the 2S River Basins to downstream, including Cambodia territory and mainstream flow change and address the issues of cost and benefit sharing between the sectors and sub-basin's countries" focusing on transboundary issues, while also focusing in the sub-basin of the Sesan and Srepok (MRC, 2016). Such activities are an important first step to understand the current water development environment, its impact and potential requirement to mitigate these impacts. Furthermore, the MRC Transboundary Environmental Impact Assessment (TbEIA) framework, currently being piloted in the 3S River Basins, could be useful in its application and identifying an effective mitigation measure plan for current and future development scenarios.

As usual, upper development of water resources would create negative impacts to downstream. Viet Nam is conscious of this and has extended technical and operational rules for minimising these impacts. However, development consequences are evident. The assessment of current issues and the formulation of a mitigation plan for downstream is required.

4.5 Institutional and Technical Capacity to Improve Transboundary Coordination and Cooperation

Background

Cambodia and Viet Nam are faced with a lack of capacity to manage water resources due to a lack of professional hydrologists, environmentalists, modellers, irrigation engineers, water resources planners, and also funding. Additionally, it is recognised that the capacity of the sub-national Cambodian government is still low, for both decision making and technical knowledge. Based on the national survey in Cambodia undertaken for the 2S transboundary project, it was found that government staff, particularly at the sub-national level, are still limited in their technical capacity and have limited knowledge and experience in negotiating transboundary water resources management issues with Viet Nam. In Viet Nam, despite education and training efforts so far, there is evidence that human resources development is also needed. Targeted people should include, not only concerned provincial staff and related communities, but also professionals of developer agencies and technical institutions who are key human resources in charge of the implementation of transboundary tasks.

Concern

Whilst there have been attempts between Cambodia and Viet Nam to meet periodically at the government or ministry levels to discuss transboundary water issues including the 2S River Basins, this has occurred only periodically. With large water infrastructure already developed in the upper 2S and currently being implemented in the lower 2S, through a central and sector oriented approach, without effective transboundary cooperative mechanisms sub-optimal development may result. There is a need to establish a permanent coordination mechanism for cooperation between the two countries, and the right type of cooperative effort, where the benefits of the cooperation outweigh the costs, and the process and outcomes are politically and socially acceptable (Watt, 2015).

The capacity of both countries requires improvement for better coordination and cooperation, at the institutional and individual levels (national, provincial and local). In particular, capacity in collecting, analysing and managing data and information, modelling, flood forecasting, emergency preparedness, impact assessment, disaster risk management, and implementation of coordination mechanisms. Adequate staffing (and appropriate skill-set), resourcing, equipment, monitoring systems are also required to improve capacity for better coordination and cooperation at the transboundary level.

4.6 Stakeholder Engagement and Awareness on Water Management

Background

The MRC's Communication Strategy and Information Disclosure Policy aims to improve regional and national stakeholder participation through enhancing stakeholder access to information which will support strategy preparation and development by respecting community and wider popular participation approaches in each country (MRC, 2013a). The projected future development in the 2S River Basins emphasises the need for adequate stakeholder engagement and the creation of awareness on water management issues to ensure sustainable river utilization and adequate environmental flow of the rivers, for the benefit of all.

In the 2S River Basins, existing development projects in the upstream area have provided lessons about the importance of stakeholder engagement for a transboundary project. The development of upper dams has demonstrated limited stakeholder engagement; particularly with the involvement of communities, NGOs, Civil Society Organisations, and academia. In the early stages of the Environmental Impact Assessment and consultation processes no information was disclosed. As a consequence, the downstream community in Cambodia was not aware of the likely impacts of the dam development to the rivers, including negative impacts on ecosystems, increased flash flooding, degradation of the water quality, pollution, sedimentation and nutrient increases.

Furthermore, current and future development scenarios which include irrigation, mining, and land use change are also important concerns for relevant stakeholders to be aware of, in order to minimise impacts and put in place measures to reduce impacts and plan for unpredictable risks associated with climate change disasters or hazards, such as flood and drought in the region.

Concern

The open disclosure of information and enhanced stakeholder participation is critically important, especially the inclusion of communities in the decision-making process for any future development project in the 2S River Basins. It is therefore important to ensure transparency and accountability of the riparian country governments to their citizens and to strengthen stakeholder engagement and regional dialogue and cooperation for the use and management of the river basins for water governance in regards to water sharing, water resources management, and river basin protection.

The upper 2S hydropower development plan was made by the government of Viet Nam, while its implementation was carried out by central agencies with sectoral objectives with inadequate attention to local interests. Negative impacts were only highlighted where the operation impacted on tourism sites, for example, waterfalls and national parks in the upper Srepok basin, where a value was placed on these locations by concerned community members. The remedy was made only upon local complaints

and through the release of minimum flow as indicated by the rule of operation of reservoirs. As a consequence, the involvement of stakeholders and local communities is indispensable.

