



**THE REPUBLIC OF UGANDA**

**MINISTRY OF WATER AND ENVIRONMENT**

**JOINTLY WITH**

**MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES**

**TERMS OF REFERENCE**

**FOR**

**CONSULTANCY SERVICES FOR FORMULATION OF A NATIONAL  
IRRIGATION MASTER PLAN FOR UGANDA**

**August 2024**

## **1 Background**

Development in the Agricultural Sector has stagnated due to total dependence on rainfall which has become un-reliable since the 1970s. The annual rainfall ranges between 500mm in the semi-arid areas and 2000mm in some parts of Lake Victoria crescent. The land under formal irrigation is 14,418ha (*small-scale irrigation – 300 ha, commercial irrigation 12,082 ha and Government irrigation schemes 2,036 ha*). This is less than 0.5% of potential irrigable area of 3,030,000 ha. On the other hand, about 53,000 ha of land is under informal swamp rice irrigation mainly in the districts of Tororo, Butaleja, Pallisa, Budaka, Bugiri, Kibuku, Namutumba, Lira, Dokolo, Soroti and Iganga where swamps around streams flowing into lake Kyoga have been developed for irrigation by local groups of farmers.

Uganda has one the highest irrigation potential in the world with over 15% of her surface area covered by freshwater resources. The sum of the external and internal renewable surface water resources (the average annual river flow generated from precipitation) in Uganda amounts to 43.3 billion cubic meters per year, while the dependence ratio (proportion that originates outside the country) was about 69% as of 2013. The present utilization rate of the internal renewable water resource is low (2.8%). The utilization rate of the entire renewable surface water resources stood at 0.01% as of 2013. If the full irrigation potential was to be exploited, the demand for water would be increased by over 400% by 2030 translating into a utilization rate of renewable surface water resource of 0.05%.

### **1.1 Strategic Direction for development of irrigation**

The Government of Uganda has prepared the National Irrigation Policy (2018) to direct the development and implementation of irrigation interventions to ensure optimal use of available land and water resources for increased agricultural production and productivity to contribute effectively towards food security, wealth and employment creation, and export promotion. This policy is in line with Uganda’s international commitments including the Sustainable Development Goals, and Agenda 2063 as well as the Vision 2040 notes that: “the Uganda aspires to transform agriculture from subsistence to commercial agriculture through both mechanization and introduction of modern irrigation systems”.

Irrigated Agriculture interventions are anticipated to contribute to achievement of the following development objectives:

1. Growth and employment creation. A highly productive agricultural sector is needed for rapid industrialization of the economy, which in turn is needed to boost employment and move toward Vision 2040 economic targets.
2. Demand for agricultural exports. Demand for agricultural exports will increase as regional and global food needs rise; by enhancing productivity and production, effectively deployed irrigation in Uganda will allow for increased exports to meet this demand.

3. Enhancing value addition in key growth opportunities. Boosting agro-processing will require increased production and productivity through irrigation to stabilize demand for raw agricultural commodities.
4. Import substitution for food security. In addition to boosting exports, irrigation can reduce imports by closing the food demand growth gap, particularly considering urban population increases. Note that there may be tradeoffs between land and water used to promote import substitution versus generate agricultural exports.
5. Climate change and its impacts on agriculture and economic growth. In addition to enhancing productivity and production, irrigation will boost the resilience of food production to climate change by avoiding drought-induced crop failures.

### **1.1.1 Framework Master Plan**

Government formulated and adopted a Framework Master Plan (2011) that broadly elaborates higher level objectives of irrigation development in Uganda, and a 4-Stage Strategy (Immediate, Short, Medium, and long term), which defines a) enabling policy, b) institutional arrangements, c) resource allocation strategy, d) financing plan, e) irrigation measures, f) service provisions among aspects, and modalities necessary for a reinvigorated, expanded and upgraded irrigation sub-sector in Uganda.

### **1.1.2 Comprehensive National Irrigation Master Plan**

The Government now intends to develop a comprehensive National Irrigation Master Plan (NIMP). The comprehensive National Irrigation Master Plan for Uganda is a long-term plan that will guide irrigation planning and provide a strategic framework for prioritized investments for development of irrigation infrastructure demonstrated to be technically feasible, economically viable, socially desirable, and environmentally sustainable.

## **1.2 Goals and Targets of Irrigated Agriculture**

The government has defined a framework to shape the formulation of the NIMP, defining the goals, objectives, assumptions, and targets for NIMP.

The Agricultural Sector overview in Uganda entails focus on the: (i) Agro climatic/ecological Production Zones (APZs), (ii) Current Agricultural Production and Productivity, (iii) Constraints and Challenges facing Agricultural Production and Productivity, and (iv) Existing interventions to address the challenges and their extent of success.

The focus on agricultural production and productivity specifies major crops including especially the defined 12 major production lines (Coffee, Cotton, tea, Cocoa, Tobacco, Sugarcane, Maize, Rice, Beans, Palms, Horticulture, Soya beans) in the National Development Plans: NDP III and NDP IV Strategic Directions. The specific crop production systems, the production rates in the respective APZs, and the extent of irrigation acreage that is presently under both rainfed and irrigation are elaborated including the current yields from both rainfed, and irrigated agriculture where it exists.

The overview of a strategic direction for irrigation development in Uganda considers aspects including Geographical Description of Uganda, Socioeconomic, Demographic and Cultural Issues, Land Tenure systems, Land Cover and Land Use, Physical Environment, Ecology and Topography, Climatology, Geology and Soils, Existing Water Resources, and water use patterns, Existing Policy and Legal Framework for Irrigation, and Existing Institutional Framework.

The identified major challenges to irrigation development include investment constraints as irrigation is a capital intensive, inadequate investment incentives, institutional organizations challenges, and very variable spatial and temporal natural water resource availability.

### **1.2.1 Overall Goal**

The overall goal of the National Irrigation Master Plan (NIMP) is to provide a long-term plan that will guide irrigation planning and provide a strategic framework for prioritized investments for development of irrigation infrastructure demonstrated to be technically feasible, economically viable, socially desirable, and environmentally sustainable. The Master Plan will address the issues identified above and develop priorities for investment that can be quickly enacted. The Master Plan is to promote equitable outcomes and align with existing national and regional development plans.

### **1.2.2 Overall Targets**

The strategic direction for irrigation development developed a set of crop production targets and resulting irrigation areas based on 2No. illustrative socioeconomic scenarios: Business as Usual (BAU) and Vision 2040.

BAU is a “low-end” scenario, assuming that production grows proportionate to population growth, and maintains current per capita food demand. On the other hand, Vision 2040 is an aggressive growth scenario, assuming the food security and macroeconomic goals of Vision 2040 are achieved, which requires a massive expansion of both rainfed and irrigated acreage.

Under the BAU scenario, population is assumed to be the single factor that drives increased production targets for all crops. Population increases increase from current levels (approximately 41 million) to UN projected levels of 73 million by 2040, or 78 percent increase. This scenario also assumes that rainfed yields increase due to technological advancement (e.g., enhanced seed varieties) by 30 percent, following work by the International Food Policy Research Institute (IFPRI) <sup>1</sup>.

