Myanmar: Pilot introducing the National Water Framework Directive

Ingrid Nesheim, Bente M. Wathne, Bo Ni, Zaw Lwin Tun

Myanmar, IWRM, River Basin Management, EU Water Framework Directive

Myanmar has an abundance of natural resources; including water, oil and natural gas, gemstones, industrial minerals and timber, yet there are still challenges for management. Rainfall is unevenly distributed leading to damage related floods, flash floods, and to water shortages and droughts. Point source discharges and non-point source discharges cause in places poor water quality. To take responsibility for the overall management of national water resources and to facilitate for a coordinated approach, the Myanmar National Water Resources Committee (NWRC) was established in 2013. The NWRC adopted in 2014 an important policy framework entitled, the National Water Framework Directive (NWFD). This policy framework, inspired by the EU WFD covers principles such as river-basin management, good ecological status of water bodies, integration, and stakeholder participation. This paper presents the NWFD and a project initiative to pilot introduce its principles in the Sittaung River Basin in Myanmar. A brief overview of Myanmar’s environmental and socio-economic situation is presented along with information on general governance of water resources in Myanmar. To support the pilot introduction of the IWRM concept, the project also involves IWRM technical components, such as a special surveillance programme for Inlay Lake, the upgrading of a water quality lab, a water quality database, and water quality criteria. The rational for the project is to learn from the experiences gained through this pilot initiative of river basin management approach for future benefits in Myanmar.

Introduction

Myanmar, previously known as Burma, the largest country in Mainland South East Asia has received international attention because of its abundance of natural resources including water, oil and natural gas, gemstones, industrial minerals and timber, and because of its past as a closed military regime. For several decades, roughly the period between 1962 and 2011, the country was under direct or indirect control of the military and almost all aspects of society were nationalized. This situation led to strict international economic and diplomatic sanctions and by the mid 1980’s the country was impoverished. Driven by political and social protests, in 1988 the newly established military government, The State Law and Order Restoration Council (SLORC), adopted several policies and regulations to open and liberalize the economy [1]. The one party military rule, however, continued until 2011 and alongside the international economic and diplomatic sanctions. The SLORC continued to rule the nation until 2011 when a nominally civilian government, entitled “Union Solidarity and Development Party” replaced the military government as a result of the first multiparty election in twenty years[2]. U (Mr.) Thein Sein, a former military commander, but a moderate reformist, was then sworn in as president of the country. U Thein Sein has during his years as president been responsible for a gradual democratization process leading up to the first free democratic elections with international observers last November 2015. His term as president is set to end on 31 March 2016, as recently the National League for Democracy (NLD), the party of Daw (Mrs.) Aung San Suu Kyi, won the November election. The new NLD government formally took place on April the first with Htin Kyaw as appointed president.

Parallel with the liberalized regulations and policies, foreign investment has since the late 1980s increased. Firstly by other Asian countries and in particular China, but then following the democratic moves in 2011–2013 and the lifted sanctions, a number of companies have invested to gain a part in the country’s rich natural re-
sources. However, foreign investment and an increasing population have caused unsustainable exploitation of natural resources with a negative impact on biodiversity, water quality and quantity causing a burden particularly on the poor. The environmental legislation for the sustainable utilization and for the protection of the country’s natural resources has until recently been very weak. The country has lacked environmental standards and a framework for environmental impact assessments (EIA), important and necessary tools for sustainable development. Furthermore, environmental responsibility has been fragmented and placed with the sector ministries themselves, in general an unfavorable situation as a sector policy goal is often in conflict with environmental conservation. Until 2011 with the establishment of the Ministry of Environmental Conservation and Forestry (MOECAF), no ministry had overall responsibility for environmental matters. MOECAF has been designated the responsibility for the protection and conservation of wildlife and sustainable management of the forest resources and ecosystems. With regard to the water resources, it is the National Water Resources Committee (NWRC) established July 25th 2013 consisting of members from several ministries, which is the highest authority on water resources management. In December 2014 the NWRC adopted an important policy framework entitled the National Water Framework Directive. This policy framework, inspired by the EU WFD, includes seven important principles for an integrated water management including the river basin management approach.