It is therefore important to raise awareness, understanding and ensure meaningful and constructive involvement and engagement of upstream and downstream stakeholders in the decision-making process (planning and management) of integrated water resources and river basin management in the 2S.

5. Conclusion

Applying IWRM principles has proved a challenge demonstrating that measures need to be put in place to ensure stronger cooperation between Cambodia and Viet Nam, with the goal of a sustainable 2S River Basins.

Viet Nam has more actively utilised and exploited its water resources within the 2S River Basins for both hydropower and irrigation purposes, while Cambodia water development is still limited due to the technical and financial limitations.

There is still weak coordination and cooperation on transboundary water resource development and management due to the lack of a transboundary cooperation mechanism; weak implementation of the MRC procedures; limited capacity of the government and local communities; and deficient sharing of information and data on flows downstream, flood forecasting, flood control, and warning mechanisms.

The potential impacts of future infrastructure development, including: extensive irrigation, mining, ELC, and urban drainage in the rivers is likely to disrupt the water quality, and health of the aquatic ecosystem, ecological reserves and natural habitats, leading to a decline of fisheries resources and loss of biodiversity, which are the main sources of food for the Mekong people.

To deal with the priority transboundary water resources management issues discussed in this paper, existing mechanisms and plans need to be improved and enhanced as well as the development of new mechanisms for cooperation between Cambodia and Viet Nam.

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Annex A - Plans and Policies Reviewed

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

Cambodia

- 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
- 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, Cambodia, and Viet Nam
- The Declaration of the First MRC Summit held on 5 April 2010 in Hua Hin, Thailand highlighted 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 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

Viet Nam

- Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, 1995 and Procedures related.
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- EIA Report on Srepok irrigated agriculture, WR University and VESDI (NGO), 2008
- Official arrangement for EVN to communicate Cambodia, VNMC, 2011
- Law on Water Resources, 2012
- PM Decision No 936 dated 18 July 2012 on Socio-Economic Master Plan in the Central Highlands unto 2020.
- Institutional support for IWRM through RBO establishment, Feasibility Report, VNMC, 2013
- Assessment of transboundary conflict in Sesan river, WR University, 2013
- PM Decision No 1182 dated 17 July 2014, Rule of Conjunctive Operation of Reservoirs at the Upper Sesan scheme
- PM Decision No 1201 dated 23 July 2014, Rule of Conjunctive Operation of Reservoirs at the Upper Srepok scheme
- Starving the Mekong, International Rivers, 2014
- Hour operation records of Sesan 4 (2009-2015)
- Hour operation records of Sesan 4A (2013-2015)
- Day operation records of Srepok 4A (2010-2014)
- Annual Statistics of the Central Highlands provinces

Annex B – Field Visit to the 2S in Cambodia and Viet Nam

Field Trip Report

Joint Transboundary Field Trip to the Sesan and Srepok River Basins between Cambodia and Viet Nam

22-26 August 2016

The field trip enabled the participants to:

- Observe and discuss transboundary issues (Outcome 1)
- Meet with key provincial officials, hydropower dam operators, and local villagers
- Start considering the next step in developing transboundary coordination mechanisms (Outcome 2)

Field Trip to the Sesan and Srepok River Basins in Cambodia and Viet Nam			
Location	**Observations**	**Transboundary Issues verified**	**People Met**
CAMBODIA Day 1 – 22 August 2016			
Travel from Phnom Penh to Stung Treng, Cambodia			
Day 2 – 23 August 2016			
Governor Office, Stung Treng	A discussion was held on the importance of strengthening mechanisms between Cambodia and Viet Nam in the River Basins • There is a need for water security for the province and Cambodia as a whole • Cambodia has not utilised available water as yet. • Substantial development upstream • Cambodia looking to learn from upstream countries • Important to promote opportunities for cooperation and maximise water resources whilst protecting the environment and social issues. • Extremes experienced recently in drought, flood and the added impact of climate change.	• Communication and Coordination Mechanisms on information sharing and data • Institutional and Technical Capacity to improve transboundary coordination and cooperation • Mitigation measures to address social and environmental impacts	• Field Trip members • Deputy Governor, PDoWRAM Director and Officers
Lower Sesan II hydropower dam site in Stung Treng province	• Lower Sesan II dam site is currently under construction, starting in 2015 and will be completed by 2019. Cost $800 million to build. Currently employing 1800 staff. • Electricity will be generated (400 MW) using 8 turbines and feed into the Cambodian National electricity grid. • Hydro Lancang Electricity owned. Will become Cambodian government property in 40 years. • The Sesan-Srepok confluence is 7 kms upstream of the Lower Sesan II. • No sediment flushing to occur, no transportation. A fishway will be constructed in the future.	• Monitoring and assessment of flow • Flood forecasting, flood control and flood warning mechanism • Communication and coordination mechanisms on information and data sharing • Mitigation measures to address social and environmental impacts	• Field trip members • Project Manager and Construction Manager for the Lower Sesan II hydropower project, Hydro Lancang Electricity
Travel to Ratanakiri			