Under Vision 2040, the following population, economic, and policy assumptions:

- Population projection. The Vision 2040 population projection of 61 million persons by 2040 based on assumption of population reduction policies as UN POP projection are for 73 million persons by 2040.
- Economic projection. Vision 2040 projects GDP per capita will grow to \$9,600 by 2040 from \$817 in 2020 (World Bank), or an 11-fold increase. Exports of cash crops will be

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<sup>1</sup> Fukase, E. and Martin, W., 2020. Economic growth, convergence, and world food demand and supply. *World Development*, 132, p.104954.

increased, while imports of crops will be greatly reduced to maximize food self-sufficiency.

- Policy Scenario. Vision 2040 projects that Uganda will transform for a primarily subsistence small holder agricultural sector to a predominate commercial farming sector utilizing high yield seed varieties and high inputs.

#### a) Production Targets

Table 1 below presents the production targets (in Tonnes) under the BAU and Vision 2040 scenarios.

**Table 1: production targets (in Tonnes) under the BAU and Vision 2040 scenarios**

Crop Enterprise	Production (Tonnes)		
	Current (2018)	2040 BAU target	Vision 2040 target
Maize	2,785,073	4,932,775	6,825,879
Millet	73,129	129,522	179,230
Sorghum	109,174	193,363	267,572
Rice	167,047	295,865	988,919
Beans	438,433	776,530	2,595,526
Soyabeans	126,880	224,723	751,130
Sweet potatoes	1,073,058	1,900,544	2,629,936
Irish potatoes	260,847	461,999	1,544,214
Simsim	43,606	77,233	258,148
Groundnuts	133,944	237,235	792,946
Banana-food	9,439,573	16,718,877	23,135,260
Banana-sweet	145,278	257,309	860,048
Banana-beer	406,382	719,762	2,405,781
Cassava	2,660,581	4,712,281	6,520,765
Coffee-robusta	192,151	340,328	1,137,534
Coffee-arabica	61,628	109,152	364,838
Other cash crops	544,958	965,201	3,226,153

#### b) Irrigated Acreage targets to reach the Vision 2040

A crop and APZ specific linear programming (LP) model was developed using the Generalized Algebraic Modeling System (GAMS) software program for solving resource allocation challenges in agricultural contexts. The model was designed with a constraint that the production target for each crop is met, and a cost of adding new irrigated areas.

The resulting cropping pattern under Vision 2040 is a new orientation around commercial agriculture that leads to shifting crops from traditional locations to the best areas in the country to maximize crop yields. The new areas are characterized by: ease of land availability, access to water for irrigation, land suitability for priority crops and irrigation, and soil fertility among other factors. The irrigation targets include BAU and three variants of Vision 2040 that impose on irrigated area: (1) no limits, (2) a maximum of 1,000,000 Ha, and (3) a maximum of 500,000 Ha.

## **2 Objective of the Assignment**

The objective of this assignment is to prepare a comprehensive National Irrigation Master Plan for Uganda to enable prioritized investments that improve water management and agricultural productivity, including improved resilience to impacts of climate variability and change, through approaches that are economically viable, socially desirable, and environmentally sustainable.

The Master Plan will enable the Government to approach potential investors (e.g., bilateral development partners, IFIs, the private sector and the Government) with prioritized investments in irrigation development for their consideration.

The *Expected Output* is a concise and coherent Irrigation Master Plan which will guide prioritization of investments to improve water management and agricultural productivity while maintaining a proper balance among the environmental, social, and economic restraints.

### **2.1 Target Area**

The targeted area covers the entire country based on the Agricultural Sector Strategic Plan (ASSP), Water for Production updated Strategy and Investment Plan, and Water for Agricultural Production (WfAP) Framework Investment Plan. Prefeasibility analyses and detailed development plans will be developed for identified irrigation schemes of the Master Plan. The Client has developed a list of some of the potential medium and large schemes across the country which the Consultant shall verify and conduct subsequent analyses. For micro and small-scale schemes, the Consultant shall define broad areas and delineate the targets to be achieved aligned to priority crops, which should be guided by specific approaches like farmer led irrigation among others.

## **3 Scope of Work**

### **3.1 Review of Framework and Strategic Approach**

The Consultant shall review and update the framework and Strategic Approach for the Master Plan taking into account such aspects as the strategic alignment, resource optimization, Coordinated action among multiple stakeholders, adaptability and risk management mechanisms, evidence – based decision making (integrating water informatics, program monitoring, evaluation and learning mechanisms), Assessment of long - term impact of the Master plan, and development pathways including Public/Private Partnerships, Farmer Led Irrigation, among others.

### **3.2 Comprehensive National Irrigation Master Plan**

The Comprehensive National Irrigation Master Plan will provide for effective water resources planning, identify opportunities and constraints for development and management of irrigation infrastructure to sustain economic, social, and environmental uses.

The preparation of the comprehensive National Irrigation Master Plan shall therefore cover the following focus areas:

- a) Irrigation Infrastructure Development
- b) Enabling Productive Irrigation Agriculture Services
- c) Sustainable Institutional Development of Irrigation Agriculture
- d) Irrigation Investments, Financing, and Implementation Plan

To achieve the objective mentioned above, the detailed scope of the work for the study shall entail the following:

### **3.2.1 Irrigation Infrastructure Development**

The Consultant shall undertake detailed assessment for infrastructure development of irrigation systems categorised into four types: (i) Micro Scale – less than 5 hectares, Small Scale comprising 5 – 100 hectares, Medium Scale consisting of 100 – 1000 hectares and Large Scale greater than 1000 hectares. The aspects to be studied are elaborated below.

#### **a) Agronomy Assessment**

The Consultant shall undertake agronomy assessment aligned to the priority crops and the specific Agro climatic/ecological Production Zones (APZs). The discussion shall include among other aspects the soil and land suitability, current and potential agricultural practices and selected crops and cropping patterns for market oriented irrigated crop agriculture, cropping calendars, agricultural inputs, etc.

The assessment shall also cover improved soil management practices, production, and productivity with or without irrigation, current and potential crop yield assessment based on the yield gap analysis – difference between actual yield and the maximum obtainable yield and determine the optimal factors and yield development trends impacts due to the Irrigation Master Plan interventions.

#### **b) Irrigation Water Demand Assessment**

The irrigation water demand assessment shall be defined for the selected priority crop in each APZ, and for each Irrigation System and Scheme Category i.e., Micro, Small, Medium, and Large Scale. The Consultant shall carry out an in-depth assessment of irrigation water requirements based on crop water requirements for the potential irrigation system types identified (micro scale, small scale, medium scale, and large scale), taking into consideration the projected farming/cultivation/agricultural land use, agro-ecological characteristics, climatic characteristics, the selected crops and potential impacts of future climatic variability and change. Specific reference shall be made to the FAO Irrigation Manuals.

The Consultant shall formulate strategies necessary for securing coverage of all crop water requirements, develop and/or improve irrigation methods for the optimization of the available water resources.

#### **c) Assessment of Irrigable Potential Area**

The Consultant shall review and develop specific priority crop targets aligned to the gross targets under the various scenarios: BAU, and the Vision 2040.

The Consultant shall review and refine the irrigation potential areas within the specific APZs and shall assess and identify the water resources potential, land resources potential and socio-economic Potential.

