



Netherlands Commission for  
Environmental Assessment

# Quick Scan (Review) of the National Water Resources Master Plan

Memorandum by the NCEA

## RWANDA



4 August 2015



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## Advice of the Secretariat

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**To** Rwanda Natural Resources Authority (RNRA), Water Resources Department

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**From** The Netherlands Commission for Environmental Assessment (the NCEA)

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Rwanda, draft January 2014

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# 1. Introduction

In recent years, Rwanda has developed a policy framework for Integrated Water Resources Management (IWRM) as its key policy approach to managing its water resources. Among others, a National Water Resources Management Plan (NWRMP) has been drafted. For the NWRMP, as well as any future catchment level management plans, Strategic Environmental Assessment is required by Rwandan Law<sup>1</sup>, supported by General Guidelines and procedures for SEA from June 2011. Even though a formal screening list, determining whether a plan should be subject to SEA or not, does not yet exist, the law recognises that SEA is a vital tool for cases where environmental assessment is required for master plans for the development of regions and sectors. The NWRMP (sectoral master plan) and subsequent catchment plans (regional sectoral plans) obviously fall under this requirement.

In 2013, the Netherlands Commission for Environmental Assessment (NCEA) published a scoping report<sup>2</sup> advising to carry out an SEA for the NWRMP and the subsequent catchment plans. On the Master Plan, which at the time was scheduled for finalisation end of 2013, the NCEA concluded:

*... that if all of the proposed elements will be developed as foreseen, the Master Plan will become the main document guiding IWRM implementation in the next five years and will therefore be of key importance to the Water Department as its key reference point for IWRM practice;*

*... that the reliability of the information base for the IWRM master plan will be limited. While this seems sufficient for general planning at national level, decision-making should take into account that for catchment level planning, more detailed information will be needed through an up-to-date monitoring system;*

*... that further detailed catchment assessments are an absolute necessity before any final planning decision can be taken at catchment level;*

*... that the current master plan development process may overlook important water related environmental/ecosystem services. As a result, some uses may be neglected, potentially creating conflicts, which IWRM ought to avoid and manage. This may be solved by a participatory planning process at catchment level.*

*... that the master plan validation process would merit the use of SEA as a tool to provide independent information to the decision making process, and allow for the required ownership by the RWRD and other parties.*

The NCEA then outlined Terms of Reference for such an SEA, as well as generic ToR for SEA for future catchment plans. Nevertheless, for reasons unknown to the NCEA, the recommendation to carry out an SEA for the NWRMP has not been taken up so far.

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<sup>1</sup> Rwanda's Organic Law on the Environment (N04/2005) in Ch4, art 67

<sup>2</sup> NCEA (2013) Scoping Advice for the Dutch IWRM support programme, Available at:

[http://api.commissiemer.nl/docs/mer/diversen/095\\_sea\\_scoping\\_adv\\_dutch\\_iwrm\\_rwanda.pdf](http://api.commissiemer.nl/docs/mer/diversen/095_sea_scoping_adv_dutch_iwrm_rwanda.pdf)

## 1.1 Request for review

As of 2015, the Netherlands is supporting the implementation of IWRM in Rwanda through a 4-year technical support programme (2015–2019). A Dutch–Rwandan International Support Unit (ISU) is being created at the Rwanda Natural Resources Authority (RNRA) to carry out the programme. Among others, IWRM catchment plans will be developed in four demonstration catchments. For each of these catchment plans, Strategic Environmental Assessment (SEA) will be carried out.

The NWRMP itself is in its final stages of approval and an SEA would come too late to influence the plan itself. However, as stated by the Director of the Water Resources Department of the RNRA, an SEA would have been a good input to inform catchment planning. The Director (by e-mail of 8/7/2015) therefore requested the NCEA to conduct a review of the NWRMP and related documents, even though an SEA has not been done. Purpose of the review was to assess instead whether, from an SEA perspective, environmental and sustainable development concerns are integrated into the NWRMP, and whether it takes into account all relevant water-related services in a consistent way, allowing reliable planning for future catchment level management of water resources. In the case of shortcomings, the consequences for catchment planning are assessed and recommendations are given for actions or supplementary information needed to address these shortcomings. These recommendations can be considered an input for the upcoming catchment planning or can be addressed in a future update of the NWRMP itself. SEA for catchment planning in four demonstration catchments will start in September 2015, through a series of SEA scoping workshops organised by the Dutch–Rwandan IWRM programme and facilitated by the NCEA.

## 1.2 Approach to this Quick Scan

As time for drafting this advice was restricted to 3 days only, the NCEA had to limit the scope and approach of its review, which took the form of a Quick Scan. This advice is a so-called NCEA 'Advice of the secretariat', for which a team was formed consisting of one NCEA technical secretary (Ms Gwen van Boven) and one external expert (Mr Roel Slootweg).

Both reviewers visited Rwanda in December 2012 in relation to the earlier mentioned NCEA advice on scoping for SEA for IWRM in Rwanda<sup>3</sup>, and are as such familiar with the issues addressed in the NWRMP. A national level workshop with 40 participants representing some 20 organisations in the water sector, predominantly from government, was part of this mission. This workshop revealed important issues and priorities related to water management and linkages to other policy fields. The resulting NCEA scoping advice presented three sets of ToRs, one of which was specifically aimed at the SEA for the NWRMP. This particular ToR has been used as reference for this current review advice and can be found in annex 1.

