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The Council Study

Study on the sustainable management and development of the Mekong River, including impacts of mainstream hydropower projects

Scoping of the formulation and assessment of development scenarios

Concept Note

This note identifies scenarios and baselines, taking into account the requests from Member Countries in the 3rd RTWG Meeting on the Council Study (14 Nov 2014) and the 21st Council Meeting (15 Jan 2015), including:

- The role of the BDP in the formulation of development scenarios and in the socio-economic and macro-economic assessments
- The need to use existing and accepted MRC basin-wide assessment approach and methodology, and the management of and participation in the BioRA Team by different Programmes
- Methodology should support future uses for basin planning and management
- The need for high-level oversight in the form of Steering Committee

Prepared by:

**Cumulative Assessment Team in consultation with
Thematic Teams and Discipline Teams**

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Contents

- 1. Aim of this note**
- 2. Essential context and background information**
 - 2.1 Objectives and approach
 - 2.2 Lessons learnt
- 3. Scoping of the formulation of scenarios and baselines**
 - 3.1 Scoping of scenarios
 - 3.2 Scoping of baselines
 - 3.2 Overview of scenarios and baselines
- 4. Scoping of the assessment of the scenarios**
 - 4.1 Assessment methodology and tools
 - 4.2 Use of the assessment results
 - 4.3 Differences with the 2008-2010 MRC/BDP scenario assessment
- 5. Implementation arrangements**

1. Aim of this Note

This aim of this Concept Note is to: (i) scope the formulation and assessment of development scenarios under the Council Study and (ii) review implementation arrangements. The note will be discussed during the 4th RTWG Meeting on 10 March 2015.

The note is structured as follows:

- Section 2 provides the necessary context and background information.
- Section 3 provides the scoping of the formulation of the scenarios and associated baselines
- Section 4 provides the scoping of the assessment of formulated scenarios.
- Section 5 provides the implementation arrangements.

For the preparation of the note the following information has been reviewed:

- The Council Study Inception Report;
- The MRC/BDP Scenario Assessment in 2008-2011 and its 2014 review;
- Review of the IBFM process in 2004-2007;
- The minutes of the 3rd RTWG Meeting and the 21st Council Meeting; and
- The draft updated Basin Development Strategy and draft MRC Strategic Plan 2016-2020.

Earlier drafts of this Note were discussed with MRC Programmes (23 February and 2 March 2015).

2. Essential context and background information

2.1 Objectives and approach

The **main objectives** of the Council Study are:

- (1) **Further understand** the environment, social and economic consequences (positive and negative) of water resources development;
- (2) **Enhance the BDP process** to support the Member Countries (MCs) in the sustainable development of the basin; and
- (3) Promote **capacity building**.

In short, the study will further enable the MRC to advise the Member Countries on the impacts of water resources development on people, economies and the environment of the Mekong Basin. This study will reduce the uncertainty in estimating

these impacts, providing the MCs with more robust information to support decision-making.

Drivers of impact. It has been agreed that the Council Study would focus on the impacts caused by water resources development in the following thematic areas:

- Irrigation: water use, return flows, water quality, proposed diversions, etc.;
- Agriculture and land use: watershed management, deforestation, livestock and aquaculture, fisheries, etc.;
- Domestic and industrial water use: urban development, waste water disposal, water quality, sediment extraction, etc.;
- Flood protection structures and floodplain infrastructure: roads, levees and embankments;
- Hydropower development: potential of alternative energy options; and
- Navigation: infrastructure to aid navigation.

Study area. For the above thematic areas identified as causing impact, the entire Mekong Basin will be considered. It has been also agreed that the assessment of the positive and negative impacts of this development will put an emphasis on the following areas:

- A corridor on both side of the mainstream from Chinese border to Kratie (Cambodia);
- The Cambodia Floodplains including the Tonle Sap River and Great Lake;
- The Mekong Delta in Cambodia and Viet Nam; and
- The coastal areas directly influenced by the Mekong estuary.

The rationale for this is that the Council Study focusses on transboundary issues, including the regional distribution of benefits, costs, impacts and risks of basin development. Socio-economic benefits that arise, or could arise, outside the above areas will be evaluated where they are relevant for the regional distribution analysis.

Temporal scope. This has not been described so far. The objective of the Council Study refers to “advising on the impacts of water resources development”. This can be taken to mean that the temporal scope of the scenarios would cover past, ongoing and planned water resources development, and ensure:

- **Avoidance of duplication.** The IBFM process (2004-2007) assessed trade-offs between basin development and the related environmental and social impacts in determining what could constitute acceptable flows for the Lower Mekong River. In addition, the SEA of 2009-2010 assessed the planned LMB mainstream dams. The MRC/BDP scenario assessment of 2009-2011 assessed the impact of ongoing and planned development. Furthermore, the ongoing Mekong Delta Study focuses also on the planned mainstream dams. As intended, the Council Study should therefore build on MRC studies, and especially update and improve the MRC/BDP assessment results;
- **Reasonable and equitable use.** In line with the 1995 Mekong Agreement, decisions on new water resources development can be made with better

confidence with information on the distribution of the benefits, costs, impacts and risks across the basin countries and whether the distribution is reasonable, equitable and fair. This necessarily requires the assessment of past, ongoing and planned water resources development; and

- **Sustainable development.** Decisions on new water resources development can be made with better confidence with information on whether overall water resources development in the Mekong Basin is moving towards basin-wide “optimal” and sustainable development (as directed in the 1995 Mekong Agreement), and addressing long-term needs, including climate change adaptation and environmental protection. This requires the exploration of development opportunities to improve currently planned development.

