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Report No: PAD1387

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT PAPER

ON A

PROPOSED ADDITIONAL CREDIT

IN THE AMOUNT OF SDR 41.3 MILLION
(US\$58 MILLION EQUIVALENT)

AND A PROPOSED ADDITIONAL GRANT FROM THE KOREA WORLD BANK GROUP
PARTNERSHIP FACILITY

IN THE AMOUNT OF US\$3.5 MILLION

TO THE

REPUBLIC OF KENYA

FOR A

KENYA WATER SECURITY AND CLIMATE RESILIENCE PROJECT

June 4, 2015

Water Global Practice
Africa

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CURRENCY EQUIVALENTS

(Exchange Rate Effective as of April 30, 2015)

Currency Unit = Kenya Shilling (K Sh)
K Sh 94.65 = US\$1
US\$1.40647 = SDR 1

FISCAL YEAR
July 1 – June 30

ABBREVIATIONS AND ACRONYMS

AAD	Average Annual Damage
AF	Additional Financing
A-I-E	Authority to Incur Expenditure
APVC	Agricultural Products Value Chain
ASCV	Agricultural Support and Chain Value
CDD	Community-driven Development
CF	Conversion Factor
CWSB	Coast Water Services Board
DA	Designated Account
DMA	District Metering Area
EFA	Economic and Financial Analysis
EIRR	Economic Internal Rate of Return
ESMF	Environment and Social Management Framework
FIRR	Financial Internal Rate of Return
FM	Financial Management
GIS	Geographic Information System
GoK	Government of Kenya
GRS	Grievance Redress Service
HVC	Higher-value Crop
ICT	Information Communication Technology
IDA	International Development Association
IF	Investment Framework
IFR	Interim Financial Report
IRR	Internal Rate of Return
ISC	Implementation Support Consultant
IWUA	Irrigation Water User Association
KALRO	Kenyan Agricultural and Livestock Research Organization
K Sh	Kenya Shilling
KfW	Kreditanstalt für Wiederaufbau (KfW Development Bank)
KWPF	Korea World Bank Group Partnership Facility
KWSCR-1	Kenya Water Security and Climate Resilience Program - Phase 1

KWSCR-2	Kenya Water Security and Climate Resilience Program - Phase 2 (Coastal Region Water Security and Climate Resilience Project)
LNIS	Lower Nzoia Irrigation Scheme
LVNWSB	Lake Victoria North Water Services Board
LPCD	Liters per capita per day
M&E	Monitoring and Evaluation
MDWENR	Mombasa County Department of Water, Environment, and Natural Resources
MEWNR	Ministry of Environment, Water, and Natural Resources
MoA	Memorandum of Agreement
MOWASCO	Mombasa Water and Sewerage Company
MoU	Memorandum of Understanding
NIB	National Irrigation Board
NPV	Net Present Value
NRW	Non-revenue Water
O&M	Operation and Maintenance
PA	Project Account
OP/BP	Operational Policy/Bank Procedures
PAD	Project Appraisal Document
PCC	Project Coordination Committee
PDO	Project Development Objective
PIU	Project Implementation Unit
PIWS	Program for Improvement of Water Services
PMU	Project Management Unit
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SDR	Special Drawing Rights
SOE	Statement of Expenditure
SRI	System for Rice Intensification
TF	Trust Fund
ToR	Terms of Reference
VEI	Vitens Evides International
VMG	Vulnerable and Marginalized Groups
VMGF	Vulnerable and Marginalized Groups Framework
WaSSIP	Water and Sanitation Services Improvement Project
WOP	Water Operators Partnership
WKCDD & FM	Western Kenya Community Driven Development and Flood Mitigation
WRMA	Water Resources Management Authority
WRUA	Water Resources User Association
WSS	Water Supply and Sanitation

Regional Vice President:	Makhtar Diop
Country Director:	Diarietou Gaye
Senior Global Practice Director:	Junaid Ahmad
Practice Manager:	Jonathan Kamkwalala
Task Team Leader:	Eileen Burke

REPUBLIC OF KENYA
ADDITIONAL FINANCING -
KENYA WATER SECURITY AND CLIMATE RESILIENCE PROJECT

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ADDITIONAL FINANCING DATA SHEET

Republic of Kenya

Additional Financing - Kenya Water Security and Climate Resilience Project (P151660)

AFRICA

GWADR

Basic Information - Parent									
Parent Project ID:	P117635	Original Environmental Assessment Category:	A - Full Assessment						
Current Closing Date:	01-Oct-2020								
Basic Information - Additional Financing (AF)									
Project ID:	P151660	Additional Financing Type (from AUS):	Scale Up						
Regional Vice President:	Makhtar Diop	Proposed EA Category:	A						
Country Director:	Diarietou Gaye	Expected Effectiveness Date:	01-Oct-2015						
Senior Global Practice Director:	Junaid Kamal Ahmad	Expected Closing Date:	31-Dec-2022 (IDA) 31-Dec-2020 (KWPF)						
Practice Manager/Manager:	Jonathan S. Kamkwala	Report No:	PAD1387						
Team Leader(s):	Eileen Rose Burke								
Borrower									
Organization Name	Contact	Title	Telephone	Email					
The National Treasury	Jackson N. Kinyanjui	Director of External Resources	254-20-2252299	---					
Project Financing Data - Parent (Kenya Water Security and Climate Resilience Project-P117635) – (US\$155 million)									
Key Dates									
Project	Ln/Cr/TF	Status	Approval Date	Signing Date	Effectiveness Date	Original Closing Date	Revised Closing Date		
P117635	IDA-52680	Effective	18-Jun-2013	29-Jul-2013	24-Oct-2013	01-Oct-2020	31-Dec-2022		
Disbursements (US\$, millions)									
Project	Ln/Cr/TF	Status	Currency	Original	Revised	Cancelled	Disbursed	Undisbursed	% Disbursed
P117635	IDA-52680	Effective	XDR	103.40	103.40	0.00	5.62	97.78	5.43

Project Financing Data - Additional Financing - Kenya Water Security and Climate Resilience Project (P151660) (US\$61.5 million)					
<input type="checkbox"/>	Loan	<input checked="" type="checkbox"/>	Grant	<input type="checkbox"/>	IDA Grant
<input checked="" type="checkbox"/>	Credit	<input type="checkbox"/>	Guarantee	<input type="checkbox"/>	Other
Total Project Cost:	67.3	Total Bank Financing:	61.50		
Financing Gap:	0.00				
Financing Source - Additional Financing (AF)				Amount	
BORROWER/RECIPIENT				5.80	
International Development Association (IDA)				58.00	
Korea World Bank Group Partnership Facility (KWPF) Trust Fund				3.50	
Total				67.30	
Policy Waivers					
Does the project depart from the CAS in content or in other significant respects?				No	
Explanation N/A					
Does the project require any policy waiver(s)?				No	
Explanation N/A					
World Bank Team Composition					
Bank Staff					
Name	Role	Title	Specialization	Unit	
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Extended Team

Name	Title	Location
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Juan Morelli	Agricultural Economist	Montevideo

Locations

Country	Region	Location	Planned	Actual	Comments
Kenya	Western	Siaya County Busia County	X	X	The Lower Nzoia Irrigation Scheme and Flood Protection Works are located in Siaya and Busia Counties in Western Kenya. Additional counties in the Nzoia River catchment area may be included in watershed management activities.
Kenya	Coast	Mombasa County	X		

Institutional Data

Parent (Kenya Water Security and Climate Resilience Project-P117635)

Practice Area (Lead)

Water

Contributing Practice Areas				
N/A				
Cross Cutting Topics				
[X] Climate Change				
[] Fragile, Conflict & Violence				
[] Gender				
[] Jobs				
[] Public Private Partnership				
Sectors / Climate Change				
Sector (Maximum 5 and total % must equal 100)				
Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Public Administration, Law, and Justice	Public administration-Water, sanitation and flood protection	40	100	
Water, sanitation and flood protection	General water, sanitation and flood protection sector	25	100	
Agriculture, fishing, and forestry	Irrigation and drainage	20	100	
Water, sanitation and flood protection	Water supply	10	100	
Industry and trade	Agro-industry, marketing, and trade	5	100	
Total		100		
Themes				
Theme (Maximum 5 and total % must equal 100)				
Major theme	Theme	%		
Environment and natural resources management	Water resource management	64		
Rural development	Rural services and infrastructure	20		
Social protection and risk management	Natural disaster management	16		
Total		100		

Additional Financing - Kenya Water Security and Climate Resilience Project (P151660)				
Practice Area (Lead)				
Water				
Contributing Practice Areas				
N/A				
Cross Cutting Topics				
[X] Climate Change				
[] Fragile, Conflict & Violence				
[X] Gender				
[] Jobs				
[] Public Private Partnership				
Sectors / Climate Change				
Sector (Maximum 5 and total % must equal 100)				
Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Water, sanitation and flood protection	General water, sanitation and flood protection sector	80	100	
Public Administration, Law, and Justice	Public administration- Water, sanitation and flood protection	20	100	
Total		100		
Themes				
Theme (Maximum 5 and total % must equal 100)				
Major theme	Theme	%		
Environment and natural resources management	Water resource management	80		
Social protection and risk management	Natural disaster management	20		
Total		100		
Consultants (Will be disclosed in the Monthly Operational Summary)				
Consultants Required? Consultants will be required.				

I. Introduction

1. This project paper seeks the approval of the Executive Directors to provide an additional International Development Association (IDA) credit in an amount of US\$58 million, along with a level-one project restructuring for the first phase of the Kenya Water Security and Climate Resilience Program (KWSCR-1) (P117635) (credit number 5268-KE). An additional grant from the Korea World Bank Group Partnership Facility (KWPF) Trust Fund (TF)¹ in the amount of US\$3.5 million to the Republic of Kenya is also being sought for the project. This will be the first restructuring for the KWSCR-1 project.

2. At the request of the Government of Kenya (GoK), the proposed additional credit will finance new activities that were not envisioned in the original project. The Additional Financing (AF) will support improved and new flood control infrastructure on the Lower Nzoia River, providing enhanced flood protection for 66,700 people as well as new watershed management activities in the Nzoia Watershed. The additional grant from the KWPF will support an improved flood early warning system. The associated restructuring will allow for reallocation of existing project funds to new activities aiming to strengthen water service delivery and operations of the Mombasa Water and Sanitation Company (MOWASCO), the water utility providing services to Mombasa. The restructuring is expected to result in more efficient water services for at least 48,000 households.

3. The new activities to be supported by this AF build upon and leverage past World Bank projects. For example, the Western Kenya Community Driven Development and Flood Mitigation (WKCDD & FM) project (P074106) undertook studies of the flood situation and potential mitigation measures in the area of the Nzoia River, including thorough community consultations. The studies recommended extensive rehabilitation and improvement of the Lower Nzoia dyke structures to protect the local communities. Based on these studies, the National Treasury of Kenya requested an AF for the flood control infrastructure through the KWSCR-1 project.² Because the flood control infrastructure protects the Lower Nzoia Irrigation Scheme (LNIS) being financed under the KWSCR project, there are efficiencies to be gained through joint implementation of the LNIS and the flood protection works through KWSCR-1. This AF also establishes linkages between the Bank's work in the water sector and in other sectors, and it advances the Water Global Practice's long-term strategy of providing integrated support to client countries.

4. The restructuring will also leverage development impacts of ongoing projects. The proposed activities in Mombasa County will enable it to provide water to the citizens of Mombasa more efficiently. As the Kenya Water Security and Climate Resilience Program - Phase 2 (KWSCR-2) Project is financing part of the Mwache multipurpose dam, which will supply additional water to the city of Mombasa and other coastal towns by 2019, this restructuring will enable improved financial performance of MOWASCO and will ensure its readiness for future increases in its water supply through the KWSCR program.

¹ Pending approval from the Korea World Bank Group Partnership Program. The government of Korea has already approved the financing for this project, in accordance with the Administrative Agreement for the KWPF.

² It should be noted that the WKCDD & FM project was designed and approved to study but not implement long-term structural flood mitigation measures.

5. Complementary funding for the proposed new activities includes US\$8 million from the government of the Netherlands for MOWASCO activities³ as well as US\$5.8 million in counterpart funds from the GoK.⁴

II. Background and Rationale for Additional Financing

6. Water security and climate resilience are critical issues for Kenya, given that its people and economy are highly vulnerable to erratic climatic patterns and limited water availability. Many key sectors (agriculture, tourism, hydro-energy, etc.) depend on rainfall and water availability. From 1992 to 2012, Kenya topped Africa with regard to people affected by droughts (~46 million people) and stood fifth in terms of those affected by floods (~2.8 million people). Kenya has limited freshwater endowments and is classified as a chronically ‘water scarce’ country in absolute and relative terms. It faces high inter-annual and intra-annual rainfall variability. Climate variability and hydro-climatic shocks (droughts and floods) affect the poor disproportionately, and climate change is projected to exacerbate existing climate risks and water resource constraints. Kenya has yet to adequately manage its highly variable hydrology to improve climate resilience, as evidenced in decades-long under-investment in water infrastructure. The massive water infrastructure gap has been estimated at US\$5–7 billion.

7. The 2010 Constitution of Kenya delineates the devolution of a number of functions in the water sector from the national level to that of its 47 counties. This institutional reorganization demands the establishment of a clear division of functions and responsibilities at the national and county levels as well as meeting the capacity needs to support the transfer of designated functions to the counties.

8. To help address these challenges, the GoK has planned a large water sector program to prepare and establish priority infrastructure and strengthen supporting institutions. As part of this program, the GoK is implementing the KWSCR program, with two projects currently being financed by the Bank. The ongoing KWSCR-1 project is a US\$155 million IDA operation that was approved by the Board on June 18, 2013 and declared effective on October 24, 2013. KWSCR-1 provides a framework for a series of operations to help the GoK improve its institutional capacity and infrastructure for water security and climate resilient growth. The project development objectives (PDOs) of KWSCR-1 are to (a) increase availability and productivity of irrigation water for project beneficiaries and (b) enhance the institutional framework and strengthen capacity for water security and climate resilience for the country.

9. The current KWSCR-1 includes the following three components:⁵

- **Component 1: Water Resources Development** (US\$76.8 million) supports climate resilience and water security for economic growth by financing water investments and by building a longer-term investment pipeline. Component 1 includes (a) implementation of

³ Note that this funding is not reflected as official project cofinancing in this document as the funding is not directed through the National Treasury of Kenya. Instead, the support is delivered from the government of Netherlands through the Vitens Evides International (VEI) partnership with MOWASCO, as outlined in memoranda of understanding (MoUs) between the involved parties.

⁴ The GoK financing includes payment for land and other resettlement costs as well as other expenses related to project activities.

⁵ The project also included a US\$3 million project preparation advance and US\$3.7 million unallocated funds.

an irrigation scheme in Lower Nzoia and (b) identification and preparation of new investments, starting with the Mwache Dam, to be financed by IDA through KWSCR-2.

- **Component 2: Effective Water Sector Institutions** (US\$56.3 million) supports the strengthening of current sector institutions as well as reform activities. The component funds reform and devolution of the water sector, as mandated by the 2010 Constitution of Kenya, as well as improvement in the capacity and knowledge base for basin-level water resources management in Kenya. This component also includes strengthening the planning, analysis, and licensing functions of the Water Resources Management Authority (WRMA).
- **Component 3: Support for Project Implementation** (US\$15.2 million) supports the Project Management Unit (PMU) to provide for effective KWSCR-1 implementation.

10. The second project in the program, KWSCR-2, was approved by the Bank's Board on December 16, 2014. The PDO of KWSCR-2 is to sustainably increase bulk water supply to Mombasa County and Kwale County and increase access to water and sanitation in Kwale County.

11. **Project performance.** The current KWSCR-1 project is rated Moderately Satisfactory with regard to implementation progress and progress toward the PDO. The project continues to take leadership in moving forward the water sector reforms and devolution process, including through the engagement of key stakeholders to advance the final draft of the Water Bill, which is undergoing a third reading in parliament. Significant progress has been made in the water investment pipeline, where an initial set of preparatory studies focused on the coastal region is under development. A list of priority projects throughout the country has been developed for further consultations. However, project start-up was slow, given the political and constitutional transition, uncertainty surrounding the water sector in the devolution process, and the slow pace of PMU formation. To date, 5.43 percent of project funds have been disbursed. To mitigate these shortcomings, the PMU is in the process of hiring four major Implementation Support Consultants (ISCs) and is addressing other implementation support bottlenecks. The ISCs are expected to significantly increase capacity for project implementation, including the advancement of works planned under the project. The PMU and Project Implementation Unit (PIU) have made large strides in project implementation in the past months, appointing new PIU members where performance was lagging and advancing 19 critical procurements needed to speed up the pace of implementation. The project has also complied with all three of its legal covenants related to project implementation.

12. **AF and restructuring.** The proposed AF for KWSCR-1 was requested by the National Treasury of the GoK in February 2014 and again in July 2014 to fund flood control infrastructure in the Lower Nzoia River basin. Every year, an estimated 66,700 inhabitants are negatively affected by the flooding of the Lower Nzoia River. The flood-affected communities are impoverished, with almost 70 percent of the community members reporting per capita incomes of less than US\$1 per day; thus, they lack economic resources necessary to cope with the effects of flooding. The flood control infrastructure has been proposed under the AF to KWSCR-1 because of its alignment with the project objectives and the implementing institution and because of benefits to be gained through joint implementation with the collocated Nzoia Irrigation project, which is already being financed under KWSCR-1. To help extend the life of the flood

protection works, the GoK will also allocate a portion of the AF toward watershed management activities upstream of the planned flood control infrastructure, to reduce sediment loads.

13. In addition, the GoK has requested a reallocation of existing KWSCR-1 funds to support a program for improved water services and management in Mombasa County. This program, to be implemented by MOWASCO, would enable it to deliver water more efficiently to its customers and would prepare it to manage the additional water that will be provided to the county through KWSCR-2. The component also includes complementary support to the Mombasa County Department of Water, Environment, and Natural Resources (MDWENR) to comply with its devolved water and sanitation functions, including its legal and institutional functions. The program will fund institutional reform of the utility, the formation of District Metering Areas (DMAs) and other technologies to help reduce non-revenue water (NRW), and improvement of secondary and tertiary distribution networks. The program will leverage development impacts through coordination with funding from the government of the Netherlands, which is already financing implementation of the program on a pilot basis. As MOWASCO activities aim to increase water security and strengthen the institution, the new activities are in line with the original design of the KWSCR-1 project, namely Component 1: Water Sector Development and Subcomponent 2.1: Effective Water Sector Institutions.

14. Reallocation of existing KWSCR-1 funds is required because the needs of the government have changed since the design of KWSCR-1 due to evolving water sector reform processes and the constitutionally mandated devolution. Under KWSCR-1, activities were included to build a water sector investment pipeline by designing new water projects. Given the GoK's goal of increasing the speed of implementation of water sector development and to provide more tangible results in parallel to the preparation of new investments, Subcomponent 1.2: Water Investment Pipeline is being reduced by US\$20 million. Subcomponent 1.2 will still undertake 56 studies to advance the investment pipeline, as envisioned at appraisal of the original project. However, not all of the studies financed will be prefeasibility or feasibility studies, and the project will now fund less costly but necessary environmental, social, and economic studies as well. In addition, the KWSCR-1 PMU is involved in fewer administrative aspects of the water sector devolution process than envisioned at the time of original project design. For example, the PMU has not been tasked with monitoring the devolution of assets. As such, asset auditing activities and other administrative tasks are being dropped through the restructuring, and Subcomponent 2.1: Support for Water Sector Transition and Reforms will be reduced by US\$5 million.

15. The revised financing allocations and project descriptions are reflected in table 1:

Table 1: Total Project Cost, Including Proposed AF and Reallocation (US\$, millions)

Component	Original IDA Financing	Original KfW Financing	Proposed Reallocation of Original IDA Financing	Proposed AF (IDA)	Proposed AF (KWPF TF)	Total Proposed Financing
1. Water Resources Development	76.8	20.1	5.0	58.0	3.50	163.4
Subcomponent 1.1: Water Sector Investments						
Subcomponent 1.1.1: Program for Enhanced Water Security in the Nzoia River						
Subcomponent 1.1.1.1: Water Sector Investments - Lower Nzoia Irrigation	26.8	20.1	–	–	–	46.9
Subcomponent 1.1.1.2: Lower Nzoia Flood Protection	–	–	–	54.0	3.50	57.5
Subcomponent 1.1.1.3: Nzoia Watershed Management	–	–	–	4.0	–	4.0
Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County	–	–	25.0	–	–	25.0
Subcomponent 1.2: Water Investment Pipeline	50.0	–	- 20.0	–	–	30.0
2. Effective Water Sector Institutions	56.3	–	- 5.0	–	–	51.3
Subcomponent 2.1: Support for Water Sector Transition and Reforms	26.1	–	- 5.0	–	–	21.1
Subcomponent 2.2: Strengthening Water Management and Planning	30.2	–	–	–	–	30.2
3. Support for Project Implementation	15.2	–	–	–	–	15.2
4. Project Preparation Advance	3.0	–	–	–	–	3.0
5. Unallocated	3.7	–	–	–	–	3.7
Total Project Costs	155.0	20.1	0.0	58.0	3.50	236.6

16. The following subcomponents are proposed to be added to the project:

17. **Subcomponent 1.1.1.2: Lower Nzoia Flood Protection (US\$54 million in AF from IDA, US\$3.5 million from KWPF TF).** Proposed activities will include (a) repair and improvement of existing dykes and construction of new dykes, culverts, and drains to provide enhanced flood protection to the communities of the Lower Nzoia River and (b) strengthening of monitoring and community early warning mechanisms.