Under identification of water resources potential, the Consultant shall collect and analyze all necessary data on collecting system of the water resources and develop and verify Hydrology/Discharge profiles [H-Q] curves of major streams. The Consultant shall assess the land resources potential including land suitability mapping discussing land unit classification, soil types and land cover classification, current and future land use, and availability for irrigation agriculture. He shall investigate the Socio-economic Potential considering among other parameters the population density, road density (including the level of road) and food security condition. Individual potential for each study zone shall be overlaid on the national map using GIS and the Potential irrigable area will thus be estimated by overlaying these three assessment maps. Potential should be classified into three categories, i.e., high, medium, and low and described on the national map.

The November 2011 Framework Irrigation Master Plan identifies the potential irrigable land as 566,465 ha, while the Regional Agricultural Trade and Productivity Project (RATP) of the Nile Equatorial Lakes Subsidiary Action Plan (NELSAP), 2012 study identifies the 60% potential at 3.03 million ha, based on fuzzy logic. The fuzzy approach gives an indication of possible potential, at 60% and needs to be refined.

The new study should take the parameters used in the fuzzy study and apply the Boolean approach using newly defined criteria for irrigation suitability. New classes should be identified for hill, surface, and pressure (drip and sprinkler) irrigation, plus additional classes for wetland irrigation separated into permanent and seasonal wetlands. The Consultant shall hold stakeholder consultations to obtain agreement for the irrigable criteria to be used in this exercise and shall use the greatest detail of soil mapping available for this exercise.

The irrigable potential assessment shall consider the priorities accorded to respective regions and areas within the country aligned to the National Development Plans.

*The irrigation potential areas determined should respond to the requisite areas within the respective APZs for each specific priority crop, and the best suited farming system and projected trend in expansion targeting the Micro, Small Scale systems, Medium and Large-Scale Schemes.*

#### **d) Delineation, Categorization, and Mapping of Irrigation Systems and Schemes**

For each specific priority crop and the farming system within the specific APZs, the Consultant shall categorize the Micro, Small Scale systems, Medium and Large-Scale systems, and schemes.

The Consultant shall define the scope and packaging for the various scales of irrigation and identify, delineate, and map out potential for small, medium to large scale irrigation systems using the result of the irrigation potential established and propose irrigation scheme development scenarios and approaches.

The Consultant shall carry out an assessment of the irrigation system options covering the following types:



- i) Systems based on gravity flow of rivers and streams from mountainous and other hilly areas of the country,*
- ii) Systems based on gravity flow from other surface water sources such as dams, lakes and water harvesting storage.*
- iii) Systems based on water pumping from all water sources (surface water lakes/swamps, dams and valley tanks, ground water aquifers, water harvesting, etc),*
- iv) Bulk water transfers.*

The irrigation systems assessment shall also include conveyance mechanisms, technical considerations for storage and efficient water distribution and field application. The irrigation systems shall be analysed taking into consideration suitability of soils, geology, climate, topography, land use, agronomy, vegetation, environment, etc for irrigation while also factoring Climate Change and Environmental Flow Requirements.

The Consultant shall prepare an inventory of the delineated irrigation systems based on the classification and categorization adopted. The identified irrigation schemes from the study shall be mapped out using GIS.

#### **e) Integrated Water Resources Management and Availability**

The preparation of the comprehensive National Irrigation Master Plan shall, in accordance with the National Irrigation Policy, be based on Integrated Water Resource Management (IWRM) principles through supporting integrated planning, development and management of water resources for multiple uses.

The Consultant shall study the availability and exploitation of water resources, production potential and utilization and allocation of water to be harnessed for irrigation to increase production and productivity and supplement dependence on rain fed agriculture. The Water Resources Assessment must be matched with the catchments, and the respective APZs with the mapped areas for the respective priority crops where irrigation is going to be needed. The adequacy of the resource must be assessed for each specific category i.e., micro, small, medium, and large-scale schemes. The catchments for the identified irrigation systems shall be captured on the national map using GIS.

The Consultant shall utilize appropriate models to simulate the following components; (i) available surface water in rivers and lakes dependent on base flow and change in storage respectively, (ii) Ground water that depends on the average aquifer yield and drilling success (examining the extent and availability of GW for irrigation), and (iii) the runoff dependent on the rainfall and the runoff coefficient that varies for the different catchments and areas. The analysis should explore the complementary approach of the water sources for a selected priority crop in each APZ that may be experiencing water stress in terms of available surface and ground water. This should define on-site or off-site water resource potentials to provide irrigation to the delineated systems and schemes.

The Consultant shall also use water allocation models, like WEAP, River ware or MIKE-HYDRO-BASIN, to prepare development scenarios allocating available water. Other

internationally tested irrigation models outside those mentioned may be explored. This shall include all water uses, like domestic water use, livestock, aquaculture, hydropower, recreational use, and irrigation.

The Consultant shall undertake a water audit (water balance) for each of the catchments, that is consistent with sustainable water resources utilization, and analyze the amount that is available to meet the crop water requirements of the selected priority crops for each of the APZs after consideration of the various water demand.

The study assessments should align the guidelines that shall provide the basis for water development, water control for different uses and for land use planning (e.g., catchment projection, flood zoning, potential areas for irrigation, reclamation of delta and swamp etc.) at the level of individual catchments to the irrigation systems.

The study shall assess approaches for optimal utilization and promotion of water use efficiency and irrigation system efficiency. The Consultant shall further give an insight on hydro power and other water resources allocation strategies, rights and their impact on irrigation planning and development

***Irrigation and Climate Change Adaptation.*** Irrigation developments are expected to improve Uganda’s resilience to possible future increases in climatic variability and change. These benefits need to be brought out clearly also as an opportunity to tap into funding opportunities for climate change adaptation investments. The Consultant should review the; Uganda Strategic Investment Framework for Sustainable Land Management (U-SIF SLM) 2010-2020; Uganda Climate Smart Agriculture Programme 2015-2025; Nationally Appropriate Mitigation Actions (NAMA) in Uganda and the draft “Climate Change Vulnerability Assessment, Adaptation Strategy and Action Plan for the Water Resources Sector” prepared by DWRM, and consult with the Climate Change Unit for on-going adaptation studies under their direction.

**f) Identification and classification of a ladder of options for smallholder farmers**

Uganda possesses close to 70% smallholder farmers practicing subsistence agriculture. It is therefore important to pay a lot of attention to this category of farmers that are spread across the country with limited land and water resources, and are outside the potential irrigation schemes. Small holder farmer-based irrigation systems shall be instrumental for transformation from subsistence to commercial agriculture as they transit through progressive to commercial farmers. National guidance arising out of this study shall inform the zonal most economically viable crops and irrigation models or combinations for promotion by the districts within the APZs. The Consultant shall make recommendations on how to accelerate the small-scale irrigation development which benefit the smallholder farmers in Uganda using the experience of other countries.

*The NIMP shall define irrigation models or combinations for selected priority crops that are suitable and viable for small holder farmers and prescribe the suitable financing mechanisms for small holder farmer-based irrigation systems for the selected priority crops.*

### **g) Schematic Designs for Irrigation Systems and Schemes**

The Client has identified a list of medium and large schemes which the Consultant will examine, categorize and rank, and prepare schematic designs of the proposed irrigation systems and schemes' layout and extents of coverage for the selected priority crop(s) in the respective APZs. For micro and small scale schemes, the Consultant shall define broad areas and delineate the targets to be achieved aligned to priority crops in the respective APZs, which could be guided by specific approaches like farmer led irrigation among others.