Given the comprehensive context of the Council Study with its unique “platform” for discussion and decision making (the Ministerial Council), the Council Study should provide the full picture of water resources development as envisioned in the 1995 Mekong Agreement.

2.2 Lessons learnt

The following lessons learnt from the MRC/BDP scenario based planning are relevant to the Council Study.

The number of scenarios should be restricted to the minimum necessary to permit coverage of reasonably possible future developments in the Basin that reflect the breadth of alternative development issues which the Member Countries may have to address in the coming years. There is little point in defining a large number of scenarios, each slightly different from the others. Too many scenarios lead to “scenario fatigue” by providing more information to policy makers and their advisors than they can absorb.

A reasonably possible scenario is a “plausible” scenario, or at least “not implausible”; but scenarios that are low in probability but high in consequences could be of interest to the Mekong Basin. Such scenarios are considered in the ‘exploratory’ scenarios that examine where opportunities lie in future to address longer term needs and challenges, such as climate change.

There is a strong interplay in the Mekong Basin between flood, energy, agriculture, environment and climate change (and thus between the six agreed thematic sectors). A sector based approach, whilst useful in terms of understanding development drivers, will not provide a comprehensive picture by which to understand trade-offs between sectors and to support planning and decision-making. Therefore, only “integrated” scenarios should be assessed.

The assessment of future looking water resources development scenarios needs to take **exogenous development**¹ into account. Even without any further development of water resources in the Mekong Basin, the economic, social and environmental landscape will still change dramatically as a result of developments in the other

¹ Development outside the water sector, such as population growth, urbanization, industrialization, transport, trade, education, employment, etc.

sectors. Not accounting these changes is equivalent to incorrectly attributing all environmental, social and economic impacts to water resources development.

The impact of climate change could significantly increase or decrease impacts of the longer-term development scenarios.

3. Scoping of the formulation of scenarios and associated baselines

3.1 Scoping of scenarios

The information provided in Section 2 leads to the following direction for the formulation of the development scenarios to be assessed under the Council Study:

- The formulated development scenarios will be basin-wide and 'integrated' development scenarios, representing different combinations of development in the agreed six thematic areas;
- The formulated scenarios will cover past, ongoing, planned, exploratory and alternative water resources development in the above six thematic areas;
- The formulated scenarios need to be realistic and at least plausible; and
- The formulated scenarios that look at possible levels of development beyond 2020 need to be assessed with and without consideration of climate change (CC) impacts.
- The number of scenarios should be kept as small as possible.

Following this guidance the following development scenarios are proposed for assessment under the Council Study:

- **Early Development Scenario² (2007)**. This is 1 development scenario;
- **Definite Future Scenario (2020)**. This is 1 development scenario;
- **Planned Development Scenario (2040)**. This is 1 development scenario and 3 CC scenarios;
- **Exploratory Scenarios (2060)**. These are up to 5 development scenarios and 3 CC scenarios; and
- **Alternative Plan Scenarios (2040)**. These are up to 3 development scenarios and 3 CC scenarios.

Each formulated scenario has a basin-wide scope and is composed of development in the above six thematic areas. The Early Development Scenario includes the water resources development in the agreed thematic areas as of 2007. The MRC Fisheries

² Since this scenario covers a past situation, it could be renamed 'Early Development Situation'

Programme proposes to consider the fisheries sector as well during the formulation of the scenario.

The Definite Future Scenario includes all water resources development in the six thematic areas that is expected to be in place by 2020 because the development is currently under construction or firmly committed.

The Planned Development Scenario (2040) adds all planned water resource development in the six thematic areas to the development in the Definite Future Scenario. The year 2040 is chosen because some countries are planning water resources development in official documents that will be commissioned during 2030-2040. The Planned Development Scenario will be assessed without consideration of climate change impacts and with the modifying effect of 3 climate change scenarios.

The Exploratory Scenarios will build on the Planned Development Scenarios to test development opportunities in the six thematic areas to explore how longer term needs can be addressed (including adaptation to climate change) and the currently planned development further improved (amongst other through creating synergies between thematic areas). The MRC/BDP scenario assessment shows that the current national plans fall short in protecting key environmental assets and protecting millions of people against major floods. Also, the distribution of the benefits, impacts and risks from planned basin development may not be viewed as equitably distributed. The Exploratory Scenarios will be assessed without consideration of climate change impacts and with the modifying effect of 3 climate change scenarios.