18. **Subcomponent 1.1.1.3: Nzoia Watershed Management (US\$4 million in AF from IDA).** Proposed activities include planning and implementation of watershed management activities throughout the Nzoia Watershed, with a goal of improving livelihoods through the

promotion of sustainable land management practices and reduction of sediment loads in the Lower Nzoia Watershed. The highest erosion hotspots will be identified and watershed management activities will be implemented in these areas, potentially including soil conservation, improved grazing and cropping patterns, terracing, gully repair, construction of small physical structures on the river that reduce water velocity and subsequently reduce erosion, and other needed community entry-point and livelihood activities.

19. Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County (US\$25 million IDA financing reallocated from Subcomponents 1.2 and 2.1). Activities will include the design and implementation of the first phase of a program for the reduction and management of NRW, to be implemented by MOWASCO, as well as other activities to increase the institutional capacity of MOWASCO and Mombasa County. Future phases beyond this financing will be sought from other sources, including a potential new Bank-financed project.

20. Alignment with country and Bank strategies. The proposed investments are consistent with Kenya's Vision 2030 targets on both water supply and flood protection, which seek "to ensure water and improved sanitation availability and access to all by 2030," as "more efficient management of Kenya's scarce water resources, for household and commercial enterprises, will therefore be necessary to achieve the economic, social, and political priority projects suggested by Vision 2030." Vision 2030 sets forth a commitment to provide better flood protection, to "substantially reduce losses due to floods." In addition, the proposed new activities are consistent with several areas of the Kenya-World Bank Group Country Partnership Strategy, including the commitment to support increased women's access to water services and improved capacity to manage risks from climate change.

21. The AF and restructuring establish linkages between different programmatic phases of the KWSCRIP as well as to other Bank projects in Kenya in the water sector, by connecting irrigation to flood protection and water storage to service delivery while aligning supporting institutions and capacity building, thereby contributing to the sustainability of expected results and improving value for money.

22. Compliance with Bank procedures and policies. There are no exceptions to Bank policies or procedures requested for the processing of this AF. No waivers of Bank policies are required nor has any waiver been requested of the managing director of the Bank or the Board of the World Bank Group.

III. Summary of Proposed Changes

The additional credit and grant are proposed to support new activities that were not included in the original project, namely improved and new flood control infrastructure and flood forecasting on the Lower Nzoia River. Reallocation of existing funds is proposed to support an NRW reduction and utility turnaround program in Mombasa County and watershed management activities in the Nzoia River catchment.

It is proposed that the PDO be broadened slightly to more clearly reflect the intensive support being provided to the coast and Western Kenya. Further, changes to the results indicators and milestones are proposed to reflect the new flood preparedness and improved efficiency of the Mombasa utility and to simplify the results framework in line with World Bank/OPCS guidance in 2014. To allow ample time for project implementation and recognizing the long timeline required for institutional and sectoral reform, the project closing date for the IDA credit is being extended.

Changes are being made to the project implementation fiduciary agreements, to facilitate faster implementation of project activities by the National Irrigation Board (NIB) and by the WRMA. Further, flexibility is being added to the project Legal Agreement, to allow the eventual devolution of procurement and implementation responsibilities to county or other governmental entities, if requested by the Ministry of Environment, Water, and Natural Resources (MEWNR) and if the requisite capacity exists.

Change in Implementing Agency	Yes [] No [X]
Change in Project's Development Objectives	Yes [X] No []
Change in Results Framework	Yes [X] No []
Change in Safeguard Policies Triggered	Yes [] No [X]
Change of Environmental Assessment Category	Yes [] No [X]
Other Changes to Safeguards	Yes [] No [X]
Change in Legal Covenants	Yes [] No [X]
Change in Loan Closing Date(s)	Yes [X] No []
Cancellations Proposed	Yes [] No [X]
Change in Disbursement Arrangements	Yes [] No [X]
Reallocation between Disbursement Categories	Yes [X] No []
Change in Disbursement Estimates	Yes [X] No []
Change to Components and Cost	Yes [X] No []
Change in Institutional Arrangements	Yes [X] No []
Change in Financial Management	Yes [X] No []
Change in Procurement	Yes [] No [X]
Change in Implementation Schedule	Yes [X] No []
Other Change(s)	Yes [X] No []

Development Objective/Results	
Project's Development Objectives	
Original PDO	
The PDOs of KWSCR-1 are to (a) increase availability and productivity of irrigation water for project beneficiaries and (b) enhance the institutional framework and strengthen capacity for water security and climate resilience for the country.	
Change in Project's Development Objectives	
Explanation: As many of the interventions in the project and the proposed AF are regional and not national in nature, it is proposed that 'for the country' be replaced with 'in certain areas of the country'.	
Proposed New PDO - AF	
The PDOs of KWSCR-1 are to (a) increase availability and productivity of irrigation water for project beneficiaries and (b) enhance the institutional framework and strengthen capacity for water security and climate resilience in certain areas of the country.	
Within the PDO, 'capacity for water security and climate resiliency' primarily includes improved water services, flood protection, and analytical capacity to understand and manage hydrological variability.	
Change in Results Framework	
Explanation: Further changes to the results indicators and milestones are proposed to reflect the new flood preparedness and improved Mombasa utility efficiency; to allow more time for project implementation; to reduce and clarify expected deliverables under the investment pipeline subcomponent and the water sector reforms subcomponent resulting from reallocation of funds; and to simplify the results framework in line with World Bank/OPCS guidance in 2014.	
Compliance	
Covenants - Additional Financing - Kenya Water Security and Climate Resilience Project - P151660	
All three existing legal covenants related to project implementation have been fully complied with.	
Conditions - Not applicable	
Risk	
Risk Category	Rating (H, S, M, L)
1. Political and Governance	Substantial
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Substantial
8. Stakeholders	Substantial
9. Other	—
OVERALL	Substantial

Finance						
Loan Closing Date - Additional Financing - Kenya Water Security and Climate Resilience Project - P151660						
Source of Funds			Proposed Additional Financing Closing Date			
Grant from KWPF			31-Dec-2020			
IDA Credit from CRW			31-Dec-2022			
Loan Closing Date(s) - Parent (Kenya Water Security and Climate Resilience Project - P117635): 1-Oct-2020						
Explanation: It is proposed that the project closing date for IDA-funded activities be extended from October 1, 2020 to December 31, 2022, to allow additional time for implementation of project activities, achieve desired development impact, and increase the likelihood of sustainability of project gains. The extension of the project closing date will allow adequate time for the continuation of agricultural extension and marketing services after the LNIS is constructed, as well as more capacity building at MOWASCO and improved flood early warning mechanisms in the Lower Nzoia River.						
Ln/Cr/TF	Status	Original Closing Date	Current Closing Date	Proposed Closing Date	Previous Closing Date(s)	
IDA-52680	Effective	01-Oct-2020	01-Oct-2020	31-Dec-2022	n.a.	
Allocations - Additional Financing - Kenya Water Security and Climate Resilience Project - (P151660) (US\$, millions)						
Source of Fund	Currency	Category of Expenditure	Allocation		Disbursement % (Type Total)	
			Proposed	Proposed	Proposed	Proposed
IDA	XDR	Goods	3.00		100	
IDA	XDR	Works - USD	54.00		100	
IDA	XDR	Consulting Services - USD	3.00		100	
IDA	XDR	Operating Costs	1.50		100	
		Total:	61.50		100	
Reallocation between Disbursement Categories						
Explanation:						
To allow flexibility in implementation and to reduce the need for many changes to the Legal Agreement during project implementation, the disbursement categories for goods, works, and consulting services for all components will be combined into one category through restructuring. All remaining proceeds and AF for these categories will be moved into the new disbursement category, with the exception of an increase of operational costs for the implementation of the new project activities.						
Ln/Cr/TF	Currency	Current Category of Expenditure	Allocation		Disbursement % (Type Total)	
			Current	Proposed	Current	Proposed
IDA-52680	XDR	Goods under Part 1 (a) (i)	1,660,000	0	33	0

IDA-52680		Goods excluded under Part 1 (a) (i)	4,670,000	30,342	100	100
IDA-52680		Works under Part 1 (a) (i)	12,920,000	0	54	0
IDA-52680		Works under Part 2 (c) (iv)	2,530,000	0	100	0
IDA-52680		Consultants Services under Part 1 (a) (i)	2,540,000	0	54	0
IDA-52680		Consultants Services excluded under Part 1 (a) (i)	70,510,000	1,072,303	100	100
IDA-52680		Operating costs	4,110,000	8,220,000	100	100
IDA-52680		Refund of Preparation Advance	2,050,000	666,850	0	100
IDA-52680		Unallocated	2,410,000	2,410,000	0	100
IDA-52680		Designated account (DA)	0	0	0	0
IDA-52680		DA	0	0	0	0
IDA-52680		DA	0	0	0	0
		Goods, Works, Consultants Services and Training	0	91,000,505	0	100
		Total:	103,400,000	103,400,000	100%	100%

Components

Change to Components and Cost

Explanation: Component 1 - Water Resources Development has been expanded to include new activities: Nzoia Flood Control and Early Warning; Nzoia Watershed Management; and Program for Improvement of Water Services in Mombasa County.

Component 2 - Water Sector Institutions has been reduced to exclude administrative issues associated with reforms.

Current Component Name	Proposed Component Name	Current Cost (US\$, millions)	Proposed Cost (US\$, millions)	Action
Component 1: Water Resources Development	Component 1: Water Resources Development	104.50	163.40	Revised
Component 2: Effective Water Sector Institutions	Component 2: Effective Water Sector Institutions	56.30	51.30	Revised
Component 3: Support for Project Implementation	Component 3: Support for Project Implementation	15.20	15.20	No change
Project Preparation	Project Preparation	3.00	3.00	No change

Advance	Advance			
Unallocated	Unallocated	3.67	3.70	No change
	Total:	182.67	236.60	

Other Change(s)

Implementing Agency Name	Type	Action
Ministry of Environment, Water & Natural Resources	Implementing Agency	No change

Change in Implementation Schedule

See proposed changes to closing date, given above.

Implementation Arrangements. The implementation arrangements are to date unchanged with regard to the PMU in the MEWNR or its successor.

The PMU team will be expanded to implement the additional activities in this AF and restructuring, most notably in procurement, financial management (FM), safeguards, and infrastructure. In addition to strengthening implementation at the overall project level, the PMU plans to provide necessary facilitation and oversight at the regional level by establishing a regional coordination unit for Western Kenya, to be situated in existing government offices, much like the regional coordination unit already established in the coastal region.

Additional changes are being made to the implementation structures to increase the involvement of the executing agencies and to allow for faster project implementation. The NIB, the executing agency for Subcomponent 1.1.1.1: Water Sector Investments - Lower Nzoia Irrigation, will now take on FM roles, as detailed in annex 5. The WRMA will be mandated to undertake community-driven development (CDD) type FM arrangements, for the implementation of Subcomponent 1.1.1.3: Nzoia Watershed Management.

A new executing agency will undertake Subcomponent 1.1.1.2: Lower Nzoia Flood Protection on behalf of the ministry. A range of agencies were explored in close consultation with the legal advisor of the PMU, and the Lake Victoria North Water Services Board (LVNWSB) was found to be most suitable, in terms of its experience in undertaking large works contracts. Of the regional public institutions in the area of the Nzoia River, it has significant experience with the execution of construction contracts, although mainly in water supply. It has served as an implementing agency for the Bank-financed Water and Sanitation Services Improvement Project (WaSSIP), which has been under implementation since 2008 with satisfactory performance. Under the current WaSSIP AF, the LVNWSB is implementing 32 consultancy services, 14 goods, and 10 works contracts. The works contracts involve relatively large water supply projects and drought mitigation activities. LVNWSB staff have already received training under the WaSSIP in FM, procurement, and safeguards. Regarding eventual ownership and responsibility of the maintenance of the dykes after the completion of the KWSCRIP program, the MEWNR plans to undertake a study once the new National Water Bill has been enacted to determine the most appropriate institutional home for the flood mitigation infrastructure. Eighteen months after the passage of the National Water Bill, the PMU shall present to the Bank its decision for the eventual ownership of the asset as well as a financial plan to cover maintenance costs.

The WRMA of the MEWNR has been proposed as the executing agency for the improvement of the flood early warning systems under Subcomponent 1.1.1.2 and for Subcomponent 1.1.1.3: Nzoia Watershed Management. The WRMA already serves as the executing agency for Subcomponent 2.2: Strengthening Water Resources Management and Planning of KWSCRIP-1 and has recently appointed a new PIU for the project.

The WRMA will take a coordination role, working closely with the counties and other stakeholders to implement these components. Given the decentralized nature of the watershed management project activities, the WRMA has been assessed to have adequate capacity to use CDD-type FM systems to implement community-level watershed management activities. The WRMA is already implementing CDD-type activities under the Bank-financed WKCDD & FM project and will continue to use the same model for this project.

MOWASCO will serve as the executing agency for Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County. MOWASCO has worked closely with the Coast Water Services Board (CWSB) in the implementation of the Bank-financed WaSSIP project, including in evaluation processes, contract management, design, and supervision of works. MOWASCO staff have also received training under the project, including in financial management, procurement and other technical aspects.

Recognizing the uncertainty in the institutional outcome of the devolution process and the possible need for the project to employ new implementation modalities in the coming years, the flexibility in the KWSCR-1 Legal Agreements has been increased. If institutions are given new mandates and if the MEWNR so requests it and if the World Bank reviews implementation capacities and finds them to be adequate, the implementation structure of the project may be devolved to match the country context, provided it is in compliance with the legal structure of Kenya. Such a devolution of implementation duties would be contingent upon an implementation agreement between the PIU and the executing agency, under terms approved by the Bank. If this occurs, the Bank will record the country requests, results of its reviews, and any decisions taken in aide memoires and accompanying management letters. This approach is consistent with the approach to institutional arrangements across the Kenya country program. To allow for flexibility in implementation of the project, the executing agencies will not be named in the financing agreement for KWSCR-1.

To ensure that the government has adequate capacity to implement the project, ISCs will be used to work with the PMU and executing agencies. To expedite implementation and to ensure that activities are undertaken in a complementary manner, it is planned that the ISCs that are currently being selected or are already onboard for other KWSCR-1 and 2 activities will be asked to support the activities in the AF as well. The Nzoia Flood Protection activities have been added to the scope of work for the ISC of the Lower Nzoia Irrigation Project as the flood and irrigation works are complementary. An illustration of the coordinating role of this ISC and its position in the implementation of flood and irrigation works is included in annex 5.

VEI has already been hired by MOWASCO with funds from the government of the Netherlands to design and oversee implementation of an NRW reduction program and a utility management turnaround program. As such, VEI will act as the ISC for Subcomponent 1.1.2 with the main role of (a) providing the necessary upstream diagnostics required to reform the utility and improve its technical, administrative and commercial performance; (b) supporting MOWASCO in the implementation of the institutional reform; and (c) undertaking necessary analysis, preliminary and final designs, tendering, and supervision of the construction works related to the NRW reduction program. The above work by VEI in the capacity of ISC for Subcomponent 1.1.2 is ongoing and will follow all GoK safeguard regulations and Bank-approved safeguards frameworks for the project; the Bank will review all design reports before tendering of works.

IV. Appraisal Summary

Economic and Financial Analysis

Explanation:

Program for Enhanced Water Security in the Nzoia River. Because of the close interrelationship between the LNIS already being funded by KWSCR-1 and the Nzoia Flood Protection Infrastructure proposed to be financed through this AF, a single economic and financial analysis (EFA) of the joint investment for flood

protection and for irrigation development in the Lower Nzoia area was conducted, including LNIS-1 with 4,022 ha of net irrigated area in the left bank of the river and Phase 2 with 3,622 ha of net irrigated area in the right bank (LNIS-2 starting by 2019).

Investment costs in flood protection and for enhancing water security and productivity of water for project beneficiaries in the Lower Nzoia area were estimated at US\$162.4 million, including (a) flood control structures (US\$57.5 million); (b) watershed catchment area management (US\$4 million); (c) LNIS-1 (US\$54.6 million);⁶ and (d) LNIS-2 (US\$46.3 million). ‘With project’ and ‘without project’ scenarios were prepared to estimate project benefits. With the project, it was assumed that all targets expected from the joint investments in flood protection and irrigation would be met. Without the project, the performance of the existing production systems in the flood-prone area would remain unchanged as they will continue to bear the risk of recurrent floods. The primary benefits of the proposed joint investments were derived from the expected avoided material and nonmaterial damages that the improved flood protection structures will bring about on the protected areas. In addition, as irrigation also becomes viable due to the flood protection and from the irrigation investments, the value of benefits from irrigation were also considered.

For the primary benefits, a probability-based cost-benefit analysis was carried out by estimating the difference of expected value of losses under ‘with’ and ‘without’ the proposed flood protection structures. The analysis was based on simulations of possible flood events in the area, preparation of flood maps, estimations of affected assets, material losses on capital stock, and losses in production activities. Nonmaterial benefits included disruptions to people’s lives, health-related costs, and so on.

The aggregation of the typical farm models, together with the representative market linkage investments allowed estimating the overall financial and economic results from the proposed development of the LNIS. Marketing linkages to be supported will be facilitated by the formation of farmer cooperatives for enhancing access to higher-value markets, including both domestic and export markets, mainly to East African countries. The parent project, as envisioned at the outset, will support the installation of facilities for rice milling and for packing, processing, and storing fruits and vegetables in cold chambers or other adequate facilities, as required and viable.

The proposed overall investment for flood control and irrigation development (US\$162.4 million) shows an Economic Internal Rate of Return (EIRR) of 13.8 percent and a Net Present Value (NPV) of US\$53 million (with 10 percent discount rate). Sensitivity analysis is included in annex 6. Beneficiaries’ family revenues are expected to increase by about 2.3 to 4.3 times as flood protection, irrigation, training, and technical support is made available. In addition, beneficiaries are expected to experience social improvements not captured in the economic analysis, including more regular access to school in the flood season. Details of the analysis are provided in annex 6.

Economic Analysis - Program for the Improvement of Water Services in Mombasa County

Rationale for public engagement. The efficiency and equity of water and sanitation service delivery to Mombasa city residents is currently very poor due to many factors, including an ineffective institutional structure for service provision under a previous legal framework, historical politicization of the water sector in Mombasa, and the constitutional transition. According to the recent utilities shadow credit ratings done in Kenya, Mombasa is among the 14 water service providers assessed to be in the ‘No Rating’ or below investment grade category. MOWASCO is not in a position to provide a service of adequate quality to its customers and consequently, cannot recover the costs of operating and maintaining the systems nor undertake

⁶ This figure includes the total project cost: US\$26.8 million from IDA; US\$20.1 million from KfW; and US\$7.7 million from the GoK.

basic capital investments. Moreover, in its current condition, MOWASCO cannot attract funding from financial institutions or the private sector to improve its services and fully discharge its mandate. The consequences are mismanagement of the scarce water resources and the inequality in access to water supply and sanitation (WSS) services. Therefore, public involvement is justified to improve the operational and service delivery model of the utility and enhance its readiness to receive new bulk water from the Mwache Dam that will be financed under KWSCR-2.

