



# BASELINE ASSESSMENT REPORT

## INTRODUCTION

Strategic Environmental Assessment of the  
Hydropower Sector in Myanmar

IN PARTNERSHIP WITH:



*Creating Markets, Creating Opportunities*

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## ABBREVIATIONS

|        |  |
|--------|--|
| AG     | Advisory Group   |
| AIRBM  | Ayeyarwady Integrated River Basin Management                             |
| CDC    | City Development Committee   |
| CDD    | City Development Committee   |
| CDZ    | Central Dry Zone   |
| CSO    | Civil Society Organization   |
| DHPI   | Department of Hydropower Implementation                                  |
| DHPP   | Department of Hydropower Planning  |
| DMH    | Department of Meteorology and Hydrology                                  |
| DWIR   | Directorate of Water Resources and Improvement of River Systems          |
| E&S    | Environmental and Social   |
| ECC    | Environmental Compliance Certificate                                     |
| ECD    | Environmental Conservation Department                                    |
| EGs    | Expert Technical Groups  |
| EIA    | Environmental Impact Assessment  |
| EMP    | Environmental Management Plan  |
| EPC    | Electric Power Corporation   |
| ESB    | Electricity Supply Board   |
| ESIA   | Environmental and Social Impact Assessment                               |
| FESR   | Framework for Economic and Social Reform                                 |
| GAD    | General Administration Department  |
| GIS    | Geographical Information System  |
| GMS    | Greater Mekong Sub-region  |
| GOM    | Government of Myanmar  |
| HPP    | Hydropower Plant   |
| IEE    | Initial Environmental Examination  |
| IFC    | International Finance Corporation  |
| IWRM   | Integrated Water Resources Management                                    |
| IWT    | Inland Water Transport   |
| JICA   | Japan International Cooperation Agency                                   |
| KBA    | Key Biodiversity Area  |
| MEI    | Myanmar Environment Institute  |
| MEPE   | Myanmar Electric Power Enterprise  |
| MOALI  | Ministry of Agriculture, Livestock and Irrigation                        |
| MOC    | Ministry of Construction   |
| MoE    | Ministry of Energy   |
| MOECF  | Ministry of Environmental Conservation and Forestry                      |
| MOEE   | Ministry of Electricity and Energy                                       |
| MOEP   | Ministry of Electric Power   |
| MOF    | Ministry of Forestry   |
| MOFA   | Ministry of Foreign Affairs  |
| MOI    | Ministry of Industry   |
| MONREC | Ministry of Natural Resources and Environmental Conservation             |
| MOTC   | Ministry of Transport and Communication                                  |
| MW     | Megawatts  |
| NCDP   | National Comprehensive Development Plan                                  |
| NCEA   | National Commission for Environmental Affairs                            |
| NECCCC | National Environmental Conservation and Climate Change Central Committee |
| NEMC   | National Energy Management Committee                                     |
| NEMP   | National Electricity Master Plan   |

|      |  |
|------|--|
| NEP  | National Electrification Plan          |
| NGO  | Non-government Organization            |
| NLD  | National League for Democracy          |
| NWP  | National Water Resources Policy        |
| NWRC | National Water Resource Committee      |
| PA   | Protected Area                         |
| PDR  | People's Democratic Republic           |
| PFE  | Permanent Forest Estate                |
| PRC  | People's Republic of China             |
| RBO  | River Basin Organization               |
| SEA  | Strategic Environmental Assessment     |
| SEI  | Stockholm Environment Institute        |
| SEP  | Stakeholder Engagement Plan            |
| SOBA | State of the Basin Assessment          |
| TOR  | Terms of Reference                     |
| UN   | United Nations                         |
| USDP | Union Solidarity and Development Party |
| WRUD | Water Resources Utilization Department |
| WWF  | World Wildlife Fund                    |

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# TERMINOLOGY

**River Basin:** area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta.

**Sub-basin:** is an area of land where a basin forms within a larger river basin

**Watershed:** used to describe a smaller area of land that drains to a smaller stream, river, lake or wetland. Often watersheds are subdivided into five different basic units based on the size of the watershed: catchment, sub-watershed, watershed, sub-basin and basin (from small to large).

## 1 BACKGROUND

Myanmar, the largest country in Southeast Asia, has the least developed economy in the region (UNDP 2013)<sup>1</sup> despite having some abundant natural resources and a relatively low population density. The current level of development is illustrated by Myanmar's substantial shortfall in energy supply, with only 33% of households connected to grid electricity supply.

Recognising that access to electricity is an important pillar in raising livelihoods (particularly in rural areas where 70% of Myanmar's poor live) and achieving broad economic development, the Government of Myanmar (GoM) aims to rapidly increase power generation and electrification across the country over the next 10-20 years to provide affordable and reliable energy. Key sector targets include increasing national generation capacity by 500-1,000 MW per year over the next 10 years to reach 16,665 MW of installed capacity, and increasing the electrification rate to 75% by 2021/2022, then to 100% by 2030, and increasing energy exports to increase foreign exchange earnings.

To meet these targets the government is considering a mix of power generation options, including gas, hydropower and other renewable energy alternatives. Given that the country is rich in hydropower resources, being home to major river basins and high annual rainfall in most areas, hydropower looms as an important contributor to the provision of affordable electricity. Almost the entire Ayeyarwady River Basin (91%, covering ~372,907km<sup>2</sup>) lies within Myanmar, as well as close to half of the Thanlwin basin (42%, covering ~127,745km<sup>2</sup>) and a small area of the Mekong basin (2.7%, covering ~ 22,070 km<sup>2</sup>). In addition, the Sittaung River Basin and the Rakhine and Tanintharyi coastal basins are other notable resources.

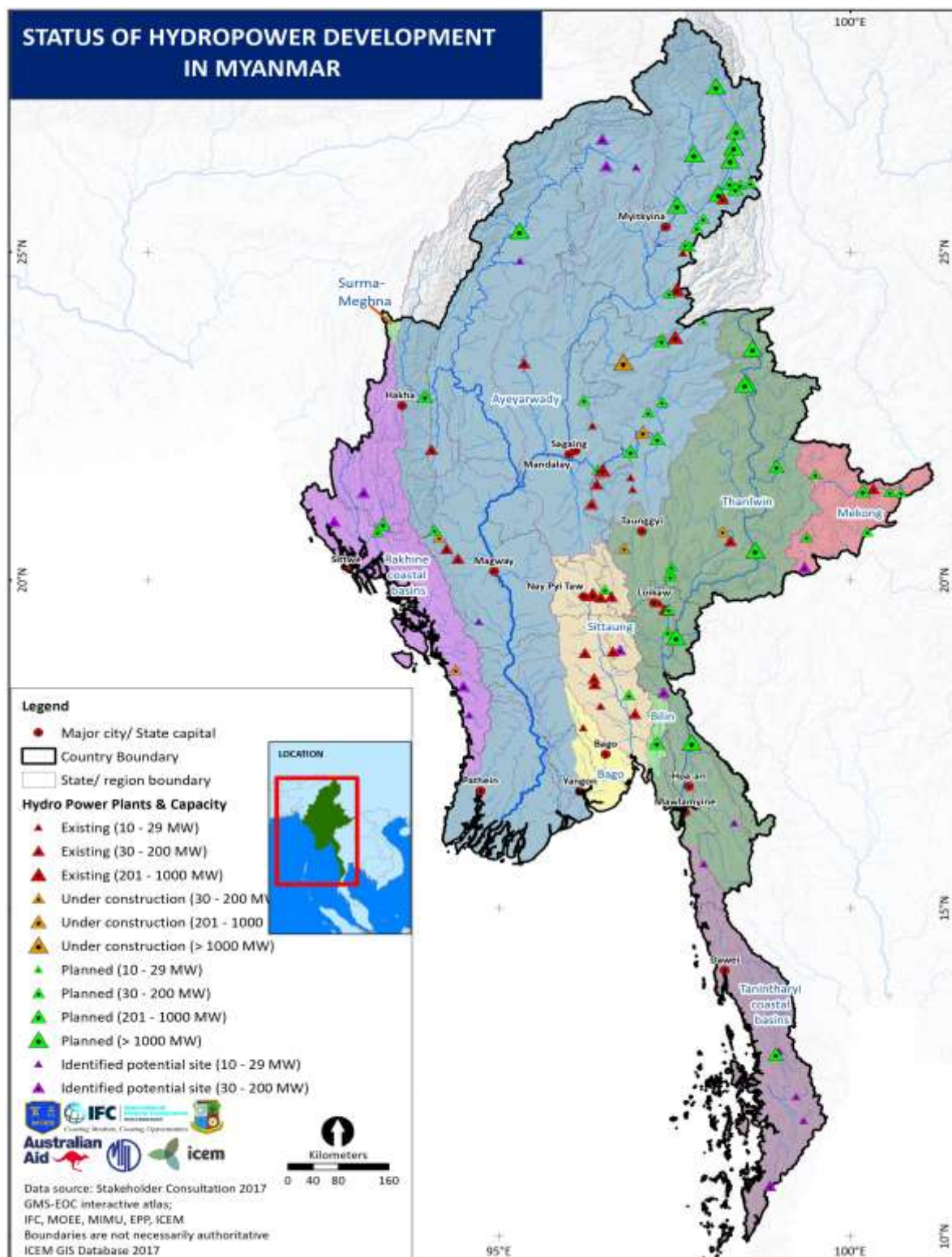
But these substantial aquatic resources provide a range of essential ecosystem services that will be lost or degraded by inappropriate large-scale hydropower development, including maintaining river ecological and geomorphic processes, and providing important livelihood resources, therefore hydropower development must be sustainable.

Hydropower development is at an early stage in Myanmar, with 29 hydropower projects (HPPs) greater than 10 MW capacity in operation, totalling 3,298 MW installed capacity, while an additional six HPPs are under construction with an installed capacity of 1,564 MW, the largest being the 1,050 MW Shweli 3 hydropower plant in the Ayeyarwady Basin (Figure 1.1). In contrast, GoM has received proposals for the development of a further 51 hydropower projects totalling 42,968 MW. There are also an additional 18 sites have been identified for potential hydropower development by state/regional governments totalling 994 MW. The sector is moving towards larger projects and away from Government-dominated development towards being driven by private enterprise.

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<sup>1</sup> UNDP. (2013). Accelerating Energy Access for All in Myanmar. United Nations Development Programme, Yangon, Myanmar

### Figure 1.1: Status of hydropower development in Myanmar



Limited river basin changes have resulted from hydropower development to date across the country due to limited installed capacity across a large area in four river basins, with minimal hydrological, geomorphic, ecological and socio-economic impacts from medium to large scale hydropower development, but this will change if business-as-usual (BAU) development occurs. The addition of up to 48,000 MW of medium to large scale HPPs under BAU development over the next 30 years will entail most major rivers being developed, resulting in river fragmentation, substantial changes to river

processes and functions, and the loss of unique environmental and social values. These adverse impacts have been recognised, with vocal opposition to some major planned projects leading the government to suspend three major HPPs<sup>2</sup> on environmental and social grounds.

No national or basin level policies or plans exist to guide sustainable hydropower based on integrated water, land, ecosystem and socio-economic objectives. In the absence of these plans the sector is being planned in the traditional manner - on an opportunistic, individual project basis focused on project economic return and engineering feasibility. This project-centric planning model locks in the project site at the pre-feasibility stage with limited consideration of site impacts and little to no consideration of the cumulative impacts of multiple projects on sub-basins. This results in most larger rivers being modified by hydropower projects, with limited reservation of large rivers in a natural state to maintain riverine processes and unique and representative values.

It is imperative that project siting is done well as good site selection avoids major impacts on river flows, geomorphology, aquatic ecology and livelihoods, particularly relating to river connectivity and cumulative impacts, that last for the life of the project, which is normally over 100 years.

In response to the increasing challenges of hydropower planning in Myanmar, and recognising the opportunity to develop a sustainable hydropower sector, GoM, through a partnership between the Ministry of Electricity and Energy (MOEE) and Ministry of Natural Resources and Environmental Conservation (MONREC), with support from the International Finance Corporation (IFC) and the Australian Government, conducted this Strategic Environmental Assessment (SEA) of the national hydropower sector as the first stage in basin-wide planning.

Myanmar is in a unique position of being able to develop hydropower in an integrated and sustainable manner before significant impacts occur to river systems, balancing the generation of substantial renewable energy to drive the economy and improve livelihoods with the retention of important bio-physical processes and values and socio-economic benefits for current and future generations.

## **1.1 Structure of the SEA reports**

The SEA consists of the following outputs:

### **Scoping and baseline assessment:**

1. Stakeholder Engagement Plan (SEP)
2. Regional River Basin Report- Key Findings;
3. Baseline Assessment Report;

### **Sustainability analysis:**

4. Volume I- Evaluation of sub-basins- for 58 sub-basins in Myanmar
5. Volume II- Project sustainability analysis- for all planned
6. Sustainability Analysis Report
7. Hydropower project GIS database

### **Mitigations and recommendations:**

8. Final SEA Report

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<sup>2</sup> The Myitsone HPP (6,000 MW) on the Ayeyarwady River, Tamanthi HPP (1,200 MW) on the Chindwin River and the Wei Gyi HPP (4,540 MW) on the Thanlwin River have been suspended by GoM after environmental groups and civil society called on the government to halt hydropower projects on the mainstems of these major rivers, citing potential negative environmental and social impacts. A Presidential Order was issued on 12 August 2016 to form a commission to review the Myitsone HPP and other projects planned in the upper Ayeyarwady River.

## 2 PURPOSE, VISION AND SCOPE OF THE SEA

### 2.1 SEA Purpose

The primary purpose of the SEA is to provide the first edition of the sustainable development planning framework for hydropower in each major river basin in Myanmar, to improve project siting from the outset by considering site and cumulative environmental and socio-economic impacts at sub-basin and basin levels. This foundation planning tool seeks to achieve a balance between energy development and the protection and maintenance of important processes and values in each basin.

Adherence to the framework aims to deliver large scale affordable electricity at a low E&S ‘cost’ by:

- maintaining significant river processes and functions, ecosystem services and biodiversity;
- maintaining unique and representative values; and
- avoiding major livelihood impacts and understanding conflict risks.

The SEA does not seek to provide a definitive, one-off plan for hydropower development over the next 30 years because (i) the baseline information available to inform planning at this time is limited in a number of key areas, and (ii) complex trade-offs will need to be made between protection of the environment and hydropower development. Instead it provides the initial (‘first edition’) planning framework and a clear roadmap of actions to implement and progressively improve future hydropower and related river basin planning. In doing so, integrated basin-wide planning is immediately brought into the front end of HPP siting and decision making to develop a more sustainable sector. This is essential for contending with the number and scale of proposed projects rather than letting BAU development continue, whilst providing stakeholders with some essential base-level planning information.

The framework is supported by:

- a clear roadmap of policies, plans, and studies required to implement and periodically revise the framework, including the collection of key information to fill data gaps;
- a national GIS database of existing and proposed hydropower projects over 10 MW capacity;
- a baseline description and GIS layers of the main environmental, social and conflict features in each sub-basin that have the potential to be impacted on by hydropower projects (based on best available information);
- a rating of each proposed project based on major likely environmental and social impacts; and
- a summary description of BAU hydropower development impacts on sub-basins and basins, providing direction for the sustainable development framework.

### 2.2 SEA Vision and Objectives

The SEA vision for hydropower development in Myanmar is:

*Sustainable hydropower development based on integrated water, land and ecosystem planning, balancing a range of natural resource uses and priorities to achieve economic development, environmental sustainability and social equity.*

This translates to maintaining healthy river basins, where important natural basin processes are maintained (seasonal river flows, basin geomorphological processes, aquatic ecosystems and major river connectivity), and unique and representative values are retained, with the level and type of hydropower development kept within the sustainable limit or ‘carrying capacity’ of each basin, whilst delivering economic benefits from the supply of affordable and reliable energy.

This vision is supported by the SEA objectives of:

- i) enhancing the understanding of and dialogue between decision makers and other stakeholders about the range of natural and socio-economic values and stakeholder priorities that need to be considered in formulating the sustainable hydropower development pathway;
- ii) defining a sustainable development pathway (framework) for hydropower in Myanmar over the next 30 years that:



- accounts for (i) scientific and (ii) stakeholder values;
- achieves the dual aims of (i) sustainable use and protection of natural resources and ecosystems, and (ii) long-term economic development;
- iii) providing a set of key actions (policies, plans and studies) required to implement and periodically update the sustainable development pathway; and
- iv) achieving broad consensus on the sustainable development pathway.

The SEA is founded on the understanding that hydropower generation and environmental and social protection can co-exist when planned in an integrated and balanced manner.