For all the above scenarios, the regional distribution of the benefits, costs, impacts and risks of water resources development in the Mekong Basin will be assessed. Thus the assessment will provide this regional distribution at different points in time: 2007, 2020, 2040 and 2060. This information permits basin-wide discussions to identify acceptable pathways that could increase regional benefits, mitigate regional costs, and provide water-related security in an equitable manner through cooperation.

The results will be used to formulate a few Alternative Plan Scenarios that will represent possible adapted national water resources development plans that set the countries on the path of optimal and sustainable development whilst maximizing medium term gains. Up to three Alternative Plan Scenarios will be formulated to illustrate possibilities and provide a choice to decision makers, e.g. gradual/fast development, different options for flood management and hydropower development. The Planned Development Scenario will be assessed without consideration of climate change impacts and with the modifying effect of 3 climate change scenarios.

If the Alternative Plan Scenarios show larger regional benefits and smaller regional costs, the Member Countries have an incentive to modify their national water resources development plan to greater mutual benefit.

3.2 Scoping of the baselines

The baseline will be used as a “reference scenario” with which the hydrological, environmental, social and economic changes caused by a development scenario can be compared. The baseline comprises the hydrological and the water resources development components. In addition, there is the exogenous development situation

(brought about by developments outside the water sector) that needs to be taken into account.

Hydrological baseline. The required hydrological baseline is available. The extended 1985-2000 baseline to 2007³ can be used to assess the hydrological changes under each of the proposed scenarios. The 1985-2007 baseline still represents natural flow conditions in the Mekong mainstream. The assessment results for each scenario will provide the changes relative to the natural flow regime.

It is not advised to extend this baseline further: (i) before 1985, less meteorological data are available for calibrating and validating the baseline and (ii) after 2007, hydropower development in the upper Mekong Basin started to modify the natural flow regime.

Development baseline. In order to provide the full picture of the water resources development (Section 2.1), the development baseline represents a situation whereby there is no significant water resources development in the Mekong Basin. Thus, the Early development Scenario (2007) includes the water resources development in the six thematic areas that was in place by 2007. The Definite Future Scenario includes all water resources development in the six thematic areas that is expected to be in place by 2020. And so on.

Exogenous development situation. This represents the environmental, social and economic development situation brought about by developments outside the water sector. Against this situation the water resources development scenarios will be assessed. Ideally, the exogenous development situation is assessed for the same year as the water resources development situation within the development scenario.

For example, for the Planned Development Scenario (2040), which assesses the impacts of the water resources development in the six thematic areas that is planned to be in place by 2040, the exogenous development situation is the environmental, social and economic situation in the year 2040 that is predicted to be brought about by developments outside the water sector.

It is recommended to prepare the exogenous development situations only for the assessment indicators within the draft MRC Indicator Framework, which will also be used for the assessment of the scenarios themselves (see Section 4).

Summary. Table 1 below provides an overview of the various scenarios, baselines and situations that will be considered under the Council Study.

³ Includes the baseline data until the end of 2007.

Table 1. Considered scenarios, baseline and development situations

Development scenarios	Number of development scenarios	Number of CC scenarios	Hydrologic baseline (natural flow regime)	Water resources development within scenario (impacts of which will be assessed)	Exogenous development situation (due to developments outside the water sector)
Early Development Scenario	1	-	1985 - 2007	All up to 2007	2007
Definite Future Scenario	1	-	1985 - 2007	All up to 2020	2020
Planned Development Scenario, with/without CC	1	2 to 3	1985 - 2007	All up to 2040	2040
Exploratory scenarios, with/without CC	up to 5	2 to 3	1985 - 2007	All up to 2060	2060
Alternative Plan Scenarios ⁴ , with/without CC	2 to 3	2 to 3	1985 - 2007	All up to 2040	2040

3.3 Overview of scenarios and baselines

Early Development Scenario (2007)

Purpose of scenario. The main purpose of this scenario is to assess the distribution of the benefits, costs, impacts and risks of water resources development in the Mekong Basin as of 2007.

Early development may not have significantly changed the flow regime in the Mekong mainstream but it has led to significant environmental, social and economic changes, particularly in those parts of the countries where the water resources development started early. Information on such changes will allow the MCs to consider whether the benefits, impacts and risks of future water resources development are reasonable and equitable.

Scope. This scenario covers the period from the beginning of large-scale water resources development until the year 2007 when the flow regime of the Mekong mainstream was considered to be still in its natural state. This scenario includes the water infrastructure and the land use/cover changes in in the six thematic areas as of 2007.

⁴ Can be named also after the title of the Council Study: Sustainable development and management scenarios

Formulation. The formulation of this scenario is straightforward: development in the six thematic areas was virtually absent initially and well known in 2007, and available in MRC databases and national planning documents.