In 2013, the draft NWRMP was planned to be subjected to a validation process involving the various relevant departments. As the plan itself appeared to be developed in relative isolation by consultants, this validation process was considered an important step in ensuring whether the plan is consistent with existing government policies and to create ownership among government departments. Whether the validation process has been carried out and whether

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<sup>3</sup> NCEA (2013) Scoping Advice for the Dutch IWRM support programme, Available at: [http://api.commissierner.nl/docs/mer/diversen/095\\_sea\\_scoping\\_adv\\_dutch\\_iwrm\\_rwanda.pdf](http://api.commissierner.nl/docs/mer/diversen/095_sea_scoping_adv_dutch_iwrm_rwanda.pdf)

relevant government departments have provided their inputs is unknown to the NCEA. The available documents date from before the planned validation process. The following documents were available for review:

- Consultancy services for development of Rwanda National Water Resources Master Plan, tender number 021/rnra/2011–2012:
  - Master Plan Report – Main Volume, draft January 2014 : 226 pp. – this report contains three core products: i) the Master Plan, ii) the Water Management Information System, and iii) the institutional and legal road maps.
  - Exploratory phase report – executive summary, final version, February 2014: 17 pp. This report provides background information on methodologies and gives valuable conclusions and recommendations for further work.
  - Master Plan Report – Executive Summary & Policy Brief, final version, February 2014: 27 pp.
  - Master Plan Report – appendix 05nnyl: Catchment Master Plan<sup>4</sup> – NNYL draft, December 2013: 89 pp.

In the following chapters, we first present our key observations and recommendations with a specific focus on catchment planning (chapter 2). In chapter 3, we elaborate in detail how we have come to the key conclusions, by providing observations for each requirement of the ToR, including recommendations on how to proceed.

## 2. Key observations and recommendations

With the elaboration of the National Water Resources Master Plan, Rwanda has made an important step towards water resources management. The NWRMP (and underlying documents) provide information that was previously lacking or less accessible, especially in relation to water quantity, and potential surpluses and shortages of water. This is relevant information to understand water availability and potential stresses when compared to current and expected future water use.

However, the NWRMP provides little information on water quality and does not address all water-related issues nor the social and economic development issues linked to water. The NWRMP is an elaborate water balance study with projections into the future; it is not a master plan as such. The NCEA specifically observes the following shortcomings:

- first and foremost, the NWRMP appears to make (sometimes implicit) choices for development solutions while overall, the water related development issues are not clearly identified. If the problem is poorly understood, how to know whether proposed measures are appropriate?
- data and information used in the NWRMP are characterized by a high level of uncertainty/unreliability. While this is recognized as such at different levels in the NWRMP, it does not lead to prudence in the selection of projects when drafting catchment master plans;

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<sup>4</sup> Other catchment master plans have been drafted, but have not been made available for this review. The NCEA assumes this example to be representative for other catchment master plans, so that recommendations apply to all.

- the NWRMP seems to have been developed in relative isolation, with limited participation of stakeholders, or consistency checks with relevant sectors plans;
- all in all, the status of the NWRMP as well as of the catchment plans is unclear. Only one catchment plan was available for review, but apparently 9 have been produced. It is also unclear what kind of decisions they are supposed to facilitate. It is unclear how they relate to the catchment plans that will be developed in the Dutch–Rwandan IWRM programme.

With limited understanding of actual development needs, pertinent sector plans or stakeholder involvement, it would be risky to make far reaching choices for water resources management interventions. The NWRMP is ambivalent in its messages; on the one hand it stresses the limited reliability of the information, yet it can be interpreted as making concrete choices on IWRM projects at the level of catchment master plans. These choices have been made only to provide a very rough quantification on future water supply and demand; they do not imply concrete choices. Nevertheless, the risk of misreading is real.

- With respect to the NWRMP itself, the NCEA recommends prudent use of the document and to treat it in essence as a hydrological balance study, providing important information for management purposes at national level, but not as a master plan, making choices for development options. For this purpose, the current document does not contain sufficient basis.
- For the purpose of catchment planning, the NCEA recommends to carry out a pro-active SEA for each catchment plan, well-timed to be able to influence the catchment plans themselves. The NCEA also recommends to develop the ToR for these SEA interactively by involving key sector representatives, allowing consistency checks, and involving diverse stakeholders allowing a proper identification and assessment of actual development needs and possible sustainable solutions. As a basis, the earlier developed generic ToR for SEA for catchment planning can be used.

### 3. Detailed observations and recommendations

The structure of this chapter follows the ToR for the SEA for the NWRMP, developed by the NCEA (Annex 1). These ToR required an assessment of impacts and alternatives, focussing on a number of aspects, in six steps. These have now been reviewed and include:

1. Planning process management
2. Reliability and representativeness of data
3. Master Plan methodology and sustainability
4. Alternative development options and scenarios
5. Transboundary effects
6. Institutional arrangements

Within each step, substeps are given (*in italics*) that were also derived from the ToR.

#### 3.1 Planning process management

This refers to SEA in relation to planning process management. Since no SEA was carried out for the NWRMP, a review of these recommendations is not relevant and was left out.

#### 3.2 Reliability and representativeness of data

- a) *Assess the quality and reliability on the availability of water. Indicate where a cautious approach in the use of the available data is necessary.*

The NWRMP provides a first ever overview of catchments defined by hydrological boundaries, water balances showing surpluses or deficits at catchment level, with rough estimates for the future based on estimative water demand development and resources development potential. Such a valuable information gathering exercise is an enormous step in the development of effective IWRM in Rwanda. Climatic water balances (not taking into account human use) provide valuable insight in water availability, over time and space.

Rainfall monitoring data is generally satisfactory. However, the master plan itself (NWRMP p. 156) already points out a number of inherent weaknesses in the other available data:

- *surface water monitoring data is generally good for large catchments but station data is insufficient, lacking absolute topographic reference level, discharge measurements are absent or at best out of date. For small catchments the monitoring is not sufficient;*
- *groundwater monitoring data is systematically unavailable;*
- *water quality monitoring is insufficient.*

The report further states that '*analysis of data is typically done within the framework of a project. Hence, government spends substantial efforts in the collection of water resources data but these data are mostly not professionally handled and analysed*' (NWRMP p. 156).

The data are aggregated at catchment level and as such do not provide any insight on water distribution and water related services within a catchment. It is sufficient to obtain an overview at national level of distribution patterns of water availability over time and over catchments, but for catchment level planning this is insufficient.