## 2.3 Scope of the SEA

The SEA is a macro level assessment, providing upper level planning guidance. As such it is focused on priority environmental and socio-economic values and issues. These issues relate to significant long term and broad scale impacts that need to be considered and avoided or minimised where possible when initially siting projects.

The SEA covers the whole of Myanmar, divided eight major river and coastal basins that are each addressed separately (Ayeyarwady, Thanlwin, Mekong, Sittaung, Bago & Myit Mo Hka, Bilin basins and the Tanintharyi and Rakhine coastal basins. Each basin has been divided into sub-basins to enable an adequate level of analysis and provide appropriate planning and management units.

The SEA considers projects with 10 MW installed capacity and above, thereby capturing all medium and large projects. A 10 MW<sup>3</sup> project was selected as the cut-off as the minimum size, with projects equal to and above this capacity usually creating notable impacts, being located on larger rivers, having larger dams and reservoirs, and creating greater flow diversion. While some projects with less than 10 MW capacity may have a greater environmental and social impact than larger projects, small sized projects were excluded from SEA analysis to keep the focus on significant basin impacts. In addition, large scale irrigation projects were also analysed.

The temporal boundary applied to the SEA is the expected 30 year rapid development phase of the hydropower sector, when it is assumed that up to 48,000 MW of capacity may be installed. Whilst the SEA focuses on improving planning over this development horizon it recognises that the impacts of medium to large scale hydropower projects occur the lifetime of these major capital infrastructure developments, which will generally be in excess of 100 years.

## 2.4 Significant issues and themes

The SEA focuses on significant environmental and socio-economic issues directly related to major hydropower impacts as these issues are critical in the avoidance of major impacts when siting projects. The major environmental and social impacts of medium to large scale hydropower are summarised in Table 2.1.

**Table 2.1: Major potential environmental and social impacts of hydropower**

| Factor               | Potential Impact                        | Cause  |
|----------------------|---|--|
| <b>Environmental</b> | River hydrology changes                 | <ul style="list-style-type: none"> <li>• Daily flow changes from peaking power releases</li> <li>• Seasonal flow changes from storage project releases</li> <li>• Downstream river dewatering between the dam and powerhouse</li> </ul>  |
|                      | River geomorphology changes/degradation | <ul style="list-style-type: none"> <li>• Reduction in downstream sediment load due to reservoir trapping</li> <li>• Increased downstream river bank and bed erosion due to reduced sediment load and ‘sediment hungry water’</li> <li>• Occasional release of large volumes of sediment when periodically flushing the desanding basin/pond/reservoir</li> </ul> |

<sup>3</sup> The upper limit of the United Nations Industrial Development Organisation (UNIDO) definition of small hydro.

| Factor                   | Potential Impact  | Cause   |
|--------------------------|---|---|
|                          | Water quality changes/deterioration   | <ul style="list-style-type: none"> <li>Reduced water quality from the seasonal detention of water in storage project reservoirs (e.g. changes in temperature, dissolved oxygen content and nutrient levels)</li> <li>Periodic release of sediment from a desanding basin/pond/reservoir</li> </ul>  |
|                          | Aquatic ecosystem/biodiversity degradation/loss   | <ul style="list-style-type: none"> <li>Aquatic ecosystem degradation/loss of aquatic biodiversity from river flow changes, alteration of water quality, and creation of impassable obstacles for fish migration</li> </ul>  |
|                          | Terrestrial ecosystem/biodiversity degradation/loss   | <ul style="list-style-type: none"> <li>Direct loss of terrestrial biodiversity on the project site, primarily from the reservoir area</li> <li>Loss of terrestrial habitat connectivity due to the reservoir</li> <li>Indirect loss from induced resource harvesting due to improved access into the area</li> </ul>  |
| <b>Socio-economic</b>    | Land acquisition and resettlement, loss of private agricultural/forestry land                             | <ul style="list-style-type: none"> <li>Acquisition of private land and assets</li> <li>Physical displacement/resettlement of households</li> <li>Conversion of existing productive land uses (e.g. agriculture, forestry) to hydropower facilities</li> </ul>   |
|                          | Loss of or reduction in communal natural resources supporting livelihoods or cultural/religious practices | <ul style="list-style-type: none"> <li>Removal of forests, grassland, fishing, aquaculture, water supply for irrigation and domestic consumption, etc.</li> <li>Disruption of the natural river flow regime used for religious, cultural or recreational purposes</li> </ul>  |
|                          | Loss of important natural/cultural heritage/religious sites   | <ul style="list-style-type: none"> <li>Inundation or removal of unique sites</li> </ul>   |
|                          | Access/transport restrictions   | <ul style="list-style-type: none"> <li>Curtailing river transport and cross-river access</li> </ul>   |
|                          | Community safety  | <ul style="list-style-type: none"> <li>Safety risks associated with: <ul style="list-style-type: none"> <li>- the sudden release of a large volume flow (generation flow and/or spill flow)</li> <li>- structural failure/dam break resulting in the sudden release of a large volume of stored water (although a highly unlikely event)</li> </ul> </li> </ul> |
|                          | Impacts on indigenous peoples   | <ul style="list-style-type: none"> <li>Potential differential impacts on indigenous peoples livelihoods and physical displacement</li> </ul>  |
| <b>Cumulative impact</b> | Cumulative sub-basin and basin impacts  | <ul style="list-style-type: none"> <li>The combined impact of multiple water resource developments along a river or in a sub-basin</li> </ul>   |

In addition, conflict was recognised as an important feature in Myanmar that had to be recognised as both a major development constraint and potential impact-related issue when planning sustainable hydropower development. Seven strategic themes emerged from these impact issues in consultation with MOEE, MONREC and a broad range of stakeholders, forming the structure of the baseline assessment:

1. Hydropower and hydrology;
2. Geomorphology and sediment transport;
3. Aquatic ecology and fisheries;
4. Terrestrial biodiversity;
5. Economic development and land use;
6. Social and livelihoods; and
7. Conflict.

The Draft Baseline Assessment Report was released as separate chapters for public for review and comment from 8th June to 20th July 2017. The SEA presents a baseline picture for each theme in Chapters 2-8, described for each basin.

## 2.5 SEA Relationship with other levels of hydropower planning

The SEA is the first level in a three-tiered integrated planning regime proposed for medium to large scale hydropower. The SEA will be successively supported by two more detailed and location-specific planning tools:

- Cumulative Impact Assessment (CIA); and
- Environmental and Social Impact Assessment (ESIA) or Initial Environmental Examination (IEE).

A CIA is recommended to be conducted in sub-basins and watersheds where multiple major water resource development projects (hydropower and/or irrigation) are proposed that are likely to have a combined effect on significant environmental and socio-economic values. The CIA provides the baseline context of the combined impact zone, requiring baseline data to be collected on key features where existing information is deficient, and assesses the cumulative impacts of these projects on bio-physical and socio-economic conditions. The CIA is designed to provide a good indication on the level of development / changes to baseline conditions that is sustainable, relating to the number, type and scale of HPPs.

The final and most detailed level of impact assessment is the project-specific ESIA or IEE. In accordance with the Myanmar EIA Procedures (2015), all development projects have to undergo an impact assessment, either in the form of a full EIA or a simpler IEE. Hydropower projects that have an installed capacity equal to or greater than 15 MW, or a reservoir volume equal to or greater than 20 million m<sup>3</sup>, or a reservoir area equal to or greater than 400 ha, are required to prepare an EIA. For other HPPs from 1 MW to less than 15 MW capacity, with a reservoir volume below 20 million m<sup>3</sup> and a reservoir area below 400 ha, an IEE is required.

## 2.6 Information limitations

The SEA has been prepared with limited data in a number of key areas, including river hydrology and geomorphology, riverine ecosystems and aquatic species, and socio-economic conditions and livelihoods. In the absence of detailed information indicative or proxy information has been used to assess these features, or where the best available information was deemed inadequate or not sufficiently uniform the feature was not evaluated.

The sustainable development framework for hydropower development will be periodically revised as key information becomes available. In the short to medium term more detailed information and data will be obtained through a combination of studies that are underway or about to commence, studies that have been identified in the SEA as being required to effectively implement and periodically update the SEA, the monitoring of operational hydropower projects, and feasibility studies and assessments undertaken by hydropower developers.

Key studies that are underway that will help to inform the first revision of the sustainable development framework include the Ayeyarwady Integrated River Basin Management Project (AIRBM) being undertaken by the National Water Resources Committee with support from the World Bank, and a number of research projects supported by the Water, Land and Ecosystems (WLE) Initiative of the Consultative Group for International Agricultural Research (CGIAR).



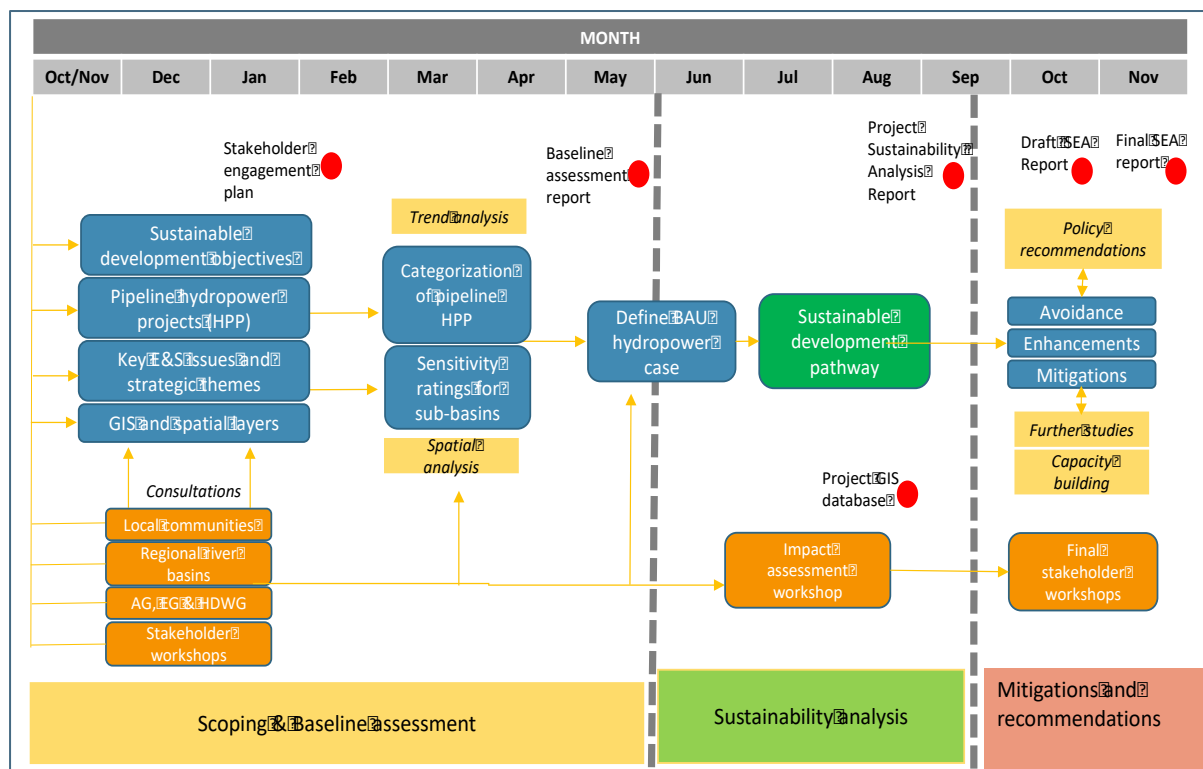
### 3 METHODOLOGY

The SEA methodology was designed as an open process, canvassing the broad views of stakeholders and specialists, obtaining the best available objective information on hydropower projects, natural resources and socio-economic conditions from a range of sources, building consensus on the need for and direction of sustainable hydropower development, and providing a well reasoned sustainable development framework. The main steps, illustrated in (Figure 3.1), were:

- Issue scoping;
- Hydropower project GIS database preparation;
- Environmental and socio-economic baseline evaluation;
- BAU sub-basin and project sustainability analysis;
- Sustainable development framework setting; and
- Recommendations on policies, procedures, plans and studies to implement the framework.

Each step will be underpinned by broad consultation with a full range of stakeholders.

Figure 3.1: SEA implementation methodology and timing



#### 3.1 Issue scoping

Issue scoping involved a series of stakeholder engagement activities with government, civil society organisations (CSOs) and hydropower companies, including; multi-stakeholder workshops, regional river basin consultations, information sessions, direct discussions, and Advisory Group (AG) and technical Expert Group (EG) meetings. These consultations canvassed the views of experts to identify important environmental and socio-economic issues for the development and management of the river basins, as detailed in Section 1.5 of this report.

- Key issues and concerns were identified that stakeholders consider strategically important for river basin development, protection and management in Myanmar. The issues were then consolidated into seven strategic environmental and socio-economic themes for analysis.

### 3.2 Hydropower Project (HPP) GIS Database

A national GIS database of existing and proposed hydropower projects over 10 MW capacity was developed to take stock of the status of hydropower development in each basin and sub-basin. The database provides the location of each project and a summary of key project information, including

- **Ownership and development status:** foreign or local investment, stage of development, date EIA or feasibility was submitted, and year the project will be commissioned;
- **Key technical data:** installed capacity (MW), type of project (e.g. run-of-river, storage, multi-purpose), annual generation (GWh/year), dam height, reservoir storage volume and surface area, average water retention time, and use of power (domestic / export %).

### 3.3 Baseline evaluation

Baseline information and spatial data was compiled to evaluate the existing conditions and trends in each of the eight major river basins. Where appropriate, GIS layers of existing conditions were prepared, and the basins divided into a total of 58 sub-basins for ease of analysis. Only key biophysical and socio-economic ‘values’ were analysed, relating to those features likely to be significantly impacted by hydropower development. Environmental and social ratings were developed for each sub-basin under the strategic themes of:

1. Geomorphology;
2. Aquatic ecology and fisheries;
3. Terrestrial biodiversity;
4. Social and livelihoods; and
5. Conflict.

### 3.4 Project sustainability analysis and impact assessment

A rapid assessment (or screening) of all proposed hydropower projects will be undertaken based on key impact indicators for each environmental and socio-economic theme. The main design features of each HPP will then be overlaid onto the baseline biophysical and socio-economic ‘values’, with risk ratings for each theme calculated for project comparison purposes. Cumulative impacts of these BAU projects will be assessed at the sub-basin and basin levels, providing direction for sustainable hydropower development over the next 30+ years.

### 3.5 Sustainable development framework

A sustainable development framework (SDF) will be developed to balance hydropower development with the maintenance and protection of important environmental and social values. It will provide a whole-of-basin planning framework for riverine resources within each basin, primarily based on sub-basin analysis and trade-offs that aim to achieve 100+ year outcomes.