Economic justification. The economic analysis for KWSCR-2 was conducted considering the overall investments required to deliver water to households in the coastal region, including investments required to improve the operational efficiency of MOWASCO and reduce the NRW. The EIRR of KWSCR-2 was more than 36 percent. A standalone separate cost-benefit analysis was completed for the Program for the Improvement of Water Services in Mombasa County, designed with the aim of reducing NRW through investments in infrastructure and reduction and institutional support component of KWSCR-1 (see Annex 6 for details). The analysis assumed three technology options. Option 1 is the least costly and assumes interventions in tertiary network rehabilitation and expansion, as well as introduction of improved metering and division of the city into DMAs. Option 2 assumes investments in new primary and secondary pipes in addition to improvements in Option 1. Option 3 involves the introduction of Information Communication Technology (ICT) to effectively deal with the problem of meter tampering, controlling pipe bursting, and reducing energy costs in addition to investments in primary, secondary, and tertiary pipe networks included in Options 1 and 2. These options vary in unit cost as well as expected outcomes, including level of NRW reduction, volume of water billed, realizable number of connections, and per capita water consumption (see Annex 6). The three options have an acceptable EIRR. The EIRR ranges from 14 to 17 percent. Thus, the interventions contribute to the financial sustainability of the utility company in addition to augmenting the water supply. Based on economic efficiency criteria, Option 3 that involves the introduction of ICT has the highest rates of economic return. However, as Option 3 has the highest unit cost per connection, a smaller area of Mombasa could be covered with project proceeds. Option 1, which involves only interventions in tertiary pipe networks, has the lowest cost per connection, and a larger number of connections are possible with the given budget. Thus, implementation of Option 3 could be an appropriate medium- to long-term strategic objective of the utility company.

As cost escalation is always a concern, the sensitivity of the economic viability of the intervention options or options to the unit cost assumptions was assessed. Option 1 remains economically viable if unit costs increase up to 74 percent. The economic viability of Option 2 would be compromised if the unit cost increases by more than 43 percent. Option 3 would be economically nonviable if the unit cost escalates by more than 37 percent. The cost escalation affects not only the economic viability of the intervention options but also the number of connections or level of service coverage, implying the need for carefully prioritizing the DMAs as the budget may not be enough to benefit all DMAs. As such, cost control will be an important factor in project implementation.

World Bank added value. Turning around the current suboptimal performance of MOWASCO and other similar utilities in Kenya requires learning from international experiences and Kenya's own experiences and the Bank's sustained and innovative engagement, which is justified based on the following considerations. First, the experiences gained and the knowledge accumulated from the Bank's engagement in similar situations across the world can be effectively deployed to improve the situation. Second, the Bank's engagement may leverage other related initiatives in Kenya and facilitate knowledge sharing. Finally, the Bank's involvement may be a catalyst for the involvement of other donors and synchronization of efforts.

Technical Analysis

Explanation:

Subcomponent 1.1.1.2: Lower Nzoia Flood Protection (US\$54 million in AF from IDA, US\$3.5 million expected from the KWPF). As noted earlier, an average of 66,700 individuals are affected by annual flooding of the Nzoia River. The flood-affected population is extremely economically vulnerable, with 70 percent of community members reporting per capita incomes of less than US\$1 per day.⁷ The flood periods present great hardship to the communities, especially when the dykes breach, as people are displaced, property is destroyed, schools and businesses cannot function, and the incidence of waterborne diseases increases. For example, during the flood season when floods breach the existing dykes, the reported incidence of waterborne diseases, including malaria, diarrhea, and typhoid, can increase by as much as 34 percent over those seasons where the flooding is contained in the riverbed.⁸

The proposed improvement works for flood mitigation dykes have been planned to protect residents' lives and property as well as the new irrigation scheme, including infrastructure and crops. The dykes have been designed based on an estimated 750 m³/sec flood flow which is equivalent to a 30-year return period. Proposed dyke works comprise 5.8 km of new dykes and 28.4 km of improvement to existing dykes. The main works in the flood mitigation dykes component comprise an earth embankment wall about 5.0 m high, which also provides a 5.0 m wide road at the crest.

Several alternatives to the proposed flood control infrastructure and to Bank financing for the Lower Nzoia Flood Control activities were considered. Through the WKCD & FM Project funded by the Bank, over 15 potential options for coping with the Lower Nzoia floods were assessed based on technical viability and financial, social, and environmental costs, through a participatory process. The option of rehabilitation of existing dykes and construction of new dykes was chosen as the preferred solution by the communities and the government. Before implementation begins, the designs for the Nzoia dykes and irrigation will be jointly optimized, to reduce any backflow issues that may occur at the end of the dykes in the Lake Victoria delta.

Second, other sources of finance for the Lower Nzoia Flood Control infrastructure were considered, including direct government budget allocation or other financing sources. KWSCR-1 was chosen as the appropriate mechanism for finance and implementation of the works because of efficiencies in implementation and in safeguards achieved through the construction of the works in conjunction with the Lower Nzoia Irrigation Project.

Subcomponent 1.1.1.3: Nzoia Watershed Management (US\$4 million in AF from IDA). There are several reasons why watershed management activities in the upper Nzoia watershed are justified to reduce the sediment loads downstream. Rates of sedimentation in the Lower Nzoia Watershed are extremely high, estimated at 65 mm per year since 1981. The carrying capacity of the Lower Nzoia River channel has progressively reduced over the past years due to the sedimentation. This has reduced the efficacy of the current dykes and increased the maintenance costs of the Bunyala irrigation scheme in Western Kenya, which derives its waters from the Nzoia River and which, under KWSCR-1, will be rehabilitated and incorporated into the LNIS. With higher intensity rainfall events projected with climate change, the rate of sedimentation is expected to increase. It is estimated that the proposed Nzoia dyke improvements could have an improved carrying capacity of 30 years⁹ with proper watershed management and reduction of sediments to 25 mm per

⁷ WS Atkins International Limited in Association with Howard Humphries East Africa, Feasibility Study and Preliminary Environmental and Social Impacts Assessment Report for the Lower Nzoia Flood Infrastructure, September 2013.

⁸ Source: MEWNR, using field data collected from the Rukala and Mukhombola Health Clinics, comparing flood years 2011 and 2012.

⁹ As compared to a carrying capacity of 15 years, without watershed management interventions.

year. This would ensure higher rates of protection from the improved Nzoia flood protection and decrease maintenance costs at the Lower Nzoia Irrigation Project - Phase 1 to be financed under KWSCR-1.

Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County (US\$25 million IDA reallocated from Subcomponents 1.2 and 2.1). The reduction of NRW losses of MOWASCO will enable it to provide water to the citizens of Mombasa more efficiently. In addition, the KWSCR-2 project is to finance part of the Mwache multipurpose dam, to supply additional water to the city of Mombasa and other coastal towns by 2019. For the Mwache investment to be productive, efficient, and sustainable, the water service provided by MOWASCO and its overall financial performance must be strengthened so that MOWASCO can more efficiently provide water to its customers and generate revenues to contribute to the repayment of the KWSCR-2 IDA loan. As part of the overarching KWSCR program, KWSCR-1 was designed to allow the government early access to funds for this type of work, to ensure its readiness for later phases of the KWSCR program. A MoU has been signed between the MEWNR and the Mombasa County Government to provide financial support through KWSCR-1 to improve MOWASCO's performance.¹⁰

Social Analysis

Explanation:

With the proposed AF for the Water Security and Climate Resilience Program activities the project remains classified as Category A.¹¹ The program follows a framework approach for environmental and social safeguards so that, irrespective of the source of funding, a unified approach to preparation and supervision of safeguards applies. Various assessments and plans have been and continue to be prepared following the guidance provided in the frameworks (Environment and Social Management Framework [ESMF], Resettlement Policy Framework [RPF], Vulnerable and Marginalized Groups Framework [VMGF], and Investment Project Financing). The ESMF and VMGF have been updated and re-disclosed on February 24, 2015 and April 9, 2015, respectively. For the AF for the Nzoia Flood Control activities, a draft Environmental and Social Impact Assessment and a draft Resettlement Action Plan (RAP) have been disclosed on February 25, 2015 and April 20, 2015, respectively. Once the designs for the Lower Nzoia dykes are finalized, including harmonization of designs with the LNISs and to minimize any downstream 'backflow' effects to which the dykes could contribute, the RAPs for both the LNIS and the Nzoia dykes will be updated, including mechanisms for coordination of resettlement between the projects, and will be re-disclosed. Strengthening of safeguards capacity is needed in the PIUs for the project, and the KWSCR includes focused capacity-building efforts for specific PIUs.

The Lower Nzoia Flood Protection project is located in Busia County, which has an area of 1,628 km². The current dykes have a total length of 34.09 km comprising 17.0 km on the southern side and 17.09 km on the northern side. Despite the fact that the proposed combination of interventions was the best in meeting the project objectives, the construction, operation, and decommissioning phases are likely to have certain adverse impacts on the local community and the immediate surrounding environment, given the nature of the project environment. The major activity in the project will be earthworks. The majority of negative impacts anticipated during construction are expected to be of medium or low significance, which can further be reduced through implementation of suggested mitigation measures. The project area's natural environment is a

¹⁰ The MoU is a framework of cooperation and understanding for the parties to guide implementation of activities for enhanced water supply to meet the water demand up to the year 2035 for Mombasa County and to supply parts of Kwale County, as part of the objectives of KWSCR-2, through development of Mwache Dam and the related infrastructure. It was signed on October 16, 2014 by the Principal Secretary from the State Department of Water and a County Executive Committee Member representing governance of Mombasa County. Signing took place at the World Bank headquarters in Washington, D.C.

¹¹ The project has triggered the following safeguards: Environmental Assessment (OP/BP 4.01); Natural Habitats (OP/BP 4.04); Pest Management (OP 4.09); Physical Cultural Resources (OP/BP 4.11); Indigenous Peoples (OP/BP 4.10); Involuntary Resettlement (OP/BP 4.12); and Projects on International Waterways (OP/BP 7.50).

mix of natural aquatic, riparian, and wetland habitats. Review of documented flora and fauna species has not revealed any species of special conservation concerns.

Construction of the broader and higher dykes will also necessitate an additional strip of land adjoining the existing dykes. Some properties and even families whose residential structures are built right at the foot of the existing dykes will have to be relocated. While project designs have not been finalized, a census showed that land-take for the flood protection project activities could affect 1,163 households, encompassing 4,482 individuals. Of this, a total of 225 residential structures could be affected. The remaining households would be affected by land-take or need to relocate non-residential structures for the expansion of dykes or right-of-way. Land-take will be required on the sides of the existing dykes, which are being used for grazing and cultivation of crops as the flood structures get strengthened. These figures will be updated through the process of finalizing the project designs and during the undertaking of updates of the RAP, which will follow the RPF that is already disclosed for the parent project.

For the Program for the Improvement of Water Services in Mombasa County, some construction is expected to install new or replace and/or improve existing secondary and tertiary distribution networks, as well as to install water meters. Once these civil works have been designed, the PMU will work with MOWASCO on developing Environmental and Social Management Plans for the small civil works that will be undertaken under this activity. For the Mombasa area, permanent land acquisition and displacement are not likely since the project activities include rehabilitation of the existing water pipeline. Where land acquisition cannot be avoided for any new pipeline, site-specific plans will be prepared during project implementation according to guidance from the RPF.

Environmental Analysis

Explanation:

See Social Analysis section, above.

Other Changes: Risk

Explanation:

The current risk rating of the AF is Substantial. Some major risks and their mitigation measures include the following:

- **Risk.** Uncertainty surrounding the ongoing devolution process and a lack of clarity regarding the roles and responsibilities of various institutions could continue to slow project implementation.
 - **Mitigation measures** include support from the project to entities in the water sector to help them understand devolution issues and to agree on a way forward; involvement of counties in project steering committees and other project execution entities to ensure ownership when further devolution of responsibilities occur; high-level ministerial monitoring of project implementation and commitment to quickly resolve impediments to implementation; more flexibility in the project financing document to allow for changing executing agency structures to mirror devolving functions to the counties. The Bank is also supporting analysis to provide both the national and the county governments with different mechanisms for the management of water in a devolved institutional setting, including of the Coast bulk water system.
- **Risk - Program complexity.** The KWSCR program is already complex, with many subprojects and activities. The addition of more activities could further slow implementation progress.
 - **Mitigation measures** include increased staffing of the PMU in areas needed to reduce implementation bottlenecks, including procurement; hiring of firms as ISCs to enhance technical capacity and implementation speed; and formation of new oversight mechanisms at high management levels in the MEWNR.

- **Risk - Safeguards.** The flood mitigation works are a Category A safeguards project involving resettlement and will need to be coordinated with the resettlement for the Lower Nzoia Irrigation Project.
 - **Mitigation measures** include design of draft RAPs for the flood and irrigation projects and will involve further consultation with the affected communities. The RAPs determine a baseline and outline the process for resettlement. The RAPS will then be refined once the joint design of the flood and irrigation projects is complete, including measures to decrease any potential backflow effects at the mouth of the Nzoia River. The PMU is establishing a safeguards tracking system for the project and coordination mechanisms and will provide training to the PIUs and other involved agencies.
- **Risk - Security.** There is a further implementation and supervision risk posed by the security restrictions in the country. Travel to Mombasa and surrounding areas has been limited for Bank staff. While the situation has improved over the past months, if the situation deteriorates, project implementation could be affected as Bank supervision of the activities would need to be conducted remotely.

V. World Bank Grievance Redress

Communities and individuals who believe that they are adversely affected by a Bank-supported project may submit complaints to existing project-level grievance redress mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project-affected communities and individuals may submit their complaint to the Bank's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the Bank's attention and Bank management has been given an opportunity to respond. For information on how to submit complaints to the Bank's corporate GRS, please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the Bank Inspection Panel, please visit www.inspectionpanel.org.

Annex 1. Results Framework
SUMMARY OF CHANGES

Project Name:	Additional Financing - Kenya Water Security and Climate Resilience Project (P151660)		Project Stage:	Additional Financing	Status:	FINAL
Team Leader(s):	Eileen Rose Burke	Requesting Unit:	AFCE2	Created by:	Ernestina Attafuah on 02-Mar-2015	
Product Line:	IBRD/IDA	Responsible Unit:	GWADR	Modified by:	Eileen Rose Burke on 17-Apr-2015	
Country:	Kenya	Approval FY:	2015			
Region:	AFRICA	Lending Instrument:	Investment Project Financing			
Parent Project ID:	P117635	Parent Project Name:	Kenya Water Security and Climate Resilience Project (P117635)			

Project Development Objectives

Original PDO - Parent:

The PDOs of KWSCR-1 are to (a) increase availability and productivity of irrigation water for project beneficiaries and (b) enhance the institutional framework and strengthen capacity for water security and climate resilience for the country.

Proposed PDO - Additional Financing:

The PDOs of KWSCR-1 are to (a) increase availability and productivity of irrigation water for project beneficiaries and (b) enhance the institutional framework and strengthen capacity for water security and climate resilience in certain areas of the country.

Within the PDO, 'capacity for water security and climate resiliency' primarily includes improved water services, flood protection, and analytical capacity to understand and manage hydrological variability.

Results

Core sector indicators are considered: Yes

Results reporting level: Project level

Project Development Objective Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
No change	Area provided with irrigation and drainage services	<input checked="" type="checkbox"/>	Hectare	Value	0.00	0.00	4043.00
				Date	01-Oct-2013	11-Dec-2013	01-Oct-2020
				Comment	-	-	-
No change	Area provided with irrigation and drainage services - new	<input checked="" type="checkbox"/>	Hectare Subtype Breakdown	Value	0.00	0.00	4,043.00
				Date	01-Oct-2013	11-Dec-2013	01-Oct-2020
				Comment	-	-	-
Revised	Value of scheme agricultural products per m ³ of water used	<input type="checkbox"/>	Number	Value	16.00	16.00	30.00
				Date	01-Oct-2013	11-Dec-2013	31-Dec-2022
				Comment	-	-	-
New	Number of people with increased flood protection	<input type="checkbox"/>	Number	Value	0.00		66,700.00
				Date	30-Jun-2015	-	31-Dec-2022
				Comment	-	-	-
New	Decrease in percentage of NRW	<input type="checkbox"/>	Percentage	Value	0.00	0.00	40.00
				Date	30-Jun-2015	-	31-Dec-2022
				Comment	-	-	-
Revised	Direct project beneficiaries	<input checked="" type="checkbox"/>	Number	Value	0.00	0.00	425,000.00
				Date	01-Oct-2013	11-Dec-2013	31-Dec-2022
				Comment	-	-	-
No change	Female beneficiaries	<input checked="" type="checkbox"/>	Percentage Subtype Supplemental	Value	0.00	0.00	48.00
Text	Water Policy adopted and Water Bill enacted	<input type="checkbox"/>		Value	Water Policy and bill in draft form	Water Policy and bill in draft form with parliament	Water Policy adopted and Water Bill submitted to

Project Development Objective Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
							parliament and approved
				Date	01-Oct-2013	05-Sep-2014	03-Oct-2016
				Comment	–	–	–
No change	Satisfactory ratings of key water institution performance contracts	<input type="checkbox"/>	Text	Value	Scores of ‘fair’ or higher across the majority of key water sector institutions	Scores of ‘fair’ or higher across key water sector institutions	Scores of ‘very good’ or higher across the majority of key water sector institutions
				Date	01-Oct-2013	11-Dec-2013	01-Oct-2020
				Comment	–	–	–
Marked for deletion	Yields of major irrigated crops in irrigation scheme	<input type="checkbox"/>	Number	Value	–	–	–
				Date	01-Oct-2013	11-Dec-2013	01-Oct-2020
				Comment	–	–	–
Marked for deletion	Paddy	<input type="checkbox"/>	Number Subtype Supplemental	Value	5.00	5.00	8.00
Marked for deletion	Banana	<input type="checkbox"/>	Number Subtype Supplemental	Value	0.00	0.00	45.00
Marked for deletion	Passion fruit	<input type="checkbox"/>	Number Subtype Supplemental	Value	0.00	0.00	35.00
Marked for deletion	Maize	<input type="checkbox"/>	Number Subtype	Value	1.30	1.30	5.00

Project Development Objective Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
			Supplemental				
Marked for deletion	Tomato	<input type="checkbox"/>	Number Subtype Supplemental	Value	10.00	10.00	30.00

Intermediate Results Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
Revised	Cropping intensity	<input type="checkbox"/>	Percentage	Value	77.00	77.00	170.00
				Date	26-Aug-2013	11-Dec-2013	27-Mar-2020
				Comment	-	-	-
No change	Value of scheme agricultural products marketed	<input type="checkbox"/>	Amount (USD)	Value	534.00	534.00	2,683.00
				Date	-	11-Dec-2013	-
				Comment	-	-	-
No change	Water users provided with new/improved irrigation and drainage services	<input checked="" type="checkbox"/>	Number	Value	0.00	0.00	2,100.00
				Date	-	11-Dec-2013	-
				Comment	-	-	-
No change	Water users provided with irrigation and drainage services - female	<input checked="" type="checkbox"/>	Number Subtype Breakdown	Value	0.00	0.00	1008.00
				Date	-	11-Dec-2013	-
				Comment	-	-	-
New	Number of villages receiving increased flood protection	<input type="checkbox"/>	Number	Value	0.00	0.00	180
				Date	30-Jun-2015	-	31-Dec-2022
				Comment	-	-	-
New	Number of people consulted	<input checked="" type="checkbox"/>	Number	Value	0.00	200.00	1800.00
				Date	01-Oct-2013	06-Apr-2015	30-Dec-2022

Intermediate Results Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
				Comment	-	-	-
New	Percentage increase in active connections	<input type="checkbox"/>	Percentage	Value	0.00	-	50.00
				Date	06-Apr-2015	-	30-Dec-2022
				Comment	-	-	-
No change	Development and use of Investment Framework (IF)	<input type="checkbox"/>	Text	Value	Initial IF has been developed	IF is being applied to investments in Coastal Region	IF applied for all water sector investments
				Date	-	05-Sep-2014	-
				Comment	-	-	-
Revised	Studies completed and meeting requirements of IF	<input type="checkbox"/>	Number	Value	0.00	-	56.00
				Date	01-Oct-2013	05-Sep-2014	31-Dec-2022
				Comment	-	-	-
No change	Compliance with water sector transition plan	<input type="checkbox"/>	Percentage	Value	-	-	100.00
				Date	-	11-Dec-2013	-
				Comment	-	-	-
Marked for deletion	Audits of assets and liabilities	<input type="checkbox"/>	Number	Value	0.00	0.00	16.00
				Date	-	11-Dec-2013	-
				Comment	-	-	-
New	Number of organizations receiving 'just-in-time' legal and operational support in sector reform process	<input type="checkbox"/>	Number	Value	0.00	-	18.00
				Date	01-Oct-2013	-	31-Dec-2022
				Comment	-	-	-
No change	Basin plans developed in six basins with support of enhanced analytical tools and structured stakeholder consultations	<input type="checkbox"/>	Text	Value	-	-	Final consultation complete
				Date	-	11-Dec-2013	-
				Comment	-	-	-

Intermediate Results Indicators							
Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
Revised	New or upgraded monitoring stations (hydrologic, hydro-meteorological, and groundwater) with real-time telemetry in place	<input type="checkbox"/>	Number	Value	0.00	–	494.00
				Date	01-Oct-2013	05-Sep-2014	31-Dec-2022
				Comment	–	–	–
No change	Project monitoring and evaluation (M&E) established and operational	<input type="checkbox"/>	Text	Value	n.a.	M&E officer appointed; terms of reference (ToR) for impact evaluation being finalized	Fully operational
				Date	–	05-Sep-2014	–
				Comment	–	–	–
Revised	Procurement undertaken according to procurement plan	<input type="checkbox"/>	Yes/No	Value	–	Yes	Yes
				Date	–	05-Sep-2014	31-Dec-2022
				Comment	–	With some delays	–
No change	Reports produced on time and with adequate quality (project physical and financial progress); annual (audit, training, monitoring), midterm, and final evaluation	<input type="checkbox"/>	Yes/No	Value	Yes	Yes	Yes
				Date	–	05-Sep-2014	–
				Comment	–	–	–
Marked for deletion	Staff and Water Resources User Associations (WRUAs) trained in areas related to water management and planning.	<input type="checkbox"/>	Number	Value	0.00	0.00	600.00
				Date	–	11-Dec-2013	–
				Comment	–	–	–
Marked for deletion	Operational water user associations created and/or strengthened	<input checked="" type="checkbox"/>	Number	Value	0.00	0.00	11.00
				Date	–	11-Dec-2013	–
				Comment	–	–	–
Marked for	Basin spatial knowledge bases	<input type="checkbox"/>	Text	Value	Inadequate	–	Spatial knowledge

Intermediate Results Indicators

Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
deletion	developed for six basins				spatial knowledge base in six basins		bases updated with all information generated
				Date	–	11-Dec-2013	–
				Comment	–	–	–
Marked for deletion	Result completion rate	<input type="checkbox"/>	Percentage	Value	0.00	0.00	100.00
				Date	–	11-Dec-2013	–
				Comment	–	–	–

Kenya: Additional Financing - Kenya Water Security and Climate Resilience Project (P151660)

Revised Results Framework

Project Development Objective: (a) to increase the availability and productivity of irrigation water for project beneficiaries and (b) to enhance the institutional framework and strengthen capacity for water security and climate resilience in certain areas of the country.