Field Trip to the Sesan and Srepok River Basins in Cambodia and Viet Nam			
Location	**Observations**	**Transboundary Issues verified**	**People Met**
Water supply scheme– Lumphat town of Ratanakiri province in the Lower Srepok basin. Visit to the new Ratanakiri PDOWRAM Office at Banlung city.	• Water treatment plant observed using filtering process and pumped from nearby creek (a tributary of the lower Srepok River). • Privately owned • 3000 households subscribe to use the water, payment for service	• N/A	• Field trip members • Water Treatment Plant Operators
Day 3 – 24 August 2016			
Ratanakiri province – Lower Sesan River – site of flood, and observation of water fluctuation	• Site of flood area and observation of water level fluctuation at the lower Sesan River near the Cambodian and Vietnamese border (approximately 5 km distance). • Community members were consulted. A boatman remarked the actual water level fluctuation varied between 0.5 m – 1m. The Village was relocated due to the flood from the Yali dam event that occurred in 2000. • The situation has improved since 2011, although localised flooding from the tributary occurredmore recently.	• Monitoring and assessment of flow • Mitigation measures to address social and environmental impacts • Stakeholder engagement and awareness on water management	• Field trip members • Community members
Travel from Ratanakiri to Cambodia and Viet Nam border then on to the Upper Sesan 4 and 4A			
VIET NAM Day 3 – 24 August 2016			
Upper Sesan 4 and 4A Hydropower Plants	• Cambodia interested in the impacts of river regulation of the upper Sesan as it has implications on people and provinces downstream in Ratanakiri and Mondulkiri, Stung Treng province • Upper Sesan 4 and 4A, located in Viet Nam the last hydropower dams before the Cambodian border. • Upper Sesan 4 generates 360 MW of electricity and Upper Sesan 4A 63MW. • Operation rule ensures a minimum release of 195 m^3/sec from the Upper Sesan 4A. • Cascade hydropower projects in the upper Sesan River. • Cambodia's National World Bank project is trying to understand the water demand on Cambodia side. • Upper Sesan 4 Hydropower company communicates to Cambodia, both directly and via VNMC and CNMC, about potential flood, in emergency 3-4 hours in advance, also provides a 15-day bulletin. • Cambodia stressed the need for immediate information in rainy season for both flood and drought. • Last year, the 2015-2016 dry season, was noted as an especially dry season, making it difficult to deliver the minimum flow. • High fluctuation also noted as an issue for Cambodia to respond to.	• Monitoring and assessment of flow • Flood forecasting, flood control, and flood warning mechanism • Communication and coordination mechanisms on information and data sharing • Mitigation measures to address social and environmental impacts • Institutional and technical capacity to improve transboundary coordination and cooperation	• Field trip members • Sesan 4 and 4A hydropower operators
Travel to Pleiku, Viet Nam			
Day 4 – 25 August 2016			
Travel to Buon Ma Thuot, Viet Nam			

