Food and Agriculture Organization of the United Nations

CIHEAM IAM BARI

AgWA Partnership for agricultural water for Africa

Emerging practices from Agricultural Water Management in Africa and the Near East

Thematic Workshop

Country experiences

Uganda – Mubuku Irrigation Scheme

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29 August 2017

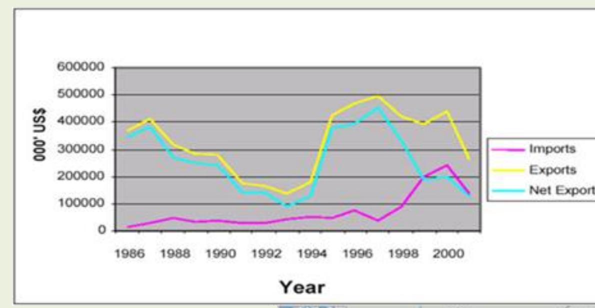
Theme 6:
Water Accounting

PRESENTATION OUTLINE

Background and Introduction

Problem Statement and Definition (Pilot Area)

Objectives and Scope



Project Components and Approach

Outputs, Results and Lessons Learned

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Background and Introduction

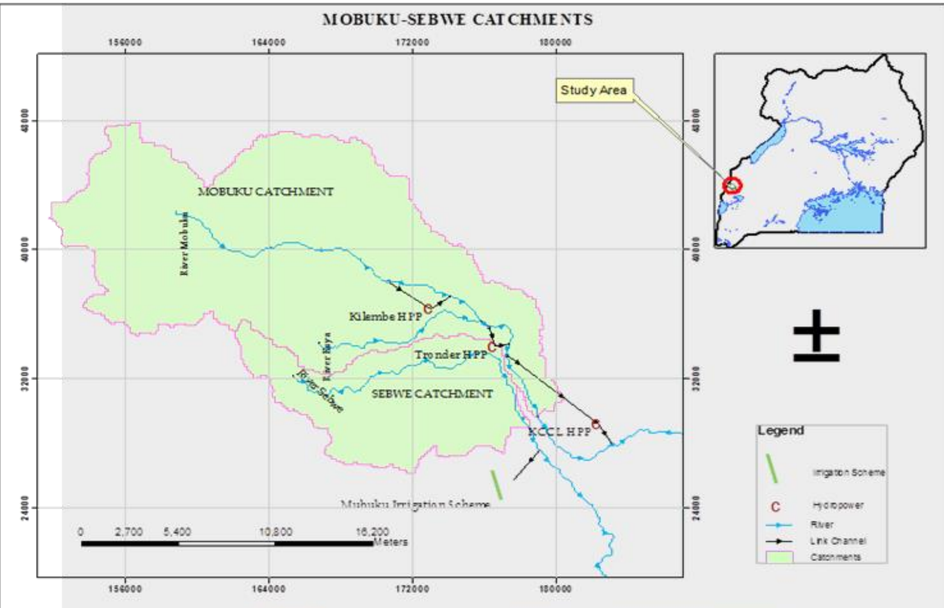
Agriculture contributes > 20 % of the GDP of the entire Nile Basin. 160 Million people of the NB population (240) have jobs in the agriculture sector.

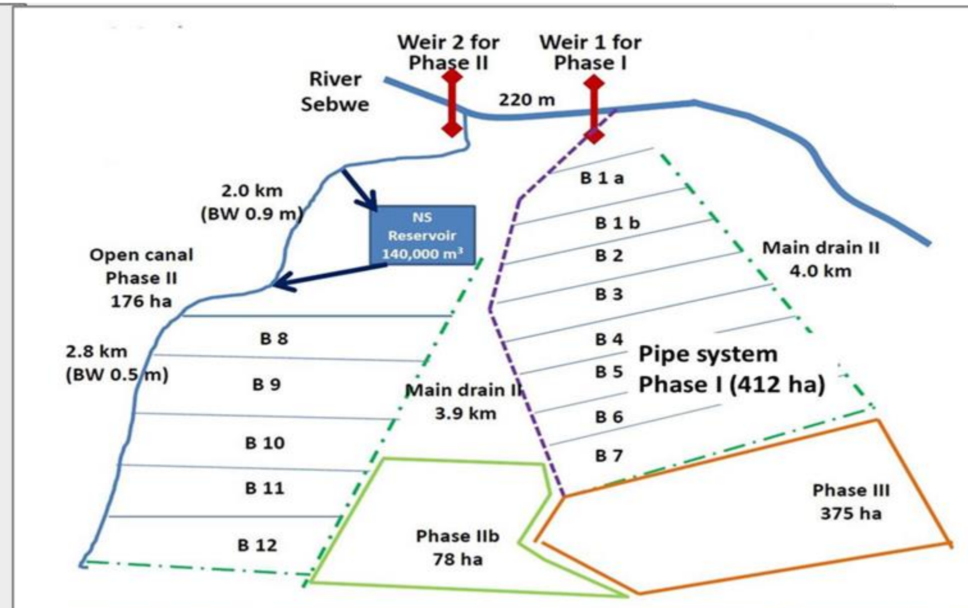
Agriculture dominates the Ugandan economy and society, contributing 44% of the total output and employing 80% of the labor force.

The agricultural sector is the backbone of Uganda's economy as its main source of livelihood and contributes over 70 percent of Uganda's export earnings and provides the bulk of the raw materials for most of the industries that are predominantly agro-based.

Factors such as *market access, licensing and quantitative import restrictions, implementation of regional trade agreements, use of special safeguards, domestic support*, and *export subsidies* are effective; AGRICULTURE PRODDUCTIVITY AND IRRIGATION are at the center.

PILOT AREA LOCATION





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OBJECTIVES – PILOT RELATED

The overall study objective is to *explore scenarios of Mubuku irrigation expansion coupled with other water uses in the Mubuku catchment*.

Specific objectives;

- Undertake situation assessment and field visit.
- Develop a DSS application for the Mubuku catchment.
- Develop & analyze 2 – 3 scenarios of Mubuku irrigation expansion under different irrigation efficiency levels.
- Explore Mubuku scheme expansion under different AWU efficiencies; guided by the design plans and practices.
- Draw solid recommendations; justified by findings.