Myanmar’s environmental and socio-economic situation
Myanmar shares borders with Bangladesh and India to the west, and China, Laos and Thailand to the east (Figure 1). There are three main geographic regions: the more remote mountainous regions in the north, the dry-land in the central area, and the delta area in the south. The overall climate is tropical monsoon where three distinct seasons can be identified. The cold season occurs in the months from November to January, followed by the dry season from February to April and then a wet season from May to October. Ninety percent of the annual rainfall is received during mid-May to mid-October, with between 5,000 mm in the south, and 750 mm in the central area of Myanmar. The present total population counts 51 million multi-ethnic people based on the census of April 2014 [4]. Among these, the Bamar account for approximately two-thirds, the Shan and Kayin population each account for approximately 10 percent, while the Wa, Chin, Akha, Kachin, Kayar (Karen), Lahu, Kokang, Tavoyan, Pa-Oh, Naga, Mon, Kayan, Rakhine (Arakan), Palaung, Danu, Indian, and Chinese population vary from under 1 percent to 3.50 percent [5]. The majority of the country’s ethnic groups live in states along the border areas. Approximately 70 percent of the population live in rural areas and are subsistence farmers. Most of the agricultural area is cultivated with rain-fed rice, but irrigated areas have steadily increased to up to 27 percent of total cultivated area the recent decades to provide for cultivation of two to even three crop cycles in the year [6]. It is the delta area region, including the Ayeyarwady, Bago and Yangon region, which is most densely cultivated. Seventeen larger dams have been constructed for irrigation and hydropower production. There are six ongoing large irrigation dam projects, and several more are planned. In addition to irrigation, the rivers are important for transportation of agricultural products, for navigation among villages, and as sources for hydroelectric power. Yet, Myanmar’s water resources are largely undeveloped. The catchment area of Myanmar’s

Figure 1: The map shows the location of Myanmar and its states and regions, the capital of Nay Pyi Taw, and the commercial capital of Yangon. Source: tny.de/myanmar_map
eight principle river basins (Figure 2) comprises about 737,800 km². The average inflow of water is 1,081.3 km³ while current utilization comes to about 39.55 km³ (3.7 percent) of total [6], hence potential future utilization of water resources is large. Besides water for irrigation of agriculture, water for hydropower is of significant interest and only 2,660 MW of an estimated potential of more than 100,000 MW from the country’s rivers have been developed [7].

Despite Myanmar’s abundance of natural resources, there are still challenges for management. Rainfall is unevenly distributed leading to damage related floods, flash floods, and to water shortages and droughts. Exacerbating these challenges are mining and logging activities along the upper reaches of river basins causing erosion and sedimentation. Over the years, heavy deforestation has taken place in various parts [8]. Rainwater in deforested areas bring along large amounts of sediment towards streams and rivers. The increase in rainfall-runoff has resulted in higher floods with shorter duration and increased sedimentation in the lower reaches of rivers. This is shown in negative effects on the operational life of hydropower and irrigation supply reservoirs by reducing their storage capacity. An important aim is for rainwater to be absorbed by thick forests and forest soils for subsequent filling ground-water sources. Industrial development, the use of agro-chemicals, mining activities, and the almost complete lack of waste water treatment plants and of collection of waste in general in the country place a high burden on water quality in rivers and lakes. The previous lack of legal planning framework and the lack of a participatory approach in the laws have increasingly been problematic for the governance of natural resources in Myanmar. Presently, however, Myanmar places high priority on enhancing the protection of its biodiversity and habitats. The president U Thein Sein has in many cases emphasized the need to ensure that economic growth has to be environmentally sustainable and inclusive to secure the natural resources on which a large percentage of Myanmar’s human population still depends [10, 11].