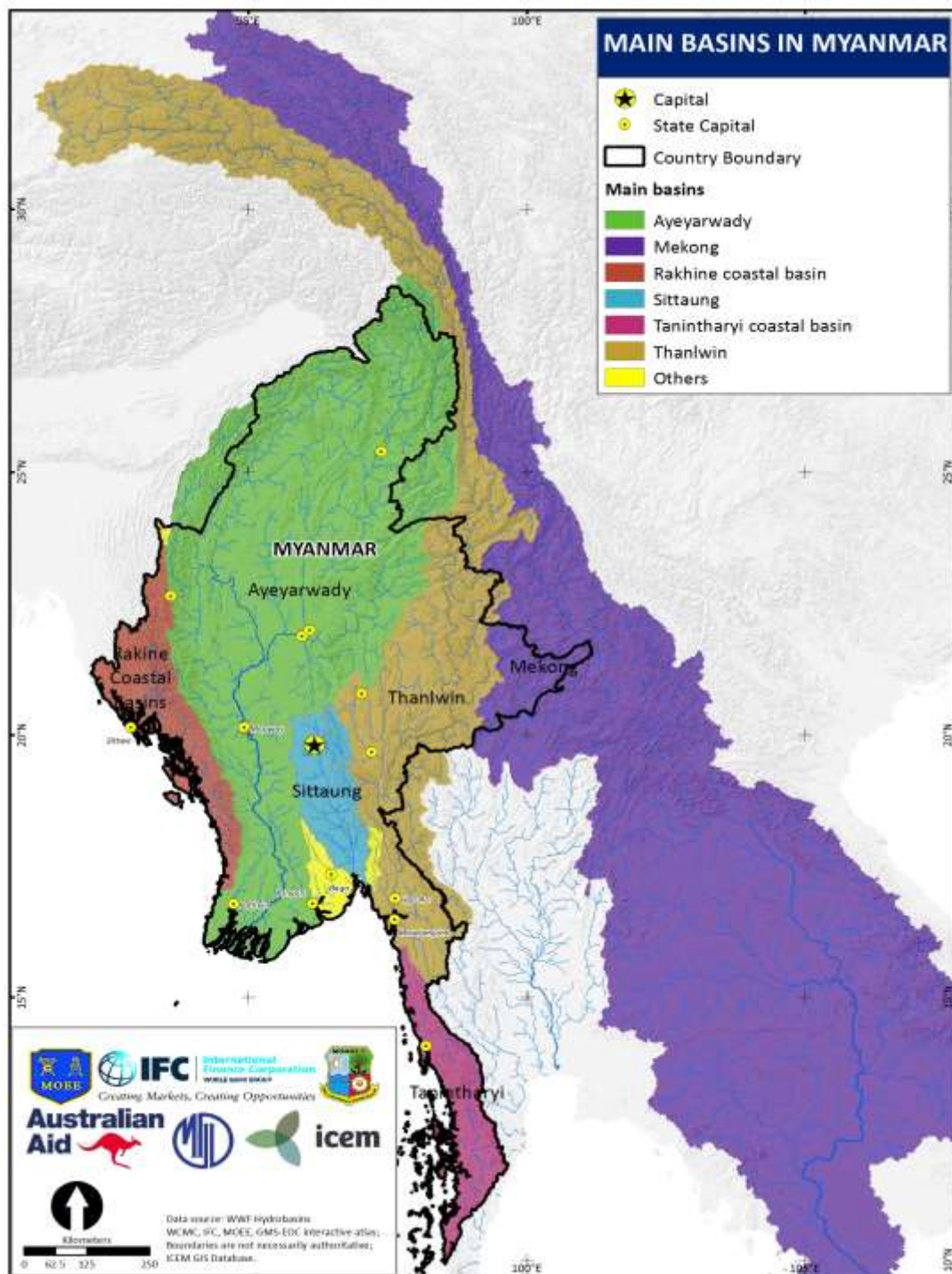
### 3.6 Recommendations on policies, plans, procedures and studies to implement the framework

A program of key actions (policies, procedures, plans, studies and monitoring) will be prepared to implement and periodically update the SDF. This will include recommendations on policies and procedures for government implementation of the SDF, obtaining critical baseline data to fill gaps and improve planning at basin and target sub-basin levels, and establishing a timetable for periodic SDF revision based on the new information obtained. These actions will include coordination between multiple sectors to avoid parallel planning, as well as institutional capacity enhancement.

## 4 RIVER BASINS

Myanmar contains six discrete river basins and two coastal areas that consist of a collection of small watersheds draining directly into the sea that are referred to as coastal basins for analysis purposes (Figure 4.1). The Ayeyarwady, Thanlwin and Mekong are the three major transboundary basins in Myanmar, covering a combined 77.8% of the country. The Surma-Meghna Basin, which flows through India and Bangladesh also covers a small area (~791.64km<sup>2</sup>) in Myanmar. The smaller Sittaung, Bago & Myit Mo Kha and Bilin river basins are wholly contained within Myanmar and the Tanintharyi and Rakhine coastal basins each consist of a collection of smaller watersheds.

Figure 4.1: Main river basins in Myanmar



The total basin area, river length and states/regions of the eight major drainage basins is summarized below in in Table 4.1.

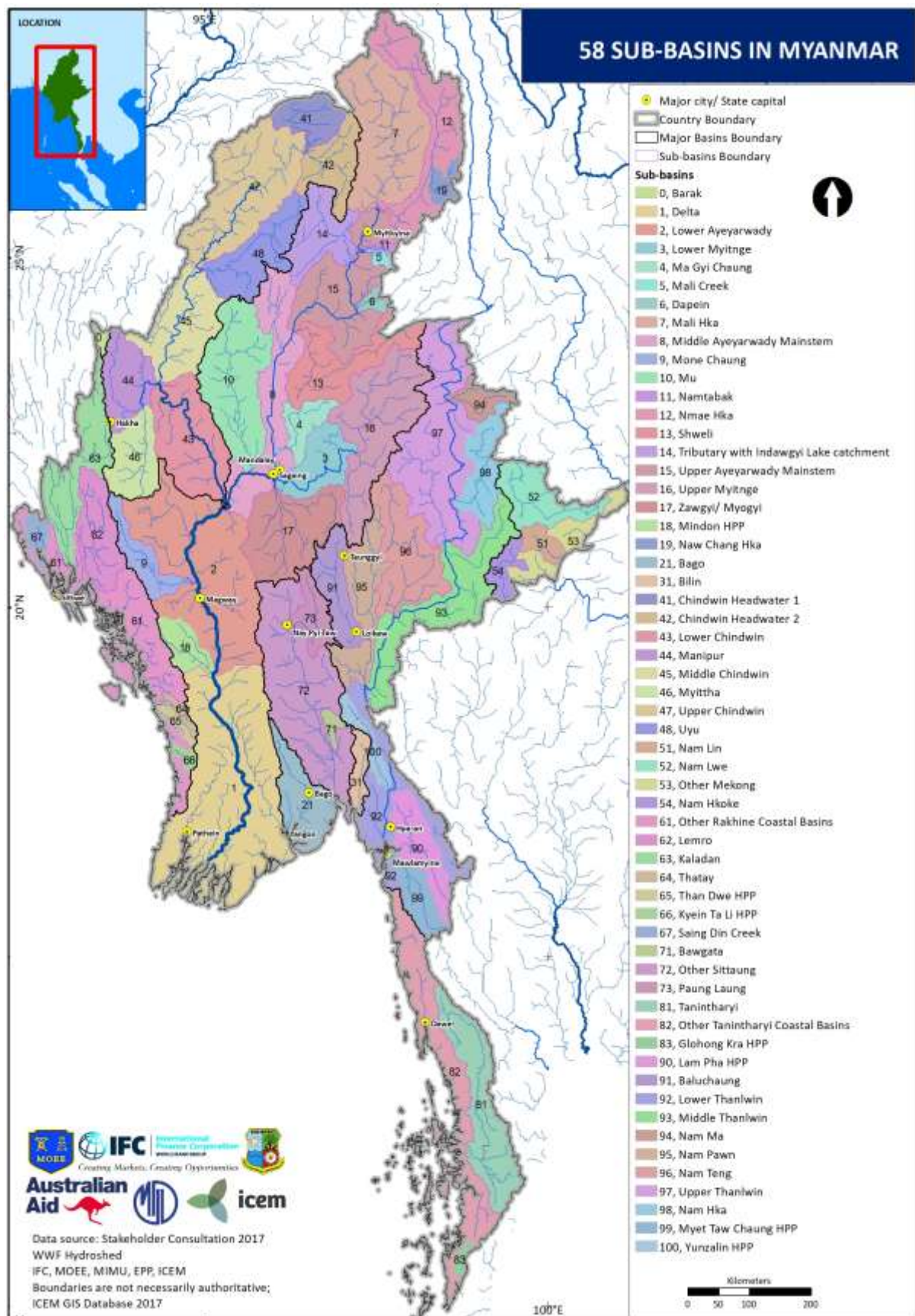
**Table 4.1: Major river basins in Myanmar**

| Basin                         | Total basin area (km <sup>2</sup> ) | Basin area within Myanmar (%)     | Basin area in other countries (%)                                     | Area of Myanmar (%) | Total river length (km) | State/regions   |
|-------------------------------|-------------------------------------|-----------------------------------|---|---------------------|-------------------------|---|
| <b>Ayeyarwady</b>             | 412,500                             | 91<br>(~372,907 km <sup>2</sup> ) | PRC - 5<br>India - 4  | 55.5                | 2170                    | Ayeyarwady, Bago, Chin, Kachin, Magway, Mandalay, Naypyitaw, Rakhine, Sagaing, Shan, Yangon |
| <b>Thanlwin</b>               | 284,200                             | 42<br>(~127,745 km <sup>2</sup> ) | PRC - 53<br>Thailand - 5  | 19                  | 2400                    | Mon, Bago, Kachin, Kayah, Kayin, Mandalay, Shan   |
| <b>Mekong</b>                 | 824,000                             | 2.7<br>(~22,070 km <sup>2</sup> ) | PRC - 21<br>Lao - 24<br>Thailand - 23<br>Cambodia - 20<br>Vietnam - 8 | 3.3                 | 3469                    | Shan  |
| <b>Sittaung</b>               | 34,950                              | 100                               | -   | 5.2                 | 450                     | Mon, Bago, Kayah, Kayin, Magway, Mandalay, Naypyitaw, Shan                                  |
| <b>Bago &amp; Myit Mo Kha</b> | 10,050                              | 100                               | -   | 1.5                 | 220                     | Mon, Bago, Yangon   |
| <b>Bilin</b>                  | 3056.37                             | 100                               | -   | 0.46                | 160                     | Bago, Kayin, Mon  |
| <b>Tanintharyi</b>            | 43,800                              | 00                                | -   | 6.8                 | 400                     | Mon, Kayin, Tanintharyi   |
| <b>Rakhine</b>                | 53,860                              | 100                               | -   | 8.1                 | 280                     | Ayeyarwady, Bago, Chin, Magway, Rakhine   |

The river basins are too large an area to assess the sustainability of planned projects, therefore the basins were divided into 58 sub-basins for analysis in the SEA (Figure 4.2).



Figure 4.2: 58 sub-basins in Myanmar



The following sections provide an overview of the major river basins and sub-basins in Myanmar.

## 4.1 Ayeyarwady Basin

The transboundary Ayeyarwady basin covers around 412,500km<sup>2</sup>, of which 91% (~372,907km<sup>2</sup>) lies within Myanmar, around 5% (~21,400 km<sup>2</sup>) is in the People's Republic of China (PRC) (mostly Yunnan), and 4% (~17,400 km<sup>2</sup>) is situated in India (Manipur and Nagaland).

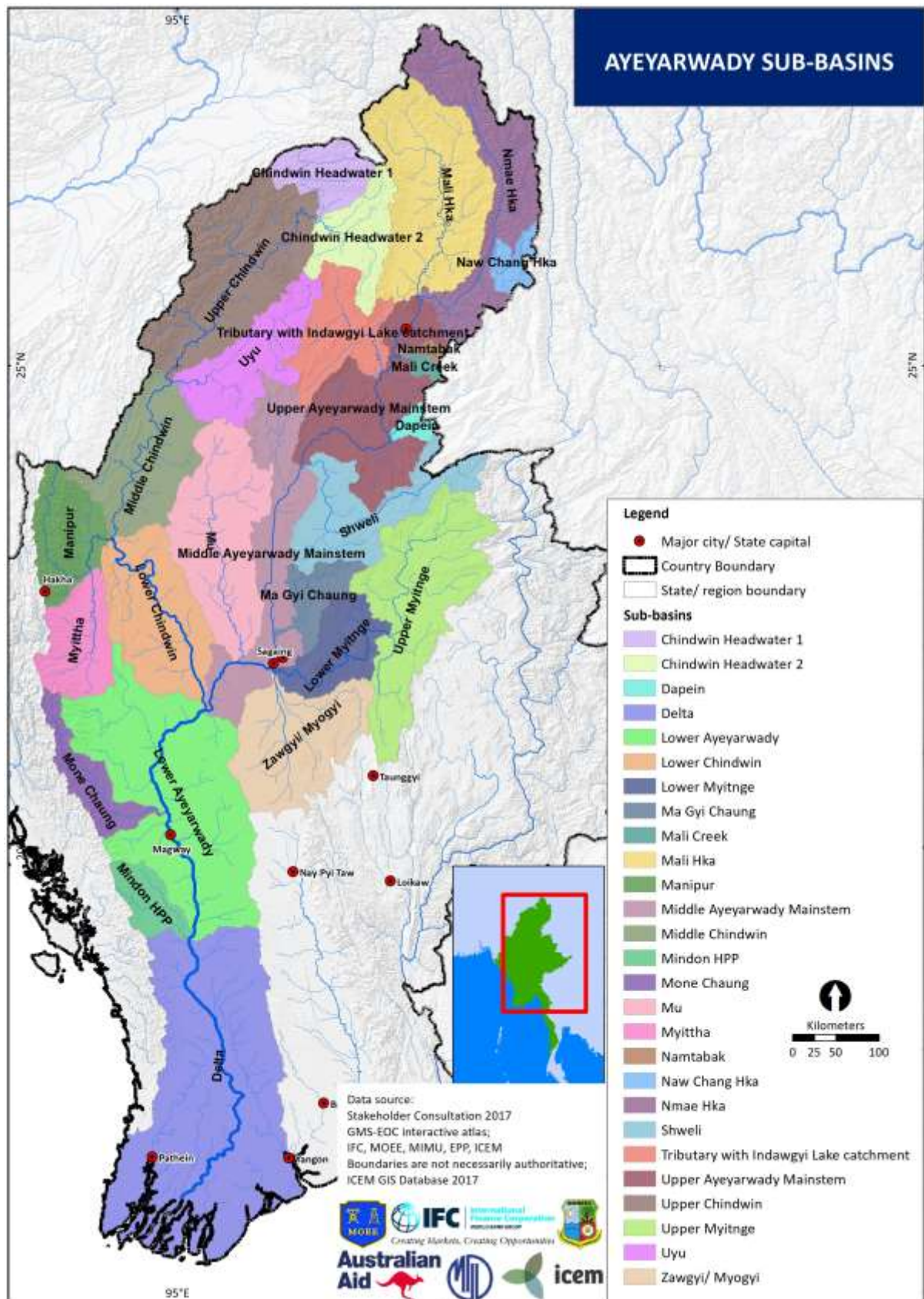
The basin covers approximately 55.5% of Myanmar's land area with major tributaries within Myanmar being the Mali, N'mai, Chindwin, Shweli, Dapein Mu and Mytinge rivers. The 2,170 km long Ayeyarwady River (commencing at the confluence of the Mali and N'mai rivers) is commonly referred to as having three regions: 1) Chindwin River, 2) Upper Ayeyarwady, and, 3) Lower Ayeyarwady, which includes the Delta area.

The headwaters of the basin flow from mountains and hills along the Myanmar-PRC border, including an area within PRC, where elevations exceed 5000m asl. Ayeyarwady River flows are highly seasonal, with 90% of yearly discharge occurring during the monsoon season (mid May to mid November).

The sub-basins within the Ayeyarwady basins, as defined for this SEA, are shown in Figure 4.3, further information on area (km<sup>2</sup>), population and states/regions for each sub-basin is also summarised below in Table 4.2. The area and population in the sub-basins are estimated using GIS analysis.



Figure 4.3: Sub-basins in the Ayeyarwady Basin



**Table 4.2: Summary of Ayeyarwady sub-basins**

| Sub-basin                              | Area            |            | Population | State/Region  |
|--|-----------------|------------|------------|---|
|  | km <sup>2</sup> | % of basin |            |   |
| Delta                                  | 53084           | 19.25      | 11,815,891 | Ayeyarwady, Bago, Magway, Rakhine                           |
| Lower Ayeyarwady                       | 37114           | 13.46      | 3,563,016  | Bago, Chin, Magway, Mandalay, Nay Pyi Taw, Rakhine, Sagaing |
| Lower Myitnge                          | 8070            | 2.93       | 1,221,902  | Mandalay, Shan  |
| Ma Gyi Chaung                          | 4340            | 1.57       | 167,149    | Mandalay, Shan  |
| Mali Creek                             | 719             | 0.26       | N/A        | Kachin  |
| Dapein                                 | 1236            | 0.45       | 62,914     | Kachin  |
| Mali Hka                               | 23287           | 8.44       | 74,211     | Kachin  |
| Middle Ayeyarwady mainstem             | 17940           | 6.51       | 3,344,726  | Kachin, Magway, Mandalay, Sagaing, Shan                     |
| Mone Chaung                            | 5974            | 2.17       | 232,711    | Chin, Magway, Rakhine                                       |
| Mu                                     | 19708           | 7.15       | 1,953,363  | Mandalay, Sagaing   |
| Namtabak                               | 718             | 0.26       | N/A        | Kachin  |
| Nmae Hka                               | 17501           | 6.35       | 25,296     | Kachin  |
| Shweli                                 | 13141           | 4.77       | 328,567    | Kachin, Mandalay, Sagaing, Shan                             |
| Tributary with Indawgyi Lake catchment | 9357            | 3.39       | 673,608    | Kachin, Sagaing   |
| Upper Ayeyarwady mainstem              | 17939           | 6.51       | 894,488    | Kachin, Sagaing, Shan                                       |
| Upper Mytinge                          | 22448           | 8.14       | 718,996    | Shan  |
| Zawgyi/ Myogyi                         | 16327           | 5.92       | 2,099,186  | Magway, Mandalay, Sagaing                                   |
| Mindon HPP                             | 4445            | 1.61       | 205,439    | Magway, Rakhine   |
| Naw Chang Hka                          | 2401            | 0.87       | 20,039     | Kachin  |

The Ayeyarwady Basin is the largest and most economically significant river basin in Myanmar. Approximately 34.3 million (66% of Myanmar's population) live in the Ayeyarwady Basin (2013). Around 1.9 million people live within the Ayeyarwady Basin in Yunnan and 2.8 million people in India, mainly in Manipur. Population density across the basin varies from just 18 people/km<sup>2</sup> in Kachin State, to around 60 people/km<sup>2</sup> in the Mandalay region, and more than 180 people/km<sup>2</sup> in the Ayeyarwady region (Delta). High population densities are concentrated around the major cities and plains of the central zone. Almost half (45%) of the basin population in Myanmar live in the central dry zone regions (Mandalay, Sagaing and Magway) which make up 40% of the basin. The basin crosses the states/regions of Ayeyarwady, Bago, Chin, Kachin, Magway, Mandalay, Naypyitaw, Rakhine, Sagaing, Shan and Yangon.