Hydrological baseline. The available hydrological 1985-2007 baseline, which still represents natural conditions, can be used. There is no need for modelling this scenario with the DSF since the flow in the flow regime in mainstream has not significantly changed. The assessment of the economic, environmental and social assessment indicators of the MRC Indicator Framework can be based on observed data.

Definite Future Scenario (2020)

Purpose of scenario. The main purpose of this scenario is to assess the distribution of the benefits, costs, impacts and risks of water resources development in the Mekong Basin as predicted in 2020.

Scope. This scenario includes all existing (before and after 2007), under-construction, and firmly committed development in the six thematic areas which are expected to be in place by 2020. The impacts (positive and negative) of this scenario are inevitable (although some negative impacts could be mitigated).

Formulation. The formulation of this scenario is straightforward: the existing, under-construction and firmly committed development in the six thematic areas is available in MRC databases and national planning documents. Nevertheless, a considerable amount of work may still be needed to formulate the scenario, depending on the status of some of the sector development databases in the six thematic areas.

Planned Development Scenario (2040)

Purpose of scenario. The main purpose of this scenario is to assess the distribution of the benefits, costs, impacts and risks of water resources development in the Mekong Basin as of 2040.

Scope. In addition to the development in the Definite Future Scenario, the Planned Development Scenario includes all water resources development that is planned in the six thematic areas in the Mekong Basin. On a timescale, the scenario covers the water resources development that would be in place by 2040 assuming these plans are fully implemented.

Formulation. Also the formulation of this scenario is straightforward. The planned water resources development in the six thematic areas is available in MRC databases and national planning documents. Still, a considerable amount of work may be needed to formulate the scenario, depending on the status of some of the sector development databases in the six thematic areas.

Exploratory Scenarios (2060) (with examples)

Purpose of scenarios. The main purpose of these scenarios is to explore where opportunities lie in the future to sustainably address longer term needs and provide a

comprehensive response to climate change and other challenges. The results will then be used to identify adaptation measures that are feasible under a range of future climatic conditions. These adaptation measures will be included in the Alternative Plan Scenarios.

Ongoing activities. The CCAI is already assessing the medium (2060) and long-term (2090) impact of a range of medium and extreme Climate Change Scenarios, which are based on global GHG emission scenarios and Global Circulation Models (GCM). The FMMP is assessing the impact of floodplain reduction of flood security and the environment.

Scope. The Exploratory Scenarios will build on the Planned Development Scenarios to test the development opportunities in the six thematic areas that could further increase regional benefits, mitigate regional costs, and strengthen water related security.

Formulation. The Exploratory Scenarios will include much of the Planned Development Scenario as well as plausible options for water resources development through to 2060.

Examples of plausible water resources development options that will be explored are:

- Increases of natural and human-made storage capacity to adapt to climate change and provide higher levels of flood protection;
- Potential measures to protect key environmental assets and functions;
- Potential responses to rising and/or changing food demand and household food security;
- Hydropower optimization in the context of regional energy demands, changing flows, and acceptable transboundary impacts;
- Options to improve the navigability of the Mekong mainstream, including the stretch between Kratie and Chiang Saen;
- Potential measures for floodplain management; and

Alternative Plan Scenarios (2040)

Purpose of scenarios. These scenarios represent possible adapted national plans. The scenarios will be based on the results of the assessment of the Planned Development Scenario and new ideas from the assessment of the Exploratory Scenarios. The assessment results can be compared with those of the Planned Development Scenario.

The Alternative Plan Scenarios would set the countries on the pathway of optimal and sustainable development. It is in line with one of the objectives of the Council Study to enhance the BDP process to support the MCs in the sustainable development of the Mekong basin.

Scope. These scenarios will include much of the Planned Development Scenario (but not necessarily all), as well as new development opportunities.

Formulation. Two to three Alternative Plan Scenarios will be formulated to illustrate possibilities and provide a choice. High negative impact and/or low benefit projects could be removed from the Planned Development Scenarios and low impact and/or high benefit projects added, including projects of basin-wide significance and joint projects and other cost and benefit sharing options. On a timescale, the scenario covers the period through to 2040.

4. Scoping of the assessment of the scenarios

4.1 Assessment methodology and tools

The proposed methodology and tools build on the experiences and results of comparable assessments under the IBFM process (2004-2007) and the 2009-2011 MRC/BDP scenario assessment. The quantification of the distribution of the benefits, costs, impacts and risks of the identified development scenarios requires a “triple bottom line assessment” that uses a wide range of relevant environmental, social and economic assessment indicators.

Hydrologic assessment. First the hydrological changes caused by each scenario will be assessed with MRC’s suite of simulation models, taking into account the developments and plans in the upper Mekong Basin. The predicted changes include a range of hydrological indicators related to water flows, floods, flow reversal in the Tonle Sap river, salinity intrusion, sediment transport, and water quality. These changes will “drive” changes in many (but not all) of the environmental, social and economic indicators.