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PROJECT COMPONENTS – PILOT RELATED

FAO Uganda requested the NBI Secretariat (Nile-SEC) to assist MWE – Uganda in developing a Decision Support System (DSS) application for the Mubuku [Sebwe] catchment (*present as well as potential water users*).

The study aims at exploring potential expansion of the Mubuku irrigation scheme under a range of scenarios addressing **improved irrigation efficiencies**. Study duration: January – July 2017.

FAO signed a Letter of Agreement with NBI to support the Ministry in undertaking the study; following essentially *consultative approach*.

Technical work involved:

- Data compilation, processing, and gap filling;
- Building the model (calibration/validation) and scenarios;
- Modeling of the catchment behaviour (Simulations);
- Generating indicators for modeling parameters; and
- Analysis of results and training (capacity building).

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PROJECT COMPONENTS – PILOT RELATED

The study was carried out in two phases:

Phase I : Inception phase

(Collect, Compile and process relevant data)

- Setting the scene for the model development, scenario building and multi-criteria 'comparative' analysis.
- This phase focuses on gathering data and information from all sources; including the field mission.

Phase II : Analysis and DSS Application Development

- Develop the Mubuku catchment model, *Benchmarking.*
- Develop the DSS application; *water resources planning.*
- Model four "broadly agreed" scenarios using the NB-DSS to account for Mubuku irrigation expansion; simulations, MCA.
- Analyse the modelling results and synthesize study findings.
- Present study conclusions and recommendations (RT & WK).

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PROJECT COMPONENTS – PILOT RELATED

A DSS application for Mubuku catchment developed (*can be used to perform unlimited number of planning alternatives; data and model were handed over*).

A DSS application with extended MET records and river discharges (*to be updated regularly*).

Four DSS planning scenarios that fully address Mubuku irrigation expansion scope under different improved irrigation efficiency levels.

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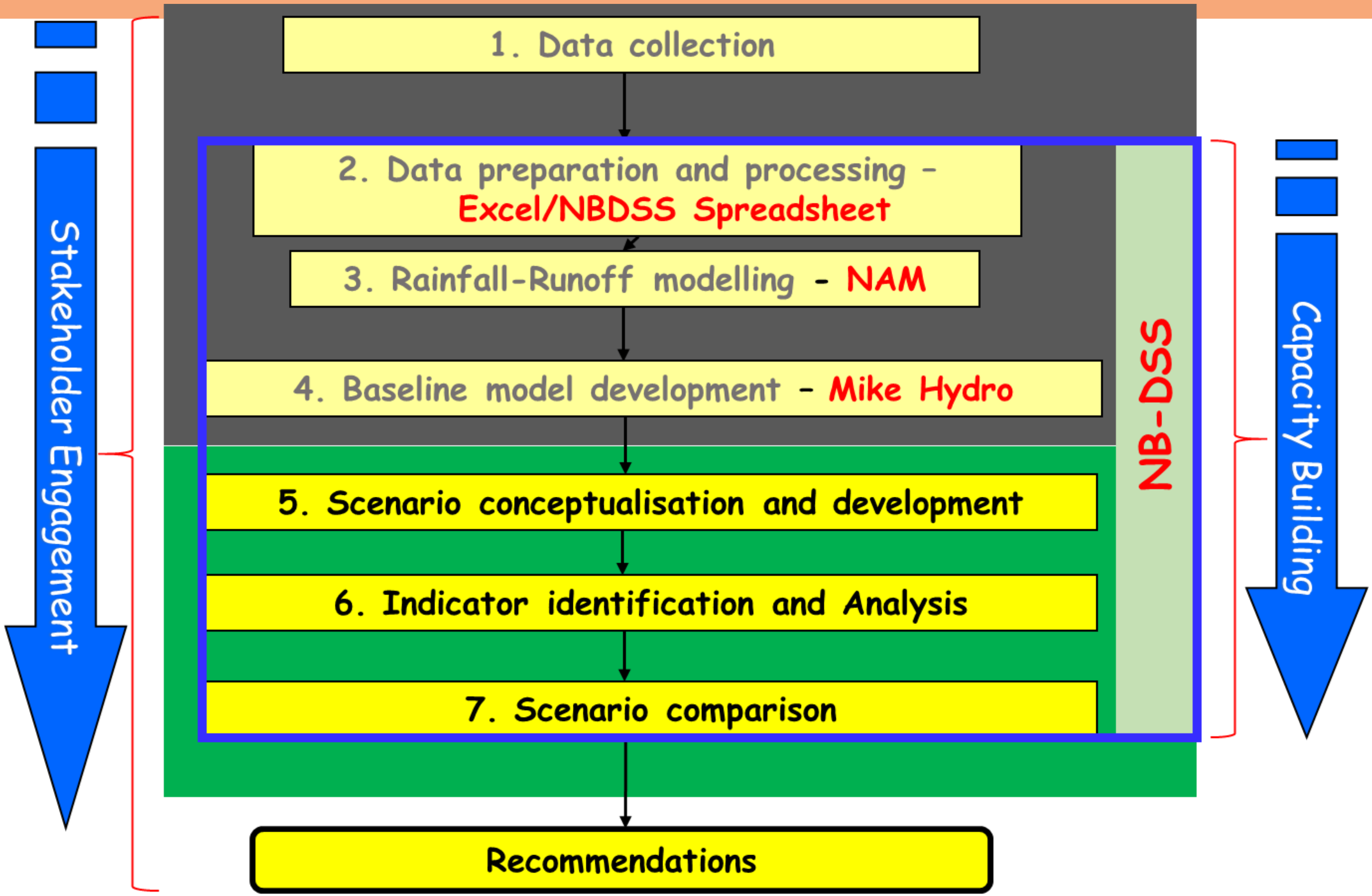
WORK FLOW – PILOT RELATED



PLANNING SCENARIOS– PILOT RELATED

Key considerations in scenario formulation

- Irrigation efficiency improvement based on:
  - Conveyance
  - Distribution
  - Application systems
- Improving any single system efficiency improved the combined efficiency
- Baseline/Reference case:
  - Main canals - Lined and piped systems
  - Laterals – Lined
  - Sub-laterals – Earthed
  - Field ditches – Earthed (out of shape)
  - Poorly maintained furrows