### **h) Environmental and Social Assessment**

The Consultant shall carry out a rapid social and environmental assessment for the delineated irrigation systems and undertake identification of risks, determine the magnitude, and analyze the potential impacts to irrigation interventions and the respective mitigation measures. The Consultant shall determine the approaches to minimize social and environmental risks through adoption of best practicable social and environmental options including compensatory measures, water/wastewater reuse, recycling, reduction and precautionary, preventive and mitigation measures.

Much of the potential irrigable land in Uganda is based on wise use of wetlands. The suitability of these wetlands for irrigation development needs to be assessed considering the potential environmental impacts and the trade-offs between environmental and agricultural uses and benefits. The Consultant shall therefore provide recommendations on how to utilize the wetland for agricultural production focusing on the approach of wise use of wetland.

*Note: The Consultant is expected to acquire necessary data from the responsible agencies and meet all associated costs for the data.*

### **3.2.2 Enabling Productive Irrigation Agriculture Services**

The key challenges to productive irrigation agriculture include ineffective integration and linkages of farmers in the value chain causing inefficiencies, information asymmetries, coordination failures among production and markets players, unreliable access to markets for inputs supply and produce trading, limited credit to finance agricultural value chains, inadequate post-harvest loss management and poor mobility and access roads connecting producers to markets.

The Consultant shall assess the challenges of productive irrigation agriculture on zonal basis, with linkages to the irrigation systems, identify the market opportunities (supply and produce and other consumer goods) and the market chains, access to market information, access to credit, post-harvest handling/storage and develop strategies to address agro-enterprise development needs of farmers, producer organizations, market participants and related institutions in the commodity value chains. The above challenges require execution of productivity-enhancing irrigation investments that respond to market opportunities and needs through productive alliances with the actors and participants.

The Consultant shall assess the agricultural road density (km/sq.km of arable or irrigable land) for the delineated irrigation systems and estimated interventions to eliminate productive mobility and access constraints.

The Consultant shall develop strategies and approaches to establish a favorable environment for irrigated agriculture as a business, engender prioritization of irrigation of high value crops that respond to competitive market opportunities to ensure higher returns on investment, diversification of crop, livestock and fisheries production and productivity, adopt commercial transition arrangements that supports viable contract farming modalities with inherent incentives structures, strengthen market efficiency for inputs supply and produce trading.

The Consultant shall prepare guidelines for operational and advisory support to farmers/producers, commercial/market participants to ensure effective prioritization, efficient utilization and sustainability of irrigation agriculture interventions, support to targeted production enterprises responding to available market opportunities and linkages, formalization of organizations and contractual relationships.

### **3.2.3 Sustainable Institutional Development of Irrigation Agriculture**

#### **a) Institutional and Organizational Framework**

For effective implementation of the proposed irrigation Master Plan the Consultant shall formulate an appropriate institutional framework and shall recommend appropriate capacity building strategies. This will take into consideration the existing mandates of various stakeholders, legislation and policy framework, and possible funding mechanisms.

The Consultant shall assess and carry out problem analyses, derive and propose measures to address institutional challenges related to insufficient legal framework for management and regulation of irrigation agriculture services, farmers' insufficient ability or inexperience of irrigation management, weak ownership and financial base of farmers, inefficient and inadequate technical training services for the farmers, lack of efficient support for the farmers' bottom up movement by the government institutions, inefficient harmonization of relevant governmental organizations and other bottle-necks identified by the Consultant.

#### **b) Sustainable Irrigation Management**

The Consultant shall prepare a plan for rational use of water for irrigation, maximizing revenues and increasing efficiency of irrigation systems (micro, small, medium, and large scale). The Consultant shall analyze the various scheme management models, identify pros and cons of each model and recommend the best scheme management model(s) for each irrigation systems category.

The Consultant shall propose institutional arrangements and legal framework for scheme management, to enable collaborative management, development, and cost-sharing, including O&M, such as Irrigation Water User Associations (IWUAs) and Catchment Management Organizations (CMOs), Producer/Farmer Organizations, Productive-Commercial Alliances etc. The Consultant shall develop a detailed strategy and implementation plan for operation and

maintenance of the irrigation infrastructure including reservoirs, irrigation, and drainage networks.

The Consultant shall assess and propose models for effective and efficient management of irrigation systems (micro, small, medium, and large systems) at most appropriate level or multi layered joint arrangements to ensure financial viability and functional performance.

**c) Agricultural and Irrigation Advisory/Extension Services**

It is expected that advisory/extension services will have to be considerably expanded and strengthened for realization of the objectives of the proposed irrigation master plan. The nature and extent of such services required shall therefore be identified by the Consultant as well as a proposed approach to expanding/strengthening them. The Consultant shall refer to the National Agricultural Extension Policy and Strategy (2017) for guidance. The Consultant shall discuss recommendations on the strengthening of Agricultural and Irrigation Advisory extension system for irrigation development using experiences from other countries.

**d) Research and Innovations**

The Consultant shall study the framework for irrigation agriculture research and define mechanisms to strengthen research, innovation and technology development in relevant institutions and dissemination of irrigation knowledge among stakeholders at national, regional, district and local levels to attain high productivity and meet quality standards.

**e) Cross Cutting Issues**

The Consultant shall review the importance of women, youth, persons with disabilities, and those living with HIV/AIDS in irrigated agriculture and define mainstreaming measures targeted at integrating aspects of social protection, skills enhancement, empowerment and knowledge acquisition and access to productive resources considered in irrigation interventions and agriculture value chains development.

**f) Guidelines for Institutional Capacity Development for Irrigation Agriculture**

The Consultant shall prepare guidelines for institutional capacity development for addressing actions to:

- i) Strengthen the institutional capacity and establish an effective management framework for productive investments with involvement of key actors/players of all players both at national and local levels to ensure good governance of irrigation development investments, deliver efficiency in water use and maintain the functionality of all irrigation systems.
- ii) Establish effective farmer organizations based on enterprise/producer associations/alliances supported enabling them to implement plans to improve production and marketing through a clear and coherent framework with roles and responsibilities.

- iii) Strengthen institutional/organizational technical capacity – training and extension services, financial capacity – credit, cost recovery and tariffs for O&M, private sector capacity – promotion and support for value chain actors.
- iv) Set-up framework for farmers and produce organization business planning, adoption of technologies, skills development for improvement of productivity and sustainability of investments.
- v) Establish MIS System, database for registration and monitoring of farmers/producer groups, mobile technology for supply and produce markets. Establish functional MIS with proper linkages for information sharing amongst farmers, farmer/producer organizations, local governments, zonal/regional centers and national level on production, irrigation investment management services. The monitoring and evaluation framework shall be operationalized to feed into both the Agriculture Water Management Information System (AWMIS) / M&E system at MAAIF and the Water MIS under MWE.
- vi) Strengthen sub-sector Monitoring and Evaluation at farmer/producer, local, zonal/regional, and national levels linked to irrigation policy and strategies and streamline reporting mechanisms to ensure effective planning and development of irrigation interventions.