Within the PDO, ‘capacity for water security and climate resiliency’ primarily includes improved water services, flood protection, watershed management, and analytical capacity to understand and manage hydrological variability.

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**									Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition)
				YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9				
Indicator One: Area provided with irrigation and drainage services - new and improved	<input checked="" type="checkbox"/>	Hectare	0	0	0	0	0	777	2,000	4,043	4,043	4,043	Annual	M&E system, periodic progress reports	PMU/NIB	For LNIS Phase 1, based on progression of the works. Does not include existing Bunyala scheme.
Indicator Two: Value of irrigation scheme agricultural products per cubic meter of water used	<input type="checkbox"/>	K Sh per m ³	16	16	16	16	16	16	16	20	30	30	Annual	M&E system, periodic progress reports; Sample physical records (volume) and users register (area)	PMU/NIB	For LNIS Phase 1
Indicator Three: Number of people with increased flood protection	<input type="checkbox"/>	Number	0	0	0	0	0	66,700	66,700	66,700	66,700	66,700	Annual	Construction reports, census reports	PMU/LVNWSB	Includes residents of the 180 villages in the vicinity of the Lower Nzoia Flood Protection activities. This includes people located directly adjacent to the area to be protected by the dykes as well as people in nearby communities that will

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**									Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition)	
				YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9					
																	benefit from protection to roads and other community infrastructure.
Indicator Four: Decrease in percentage of NRW		%	51	51	51	51	45	40	37	34	31	31	Annual	M&E system, periodic progress reports	VEI		NRW is defined as 1 - (amount of water for which tariffs are collected in DMA/ amount of water entering DMA).
Indicator Five: Direct project beneficiaries	<input checked="" type="checkbox"/>	Number	0	0	0	0	60,000	135,000	200,000	300,000	400,000	425,000	Annual	M&E system, periodic progress reports	PMU		Includes direct beneficiaries of DMA services and flood protection/irrigation
Sub-indicator Five: Direct project beneficiaries - % of which are female	<input checked="" type="checkbox"/>	Percentage (Subtype/ Supplemental)	0	0	0	0	48	48	48	48	48	48	Annual	M&E system, periodic progress reports	PMU		
Indicator Six: Water Policy adopted and Water Bill submitted to Parliament	<input type="checkbox"/>	Qualitative	Water policy and bill in draft form	Water policy and bill in draft form with ministry	Water policy and bill in near final form with cabinet	Final reading of Water Bill to be held in parliament	Water policy and bill adopted	Water policy and bill adopted	Water policy and bill adopted	Water policy and bill adopted	Water policy and bill adopted	Water policy and bill adopted	Annual	M&E system, periodic progress reports	PMU		
Indicator Seven: Satisfactory ratings of key water institution performance contracts	<input type="checkbox"/>	Qualitative	A score in the 'fair' range across key water sector institutions	Scores of 'fair' or higher across key water sector institutions	Scores of 'fair' or higher across key water sector institutions	Scores of 'fair' or higher across key water sector institutions	Scores of 'fair' or higher across key water sector institutions	Scores of 'good' or higher across key water sector institutions	Scores of 'good' or higher across key water sector institutions	Scores of 'good' or higher across key water sector institutions	Scores of 'very good' or higher across key water sector institutions	Scores of 'very good' or higher across key water sector institutions	Annual	M&E system, periodic progress reports	PMU		Annual performance contracts are entered into on an annual basis between the GoK through the MEWNR and water sector institutions. Performance contracts include annual targets in the following areas: finance and stewardship; service delivery; non-financial (for example, compliance with strategic plans);

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**									Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition)
				YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9				
																<p>operations (for example, Vision 2030 projects/outcomes, outputs/outcomes aligned to subsector performance standards, and project implementation); dynamic/qualitative (for example, work environment and employee satisfaction); and corruption eradication.</p> <p>The total score assigned is a weighted average of the points given in each area (out of a maximum of 100 points). The total score assigned is categorized into excellent, very good, good, fair, and poor.</p> <p>This indicator will track movement in the total score assigned and the categorization based on the total score. Satisfactory refers to scores in the excellent, very good, and good ranges, whereas unsatisfactory refers to those in the fair or poor ranges.</p> <p>Key water institutions</p>

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**									Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition)
				YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9				
																are the MEWNR, NIB, and WRMA.

INTERMEDIATE RESULTS

Intermediate Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**									Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition)
				YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9				
Intermediate Result (Component 1): Water Resources Development																
Subcomponent 1.1																
Intermediate Result Indicator One: Cropping intensity	□	% hectares cropped per hectare irrigable land, for all crops	77	77	77	77	77	100	140	163	163	170	Annual	M&E system, periodic progress reports	PMU/ NIB	For LNIS Phase 1. The targets from years 1 to 4 (the period when the scheme will be constructed) are not zero as the initial cropping intensity relates to an area already developed in the small Bunyala scheme that will be rehabilitated (but will continue operating for paddy and new crops under the form of pilot and demonstration farms by all Irrigation Water User Associations [IWUAs]).

Intermediate Result Indicator Two: Value of scheme agricultural products marketed	<input type="checkbox"/>	K Sh, million	534	534	534	534	534	612	878	1,392	1,392	1,392	Annual	M&E system, periodic progress reports; sample survey (price) and sample physical records (volume)	PMU/NIB	For LNIS Phase 1. The term 'value' refers to that of agricultural products sold in the market. In case there is a structural change in the economy resulting in a major change in prices, reported valued will be indexed.
Intermediate Result Indicator Three: Water users provided with new/ improved irrigation and drainage services	<input checked="" type="checkbox"/>	Number	0	0	0	0	194	850	2,100	2,100	2,100	2,100	Annual	M&E system, periodic progress reports	PMU/NIB	–
Sub-intermediate Result Indicator Three: Water users provided with new/ improved irrigation and drainage services - female	<input checked="" type="checkbox"/>	Number (Subtype /Supplemental)	0	0	0	0	201	920	1,008	1,008	1,008	1,008	Annual	M&E system, periodic progress reports	PMU/NIB	–
Intermediate Result Indicator Four: Villages receiving increased flood protection		Number	0	0	0	0	0	180	180	180	180	180	Annual	'Increased flood protection' includes protection from improved dykes and/or from flood early warning systems	PMU	Includes the 180 villages in the vicinity of the Lower Nzoia Flood Protection activities. This includes villages located directly adjacent to the area to be protected by the dykes as well as nearby communities that will benefit from protection to roads

																and other community infrastructure.
Intermediate Result Indicator Five: Number of people consulted		%	0	200	400	600	800	1,000	1,200	1,400	1,600	1,800	Annual	Project reports	PMU, PIUs	–
Intermediate Result Indicator Six: Percentage increase in active connections		%	n.a.	0	0	10	20	30	40	50	60	60	Annual	Project Reports	VEI	To be measured in MOWASCO DMAs with project interventions. Baseline for each DMA to be established at the time work in each DMA begins.
Subcomponent 1.2																
Intermediate Result Indicator Seven: Development and use of IF	<input type="checkbox"/>	Qualitative / phases	0	Draft IF	Initial IF revised, including based on lesson learned from early application and stakeholder consultation	IF approved by national consultation process	IF applied for all water sector investments	IF applied for all water sector investments	IF applied for all water sector investments	IF applied for all water sector investments	IF applied for all water sector investments	IF applied for all water sector investments	Annual	M&E system, periodic progress reports	PMU	The 'national consultation process' referred to in Year 3 could be in the form of the Annual Water Sector Conference (2016).
Intermediate Result Indicator Eight: Studies completed to advance investment pipeline	<input type="checkbox"/>	Number	0	0	10	24	32	40	158	56	56	56	Annual	M&E system, periodic progress reports	PMU	This intends to measure the progressive development and expansion of the investment pipeline. Investment planning studies, including but not limited to master plans, scoping, prefeasibility, feasibility, design, and economic analysis.
Intermediate Result (Component 2): Effective Water Sector Institutions																

Subcomponent 2.1																
Intermediate Result Indicator Nine: Compliance with water sector transition plan	<input type="checkbox"/>	% (of annual targets met)	n.a. (Water sector transition plan being finalized)	100	100 (Transition plan revised to correspond with Ministry responsibilities)	100	100	100	100	100	100	100	Annual	M&E system, periodic progress reports	PMU	This will be measured progressively on the basis of the annual targets included in the transition plan. The transition plan will be revised periodically, as needed, to reflect evolving needs during the transition process.
Intermediate Result Indicator Ten: Number of organizations receiving 'just-in-time' legal and operational support to sector reform process (counties, government entities, boards, utilities, and community groups)		Number	0	8	12	14	16	17	18	18	18	18	Annual	M&E system, periodic progress reports	PMU	–
Subcomponent 2.2																
Intermediate Result Indicator Eleven: Basin plans developed in six basins with support of enhanced analytical tools and structured stakeholder consultations	<input type="checkbox"/>	Qualitative/ phases	0	System for knowledge base created	System for knowledge base created	Knowledge base populated	Initial structured stakeholder consultations complete	Modeling tools complete	Draft basin plans complete	Final consultation complete	Final consultation complete	Final consultation complete	Annual	M&E system, periodic progress reports	PMU	Baseline 2013 - zero. Expected target by Year 7 is six basin plans. Analytical tools are based on the water and climate risk information system knowledge base and supporting modeling tools (for example, simulation, optimization, and multicriteria analysis)

																	to analyze implications of proposed water investments and climate scenarios. Structured stakeholder consultations are held to help envision the future of the basin and agree on criteria and indicators for a 'well-managed' basin. Rolling basin plans are developed based on the analytical and stakeholder inputs to support development and management decisions.
Intermediate Result Indicator Twelve: New or upgraded monitoring stations (hydrologic, hydro-meteorological, and groundwater) with real-time telemetry in place	<input type="checkbox"/>	Number	1	1	Planning and design underway	100	170	240	320	480	494	494	Annual	M&E system, periodic progress reports	PMU	Target by Year 7 is new or repair of a mix of types of monitoring stations. An indicative breakdown could include surface water 150, groundwater 122, and meteorological 222. Actual breakdown of stations to be rehabilitated or installed will be determined by survey and design study through project. Water quality stations are incorporated into each surface and groundwater monitoring station.	

Intermediate Result (Component 3): Support for Project Implementation

Intermediate Result Indicator Thirteen: Project M&E established and operational	<input type="checkbox"/>	Qualitative	NA	Established	M&E officer appointed. ToR for impact evaluation being finalized.	Fully operational	Fully operational	Fully operational	Fully operational	Fully operational	Fully operational	Fully operational	Annual	Project records	PMU	–
Intermediate Result Indicator Fourteen: Procurement undertaken as per procurement plan	<input type="checkbox"/>	Yes/No	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Annual	Project records, post-procurement reviews	PMU	Defined as ‘all procurements comply with procurement plan’.
Intermediate Result Indicator Fifteen: Reports produced on time and with adequate quality (project physical and financial progress); annual (audit, training, monitoring); midterm and final evaluation	<input type="checkbox"/>	Yes/No	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Annual	Project records	PMU	–

Annex 2. Systematic Operational Risk-rating Tool

Republic of Kenya
Additional Financing –
Kenya Water Security and Climate Resilience Project (P151660)

Risk Category	Rating
1. Political and Governance	Substantial
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Substantial
8. Stakeholders	Substantial
9. Other	–
OVERALL	Substantial

Annex 3: Detailed Description of Modified and New Project Activities

Republic of Kenya

Additional Financing –

Kenya Water Security and Climate Resilience Project (P151660)

Subcomponent 1.1.1.2: Lower Nzoia Flood Protection (US\$54 million in AF from IDA, US\$3.5 million KWP TF)

1. The Lower Nzoia River basin has recently been subject to more frequent flood events, as frequent as every two or more years, because of lack of flow capacity of existing dykes and the deterioration and weakening of the dykes. The dykes were constructed in the 1970s and have reached the end of their design life. The existing flood mitigation dykes stretch for a length of 17.1 km on either side of River Nzoia after Rwambwa Bridge to Lake Victoria. The flow capacity of the existing dykes is between 410 m³/sec and 450 m³/sec, which is equivalent to a 5-year flood. This capacity will continue to decrease over time because of sediment buildup caused by erosion in the upper catchment area as time goes by.

2. The proposed flood protection works were designed under the WKCDD & FM project, which is scheduled to close in 2015. A thorough three-stage consultative process spanning several years was undertaken to consider options for flood control in the Nzoia Basin. The option to undertake long-term structural rehabilitation of existing dykes and culverts, with realignment and construction of new dykes in certain sections of the river, was chosen because of the level of flood protection it will provide. The GoK requested AF from the Bank through the KWSCR-1 project, to implement the dykes.

3. The proposed improvement works for flood mitigation dykes have been planned to protect residents' lives, health, and property, as well as the new irrigation scheme, including infrastructure and crops. The dykes have been designed based on an estimated 750 m³/sec flood flow which is equivalent to a 30-year flood. In addition to improvement of 28.4 km of existing dykes, the project will build 5.8 km of new dykes. The completed dykes will comprise an earth embankment wall about 5.0 m high and provide a 5.0 m wide road at the crest. A summary of the proposed work is listed:

- **Southern dykes:** 17.1 km
 - Realign sections of the dykes: New dykes 4.7 km.
 - Raise and strengthen the existing dykes: 12.4 km.
- **Northern dykes:** 17.1 km
 - Realign sections of the dykes: New dykes 1.1 km.
 - Raise and strengthen the existing dykes: 16.0 km.
- Provide filter drains on new and existing dykes.
- Provide 8 gates at specific locations on the northern dykes.

4. The new realigned dyke system was designed through hydraulic modeling of various potential interventions. The designed height of dykes was considered for future sedimentation of 25 mm per year. The design of the dykes will be reviewed and optimized by the KWSCR-1 ISC to ensure compatibility with the new Lower Nzoia Irrigation Project and to optimize flood protection based on cost.

5. In addition to dykes, the project will improve a flood early warning system that exists for the Lower Nzoia River to minimize damage to life and property in the event of a flood. The system is currently used for daily flood forecasting by the Kenya Meteorological Authority, which is part of the MEWNR. Through the project, the flood early warning system will be improved to include a combination of IT and river water management technology. It could possibly include real-time monitoring of hydraulic data, including closed circuit television and containment action for flood events through the early warning broadcasting system based on alarm criteria. Other potential improvements could include installation of hydraulic measuring devices, including water level gauges and rainfall sensors; flood analysis, including inundation mapping, and refinement of flood warning criteria for Lower Nzoia River; establishment of a customized control system with monitoring system; and technology transfer and international knowledge sharing, as well as other community preparedness activities.

Subcomponent 1.1.1.3: Nzoia Watershed Management (US\$4 million in AF from IDA)

6. Rates of sedimentation in the Lower Nzoia Watershed are extremely high, estimated at 65 mm per year since 1981. The carrying capacity of the Lower Nzoia River channel has been increasingly reduced over the past years due to rapid sediment deposit. This has reduced the efficacy of the current dykes and increased the maintenance costs of the Bunyala irrigation scheme in Western Kenya, which derives its waters from the Nzoia River and which, under KWSCR-1, will be rehabilitated and incorporated into the LNIS. With higher intensity rainfall events projected with climate change, the rate of sedimentation is expected to increase. It is estimated that the proposed Nzoia dyke improvements could have an improved carrying capacity of 30 years.¹² With proper management, sediment buildup could be reduced to 25 mm per year. Improved management of the Nzoia Watershed would ensure increased effectiveness of the improved Nzoia flood protection and decreased maintenance costs at the Lower Nzoia Irrigation Project - Phase 1, to be financed under KWSCR-1.

7. Proposed activities include strengthening sediment monitoring (including but not limited to adopting and implementing standardized measuring and recording, appropriate selection of monitoring sites, and coordination among the intervening institutions and groups—mainly the WRMA, counties, and WRUAs) as well as planning and implementation of watershed management activities in the areas with the highest rates of erosion in the Nzoia Watershed, with the goal of improving livelihoods through the promotion of sustainable land management practices and reduction of sediment loads in the Lower Nzoia Watershed. The highest erosion hotspots will be identified and watershed management activities will be designed in consultation with the communities. Communities will be assisted in the preparation of watershed management plans, which will potentially include soil conservation, improved grazing and cropping patterns, terracing, gully repair, construction of small physical structures on the river that reduce water

¹² As compared to a carrying capacity of 15 years, without watershed management interventions.

velocity and subsequently reduce erosion, and other needed community entry-point and livelihood activities. These watershed management plans, developed with the support of analytical tools and informed by stakeholder consultations, will reflect improved capabilities for watershed management.

Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County (US\$25 million in IDA Financing reallocated from Subcomponents 1.2 and 2.1)

8. This subcomponent will provide support to MOWASCO in Mombasa County to improve its operational efficiency and water distribution capacity as well as to improve billing and revenue collection. The activities include MOWASCO turnaround, including improved institutional arrangements and the formation of DMAs. Improved water service delivery will be reflected by reduction in NRW and a subsequent increase in revenues collected by MOWASCO. In so doing, and through additional institutional support to the MDWENR, this component will support the MDWENR to comply with its devolved water and sanitation functions.

9. Mombasa is Kenya's second largest city (about 1.2 million people). The utility faces several key challenges: limited water supply, operational inefficiencies, and therefore, inadequate services provision to population, together with significant NRW issues. The water demand is about 150,000 m³ per day; less than half is supplied by MOWASCO. In addition, over 50 percent of the water is lost as NRW, resulting in severe financial implications for the company.

10. Availability of water in Mombasa will significantly increase when Mwache Dam becomes operational, which is expected by 2019. To accommodate for this change, an institutional overhaul of MOWASCO and improvements in the efficiency of the distribution system are required. For this purpose, Mombasa County has requested support from the national government through KWSCR-1, which has resulted in a MoU signed in October 2014.¹³

11. MOWASCO has entered into a 4-year Water Operators Partnership (WOP) with VEI, supported by a US\$8 million grant from the government of the Netherlands, which will provide technical and capacity-building support to reduce NRW and improve MOWASCO's sustainability. VEI, as the subcomponent's ISC, will provide a diagnosis; support the implementation of MOWASCO's institutional reform and performance improvement; and undertake the analysis, design, tendering, and supervision of the NRW-related construction works. The Bank will provide for overall supervision and will review all design reports and tender documents before tendering of works that are to be funded under KWSCR-1.

¹³ The MoU is a framework of cooperation and understanding for the Parties in order to guide implementation of activities for enhanced water supply to meet the water demand up to the year 2035 for Mombasa County, and supply parts of Kwale County, as part of the objectives of KWSCR-2, through development of Mwache Dam and the related infrastructure. It was signed on October 16, 2014 by the Principal Secretary from the State Department of Water and a County Executive Committee Member representing governance of Mombasa County. Signing took place at the World Bank headquarters.