**Governance of water resources**

Prior to 1989, no governmental agency had responsibility for controlling the impacts of pollution discharge, water abstraction or retention. Environmental impact of actions was the responsibility of each sector authority until the Ministry of Foreign Affairs (MOFA) first took some responsibility over environmental matters in 1989, as part of actions to authorize domestic environmental protection issues [12]. However, as there has been a lack of an existing framework for Environmental Impact Assessment of development projects, in reality sectoral responsibility for environmental impacts has been the general situation until very recently. In 2011, the Ministry of Forestry was reorganized to have responsibility for environmental matters and the ministry was renamed as Ministry of Environmental Conservation and Forestry (MOECAF). The designation of an environmental ministry placed environmental protection on the development agenda. MOECAF is responsible for monitoring all development activities so that those activities do not lead to the occurrence of deterioration and degradation of the natural environment in the country. The Environmental Conservation Law was adopted in 2012, and a department under MOECAF, the Environmental Conservation Department, has been developing a framework for an Environmental Impact Assessment. However, institution and capacity building for the operationalization of the EIA framework is still greatly needed in the country [9]. The number of governmental institutions identified as having some responsibility for water issues number around 17 institutions (Table 1). Furthermore,
and more serious is the situation of lack of transparency between ministries and departments. Monitoring data on water quality and hydrology collected by one department are not shared among departments (personal communication in 2015).

To take responsibility for the overall management of national water resources and to facilitate for a more coordinated approach, in 2013, the Myanmar National Water Resources Committee (NWRC) was established by a presidential degree. The overall mandate of the

Table 1: A number of institutions in Myanmar are working on water related issues. The table overview is adapted from a seminar presentation in the Netherlands, 2013. Source: Win Hlaing

<table>
<thead>
<tr>
<th>Ministry</th>
<th>Function</th>
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<tbody>
<tr>
<td>Ministry of Transport</td>
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<td>Department of Meteorology and Hydrology</td>
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<td>Directorate of Water Resources and Improvement of River Systems</td>
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<td>Ministry of Agriculture and Irrigation</td>
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<td>Ministry of Electric Power</td>
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<td>Ministry of Industry</td>
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<td>Factories</td>
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<td>Ministry of Livestocks Breeding, Fisheries and Rural Development</td>
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<td>Myanmar Fishery Enterprise</td>
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<td>Ministry of Construction</td>
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<td>Department of Rural Development</td>
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<td>Ministry of Construction</td>
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<td>Ministry of Science and Technology</td>
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<td>Technology University</td>
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<td>Township level</td>
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<table>
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<th>Functions</th>
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<tr>
<td>Water assessment of major rivers</td>
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<tr>
<td>Data collection and analysis</td>
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<tr>
<td>Ensuring safe navigation on rivers and creeks; protecting the river systems for the beneficial utilization of the public, monitoring of water quality river training, river dredging, navigation, river bank protection and river water quality monitoring</td>
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<tr>
<td>Provision of irrigation water to farmland, and monitoring of water quality irrigation water supply, construction, operation and maintenance of irrigation dams and flood protection embankments, agriculture water quality monitoring</td>
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<tr>
<td>Pump irrigation and rural water supply</td>
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<tr>
<td>Reforestation and Conservation of forests</td>
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<tr>
<td>Environmental conservation and management</td>
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<tr>
<td>Hydropower generation</td>
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<tr>
<td>Industrial use, water treatment</td>
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<tr>
<td>Fishery works, monitoring and controlling water body</td>
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<tr>
<td>Domestic and rural water supply and sanitation</td>
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<tr>
<td>Environmental Health, Water quality assessment and control, monitoring water quality</td>
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<tr>
<td>Domestic water supply</td>
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<tr>
<td>City water supply and sanitation, water conservation and protection works</td>
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<tr>
<td>Water resources management related activities, especially consultation</td>
</tr>
<tr>
<td>Training and Research</td>
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<tr>
<td>Organizing water needs, conservancy needs</td>
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NWRC is institutional strengthening including formulation of proper national water policy, law, a national water framework directive, and capacity building to related stakeholders. An important decision made by the NWRC in 2014 was to transform governance of water resources; going from a sectoral approach to integrated river basin management. It is particularly the National Water Framework Directive (NWFD), a holistic policy framework adopted by the NWRC, which emphasize the principle of the River Basin Management approach and the development of River Basin Management Plans. This policy framework will provide an important baseline for the development of a new holistic water law, a development which the NWRC is responsible for. The current water legislation is fragmented and environmental responsibility is divided among sectors in line with the principle of sector responsibility but with little coordination. The NWFD is inspired by the EU WFD in that it parallels several of the same principles as those in the European directive, including among others River Basin Management. While the EU WFD, however, is a law and a detailed operational framework, the NWFD is not a law, but rather a quite brief policy framework of seven described principles.