#### 4.1.1 Chindwin sub-basins

The Chindwin River is considered the main tributary of the Ayeyarwady River and within Myanmar and comprises around 26% (~97156.69km<sup>2</sup>) of the Basin, or around 8.6% of total land area in Myanmar. There are eight Chindwin sub-basins that will be used for analysis in the SEA and these are detailed below in Figure 4.4 and Table 4.3.



**CHINDWIN SUB-BASINS**

95°E

**Legend**

- Major city/ State capital
- Country Boundary
- State/ region boundary
- Sub-basin Boundary

**Sub basins**

- Chindwin Headwater 1
- Chindwin Headwater 2
- Lower Chindwin
- Manipur
- Middle Chindwin
- Myittha
- Upper Chindwin
- Uyu

LOCATION

25°N

Kilometers

0 15 30 60

Myittha

Manipur

Middle Chindwin

Uyu

Upper Chindwin

Chindwin Headwater 1

Chindwin Headwater 2

Lower Chindwin

Hakha

Mandalay

Sagaing

Myittha

95°E

25°N

**MOE**

**IFC**

**Australian Aid**

**icem**

Data source:  
Stakeholder Consultation 2017  
GMS-EOC interactive atlas;  
IFC, MOEE, MIMU, EPP, ICEM  
Boundaries are not necessarily authoritative;  
ICEM GIS Database 2017

**Table 4.3: Summary of Chindwin sub-basins**

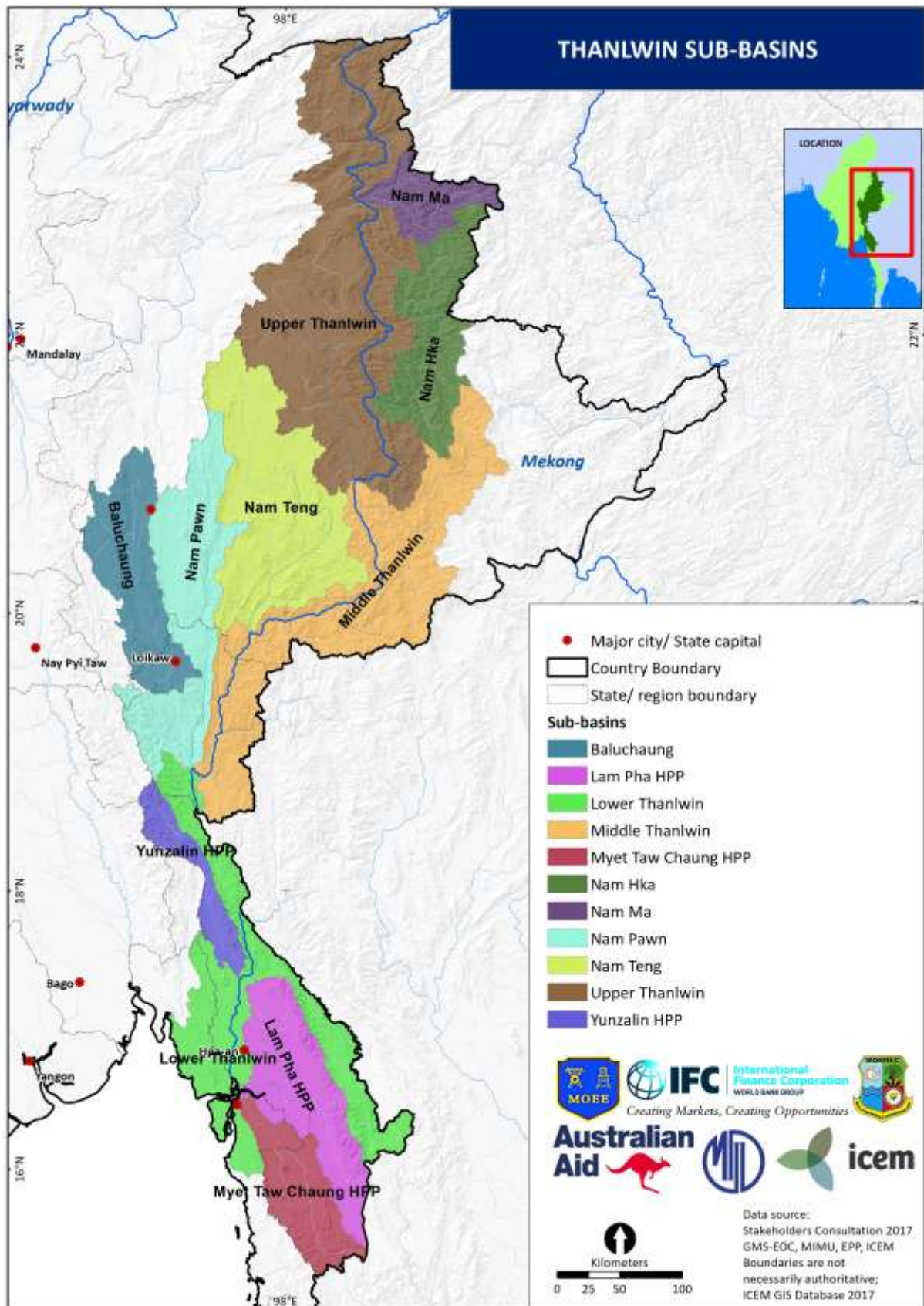
| Sub-basin            | Area            |            | Population | State/Region              |
|----------------------|-----------------|------------|------------|---------------------------|
|                      | km <sup>2</sup> | % of basin |            |                           |
| Chindwin Headwater 1 | 5977            | 6.15       | 51,980     | Kachin, Sagaing           |
| Chindwin Headwater 2 | 7813            | 8.04       | 60,019     | Kachin, Sagaing           |
| Lower Chindwin       | 16621           | 17.11      | 3,563,016  | Magway, Mandalay, Sagaing |
| Manipur              | 8972            | 9.23       | 516,151    | Chin, Sagaing             |
| Middle Chindwin      | 14376           | 14.80      | 278,877    | Chin, Sagaing             |
| Myittha              | 8644            | 8.90       | 230,513    | Chin, Magway, Sagaing     |
| Upper Chindwin       | 23314           | 24.00      | 112,506    | Kachin, Sagaing           |
| Uyu                  | 11440           | 11.77      | 370,874    | Kachin, Sagaing           |

## 4.2 Thanlwin Basin

The transboundary Nu-Thanlwin basin covers approximately 284,200 km<sup>2</sup>, of which approximately the upper 53% (~150,600 km<sup>2</sup>) lies within the PRC, 42% in Myanmar and 5% in Thailand. The Nu-Thanlwin River, referred to as the Nu (Upper Salween) in China and the Thanlwin (Lower Salween) in Myanmar and Thailand, is the second longest river in Southeast Asia (after the Mekong). The basin is narrow and mountainous, flowing 2,400 km from 4,000 m asl on the Tibetan plateau eastwards then south through Yunnan in the PRC, entering Myanmar in the northeast and flowing south into the Bay of Martaban.

The basin covers 19% of Myanmar's total land area, with major tributaries within Myanmar being the Nam Pang and the Nam Pilu/Nam Pawn and the Moei River, which flows north out of Thailand. A 130 km section of the river forms the border between Myanmar and Thailand. The base river flow is provided by glaciers in the upper reaches. The basin discharges an average of 4,978 m<sup>3</sup>/s, with 89% of flows occurring during the monsoon season and 11% during the dry season. The 11 sub-basins that will be used for analysis in the SEA and these are detailed below in Figure 4.5 and Table 4.4.

Figure 4.5: Thanlwin sub-basins





**Table 4.4: Summary of Thanlwin sub-basins**

| Sub-basin           | Area            |            | Population | State/Region            |
|---------------------|-----------------|------------|------------|-------------------------|
|                     | km <sup>2</sup> | % of basin |            |                         |
| Lam Pha HPP         | 8,907           | 7.16       | 486,225    | Kayin, Mon              |
| Baluchaung          | 7,837           | 6.30       | 892,747    | Kayah, Mandalay, Shan   |
| Lower Thanlwin      | 13,972          | 11.23      | 1,716,525  | Kayah, Kayin, Mon       |
| Middle Thanlwin     | 20,264          | 16.28      | 134,457    | Kayah, Shan             |
| Nam Ma              | 3,424           | 2.75       | 24,479     | Shan                    |
| Nam Pawn            | 11,572          | 9.30       | 435,364    | Kayah, Kayin, Shan      |
| Nam Teng            | 15,386          | 12.36      | 339,258    | Kayah, Shan             |
| Upper Thanlwin      | 29,352          | 23.59      | 1,122,780  | Shan                    |
| Nam Hka             | 8,074           | 6.49       | 19,732     | Shan                    |
| Myet Taw Chaung HPP | 5,664           | 4.55       | 450,659    | Kayin, Mon              |
| Yunzalin HPP        | 3,036           | 100.00     | 8076       | Bago, Kayah, Kayin, Mon |

It is estimated that over 10 million people live in the basin - 3.8 million in China, 6.1 million in Myanmar, and 0.6 million in Thailand ([www. worldpop.org](http://www.worldpop.org)). Population density is highest in Mon State (more than 300 persons per km<sup>2</sup>) and western Yunnan (up to 100 persons per km<sup>2</sup>), and lowest in Tibet (5 people per km<sup>2</sup>). In Myanmar, the Thanlwin River flows through Shan, Kayah, Kayin states and Bago region.

### 4.3 Mekong Basin

The Mekong Basin is located in Shan State East and comprises approximately 2.7% (~22,070 km<sup>2</sup>) of the total country area.<sup>4</sup> With its origins in the Tibetan Plateau, the Mekong River flows down along the border with PRC, as well as with the Lao People's Democratic Republic (LAO PDR) - also forming the border of the Mekong sub-basins within Myanmar. The tributaries of the Mekong Basin in Myanmar feed into the Mekong River along those borders, contributing 17.6 km<sup>3</sup> annually to the annual average flow in the River of 475 km<sup>3</sup> - accounting for approximately 3.7% of total annual average flow. Like the neighbouring Thanlwin Basin, most runoff occurs during the monsoon season (mid-May till mid-November). The Mekong Basin has been divided into four sub-basins these are shown below in Figure 4.6 and Table 4.5.

**Table 4.5: Summary of Mekong sub-basins**

| Sub-basin    | Area            |            | Population | State/Region |
|--------------|-----------------|------------|------------|--------------|
|              | km <sup>2</sup> | % of basin |            |              |
| Nam Lin      | 2638            | 12.02      | 207,869    | Shan         |
| Nam Lwe      | 9364            | 42.67      | 366,861    | Shan         |
| Other Mekong | 6534            | 29.77      | 79,890     | Shan         |
| Nam Hkoke    | 3411            | 15.54      | 104,649    | Shan         |

<sup>4</sup> [http://www.fao.org/nr/water/aquastat/basins/mekong/mekong-CP\\_eng.pdf](http://www.fao.org/nr/water/aquastat/basins/mekong/mekong-CP_eng.pdf)

Figure 4.6: Mekong sub-basins

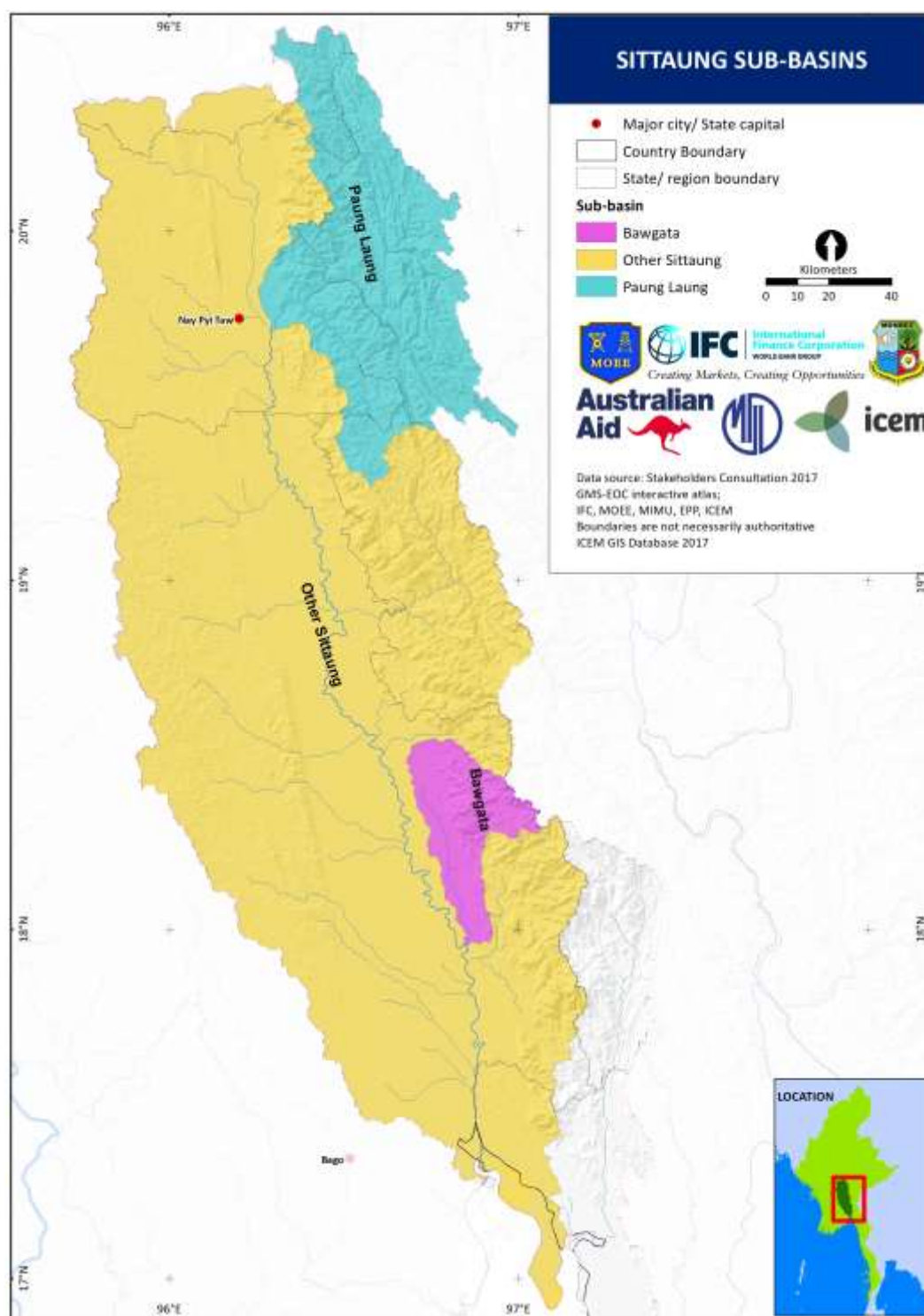


#### 4.4 Sittaung Basin

The Sittaung Basin covers approximately 34,950km<sup>2</sup>, or ~5.2% of the total land area of Myanmar. The Basin drains from the northeast of Yamethin on the edge of the Shan Plateau, flowing 450 km south before discharging into the Gulf of Martaban. The Sittaung River lies between the forested Bago Mountains on the west, and the steep Shan Plateau on the east. The Basin has a large variation

in rainfall, ranging from 889 mm per annum in the north to 2,540-3,810 mm per annum in the south. The mean annual river discharge into the Gulf of Martaban is flow is around 1,540 m<sup>3</sup>/s (equivalent to a unit flow of 32 l/s/km<sup>2</sup>). The river is navigable year-round for 40 km, and during three months in the monsoon for 90 km.<sup>5</sup> 23 major tributaries flow into the main river. The Sittaung has been divided into three sub-basins for analysis in the SEA as shown below in Figure 4.7 and Table 4.6.