Subcomponent 1.1.2.1: MOWASCO Turnaround and Institutional Strengthening of the MCDWENR (US\$5 million)

12. **Activity 1: Institutional strengthening of the MCDWENR.** This activity will provide support to the MCDWENR to comply with its devolved water and sanitation functions. It will support an institutional design and assessment of corporate models of well-functioning and high-performing water utilities based on international experience to modernize service provision governance and accountability of the service provider. It will help develop county water and sanitation policies, laws, regulations, and standards based on international best practice while aligned with the national legal and institutional framework and the 2010 Constitution of Kenya, including the ongoing devolution processes. It will support a strong enforcement scheme entailing connections, billing, and revenue collection. It will also include strategic planning, a minimum-cost WSS investment plan, a financing strategy, a model for raising resources for the MCDWENR, and integration of information systems, including geographic information system (GIS) and software and hardware for implementation. In addition, this activity is expected to provide resources to the county to hire experts in water, sanitation, water resources management, strategic and financial planning, information systems integrations and utilization, and human resources management to spearhead the transformation of the service delivery model in the county.

13. **Activity 2: Performance improvement of MOWASCO (MOWASCO turnaround).** It will include the company's business remodeling, including reviewing the organizational structure, functions, staffing and reporting mechanisms, operating procedures and standards, integration and enhancement of work groups, tariff setting evaluation and monitoring, among others. It also encompasses mechanisms internal to MOWASCO to enable it to interact with the county government and other water entities such as coast bulk water provider and the national water services regulator. Areas that the project will likely support include the following:

- Specialized technical support for MOWASCO turnaround, from design stages to implementation and performance assessment. Based on VEI's recommendations after an institutional assessment, activities in this area will include the design and implementation of new management practices, operating procedures, policies, and standards.
- Implementation of a training and capacity-building strategy for the company. VEI is supporting the preparation of this strategy that is focused on enhancing quality; improving culture, performance, and attitude of staff; changing or modernizing procedures; improving the standards of personnel in the field; coping with staff turnaround; and improving accountability and rules enforcement.
- Provision of software and equipment necessary for the capacity-building program.
- Improvement and enhancement of information systems, including a condition assessment and geo-referenced asset mapping for MOWASCO.
- Implementation of an integrated system that links up different departments, including GIS data, metering, billing, revenue collection, and connections' control.
- A financial expert in charge of financial planning as well as strategic company planning will be provided at an early as a support to the strategic planner provided by the ISC.
- Support to the business unit, including on how to deal with illegal connections, reluctance to paying for water services, and handling specific clusters of clients. This may include

review of the legal framework, establishment of fines/penalties, and a strong and consistent commercial campaign targeting water users.

Subcomponent 1.1.2.2: Reduction of NRW (US\$20 million)

14. This subcomponent will support the implementation of an NRW reduction program, mainly by revising connections, introducing or improving meters, and partially rehabilitating and expanding the tertiary distribution network and, to a limited extent, the secondary network.

15. **Activity 1: Rehabilitation of the tertiary networks by establishment of DMAs.** This activity is aimed at drastically reducing NRW in selected areas to contribute in improving MOWASCO's operational and financial performance. The activity will follow International Water Association (IWA) guidelines on the need to measure flows of water being dispatched and consumed by customers to improve services, identify and fix leaks in the tertiary distribution network, and eliminate illegal connections.

16. The project will build on ongoing MOWASCO/VEI pilot work in 8 DMAs. VEI, as the ISC, will undertake the preparatory work before implementing the DMAs, including detailed designs, tender documents, and supervision of works. The lessons learned during the pilot phase will be tapped. Zoning rationale, selection of DMAs for better early results and a positive perception of works by users, and clustering or grouping DMAs for efficiency and attaining economies of scale will be used.

17. The network is currently divided into four zones—Island, West Mainland, North Coast, and Likoni (south)—comprising several DMAs. The rationale for choice and sequencing of DMAs for project activities will include (a) giving priority to poor areas; (b) maximizing investment efficiency; (c) maximizing expected revenue; (d) applying a 'low hanging fruit' approach; and (e) working first in less complicated areas. Technical criteria include (a) water availability; (b) areas with highest NRW; (c) cost per connection; and (d) willingness to pay. The final number of connections to be subject to these improvement activities will be based on costs per connection compared to the overall budget.

18. **Activity 2: Rehabilitation of the secondary distribution systems.** Modifying and improving the secondary distribution system is essential to consolidate DMA efforts to prepare the distribution system, MOWASCO, and water users for any additional water supplied to Mombasa. This activity includes construction works on a portion of the secondary distribution systems as well as provision of goods and services such as valves, pipes, joints, macro meters, leak detection, and remote data transmission devices. VEI will provide a detailed concepts catalogue for works and goods/services. Works will start only in areas where DMAs are implemented.

Annex 4. Revised Estimate of Project Costs

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Table 4.1: Project Cost by Component (US\$, millions)

Component	Original IDA Financing	Original KfW Financing	Proposed Reallocation	Proposed AF (IDA)	Proposed AF (KWPF TF)	Total Proposed Financing
1. Water Resources Development	76.8	20.1	5.0	58.0	3.5	163.4
Subcomponent 1.1: Water Sector Investments						
Subcomponent 1.1.1: Program for Enhanced Water Security in the Nzoia River						
Subcomponent 1.1.1.1: Water Sector Investments - Lower Nzoia Irrigation	26.8	20.1	–	–	–	46.9
Subcomponent 1.1.1.2: Lower Nzoia Flood Protection	–	–	–	54.0	3.5	57.5
Subcomponent 1.1.1.3: Nzoia Watershed Management	–	–	–	–	–	4.0
Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County	–	–	25.0	–	–	25.0
Subcomponent 1.2: Water Investment Pipeline	50.0	–	-20.0	–	–	30.0
2. Effective Water Sector Institutions	56.3		-5.0			51.3
Subcomponent 2.1: Support for Water Sector Transition and Reforms	26.1	–	-5.0	–	–	21.1
Subcomponent 2.2: Strengthening Water Management and Planning	30.2	–	–	–	–	30.2
3. Support for Project Implementation	15.2	–	–	–	–	15.2
4. Project Preparation Advance	3.0	–	–	–	–	3.0
5. Unallocated	3.7	–	–	–	–	3.7
Total Project Costs	155.0	20.1	0.0	58.0	3.5	236.6

Table 4.2: Project Costs by Disbursement Category (IDA Credit Only)

Category	Amount of the Original Credit Reallocated (expressed in SDR)	Amount of the Additional Credit Allocated (expressed in SDR)	Percentage of Expenditures to be Financed (inclusive of Taxes)	Total Credit Amount (expressed in SDR)
(1) Goods				
(a) Goods under Part 1 (a) (i) of the project	0	0	0	0
(b) Goods excluded under Part 1 (a) (i) of the project	30,342	0	100	30,342
(2) Works				
(a) Works under Part 1 (a) (i) of the project	0	0	0	0
(b) Works under Part 2 (c) (iv) of the project	0	0	0	0
(3) Consultants Services				
(a) Consultants services under Part 1 (a) (i) of the project	0	0	0	0
(b) Consultants services excluded under Part 1 (a) (i) of the project	1,072,303	0	100	1,072,303
(4) Operating Costs	8,220,000	0	100	8,220,000
(5) Refund of Preparation Advance	666,850	0	Amount payable pursuant to Section 2.07 of the General Conditions	666,850
(6) Unallocated	2,410,000	0	100	2,410,000
(7) Goods, works, consultants Services, and training (under all parts of the project)	91,000,505	41,300,000	100	132,300,505
TOTAL AMOUNT	103,400,000	41,300,000	–	144,700,000

Note: SDR = Special Drawing Rights.

Table 4.3: Project Costs by Disbursement Category (KWBF TF only)

Category	Additional KWPF Grant(US\$)
Goods (excluding vehicles), consultants services, operating costs and training (under all parts of the project)	3,500,000
TOTAL AMOUNT	3,500,000

Annex 5. Revised Implementation and Support Arrangements

Republic of Kenya

Additional Financing –

Kenya Water Security and Climate Resilience Project (P151660)

Implementation Arrangements

1. The overall responsibility for project management and implementation will remain with the MEWNR or its successor.
2. As is the case for the existing KWSCR-1 project, the core functions of the PMU will continue being those of coordination and facilitation, environmental and social safeguards supervision, M&E and impact evaluation, annual work programming and budgeting, and reporting. The PMU will continue to undertake procurement, FM, and reporting for all project activities except for those undertaken by the NIB (explained further below). The PMU will also be responsible for ensuring the application of social and environmental safeguards frameworks (ESMF, RPF, VMGF, and IPMF) and supervising the implementation of safeguards instruments for all activities across the project, including those implemented by executing agencies.
3. The PMU currently serves as the ‘implementing agency’ for the overall project. Meanwhile, the agencies that execute investments of other project-related activities under their mandate serve as ‘executing agencies’¹⁴ for the project. The executing agencies will be responsible for delivering most of the subcomponent activities, including project planning and reporting, civil works supervision, implementation of social and environmental safeguards instruments, etc. The PMU will continue to be responsible for coordinating and facilitating execution by the executing agencies, reporting on progress, ensuring safeguards compliance, resolving issues and constraints to timely and efficient project implementation, and undertaking all procurement and FM for activities implemented by the executing agencies, with the exception of certain FM activities under Subcomponent 1.1.1.1: Water Sector Investments - Lower Nzoia Irrigation, to be undertaken by the NIB, as outlined below. Executing agencies will provide the PMU ToR and goods specifications required to prepare bidding documents and all invoices, payment certificates, and other data that may be needed for FM and reporting. The PMU will manage the project account and clear and process all requests for payments.¹⁵ Invariably, the

¹⁴ The MEWNR, through the PMU, is responsible for the overall implementation of the project. To avoid confusion, those agencies that would typically execute investments or other project-related activities under their mandate are referred to herein as ‘Executing Agencies’.

¹⁵ The PMU may allow executing agencies to apply for imprest funds in Kenyan shillings under procedures that are acceptable to the Bank for small ‘petty cash’ type expenses that may be incurred during activity execution. The procedure for imprest payments is as follows: the executing agency (for example, the NIB for LNIS-1 in the case of Subcomponent 1.1) submits an application for imprest funds from the PMU in line with existing GoK procedures. The executing agency needs to have an authority to incur expenditure (A-I-E) issued by the Permanent Secretary of the implementing agency, the MEWNR. The A-I-E, which is a standard GoK document, will specify the nature of expenditure and the expenditure code. After the expenditures are made, the A-I-E holders will submit the supporting

PMU will be responsible for all audits. The executing agencies will approve payment requests from consultants and forward them to the PMU.

4. As in the case of the current KWSCR-1, the ISCs will support the executing agencies. The ISCs could be a consortium of firms with relevant national and international experience and will be embedded in the respective executing agencies. Together with construction and equipment contractors, specialized supervisory teams, and so on, the ISCs will deliver elements to provide, among others, project supervision and reporting in its several phases, civil and electromechanical works and installations supervision, and implementation of social and environmental safeguards instruments. The ISCs will also provide capacity building to executing agencies, including specific technical areas in both project components as well as in more general terms, those activities pertaining to fiduciary and safeguards functions, for which specific coordination with the PMU will be in place.

5. VEI has already begun work with MOWASCO through support from the government of the Netherlands to design and oversee implementation of an NRW reduction program and a utility management turnaround program. As such, VEI will act as the ISC for Subcomponent 1.1.2 with the main role of (a) providing the necessary upstream diagnostics required to reform the utility and improve its technical, administrative, and commercial performance; (b) supporting MOWASCO in the implementation of the institutional reform; and (c) undertaking necessary analysis, preliminary and final designs, tendering, and supervision of the construction works related to the NRW reduction program. The above work by VEI in the capacity of ISC for Subcomponent 1.1.2 is ongoing and will follow all GoK safeguard regulations and Bank-approved safeguards frameworks for the project; the Bank will review all design reports prior to tendering of works.

Project Execution and Role of Executing Agencies

6. Executing agencies will work closely with the PMU (which is the implementing agency) to execute activities under the KWSCR-1 AF. The executing agencies will be responsible for delivering most of the subcomponent activities, including project planning and reporting, civil works supervision, and implementation of social and environmental safeguards instruments. In the case of Subcomponent 1.1.1.1 undertaken by the NIB, certain FM roles will also be taken on by the NIB (see below).

7. **A new executing agency has been proposed for Subcomponent 1.1.1.2: Lower Nzoia Flood Protection.** A range of agencies were explored in close consultation with the legal advisor of the PMU, and the LVNWSB, under the stewardship of the MEWNR, was found to be most suitable with regard to its mandate and experience. For this project, while the LVNWSB has not implemented a dyke project in the past, of the regional public institutions in the area of the Nzoia River, it has significant experience with the execution of water supply construction contracts. It has served as an implementing agency for the Bank-financed WaSSIP, which has been under implementation since 2008 with satisfactory performance. Under the current WaSSIP AF, the LVNWSB is implementing 32 consultancies services, 14 goods, and 10 works contracts. The

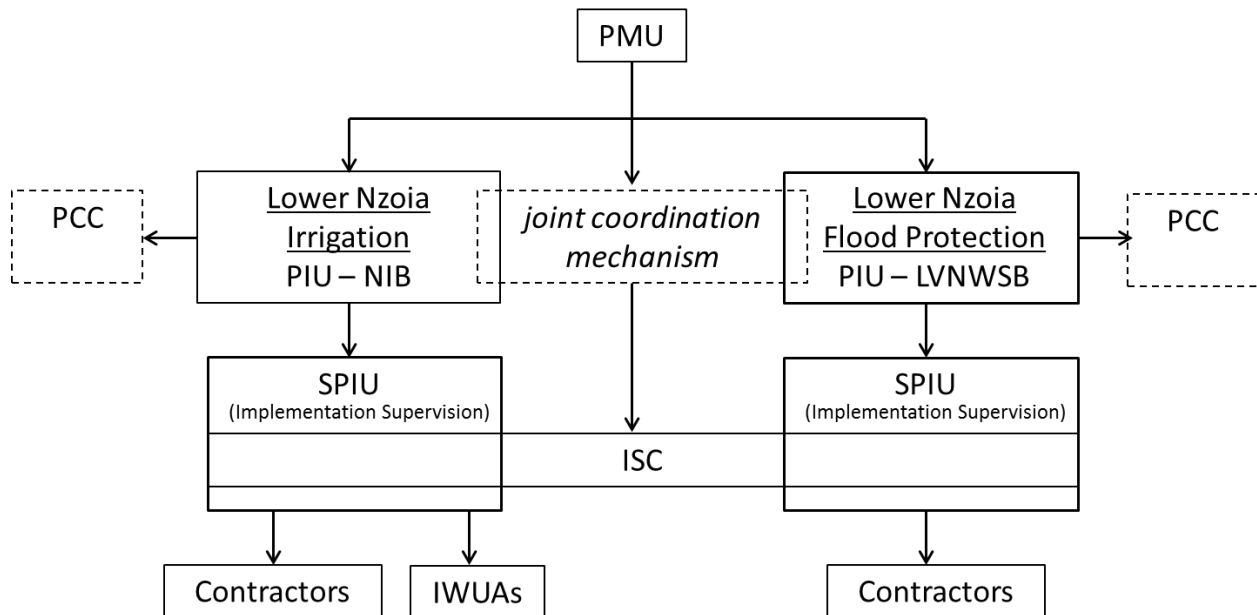
documents back to the PMU for the payment voucher to be raised. Applications for additional imprest payments can be made using the same procedure.

works contracts involve relatively large water supply projects and drought mitigation activities. LVNWSB staff have already received training under WaSSIP in FM, procurement, and safeguards. For eventual ownership and maintenance of the dykes, 18 months after the passage of the National Water Bill, the PMU shall present the Bank with a recommendation, emerging from a study, naming the most appropriate owner and manager of the dykes, along with an FM plan for dyke maintenance.

Implementation Structures

8. **Subcomponent 1.1.1.1: Water Sector Investments - Lower Nzoia Irrigation and Subcomponent 1.1.1.2: Lower Nzoia Flood Protection.** The following illustration delineates the preliminary proposed relationship among the PMU and the PIUs within the executing agencies responsible for executing irrigation and flood control activities in this AF. Given the interdependency of development works and capacity building related to irrigation and flood protection, the PMU will develop a mechanism that will jointly coordinate project planning and management of the two components at the PIU level (a ‘joint coordination mechanism’). Recognizing that PIU-level decision making will need to be strongly supported by field-level oversight, a scheme-level PIU will be based in the project area for each component, to provide day-to-day supervision of activities. Further coordination at the implementation level will be ensured by embedding a common set of ISCs within the scheme-level PIUs. Non-overlapping component-specific activities will be coordinated by separate Project Coordination Committees (PCCs) in conjunction with each PIU. As the activities are shaped, this implementation structure is expected to further evolve to reflect the institutional context.

Figure 1: Implementation Structure for Activities under Subcomponents 1.1.1.1 and 1.1.1.2



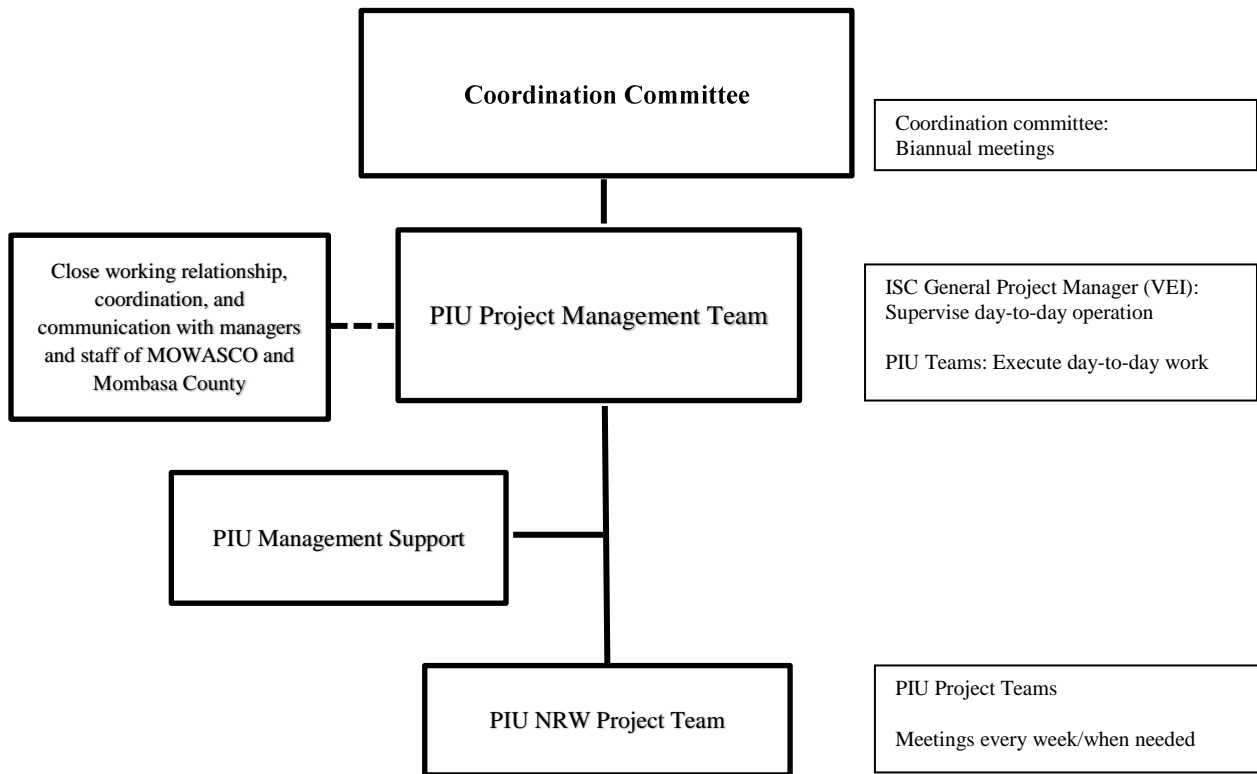
9. The WRMA of the MEWNR has been proposed as the executing agency for the improvement of the flood early warning systems under Subcomponent 1.1.1.2 and for Activity 1.1.1.3: Nzoia Watershed Management. The WRMA already serves as the executing agency for Subcomponent 2.2: Strengthening Water Management and Planning of KWSCR-1 and has

recently appointed a new PIU for the project. Given the decentralized nature of the watershed management project activities, the WRMA has been assessed to have adequate capacity to use CDD-type FM systems to implement community-level watershed management activities. These are further outlined below.