### **3.2.4 Irrigation Investment, Financing, and Implementation Plan**

#### **a) Economic and Financial Analysis**

The Consultant will undertake the macro economic and financial analyses for development of irrigation systems (micro, small, medium, and large scale) delineated to determine the costs and benefits, rate of return on investments in irrigation development in Uganda over the set horizon. The indicative investment capital costs, replacement and operation and maintenance costs, cost recovery revenue streams, management and capacity development shall be analysed. The Consultant shall define guiding cost recovery tariff structures and levels for irrigation services related to cropping seasons, farm acreage, water use efficiency and targets for farmers meeting costs for operation and maintenance of the irrigation scheme.

The Consultant shall use the Multi-Criteria-Analysis to rank and prioritize irrigation systems for final selection into the National Irrigation Master Plan and shall hold stakeholder consultations to agree criteria for analysis.

#### **b) Prioritization of Irrigation Investments**

The Consultant shall prepare indicative priority investments for irrigation systems (micro, small, medium, and large scale) based on agreed selection criteria that considers technical feasibility, economic viability, social desirability, environmental sustainability, institutional functionality, and other suggested conditions. The selected criteria for allocation and priority setting for irrigation systems development shall ensure fairness and equity.

The Consultant shall develop the portfolio for irrigation schemes development based on catchment local and zonal level for all irrigation systems (micro, small, medium, and large scale) and including productive irrigation support services, institutional capacity development, agricultural extension services, cost recovery etc. The portfolio for irrigation schemes development shall elaborate the command areas, catchment areas, proposed water sources and technology options. The Consultant shall assess the investment requirements for implementation of the proposed portfolio for irrigation schemes development. This plan will be phased, and shall be consistent with the Vision 2040 or other set horizon.

**c) Investment Mechanisms and Financing Arrangements**

The Consultant shall prepare an investment strategy and framework to guide the implementation of the irrigation development plan. The Consultant shall assess probable investment mechanisms and financing arrangements for productive commercially oriented market responsive irrigation development to ensure strategic, adequate, and reliable implementation of the National Irrigation Master Plan. The financing arrangements should enable funding viable productive investments and services for irrigation systems including micro, small, medium, and large scale at respective producer, local, zonal/regional, and national levels and should incorporate support for profitable farming practices.

**d) Creation of Attractive Investment Climate**

Consultant shall define measures aimed at establishing an attractive climate for investment in irrigation through Producer Public-Private Partnerships (PPPPs) supported with requisite long-term finance, tax incentives, stable security of tenure, matching grants for producer organizations, partial credit guarantees etc. The Consultant shall align the investment mechanisms and financing arrangements to ensure effective resource mobilization from internal and external sources for irrigation development. The investment and financing arrangements shall as well consider affordable credit facilities and low interest loans for development of irrigation systems including supporting individual progressive farmers to invest in micro and small-scale irrigation systems executed through local community arrangements.

**e) Implementation Plan and Phasing**

The Consultant shall prepare an implementation plan and shall propose appropriate phasing for implementation of the National Irrigation Master Plan largely incorporating key aspects:

- i) Short Term Interventions – stimulation/orientation of farmers/producers and value chain players and institutions to execute commercially oriented irrigation development.
- ii) Medium Term Interventions – transition of farmers/producers and value chain players to private sector led irrigation development.
- iii) Long-Term Interventions – target market-led self-financing Producer Public-Private Partnerships for investment in infrastructure, management, and value chain support services for development of sustainable irrigation agriculture.

#### **4 Stakeholder Consultations**

The Consultant shall make wide consultations with all the key governmental and non-governmental stakeholders associated with the irrigation sub-sector. These shall include Development Partners (World Bank, African Development Bank, French Development Agency, DANIDA, USAID, JICA, European Union and others involved in the sector), Agencies such as The Food and Agriculture Organization (FAO) and World Food Programme.

The line ministries and Organizations shall include Office of the Prime Minister (OPM), Ministry of Agriculture Animal Industry and Fisheries (MAAIF) and its agencies, National Agricultural Advisory Services (NAADS), National Agricultural Research Organization (NARO) and associated research institutes, Zonal Agricultural Research and Development Institutes (ZARDIs), Ministry of Finance Planning and Economic Development (MoFPED), National Planning Authority (NPA), Ministry of Water and Environment (MWE) and its agencies and regional structures, National Environment Management Authority (NEMA), Uganda National Meteorological Authority (UNMA), Ministry of Trade Industry and Cooperative (MoTIC), Ministry of Local Government (MoLG), Ministry of Gender Labour and Social Development (MGLSD), Ministry of Energy and Mineral Development (MEMD), Ministry of Information and ICT, National Information Technology Authority – Uganda (NITA-U) and District Local Governments.

Other stakeholders include Private Sector Institutions, Non-Government Organizations (NGOs), Civil Society Organizations (CSOs), Community Based Organizations (CBOs), Farmer/Producer Organizations which include community groups, associations, cooperatives, producers and produce agents, among others; and financial institutions engaged for agriculture credit at local and national level, insurance firms and other players in the agriculture sector linked to irrigation development.

Workshops shall be organized by the Consultant for dissemination of findings to all the key stakeholders. The financial and logistical obligations concerning these meetings shall be met by the Client. The Consultant will be required to include a provisional sum of USD 50,000 to meet the costs of holding the workshops/meetings. The Consultant shall only plan and budget for financial and logistical obligations towards all its key experts to ensure they fully attend and participate in the workshops. Any contractual liabilities shall be managed administratively with the Client according to the provisions of the Governing contract.

#### **5 Training and Capacity Building**

For purposes of capacity building and ensuring adequate direct involvement of the Client in delivering the final project objectives, the Client will assign staff that shall be agreed upon with the consultant prior to commencement of the consultancy services.

The Consultant shall work with, and train designated staff with the aim of developing capacity and knowledge transfer. Training will include key areas related to the assignment such as technical studies, investigations, economic and financial modelling, climate change modeling,



training in software and tools used etc. The training measures are aimed at cultivating strategic irrigation projects' formulation knowledge and overall competencies of the designated technical staff. The Consultant shall propose training topics in the technical proposal which will be further defined during consultative meetings with respective entities.

The proposal shall include an approach and methodology for the knowledge transfer throughout the assignment, the proposed training obligations of the consultant, the type and duration of training activities to be undertaken, the optimum number of participants in each training, methodology for monitoring and evaluation of trainees, and any post training support and resources.

## **6 Duration of the assignment**

The duration of the Consultancy Services shall be twelve (12) Calendar months. It is the responsibility of the Consultant to establish a detailed work program within the above time estimate.

## **7 Reporting and Schedule**

The Consultant will be directly responsible to a Technical Coordination Committee comprising of senior technical staff from Ministry of Water and Environment (MWE), Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Ministry of Trade Industry and Cooperatives (MoTIC), Ministry of Finance Planning and Economic Development (MoFPED), National Environment Management Authority (NEMA), National Planning Authority (NPA). The Commissioner - Water for Production (MWE) and Commissioner – Agricultural Infrastructure, Mechanization and Water for Agricultural Production (MAAIF) shall co-chair the Technical Coordination Committee.