The NCEA concludes that, given the importance of the master plan as a guiding document for IWRM in Rwanda, it is of utmost importance to understand the inherent weaknesses of the document. The data provide order of magnitude information aggregated at catchment level 1

(i.e. sub-catchments of the Nile and Congo basins). The coarse character of the information makes it appropriate for providing an overview of water quantity issues at national level, to a certain extent highlighting the main quantity related issues at catchment level; the information however is not sufficient for catchment level planning.

- Given the inherent weaknesses of the data used to develop the NWRMP, the NCEA recommends to cautiously use the NWRMP in catchment planning, and only as a basis for the analysis of the development potential provided by water resources in a catchment, in order to address the development needs of the population.

b) *Assess the quality and reliability of water supply and demand per catchment.*

For the water demand data per catchment, even more estimative figures had to be used. Based on existing population data, growth projections thereof and identified development opportunities, water balances (water resources – water demand equilibriums) for the current situation and for 2020, 2030 and 2040 future dates have been estimated for the nine catchments. For example:

- According to the plan (NRWMP p. 37), *'information on actual water use in Rwanda is scarce and incomplete. Water use for other purposes (all industrial, ecological, administrative, emergency, ornamental, etc.) when not included in the EWSA production systems, remains unaccounted for'*. Water demand thus remains a highly hypothetical figure based on assumptions. For 2012, for example, the calculated water demand was twice the actually recorded water use (p. 7 exploratory phase report) .
- Furthermore, the plan states that *'any workable information on consumptive water use from industrial units is lacking'* (NRWMP p.30), and *'also for mining and quarries there is no workable information available'* (p. 31). *The consumptive demand of environmental water use is de facto zero. However, a minimum flow of about one third of the surface flow should remain available on a monthly basis.*
- Consumptive demand for hydropower generation is considered zero (NRWMP p. 32) even though reservoirs are known to cause significant evaporation and infiltration.

Despite these uncertainties, the Master plan presents water quantities (per catchment with monthly time resolution), consumptive water demand over the planning period up to 2040 with intermediate demand projections for 2020 and 2030, catchment water balances and national flow schedules for the entire planning period. It also presents a national investment programme and a listing of issues and recommendations such as numbers of suitable dam sites, opportunities for irrigation development reaching 10 of thousands of hectares, etc. are provided, including the estimated investment costs per catchment.

The master plan thus appears to make far-reaching choices. This seems contradictory to the repeatedly stated need to carry out more detailed catchment plans. It is therefore important to understand the reason for such choices. These only lie in the need for having quantified information on future scenarios in order to have an estimate of water demand development in the future.

To cite the Master Plan itself: *'The water resources master plan comprises 9 catchment based Master Plans which can be seen as a useful first draft based on all available information of water resources plus a number of supplemental water resources investigations (especially on groundwater, small catchments and water quality issues) as presented in the Exploratory*

*Phase Report. The catchment master plans are also a first projection of demand which is however not very detailed or precisely located within the catchment'* (NWRMP p. 110).

■ The NCEA recommends to treat the scenarios of future water demand with caution. Due to many estimates and assumptions, they provide relatively poor information. Their usefulness lies in providing a national overview of areas of potential future water stress, in order to prioritise water resources development interventions.

c) *From a catchment planning and management perspective, identify gaps in information and define additional data collection or verification needs for realistic catchment planning purposes. Note: these needs may differ per catchment!*

As stated above, the available data are aggregates at catchment level and insufficient for planning purposes within a catchment. Only one catchment plan was available for review. This *'catchment concerns the middle section of the Nyabarongo River, where it changes from a mountain stream with a significant gradient to a broad valley (from one to several kilometers wide) that is flooded annually over its entire width. The lower Nyabarongo catchment comprises numerous smaller catchments as well as three significant tributaries in the form of the Base (in the North West), the Mambu (in the West), and the Nyabugogo River (in the East)'* (NNYL-CMP p.1). In other words, this catchment includes a variety of landscapes which (most probably) need to be treated separately when talking about management and/or development planning. This hasn't been done in the NNYL-CMP.

Reliability of the information is limited, as explained earlier and repeatedly emphasised by the document itself. For example:

- on p. 32 the NNYL-CMP states in relation to dam volumes: *'It is explicitly mentioned that this assessment is very approximate and gives an order of magnitude only'*. Nevertheless, hydropower sites have been identified, without any references to studies or sources of information.
- Similarly page 30 provides details on water regulation dams for seasonal redistribution of water.
- The table on page 28 (table 4) gives an indicative description of the hydrological impact from a change of land use. The report states that *'local conditions may produce different results based on topography and soil infiltration and water retention characteristics'*. It remains unclear what this remark implies; probably it says the data are averages only and should not be used for local purposes?

The NNYL-CMP provides ideas on water development projects without an indication for the purpose of such measures. For example:

- on p. 32: *'There is some scope for the development (regulation) of surface water resources by means of a series of artificial reservoirs at selected locations throughout the catchment'*. The plan does not make a reference to the problem which is supposed to be addressed by these measures, nor to potential upstream developments (e.g. what happens if upstream plans are implemented) and neither reference is made to potential downstream consequences of suggested measures.
- And: *'Lake Muhazi drains an important inflow area with a potential for flow regulation to control flooding in the Kigali area (area of 1540 km<sup>2</sup>) and the possibility to operate it as a storage reservoir for carrying over surface water from the wet season to the dry*

*season'* (p. 4). No further information is given on flooding problems, nor whether these problems are serious.

The status of the Catchment Master Plans remains unclear to the reviewers, including what kind of decisions they are supposed to facilitate. Only one CMP is available for review (NNYL), but apparently 9 have been produced. As indicated above, in the NNYL-CMP quite far reaching choices appear to be made in water resources management interventions, without any details on actual development needs, pertinent sector plans or stakeholder involvement. Furthermore, catchment planning is also expected through the Dutch IWRM support programme. The relation with the CMP is unclear.