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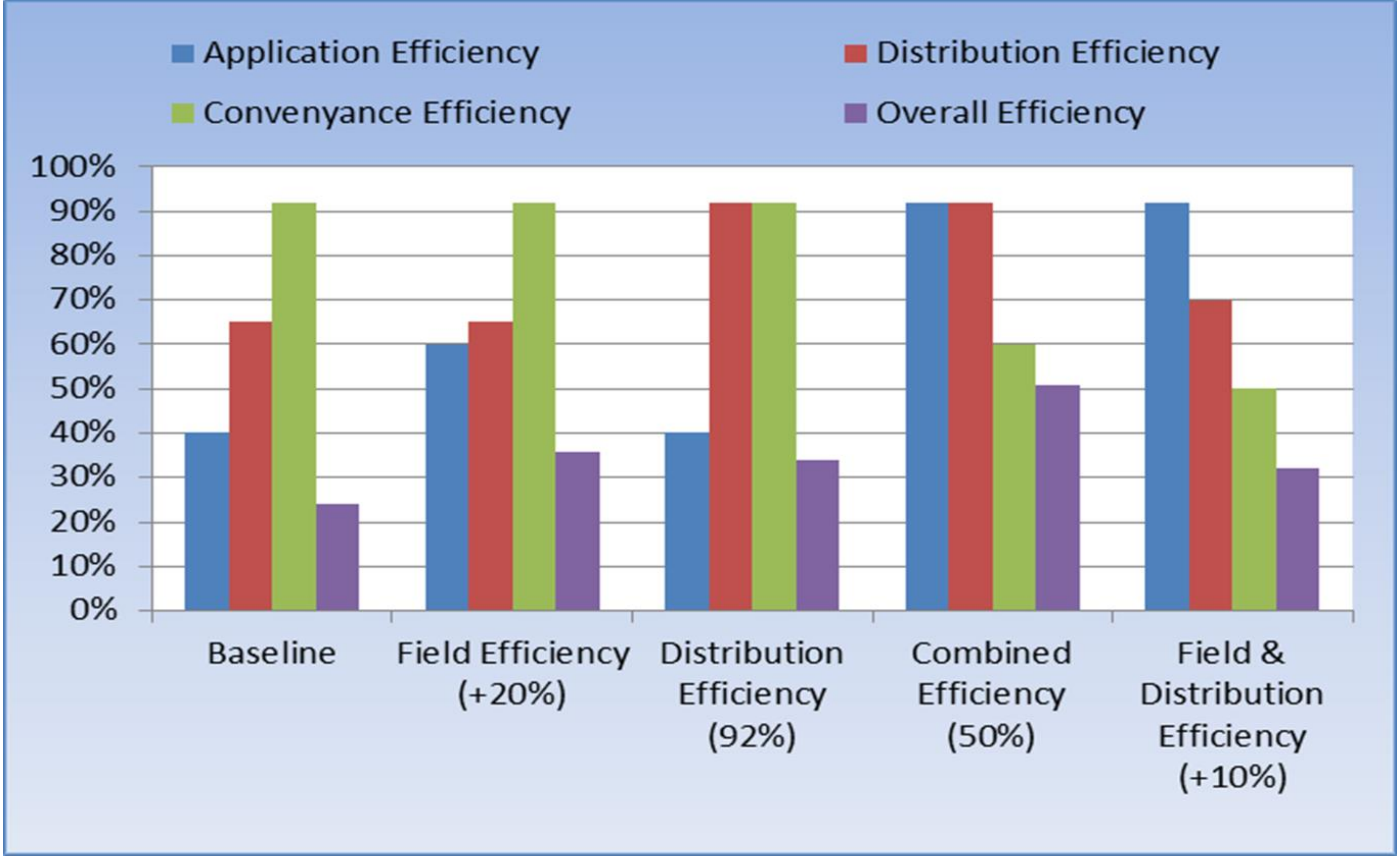
PLANNING SCENARIOS – PILOT RELATED



PLANNING SCENARIOS DETAILS – PILOT RELATED

Proposed Scenarios *(workshop/Stakeholder recommendations)*	**Formulated Scenarios description** *[order of efficiencies, E_c * E_d * E_a for conveyance, distribution, and application respectively*
Baseline	E_c * E_d * E_a 92% * 65% * 40% = **23.92%**
1 - Improvement of the application efficiency by 20%	Improvement of the application efficiency by 20% from the baseline 92% * 65% * 60% = **35.88%** *E_a improved from 40% to 60%*
2 - Improvement of the distribution efficiency up to 65%-75%	Improvement of the distribution efficiency up to 92% 92% * 92% * 40% = **33.86%** *E_d improved from 65% to 92%*
3 - Improving overall Irrigation efficiency up to 50%-60%	Improving overall Irrigation efficiency up to 50%-60% (combines E_d and E_a) 92% * 92% * 60% = **50.78%.** *E_d improved from 65% to 92% and E_a improved from 40% to 60%*
4 – Mix of Scenarios 1 and 2	Slight improvement of the overall efficiency (combines E_d and E_a) 92% * 70% * 50% = **32.2%** *E_d slightly improved from 65% to 70% and E_a improved from 40% to 50%.*