The following key reports will be prepared by the Consultant and submitted to the Commissioner Water for Production (MWE) and Commissioner Agricultural Infrastructure, Mechanization and Water for Agricultural Production (MAAIF) for review and dissemination to key stakeholders. The reports shall be prepared in Microsoft Office Windows XP Professional or compatible software and hardware. Other software that may be used in the carrying out the assignment shall be declared and ought to be compatible with Windows XP operating system. The reports shall include exhaustive illustrations of the content in the form of digitized colored photographs, figures and drawings. Six hard copies of each report shall be submitted together with a soft copy in the form of a clearly labelled compact disc. All reports shall be prepared in the English language at the consultants' cost.

The assignment will commence as soon as the necessary instructions in this regard have been issued by the Client. The assignment will be carried out over a period of twelve (12) calendar months.

The National Irrigation Master Plan deliverables will be presented as follows:

***(i) Inception Report***

One (01) calendar month after commencement of the assignment, the Consultant will be expected to submit a Technical Appraisal Report which will elaborate among others, a detailed and explicit methodology, work plan, staff organization and schedules. The report shall also address, among others, details of the pertinent key technical, institutional, socio-economic, and environmental issues that will have to be taken into consideration.

***(ii) Interim Report***

Three (03) calendar months after commencement of the assignment, the Consultant will be expected to submit an Interim Report which will elaborate the Review of Framework and Strategic Approach for the Master Plan taking into account such aspects as the strategic alignment, resource optimization, Coordinated action among multiple stakeholders, adaptability and risk management mechanisms, evidence – based decision making (integrating water informatics, program monitoring, evaluation and learning mechanisms), Assessment of long - term impact of the Master plan, and development pathways including Public/Private Partnerships, Farmer Led Irrigation, among others.

The report shall further elaborate the preliminary desk and field investigations, studies and analyses, corresponding GIS mappings and or model results of the various study aspects including Agronomy Assessment, irrigation potential, and delineation and mapping of irrigation systems and schemes.

***(iii) Draft Detailed Portfolio for Irrigation Scheme Development***

Five (05) calendar months after commencement of the assignment, the Consultant will be expected to submit the Draft Detailed Portfolio for Irrigation Schemes Development. The report shall incorporate all comments and observations on the Interim Report from the Client, and shall including among other aspects detail outlines and schematic designs of the irrigation systems and schemes' layout and extents of coverage for the selected priority crop in the respective APZ, as well as the associated cost estimates, and financial and economic analyses.

***Note: The Consultant's submission shall be considered complete, submitted together with all the primary data, simulation model input and result files, GIS shapefiles and CAD Drawings.***

***(iv) Detailed Portfolio for Irrigation Scheme Development***

Eight (08) months from the date of commencement of the assignment, the Consultant will be required to submit the Detailed Portfolio for Potential Irrigation Scheme Development and make a presentation. The Detailed Portfolio for irrigation scheme development must include a high-level prefeasibility report for medium and large-scale potential irrigation schemes following the tasks under Section 3. For sites requiring major hydraulic infrastructure such as dams, the prefeasibility must entail more rigorous hydrological, geological, geomorphological, and geotechnical desk study assessments.

The report shall extensively detail indicative priority investments for irrigation systems (micro, small, medium, and large scale) based on agreed selection criteria that considers technical feasibility, economic viability, social desirability, environmental sustainability, institutional functionality, and other suggested conditions. The selected criteria for allocation and priority setting for irrigation systems development shall ensure fairness and equity.

The report shall further detail potential irrigation development packages based on catchment local and zonal level for all irrigation systems (micro, small, medium, and large scale) The potential irrigation development packages shall include the command areas, catchment areas, proposed water sources and technology options.

From the submission and presentations, the Consultant will receive comments and recommendations for improvement or adoption at Draft Irrigation Master Plan stage.

***Note: The Consultant's submission shall be considered complete, submitted together with all the primary data, simulation model input and result files, GIS shapefiles and CAD Drawings.***

***(v) Draft Irrigation Master Plan***

Ten (10) calendar months from the date of commencement of the assignment, the Consultant will be required to submit a Draft Irrigation Master Plan and make a presentation within two (2) weeks of the submission. In preparation of this report, the Consultant shall lay out the strategic direction for irrigation development combining all the findings from the previous two deliverables i.e., the Draft Detailed Portfolio for Irrigation Scheme Development, and Detailed Portfolio for Irrigation Scheme Development. The discussion should also clearly elaborate proposed productive irrigation support services, institutional capacity development, agricultural extension services, cost recovery, proposed governance and irrigation management improvement strategies, and proposed financing arrangements or approaches, etc.

The report shall ***elaborate all requirements in accordance with the scope of work detailed under Section 3 of these Terms of Reference.*** The report shall further present ***a detailed analysis and refined cost estimates and economic feasibility assessments for implementation of the Master Plan.*** From the submission and presentations, the Consultant will receive comments and recommendations for improvement or adoption at Final stage.

***Note: The Consultant's submission of the Draft Irrigation Master Plan shall be considered complete, submitted together with all the primary data, simulation model input and result files, GIS shapefiles and CAD Drawings.***

***(vi) Stakeholder Consultations Report***

The Consultant shall commence consultations with all key stakeholders ten (10) months from commencement of the assignment for a duration of one (1) month. The Consultant will hold seminars to obtain consensus on the identification and selection criteria for development projects, and strategic and investment plans for the master plan. The Consultant will use the opportunity to receive feedback from the key stakeholders and shall make improvements to the

Draft National Irrigation Master Plan. Furthermore, the Consultant shall be expected to submit a Stakeholder Consultation report together with the Final Irrigation Master Plan.

***(vii) Completion of Training Report***

Ten (10) calendar months from commencement of the assignment, the Consultant shall submit the Completion of Training Report that shall state the type and duration of training activities undertaken during the execution of the assignment, the number of participants in each training, methodology for monitoring and evaluation of trainees, training outputs and achievements, as well as recommendations for further / continued training if any, and any post training support and resources.

***(viii) National Irrigation Master Plan***

On receipt of Client's formal comments on the Draft Irrigation Master Plan, the Consultant will proceed with finalization of the National Irrigation Master Plan to be submitted by the end of the Twelfth (12<sup>th</sup>) month after the commencement of the assignment.

***Note: The Consultant's submission of each deliverable shall be considered complete, submitted together with all the primary data, simulation model input and result files, GIS shapefiles and CAD Drawings.***

**8 Firm Qualifications, Logistical Setup and Staffing**

Minimum of 15 years of core business as a Consultant in undertaking strategic planning for Water Resources Infrastructure Development Projects.

The Consultant shall demonstrate experience in carrying out at least one (01) large scale water infrastructure strategic planning project in the last 10 years of a value of at least US\$ 0.75 Million. The assignments must include significant engineering infrastructure such as dams, bulk water supply systems and or large-scale irrigation systems i.e. 3,000ha and above.

The Consultant shall further demonstrate experience in carrying out at least two (02) Feasibility Studies and design assignments for medium to large scale irrigation i.e. 3,000 ha and above, in the last 10 years.

The Consultant shall also attach Contract Agreements and Completion Certificates of the completed similar assignments in English, in addition to the actual scope and value of work undertaken.