The NCEA concludes that the NWRMP and its Catchment master plans put potential future development scenarios against the available water resources for the sake of providing an overview of potential water quantity issues at national level. At the same time, it acknowledges important gaps in (reliability of) information to allow planning. Yet by making implicit, often unexplained choices on for example dam sites and surface areas for irrigation development, the Master Plan appears to provide guidance on catchment development planning, while this can not be its goal in its present form.

- The NCEA recommends to use the NWRMP information and suggestions for water resources management interventions as a relevant yet incomplete input into a catchment planning process aimed at addressing the development needs of the area.
- The NCEA further recommends to use expert input for a detailed inventory of water resources management issues at sub-catchment level, combined with a participatory component to assess the needs and aspiration of population and businesses. Due to the lack of such a participatory approach in the present master plans it is difficult to assess what development needs are actually addressed by the master plans.

*d) Assess validity of MIS and appropriateness for WRM monitoring and management purposes at catchment level. Assess which measures are proposed (and under implementation) for improvement. Provide recommendations on how to deal with gaps in knowledge or methodological challenges.*

The Master Plan extensively elaborates on the Management Information System (chapter 3), its purposes for IWRM, the modular structure making it flexible for use and adjustments, and the linkage to the proposed Water Permit procedure. It includes example memoranda of understanding for exchange of data and a cost estimate for operation and maintenance.

The most important information may be found in the final section of chapter 3 where a SWOT analysis provides fairly detailed information on risks and weaknesses. Solutions and actions have been defined. The amount of actions required is reason for worry. Especially given the concern that the MIS has been developed in relative isolation by consultants and uptake/learning by RNRA staff may have been too limited for them to deal with those actions.

- The NCEA concludes that the Master Plan is realistic in its expectations with respect to the MIS and reiterates the NWRMP's own principal recommendation that *'the Water MIS to be implemented in an efficient and sustainable way, that its implementation should be accompanied by substantial further training and support. After a testing period of maximum a few months, the Water MIS tools and all related operations should be evaluated towards their opportunities, strengths, weaknesses and threats and adequate solutions should be*

*proposed for the improvement of the system.*' (NWRMP p.142). It is unclear if this has received any follow up, so the NCEA can only emphasise the importance of this recommendation given by the experts themselves.

### 3.3 Master Plan methodology and sustainability

The objectives of the NWRMP study were to quantify available water resources, water demand by sector and catchment, identify surplus and deficit areas, propose a management plan for rational utilization of available quantity of water resources, and qualify all available water resources in the study area (NWRMP p. 2-3). These objectives limit the master plan study to water quantities only. This is rather contradictory to the definition of IWRM (provided in the executive summary of the master plan, p.vi), being '*a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*'. A master plan ideally should look at the interactions between land and water, water-related services, and linkages to potential beneficiaries. Given the weak information basis and the early phase of development of IWRM in Rwanda, it may be too much to expect that all these issues can be addressed from the onset.

- The NCEA recommends to consider the NWRMP as a first contribution of information needed for a true IWRM approach, because currently it is a water quantity focussed document, not addressing all issues that would be expected in an IWRM approach. As a first step the effort is commendable, but its limitations have to be recognised.

Next, the ToR for SEA detailed the following tasks:

- a) *Propose a list of important water related ecosystem services provided by surface and groundwater systems of Rwanda.*
- b) *Assess the way in which these services are represented by the Master Plan; can all relevant ecosystem services be recognised in the Master Plan.*

According to the 40 participants in the 2012 scoping workshop the main water related services in Rwanda include biodiversity, food production, transport (navigation), domestic use, sanitation, mining (process water), hydropower, recreation, water storage, industry, construction, fisheries and climate regulation. These water-related services would thus be expected to feature in a water resources master plan.

Furthermore, participants to the workshop were asked to indicate water-related priorities that would require urgent attention, and to localise these main issues on a map with catchment areas. The issues mentioned related to: pollution (15 times mentioned, including 5x sediments); floods (7 times); institutional framework (6); recognition of value of water (6); waste water treatment and sewage (6); water supply infrastructure (6); land degradation/ deforestation (5); irrigation needs (2); loss of biodiversity (uncertainty about) (2); natural risks/ climate change (2); wetland reclamation (2).

Several of these issues are indeed mentioned in the Master Plan, but since many of these are considered not to affect water quantity (fisheries, biodiversity, floods, sediments, pollution, etc.), they are not treated in any detail. From a water balance perspective this can be explained. From an IWRM perspective some major questions remain unaddressed however:

- How do the proposed water resources development projects affect all the other services of the water system (for example: wetland conversion to irrigated land will affect the

water storage capacity of a catchment; water storage does not influence an overall water balance, it only delays the flow of water to downstream areas, which is essential to reduce flood risk). Are the proposed projects the best solution to address actual development needs?

- How do land use practices influence the water system (for example: deforestation of hills may lead to increased erosion and subsequent clogging of water ways and reservoirs. Also this does not influence the overall water balance, but it may affect the water transport capacity of rivers or shorten the lifetime of reservoirs).
- What are the actual development constraints and opportunities of a catchment; what role does water play?

■ In catchment planning, the NCEA recommends to make an updated inventory of water related development needs and opportunities, based on stakeholder and expert input. Recognising the services provided by the land & water system facilitates the identification of stakeholders. Assessing the views and opinions of stakeholders as well as experts, ideally in an iterative manner, leads to a ranking of issues that need to be addressed at catchment level. Linkages to up- and downstream catchments have to be taken into account.

c) *Assess whether proposed measures will have an impact on ecosystem services. Are these impacts accounted for in the Master Plan? (For example: irrigation development can be considered in terms of amount of water needed, but large scale (wet)land conversion may have serious consequences for river hydrology.)*

As indicated above, the NWRMP is primarily focussed on water quantities and water balances. In such a water quantity only approach, all other water-related services and their values to society are easily ignored. Some examples:

- Consumptive use is considered zero for recreational purposes, navigation, fisheries, natural reserves and eco-tourism; they therefore hardly feature in the master plan. Indicative is a remark from the NNYL catchment plan (p.27): 77% of water is lost through evapotranspiration. The fact that this water is in fact used for another purpose (e.g. rainfed agriculture) makes the use of the word 'loss' inappropriate.
- NNYL catchment plan (p.46): *'Water supply for irrigation in marshlands: this irrigation technique is relatively cost effective in comparison with other techniques. Moreover, with an increased water demand as compared with the 'undeveloped' situation of only 2.000 cubic meter per ha per year, this technique is also 'water effective!'*

The way in which services provided by the water system are treated is by defining environmental flow requirements:

- *'Environmental flow is the surface flow that allows to sustain the essential ecological and social functions from the hydrological environment. These requirements have not been studied for the conditions in Rwanda and are consequently largely unknown. Pending further investigations, the minimum environmental demand of surface waters is assumed to correspond to one third of the average monthly flow. Especially for smaller water courses (flow of less than 1 m<sup>3</sup>/s) this quantity is likely to be insufficient. It should be noted that the rather arbitrary environmental demand condition by 2040 will not be satisfied during the dry season of most years. Pending environmental research into this matter, priority is given to the development potential from the water resources. A*

*significant reduction of environmental flow demand may exceptionally be tolerated but should be monitored closely with special attention for undue lowering of groundwater table in the floodplain, stagnant flow and compromised water quality standards (especially nutrients and toxic substances).’ NNYL catchment plan (p. 56).*

This section implies that water development projects may go at the costs of other environmental services such as water storage and flood control, fisheries productivity, sediment transport and storage, groundwater replenishment, wetland productivity and biodiversity conservation. This observation is supported by another remarks, such as:

- *‘With respect to the environmental flow requirements, these are merely based on notions adopted from elsewhere and lack scientific basis. Considering the importance of natural resources as a driver for development and poverty alleviation, the environmental flow criterion is not very stringently applied’*(NNYL–CMP p. 36)

Such statements ignore the multifunctional character of the water resources system and may lead to irreparable and unacceptable damage to the system.

- The NCEA recommends to refrain from making statements on acceptability of loss of environmental services in this NWRMP. The NWRMP in its current form is primarily a technical water balance study and not a policy document suitable for comparison of options for development choices that should be left to policy makers.
- The NCEA further recommends to stop using the environmental flow concept as it apparently leads to an ineffective contrasting view between environment and development.
- Instead, the NCEA recommends to describe the water system as a multifunctional system, providing products and services for human well-being, making it possible to take balanced decisions on the use of the system. Water in this respect can be consumed (for irrigation, industry, or human consumption), but can also be a facilitator for economic activities (navigation; fisheries) or maintaining a safe living environment (water storage for flood control; wetlands trapping pollutants and sediments). Such a description of services allows for transparent trade-offs in decision making as the development of one service can go at the cost of other services (e.g. irrigation development reduces downstream flows), while other services may reinforce each other (wetlands provide flood buffer, sediment trap, fisheries resources and opportunities for biodiversity conservation).

d) *Water quality represents an important aspect for the availability of water resources. Assess whether interactions between water quality and quantity have been addressed appropriately by the Master Plan.*

These have not been addressed by the master plan. Although water quality maps have been presented, and some information on the causes of water quality deterioration has been presented, water quality issues are not addressed as such in the master plan.

- The NCEA recommends to consider water quality issues as an essential part of catchment planning as it affects the services of the water system and thus affects the development potential of water resources, within the catchment or in downstream catchments.

e) *Provide suggestions for aspects that need to be taken into account and for which additional information needs to be collected; if this is impossible, identify potential*

*oversights in the Master Plan and provide advice on how to deal with this in water resources monitoring and further water management planning.*

- The NCEA recommends to focus the planned catchment planning efforts in the 4 demonstration catchments on a broad analysis of development needs and development opportunities linked to water resources, using a pro-active SEA, in time to influence the catchment plans themselves.

The NCEA has concluded earlier that the focus of the catchment plans is narrow, on water quantity and water resources development projects and their status remains unclear. A pro-active SEA can inform this planning process with an assessment of development constraints and opportunities of the land & water system in a catchment. The most helpful approach for such an assessment is to translate the land & water system in terms of products and services (sometimes referred to as “landscape functions”, or “environmental services” or “ecosystem services”) that represent values for citizens and companies and thus can be linked to stakeholders (how does the environment influence the plan).

By assessing alternative development options on their social, economic and ecological impacts, winners and losers can be identified and alternatives can be compared (how does the plan influence the environment). Up- and downstream linkages are part of such assessment, both in terms of impacts of the environment on the plan and impacts from the plan on the environment.

In this assessment the National and Catchment Master Plans provide a static picture of water balances and a hint to water demand in future. The Management Information System would ideally provide more dynamic information based on continuous monitoring. It is unclear how far the implementation of the MIS has progressed, but this can be dealt with through on-going measurements during the catchment planning processes.

### 3.4 Alternative development options and scenarios

- a. Check whether various alternative options or scenarios are provided by the Master Plan.*

The NWRMP suggests measures to be taken to maintain the equilibrium between water supply and demand. For water demand development low, middle and high demand scenarios are used, with time horizons at 2020, 2030 and 2040 (NWRMP p. 5). At the level of catchment plans numbers of dams, and surface area of irrigated agriculture to be developed are mentioned without any further explanation where these data come from, what human benefits are accrued from these interventions or what alternative water uses could result in similar or larger human benefits.

Even though the inception report<sup>5</sup> stated that available options are overwhelming and should be considered on the basis of their economic, social and environmental merits, the NCEA observes that neither the NWRMP nor the reviewed catchment plan include development alternatives. It would have been relatively easy to envisage a water intensive and a water savings alternative, taking into account developments in for example water saving technology, development of water-stress resistant cultivars, etc. This would provide an idea of the band-width within which development can be realised.