Triple bottom line assessment. Based on the hydrological changes and physical impact caused by each scenario, the Discipline Team supported by the Thematic Teams (section 5) will conduct an integrated assessment of each scenario based on a set of agreed environmental, social and economic assessment indicators. For this purpose, MRC Programmes have been developing the MRC Indicator Framework (MRC IF) during the last few years. As indicated in the Council Study Inception Report, the indicators of the MRC IF provide a solid basis for assessment under the Council Study.

The MRC Indicator Framework. The MRC IF sets out a hierarchy of strategic and assessment indicators that are underpinned by a wide range of monitoring indicators, covering the five dimensions of sustainability (see Box). The MRC IF includes 71 assessment indicators (see Appendix 1). Together these indicators provide the information

Five dimensions of the new MRC Indicator framework	
□ Economic dimension	<i>Performance of water and related sectors and contribution to riparian economies</i>
□ Social dimension	<i>Conditions of livelihoods and employment</i>
□ Environment dimension	<i>Status of water flows, quality, sediments and environmental assets</i>
□ Climate change dimension	<i>Climate change trends, vulnerability and adaptation</i>
□ Cooperation dimension	<i>Benefits derived from the Mekong river basin and from cooperation in its development and management</i>

required to quantify the distribution of the benefits, costs, impacts and risks of each scenario at the appropriate level of detail. Quantification of the positive and negative (transboundary) impacts is an essential underpinning of the subsequent regional discussions and negotiations of acceptable levels of water security, risks, transboundary impacts, and benefit and cost sharing.

Expert judgement. About half of the assessment indicators within the MRC Indicator Framework can be quantified scientifically without “expert judgment” based on the values of the 250 monitoring parameters in the MRC IF. The monitoring parameters comprise mostly nationally monitored and assembled data. Many of these data have been collected in the MRC Information System. The other half of the assessment indicators requires significant expert judgment. The Council Study will further improve the MRC Indicator Framework, increase the portion of science-based indicators, and limit reliance on expert opinion.

It will be important to clearly describe the method and possible tools that will be used to quantify each of the assessment indicators so that stakeholders can scrutinise the underlying assumptions and reproduce the assessment results. Currently, such descriptions exist for about half of the assessment indicators in MRC IBFM and BDP documents. These need to be reviewed and where needed updated and expanded, with a view to putting a robust and as far as possible quantifiable list of science-based indicators in place for the Council Study.

DRIFT. DRIFT has been developed as a tool for assessing ecosystem response to water-resource developments. In 2004, an earlier version of DRIFT has been applied by the MRC (during IBFM) to assess the environmental flow requirements in the Mekong mainstream, with a view to determining the amount of water that is still available for development in the Mekong Basin.

DRIFT comprises a process and a DSS with “response curves” that depict the relationship between a biophysical indicator and driving variables, such as duration and minimum flow in the dry season, sediment supply, continuity barriers, etc. The DRIFT DSS will be used to develop science-based response curves to quantify environmental indicators in the MRC IF (which includes the biological resources).

Integrated assessment. Only integrated, multi-sector scenarios will need to be assessed against the indicators of the MRC Indicator Framework. The 2009-2010 MRC scenario assessment demonstrated strong inter-dependencies and interaction between the water related sectors, including between hydropower, irrigation, fisheries, flood, and environmental sectors.

Integrated assessment, rather than individual sector assessment, is in line with IWRM and nexus principles and the latest best international practice guidance from the UN Water Convention and others.

Data and information requirements. A four-country agreement on the scenarios, the baselines, the exogenous development situations, and the assessment indicators within the MRC Indicator Framework provides the opportunity to focus efforts to address knowledge gaps and collect data to the needs of the scenario formulation and assessment. For example, the discipline teams can align their work plans around building assessment processes related to the agreed assessment indicators and the

Thematic Teams can start formulating the thematic components of development scenarios.

4.2 Use of the assessment results

The assessment results will enable basin-wide discussions to identify acceptable pathways that could increase regional benefits, mitigate regional costs, and provide water-related security in an equitable manner through cooperation. This consensus building process requires IWRM capabilities across the basin and institutions, and time for consultation. It will also require close consideration of a range of complementary measures that may be needed to offset or mitigate the impacts of agreed development.

With many and diverse stakeholders, it will be important to present information and results in ways that suit the needs of the various stakeholder groups. This could lead to improved comprehension and more productive dialogue on basin development, based on facts and less on emotion. Some stakeholders would like to review all data and documentation to better understand the assumptions underlying the ultimate results, while decision makers may want to see only an executive summary with the results shown in self-explanatory maps, tables, graphs and charts.

It will be important to provide training to key stakeholders to maximize their engagement in the process. For example, early training in scenario formulation and assessment will be important for the many new members of the RTWG. Negotiation training of senior officials would be important at a later stage in advance of discussions of the new assessment results.

The results of the assessment and basin-wide discussions will feed into the MRC Knowledge Base and will be used for basin development and management planning, in particular the preparation of the five-year editions of the Basin Development Strategy and the formulation of basin-wide sector and cross-cutting strategies (hydropower, fisheries, flood, navigation, environment, climate change, etc.).