Field Trip to the Sesan and Srepok River Basins in Cambodia and Viet Nam			
Location	**Observations**	**Transboundary Issues verified**	**People Met**
Upper Srepok 4 and 4A Hydropower Projects	• Upper Srepok 4 generates 80MW of electricity with 2 generators. • Upper Srepok 4A is 10 kilometres away and generates 64 MW, with the flow being distributed by a wide canal. • The Upper Srepok 4 and 4A are the last of the hydropower dams before the Cambodian and Vietnamese border, which is approximately 50 km away. Not many people live near the border area. • There are seven hydropower dams on the upper Srepok. • The Prime Minister of Viet Nam introduced the Rule of Conjunctive Operation in the upper Srepok River. • The reduced flow due to cascading hydropower development has improved river bank stability and access to the river. • The minimum flow release is 27 m^3/sec and maximum recharge is 400 m^3/sec • The same information sharing from the Hydropower operators in Viet Nam to Cambodia, via VNMC and CNMC, is followed with a 15-day bulletin plus emergency reporting. • Cambodia do not have technical monitoring in the Mondulkiri Province on the lower Srepok River, downstream of hydropower dams. Installation can be arranged through the WB National project.	• Monitoring and assessment of flow • Flood forecasting, flood control, and flood warning mechanism • Communication and coordination mechanisms on information and data sharing • Mitigation measures to address social and environmental impacts • Institutional and technical capacity to improve transboundary coordination and cooperation.	• Field trip members • Hydropower operators
Ban Don Hydro-meteorological (Hydromet) Station	• There are 4 hydromet stations on the upper Srepok in Viet Nam. • The Ban Don Hydromet station is downstream from discharge of Upper Srepok 4 hydropower dam, but does not account for flow from Upper Srepok 4A. • The Ban Don Hydromet Station is therefore no longer in the right location.	• Monitoring and assessment of flow • Flood forecasting, flood control, and flood warning mechanism • Communication and coordination mechanisms on information and data sharing (specifically the accuracy of dry season hydrology data that Ban Don station provide to the MRC database)	• Field trip members • Hydromet station staff
Return to Buon Ma Thuot, Viet Nam			
Day 5 – 26 August 2016			
Joint Issues Workshop for the 2S and Mekong Delta IWRM Projects, Buon Ma Thuot, Viet Nam			

Key observations

- Transboundary cooperation between Cambodia and Viet Nam in water management and development in the Sesan and Srepok River basins, is important with the Joint Issues Paper providing an opportunity to improve cooperation where there is common concern.
- Better understanding of the situation in both Cambodia and Viet Nam in terms of:
    - current water demands,
    - operating rules of hydropower schemes, and how this is managed
    - monitoring stations,
    - how information related to hydropower operation is currently shared,
    - capacity in water management,
- And where the two countries need to build on these.
- There is a clear need to strengthen coordination mechanisms especially in the situation of minimum flows, fluctuating water levels, drought and flood, and to understand and mitigate social, economic and environmental impacts.
- An understanding of the key players in water resource management in the 2S Rivers, and how water management decisions affect local communities provides a useful context.
- Capacity building is necessary among the two countries, as Cambodia does not have strong capacity and it would be useful to work with Viet Nam in strengthening it.
- The field trip showed the Upper Sesan and Upper Srepok Rivers (in Viet Nam) being managed in two different modalities (public - public and public – private) both under state supervision and EVN electricity grid control.
- In the Upper Sesan River, the Sesan 4A Hydropower scheme enables re–regulating, with a discharge of a minimum 195 m3/sec, implemented to minimise the impacts. For the Upper Srepok Hydropower Schemes with a minimum 27 m3/sec discharge, the scope of impact is unknown to date, especially due to the long distance to the border and the remote location. It is noted that with the introduction of regulation in both the rivers, during the wet season, flood in the system has decreased and, during the dry season, the minimum flow has increased. The problem now is fluctuation (change in water level).
- Every 6 months the hydropower operators in Viet Nam undertake environmental monitoring, using an environmental monitoring system for all of Viet Nam. The monthly water quality monitoring system of the MRC in the upper Sesan andSrepok has continued since 1985, currently implemented through the HydroMet system.
- It is considered from the field trip that recent irrigation in Cambodia is small, with localised agriculture only.
- The Ban Don Hydromet station, currently reflects information the operation of hydropower prior to the new Srepok 4A. The hydromet station should be moved to another location to have more accurate results to reflect the reality of flow in the Upper Srepok River.
- The field trip enabled a better understanding of the Conjunctive Operation Rules for the Hydropower Schemes in Viet Nam and how the implementation of these rules effect water flows during the flood season and dry season and would be shared to Cambodia to understand the rules, with assistance by the MRC in its translation.
- Information and data sharing by the hydropower operators in Viet Nam includes: during normal operation,a bulletin for 15 days in advance, and in an emergency, the operators inform the Cambodian side within 3- 4 hours. It was noted that there are still some limitations due to unpredictable situations such as severe storm.

- It would be useful to be able to observe immediately the effect of mitigating measures by the Upper Sesan and Upper Srepok Rivers on the Cambodia side, and continuous dialogue about this issue to understand the real situation, through a thorough investigation and collaboration between CNMC and VNMC.
- The far distance from Ratanakiri PDoWRAM Office to the lower Sesan River, as well as the thinly scattered riverside housing have explained clearly how difficult it is for Cambodian authorities to communicate water release information to the affected local communities.
- In Viet Nam water resource management is quite advanced, including monitoring and regulating water flows.
- In Cambodia, it is less developed and therefore the focus needs to be on building capacity through the national project.
- The foundation for sustainable water management is through using scientific evidence, which ensures rigour in the data and information available.
- The important next step for the transboundary project will be to set up coordination mechanisms at the operational level.

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