Figure 4.7: Sittaung sub-basins



<sup>5</sup><https://sites.google.com/site/bagosittaungriverbasinanalysis/system-discription/a-phy/i-location-dimensions>

**Table 4.6: Summary of Sittaung sub-basins**

| Sub-basin      | Area            |            | Population | State/Region   |
|----------------|-----------------|------------|------------|--|
|                | km <sup>2</sup> | % of basin |            |  |
| Bawagata       | 1229            | 3.52       | 892,747    | Bago, Kayin  |
| Other Sittaung | 28698           | 82.20      | 3,088,695  | Bago, Kayah, Kayin, Magway, Mandalay, Mon, Naypyitaw, Shan |
| Paung Laung    | 4985            | 14.28      | 594,705    | Kayah, Kayin, Mandalay, Naypyitaw, Shan                    |

Around 5.8 million people, or 10% of Myanmar's total population is living in the basin. It's relatively densely populated due to its mild slopes between the mountains and the river course. Nay Pyi Taw District covers the upstream part of the basin, Bago District of the Sittaung Basin and Mon State covers the east part of the river mouth. A total of 7325 ha m<sup>3</sup> surface water reservoirs are in the basin, of which 42% services irrigation purposes and the other 58% a combination of irrigation water supply with hydro-electric power generation. There are nine existing HPPs in the Sittaung Basin with an installed capacity of 810 MW and an additional three planned projects.

#### 4.5 Bago and Myit Ma Hka Basin

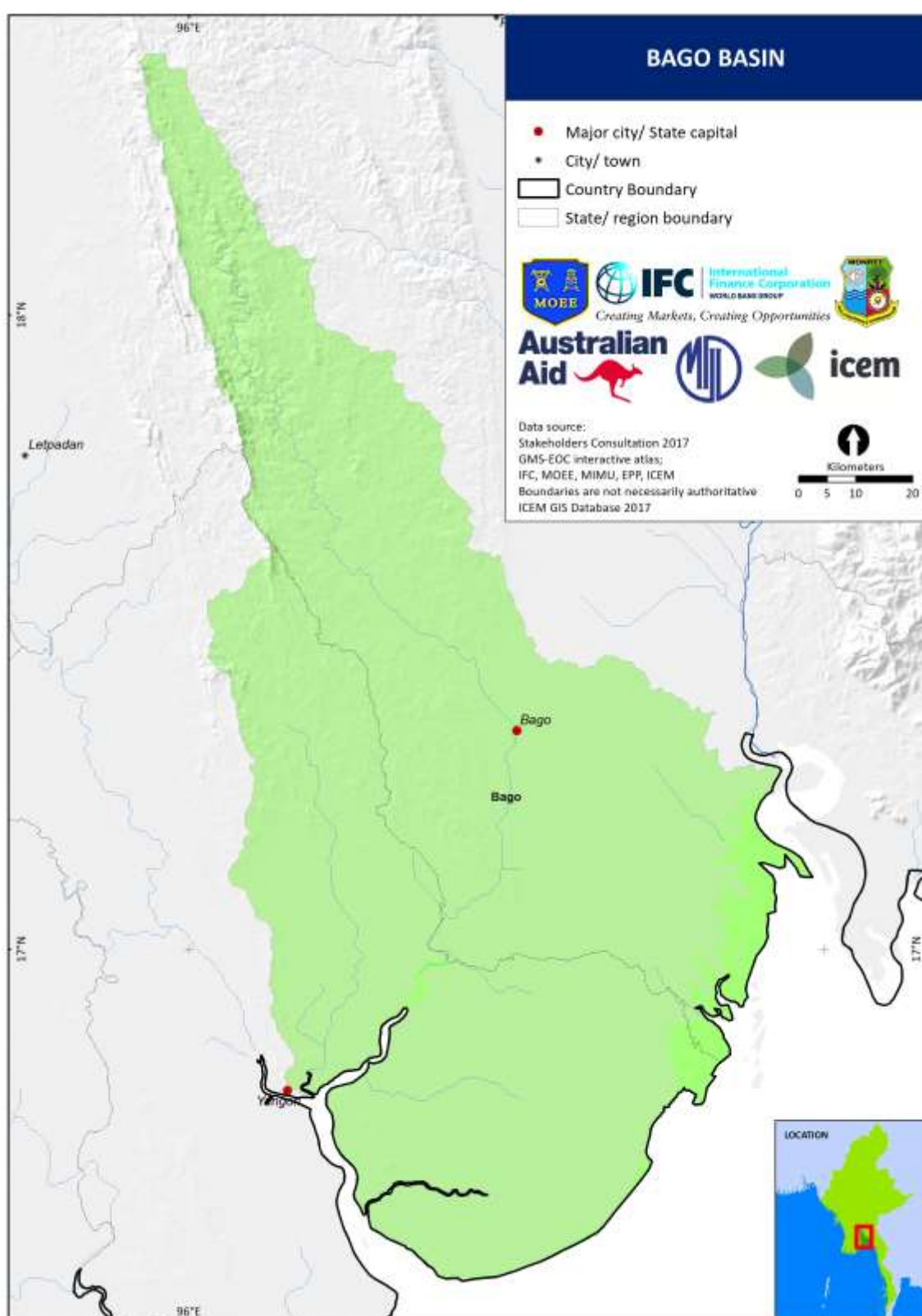
The Bago and Myit Ma Hka basin drains from the Pegu Range hills into the Myit Ma HKa River, which is called the Yangon River further downstream. The basin covers approximately 1.5% (10,050km<sup>2</sup>) of Myanmar's total land area, and the main river is about 331 km long. The Annual rainfall is around 2,980 mm in the Bago catchment area. In Bago District the population density is 124/km<sup>2</sup> (compared to the national average of 76/km<sup>2</sup>). Bago City has a population of ~284,000 (2012) and there is approximately five million people residing in the Basin (2010); with 22% living in urban areas and 78% in rural areas. The Zaung Tu (20MW) HPP is the only existing hydropower project and there are no planned projects. The map and summary information for the Basin is shown below in Figure 4.8 and Table 4.7.

**Table 4.7: Summary of Bago and Myit Mo Hka**

| Sub-basin | Area            |            | Population | State/Region |
|-----------|-----------------|------------|------------|--------------|
|           | km <sup>2</sup> | % of basin |            |              |
| Bago      | 10261           | 100.00     | 4,610,213  | Bago, Yangon |



Figure 4.8: Bago and Myit Mo Kha Basin



#### 4.6 Bilin River Basin

The Bilin River rises in Papun Township, Kayin State and flows about 210 km southwards flowing into the Gulf of Martaban. There is limited information published on the Belin basin, and information obtained from GIS analysis is summarised below in Figure 4.9 and Table 4.8.



Figure 4.9: Bilin River Basin

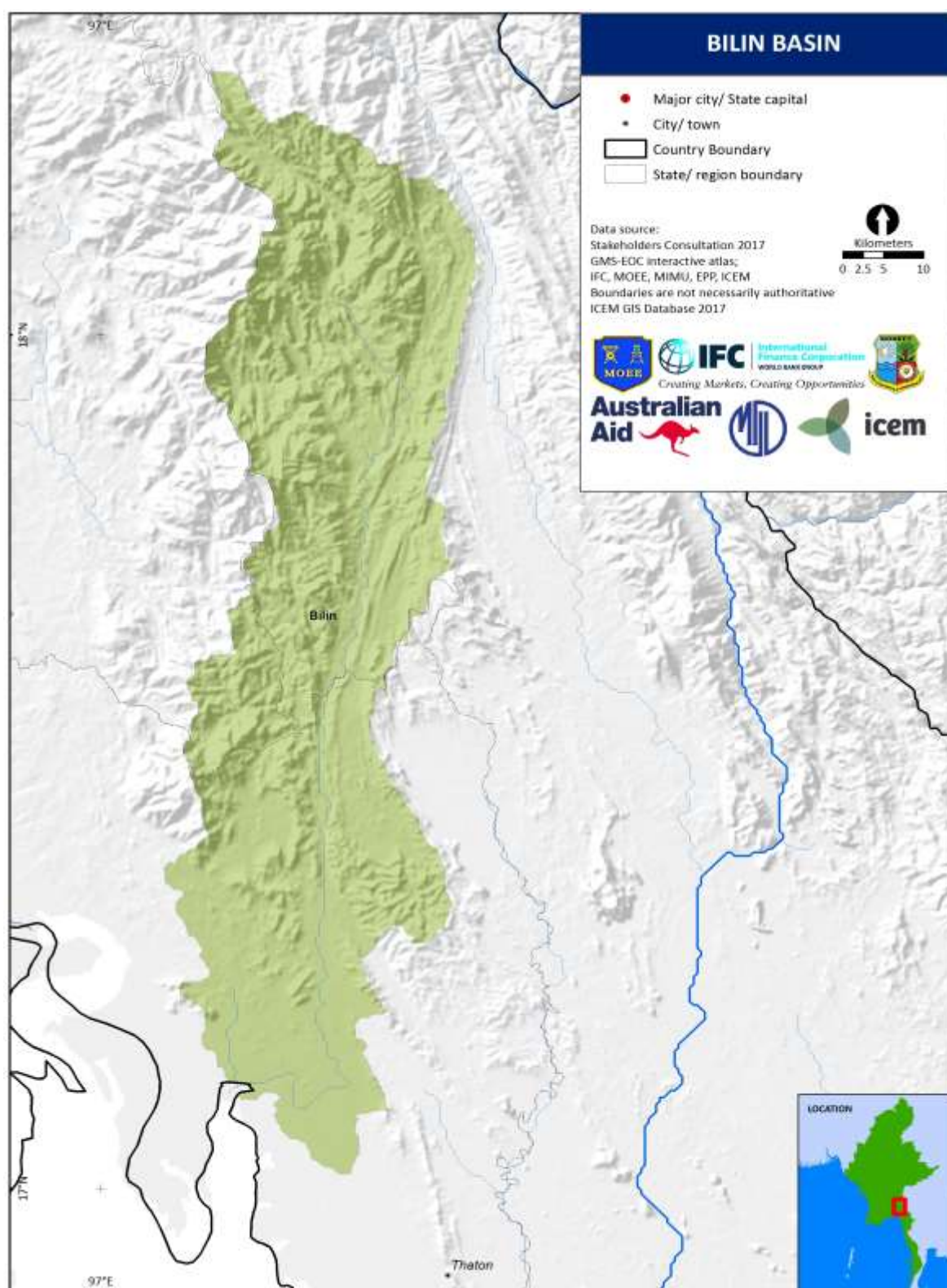


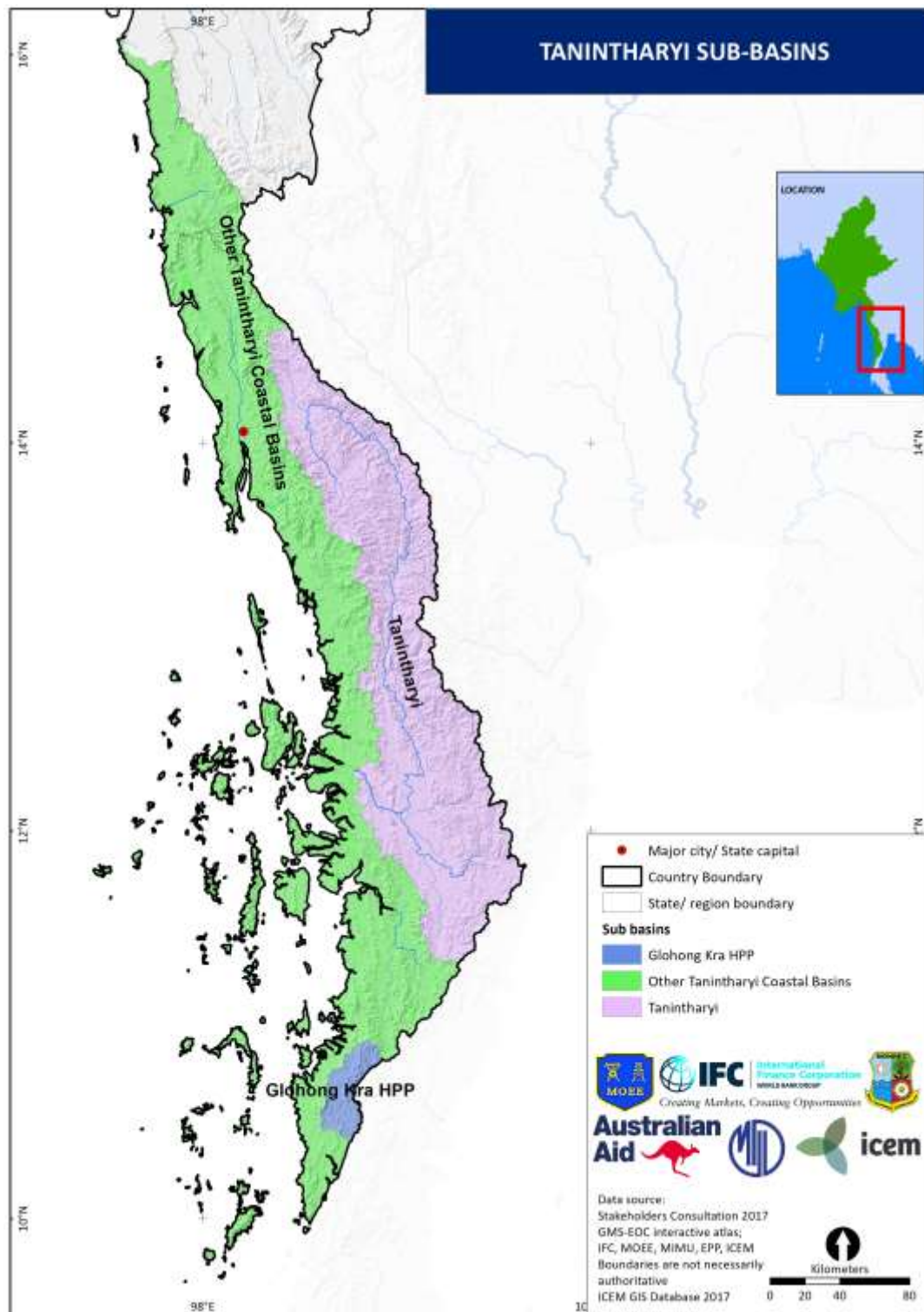
Table 4.8: Summary of Bilin River Basin

| Sub-basin | Area            |            | Population | State/Region     |
|-----------|-----------------|------------|------------|------------------|
|           | km <sup>2</sup> | % of basin |            |                  |
| Bilin     | 3056            | 100.00     | 216,160    | Bago, Kayin, Mon |

## 4.7 Tanintharyi Coastal Basin

The Tanintharyi Coastal Basin in the south of Myanmar drains into the Andaman Sea. The Tanintharyi River rises from the Tenasserim Range at an altitude of 2,074 m and flows through the Tanintharyi Region, before entering the sea at Myeik (Mergui). The basin area is 17,673 km<sup>2</sup> and is completely within the Tanintharyi region covering 41% of its total area. The basin boundary is the national border with Thailand for ~450km. The Tanintharyi Coastal Basin is divided into three sub-basins for analysis in the SEA as shown in Figure 4.10 and Table 4.9.

Figure 4.10: Tanintharyi sub-basins



**Table 4.9: Summary of Thanintharyi sub-basins**

| Sub-basin                        | Area            |            | Population | State/Region            |
|----------------------------------|-----------------|------------|------------|-------------------------|
|                                  | km <sup>2</sup> | % of basin |            |                         |
| Tanintharyi                      | 17,865          | 39.81      | 253,817    | Tanintharyi             |
| Other Tanintharyi Coastal Basins | 26,019          | 57.98      | 1,448,724  | Kayin, Mon, Tanintharyi |
| Glohong Kra HPP                  | 992             | 2.21       | 140,020    | Tanintharyi             |

#### 4.8 Rakhine Coastal Basin

The Rakhine Region in western Myanmar is flanked to the east by the Rakhine (Arakan) mountain range and to the west by the Bay of Bengal, whilst bordering Bangladesh to the north. The distance between the mountain and the sea is relatively short, usually resulting in many small river basins draining the rain falling along the mountain range. The Rakhine mountains experience some of the highest rainfall in the country, exceeding 5,000 mm per annum (in Sandoway), compensating for the small size of the sub-basins to provide enough flows for potential hydropower development.