The Consultant is expected to field a team of professionals who shall work in an efficiently coordinated process to execute the activities under the assignment prescribed and implied under Section 3 Scope of Work of these Terms of Reference.

Within the technical proposal, the Consultant shall elaborate on the envisaged logistical setup and deployment of appropriate skills for execution of the assignment. The consultant shall present the staffing schedule in a manner that clearly shows the duration when each of the proposed experts is planned to be involved in the project.

An organogram reflecting the responsibilities of each expert and line management setup of the proposed team shall be part of the proposal. It is recommended that the consultant integrates local expertise into the project execution team.

The Consultant’s core team shall include a(n): Water Resource Engineer/Hydrologist, Hydraulic Engineer, Irrigation Engineer, GIS-RS Expert, Soil Expert, Agronomist, Irrigation Management/Institutional Expert, , Dam/Geotechnical Engineer, Social Scientist, Environmental Specialist, Financial and Economic Analyst. These may be *supported by a logically scheduled optimum mix of any other professional inputs as deemed necessary.*

<b>Key personnel required</b>	<b>Main responsibilities</b>	<b>Man-months</b>
Team Leader/Water Infrastructure Expert	<ul style="list-style-type: none"> <li>- The Team Leader will oversee the overall planning and implementation of the assignment as well as coordination and management of all the other experts proposed for the assignment.</li> <li>- He / She will ensure technical and socio-economic coherence of the proposed projects, promote the exchange of knowledge and experience between the team members, provide liaison with the project management and relevant Government Institutions and ensure timely and accurate reporting.</li> </ul>	6
Water Resources Expert	<ul style="list-style-type: none"> <li>- Identification, collection, and analysis of hydrological and climatological data required for the assignment,</li> <li>- Perform hydrological assessments with the aid of suitable computer aided design software.</li> <li>- Analyze groundwater potential in targeted areas of irrigation development and propose recommendations.</li> <li>- Assess and define Integrated Water Resources Management (IWRM) approaches for catchment-based planning and regulation processes for irrigation systems development.</li> <li>- Prepare guidelines for water resources allocation for irrigation systems development.</li> </ul>	6
Hydraulic Engineer	<ul style="list-style-type: none"> <li>- Undertake reconnaissance survey, analysis, delineation, and mapping of irrigation systems options (micro, small, medium, and large scale), and conceptual design for major off-farm infrastructure including dams, diversion/abstraction/intake structures, pumping stations, and bulk storage, conveyance mains and distribution systems (primary, secondary &amp; tertiary canals, drains, pipelines) up to the water use areas.</li> <li>- Examine the adequacy of the available water sources to meet the competing demands in particular water use areas.</li> </ul>	7
GIS-RS Expert	<ul style="list-style-type: none"> <li>- Identify available GIS layers relevant to irrigation planning in Uganda; relevant themes/information are likely to include, but not be limited to soils, agro-climatology, water availability, farming systems, population, prevailing slopes, environmental hazard, etc.</li> </ul>	6

<b>Key personnel required</b>	<b>Main responsibilities</b>	<b>Man-months</b>
	<ul style="list-style-type: none"> <li>- Mapping of irrigation potential for micro, small, medium, and large-scale systems.</li> <li>- At the request of the Team Leader or any other team members, to undertake the GIS analyses and to prepare GIS graphics that support or illustrate their contributions to the National Irrigation Master Plan contribute as appropriate to the output documentation expected of the study any other relevant tasks at the request of the Team leader.</li> </ul>	
Irrigation Engineer	<ul style="list-style-type: none"> <li>- Undertake selection of an irrigation system and undertake outline design of the various irrigation systems and related irrigation infrastructure and water use amenities for irrigation within the water use areas considering the various categories namely small scale, medium and large-scale schemes.</li> <li>- Carry out selection of cost-effective irrigation systems for small scale, medium and large-scale schemes.</li> </ul>	6
Soil Expert	<ul style="list-style-type: none"> <li>- Establish or confirm as appropriate Uganda's soil taxonomy in terms of type and distribution to satisfactory detail,</li> <li>- Classify the soils generically in terms of fertility, slopes, depth and moisture holding capacity assist the National GIS Expert to map the results,</li> <li>- Create generic farming systems for each major soil type and region, that can be used for the purposes of indicative water allocation and economic analyses</li> </ul>	3
Agronomist	<ul style="list-style-type: none"> <li>- Carry out agricultural soil studies and suitability analysis for irrigation of crops and determination of crop water requirements and budgets for various crops in the potential areas. Also determine livestock watering and aquaculture water demands and supply arrangements.</li> <li>- Assess suitability of soils for crops for the proposed irrigation systems</li> <li>- Make proposals for strengthening the Agricultural and Irrigation Advisory extension system and innovative research for irrigation development.</li> <li>- Undertake assessment of suitability land tenure systems and optimal utilization of land for irrigation agriculture</li> <li>- Prepare guidelines to define institutional mechanisms and productive arrangements for farmers' security of tenure (user rights, access rights, transfer rights, exclusion rights and enforcement rights) for irrigation development</li> </ul>	3
Agribusiness Specialist	<ul style="list-style-type: none"> <li>- Undertake assignment tasks for enabling productive irrigation agriculture services.</li> </ul>	3

<b>Key personnel required</b>	<b>Main responsibilities</b>	<b>Man-months</b>
	<ul style="list-style-type: none"> <li>- Suggest generic farming systems appropriate both to the country's agro-ecological zones and to market expectations in Uganda, the Region and Globally in the short, medium, or long terms: the generic farming systems i) should be sufficient to allow indicative water allocation and economic analyses; and ii) can be expected to change over the short; medium and long terms.</li> <li>- Identify and describe any challenges and opportunities in both supply and produce markets and value-added chains.</li> <li>- Prepare strategies to enhance growth of irrigation agriculture as a business targeting profitable agro-enterprises.</li> <li>- Identify key business weaknesses, opportunities, and constraints - policy, regulatory and bureaucratic processes to be addressed.</li> <li>- Identify key value chain players, actors, and stakeholders.</li> <li>- Recommend and facilitate, support, and put in place functional agribusiness value chain development frameworks, structures, and systems in addition to training of the farmers and producer organizations in similar approaches.</li> <li>- Propose arrangements for establishment and coordination of agribusiness value chain partnerships, relationships, and constructive dialogues for irrigated agriculture commodities.</li> </ul>	
Dam/Geotechnical Engineer	<ul style="list-style-type: none"> <li>- Identify and assess locations for strategic multipurpose dams. Review existing geological and geophysical data for the proposed locations and undertake preliminary investigations to determine suitability of sites for dams and reservoir/storage.</li> <li>- Conduct thorough site reconnaissance leading to the selection of the best dam site.</li> <li>- Undertake outline design of dams and their appurtenant structures.</li> <li>- Assess Foundation conditions often determined from a visual inspection of erosional features, of outcrops, and of excavations such as highway or railroad cuts, building excavations, abandoned pits, and quarries in the general area of the damsite.</li> <li>- Assess ground-water conditions the information for which is often obtained from local wells.</li> </ul>	6
Social Scientist	<ul style="list-style-type: none"> <li>- Identification, update and collection of baseline and socio-economic data and analysis of the data for assessment of socio-economic potential for preparation of the National Irrigation Masterplan.</li> <li>- Assess socio-economic potential including demographic,</li> </ul>	3