An aspect which is receiving increasing attention internationally, is the potential impact of climate change on water resources. At the time of writing of the NWRMP little information was

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<sup>5</sup> During their visit in 2012, the reviewers were able to consult the inception report for the consultant services for the development of the NWRMP

available, but the body of knowledge is rapidly developing. In its climate change (CC) country profile the DSU summarises the CC challenges for Rwanda: extreme events including severe droughts and floods will occur more often due to climate change<sup>6</sup>.

- The NCEA recommends to identify alternative development options, based on available water resources. These alternatives will have different social, economic and environmental impacts. Comparison of such alternatives in (SEA for) catchment planning is recommended to find the optimal mix of interventions.
- The NCEA further recommends to include a climate change scenario in such an analysis to be able to verify whether proposed interventions are either increasing climate resilience (i), are 'no regret' measures (ii) from a climate change perspective, or may be considered counterproductive on the longer term (iii).

b. *Describe the proposed water management measures and identify potential alternative measures when not provided by the plan.*

The NCEA observes that in the NWRMP, several water development projects are being proposed, yet it remains largely unclear where the water development projects come from, and whether these are existing plans or necessities based on population development scenario's:

- Per catchment an overview is provided of issues that need to be addressed at catchment level (NWRMP chapter 2.5). Yet many issues cannot be reflected in the water balance studies as they are considered to be non-consumptive, i.e. they do not affect water quantity. For example: how does the excessive erosion and sediment problem in the Sebeya river, affect water flow, lifetime of downstream reservoirs, etc. (NWRMP p 91)? So, relevant water management issues remain unaddressed in the master plan, making the overview per catchment incomplete.
- The NWRMP mentions that within the context of the Irrigation Master Plan, 107 potential surface water storage reservoir sites were identified and an additional 36 sites were identified by the LWH project. With necessary information lacking, choices seem to have been made: *'While essential characteristics of these sites were mostly not available, a very approximate yet systematic assessment of sites has been done which permitted to present a number of evaluation criteria for all the potential sites'* (NWRMP p.20).
- The Master plan includes endorsement of dozens of water storage facility sites; tens of thousands of hectares of marshland conversion and irrigation development, hydropower generation locations, etc. For example: *'a number of 7 out of 26 dam sites have been found to be most interesting from a hydrological perspective'* (NWRMP p.94) and were therefore included in the plan.
- The NWRMP recognises the need for caution: *'The impact of different irrigation schemes on water resources must be assessed by special investigation programs. This is of paramount importance. Because of the ambitious irrigation program defined in the Irrigation Master Plan of Rwanda, even small impacts on the hydrological cycle may have significant consequences on water services. This is especially important for the eastern part of Rwanda (Akagera) with a balanced or even seasonally negative water balance'* (NWRMP p.23).

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<sup>6</sup> Dutch Sustainability Unit (April, 2015). Climate Change Profile: Rwanda. The DSU is hosted by the NCEA.

- And: *'For the catchments where resources are ultimately expected to be insufficient for full development, a number of measures has been proposed ranging from reduction of demand, intra annual regulation of resources (creation of surface water storage capacity), and transfer of additional resources from other catchments. A further option is the reuse of used water (if needed after treatment) which may ultimately become important when the sanitation of urban water use pushes off and it is recommended to be implemented in the irrigation sector. At the level of detail of this national study it is not very realistic to rely on this technique but it should be taken up when more precise catchment Master Plans are developed; this latter action is highly recommended'* (NWRMP p.76).

The NCEA observes that on the one hand the Master Plan clearly makes choices on the kind of measures to be taken to balance water supply with demand, on the other hand it states that more detailed catchment master plans need to be made. The status of choices in the NWRMP thus remains unclear.

The NWRMP recommends a catchment approach (p. 11) based on: identification and assessment of demand areas and service volume; identification of supply locations and zoning of adequate least cost services; prioritization of demand between primary use and commercial activities; precise timing and localization of resources development implementation works (spring – borehole – piped water supply systems); precise investment cost estimation. It does not mention the need for interactive and participatory planning based on the development needs of the population and the development potential of the services provided by a catchment, including trade-offs between up- and downstream catchments.

- It is recommended NOT to limit a catchment planning process to the planning approach suggested in the Master Plan. It is an expert driven approach which needs to be extended with a process to define the development needs in a catchment, taking into account the views, needs and aspirations of people and business.

*c. Assess the proposed measures to manage water supply and demand on their potential social and environmental consequences in qualitative terms. Assessment criteria include poverty, access to water and water related services (including gender differentiation), maintenance of water related ecosystem services.*

Concrete development planning has not been the intention of the plan, even though, as mentioned above, choices on water resources development projects have been made for the sake of having a rough estimate of future development opportunities and future water demand. Impacts of the proposed projects have not been assessed, except for their impact on the catchment water balance.

The Master Plan recommends to make use of Environmental Impact Assessment (EIA) to assess future water resources management projects and also recommends to fine-tune this EIA with the water permitting procedures (P. 199). Apparently the master plan team was not aware of the strategic environmental assessment (SEA) instrument which can be used to set sustainability boundaries for projects developed under a plan.

- The NCEA concurs with the NWRMP recommendation to implement EIAs for all water resources development project of certain size.
- Moreover, the NCEA recommends to carry out detailed and participatory catchment planning processes, accompanied by a (preferably pro-active) SEA. This will help to position

the catchment plan within the context of social and economic development needs and sustainability requirements. Special attention has to be paid to development opportunities of underprivileged groups in society, notably the poor with an emphasis on the role of women within these groups. The linkages between the water system and these stakeholder groups can be described in terms of services (ecosystem services) provided by the water system.

*d. Provide a semi-quantified overview of potential impacts by comparing the alternatives and/or the different scenarios. If possible differentiate for different time horizons.*

Since no alternatives have been developed, this is beyond the scope of a quick scan and should be part of an SEA for catchment planning.

■ The planning processes in the 4 demonstration catchments provide the opportunity to identify, in a participatory manner, development alternatives. The NCEA recommends to use SEA to assess their social, economic and ecological consequences, and inform decision making on the catchment plans. Preferably this analysis is enriched with climate change scenarios.