**Myanmar National Water Framework Directive (NWFD) includes the following seven key principles:**

- **Principle (1):** Good status i.e. clean and sufficiently stored for all ground water and surface water (rivers, lakes, transitional waters, and coastal waters) in Myanmar.
- **Principle (2):** National Water Budget; a National Water Budget must be estimated under the current hydrological and meteorological conditions taking into consideration of the Climate Change impacts already visible. The groundwater must achieve “good quantitative status” and “good chemical status” (i.e. not polluted) by 2020. Classification of groundwater bodies, “good” or “poor” according to the current status, should be examined.
- **Principle (3):** The ecological and chemical status; the ecological and chemical status of surface waters should be assessed according to the following criteria: Biological quality (fish, benthic invertebrates, aquatic flora); Hydro-morphological quality such as status of river banks, river bank structures, river training works, river continuity or substrate of the river bed; Physical-chemical quality such as temperature, oxygenation and nutrient conditions.
Principle (4): Cooperation between the Union Government and the States and Divisional Governments; the proposed Directive requires local governments (States and Divisional Governments) "to encourage the active involvement of interested parties" in the implementation of the Directive.

Principle (5): Spatial management of river basins; all major basins in Myanmar need River Basin Development Plans, which provide a clear indication of the way the objectives set for those river basins are to be reached within the required timescale. Local Governments have to cooperate and work together for the management of the river basin. River Basin Development Plans should be updated every ten years.

Principle (6): Transgressions; the River Water Transfer projects are very popular due to water scarcity around the world and heavily criticized as being contrary to the principles of Sustainable Water Resources Management of River Basins. Therefore this topic should be addressed in a proper manner.

Principle (7): Restructuring Process; citizens of Myanmar expressed their concerns over water scarcity, safety and water pollution issues through media and various workshops as well as direct communication to the President’s office.

The pilot IWRM project in Myanmar

An IWRM approach involves the river basin management approach for the development of a river basin plan – based on a collaborative effort by sector and environmental authorities across administrative borders like states, regions, towns, and municipalities. All the sectors that have responsibilities for water use and water environment should co-operate in making a water management plan that ensures a healthy aquatic environment, and satisfy the water use interests in a sustainable, fair, and well-balanced manner. The project described below aims to pilot introduce this concept in a case study river sub-basin within the Sittaung River Basin in Myanmar. The rational is to learn from the experiences gained in the project on failures and success for future benefits and for a successful future overall implementation of the NWFD principles in Myanmar. To support the pilot introduction of the IWRM concept, the project also involves IWRM technical components, such as a special surveillance program for Inlay Lake (Figure 3), the upgrading of a water quality lab, a water quality database, and water quality criteria. These components are described below.

Pilot introduction of a systematic water management for the production of a River Basin Management Plan

The project will pilot introduce the River Basin approach in the Sittaung River Basin. A proposal for a coordination arena for the discussion of cooperation of practical water management activities among different actors, i.e. the relevant state/region, district, city and township authorities, will be presented. This will involve presenting an alternative set up for decision making, considering historic practices and norms in Myanmar and experience from river basin based management in other countries. The proposal will be based on workshops and subsequent interviews with different regional and national sector authorities. Integration across different authorities that represent the different water use interests, e.g. fishermen, farmers, timber floating, drinking water, hydroelectric power, transportation, etc. is central. The proposal for coordinated decision making will also include a set up for consultation with stakeholders and civil society. The public and their stakeholders are important groups that should be allowed to influence on the water management, though in a more indirect way, via information meetings, hearings, etc. The groups that should cooperate in making the water management plans are:

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The Norwegian Institute for Water Research (NIVA) is Norway’s leading institute for fundamental and applied research on marine and fresh waters. The institute has over 200 employees, with professional backgrounds in a broad spectrum of disciplines including chemistry, biology, limnology, geology, hydrology, environmental technology, ecotoxicology, oceanography, geography, resource management and environmental economics.

NIVA’s research comprises a wide array of environmental, climatic and resource-related fields. The scientists at NIVA combine research, monitoring, evaluation, problem-solving and advisory services at international, national and local levels.

NIVA’s broad scope of scientific competence, research expertise and long-term environmental data series are important to Norwegian business and industry, public administration on municipal, regional and national levels; and the initiatives help promote Norway’s interests in international fora. In addition, NIVA has extensive experience in international research cooperation with international assignments accounting for about 20% of its turnover.