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PLANNING SCENARIOS ENHANCEMENT INTERVENTIONS

Scenario	Suggested Interventions
1 - Improvement of the application efficiency by 20% - *(Overall irrigation efficiency of 35.88%)*	• Routine furrow maintenance (free from weeds and reeds, avoid ponding, and overflows) and rehabilitation of field ditches
	• Adherence to application time to avoid runoff to the drains before application to the root zone
	• Adherence to management of releases to the fields (installation of irrigation flow meters to monitor)
2 - Improvement of the distribution efficiency up to 65%-75% *(Overall irrigation efficiency of 33.86%)*	• Lining the sub-laterals
	• Lining the field ditches
3 - Improving overall Irrigation efficiency up to 50%-60% *(Overall irrigation efficiency of 50.78%)*	• Routine furrow maintenance (free from weeds and reeds, avoid ponding, and overflows)
	• Adherence to application time to avoid runoff to the drains before application to the root zone
	• Adherence to management of releases to the fields (installation of irrigation flow meters to monitor)
	• Lining the sub-laterals
	• Lining the field ditches
4 – Mix of Scenarios 1 and 2 *(Overall irrigation efficiency of 32.2%)*	• Routine furrow maintenance (free from weeds and reeds, avoid ponding, and overflows)
	• Adherence to application time to avoid runoff to the drains before application to the root zone
	• Adherence to management of releases to the fields (installation of irrigation flow meters to monitor)
	• Rehabilitating (to manage widening and deepening) and maintaining field ditches

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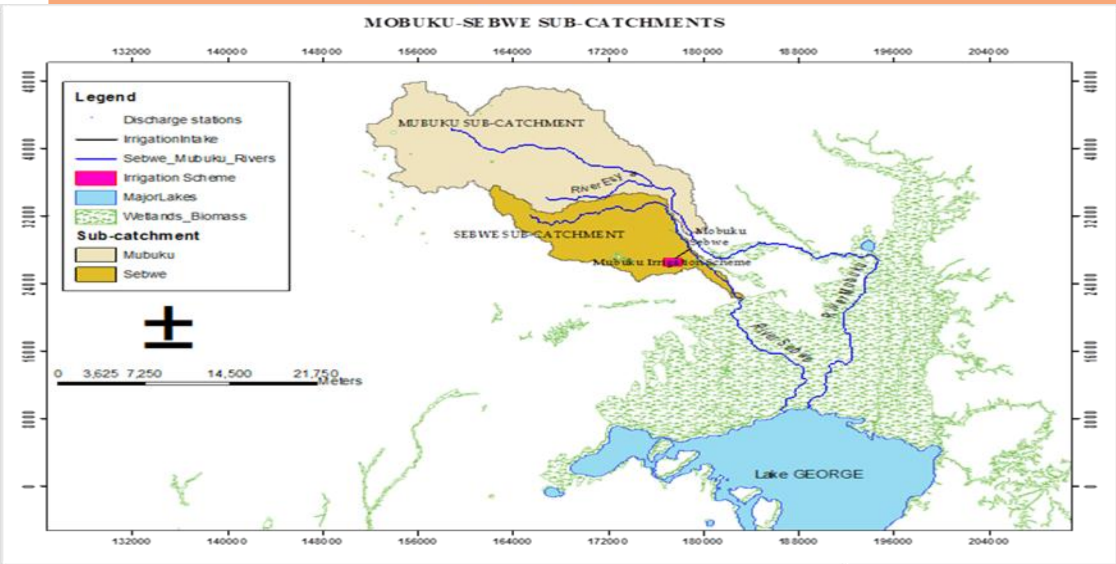
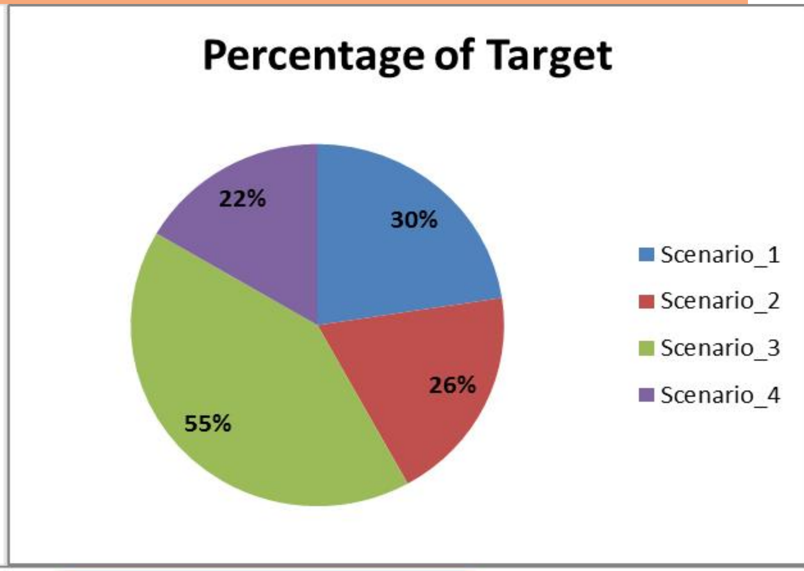
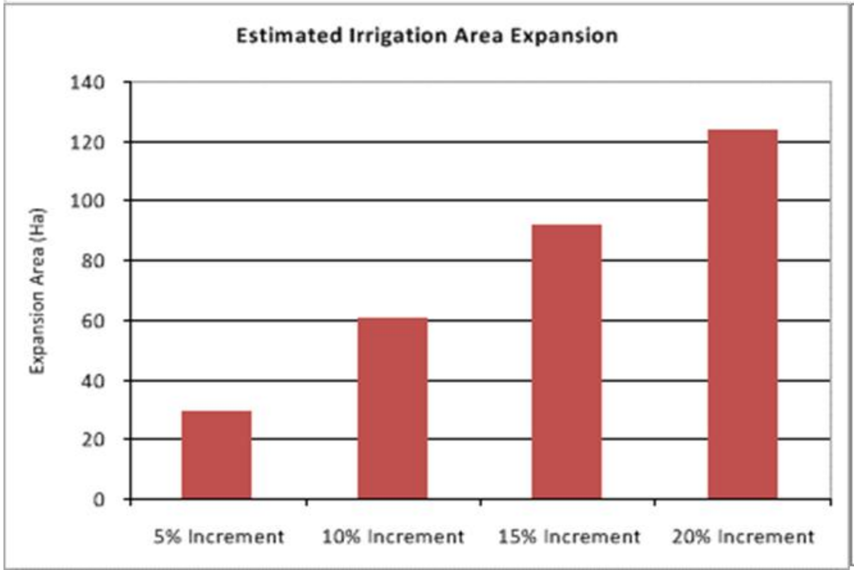
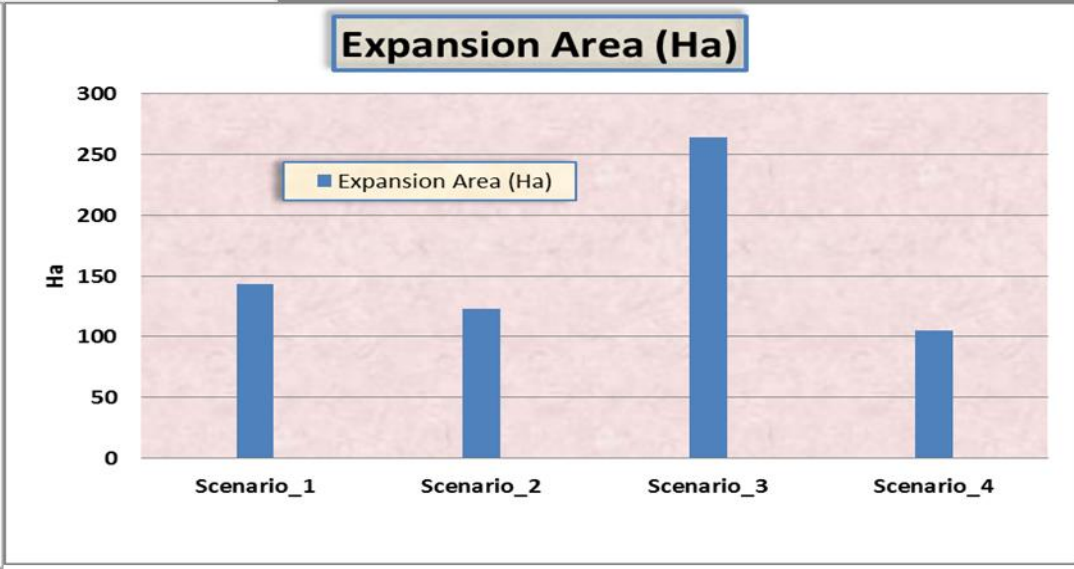
RESULTS IN FIGURES/FACTS