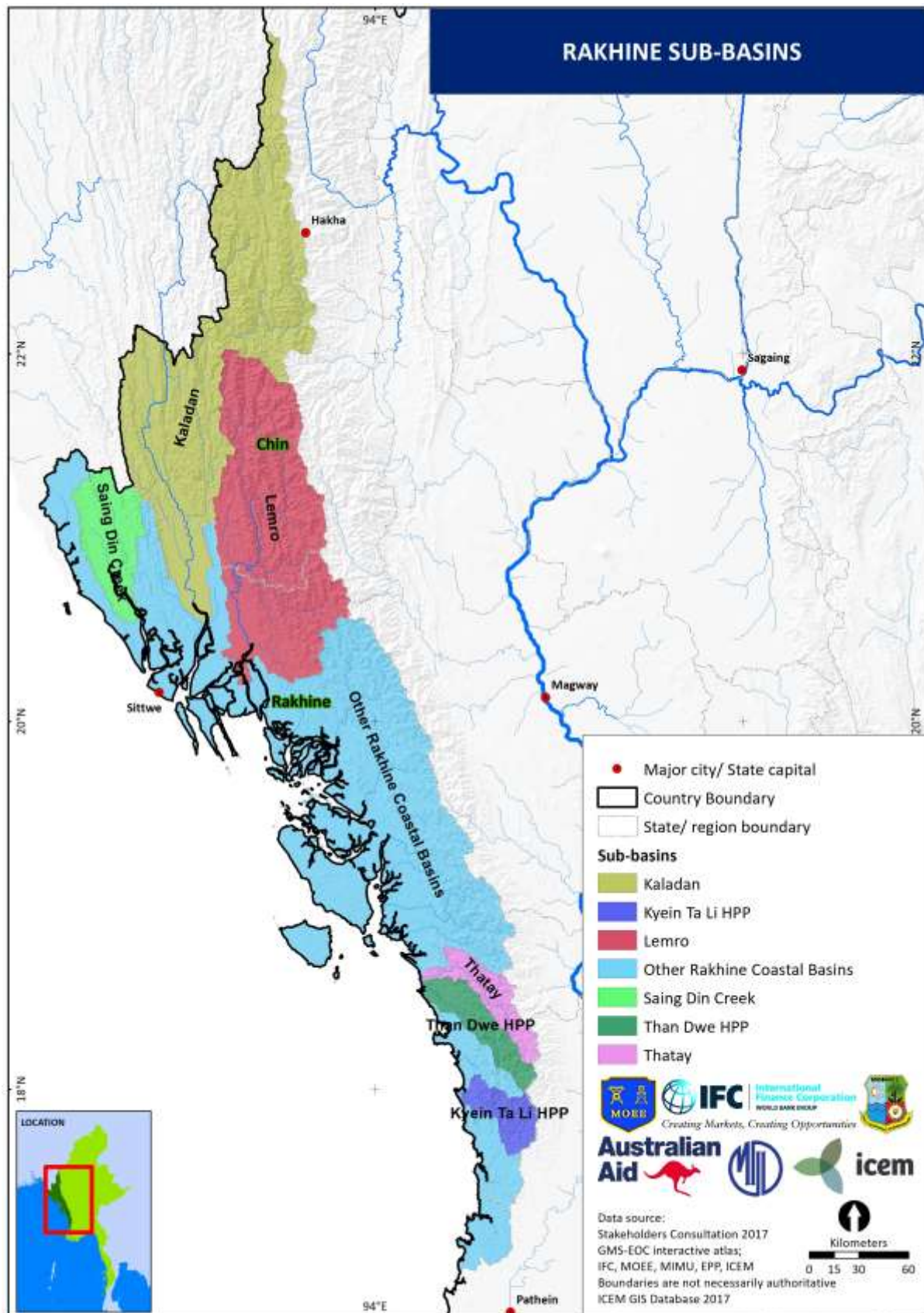
The Rakhine Coastal Basins in the west drains into the Bay of Bengal. There is currently limited information on the coastal rivers of the Rakhine Coastal Basin. The Thandwe River has a catchment area of 850 km<sup>2</sup> and one tributary which has its confluence 6km downstream of Thandwe with a catchment area as little as 250 km<sup>2</sup>. The upstream part of the Lemro River lies within Chin State (Mindat District) and the downstream and flood plains are within Rakhine State (Sittwe District). The Rakhine Coastal Basin can be divided into eight sub-basins for analysis in the SEA as shown in Figure 4.11 and Table 4.9 below.

**Table 4.10: Summary of Rakhine coastal basins**

| Sub-basin                    | Area            |            | Population | State/Region                            |
|------------------------------|-----------------|------------|------------|---|
|                              | km <sup>2</sup> | % of basin |            |   |
| Other Rakhine Coastal Basins | 24,828          | 42.96      | 1,377,840  | Ayeyarwady, Bago, Chin, Magway, Rakhine |
| Lemro                        | 9,929           | 17.18      | 410,189    | Chin, Magway, Rakhine                   |
| Kaladan                      | 13,612          | 23.55      | 320,527    | Chin, Rakhine                           |
| Nam Hkoke                    | 3,411           | 5.90       | 104,649    | Shan                                    |
| Thatay                       | 1,289           | 2.23       | 10,943     | Ayeyarwady, Bago, Rakhine               |
| Than Dwe                     | 1,359           | 2.35       | 38,349     | Ayeyarwady, Rakhine                     |
| Kyein Ta Li                  | 1,061           | 1.84       | 9,842      | Ayeyarwady, Rakhine                     |
| Saing Din Creek              | 2,304           | 3.99       | 55,545     | Chin, Rakhine                           |



Figure 4.11: Rakhine sub-basins



## 5 STAKEHOLDER ENGAGEMENT

The identification of key issues and opportunities was stakeholder led. The key issues, opportunities and development objectives were grouped into strategic themes and sorted according to their significance with input from stakeholders. The issues were identified through regional river basin consultations, direct discussions with stakeholders and multi-stakeholder workshops.

### 5.1 Stakeholder engagement plan (SEP)

The SEP outlines the stakeholder consultation and communication activities throughout each step of the SEA and the key stakeholder groups and has been released as a separate document. The SEP was prepared to ensure that key stakeholder groups were identified and effectively engaged in each of the key steps of the SEA. The SEP will be closely integrated with the overall IFC Communications Plan for the SEA.

Stakeholder engagement will occur through all key steps; however, the scoping and baseline phase was the most important for defining the geographic scope and key themes and issues to be covered in the SEA. The stakeholder consultation events were designed to capture as many states/regions as possible, and included multiple visits to major river basins in Myanmar. The stakeholder engagement activities are categorised in **Error! Reference source not found.** below as multi-stakeholder, government and civil society consultations, information session and workshops.

The SEP recognizes the dynamic nature of a SEA and consultations also entail ongoing:

- interaction with the Advisory Group (AG) and six expert groups;
- direct discussions with individual stakeholders;
- roundtable meetings with specific stakeholder groups; and
- outreach at conferences, forums and other workshops in Myanmar and the Mekong region.

### 5.2 Stakeholder groups

The first step in the SEP was to identify the key stakeholders to be consulted and involved in the SEA. The initial list of stakeholders was developed based on the TOR and updated following the kick-off meetings in October 2016 through direct conversations with IFC, MOEE, MONREC, the AG and other stakeholders. The stakeholder groups will be expanded and updated as the SEA evolves to identify additional groups which have an important stake in hydropower development and river basin management. The initial list of stakeholders was categorized under the following stakeholder groups:

- Union government;
- Sub-national government;
- National and local civil society organizations (CSOs);
- Ethnic armed organisations (EAOs);
- Political parties;
- Local communities;
- Private sector;
- International non-government organizations (NGOs);
- Universities and research institutes; and
- Multilateral development agencies and banks

The comprehensive list of stakeholder groups and how they were involved in the SEA is set out in the *Stakeholder Engagement Plan (SEP)*. The consultation plan for the peace and conflict assessment

conflict was developed in March 2017 and is summarised in *Chapter 8- Peace and Conflict* of this baseline assessment report.

### 5.3 Stakeholder engagement activities

The following key stakeholder consultation events were conducted in the Scoping and Baseline Assessment phase:

- **Kick-off meeting:** Meeting with MONREC, MOEE, IFC and other stakeholders to introduce the SEA methodology and process;
- **Regional river basin consultations:** Roundtable and workshops with different stakeholder groups at the basin and region/state level to identify the key E&S issues and opportunities in the Thanlwin, Sittaung, Chindwin and Tanintharyi basins;
- **Multi-stakeholder baseline assessment workshops:** Review findings from regional river basin consultations to identify and prioritize specific issues and opportunities at the national and basin level for the Ayeyarwady-Chindwin and Thanlwin river basins;
- **Consultation with local communities:** Key informant interviews and focus group discussions with villages affected by the Upper Paung Laung, Lower Yeywa, Bawgata, Shwe Gyin and Baluchaung 1, 2 & 3 HPPs.
- **Consultations with EAOs and political parties:** The Conflict and Peace assessment carried out additional consultations with EAOs, political parties and CSOs in Mytikina, Taunggyi, Kyauk. and, Mae Sot and Chiang Mai in Thailand.

### 5.4 Regional River Basin Consultations

The regional river basin consultations conducted in November and December 2016 were the first opportunity in the SEA to engage with stakeholders at the river basin level. Discussing the issues and opportunities facing river basin development in the Thanlwin, Sittaung, Chindwin and Tanintharyi offered important inputs in defining the SEA key themes and highlighting specific issues in the river basins for further analysis.

The consultations consisted of two separate events; 1) roundtable meetings with region/state offices of MONREC, MOEE and other ministries, and, 2) civil society workshops. These events were held in the following states/regions:

- **Thanlwin:** Taunggyi, Shan State and Loikaw, Kayah State;
- **Sittaung:** Bago and Taungoo, Bago Division;
- **Chindwin:** Monywa, Sagaing Division; and
- **Tanintharyi:** Dawei, Tanintharyi region.

The SEA team used an “affinity diagram” process which combines individual/group brainstorming with a structured approach to display the ideas/products of the brainstorming according to common themes. These themes were then used by the groups as a basis for determining the key E&S values in each of the basins. Groups were provided with base maps of the river basin to draw locations of key areas for biodiversity and livelihoods.

The frequency of issues and opportunities listed by stakeholders were recorded during the stakeholder consultations. Further analysis was done by the SEA team to group the issues and opportunities into categories. The key issues and opportunities listed by stakeholders across the four basins are shown below in Table 5.1 and Table 5.2 respectively.

**Table 5.1: Summary of frequently listed issues in regional river basin consultations**

| Issues                          | Thanlwin | Sittaung | Chindwin | Tanintharyi |
|---------------------------------|----------|----------|----------|-------------|
| Accountability and transparency |          |          |          |             |
| Benefit sharing                 |          |          |          |             |
| Conflict                        |          |          |          |             |
| Cultural heritage               |          |          |          |             |

|                           |  |  |  |  |
|---------------------------|--|--|--|--|
| Development               |  |  |  |  |
| Environmental pressures   |  |  |  |  |
| Erosion and sedimentation |  |  |  |  |
| Ethnic minorities         |  |  |  |  |
| Flooding                  |  |  |  |  |
| Governance                |  |  |  |  |
| Hydropower                |  |  |  |  |
| Land issues               |  |  |  |  |
| Livelihoods               |  |  |  |  |
| Mining                    |  |  |  |  |
| Public services           |  |  |  |  |
| Resettlement              |  |  |  |  |
| Transportation            |  |  |  |  |

**Table 5.2: Summary of frequently listed opportunities in the regional river basin consultations**

| Opportunities             | Thanlwin | Sittaung | Chindwin | Tanintharyi |
|---------------------------|----------|----------|----------|-------------|
| Access to electricity     |          |          |          |             |
| Agriculture               |          |          |          |             |
| Benefit sharing           |          |          |          |             |
| Development               |          |          |          |             |
| Environmental protection  |          |          |          |             |
| Fisheries (aquaculture)   |          |          |          |             |
| Forest management         |          |          |          |             |
| Hydropower                |          |          |          |             |
| Improving governance      |          |          |          |             |
| Improving public services |          |          |          |             |
| Land policy               |          |          |          |             |
| Livelihoods               |          |          |          |             |
| Renewable Energy          |          |          |          |             |
| Small-scale hydropower    |          |          |          |             |
| Transportation            |          |          |          |             |

Conflict and ethnic minorities emerged as significant issues in relation to hydropower development. CSOs in the Thanlwin, Tanintharyi and Sittaung basins raised issues around conflict, control of natural resources and ethnic minority groups. Many of the planned large-scale hydropower projects are in contested areas; areas that have experienced past conflict events or states/regions that are pushing for increased revenue sharing and control of natural resource projects. Due to the complex and evolving nature of conflict in Myanmar it was decided that conflict would be analysed as a separate strategic theme in the SEA. The IFC have provided additional resources for trend and spatial analysis for conflict and peace building.

Highlighting and mapping existing environmental pressures guided the analysis for the strategic themes. Stakeholders in the Sittaung River Basin reported changes in flow, sedimentation and riverbank erosion, loss of fisheries and social issues associated with existing hydropower. Assessing the impacts, benefits and cumulative effects of the nine existing HPPs in the Sittaung can be used to inform sustainable hydropower development in other major basins by learning from past experiences and observed changes in natural resources and social systems.

Mining was raised as a significant issue in the Chindwin River Basin. Such activities led to water quality pollution, riverbank erosion and sedimentation and will be assessed in the geomorphology and sediment and economic themes. Deforestation and illegal logging were highlighted in all basins; informing the biodiversity theme in mapping protected areas, forest estates and changes in forest cover. Understanding the existing environmental pressures from existing hydropower, mining and other land uses is important for establishing the baseline and the impact assessment phase when overlaying the pipeline of planned HPPs.

Identifying the opportunities for river basin development defined the economic sectors and land use for analysis in the SEA. As with the issues above it is important to consider the existing economic sectors, land uses and opportunities for development at the basin level. From the regional river basin consultations, the key economic sectors identified in addition to hydropower were mining, agriculture, forestry and transportation, including inland water transport (IWT). The relationships between hydropower and these economic sectors will be analysed in the baseline and impact assessment phases.

While there were diverging views on hydropower and river basin development, the impacts and benefits were well recognised and will form the basis of future stakeholder dialogue. Stakeholders listed hydropower, development, governance, transparency and accountability and benefit sharing as issues, but also as opportunities. Under hydropower for instance, the environmental and social impacts of existing and planned hydropower were listed but also the potential benefits of hydropower including access to electricity, improved public services and agricultural and economic development. So, although some CSOs were against large-scale hydropower development until the peace process is resolved there is a starting point for dialogue on options for hydropower development that may benefit local communities and generate revenue for states and regions.

A full summary for these consultations is provided in *Regional River Basin Consultations-Key Findings*.

## 5.5 Baseline assessment workshops (summary)

The team conducted three multi-stakeholder baseline assessment workshops in January and February 2017:

- **National Multi-Stakeholder Workshop:** Friday, January 27, 2017 in Yangon
- **Ayeyarwady-Chindwin Multi-Stakeholder Workshop:** Tuesday, January 31, 2017 in Myitkyina, Kachin State
- **Thanlwin Multi-Stakeholder Workshop:** Friday, February 3, 2017 in Loikaw, Kayah State

The multi-stakeholder workshops were open for all stakeholders to attend from the union and sub-national government, international and local NGOs, universities and private sector. The Ayeyarwady-Chindwin and Thanlwin workshops had more of a regional focus and the Yangon workshop focussed on national priorities for hydropower and river basin development. The objectives of the workshops were to:

- Share findings from regional river basin consultations and other stakeholder engagement activities;
- Present the initial spatial and trend analysis under each of the strategic themes for the SEA;
- Identify key issues and opportunities in river basin development; and
- Set priorities for the key issues and opportunities.

Stakeholders were asked to identify (on coloured cards) one priority issue or opportunity each for river basin development in Myanmar under each of the key strategic themes for the SEA. Stakeholders then set priorities on the level of importance by voting (using three red dots each) for the most important issues and opportunities (Table 5.3).

**Table 5.3: Priority SEA themes identified in multi-stakeholder workshops (% of participants)**

| Themes | Yangon | Myitkyina | Loikaw |
|--------|--------|-----------|--------|
|--------|--------|-----------|--------|



|                                       |    |    |    |
|---------------------------------------|----|----|----|
| Aquatic ecosystems and fisheries      | 13 | 2  | 3  |
| Biodiversity and protected areas      | 9  | 20 | 6  |
| Climate change                        | 10 | 19 | 9  |
| Conflict                              | 12 | 17 | 25 |
| Economics and river basin development | 12 | 7  | 9  |
| Geomorphology and sediment            | 15 | 2  | 1  |
| Hydropower                            | 11 | 17 | 26 |
| Social and livelihoods                | 18 | 16 | 21 |

The top three priorities identified in the Yangon workshop were social and livelihoods, geomorphology and sediment and aquatic ecosystems and fisheries. The participants at the Yangon workshop were mainly from NGOs, universities, hydropower companies and there were some local participants who had attended the regional river basin consultation in the Sittaung Basin. Generally, these participants had a deeper technical understanding of the cumulative impacts of hydropower development.