4.3 Differences with the 2008-2010 MRC/BDP scenario assessment

Scope 2008-2010 scenario assessment. MRC/BDP During 2008-2010, the BDP Programme has facilitated and supported a **cumulative impact assessment** of the basin countries' water resources development plans. Each scenario was formulated to represent different combinations of nationally planned sector development, with a focus on water supply, irrigation, hydropower, and flood protection.

The scope of the 2008-2010 scenario assessment embraces environmental, social and economic cumulative impacts ('triple bottom line') at a level that future directions for development can be determined jointly. Hydrological changes caused by each scenario were assessed with MRC's suite of simulation models, taking into account the developments and plans in the Upper Mekong Basin. Based on the hydrological changes and physical impact caused by each scenario, a multi-disciplinary expert group conducted an integrated assessment with an indicator framework that included 42 economic, environmental and social indicators.

Added value of Council Study scenario assessment. The proposed scope of the scenario formulation and assessment under the Council broadens and deepens the 2008-2010 scenario assessment through:

- The assessment of early water resources development which is important for the provision of a complete picture of the benefits, impacts and risks of water resources management in the Basin;
- The broadening of impact drivers to embrace all forms of water resource and related development that have potential transboundary impact in the MRC context;
- The updating of the Definite Future Scenario and the Planned Development Scenario;
- The assessment of Exploratory Scenarios that explore where opportunities lie in the future to sustainably address longer term needs and provide a comprehensive response to climate change and other challenges;
- The use of an updated MRC Indicator Framework that will be used for the 'triple bottom line' assessment of the formulated scenarios (and which will be further strengthened through the DRIFT DSS, and the more explicit assessment of regional cost and benefit sharing);
- The assessment of one or two Alternative Plan Scenarios (2040) that would set the countries on the pathway of optimal and sustainable development.
- The use of exogenous development situations, which is essential for a meaningful assessment of the longer term scenarios which assess impacts of water resources development that will be in place in 2040 and beyond.

5. Implementation arrangements

The scenario development process will be driven by the MCs and implemented by MRCS and their national counterparts with widespread and effective consultation with stakeholders. The whole process enhances governance around water resources management and builds bridges from engineering and science to stakeholders and decision makers.

The following suggests improvements to the implementation arrangements of the Council Study based on the comments and suggestions of the 3rd RTWG meeting (14 November 2014), the 21st Council Meeting, as well the issues brought up during recent consultations with MRC Programmes.

Steering Committee. Given the strategic importance and “ministerial platform” of the Council Study, the Council could appoint a small Steering Committee of senior government officials. The committee would ensure that the study is being implemented effectively, efficiently and on time in accordance with Council wishes.

The **Regional Technical Working Group (RTWG)** will periodically review and endorse the technical validity of the approaches, methodologies, tools, data and results. The RTWG includes members from line agencies, RBOs, institutes, academia, as well as experts from the MRC Programmes.

Study Management. Previous MRC studies of this scale demonstrated that it is of paramount importance that the assessments will be implemented in a coherent, integrated and consistent manner. This requires strong coordination and technical leadership to ensure the established thematic and discipline teams will work together as “one team” throughout the scenario formulation and assessment.

Thematic Teams. Six Thematic Teams have been established, as follows:

Thematic team	Lead
Land use, agriculture, irrigation, aquaculture	AIP
Domestic and industrial water use	EP
Flood protection and floodplain infrastructure	FMMP
Hydropower development	ISH
Navigation	NAP
Cumulative	BDP

The Thematic Teams (agriculture and land use change, irrigation, domestic and industrial water supply, flood protection/floodplain management, hydropower, and navigation) are responsible for the following activities and deliverables.

Main roles:

- Prepare the data and information needed (including addressing any data and knowledge gaps) for the formulation of the scoped development scenarios (Section 3.1 and 3.3) in each of the thematic areas (with BDP supporting);
- Formulate the thematic components (with BDP supporting) for each of the scoped scenarios, starting with the Early Development, Definite Future and Planned Development Scenarios. The formulation of the Exploratory Scenarios depends to some extent on the assessment results of the Planned Development Scenarios. And the formulation of the Alternative Plan Scenarios depends on the assessment results of the Exploratory Scenarios. These scenarios can be formulated later together with the Disciplinary Teams;
- Formulate the thematic components of the Exploratory and Alternative Plan Scenarios taking into account exogenous development, societal needs, and water security challenge (with BDP supporting);
- For those Thematic Teams that will engage an economist, provide inputs that feed into and participate in the socio-economic and macro-economic assessments of the Early Development, Definite Future, Planned Development, Exploratory and Alternative Plan Scenarios (in consultation with the Socio-economic and Macro-economic Discipline Team).
- Report on the intermediate and draft final results of the above main and supporting roles (with BDP supporting).