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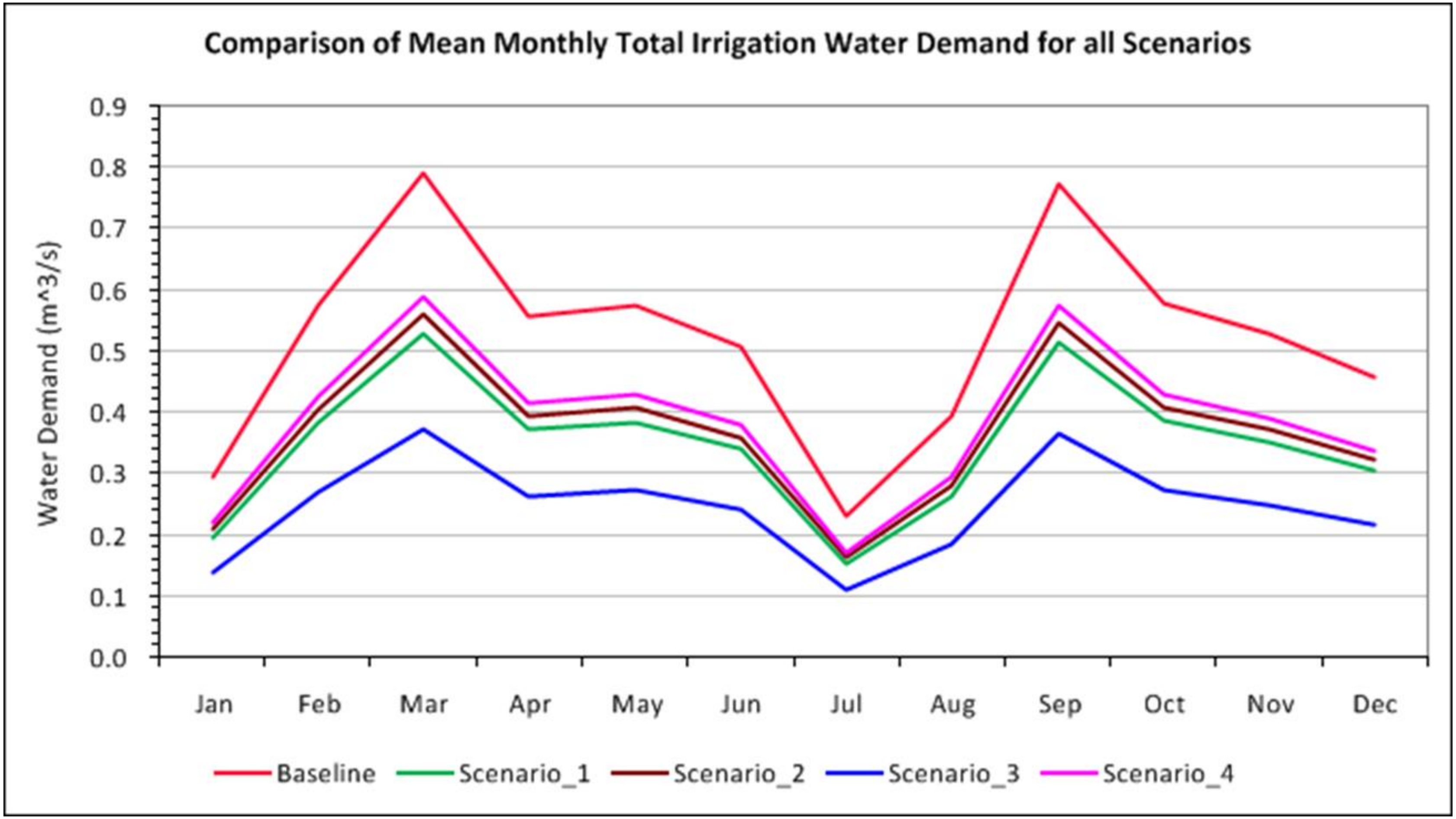
RESULTS IN FIGURES/FACTS