In Myitkina, the top three priorities were biodiversity and protected areas, climate change and conflict. The workshop was attended by Kachin State government representatives, local CSOs, academics and participants who had attended the regional river basin consultations in Monywa. There are active conflict zones in Kachin State and local CSOs have been protesting around the environmental and social impacts of the proposed Myitsone project for many years, hence there was a strong focus on conflict and ensuring the protection of biodiversity in the upstream of the Ayeyarwady.

In Loikaw, hydropower, conflict and social and livelihoods were identified as the top three areas of concern. The Loikaw workshop was attended by Kayah state government, CSOs and local stakeholders who had participated in the regional river basin consultations in Loikaw and Taunggyi. The focus in this workshop was around the impacts of hydropower, particularly in relation to resettlement, displacement and loss of livelihoods for local communities. The CSOs also raised issues around conflict and some stated that the peace process should be resolved prior to hydropower and economic development.

The baseline assessment workshops were used to update the initial trend and spatial analysis, and to identify gaps in existing knowledge and areas for follow-up in completing this baseline report.

## 5.6 Consultation with local communities affected by existing hydropower

For in-depth case study analysis, the SEA team consulted with local communities affected by two existing HPPs in April, including

- **Upper Paung Laung (140MW):** Commissioned in 2015 in the Sittaung Basin near the border of Nay Pyi Taw Union Territory and Shan State; and
- **Lower Yeywa (790 MW):** Commissioned in 2010 in the Ayeyarwady-Chindwin Basin, Mandalay Region.

These in-depth studies will provide an opportunity to validate information at the village level around the environmental and social impacts of hydropower. The findings of this report will be used in the impact assessment phase to determine how local communities have been affected by hydropower. Alongside the baseline assessment workshop in Loikaw, the team also visited the Balachaung cascade and informally interviewed local communities living near the Baluchaung 1 & 2 HPPs. As part of the Peace and Conflict assessment, consultations were also conducted in July 2017 with local communities affected by the Shwe Gyin HPP and the planned Bawgata project.

## 5.7 Advisory Group (AG) and Expert Technical Groups (EGs)

Six EGs and an overarching AG were constituted and have met frequently to provide guidance and technical inputs as the SEA has progressed. Those groups are convened by the IFC as part of the

stakeholder engagement process. The AG is chaired by IFC, and consists of 15-18 members. Its role is to:

1. Provide oversight and support to conduct the SEA; and
2. Lend support in shaping and implementing recommendations of the SEA.

The AG provides on-going advice to the SEA team on their activities, sustainable development objectives and priority setting, available baseline data and the identification of significant biophysical and socio-economic values, and consultation. In addition, each draft report is provided to AG members for review and comment. The SEA team provided initial briefings to the AG on the aim and scope of the SEA in November 2016 and on the progress of the scoping and baseline assessment phase in January 2017, March 2017, June 2017 and July 2017.

The EGs draw in additional stakeholders to provide technical inputs. Members are mainly drawn from research institutes, NGOs, the private sector and consultancies. There are six Expert Groups:

1. Hydropower and energy;
2. River hydrology and geomorphology;
3. Aquatic ecology/fisheries;
4. Terrestrial ecology, protected areas, forestry;
5. Social, livelihoods, indigenous peoples, conflict areas, cultural issues; and
6. Economics, river and basin non-hydropower use and development (including navigation, irrigation, agriculture and mining).

The Groups provide an effective mechanism for exploring each significant issue in detail. They provide an opportunity for consultation with recognized specialists in the main themes of concern to the SEA and relating to sustainable hydropower development. To date Groups meetings have been conducted in December 2016 with a second round in April and May 2017. The Biodiversity and fisheries/aquatic ecology groups held a two-day workshop in June 2017 to review the important natural areas and their attributes in each basin. A round of EG meetings was held with the six EGs in June 2017 to review the draft findings of this baseline assessment and draft methodology to be used in the sustainability analysis.

## 6 LEGAL AND INSTITUTIONAL FRAMEWORK

This section summarizes the legal and institutional framework relating to environmental protection and hydropower development. It provides an overview of the national planning framework for key issues relating to hydropower development, including water resources, land use and agriculture, fisheries and forestry.

### 6.1 Legal framework

Different sectoral ministries are formed and guided by relevant union level laws. With the approval of the president and his/her cabinet, the ministries and the relevant departments draft by-laws and regulations concerning their own sectors. Sectoral laws are commonly supported by rules, procedures, orders, guidelines, and standards. The Environmental Conservation Law 2012 and its by-laws are presented in Figure 6.1 as an example of the legal hierarchy in Myanmar.

Figure 6.1: Law, rules, procedures and guidelines under the Environmental Conservation Law 2012



Though not legally binding, policies identify and inform areas where legislation is needed or enforcement lacking, serving as a formal communication document at the highest levels of government. In addition to drafting and implementing sector-specific regulations, ministries and departments also prepare policies, strategic action plans and sectoral master plans, which guide the planning and implementation of sector-specific development and regulation activities.

Most of the sectoral master planning up to 2030 was undertaken by the previous Union Solidary and Development Party (USDP) government, and it is not clear which of the master plans will be adopted by the NLD government. Relevant to this SEA, the National Electricity Master Plan (NEMP) 2014 was not approved and is now being revised by MOEE with the assistance of Japan International Cooperation Agency (JICA). Further information on power generation mix and power sector demand is provided in *Chapter 2-Hydropower* and *Chapter 6-Economics*.

### 6.2 National Committees

Coordination between ministries and departments is limited. To address this problem the government has established numerous level inter-ministerial committees to address multi-sectoral issues. These include the:

- National Environmental Conservation and Climate Change Central Committee (NECCCCC);
- National Water Resource Committee (NWRC); and
- National Land Committee.

These committees are chaired by one of the two vice presidents and include the union level minister of the most relevant sector. They are relevant to hydropower and demonstrate the cross-cutting nature of developing hydropower in Myanmar.

### 6.3 Sub-national governance

The 2008 constitution created sub-national governments in the 14 states and regions of Myanmar. All chief ministers are appointed by the president, who in turn appoint state/region ministers. City and local governments are an extension of the state/region government, although in places like Yangon and Mandalay there are City Development Committees (CDCs).

### 6.4 Electricity and Energy

Last year, in 2016, when the NLD government came into power, Ministry of Electric Power (MOEP) 1, MOEP2 and Ministry of Electricity (MOE) were consolidated as Ministry of Electricity and Energy (MOEE). MOEE oversee both the energy and power sector administration in Myanmar, including hydropower which is the responsibility of the Department of Hydropower Planning (DHPP) and Department of Hydropower Implementation (DHPI).

#### 6.4.1 National Energy Policy

The previous government formulated a draft National Energy Policy (2014) with the following objectives related to hydropower and power generation:

- To implement a short-term and long-term comprehensive energy development plan based on systematically investigated data on the feasible potential energy resources that can be practically exploited, considering minimum impact on the natural and social environment;
- To implement programs by which the local population could proportionally enjoy the benefit of energy reserves discovered in their areas; and
- To implement programs on a wider scale, utilizing renewable energy resources such as wind, solar, hydropower, geothermal and bio-energy for sustainable energy development in Myanmar.

#### 6.4.2 National Electrification Plan and National Electricity Master Plan

The National Electricity Master Plan (NEMP) is being prepared by MOEE with JICA support and due to be completed in 2018, is assessing the appropriate power generation mix (e.g. gas, hydropower, wind, solar and coal) and developing the power development plan. Collaborative arrangements are being put in place between JICA and IFC to integrate the two processes and avoid confusion among stakeholders. One special issue for discussion is the intention of the JICA team to conduct an SEA of the NEMP as part of JICA safeguard requirements.

#### 6.4.3 Legal requirements for hydropower

The key legislation and policy documents relevant to electricity, land use, water resources, environmental conservation, disaster risk reduction, climate change and investment applicable to hydropower development are summarized in Table 6.1 below.

**Table 6.1: Laws relating to hydropower development**

| <b>Energy/electricity</b>  |
|--|
| <ul style="list-style-type: none"><li>• Electricity Law (2014)</li></ul>   |
| <b>Land</b>  |
| <ul style="list-style-type: none"><li>• Land Acquisition Act (1894)</li><li>• Vacant, Fallow, Virgin Lands Management Law (2012)</li><li>• Farmland Law (2012)</li></ul>   |
| <b>Water</b>   |
| <ul style="list-style-type: none"><li>• Conservation of Water Resources and Rivers Law (2006)</li></ul>  |
| <b>Environment</b>   |
| <ul style="list-style-type: none"><li>• Environmental Conservation Law (2012)</li><li>• Environmental Conservation Rules (2014)</li><li>• National Environmental Quality (Emissions) Guidelines (2015)</li><li>• Environmental Impact Assessment Procedures (2015)</li></ul> |
| <b>Disaster risk reduction/climate change</b>  |
| <ul style="list-style-type: none"><li>• Myanmar Action Plan for Disaster Risk Reduction (2012)</li></ul>   |

| Investment  |
|---|
| <ul style="list-style-type: none"> <li>• Myanmar Investment Law (2016)</li> <li>• Foreign Investment Law (2012)</li> <li>• Myanmar Investment Rules (2017)</li> <li>• Intended Nationally Determined Contribution – INDCs (2015)</li> </ul> |

In addition, the following policies and strategic documents with relevance to hydropower development are being drafted by GOM and are expected to be adopted in 2017/18:

- National Environmental Policy (2017);
- Strategic Framework for Environmental Policy (2017);
- Climate Change Policy (2017);
- Climate Change Strategy and Action Plan (2017);
- Green Economy Policy Framework (2017/18);
- Guidelines for Public Participation in Myanmar's EIA Process (2017/18);
- National Land Use Policy (2017/18); and
- National Water Resource Policy (2017/18).

## 6.5 Control of Natural Resources and Hydropower

Myanmar's natural resources have been predominately managed and taxed by the union government through line ministries and the state-owned enterprises under them. Since the 2008 constitution was adopted, some decentralization relevant to natural resources has taken place from both a) the union ministry side, via the transfer of some responsibilities to state/region governments, and b) new legislation or orders of individual state/region governments (TAF, 2014).<sup>6</sup>

Specifically, for the hydropower sector, according to constitution, 4a of schedule 2 (refer to session 188), state/region governments have rights to regulate:

*“Medium and small scale electric power production and distribution that have the right to be managed by the Region or State not having any link with national power grid, except large scale electric power production and distribution having the right to be managed by the Union”.*

Small scale electrical projects are defined as up to 10 MW capacity in the Electricity Law 2014, while mid-sized electrical projects are defined as  $10 < \text{to} \leq 30$  MW. Large scale projects (greater than 30 MW) are regulated by MOEE. Regardless of size, every HPP is governed by the Myanmar EIA procedures.

In summary, an HPP with the following characteristics could potentially be under the jurisdiction of state/region government and their corresponding parliament:

- Small (installed capacity of up to 10 MW) or medium (installed capacity  $10 < \text{to} \leq 30$  MW); and
- Not linked to the national grid.

## 6.6 Environment

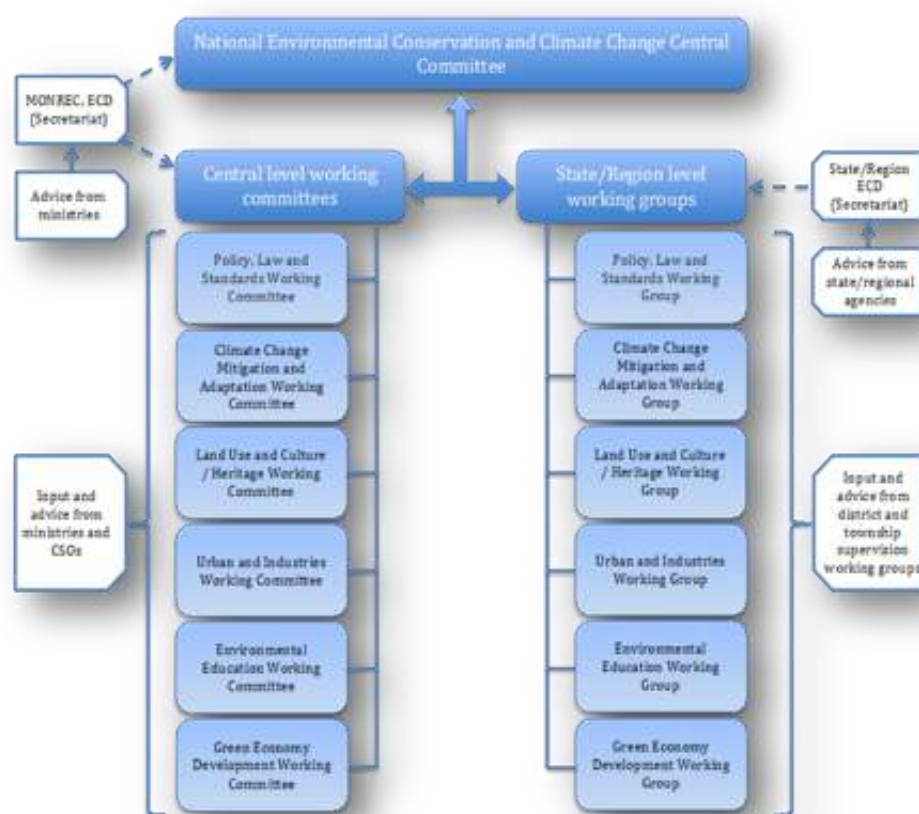
In 2016, the NLD government combined MOECA and the Ministry of Mines under a new ministry called Ministry of Natural Resource and Environmental Conservation (MONREC). Along with the Department of Mine and Forest, ECD now stands as a main, functioning department under MONREC responsible for EIA and environmental conservation.

<sup>6</sup> TAF. (2014). Natural Resources and Subnational Governments in Myanmar, Discussion Paper No.14, The Asia Foundation, Yangon, Myanmar



The National Environmental Conservation and Climate Change Central Committee (NECCCCC) addresses the multi-sectoral issues of environment and climate change and is under the guidance of the Vice President 1, and chaired by the Minister of MONREC. The committee secretary is the Director General of ECD, supported by a central working committee composed of representatives from six technical working committees. There are also states and region-level counter-parts for each working group (Figure 6.2).

Figure 6.2: Institutional arrangements for environmental conservation



The Environmental Conservation Law (2012) is the major legislation on environmental governance in Myanmar. This is supported by the Environment Conservation Rules (2014) and the EIA Procedure and Environmental Quality (Emission) Guidelines.

### 6.6.1 EIA Procedures

The EIA Procedures (2016) require all development projects, whether public or private investments, to undergo impact assessment, either in the form of a full EIA or a simpler Initial Environmental Examination (IEE). The impact assessment requirements for hydropower projects are set out in Table 6.2. If, upon reviewing the IEE report, the Review Board may require that a full EIA be prepared. Regardless of the level of impact assessment, all projects are required to have Environmental Management Plans (EMP) that detail implementation, monitoring and management measures to avoid and mitigate negative environmental impacts.

Table 6.2: EIA/IEE requirements for hydropower projects

| Project type (hydropower)                   | IEE                         | EIA                         |
|---|-----------------------------|-----------------------------|
| <b>Installed capacity</b>                   | ≥ 1 MW but < 15 MW          | ≥ 15 MW                     |
| <b>Reservoir volume (full supply level)</b> | < 20,000,000 m <sup>3</sup> | ≥ 20,000,000 m <sup>3</sup> |
| <b>Reservoir area (Full supply level)</b>   | < 400 ha                    | ≥ 400 ha                    |

MONREC and MOEE are currently jointly drafting Environmental and Social Impact Assessment (ESIA) guidelines for the hydropower sector.

The EIA Review Board and the Environmental Conservation Department assess the impacts of the proposed project relating to energy and natural resources, nature conservation and management, cultural heritage sites, waste management practices, accidents and emergency measures, monitoring details, reporting procedures and financial guarantee requirements. These and other appropriate information and conditions are described in the Environmental Compliance Certificate (ECC), which is made available to civil society and the public for review. MONREC reserves the right to modify the conditions of an ECC or require the project to revise the EMP at a later date if any new information comes to light concerning adverse impacts during construction and operation.