### 3.5 Transboundary effects

*a. Assess whether proposed water management measures have a “no regret” character from a river basin perspective. This relates to water quantity as well as water quality, and also requires verifying whether measures correspond with binding international agreements and commitments.*

With respect to Transboundary issues the master plan would, according to the inception report, study existing conventions on the use of shared water resources and, where no conventions are available, will take account of established international principles for the management of shared water resources. This seems to be entirely lacking in the NWRMP. On page 79, it refers to the international context: *‘Within an international context, the flow schedules based on average resources conditions and medium (1012) and high (later years) demand, indicate a moderate reduction of annual outflow for the Congo basin from 1295 MCM to 1064 MCM (82 % remaining). For the Nile basin the reduction is stronger from 5077 MCM to 3442 MCM (68 % remaining) (NWRMP p. 79). Similar schedules can be prepared for non average resources conditions; the 5%, 35%, 50%, 65% and 95% resources reliability conditions. Especially for the dryer resources conditions, the impact from Rwandan use on the outflow will be stronger’.*

The NNYL catchment master plan provides very little additional information: *‘Also at the international level there may be need for occasional cooperation beyond the national boundaries notably when downstream users are affected by local development decisions. For these rare instances, the cooperation platforms at national level between ministries (Minirena, Minaffet, Mineac) and at international level (NBI and NELSAP) seem adequate’.* (NNYL-CMP p. 9)

The NCEA concludes that even though significant reductions in the outflow of Nile and Congo are foreseen, especially in dry periods, there is no reference to potential impacts for

downstream countries. It cannot be assessed how important such reductions are on the total water availability for downstream countries. This is an omission.

- The NCEA recommends to assess at river catchment 0 level (Congo and Nile basins) the potential impacts of reduction in water availability, positioned within the framework of international treaties or international principles for management of shared water resources.

### 3.6 Institutional arrangements

The aspect of legal and institutional strengthening is presented in chapter 4 of the Master Plan. From an analysis of the IWRM management requirements, an update on the existing institutional framework for water management and a comprehensive proposition for improvements, a road map for an IWRM compliant institutional structure and for the corresponding legal changes is presented. Three actions which during the visit of the NCEA expert panel were considered much needed to address water management in Rwanda, are indeed comprehensively addressed by the plan:

- data collection and information management, to address the present problem of incomplete and dispersed data;
- an institutionally embedded mechanism for catchment planning, to address the problem of catchments not coinciding with administrative units;
- water permits, to address the problem of lack of information on water withdrawals.

Considering that the recently started, Netherlands-funded 'Integrated Water Resources Management Programme Rwanda 2015 - 2019' has formulated an elaborate series of activities on both the Institutional Framework and Capacity Strengthening, comments on governance aspects may be misplaced and outdated. Furthermore, for a relative outsider working at a distance it is difficult to assess whether the proposed measures are feasible, sufficient, and politically acceptable. Therefore, we refrain from further comments on this aspect.

# Annex 1: ToR for SEA for Water Resources Master Plan

**From: NCEA Scoping Advice for the Dutch IWRM support programme (January 2013)**

## **Introduction**

The Water Resources Management Strategy is at present being translated into a comprehensive National Water Resources Master Plan (Master Plan), available in draft in June 2013. The Master Plan process fully integrates and operationalises the principles of IWRM. An impressive amount of work is being carried out by an international team of consultants and a similarly impressive amount of information will become available.

The objectives of NWRMP are to:

- quantify available water resources (surface & ground, in time and space) (including water balance per (sub)catchment with monthly resolution);
- quantify water resources demand by sector and catchment;
- identify surplus and deficit areas in time and space;
- propose a management plan for optimal and rational utilization.

The initial 20 year time horizon with monthly and seasonal resolution is, according to the inception plan, expanded to 30 years, considering intermediate situations in years 2020, 2030 and 2040.

According to the ToR the Master Plan should include surface and groundwater management plans; rainwater harvesting plan; monitoring plan; institutional and organisational strengthening plan; operation and maintenance plan. However, the presentation of these 'sub' masterplans is in the view of the planning team not appropriate from an integrated water resources management point of view. A water master plan should maintain the holistic nature of IWRM and aim at the optimum allocation of available resources in each catchment or when needed transferred between catchments. In general these resources also have interdependencies (surface-groundwater interactions) that cannot be dealt with in separate studies. Therefore a different set of plans is proposed:

- operation and maintenance plan for the entire monitoring, analysis and management decision system and infrastructure;
- plan for legal, institutional and organizational strengthening required for the national water resources development and management plan;
- plan for knowledge transfer and capacity building;
- implementation plan for the water resources management system and infrastructure;
- detailed cost estimate for the water resources management system.

## **ToR for an SEA on the Master Plan**

To address some of the risks associated to the Master Plan an SEA is recommended as a tool to provide independent information to the validation and decision making process. In close collaboration with RWRD and earliest as possible, an SEA for the Master Plan should be started addressing the potential consequences of choices made by the master plan. Focus of the SEA should be on:

- contents: quality of the information base, gaps in information and consequences for decision making; are social and environmental sustainability addressed in an appropriate manner?
- governance, i.e. the appropriateness of the institutional arrangement. in particular in relation to the required flexibility for planning at catchment level, effective linkages between the MIS and planning at catchment level, representation of different sectors and levels of government and other stakeholders to ensure buy-in in IWRM processes.

#### 1. Planning process management

As observed above, questions remain regarding the exact timing and steps in the process of developing the Master Plan. If an inclusive process (allowing all relevant stakeholders to learn of, appreciate and share insights on the Master Plan) is not secured during the Master Plan development process, risk may be that stakeholders will not understand, support and ultimately, take responsibility for elements of IWRM implementation, as laid out in the Master Plan. This would render IWRM unsustainable in the longer run. In addition, the SEA itself will be less effective if it is not well integrated into the planning process of the Master Plan. It is therefore important for both the SEA and the Master Plan planning process, to get clarity on the exact planning of the process.