NIVA was founded in 1958. Head Office is at the Oslo Innovation Centre /CIENS in Oslo, with regional offices in Bergen, Grimstad, Hamar and Copenhagen, as well as a large scale research facility in the Oslo Fjord and several wholly or partly owned subsidiaries.
For the different administrative units (Regions/States, Districts, Cities, Townships)

- Different sectors (Environmental, Agriculture, fisheries, forestry, drinking water, transportation, industry, hydropower, etc.)
- Stakeholders and civil society

For the practical water management tasks we will demo-conduct the different practical tasks of the River Basin Management approach in the Bago Sub-basin (Figure 4 and 5). The overall purpose of these tasks is to provide information which can be complied into a River Basin Management Plan for the Bago Sub-basin. The tasks which will be demo-conducted consist of:

- Characterization, identification of water bodies, categorizing/operational monitoring of water bodies, pressure analysis, risk assessment, economic analysis of water use, Classification
- Prioritize water management issues
- Environmental goals
- Identification of potential measures, prioritize among measures
- Program of measures to reach the goals
- Water management plan
- Surveillance monitoring

**Monitoring of water quality**

We will mainly conduct operational monitoring and surveillance monitoring in Bago River and in Inlay Lake. Operational monitoring should serve as basis for abatement measures, and is therefore needed as part of the process of developing a River Basin Management Plan. A surveillance monitoring program is needed for monitoring and evaluating the effectiveness of IWRM activities in the basin. A separate surveillance program for monitoring of Inlay Lake will be elaborated to study and follow the development of water quality in this lake of very special national interest. While working with classification of the status of the water bodies, some time and effort will be used to propose and/or give input to national water quality standards for Myanmar, chemical, biological and bacteriological.

Regarding the chemical quality elements, water samples from Bago River and Inlay Lake will be analyzed for Chlorophyll-a, total phosphorus, free phosphate, total nitrogen, nitrate and ammonia. In addition to these key eutrophication parameters, standard water chemistry as pH, turbidity, conductivity, oxygen and water color, will be analyzed. Regarding the biological quality element, samples for qualitative and quantitative phytoplankton composition will be taken. Periphyton and...
benthic macroinvertebrates are, however, more related to river monitoring, and will be mainly included in the Bago River monitoring, while operational monitoring in Inlay Lake includes the biological quality elements that are most impacted, namely phytoplankton and aquatic macrophytes. The monitoring will also include composition and biomass of cyanobacteria (blue green algae) and hygienic parameters as coliform bacteria, indicators of the waters availability for drinking purposes.

**Environmental goals, abatement measures and water management plans**

Based on the operational monitoring of water quality, ecological status of water bodies will be described. An assessment of water body status also needs to consider water quality criteria; with respect to assessing the state of the water ecology, and with respect to assessing if the water quality is good enough for different water uses, such for drinking water, irrigation water, and food processing water. Based on the need of loading reduction, a pollution budget will be made to find out which source has to be reduced and how much. The pollution budget will be an important input for a discussion of environmental short term goals with authorities and stakeholders and will form the ground for identification of potential measures for reaching the goals.

A prioritized program of abatement measures will be proposed considering efficiency of measures, acceptance among stakeholders, and economic efficiency i.e. environmental improvement per invested money unit. For the aspects of water bodies that are in good state, proposals will be given for protective measures to prevent a negative development in the future.

A proposed River Basin Management Plan (RBMP) for the Bago Sub-basin will be developed in a way that is appropriate and acceptable for all stakeholders at the time of agreement (see UNESCO guidelines [13]). The RBMP will present the different elements of the cyclic and systematic water management; the characterization element i.e. water quality and hydrology aspects, human uses and users and the different pressures and development issues, a proposed monitoring program for the sub-basin, the pollution budget, and the prioritized measurements including arguments for the selected measurements with reference to economic efficiency. And finally, an overview of all consultations with stakeholders and civil society will be described. A draft version of the RBMP will be available for commenting by actors and stakeholders.