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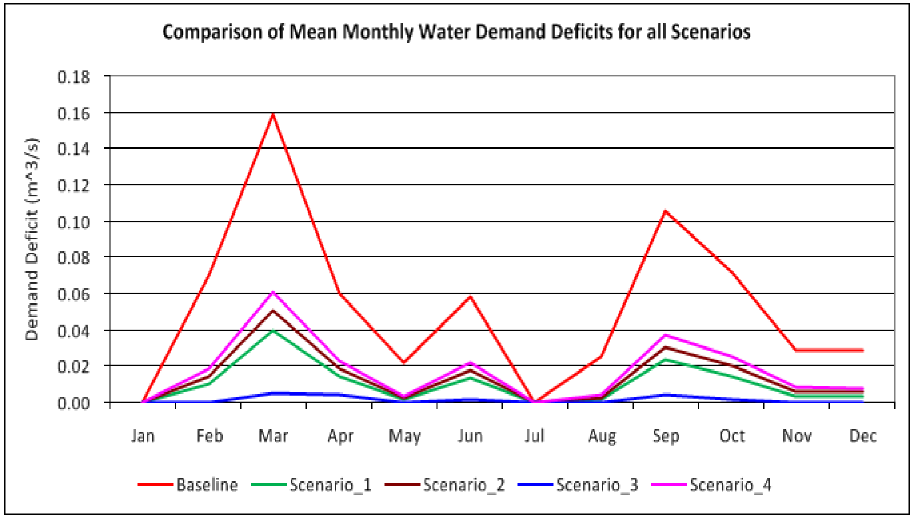
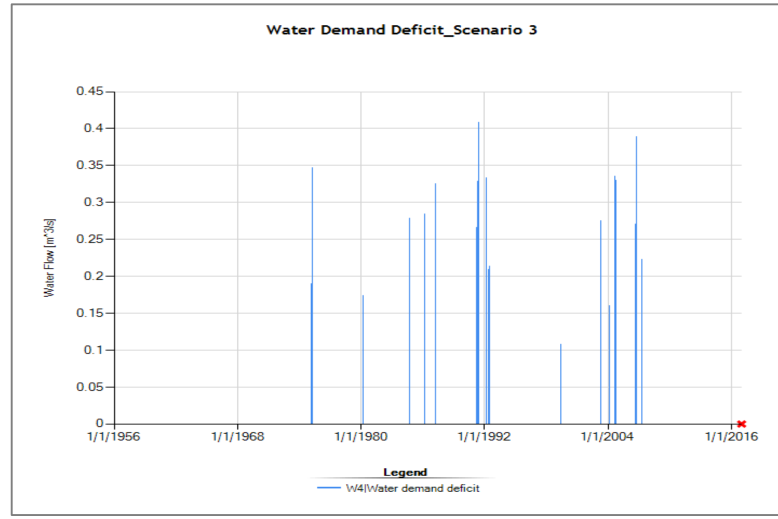
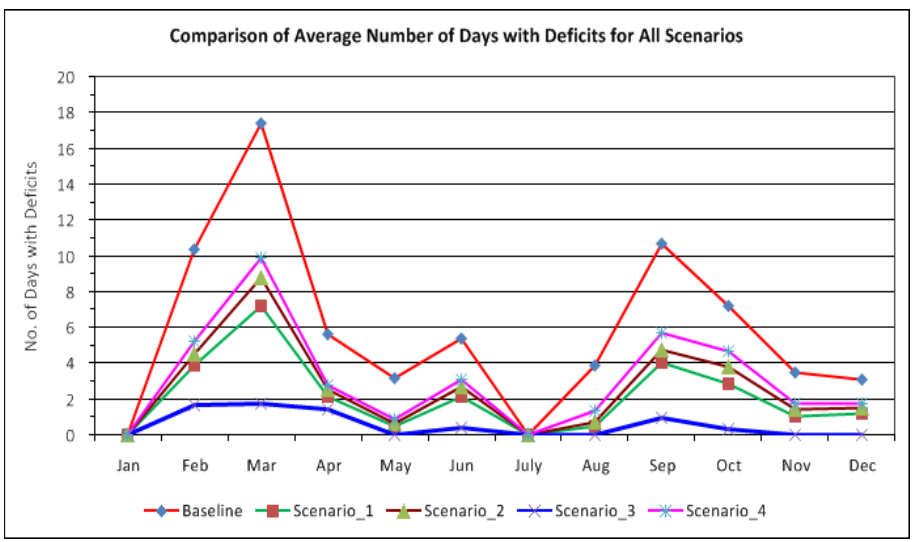
RESULTS IN FIGURES/FACTS







Scenario (3) results in terms of water deficits are isolated with **0.69%** of the time registering deficits; i.e. 154 days out of 22281 days for the whole simulation period of 61 years (1956 - 2016).