10. MOWASCO will serve as the executing agency for Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County. MOWASCO has worked closely with the CWSB in the implementation of the Bank-financed WaSSIP project including in evaluation processes, contract management, design, and supervision of works. MOWASCO staff have also received training under the project, including in FM, procurement and other technical aspects.

11. The following organogram has been proposed for the PIU for activities related to improving water services in Mombasa.

Figure 2: PIU Organogram for Subcomponent 1.1.2¹⁶



12. **Flexibility for potential future devolution of implementation responsibilities.** Given the ongoing constitutionally mandated devolution and sector legal and institutional reform, with counties set to undertake more duties in delivery of WSS and other direct services, a provision has been added to the Legal Agreement for the project to allow for flexibility in future implementation arrangements. This would allow for some duties to be shifted from the PMU to

¹⁶ This ‘Coordination Committee’ is referred to as the ‘Steering Committee’ in the MoU signed between MOWASCO and the government of the Netherlands. The name has been changed in documents related to this project (Project Paper, Legal Agreements, and so on) to avoid redundancy with the overall KWSCR-1 Project Steering Committee (which was formerly referred to as the Inter-ministerial Oversight Committee).

counterpart organizations and executing agencies during the course of the project, including procurement and implementation roles, subject to capacity assessments. This is consistent with the approach to institutional arrangements across the Kenya country program.

13. If institutions are given new mandates and if requested by the MEWNR and if the Bank reviews their implementation capacities and finds them to be adequate, the implementation structure of the project may be devolved to match the country context, provided it is in compliance with the legal structure of Kenya. Such devolution of implementation duties would be contingent upon an implementation agreement between the PMU and the executing agency, under terms approved by the Bank. If this occurs, the Bank will record the country requests, results of its reviews, and any decisions taken in aide memoires and accompanying management letters. To allow for flexibility in implementation of the project, the executing agencies will not be named in the financing agreement.

KWSCR-1 Project: Financial Management Arrangements

14. All FM arrangements under the project are to remain unchanged, with the exception of some FM capacities to be devolved to the executing agencies for activities to be conducted by the NIB in Subcomponent 1.1.1.1 and the WRMA in Subcomponent 1.1.1.3. In addition, for the new KWPF grant, a separate DA under the National Treasury and a segregated project account (PA) under the MEWNR will be employed.

15. **Changes to the NIB FM arrangements.** The NIB is a state corporation under the Ministry of Agriculture; the Permanent Secretary of the MEWNR will remain the budget holder for the overall project in line with existing GoK regulations, with an MoU established between the MEWNR and Ministry of Agriculture for the activities in Subcomponent 1.1.1.1.

16. The MEWNR is currently the implementing agency for the KWSCR-1 project; hence, it has adequate experience in the management of Bank-financed projects. The NIB also has past experience in the audit of Bank projects having been a sub-implementer under the World Bank Natural Resource Management project.

17. Under the new project design, the NIB expenditures will consist mainly of payments for relatively large contracts and works as well as consultancies with few centralized procurements which generally tend to have low FM risk, due to the use of the direct payment method (as compared to CDD-type and relatively small-value but high-volume decentralized expenditures and procurements that tend to have high fraud and corruption risk in the Kenya portfolio). The FM risk is therefore assessed as moderate for the NIB subcomponent.

18. The MEWNR PMU for the KWSCR-1 project will coordinate the project activities for the NIB. The project will use the existing DA at the National Treasury and the PA at the MEWNR for the KWSCR-1 project. The NIB will open a segregated bank account in a financial institution acceptable to the Bank to which funds will be transferred from the main PA in the MEWNR. This bank account will be used to make payments related to the NIB project activities, such as operating costs. As far as possible, payments for large contracts and

consultancies will be made using the direct disbursements method. The project has adopted the Statement of Expenditure (SOE) method of disbursement.

19. Project FM is strengthened by the fact that the MEWNR and NIB have adequate experience implementing Bank-financed investments, including the ongoing KWSCR-1, NRM, and WASSIP projects, all of which have demonstrated effective FM arrangements. The NIB is a state corporation under the Ministry of Agriculture and is also a sub-implementer under the NRM project. The NIB project payments are mainly large contracts which have low FM risk and are easy to monitor. The payments will be centralized and paid mainly through the direct payment method.

20. Summary of funds flow and disbursement arrangements - NIB

- **DA:** The project will use the existing DA for the KWSCR-1 project.
- **MEWNR PA:** The project will use the existing PA at the MEWNR.
- **NIB sub-implementer PA:** Most of the payments are for relatively large contracts and consultancies, which will be made by the MEWNR through the PMU. However, the NIB will open a segregated bank account in a financial institution acceptable to the Bank for operating costs and other projects activities under NIB.

21. **SOE method of disbursement.** The project will continue to use an SOE method of disbursement. An advance equivalent to six months' cash projection will be deposited in the DA and thereafter, the DA will be replenished against SOEs submitted to the Bank at least once every month. The PMU will be expected to submit an SOE to the Bank at least once every month for documentation of expenditures for those months during which no funds would be required. Only low-value cash payments (primarily project management expenses) are expected to be done out of the funds deposited to the DA or PA. All other payments are expected to be made using the direct payment method.

22. **Direct payment method.** For all payments other than those from the NIB, all material payments (over US\$200,000 or other lesser amount as agreed with the Bank) for local and foreign payees (including contractors and consultants) will be made using the direct payment method. For all material payments under the NIB, payments (over US\$50,000 or other lesser amount as agreed with the Bank) for local and foreign payees (including contractors and consultants) will be made using the direct payment method. All payments outlined in this paragraph should be budgeted for as appropriation-in-aid.

23. **Financial reporting arrangements.** The NIB transactions will be reported using the existing quarterly unaudited interim financial report (IFR) and annual financial statements prepared by the MEWNR.

24. **Auditing arrangements.** The NIB transactions will be subject to audit by the Office of the Auditor General of Kenya as part of the KWSCR-1 project annual audit.

25. **Changes to WRMA FM arrangements.** Under Subcomponent 1.1.1.3, the WRMA will employ decentralized FM arrangements, to allow local WRUAs to implement local watershed management activities, in line with project-agreed work plans. This will be similar to the CCD

model developed under the WKCDD & FM project of which the WRMA is a sub-implementing agency. The Project Implementation Manual (including the FM Procedures manual) should be revised to take into account activities to be implemented by the WRMA. A sub-implementing PIU will be set up by the WRMA at the project implementation site in the Western Kenya region. The WRMA will open a segregated project bank account in a commercial bank acceptable to the Bank from which project-related payments will be made. The bank account will receive transfers (in 6-month tranches) of funds from the main MEWNR project bank account on the basis of a work plan and budget approved by the MEWNR. The work plan and budget should clearly define the amount of project funds allocated for core activities as separate from any operating costs for project supervision which should not exceed 10 percent of overall expenditures in any quarter.

26. The WRMA will be expected to account for the funds transfers on a quarterly basis before receiving replenishment. The WRMA will also designate the project coordinator, project accountants, procurement officer, and other technical project implementation specialists. These will provide fiduciary oversight for the project and will supervise activities of the project at the CDD level. They will also be responsible for financial and technical reporting and procurement management. The quarterly and annual financial reports will be consolidated by the National PMU and submitted to the Bank as part of the overall project quarterly unaudited IFRs and annual audited financial reports. The WRMA subcomponent will be subject to fiduciary review by the MEWNR project team, the MEWNR Internal Audit Department, the Office of the Auditor General KENAO, and the Bank FM review.

27. The MEWNR will set up robust social accountability mechanisms, including complaints handling and public reporting structures. These will include having a telephone number and email address for the public to file complaints and corruption reports, if any; public disclosure of disbursement of funds to the WRMA and a brief description of activities, for example, on the MEWNR website; posting of the WRMA quarterly IFR and progress reports on the website; and GPS mapping of the project sites funded under the WRMA.

Annex 6. Economic and Financial Analysis

Republic of Kenya

–Additional Financing–

Kenya Water Security and Climate Resilience Project (P151660)

Subcomponent 1.1.1.1: Program for Enhanced Water Security in the Nzoia River

1. **Introduction.** The proposed AF for KWSCR-1 was requested by the GoK to fund flood control infrastructure in the Lower Nzoia River basin. Financing of this protection infrastructure was designed under the WKCDD & FM project, and its construction was a precondition for the feasibility of the LNIS—the flagship irrigation project of the Kenya Agricultural Sector Development Strategy and of Kenya Vision 2030—to be financed under KWSCR-1. The government requested for an AF under KWSCR-1 because of its alignment with the project objectives and the implementing institution and because of benefits to be gained by joint implementation with the co-located LNIS, which its first phase is being financed under KWSCR-1.

2. This annex presents the EFA of the joint investments for flood protection and for the irrigation development in the Lower Nzoia area, including Phase 1 with 4,022 ha of net irrigated area on the left bank of the river and Phase 2, assuming its construction will start in 2019 with additional 3,622 ha of irrigated area on the right bank. The rationale for verifying the joint justification of the AF proposed investment together with the LNIS proposed two phases is that without the flood protection in place, the LNIS would not be feasible. The economic justification of LNIS-1 prepared at the KWSCR-1 appraisal had assumed that the WKCDD & FM project would construct the flood protection structures.

3. **The problem.** A combination of poor land use practices, deforestation, and pollution in the Nzoia Watershed catchment area and accumulation of silt in the lower sections of the river causes recurrent floods in the lower basin lands. The catchment area is approximately 12,950 km² entirely within Kenya, along the border with Uganda. The basin drains the southern and eastern slopes of Mount Elgon and the western slopes of the Cherangani Hills down to Lake Victoria.¹⁷ There is a large variation in annual rainfall, from a minimum of 1,076 mm in areas close to the lake to a maximum of 2,235 mm upstream, with an average of 1,424 mm for the basin. In its last 20 km the riverbed slope flattens as the river meanders through a wide floodplain. The river channel width increases to 70 m and the height of the banks reduces considerably, which causes spilling of floodwaters over the banks and flooding of large areas on both sides. It is in this last section that the river gathers strength as it flows downstream as it reaches the Budalangi areas. The area has several human settlements on the valley bottom, mainly based on subsistence agriculture and livestock farming. According to the Central Bureau

¹⁷ Tributaries flowing from the high slopes of Mount Elgon attain maximum elevation in the river's basin, estimated at about 4,300 m above mean sea level. The stretch of the Nzoia River channel is about 355 km, with a mean discharge of 118 m³/sec. The flow regime of the Nzoia is occasionally as low as 20 m³/sec, with extremes over 1,100 m³/sec.

of Statistics, the poverty incidence in Western Province where this flood-prone area belongs was 61 percent in 2005.

4. To mitigate the flooding in the Lower Nzoia, the government constructed flood mitigation dykes in the 1960s.¹⁸ The dykes have, however, progressively been wearing out, and flooding and consequent impacts weigh heavily on both the local and national economies. During the rainy seasons, the highlands experience heavy rainfall and the Lower Nzoia area floods, leading to massive displacement; loss of life and property; disease outbreaks (mainly waterborne and water related); and an influx of land-based pollutants into the lake. The flood-prone area stretches about 20 km from Lake Victoria and covers both banks of the river, which includes the Budalangi area, part of the existing Bunyala scheme, and parts of the proposed LNIS, including both Phases 1 and 2. The area affected by flooding is more than 20,000 ha, and almost every year, an estimated 66,700 inhabitants are negatively affected by flooding. Due to the accelerated natural resource degradation, floods are now more frequent than before. Such a situation creates problems in water supply and sanitation, agriculture, health, education, communication, and transport. Although communities have developed ways to cope with the floods, recurrent interruption of economic activity and loss of assets divert scarce resources from alternative and more productive uses. Malaria rates in relation to flooding and altitude of the area are high and impose an additional burden on the poor.

5. **Project cost.** Total investments in flood protection and for enhancing water security and productivity of irrigation water for project beneficiaries in the Lower Nzoia area considered for this analysis are estimated at US\$162.4 million, including (a) flood control structures (US\$57.5 million); (b) watershed catchment area management (US\$4 million); (c) LNIS-1 (US\$54.6 million); and (d) LNIS-2 (US\$46.3 million). Construction for the rehabilitation of the flood control structures and LNIS-1 will start in 2016, financed under KWSCR-1, while LNIS-2 will start about 4 years later.

Table 6.1: Investment for Flood Protection and Irrigated Development Lower Nzoia

Joint Investment Costs (in US\$ million)	1	2	3	4	5	6	7	8	TOTAL
Flood Control Structure Rehabilitation	10.0	20.6	17.3	9.6	-	-	-	-	57.5
Nzoia Catchment Area Management	0.7	0.7	0.7	0.7	0.6	0.5	-	-	4.0
I&D Infrastructure Works	8.9	10.0	11.8	15.2	9.0	10.7	6.6	-	72.0
Agricultural Support and Value Chain	0.3	0.5	1.4	1.9	1.7	1.7	1.6	1.2	10.3
PIM & Project Management	3.0	0.8	1.7	4.6	1.9	3.0	2.6	1.1	18.6
Sub-Total Other Costs	22.9	32.6	32.9	32.0	13.2	15.8	10.8	2.2	162.4

6. **Project benefits.** ‘With project’ and ‘without project’ scenarios were prepared to estimate project benefits. The ‘with project’ situation assumed that all targets expected from the joint investments in flood protection and irrigation development would be met. In the ‘without project’ situation, the existing production systems performance in the flood-prone area would remain unchanged as they will continue to bear the risk of recurrent floods. Agriculture and livestock breeding are the most common livelihoods. For the financial analysis, household models show the current and future benefits at the level of beneficiaries. For the economic analysis, the financial flows of farmers were added and prices adjusted to get the economic

¹⁸ The dykes run parallel to the general direction of river flow on the north and south banks until about 2 km downstream of Rugunga, with overall lengths of approximately 17.5 km on either side of the river.

values from the point of view of Kenya's economy, excluding distortions, and taking into account the most direct expected externalities.

7. The direct benefits of the proposed joint investments were derived from the expected avoided material and nonmaterial damages that the improved flood protection structures will bring about on the protected areas.¹⁹ In addition, as irrigation also becomes viable with flood protection and from parallel irrigation development investments as the area becomes safer against floods, the following benefits were considered: (a) value of avoided material losses due to floods; (b) value of avoided nonmaterial losses (lives, health-related costs, economic activity disruptions, and so on); and (c) value of benefits from irrigation investments expected from the development in the area, including LNIS-1 and LNIS-2.

(i) The Avoided Damages

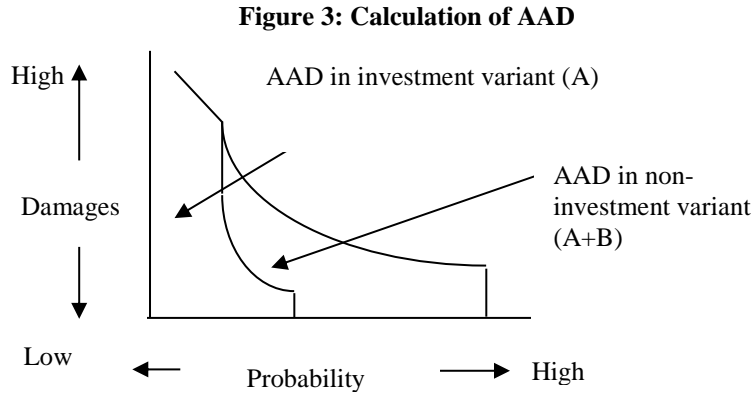
8. The Lower Nzoia Flood Mitigation alternative investments (both structural and nonstructural) were selected based on their expected impact in reducing losses in public and private assets. Investments were for enhancing protection and for disaster response capability while reducing vulnerability yield returns for capital stock damage avoided and lives saved in the events when natural hazards occur. Even though a conventional cost-benefit analysis method might be considered inappropriate to evaluate investments in prevention and post-disaster recovery activities as there are no empirical data to measure the correlation between pre-disaster investments in mitigation and reduced losses, **a probability-based cost-benefit analysis was carried out** by estimating the difference of expected value of losses under 'with project' and 'without project' scenarios. The analysis was based on simulations of possible flood events in the area, preparation of flood maps, estimations of affected assets, and losses in production activities. Nonmaterial benefits included people lives saved and health-related costs.

9. The method for quantifying avoided flood losses due to the proposed flood protection investment was based on the calculation of the weighted **average annual damage (AAD)** expected under the current situation ('without project') and under the proposed investment variant ('with project'). The AAD can be defined as an average of a series of flood damages of increased severity and weighted by its correspondent decreasing frequency. Simulated flood maps were prepared for flood events with a recurrence period of 1-in-10, 1-in-30, and 1-in-50 years.²⁰ The annual damage for each of these events allowed drawing of the ADD curves. The area under the flood loss probability curve (figure 3) was estimated by the integral, which in turn corresponds to the density of standard normal distribution function. Using the principles of standardization, the calculation of the area under the normal curve over any section was reduced to the calculation of the corresponding values of the cumulative distribution. For the flood mitigation investments of the project, the **avoided AAD is represented by the difference in the**

¹⁹ Every year thousands of inhabitants are in need of relief supplies due to flooding of the Lower Nzoia River. The flood-affected communities are impoverished, with almost 70 percent of community members reporting per capita incomes of less than US\$1 a day, thus lacking the economic resources necessary to cope with the effects of flooding.

²⁰ Digitalization of the flood maps for the selected flood events with different return periods from satellite images and hydrological modeling was prepared for this flood assessment by the Regional Center for Mapping of Resources for Development. Land use, settlements, infrastructure, and other layers of maps associated with the economic analysis were overlaid with the flood maps for calculating the value of damages under each event. Flood Assessment in Lower Nzoia River through Hydrologic Modeling, Remote Sensing and GIS Techniques, Nairobi, April 2015.

area between the two curves, that is, B. The non-investment variant damages curve include both, the AAD with the flood protection investments in place (B area) and the damages that would continue to occur (A area) under flood events that exceed the proposed design flood holding capacity of the protection structures.



Source: Odra River Basin Flood Protection Project - Project Appraisal Document (PAD) - February 2007.

10. The preparation of the flood maps for the recurrence periods mentioned above included the following activities: (a) preparation of GIS hydraulic model to generate flood inundation maps for several flood intensities and levels on the Lower Nzoia River; (b) use of satellite images for areas defined under the inundation maps to prepare land use and socioeconomic maps; and (c) estimation of the flood damages and the mitigation benefits using the prepared inundation/flood maps ‘without project’ generated from the GIS modeling. Flood damages for the 3, 5, 8, 10, 15, 20, 30, and 50 year flood recurrence and related probabilities in the ‘without project’ conditions were estimated, as shown in table 6.2. All damages from events below the 1 in 20 year recurrence period would be avoided ‘with project’. Only the 1 in 30 and 1 in 50 year events would provoke a reduced level of damages.

Table 6.2: Weighted AAD Calculations (in K Sh, million)

Recurrence Period	Exceedance Probability	Damage	Probability of Flood in Interval	Mean Damage	Annual Interval Damage
Weighted AAD without the Project					
3	0.330	52.94	0.170	26.47	4.50
5	0.200	265.08	0.130	159.01	20.67
8	0.125	589.00	0.075	427.03	32.03
10	0.100	852.41	0.025	720.70	18.02
15	0.066	1,060.21	0.034	956.31	28.69
20	0.050	1,235.40	0.016	617.70	12.35
30	0.033	1,301.72	0.016	1,268.56	21.57
50	0.020	1,330.12	0.016	1,315.92	17.11

	Total weighted AAD without the project (in K Sh, million)				192.04
Weighted AAD with the Project					
30	0.033	52.94		3,606.35	0.06
50	0.200	265.08	0.013	4,210.87	0.05
	Total weighted AAD with the project (in K Sh, million)				0.12
	Expected Avoided AAD (in K Sh, million)				191.92

11. The Economic Rate of Return (ERR) of the investment in flood protection considering only the annual avoided damages as estimated above but not taking into account the enabled irrigation development under LNIS-1 and 2 results in 1.1 percent and a negative NPV of K Sh 2.56 billion (table 6.3). This partial result indicates that without the development of irrigation in the area, the expected benefits from flood protection would not be justified. The analysis assumed a 30-year horizon (2016–2045) and using constant 2014 prices in Kenyan shillings. The discount rate used for the analysis was 10 percent. The residual value of the protection structures seen as the net asset value in the last year of the analysis was assumed at 25 percent of the investment cost.