#### SEA task 1:

- Clarify the exact phasing of the Master Plan development process, in terms of planning of all steps, participating stakeholders, and objective of the steps;
- Assess the feasibility of two options for the SEA time frame: a. Ideally start pro-actively with the SEA, as soon as possible in 2013, allowing to inform the Master Plan development process on development constraints and opportunities; b. Alternatively, do the SEA reactively, to assess the social and environmental consequences of the draft Management Plan as presented for validation. This would bring the scope of the SEA on the validation phase; c. Describe the pros and cons of each option (in terms of quality of process, quality information, potential influence of SEA, feasibility in time and capacity, etc).
- Decide on way forward. Note that international best practice would suggest pro-active SEA as it allows for better integration in the Master Plan development process. That is what the NCEA would recommend. The re-active option would however still be a "SEA proof" alternative;
- Suggest proper alignment of SEA steps as identified in the next pages to that way forward. Note that NCEA would be available to advise if so required

#### 2. Reliability and representativeness of data

The master plan process is comprehensive and will generate a significant amount of relevant information. Given major gaps in available information, the water supply and demand data, including the water balances at (sub)catchment level will be indicative only. They will be sufficient to provide an overview of potential development opportunities and constraints, but will not have enough reliability for detailed planning of interventions at catchment level. For catchment planning more refined information may be needed. This is acknowledged by the consultant drafting the Master Plan. An MIS is being developed for data collection, management and assessment purposes.

SEA task 2:

- a. Assess the quality and reliability on the availability of water. Indicate where a cautious approach in the use of the available data is necessary.
- b. Assess the quality and reliability of water supply and demand per catchment.
- c. From a catchment planning and management perspective, identify gaps in information and define additional data collection or verification needs for realistic catchment planning purposes. Note: these needs may differ per catchment!
- d. Assess validity of MIS and appropriateness for WRM monitoring and management purposes at catchment level. Assess which measures are proposed (and under implementation) for improvement. Provide recommendations on how to deal with gaps in knowledge or methodological challenges

3. Master Plan methodology and sustainability

The master plan is based on the identification of water users, roughly divided into consumptive users (taking water) and in-stream uses (example: fisheries & navigation). Environment is in this view considered as a water user requiring a minimal flow. This approach runs the risk of overlooking important water related environmental services on which people depend. Especially regulatory services such as flood buffering, surface water storage, sediment removal, and water purification service will be largely overlooked. Also local water related production services supporting the rural poor in their subsistence may be overlooked.

SEA task 3:

- a. Propose a list of important water related ecosystem services provided by surface and groundwater systems of Rwanda.
- b. Assess the way in which these services are represented by the Master Plan; can all relevant ecosystem services be recognised in the Master Plan.
- c. Assess whether proposed measures will have an impact on ecosystem services. Are these impacts accounted for in the Master Plan? (For example: irrigation development can be considered in terms of amount of water needed, but large scale (wet)land conversion may have serious consequences for river hydrology.)
- d. Water quality represents an important aspect for the availability of water resources. Assess whether interactions between water quality and quantity have been addressed appropriately by the Master Plan.
- e. Provide suggestions for aspects that need to be taken into account and for which additional information needs to be collected; if this is impossible, identify potential oversights in the Master Plan and provide advice on how to deal with this in water resources monitoring and further water management planning.

4. Alternative development options and scenarios

The Master Plan will suggest measures to be taken to maintain equilibrium between water supply and demand. The inception report states that the options are overwhelming and should be considered on the basis of their economic, social and environmental merits. It is not completely clear whether the plan will consider various alternative options or that it will provide one best option. Supposedly various scenarios are used, with time horizons at 2020, 2030 and 2040.

SEA task 4:

- a. Check whether various alternative options or scenarios are provided by the Master Plan;
- b. Describe the proposed water management measures and identify potential alternative measures when not provided by the plan.
- c. Assess the proposed measures to manage water supply and demand on their potential social and environmental consequences in qualitative terms. Assessment criteria include poverty, access to water and water related services (including gender differentiation), maintenance of water related ecosystem services.
- d. Provide a semi-quantified overview of potential impacts by comparing the alternatives and/or the different scenarios. If possible differentiate for different time horizons.

5. Transboundary effects

With respect to Transboundary issues the plan will study, when available, existing conventions on the use of shared water resources and, where no conventions are available, will take account of established international principles for the management of shared water resources.

SEA task 5:

- a. Assess whether proposed water management measures have a “no regret” character from a river basin perspective. This relates to water quantity as well as water quality, and also requires verifying whether measures correspond with binding international agreements and commitments.

6. Institutional arrangements

The Master Plan will provide an institutional assessment based on five functions that the institutional structure has to carry out: (i) strategy development, (ii) development planning, (iii) development implementation, (iv) development management, and (v) monitoring.

SEA task 6:

Each catchment in Rwanda has different biophysical characteristics and as a result provides different development opportunities and constraints. This implies that different stakeholders and different representative sector departments will have to be involved. A rigid institutional framework with fixed statutory representations may hamper the effectiveness of water management at catchment level.

- a. Assess whether the proposed institutional framework provides enough flexibility to allow for catchment-wise differentiation in catchment management planning and implementation. Flexibility related to the type of stakeholders involved at catchment level and working procedures.

Consistency between sector policies is needed for effective water resources management planning. The Master Plan process is designed as a participatory process in which all departments and agencies play their respective roles. The Master Plan process is, however, in the hand of consultants working in relative isolation. It needs to be assessed whether and up to what level all relevant sector policies are addressed by the plan, all departments feel ownership over the plan, and are willing to implement its recommendations.

- b. Make an overview of relevant sector departments and agencies: national and de-central, nation wide or in a selection of catchments, depending on time and SEA option chosen (see SEA task 1 above) and assess whether they have contributed to the workshops and validation process and whether their interests have been properly taken into account in the Master Plan.