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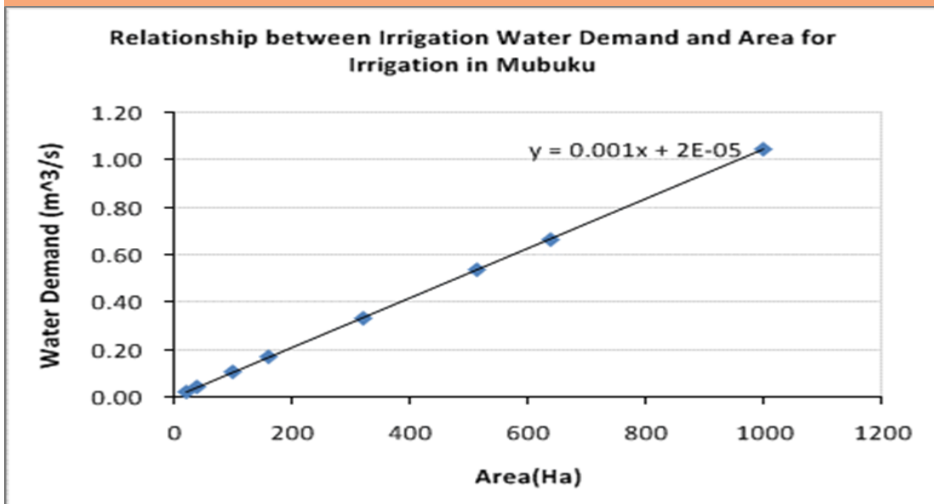
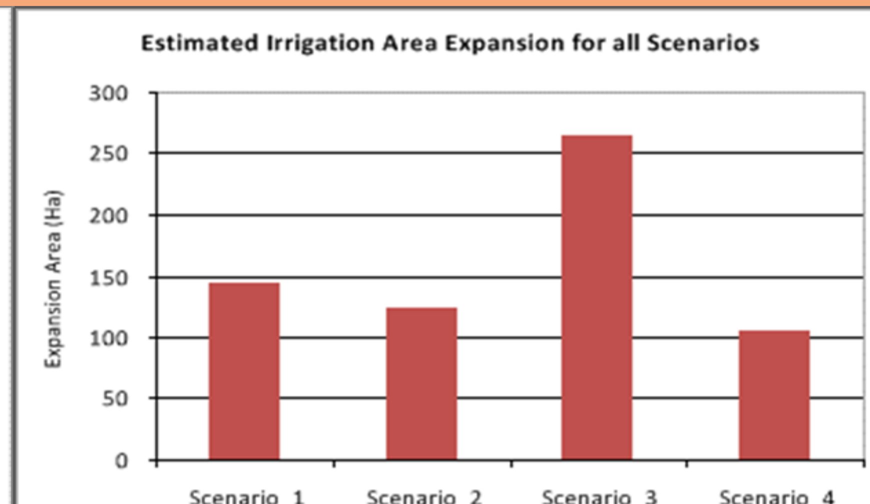
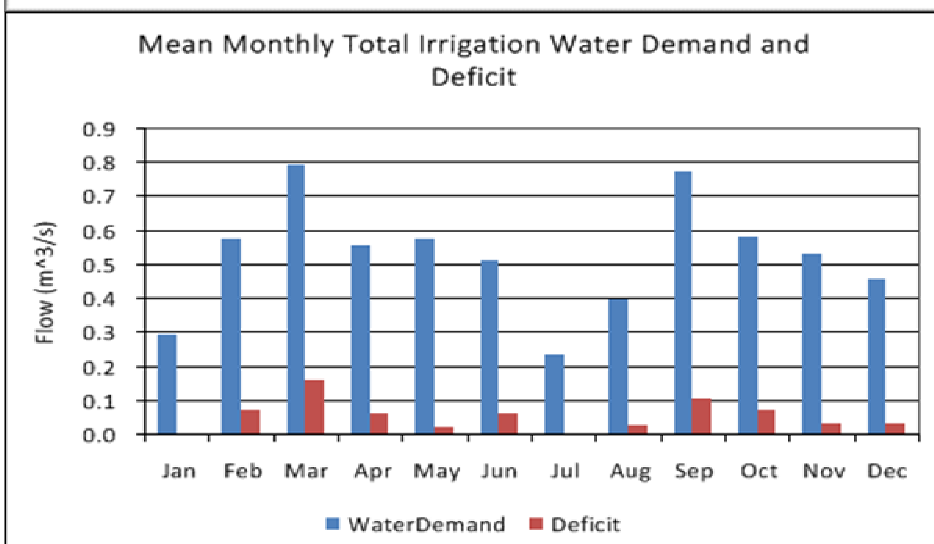
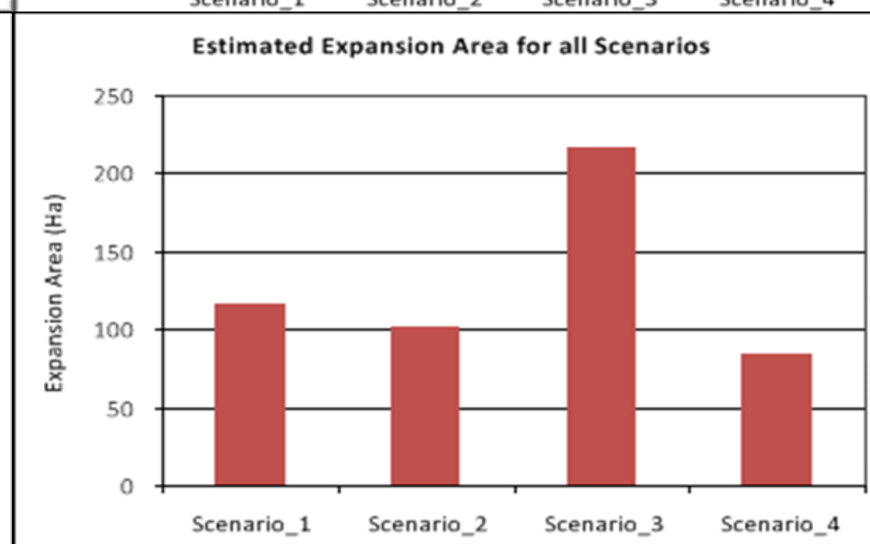
RESULTS IN FIGURES/FACTS