<b>Key personnel required</b>	<b>Main responsibilities</b>	<b>Man-months</b>
	<p>farmer populations, road density and food security.</p> <ul style="list-style-type: none"> <li>- Prepare social assessments and identify potential risks and mitigations due to irrigation developments.</li> <li>- Responsible for actions for women, youth, persons with disabilities, and those living with HIV/AIDS in irrigated agriculture and define mainstreaming measures.</li> </ul>	
Irrigation Management / Institutional Expert	<ul style="list-style-type: none"> <li>- The Consultant shall review, identify challenges, draw lessons from the current irrigation management models and make proposals for consideration of appropriate scheme management models for each irrigation scheme category. The Consultant shall strengthen mechanisms for rational use of water.</li> </ul>	2
Environmental Specialist	<ul style="list-style-type: none"> <li>- Describe and assess the environmental risks and hazards implicit in the selected draft National Irrigation Master Plan and their potential implications and specify and describe any mitigation measures.</li> </ul>	4
Financial and Economic Analyst	<ul style="list-style-type: none"> <li>- Assess and carry out a financial and economic analysis for design and construction of water for production infrastructure and facilities including irrigation systems.</li> <li>- Prepare prioritization and investment plans for irrigation development.</li> <li>- Define investment mechanism and financing arrangements for irrigation development.</li> <li>- Drawing up the implementation plan for the National Irrigation Master Plan.</li> <li>- Undertake an indicative economic and sensitivity analyses of the National Irrigation Master Plan, which as currently intended will be based on i) a range of development strategies; distributed generic farming systems and regionally specific implementation plans and ii) a supporting programme of investments in institutional formulation, training, and capacity building, and iii) which may include tax or other incentives.</li> <li>- Assess possibilities for enhancing the economic performance of the Plan and any risks of an economic or trade nature that might threaten its success or sustainability.</li> </ul>	5
<b>Total Professional Staff-months</b>		<b>60</b>



The key personnel shall have minimum academic qualifications and experience as stipulated below.

- Team Leader/Water Infrastructure Expert: 1<sup>st</sup> Degree in Civil or Hydraulic or Water Resources or Irrigation Engineering and master's degree in Water Resources or Water Supply or Irrigation or Hydraulic Engineering with at least 15 years' relevant experience in water infrastructure projects. He must also possess experience and skills in design and construction of hydraulic structures such as dams, bulk water supply, and irrigation systems. The Expert should have participated as a Team Leader in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation. S/He shall be a Registered Engineer with Uganda Engineers Registration Board or any other recognized engineering body.
- GIS – RS Expert: 1<sup>st</sup> degree in any relevant geographical, geophysical, or statistical science and a postgraduate qualification in Geographical Information Systems with at least 10 years' experience in geographical planning/monitoring and 3 years in GIS activities using state of the art software. The Expert should have participated as a GIS – RS Expert in at least 2No. water infrastructure projects involving application of geographical information systems and remote sensing analyses.
- Water Resources Expert: A bachelor's degree in water resources or Hydrology or Civil, and master's degree in water resources related field with at least 15 years relevant experience and specific similar assignments in water resources assessments and hydrological studies, use of water resources models for assessments as well as experience in use of GIS/remote sensing in river basins. The Expert should have participated as a Water Resources Expert in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.
- Soil Expert: Bachelor's degree in agriculture, soil science, or another related discipline, a postgraduate qualification in soil science or taxonomy with minimum 10 years' experience in soil surveying and classification. The Expert should have participated as a Soil Expert in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.
- Agronomist: Bachelor's degree in Agronomy or Agricultural Sciences with at least 10 years relevant experience and specific experience in agricultural studies, irrigation, and livestock development projects. The Expert should have participated as an Agronomist in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.
- Agribusiness Specialist: A bachelor's degree in Agribusiness Management/Agriculture Rural Innovation/Agriculture Extension/Agriculture Land use and Management/, Agriculture (crop) and postgraduate qualification in agribusiness, agricultural marketing, and should demonstrate at least ten years' experience in agribusiness and marketing. The Expert should have participated as an Agribusiness Specialist in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.

- **Hydraulic Engineer:** Bachelor's degree in civil or water engineering and master's degree in Hydraulic Engineering with at least 10 years relevant experience and specific similar assignments in design of hydraulic infrastructure including dams, diversion/abstraction/intake structures, pumping stations, and bulk storage, conveyance mains and distribution systems (primary, secondary & tertiary canals, drains, pipelines) etc. The Expert should have participated as a Hydraulic Engineer in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation, and entailing engineering infrastructure such as dams, bulk water supply systems and or large-scale irrigation systems. He shall be a Registered Engineer with Uganda Engineers Registration Board or any other recognized engineering body.
- **Irrigation Engineer:** Bachelor's degree in civil or water engineering and master's degree in Irrigation Engineering with at least 10 years relevant experience and specific similar assignments in planning and design of irrigation and drainage systems and water use amenities for irrigation. The Expert should have participated as an Irrigation Engineer in at least 2No. assignments involving feasibility study and design of medium to large-scale irrigation systems.
- **Dam/Geotechnical Engineer:** A bachelor's degree in civil or Dam Engineering with at least 10 years of experience in geotechnical investigations, design and construction supervision of earth dams and hydraulic structures. The Expert should have participated as a Dam/Geotechnical Engineer in at least 2No. assignments involving feasibility study and design of engineering infrastructure such as dams, bulk water supply systems and or large-scale irrigation systems. The Dam/Geotechnical Engineer shall be a Registered Engineer with Uganda Engineers Registration Board or any other recognized engineering body.
- **Irrigation Management Expert:** A bachelor's degree in Civil Engineering / Agricultural Engineering / Irrigation Management. S/he must possess at least 10 years' working experience in irrigation management, training, institutional development / management of various players / actors in the Agro-value chains. The Expert should have participated as an Irrigation Management Expert in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.
- **Social Scientist:** A bachelor's degree and master's degree in social sciences or development studies with minimum of at least 10 years of relevant experience and specific experience in baseline and socio-economic surveys and gender issues. The Expert should have participated as a Social Scientist in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.
- **Environmental Specialist:** 1<sup>st</sup> Degree in Environmental Sciences or related fields and a postgraduate qualification in Environmental Sciences with at least 10 years' experience in EIA and SIA of social projects particularly water and sanitation. He/ She should be a registered Environmental Practitioner with NEMA. The Expert should have participated as an Environmental Specialist in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.

- Financial and Economic Specialist: A bachelor's degree, and postgraduate qualifications in economics and should demonstrate at least ten years' experience in macro-economic analyses of which at least five recent years have been spent working in the agricultural and water sector and/or including value-added economics. The Expert should have participated as a Financial and Economic Specialist in at least 2No. assignments involving feasibility study and design of medium to large scale irrigation.

The Consultant is expected to provide all facilities for executing the assignment, including office and field equipment, vehicles, and office accommodation. The Consultant is expected to provide under his bid all costs associated with the assignment. The costs for workshops for presentation of Inception Report and Draft Irrigation Master Plan shall be met directly by the Client. It is also expected that the consultants will be responsible for the collection of all literature, information and data required for the assignment at our own cost.