#### 6.6.2 Draft National Environmental Policy (2017)

The National Environment Policy (NEP) is being updated and is expected to be issued in December 2017, superseding the NEP (1994). This policy will be supported by a strategic framework and relevant master plans and action plans. The strategic framework for NEP itself has been drafted and is subject to consultations. It is expected to be announced in 2017/17. The NEP (2017) builds on the 1994 policy in expressing the following core values:

- The wealth of the nation is its people, its cultural heritage, its environment and its natural resources;
- It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations; and
- Environmental protection should always be the primary objective in seeking development.

The NEP contains 23 policy principles that can be grouped into three broad categories: (i) a clean environment and healthy functioning ecosystems; (ii) sustainable economic and social development; and, (iii) mainstreaming environmental protection and management. Notable principles relating to the hydropower sector are:

- Recognize intangible values of the environment, including economic values of ecosystem services, and call for integrating them in development planning (*principle 2 and principle 12*);
- Call for the generation of energy from sustainable and renewable sources (*principle 10*);
- Call for sustainable management of natural resources and ecosystem (*principle 3, 4, and 5*); and
- Declare the rights of individuals and groups to natural resources and access to a clean environment (*principle 1, 6*).

The NEP also emphasises that past damage to the environment should be considered in present and future development planning.

#### 6.6.3 Draft Environmental Strategic Framework

The Draft Environmental Strategic Framework (2017) falls under the NEP. The following provisions in the Strategic Framework are most relevant to sustainable hydropower, biodiversity conservation, Integrated Water Resources Management (IWRM):

- *Implement a moratorium on new concessions in KBAs*, areas of potential ecological significance for ecosystem services and areas where legitimate tenure rights are yet to be recognized, registered or protected;
- *Develop and implement a national restoration and recovery plan for degraded ecosystems*, which is linked to land use and spatial planning, marine and coastal zone planning, and IWRM, and which builds upon the Forest Restoration Plan;
- Ensure that urban and regional development planning laws and the implementation of the National Urban Policy are harmonised with SEA arrangements for considering development and investment plans or programmes, and with EIA requirements for projects, at the urban and metropolitan levels;
- *Develop and implement a regime for IWRM for all river basins* in Myanmar that is based on inclusive and transparent processes and which sets sustainable water resources development

and abstraction levels for both surface and groundwater resources that ensure water for ecological outcomes.

- *Further investigate the potential for run-of-river and for small-scale hydropower development options to contribute to Myanmar's future energy needs while maintaining the ecological integrity of the country's river systems;*
- *Ensure that hydropower development is undertaken in the context of integrated planning regimes and following full consideration of all project level and cumulative (including downstream) impacts; and*
- *Support investments in new technology and innovative practices for Myanmar's power sector that prioritize clean, low-carbon, renewable and equitable power generation and supply, including prioritization of demand management and efficiency measures.*

## 6.7 Water Resources

Myanmar has high potential for social economic development owing to its abundant water resources. Water is used in all development sectors such as agriculture, hydropower, industry, fisheries, irrigation and livestock as well as being the foundation for all livelihoods. Several agencies and departments under different ministries are involved independently in the water sector (Table 6.3).

**Table 6.3: Summary of department and functions for IWRM**

| Agency   | Ministry  | Function  |
|--|---|---|
| Department of Meteorology and Hydrology (DMH)  | Ministry of Transport and Communication (MOTC)            | Water assessment of major rivers, hydrology, data collection and analysing  |
| Irrigation and Water Resource Utilization Department<br>Department of Rural Development    | Ministry of Agriculture, Livestock and Irrigation (MOALI) | Provision of irrigation water to farmland and operation of irrigation and multi-purpose dams<br>Provision of water to rural communities |
| Department of Hydropower Planning (DHPP)<br>Department of Hydropower Implementation (DHPI) | MOEE  | Hydropower planning and implementation  |
| Directorate of Industrial Supervision and Inspection                                       | Ministry of Industry (MOI)                                | Industrial use, water treatment   |
| Department of Public Health  | Ministry of Health and Sports                             | Environmental health, water quality assessment and control and monitoring water quality   |
| City Development Committee (CDD)   | Yangon, Mandalay, Nay Pyi Taw CDC                         | City water supply and sanitation, water conservation and protection works   |
| Progress of Border Areas and National Races Department                                     | Ministry of Border Areas                                  | Domestic and rural water supply and sanitation  |
| Water Resources Utilization Department (WRUD)  | MOALI   | Pump irrigation and rural water supply  |
| DWIR   | MOTC  | River training works and inland water transport<br>Lead agency for the Ayeyarwady Integrated River Basin Management (AIRBM)             |
| Forest Department  | MONREC  | Watershed management  |
| Department of Fisheries  | MOALI   | Fishery works, monitoring and controlling water bodies  |
| Department of Urban and Housing Development  | Ministry of Construction (MOC)                            | Domestic water supply   |
| Environmental Conservation Department  | MONREC  | Environmental conservation and water resource management  |
| Township government  |   | Organizing the water needs at township,   |

| Agency | Ministry | Function                        |
|--------|----------|---------------------------------|
|        |          | village tract and village level |

Those agencies implement their main duties according to their segregated and sometimes conflicting mandates and an IWRM framework is required to ensure enhanced coordination and consistency.

#### 6.7.1 National Water Resources Committee (NWRC) and policy

The NWRC was formed in 2013 to develop the National Water Resources Policy (NWP), National Water Law and a framework for IWRM for the watersheds, rivers, lakes and reservoirs, groundwater aquifers and coastal and marine waters throughout the country. The committee was abolished in March 2015 by the USDP government and was re-formed by vice president U Henry Van Tio in June 2016. The 20-member committee comprises representatives from the ministries of Border Affairs; Agriculture, Livestock Breeding and Irrigation; Transportation and Communications; Natural Resources and Environmental Conservation; Electric Power and Energy; and Planning and Finance. Other members include the mayors of Nay Pyi Taw, Mandalay and Yangon, the permanent secretaries and director generals of related ministries and departments; and water experts.

The NWRC is now drafting a national integrated water management strategy, a national water resources policy, a water framework directive and a water law to ensure that all future policy development on water resources or subjects that relate to or have an impact on Myanmar's water resources will consider:

- Further development of legal instruments and a system of institutions to protect and manage Myanmar's water resources;
- Strategies, master plans, development plans and projects that relate to or have an impact on Myanmar's water resources.

The guiding principles of the National Water Policy most relevant to sustainable hydropower development include:

- Planning, development and management of water resources need to be governed by common, integrated perspectives considering local, regional, state and national contexts, having an environmentally sound basis and taking human, social and economic needs into consideration;
- Good governance through transparent and informed decision making is crucial to the objectives of equity, social justice and sustainability. Meaningful and intensive participation, transparency and accountability should guide decision making and regulation of water resources;
- Water is essential for sustenance of ecosystems, and therefore, minimum ecological needs should be given due consideration;
- All the elements of the water cycle, i.e., evapotranspiration, precipitation, runoff, rivers, lakes, soil moisture, groundwater and the sea are interdependent; the basic hydrological unit is the river basin, which should be considered as the basic hydrological unit for planning purposes;
- The impact of climate change on the availability of water resources must be factored into water management related decisions. Water-consuming activities need to be regulated keeping in mind the local geo-climatic and hydrological situation.

#### 6.7.2 Ayeyarwady Integrated River Basin Management Project (AIRBMP) and Chindwin River Basin Organization (RBO)

The World Bank is supporting the National Water Resources Committee (NWRC) implement the AIRBMP. The Project aims develop the institutions and tools needed to implement integrated river basin management in the Ayeyarwady Basin. The State of the Basin Assessment (SOBA) report now being prepared as a foundation for an Ayeyarwady Basin Management Planning process covers the following six packages:

1. Surface water modelling;
2. Groundwater and data management;
3. Sediments and geomorphology;
4. Biodiversity and fisheries;

5. Sectoral development, macroeconomics and basin pollution assessment; and
6. 3D mapping and local consultations.

The State of the Basin assessment is scheduled to be completed in November 2017. Similarly, the Stockholm Environment Institute (SEI) and Myanmar Environment Institute (MEI) have been working to set up an RBO for the Chindwin Basin.

## 6.8 Land Use Policy

There are no clear guidelines regarding land rights, resettlement and compensation for loss of land associated with hydropower and development projects. The National Land Use Policy (2015) was adopted in 2015, but there has been no follow-up in relation to the development of a National Land Law or strategic framework to implement the principles set out in the policy.

The General Administration Department (GAD) at the township level is responsible for the acquisition of land under the Land Acquisition Act (1894) when land is required by government. It acquires land from private owners in exchange for compensation. A major problem with land acquisition is that there are no private property rights in Myanmar, with all land considered state-owned. Consequently, the government can legally acquire private land for very low compensation. Another issue with land acquisition for development projects is the concern (real or perceived) within parts of government of land speculation. Some government departments fear that on being informed of the incoming projects, people will buy land from the “real land owners” and subsequently benefit unfairly from government compensation.

Without clear procedural guidelines and without the empowerment of local governance and local stakeholders, these two issues will continue to be significant political obstacles for major hydropower development projects. Although the National Land Use Policy provided guidance to address these issues, the implementation of its principles through comprehensive laws and institutions is yet to occur.

## 6.9 National Planning Instruments

### 6.9.1 National Comprehensive Development Plan (NCDP)

Under the former USDP government the NCDP was adopted to guide Myanmar’s development over the long term (2030). It envisions Myanmar as “a developed nation integrated into the global economy” by the year 2030. To reach that vision, it sets the two long term goals of: (i) building a growing diversified and sustainable economy, and, (ii) ensuring that growth and development is inclusive and people centred. Six macro-indicators called “development outcomes” were set to keep track in realising those two long-term goals (Table 6.4).

**Table 6.4: NCDP vision, long-term goals and development outcomes**

| Vision   | Long-Term Goals  | Development Outcomes                             |
|--|--|--|
| Myanmar as “a developed nation integrated into the global economy” by 2030 | To build a growing diversified and sustainable economy                 | Average GDP per capita growth of 7.2% to 2030    |
|  |  | FDI inflows of USD 8 billion per annum (by 2021) |
|  |  | GDP potential of USD 180 billion by 2030         |
|  | To ensure that growth and development is inclusive and people centered | GDP per capita USD3,000 by 2030                  |
|  |  | Improved governance ratings, aligned to Asia     |
|  |  | Improved wellbeing of a middle income country    |

The USDP government used the Framework for Economic and Social Reform (FESR, 2012) to support the implementation of the NCDP by providing policy priorities to be implemented within the first three years from 2012-2015. The FESR set priority policy actions that supported the long-term visions and goals set in NCDP. It identifies “the quick win” policy actions in ten economic areas of fiscal and tax reform, monetary and financial sector reform, liberalization of trade and investment, private sector development, health and education, food security and agriculture growth, governance and transparency, mobile phones and internet, infrastructure, and effective and efficient government.



### 6.9.2 National Planning Laws

National Planning Laws were also adopted to project annual growth for each sector and the state/regions. The new NLD government also published the planned and actual annual growth for the last fiscal year (2016-2017), indicating that the planning laws will continue to be utilised as an important legal tool in economic planning and forecasting.

Based the National Planning Laws 2016-2017 and 2017-2018, the GDP of the electricity sector is projected to grow during the 2017-2018 fiscal year by 4.8% to a total of 853.4 billion Kyats. This growth rate was anticipated despite a 13.7% sectoral GDP growth in the previous fiscal year (2016-2017), which exceeded the planned growth of 6.5% (Table 6.5). The contribution of 1.3% to total GDP from the sector is slightly lower than the contribution for the current year (1.4%). Meanwhile the energy sector is expected to grow by 3.9%.

**Table 6.5: Planned (2017-2018) and actual GDP growth (2016-2017) for key sectors in the SEA**

| Sectors                 | Planned GDP growth<br>(2016 - 17) <sup>7</sup> | Actual GDP growth<br>(2016 - 17, estimate) | Planned GDP growth<br>(2017 - 18) <sup>8</sup> |
|-------------------------|--|--|--|
| Agriculture             | + 5.4%   | + 0.9%                                     | + 4.2%   |
| Livestock and Fisheries | + 3.1%   | + 1.5%                                     | + 3.4 %  |
| Forestry                | -23.0%   | - 64.8%                                    | + 34.1%  |
| Energy                  | +18.8 %  | -12.7%                                     | + 3.9 %  |
| Industry                | +10.8 %  | + 9.4%                                     | + 11.0%  |
| Electricity             | + 6.5%   | +13.7%                                     | + 4.8 %  |
| <b>TOTAL</b>            | +7.8%  | + 5.7 %                                    | + 7.0 %  |

Privatization across different sectors, including the hydropower sector, will continue to grow in the next few years, which will need to be carefully managed by the GOM to ensure revenue sharing and compliance with environmental, water, land use and social protection laws.

## 6.10 Agriculture, Fisheries and Forestry

Detailed information on planning laws and economic contribution of the agriculture, fisheries and forestry sectors is included in *Chapter 5- Aquatic Ecology and Fisheries* and *Chapter 6- Economics*. The water-energy-food and forest ecosystems nexus will be explored in the impact assessment phase of the SEA to assess the development objectives and targets of hydropower with other key water and land related sectors.

### 6.10.1 Agriculture

The goals of the National Agriculture Policy (2012) are to:

- Emphasize production and utilization of high-yield and good quality seeds;
- Conduct training and education for farmers and extension staff on advanced agricultural techniques;
- Implement research and development activities for sustainable agricultural development;
- Protect farmer's rights and benefits;
- Assist farmers to get fair price for their produce;
- Assist in lowering production costs, increase high quality crop production, developing and strengthening of markets;
- Encourage transformation from conventional to mechanized agriculture, production of crops appropriate to climate and extend irrigated areas;
- To undertake renovation and maintenance works on old irrigation, pumping and underground water systems;
- To support rural development and poverty reduction activities through development of the agriculture sector;

<sup>7</sup> National Planning Law (2016-17)

<sup>8</sup> National Planning Law (2017-18)

- To encourage local and international investment in the agriculture sector for the development of advancement of agricultural technology and commercial agricultural production; and
- To justify and amend existing agricultural laws and regulations in line with the current economic situation.

The draft Agriculture Development Strategy (2016) lists targets for improving sector performance, including:

- Water use efficiency - increased by 40% in five years;
- Land productivity (GDP/harvested area) - USD 1,200 - increased by 50% in five years; and
- Labor productivity (GDP/ agricultural labor) - USD 1,600 - increased by 50% in five years.

### 6.10.2 Fisheries

The National Policy on Fisheries Sector (202?) aims to:

- Promote all round development in the fisheries sector;
- Increase fish production for domestic consumption and share the surplus with neighboring countries;
- Encourage the expansion of marine and freshwater aquaculture; and
- Upgrade the socioeconomic status of the fisheries communities.

The laws pertaining to inland and marine fisheries are:

- Law relating to the fishing rights of foreign fishing vessels (1989);
- Aquaculture Fisheries Law (1989);
- Myanmar Marine Fisheries Law (1990);
- Freshwater Fisheries Law (1991);
- Law amending the law relating to the fishing rights of foreign fishing vessels (1993); and
- Law amending the Myanmar Marine Fisheries Law (1993).

### 6.10.3 Forestry

The Myanmar Forest Policy (1995), consistent with the forestry principles adopted at the United Nations (UN) Conference on Environment Development in 1992, has identified the following six priorities:

- Protection of soil, water, wildlife, biodiversity and environment;
- Sustainable use of forest resources to ensure supply of both tangible and intangible benefits accrued from the forests for the present and future generations;
- Ensure that basic needs of people for fuel, shelter, food and recreation are guaranteed;
- Efficiency to harness the full economic potential of forest resources in a socio-environmentally friendly way;
- Participation of the people in the conservation and utilization of the forests; and
- Public awareness of the vital role of forests in the well-being and socio-economic development of the nation.

The Forest Policy also aims to secure and manage 30% of the total land area under a Permanent Forest Estate (PFE), which comprises reserved forest and protected public forests. *Chapter 4 - Biodiversity* provides detailed analysis on the forest estate, Key Biodiversity Areas (KBAs), protected areas (PAs) and deforestation in all river basins in Myanmar.

## **7 STRUCTURE OF THE BASELINE ASSESSMENT REPORT**

The remaining chapters of the SEA are based around the key themes of the SEA as follows:

Chapter 2- Hydropower;

Chapter 3- Geomorphology and Sediment transport;

Chapter 4- Biodiversity;

Chapter 5- Aquatic Ecology and Fisheries;

Chapter 6- Economic Development and Land Use;

Chapter 7- Social and Livelihoods; and

Chapter 8- Conflict.

The draft Baseline Assessment Report was released as separate chapters to the AG, EGs and public for review and comment from 8 June to 20 July 2017.



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