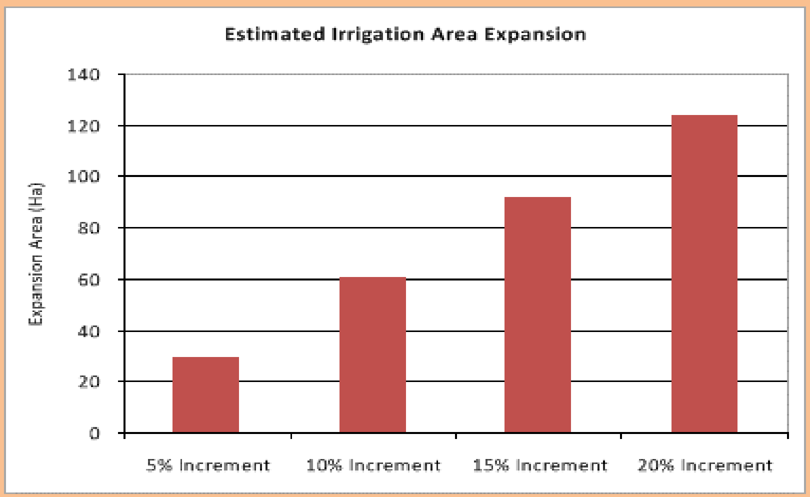




RESULTS IN FIGURES/FACTS

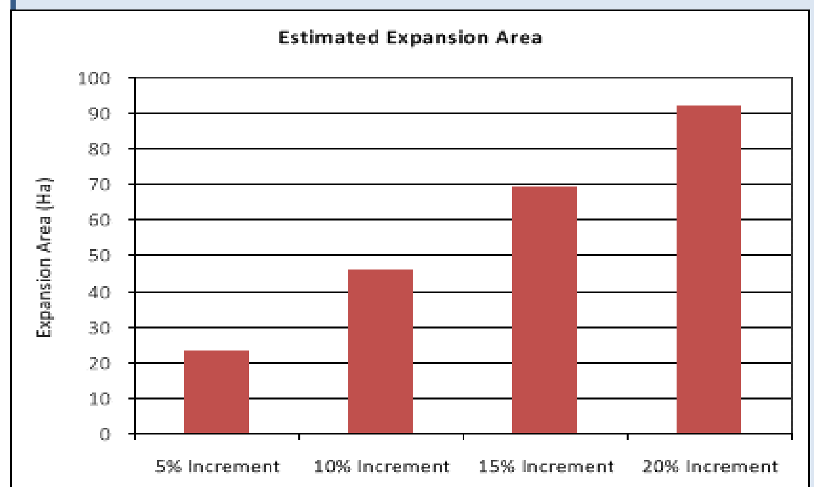
Estimated areas – Incremental water withdrawal

Based on month with Highest Deficit/Demand ratio - March



Increment	Incremental water (m^3/s)	Expansion Area (Ha)
5% Increment	0.029	29.24
10% Increment	0.061	60.68
15% Increment	0.092	92.13
20% Increment	0.124	123.58

Based on the critical crop stage for yield maximization - 22nd April



Increment	Incremental water (m^3/s)	Expansion Area (Ha)
5% Increment	0.023	23.01
10% Increment	0.046	46.03
15% Increment	0.069	69.06
20% Increment	0.092	92.09

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EXPERIENCES AND LESSONS LEARNED

Based on the assumption that the current water withdrawal satisfies the irrigation demand, a range from 84 Ha (Scenario 4) to 264 Ha (Scenario 3) of expansion area can be achieved by improving irrigation efficiency for the specific scenarios.

If the computed deficits are actually realized (lack of field data to confirm this), the saved water as a result of improved efficiency only meets the deficits (taking the maximum deficits in March), therefore no additional area can be irrigated.

Very low irrigation efficiency is currently being experienced, especially the application efficiency. Need to improve this with the suggested interventions *(even without intentions to expand the scheme).* This will significantly enhance the productivity and entire efficiency.

Need to establish water metering devices to enable collection of data about abstraction amounts a well as diversions into the laterals, sub-laterals, and field ditches – enhance data collection on system monitoring and/or performance assessment.

Need to establish current level of deficits (from field measurements and experiments) and losses so as to get a precise estimate of the water saving once these improvements in efficiencies are effected. Deficit management is key to increased yield & livelihood.

Improving the irrigation efficiency with the formulated scenarios (as an approach to expand the schemes' irrigation area) can't cover all the planned 480Ha, so it is recommended that alternative sources of water other than River Sebwe be sought.

It is recommended that the scheme installs a weather station of its own for monitoring the weather patterns other than relying on weather data from other agencies which has proven to have some issues to do with quality.

Need to investigate the possibility of having a reservoir upstream of the scheme to help manage deficits.

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CHALLENGES AND THE WAY TO IMPROVE

CHALLENGES

- DATA SCARCITY: INFORMATION GAPS.
- IRRIGATION PRACTICES: IRRIGATION SCHEDULING, SCHEME DESIGN, ETC.
- COMPETING 'UNACCOUNTED FOR' WATER USERS
- INFRASTRUCTURAL DEFICIENCY: MAINTENANCE AND APPLICATION
- EXCESSIVE DRAINAGE WATER VOLUMES: INADEQUATE DRAINS' CAPACITY
- RIVER WATER IS ALLOCATED: SYSTEM IS UNDER WATER STRESS
- NIGHT STORAGE IS NOT FULLY UTILIZED
- ILLEGAL WATER USES (CANAL AND DRAIN NETWORKS)
- WATER QUALITY DETERIORATION AND E-FLOWS (MINING, HP, ETC.)
- ECONOMIC FEASIBILITY (PUMPING AND OTHER COSTS)
- WATER LOSSES AND WATER USE EFFICIENCY

SCOPE FOR IMPROVEMENT

- FIELD MEASUREMENTS (WATER ABSTRACTION, WATER SUPPLY, DRAINAGE); HYDRO-METEOROLOGICAL AND WATER USE (DEMAND) INFORMATION.
- RELIABLE ESTIMATES (NO., UNITS, ETC.)
- ROUTINE MAINTENANCE PLAN; FINANCE.
- IWRM APPROACH TO BE ADOPTED.
- UNOFFICIAL EXPANSIONS TO BE CONSIDERED.
- CATCHMENT DEVELOPMENT PLAN.
- SYSTEM DESIGN STRICTLY APPLIED.
- AWARENESS, OUTREACH, ENGAGEMENT.
- EFFLUENT STANDARDS ENFORCED.
- HYDRO-ECONOMY PRINCIPLES INCLUDED.
- GOVERNMENT SUPPORT AND ADVISORY SERVICES; CROP YIELD OPTIMIZATION.
- CROPPING PATTERNS AND STAGGERING.
- ECONOMY OF SCALE.

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CHALLENGES AND THE WAY TO IMPROVE

CHALLENGES

- Rainfed agriculture is subject to rainfall variability
- Deviation from design
- Competing water demands
- System water stress
- Limited management capacity
- Illegal encroachments
- Localized vision/perspective

SCOPE FOR IMPROVEMENT

- Complementary irrigation is mostly a viable option.
- An integrated package:
  - Scheme Infrastructure
  - Irrigation scheduling
  - Motivation & incentives
- Inter-sectoral coordination
- Conjunctive use (SW + GW)
- Stakeholders' involvement
- National policy/framework