**Database for monitoring and water management**

A good database to manage environmental data is a key tool in IWRM. A water quality database will be developed for storing, analyzing and presenting monitoring data. The database has a general structure so that it can be used for both Bago River and Inlay Lake and as a basis for a national water quality database for Myanmar. GIS will be used to present results through maps and to serve as a management basis for the authorities and for public information. As there are several database initiatives, the project will make sure that export and import of data can easily be handled.

**A national water quality laboratory**

A laboratory is necessary for water quality monitoring, for environmental impact assessment, control of drinking water and for quality check of food processing water. The project will contribute to enabling of such activities by upgrading and modernizing the laboratory at Forest Research Institute (FRI) in Nay Pyi Taw. Key personnel will undergo training as part of the project. The lab will be able to analyze standard water quality parameters as pH, conductivity, turbidity, color, nutrients (P, N), chlorophyll, suspended solids, coliform bacteria, dissolved oxygen, biological oxygen demand, chemical oxygen demand, etc. At later stage, instruments for analysis of heavy metals, organic micro-pollutants like pesticides, PCB, will be provided.

**Challenges and recommendations**

The long term history in Myanmar including highly centralized governance, and a complete lack of transparency in environmental data for decision making is clearly an important obstacle for implementing IWRM in the country. Adding to this situation, the extreme bureaucratic and hierarchic process needed prior to meetings or other initiatives is reducing efficiency. Another challenge for an integrated decision making is the current and historic few existing mechanisms for...
stakeholder and public participation. A low tradition of public participation often also results in a situation of low engagement and little faith in government initiatives. The transformation from a sector approach to an integrated river basin management approach involves the implementation of new coordinating arenas, and new procedures to be followed. Guidelines for IWRM implementation should provide a set up for decision making within coordinating arenas; and rules for stakeholder participation. Such rules should describe how stakeholder participation should be facilitated for, ensured, and how input from stakeholders should be responded to. There is a need to specify how new administrative costs of the new procedures can be supported or covered.

Reaching the goal of good ecological status as stated in Principle 1 of the NWFD requires implementing measures, which may be costly and which may require changed behavior of actors. Lack of financial means, and low acceptance and willingness to change behavior may be important obstacles for reaching this overall goal. In particular different policy goals of different sector authorities which might contradict the goal of good ecological status can be a challenge. Related to decision making a clarification of the authority of National Water Resources Committee relative to other sector authorities, an other national committees is needed. Clarification of authority is important when having to make trade-offs among different national and sectoral policy objectives. Lack of such clarification is likely to cause confusion and inefficient decision making.

No ecological standards for surface water exist. It is necessary to adopt/develop criteria for describing chemical status, hygienic status, and ecologic status for the different main ecological water types in Myanmar. Thresholds for good ecological status will be different for a water body in mountainous area compared to one in the river delta area. Standards and environmental information should be published on an openly available national webserver. Currently, no register of water users exists in Myanmar. There is a need to develop a national register of all main water users. As the users and the uses of water are so divergent, it is for regulation purposes practical to specify different water use regimes. There is also a need to determine how to prioritize between different uses and users of water in case of water shortages.

To sum up, for the implementation of the principles outlined in the NWFD in Myanmar, elaborated guidelines for their implementation are needed. The NWFD describes some important principles to be applied, however, the policy framework does not provide for operational water management procedures.
The military one party government SLORC was renamed in 1997 as the State Peace and Development Council until its dissolution in March 2011. The military of today continues to have a strong position in Myanmar.

The general election was the fifth step in the seven-step “roadmap to democracy” proposed by the State Peace and Development Council (SPDC) in 2003 [2]. The National League for Democracy boycotted the election because the party did not consider the election as free and democratic. The United Nations expressed concern about the fairness of the election, widespread irregularities, such as advance bulk voting by local officials, were reported in some regional areas [3].

Presently, a draft framework for an Environmental Impact assessment authorized by the Environmental Conservation Department is available [9]. The draft is operationalized (personal comm. Environmental Conservation Department 2015).

The National Water Resources Committee is mandated by the Ministry of Transport.

The project is based on a formal collaboration with the Ministry of Environmental Conservation and Forestry (MOECAF). MOECAF, the Ministry of Agriculture and Irrigation (MOAI) and the Ministry of Transport (MOT) are included in the project’s steering group and contribute to the project work.

Check the references:

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