Supporting roles:

- Support the preparation of the data and information needed for the formulation of the exogenous development situations (Section 3.2 and 3.3);
- Support the assessment of the Early Development, Definite Future, Planned Development, Exploratory and Alternative Plan Scenarios; and

The Cumulative Team is responsible for the following activities and deliverables:

- Support the Thematic Teams in addressing data and knowledge gaps relevant to the formulation of the scoped development scenarios;
- Support the Thematic teams in the formulation of the thematic components of the scoped development scenarios, starting with the Early Development, Definite Future and Planned Development Scenarios (see above);
- Develop alternative assumptions and projections for exogenous development;
- Facilitate agreement with MCs on the indicator framework to be adopted in the Council Study;
- Support and review the assessment of the Early Development, Definite Future, Planned Development, Exploratory and Alternative Plan Scenarios; and
- Prepare an integrated assessment report, on the basin-wide distribution of benefits, costs, impacts and risks of the Early Development, Definite Future, and Planned Development, Exploratory and Alternative Plan Scenarios (“cumulative assessment report”).

Discipline Teams. Five discipline teams have been established, as follows:

Discipline team	Lead
Hydrological assessment	IKMP
Climate change	CCAI
Biological resources	FP*
Macro-economic assessment	BDP**
Socio-economic assessment	BDP**

**In coordination with EP (as the lead programme on environment)*

***BDP will lead the economic and social assessments with support from TCU and EP. This is in line with request from RTWG for an increased participation of BDP in these assessments, and BDP’s traditional lead role in economic and socio-economic areas in the PNPCA, Socio-economic database, and Socio-economic working group.*

The Hydrological Assessment Team is responsible for the following activities and deliverables:

- Support the formulation of the scoped development scenarios (Section 3.1 and 3.3) and prepare the hydrological baseline (1985-2007);
- Make a hydrological assessment of the Early Development, Definite Future, Planned Development, Exploratory and Alternative Plan Scenarios against

agreed hydrological indicators related to flows, flow reversal, floods, salinity intrusion, sediments and water quality;

- Support the environmental, social and economic assessment of the Early Development, Definite Future, Planned Development, Exploratory and Alternative Plan Scenarios; and
- Prepare the Hydrological Assessment Report.

The Climate Change Team is responsible for the following activities and deliverables:

- Formulate and assess a wide range of the climate change scenarios (ongoing), see Section 3.3;
- Support the formulation of the scoped development scenarios, in particular the Planned Development, Exploratory and Alternative Plan Scenarios, which will be assessed with and without consideration of climate change impacts;
- Support the preparation of the exogenous development situations;
- Select the climate change scenarios that will be used for the assessment of the Planned Development, the Exploratory Scenarios, and the Alternative Plan Scenarios;
- Develop adaptation measures for climate change in consultations with the Thematic Teams and Cumulative Team;
- Support the hydrological assessment and the environmental, social and economic assessment of the Planned Development, Exploratory and Alternative Plan Scenarios; and
- Prepare a report on the formulation and assessment of climate change scenarios; the likely impact of climate change on the environmental, social and economic assessment of the scoped scenarios; and the evaluation of regionally significant climate change adaptation measures.

The biological resources (environment) and the socio-economic/macro-economic assessment teams are responsible for the following activities and deliverables:

- Review the MRC Indicator Framework and plan for its use in the Council Study, including the necessary improvements, such as the development of science-based response curves for the indicators adopted for the Council Study (see Section 4.1);
- Address knowledge gaps and prepare the data and information needed for the preparation of the exogenous development situation in 2020, 2040 and 2060 (see Section 3.2 and 3.3), based on the MRC Indicator Framework;
- Prepare the exogenous development situation in 2020, 2040 and 2060;
- Address knowledge gaps and prepare the data and information needed for the quantification of the environmental, economic and social assessment indicators in the adopted for the Council Study MRC Indicator Framework;
- Support the formulation and hydrological assessment of the Early Development, Definite Future, and Planned Development, Exploratory and Alternative Plan Scenarios;

- Assess the environmental, social and economic impacts of the Early Development, Definite Future, and Planned Development, Exploratory and Alternative Plan Scenarios, using the MRC Indicator Framework; and
- Prepare technical reports on the methodologies used for the assessment of each of the assessment indicators (environmental, social, economic) and the formulation of the development baseline and exogenous development situations against which impacts are assessed; present the technical assessment results; and
- Improve the MRC Knowledge Base with all new data properly and centrally documented, quality assured and stored for future use.

Broader stakeholders. It will be essential to provide evidence, raise awareness and promote shared understanding among broader stakeholders related to benefits, costs, impacts and risks of current and possible future levels of basin development. This would require periodic meetings tailored to specific stakeholder groups, such as the private sector, NGOs, research organisations, the media etc., as well as an occasional regional stakeholder forum that brings all these groups together.