Table 6.3: Costs and Benefits of Flood Protection in Lower Nzoia (without irrigation)

(In KSHs Million)	With Project						
	1	2	3	4	5 to 6	7 to 29	30
Other Benefits							
Avoided Losses	-	-	-	192.0	192.0	192.0	192.0
Residual Value of Flood Protection Invest	-	-	-	-	-	-	1,230.0
Sub-Total Other Benefits	-	-	-	192.0	192.0	192.0	1,422.0
Other Costs							
Flood Control Structure Rehabilitation	782.0	1,610.0	1,352.4	782.0	-	-	-
Nzoia Catchment Area Management	57.0	57.0	57.0	57.0	38.6	-	-
O&M of Infrastructure	-	-	-	-	22.7	22.7	22.7
Sub-Total Other Costs	839.0	1,667.0	1,409.4	839.0	61.3	22.7	22.7
Cash Flow	-839.0	-1,667.0	-1,409.4	-647.0	130.7	169.4	1,399.4
IRR = 1.1%, NPV = -2,556.94							

12. Additional field work was carried out in March and April 2015 to estimate the value of avoided flood damages. The latest, most severe floods occurred in 1997, 2003, 2008, and 2011. Floods generally occur during the short rainy season and flood damages are significant as dykes break and inundation water overflows into large areas. Major damages were assessed for the following categories: (a) crops, (b) livestock, (c) schools, (d) health, (e) houses, (f) roads and culverts, and (g) relief expenses.

13. Crop losses were estimated based on the cropping pattern in the affected area, average crop yields, cost of production, and the market prices of the products. The main crops grown include rice, maize, cassava, beans, groundnuts, sweet potatoes, horticulture, and sorghum. Rice and horticulture are mainly grown for commercial purposes while the other crops are for self-consumption. Considering that losses depend on the flood depth and its duration (which are correlated), it was assumed that crop losses from floods above 3.7 m depth would bring losses equivalent to 100 percent of the value of the existing crops. Losses from lower flood depths were

estimated based on the following parameters: 70 percent loss when flood depth reaches 3.4 to 4.6 m; 50 percent loss for depth between 3.0 and 3.4 m; 25 percent loss in cases of 2.7 to 3.0 m depth; and 5 percent loss when floods reach 2.2 to 2.7 m depth.

14. Field observations showed that each household owns livestock, averaging one cow, one goat or sheep, and four poultry. The value of livestock flood losses was estimated based on the number of households displaced by the floods in 2011 (about 805 households), the value of the livestock per household, and expected depth of the floods.

15. For the assessment of flood damages on schools, eight primary and two secondary facilities were visited with a Civil Works Public Officer who assisted in valuing flood damages from recent flood events. Most toilets needed to be rebuilt and buildings showed cracks and holes in most classes. The estimation of flood losses was done with the specialists and only considered physical damages, such as the building of new toilets and rehabilitation of both class and office blocks, and considering the different flood depth scenarios as mentioned above. Other social losses, including disruption in education, were not quantified in the analysis but are critical nonetheless. For example, the 2011 floods happened when students were about to submit their final exams, and students had to be evacuated to other schools that were not affected. Lower primary students had to postpone their exams for one month.

16. In assessing damages on houses, about 10 percent of the houses in the area have iron sheet and brick walls and 90 percent have thatched or iron sheet roofing but mud walls. The value of house structures was estimated with the Public Works Officer, and the corresponding flood maps were used for determination of the structures affected at different flood depths. In the case of roads and culverts, avoided losses from floods were estimated with a Ministry of Public Works officer from Bungoma County, also considering the flood depth and duration scenarios.

17. Finally, for assessing health damages from floods, data on total number of waterborne disease cases in 2011—when 40 percent of the households were affected by the floods—gathered from the three health centers in the area was used together with the average cost of treatment in public hospitals (K Sh 150). In addition, income foregone due to workdays lost from illness (on average, 7 days rest was necessary for the recovery of sick persons) and damages on health facilities were also considered.

(ii) Induced Economic Benefits: Irrigation Development

18. Besides the avoided damages on assets, on human life, and many other facets, the main economic benefit that is expected from the flood protection of the Lower Nzoia area is the creation of the enabling conditions for the investments in irrigation development. LNIS-1 and LNIS-2 will not be implemented unless the risk of floods is significantly reduced. ‘With project’ and ‘without project’ scenarios were modeled to estimate the incremental benefit expected from the joint investments and related costs for irrigation. The expected financial impact on farmer’s income and the economic impact on the Kenyan economy were assessed with the help of crop, farm, and activity models (including livestock production, post-harvest processing, and marketing) showing the current farming practices and the changes that could be induced through the project support interventions. Models and the alternative scenarios were built using FARMOD software. The analysis was done using conservative assumptions throughout the

exercise, including attainable crop yields, cropping intensities, and level of diversification towards higher-value crops (HVCs), given that farmers in the area have small holdings with limited capacity and previous experience with irrigation.

19. Since the LNIS-1 EFA in the KWSCR-1 PAD was prepared in 2012 assuming that the rehabilitation of the flood protection dykes would have been completed before LNIS-1 started implementation, the ‘without project’ scenario assumed and reflected the enhanced security against floods for the existing farming systems and cropping patterns expected from the rehabilitated flood protection. Since this flood control rehabilitation was not done, the ‘without project’ situation for the proposed joint investment was adjusted accordingly. LNIS-2 development was also introduced into the analysis as the proposed rehabilitated dykes will also protect the right bank, thereby paving the way for the irrigation development of both banks of the river (LNIS-1 and LNIS-2).

20. Without the project, only about 550 ha of paddy rice are being irrigated in the Bunyala area. Most of the other existing farms in the project area practice subsistence rain-fed farming. Intercropping cereals and pulses with maize, sorghum, and cassava is an extended cropping strategy to avoid complete losses due to droughts or waterlogging during dry and wet seasons, respectively. Farmers typically have about 1 ha of land mainly containing natural grass and some food crops grown under rain-fed conditions, low input use, and very low productive conditions. Cash crops are limited and some that were common are no longer cultivated due to low prices; lack of markets and/or quality inputs (seed); and high incidence of pests and diseases and, as a result, are not financially attractive. Production of groundnuts, horticultural crops, bananas, sugarcane, and even beans and maize is becoming an alternative source of cash but is still limited due to flood risks, lack of technical assistance, access to adapted seeds, insufficient rainfall, and/or markets. Once flood protection and irrigation is in place, the irrigated area would increase to 4,020 ha in the left bank (Phase 1) and to an additional 3,622 ha in the right bank (Phase 2).

21. **Financial results.** Detailed crop, activity, and farm models were prepared, representing the production activities in the area considering the average resource situation²¹ as well as the current and proposed crops and production systems that could be developed. The information required on costs of production, yields, and cropping patterns for the ‘with project’ and ‘without project’ scenarios was obtained and/or derived from (a) visits to farms in the project and similar areas in Kenya; (b) data collected by the consultants preparing the prefeasibility studies, detailed design, and tender documents; and (c) new data obtained during the PMU consultants’ field visits. Ministry of Agriculture statistics and regional stakeholders’ estimations were also considered. The current situation (representing the ‘without project’ scenario) and the expected transformations after the investments for flood protection, irrigation development, and adequate technical support for production and marketing (the ‘with project’ scenario), and the resulting

²¹ The current productivity in the area is very low for the following reasons: (a) inadequate and unreliable rainfall; (b) periodic flooding causing crop destruction, especially in the low lands; (c) subsistence farming with traditional low-risk practices, low inputs use, and yields, (d) pests and diseases affecting quality and quantity of produce; (e) inadequate farm power and mechanization, resulting in delayed land preparation and planting; (f) minimal use of farm inputs like certified seeds, fertilizers, and pesticide; (g) lack of extension services; and (h) lack of credit for production activities.

costs and revenues from the main crops to be developed in the project area are summarized in table 6.4.

Table 6.4: Production and Results Indicators for Main Crops (per ha)

Crop/Activity	Average Yield (kg/ha or liters/cow)		Gross Revenue (K Sh, thousands)		Input and Labor Costs (K Sh, thousands)		Net Income (K Sh, thousands)	
	Without	With	Without	With	Without	With	Without	With
Paddy rice	3,000	8,000	105.0	280.0	73.3	97.9	31.7	182.1
Maize/beans	1,300/340	5,000/0	50.5	125.0	48.1	94.7	2.5	30.0
Soybeans	1,100	3,200	66.0	192.0	38.1	65.7	27.9	126.3
Green gram	720	1,800	64.8	162.0	48.8	60.4	25.9	101.5
Groundnuts	800	2,500	80.0	250.0	41.4	72.3	38.6	177.7
Kale	4,000	15,000	100.0	375.0	32.7	80.7	67.3	294.3
Capsicum	2,000	10,000	80.0	400.0	47.1	148.6	32.9	251.5
Tomatoes	3,500	30,000	105.0	900.0	88.8	218.8	16.2	681.2
Sweet potatoes	6,000	30,000	124.0	615.0	91.5	210.4	32.5	404.7
Watermelons	3,000	30,000	67.5	675.0	43.5	125.3	24.0	549.7
Onions	4,000	25,000	100.0	625.0	70.3	214.8	29.7	430.2
Papayas (3 years)	–	40,000	–	800.0	–	317.7	–	482.3
Bananas (4 years)	–	85,000	–	1,700.0	–	899.6	–	800.4
Passion fruit (4 years)	–	35,000	–	1,400.0	–	822.9	–	577.1
Mango (Year 9 on)	–	40,000	–	1,400.0	–	380.8	–	1,019.2

22. The significant yield increases expected from the project interventions are dependent on the proper implementation of the US\$10.9 million intense agricultural support and chain value (ASCV) and the US\$18.6 million participatory irrigation and project management subcomponents. The process will be guided by an ISC firm being contracted. A demonstration/pilot area for the proposed new crops and technologies will be installed during 2015, managed by the local PIU, NIB, in the existing Bunyala irrigated area, with the active support of the ISC and the Kenyan Agricultural and Livestock Research Organization (KALRO).²² This demonstration/pilot area will start working 3 years before the flood protection and irrigation investments are completed, generating adapted technologies, identifying planting materials and markets for HVCs, and training farmers in the completely new approach for the development of irrigated agriculture in Kenya.²³

²² KALRO, working with partners along different Agricultural Products Value Chains (APVCs) is well placed to work with the communities in using the irrigated waters for diversified crop production, management of the irrigation soils for efficient use of the waters, and linking the farmers to relevant actors, including markets, value addition, and processors along the APVC in the Bunyala Irrigation Scheme.

²³ One of the new technologies to be introduced since 2015 is the System for Rice Intensification (SRI). SRI requires 30 to 40 percent less water than used today for rice. During land preparation for transplanting rice there is a very high water requirement; the present method is to apply water to the land and allow it to percolate for about 3 days before the land is 'rotivated' with a tractor. Under the validated SRI to be promoted, these large peaks of water requirement would be substantially reduced. Also, the continuous flooding irrigation practice will be changed to

23. **Farm models** combine crops and livestock activities considered as typical for the areas in the ‘without project’ scenario. With the project, farmers will choose which crops they will cultivate, although the selection will primarily depend on the respective soil type, the need for the farmers to feed their families, the place of the crop in the farming system, and—for cash crops—the profitability or net margins to be attained. The available marketing linkages will also play a central role. The proposed crop patterns have been included considering two cropping seasons, the main crops being rice, maize, soybean, bean, green gram, groundnuts, vegetables, sweet potatoes, papaya, banana, passion fruit, and mangoes. Farm models also show the results ‘with’ the project interventions and the expected farm costs and revenues from the current and proposed productive systems.

24. Farmers will decide the crops to grow and activities to develop in their farms after participating in the training activities to be developed beginning three years before actual irrigation is available and with the assistance of the technical services to be provided under the ASCV component. HVCs—mainly fruits (passion fruit, banana, papaya, and mango); root crops (sweet potatoes); and vegetables (tomatoes, onions, watermelon, and so on)—will be identified and the cropped area expanded as the project’s ASCV activities assist, train, and support farmers on the new systems, providing them with adapted clean planting materials and developing the necessary post-harvest handling and market linkages. Crop and livestock models combined in farm models allowed estimating of the expected financial impact of the project on farmers’ incomes.

25. Table 6.5 shows that the **beneficiaries’ family revenues are expected to increase by about 2.3 to 4.3 times** as flood protection, irrigation, training, and technical support is made available. Models 1 to 3 represent farms that are in the lowland areas on both river banks that are suitable for rice growing, including the existing Bunyala scheme and out-grower areas. Even in the current rice irrigated area, income would more than double as the SRI technologies will allow increasing both water and rice productivity while reducing costs of production, together with the expected diversification of production with soybeans and other legume crops to improve soils productivity.

Table 6.5: Financial Impact at the Level of Typical Farms in the Nzoia Area (K Sh, thousands)

Farm Model Indicators		Model 1: Paddy/soybeans	Model 2: Paddy/onion-SwP	Model 3: Paddy/maize in Bunyala	Model 4: Mango/paw-paw/vegetable	Model 5: Passion fruit/banana/vegetable	Model 6: Passion fruit/banana/vegetable
Labor (day or year requirements)	Before	299	242	285	195	181	194
	After	367	413	433	411	592	580
Farm gross income (K Sh)	Before	132,232	113,168	167,520	81,112	81,768	85,274
	After	474,808	598,108	548,800	839,600	639,722	616,350
Farm net income (K Sh)	Before	122,100	133,597	153,036	118,282	107,109	112,438
	After	390,722	448,276	395,851	500,320	440,996	419,281
Return/day family labor	Before	468	553	549	608	540	580
	After	1,079	1,421	1,302	1,322	1,097	1,089

alternate drying and wetting, with an overall reduction in irrigation water requirements. SRI also reduces the need of seed, fertilizer, and pesticides.

Irrigation water use (m ³ , thousands)	Before	–	–	9.6	–	–	–
	After	7.2	12	13.1	7.6	6.6	7.5
Water productivity (K Sh/m ³)	Before	–	–	15	–	–	–
	After	54	37	30	66	67	56

26. **Water productivity.** Expected to increase from the current K Sh 15 per m³ in the Bunyala rice area to an average of K Sh 30 per m³. For Models 3, 4, and 5, water productivity is expected to reach K Sh 56 to K Sh 67 per m³ as these models represent areas with soils suitable for diversifying to fruits and vegetables. Labor requirements in the farms would be increased by 20 percent in the rice areas and up to 3.2 times in areas where fruits and vegetables would predominate. On average, labor use would be doubled as production is intensified, requiring the use of hired labor during the peak months when agricultural activities are more intense. Returns to the family labor required by the new situation would be almost tripled from K Sh 900 to K Sh 2,600 per day worked.

27. **Water charges affordability.** Payment for irrigation water was included in the crop and farm budgets based on volumetric fees and water quantities required per crop. The NIB estimated a with-project annual operation and maintenance (O&M) cost of K Sh 61.6 million for operating the Phase 1 area (K Sh 53 million plus contingency). Considering that the proposed cropping pattern requires 35 million m³ per year in Phase 1, a water charge of K Sh 1.74 per m³ would be necessary for the full cost recovery of O&M of the system. However, a tariff of K Sh 1.40 per m³ was included in this analysis considering that the IWUAs would assume many of the responsibilities for O&M of the system. The assumed water charges result in an average payment of K Sh 22,500 per irrigated hectare, varying from K Sh 25,200 per ha if rice is planted twice in the same area down to about K Sh 9,500 if crops requiring less water are grown. Even if water costs for rice might seem significant, for paddy farms it may reach up to 15 percent of the total cost of production or 4 percent of the gross value of production. On average, the cost of irrigation water for the Phase 1 area only represents 2 percent of the value of production and about 5 percent of the expected incremental farm incomes.

28. **Marketing linkages** to be supported under the ASVC activities will facilitate the formation of farmer cooperatives for developing the access to higher-value markets, including both the domestic and export markets, mainly in other East African countries. To this end, the project allocated more than US\$600,000 under the ASVC subcomponent in the original project, for supporting the installation of facilities for rice milling; for packing, processing, and storing fruits and vegetables in cold chambers; or similar linkages. Tables 6.6 and 6.7 represent the costs and benefits for rice milling and for packing and processing of passion fruit.

Table 6.6: Investments, Costs, and Benefits from Rice Milling for LNIS-1

Rice Milling AM										
FINANCIAL BUDGET (AGGREGATED)		With Project								
(In KSHs Million)		1	2	3	4	5	6	7	8 to 30	
Main Production										
Head Rice		-	95.2	149.6	285.6	455.6	646.0	775.2	816.0	
Rice ByProducts		-	3.0	4.7	8.9	14.2	20.2	24.2	25.5	
Sub-total Main Production		-	98.2	154.3	294.5	469.8	666.2	799.4	841.5	
Production Cost										
Investment										
Agricultural Support and Value Chain		240.0	24.0	-	-	-	-	-	-	
Operating										
Purchased Inputs										
Paddy Rice		-	49.0	77.0	147.0	234.5	332.5	399.0	420.0	
Other Inputs		-	12.5	17.0	27.5	41.0	55.0	70.0	76.0	
Transport		-	9.0	11.0	21.0	33.5	47.5	57.0	60.0	
PIM & Project Management		-	20.4	40.8	51.0	51.0	51.0	51.0	51.0	
Sub-Total Purchased Inputs		-	90.9	145.8	246.5	360.0	486.0	577.0	607.0	
Labor										
Labor		-	5.0	10.0	12.5	12.5	12.5	12.5	12.5	
Sub-total Operating Costs		-	95.9	155.8	259.0	372.5	498.5	589.5	619.5	
Sub-Total Production Cost		240.0	119.9	155.8	259.0	372.5	498.5	589.5	619.5	
OUTFLOWS		240.0	119.9	155.8	259.0	372.5	498.5	589.5	619.5	
Cash Flow Before Financing		-240.0	-21.7	-1.5	35.5	97.3	167.7	209.9	222.0	
Net Financing		228.0	-3.6	-10.3	-11.4	-12.6	-9.1	-3.0	-	
Cash Flow After Financing		-12.0	-25.3	-11.8	24.2	84.7	158.6	206.9	222.0	
Sub-Total Change in Net Worth		-240.0	-	-	-	-	-	-	-	
Farm Family Benefits After Financing		-252.0	-25.3	-11.8	24.2	84.7	158.6	206.9	222.0	
IRR = 30.0%, NPV = 760.95										
PRODUCTION AND INPUTS (Aggregated)		Without Project		With Project						
(In Units '000)		1 to 30	1	2	3	4	5	6	7	
Main Production										
Head Rice		-	-	0.952	1.496	2.856	4.556	6.46	7.752	
Rice ByProducts		-	-	2,975	4,675	8,920	14,235	20,195	24,220	
Operating										
Purchased Inputs										
Paddy Rice		-	-	1.4	2.2	4.2	6.7	9.5	11.4	
Labor										
Labor		-	-	10	20	25	25	25	25	

29. Table 6.6 shows the budget for the installation and operation of a rice milling facility in LNIS-1. The paddy production under LNIS-1 is expected to be around 14,000 tons per year from about 1,760 ha cultivated in both seasons. It was assumed that about 12,000 tons (85 percent) would be processed by the farmers' cooperative paying the market price of K Sh 35 per kg at the farm gate. The cooperative would haul to the milling unit with a capacity of 8 tons per hour in two processing lines. The mill would run at about 50 percent capacity so that it could also be used for processing rice from other areas. Milling paddy results in about 68 percent of head rice, 4 percent of broken rice (in three grades), and 8 percent of rice bran. About 8,160 tons of head rice would be obtained per year at maturity. The costs of milling about 12,000 tons of paddy each year would therefore be in the order of K Sh 140 million (US\$1.65 million) per year. The investment for a mill of this capacity located at LNIS-1 is estimated to cost about K Sh 264 million (US\$3.1 million).

30. It was assumed that the head rice would be sold ex-factory for K Sh 100 per kg which, with the selling of by-products, would generate K Sh 841.5 million (US\$9.9 million) per year. The operating margin would then be over K Sh 222 million (US\$2.6 million) per year at maturity (Year 8), representing a value addition of about 50 percent over the farm gate price, a margin

that could then be distributed to farmers. The financial rate of return to be obtained from investing in the milling plant is 30 percent, which makes the investment for installing the plant eligible for a medium-term credit from the banking system.