Trust building. The above proposed scenario formulation and assessment process can be used to build further trust and confidence among the MCs and strengthen maintain the Mekong spirit. This will set the stage for a common point of departure to discuss the assessment results, draw initial conclusions together on likely transboundary impacts, make initial decisions on trade-offs, and consider various options for improving water related security, including joint projects. This will set the stage for developing a shared understanding of the path to meeting the longer term needs and move towards more optimal and sustainable development.

MRC Indicator Framework for managing the Mekong Basin

Dimension / strategic indicators	Assessment indicators
Social dimension	
Living conditions and well being	<ul style="list-style-type: none"> ▫ Demographic features ▫ Level of resilience at household level ▫ Level of resilience at community level
Employment in MRC sectors	<ul style="list-style-type: none"> ▫ Proportion of population engaged in MRC sector activities ▫ Proportion of people engaged in MRC sectors vulnerable to change
Overall social condition	<ul style="list-style-type: none"> ▫ Weighted score of all social indicators
Environmental dimension	
Water flow conditions in mainstream	<ul style="list-style-type: none"> ▫ Dry season flows - Compliance with the PMFM ▫ Flood season peak flows - Compliance with the PMFM ▫ Tonle Sap reverse flows - Compliance with the PMFM ▫ Timing of onset of wet season flows ▫ Annual flooding
Water quality and sediment conditions in mainstream	<ul style="list-style-type: none"> ▫ Mainstream water quality - Compliance with the PWQ ▫ Sediment transport in the mainstream ▫ Salinity intrusion in the delta
Status of environmental assets	<ul style="list-style-type: none"> ▫ Wetland area ▫ River channel condition and habitats ▫ River bank erosion risk ▫ Aquatic biodiversity ▫ Ecologically significant areas (environmental hot spots)
Overall environment condition	<ul style="list-style-type: none"> ▫ Weighted score of all environmental strategic indicators
Economic dimension	
Economic performance of MRC sectors	<ul style="list-style-type: none"> ▫ Net economic value of irrigated agriculture: ▫ Net economic value of recession rice agriculture ▫ Net economic value of lowland rainfed rice agriculture ▫ Net economic value of savings in the cost of domestic power supply ▫ Net economic value of hydropower export ▫ Net economic value of mainstream navigation ▫ Net economic value of flood damage ▫ Net economic value of capture fisheries ▫ Net economic value of reservoir fisheries ▫ Net economic value of aquaculture ▫ Net economic value of river bank gardens ▫ Net economic value of upland forestry ▫ Net economic value of upland agriculture production ▫ Net economic value of tourism and recreation ▫ Net economic value of flooded forest ▫ Net economic value of losses in areas affected by salinity intrusion ▫ Net economic value of river bank erosion ▫ Net economic value of wetlands and key habitat and conservation areas
Contribution to basin economy	<ul style="list-style-type: none"> ▫ Proportion of MRC sectors contribution to overall GDP ▫ Food security: Percent of basin food grain demand met from basin resources ▫ Food security: Percent of basin protein demand met from basin resources ▫ Energy security: Percent basin demand met from HEP (in-country and imported from within basin) ▫ Economic value of investment in MRC sectors
Total econ. benefits	<ul style="list-style-type: none"> ▫ Aggregate net economic value from above
Climate change dimension	
Greenhouse gas	<ul style="list-style-type: none"> ▫ Greenhouse gas emissions (all MRC sectors)
Climate change trend and extreme	<ul style="list-style-type: none"> ▫ Annual Greenhouse Gas Index ▫ Occurrence of extremes ▫ Changes in temperatures ▫ Changes in rainfall patterns

Dimension / strategic indicators	Assessment indicators
Adaptation to climate change	<p><i>Policy and institutional response:</i></p> <ul style="list-style-type: none"> ▫ Level of mainstreaming climate change adaptation into policies and strategies ▫ Budget for climate change adaptation <p><i>Adaptation response:</i></p> <ul style="list-style-type: none"> ▫ Total flood protected area ▫ Total irrigation area ▫ Total water storage ▫ Coverage of disaster warning system ▫ Number of people vulnerable to climate change
Cooperation dimension	
Equity of benefits from the Mekong River system	<ul style="list-style-type: none"> ▫ Overall social condition ▫ Overall environmental condition ▫ Total economic benefits
Benefits derived from cooperation	<ul style="list-style-type: none"> ▫ Levels of engagement: Number and value of projects of basin-wide significance in own country ▫ Economic value of national benefits gained from projects of basin-wide significance in other countries ▫ Levels of engagement: Number and value of joint projects ▫ Economic value of national benefits gained from joint projects
Self-finance of the MRC	<ul style="list-style-type: none"> ▫ Proportion of MRC budget (Core + Programme) funded by national contributions during current period ▫ Ratio of Associated Project Budget to MRC budget during current period
Level of information sharing and participation	<ul style="list-style-type: none"> ▫ Approved MRC Communication Policy for the current period ▫ Approved MRC Stakeholder Participation Strategy for the current period ▫ Approved State of Basin Report for the current period ▫ Regional workshops held ▫ National workshops held ▫ Applications for data granted through MRC data portal