Table 6.7: Passion Fruit Packing, Processing, and Marketing for LNIS-1

Passion Fruit Marketing & Processing					
FINANCIAL BUDGET (AGGREGATED)					
(In KShs Million)					
	With Project				
	1	2	3	4	5 to 30
Main Production					
Passion Fruit (Export fresh market)	-	24.0	56.0	96.0	120.0
Passion Fruit (Domestic fresh market)	-	12.0	28.0	48.0	60.0
Passion Fruit Juice	-	24.0	56.0	96.0	124.0
Sub-total Main Production	-	60.0	140.0	240.0	304.0
Production Cost					
Investment	100.0				
Operating					
Purchased Inputs					
Passion Fruit	-	37.6	96.0	162.0	186.0
Other Inputs	-	5.7	14.5	25.0	28.5
Transport	-	4.5	11.0	19.0	22.5
PIM & Project Management	-	10.2	15.3	15.3	15.3
Sub-Total Purchased Inputs	-	58.0	136.8	221.3	252.3
Labor	-	4.0	7.5	8.5	9.5
Sub-total Operating Costs	-	62.0	144.3	229.8	261.8
Sub-Total Production Cost	100.0	62.0	144.3	229.8	261.8
OUTFLOWS					
Cash Flow Before Financing	-100.0	-2.0	-4.3	10.2	42.2
Net Financing	93.8	-8.2	-8.6	-3.2	-
Cash Flow After Financing	-6.2	-10.2	-12.9	7.0	42.2
Sub-Total Change in Net Worth	-100.0	-	-	-	-
Farm Family Benefits After Financing	-106.2	-10.2	-12.9	7.0	42.2
IRR = 20.2%, NPV = 104.95					
PRODUCTION AND INPUTS (Aggregated)					
(In Units)					
	Unit	With Project			
		1	2	3	4
Main Production					
Passion Fruit (Export fresh market)	tons	-	300	700	1,200
Passion Fruit (Domestic fresh market)	tons	-	300	700	1,200
Passion Fruit Juice	tons	-	300	700	1,200
Operating					
Purchased Inputs					
Passion Fruit	tons	-	940	2,400	4,050
Labor					
Labor	person day	-	8,000	15,000	17,000

31. Table 6.7 presents the estimated budget for conditioning, packaging, and processing of the passion fruit expected from the scheme. LNIS-1 would produce 4,900 tons of passion fruit from about cultivated 420 ha. Farmers would sell about 4,650 tons to their cooperative and after sorting and conditioning, about 1,500 tons of the best quality products would be exported as fresh fruit, 1,500 tons would be sold as fresh fruit in internal markets, and 1,550 tons would be processed and sold as juice. The average selling price would be K Sh 80, K Sh 40, and K Sh 80 per kg (or liter), respectively. After processing costs, the net margin of this facility would reach K Sh 42 million per year which is an added value of about 30 percent over the market value of the fruit. The Internal Rate of Return (IRR) of the K Sh 100 million to be invested in the packing and processing facility is 20.2 percent.

32. **Irrigation economic results.** The aggregation of the typical farm models, together with the representative market linkage investments presented above, allowed estimating of the overall economic results from the proposed development of the LNIS-1 and 2 schemes. Table 6.8 shows the expected cropping pattern assumed for this assessment in LNIS-1, considering the facilitating environment to be created under the project, including the participatory irrigation management

approach and the development of the necessary support to facilitate access to existing domestic and international markets.

Table 6.8: Expected Cropping Pattern Evolution in LNIS-1

CROPPING PATTERNS/ACTIVITY LEVELS (In Units)	Unit	Without Project		With Project project year					
		1 to 15	1 to 2	3	4	5	6	7	8
Cropping Intensity	Percent	118%	118%	118%	131%	159%	176%	187%	190%
Cropping Pattern									
Existing Technology									
Maize & Beans (September - January)		3,325	3,325	3,325	2,409	1,035	578	578	578
Paddy Rice	ha	557	557	557	278	0	0	0	0
Groundnuts (Sept -Jan)	ha	198	198	198	99	0	0	0	0
Tomatoes (october - february)	ha	170	170	170	85	0	0	0	0
Onions	ha	27	27	27	27	20	7	0	0
Sweet Potatoes	ha	124	124	124	62	0	0	0	0
Greengram (September - January)	ha	237	237	237	119	0	0	0	0
Kales	ha	140	140	140	70	0	0	0	0
Sub-total Existing Technology		4,778	4,778	4,778	3,149	1,055	585	578	578
New Technology									
Maize & Beans (September - January)	ha	0	0	0	367	821	908	908	908
Paddy Rice	ha	0	0	0	496	1,376	1,759	1,759	1,759
Soybeans	ha	0	0	0	150	450	600	600	600
Groundnuts	ha	0	0	0	99	198	198	198	198
Tomatoes (october - february)	ha	0	0	0	85	170	170	170	170
Onions	ha	0	0	0	35	112	160	167	167
Sweet Potatoes	ha	0	0	0	132	264	264	264	264
Greengram (September - January)	ha	0	0	0	119	237	237	237	237
Capsicums (Oct - Feb)	ha	0	0	0	35	70	70	70	70
Kales	ha	0	0	0	140	245	175	140	140
Watermelons (october - february)	ha	0	0	0	42	84	84	84	84
Subtotal Seasonal crops		0	0	0	1,699	4,026	4,625	4,597	4,597
Mango	ha	0	0	0	35	105	140	140	140
Papaya	ha	0	0	0	105	280	280	280	280
Passion Fruit	ha	0	0	0	35	140	280	420	420
Bananas (Ripening Type)	ha	0	0	0	51	152	254	355	406
Subtotal Permanent Crops		0	0	0	226	677	954	1,195	1,246
Sub-total New Technology		0	0	0	1,925	4,703	5,579	5,792	5,843
Total Cropped Area		4,778	4,778	4,778	5,074	5,759	6,164	6,370	6,421

33. The expected production from LNIS-1, including the rice milling plant and passion fruit post-harvesting, handling, and marketing facilities are presented in table 6.9. Similar cropping patterns and production structure (but about 10 percent lower than in LNIS-1) is expected from the development of LNIS-2.

Table 6.9: Expected Production from LNIS-1

PRODUCTION AND INPUTS (Aggregated) (In Units)	Without Project					With Project									
	Unit	1 to 15	1 to 2	3	4	5	6	7	8	9	10	15			
Main Production															
Paddy Rice	ton	1,670	1,670	1,670	2,323	4,654	8,004	11,347	13,546	14,074	14,074	14,074			
Head Rice	ton	-	-	-	952	1,496	2,856	4,556	6,460	7,752	8,160	8,160			
Maize	ton	4,323	4,323	4,323	3,608	2,640	3,021	4,247	5,064	5,291	5,291	5,291			
Beans	ton	1,131	1,131	1,131	944	612	409	293	216	197	197	197			
Soybeans	ton	-	-	-	165	585	1,080	1,530	1,830	1,920	1,920	1,920			
Greengram	ton	171	171	171	171	187	251	347	412	427	427	427			
Groundnuts	ton	158	158	158	158	179	263	390	474	495	495	495			
Sweet Potatoes	ton	742	742	742	1,162	1,977	3,559	5,931	7,513	7,908	7,908	7,908			
Tomatoes	tons	595	595	595	595	893	2,040	3,740	4,845	5,100	5,100	5,100			
Watermelons	tons	-	-	-	126	378	966	1,848	2,394	2,520	2,520	2,520			
Onions	tons	108	108	108	248	738	1,689	2,887	3,790	4,135	4,175	4,175			
Capsicum	tons	-	-	-	70	175	315	525	665	700	700	700			
Kales	tons	560	560	560	840	1,127	1,232	1,617	2,002	2,100	2,100	2,100			
Passion Fruit	tons	-	-	-	-	175	1,225	3,150	4,550	4,900	4,900	4,900			
Passion Fruit (Export fresh market)	tons	-	-	-	-	-	-	300	700	1,200	1,500	1,500			
Passion Fruit (Domestic fresh market)	tons	-	-	-	-	-	-	300	700	1,200	1,500	1,500			
Passion Fruit Juice	tons	-	-	-	-	-	-	300	700	1,200	1,550	1,550			
Bananas	tons	-	-	-	-	761	2,791	5,329	7,613	8,628	8,628	8,628			
Papaya	tons	-	-	-	-	2,100	5,600	6,300	5,600	5,600	5,600	5,600			
Mango	tons	-	-	-	-	-	-	70	245	525	1,050	5,600			
Operating															
Processing Production															
Paddy Rice	ton	-	-	-	1,400	2,200	4,200	6,700	9,500	11,400	12,000	12,000			
Passion Fruit	tons	-	-	-	-	-	-	940	2,400	4,050	4,650	4,650			
Irrigation Water	000 m3	6,682	6,682	6,682	11,361	22,768	30,759	32,895	34,032	34,375	34,592	34,732			
Labor (in '000 person-days)	000	962	962	962	1039	1195	1351	1514	1615	1644	1656	1674			

34. **Conversion factors (CFs)** were used for adjusting some market prices to better reflect the economic value of inputs, labor, and investment costs. No adjustment was made to the price of agricultural products. Prices adjusted for the economic analysis included fertilizer and agrochemicals for which a CF of 0.8 was applied, as well as for rural labor also with 0.8. Project investment costs were also adjusted for which a 0.92 CF was used.

35. **Results from irrigation development.** The expected EIRR of the investments required for the development of LNIS-1 and 2 involving an investment of US\$100.9 million (US\$54.6 and US\$46.3 million) are 18.7 and 18.6 percent, respectively. However, since LNIS-1 and 2 will be enabled by the enhancement of the flood control structures because the high risks of floods in the area, the analysis should take into account the overall results of the joint investments, including flood protection and irrigation development in both banks which is presented below.

36. **Overall economic results.** The quantification of the expected economic benefits of the proposed US\$162.4 million investment for flood control and irrigated agriculture development shows an overall EIRR of 13.8 percent and an NPV of K Sh 4.51 billion (with 10 percent discount rate), equivalent to US\$53 million (K Sh 85 = US\$1). These values allow concluding that the expected impact justifies the investment required, especially considering that significant multiplier effects not taken into account will be derived. The proposed flood protection and irrigation development of the area would allow not only avoiding losses from floods valued at US\$2.26 million annually but also increasing the annual gross value of production in the affected area from US\$10.1 million annually to about US\$76.5 million. The net economic benefit from agriculture and livestock in the area would grow by more than 20 times, from US\$1.88 million to about US\$38.7 million at maturity.

37. The project area, on average, would significantly increase the annual use of the labor available from about 1.7 million person-days per year to about 3.1 million, and beneficiaries would increase their household income as most of the required labor would come from their own family members; this is underused and has very low opportunity cost. In addition, since HVCs will be introduced, the value of production, and the productivity of land, water, and labor would also increase substantially. Labor productivity per day would more than double, from K Sh 540 to K Sh 1,200, value derived from the economic net benefit to be generated in the project area divided by the labor required by the new farming systems. As shown in table 6.4, these transformations would mean that the net family income would be increased on an average more than thrice, depending mainly on their current situation and the diversification toward HVC to be adopted. About 7,000 to 10,000 families are expected to come out of poverty.

38. On top of the benefits specified above, there will be other benefits for the region and the country, such as the validation of the enormous potential Kenya has if irrigated agriculture is developed based on market- and export-oriented HVC. Locally it would bring several multiplier effects through intensification of economic activities, construction, and infrastructure investments as the attractiveness of the region for potential investors is increased. The LNIS would show that investments in irrigation together with adequate support activities could have huge impacts in land and water productivity, poverty alleviation, and economic development. This, in turn, will result in creation of new jobs and many other social benefits, with reduction in social pathologies caused by generalized unemployment and stagnant poverty. These benefits will occur without a doubt, but their valuation is complex, so they were not quantified for this analysis.

39. **Sensitivity analysis.** As shown in table 6.10, the project is strong against major risks but highly sensitive to the effective transformation of the existing traditional subsistence agriculture into highly efficient production systems of HVCs. Farmers need to be properly organized to manage their business and supporting services with a highly professional team providing adequate management skills, orientation on what to produce, technical assistance, intense training and support for producing high quality products, post-harvesting handling, and marketing of products and processing to add value to their products. To mitigate these risks, a strong Bank supervision and technical support component, including a highly professional ISC will be in place. The EIRR will show the following levels if assumptions are not met, according to the following situations:

Table 6.10: Sensitivity Analysis

Event	EIRR (%)
1. Base Case	13.8
2. Investment costs 20% over the budget	11.8
3. Investment costs 30% over the budget	11.0
4. Yields or price of products 10% below estimates	12.3
5. Yields or price of products 20% below estimates	10.7
6. No rice milling or fruit processing	12.4
7. Only 80% of area developed into HVCs	12.1
8. Only 60% of area developed into HVCs	10.2
9. Only 60% of area under HVCs and no rice milling/fruit processing	8.2

Table 6.11: Lower Nzoia Development Project Economic Budget

Project Summary ECONOMIC BUDGET (AGGREGATED) (In KSHs Million)	Without		With Project											
	Project													
	1 to 30	1	2	3	4	5	6	7	8	9	10	20	30	
Main Production														
Field Crops	547	547	547	547	559	643	835	1,083	1,315	1,526	1,739	1,902	1,898	
Higher Value Crop	66	66	66	66	82	184	416	694	963	1,239	1,494	2,033	1,122	
Livestock	254	254	254	254	254	264	293	331	359	385	419	435	435	
Processed Outputs	-	-	-	-	98	154	295	618	945	1,304	1,616	2,146	2,146	
Sub-total Main Production	867	867	867	867	993	1,246	1,839	2,727	3,582	4,455	5,268	6,517	5,601	
Sub-Total On-Farm Use	34	34	34	34	38	45	55	70	84	94	105	113	79	
Sub-Total On-Farm Consumption	456	456	456	456	461	461	464	493	509	512	534	549	549	
Net Value Of Production	376	376	376	376	494	740	1,321	2,163	2,989	3,849	4,629	5,854	4,973	
Purchased Consumption	13	13	13	13	16	18	16	20	24	24	25	28	28	
Other Benefits														
Avoided Losses	-	-	-	-	192	192	192	192	192	192	192	192	192	
Residual Value of Flood Protection Inves	-	-	-	-	-	-	-	-	-	-	-	-	1,230	
Sub-Total Other Benefits	-	-	-	-	192	192	192	192	192	192	192	192	1,422	
INFLOWS	363	363	363	363	670	914	1,497	2,335	3,156	4,018	4,796	6,019	6,368	
Production Cost														
Investment														
Sub-Total Purchased Inputs	-	-	-	221	54	73	373	132	149	230	155	138	-	
Labor	-	-	-	-	8	15	14	21	28	27	27	25	-	
Sub-total Investment Costs	-	-	-	221	62	88	387	153	177	256	182	163	-	
Operating														
Purchased Inputs														
Field Crops (Rice for Milling)	15	15	15	15	66	97	168	301	425	555	654	819	819	
Higher Value Crop (Fruit for Proces	-	-	-	-	-	-	-	38	96	162	216	335	335	
Agricultural Inputs	206	206	206	206	253	314	391	516	639	755	847	994	902	
Sub-Total Purchased Inputs	221	221	221	221	319	411	560	854	1,160	1,472	1,717	2,148	2,056	
Labor	438	438	438	438	450	480	519	571	623	665	704	741	657	
Sub-total Operating Costs	659	659	659	659	769	891	1,078	1,425	1,783	2,137	2,421	2,889	2,713	
Sub-Total Production Cost	659	659	659	880	832	979	1,465	1,578	1,960	2,394	2,602	3,052	2,713	
Other Costs														
Flood Control Structure Rehabilitation	-	782	1,610	1,352	782	-	-	-	-	-	-	-	-	
Nzoia Catchment Area Management	-	57	57	57	57	39	39	-	-	-	-	-	-	
I&D Infrastructure Works	-	692	780	927	1,185	702	834	514	-	-	-	-	-	
Agricultural Support and Value Chain	-	25	39	106	151	136	131	129	91	32	11	-	-	
PIM & Project Management	-	233	64	133	358	149	232	201	83	101	60	-	-	
Operation and Maintenance of Infrastruc	-	-	-	-	-	23	23	23	23	23	23	23	23	
Sub-Total Other Costs	-	1,789	2,549	2,576	2,533	1,048	1,258	867	196	155	95	23	23	
OUTFLOWS	659	2,448	3,208	3,456	3,365	2,027	2,724	2,445	2,156	2,549	2,697	3,074	2,736	
Cash Flow	-296	-2,085	-2,845	-3,093	-2,695	-1,113	-1,227	-109	1,000	1,469	2,099	2,945	3,632	
Net Economic Benefits	160	-1,628	-2,389	-2,636	-2,234	-653	-763	383	1,509	1,981	2,634	3,494	4,181	

IRR = 13.8%, NPV = 4,515.36

Subcomponent 1.1.2: Program for Improvement of Water Services in Mombasa County

40. **Background.** The Program for Improvement of Water Services (PIWS) in Mombasa County is a new component of the restructured KWSCR-1 AF. Part b of the development objective of KWSCR-1 AF is to “enhance the institutional framework and strengthen capacity for water security and climate resilience in certain areas of the country.” The PIWS in Mombasa will contribute to the achievement of this objective.

41. The PIWS in Mombasa includes financial support for (a) institutional strengthening of Mombasa County to undertake devolved functions in WSS; (b) management turnaround of the water utility MOWASCO; and (c) implementation of investments to reduce NRW in MOWASCO’s service area. The EFA includes the assessment of the impact of investments in MOWASCO’s management turnaround and those to reduce NRW.

42. **Methodology.** An incremental cost-benefit analysis was conducted using parametric information generated by pilot DMAs implemented by the WOP. The WOP is being implemented with the support of VEI from the Netherlands.

43. To determine the incremental financial costs and benefits, two disjunctive scenarios, ‘without project’ and ‘with project’, were defined. The ‘without project’ scenario is where MOWASCO aims to achieve its water targets assisted only by the VEI WOP. The ‘with project’ scenario is defined as one where the KWSCR-1 AF project provides financial support in addition to the VEI WOP, whereby MOWASCO aims at achieving enhanced targets related to improved operating efficiency and decreased NRW.

44. **Results from the pilot implemented by the VEI WOP, costs per connection, and the NRW technology options to be assessed.** VEI has implemented eight pilot DMAs, each consisting of a closed, isolated network of interconnected pipes fed by a single-intake bulk-metered pipe, with all DMA’s customer connections metered. Hence, network administrators are able to know, with a high degree of accuracy, the level of NRW in each DMA as they can measure how much water gets into the system and how much water is billed to customers upon meter reading. With the support of the KWSCR-1 AF, a significant number of DMAs will be deployed to reduce NRW in the MOWASCO service area.

45. Because the exact areas to be targeted under the project have not been identified and as the interventions have not been designed, economic analysis has been conducted using three possible options for the project, which vary by cost per connection and degree of work to be performed. Based on the VEI WOP pilots, the following preliminary technology options for the implementation of NRW investments are taken as planning references:

- **Option 1: Only tertiary network rehabilitation and expansion are implemented.** Current mapping and DMA planning has identified areas where investment needs are limited to tertiary distribution networks’ rehabilitation and expansion and metering accessories. In this case, it is estimated that the investment cost will be about US\$145 per connection.
- **Option 2: New primary and secondary pipes are implemented in addition to tertiary networks.** Ongoing mapping by VEI has identified areas of the city where there are no

known pipelines or where unofficial, unregistered ‘spaghetti pipes’ (because of their unplanned and often chaotic layout) connect consumers to distribution pipes. In these areas, it is anticipated that the project will design a totally new distribution system and that the contractors will decommission all existing formal or informal distribution systems that are obsolete. The investment cost is about US\$265 per connection.

- **Option 3: ICT will be included to deal with recurrence of meter tampering and for controlling pipe bursting and reducing energy costs.** During implementation of pilots, VEI has experienced recurrence of meter tampering after the DMAs were put in place. To overcome this issue, it has been proposed to introduce remote metering systems as part of ICT to handle operations of MOWASCO’s network; this would limit opportunity for corruption in meter reading and graft. Also, as part of the same ICT initiative, automatic control of hydraulic pressure to reduce energy costs and prevent bursting of pipes has been proposed. If ICT is included, the investment cost could be US\$365 per connection, taking into account economies of scale for system-wide ICT implementation.

46. Incremental cost-benefit financial and economic analysis has been done for each of the technology options based on the assumptions outlined in table 6.12.

Table 6.12: Assumptions for the Incremental Cost-benefit Financial and Economic Analysis

	Baseline	Cost per connection US\$145	Cost per connection US\$ 265	Cost per connection US\$365
Registered accounts	77,380	137,931	89,530	73,505
Active Accounts	31,040	137,931	89,530	73,505
NRW	61%	39%	29%	9%
Water produced (m ³ /day)	48,000	48,000	48,000	48,000
Water billed (m ³ /day)	18,887	29,280	34,022	43,680
<i>No connections financed by project</i>		<i>137,931</i>	<i>75,472</i>	<i>54,795</i>

47. **Baseline information.** MOWASCO distribution networks has 77,380 registered customer accounts of which 31,040 are active and billed for water consumption; the remaining are inactive and not billed connections. Availability of water supplied by the CWSB system is limited to 48,000 m³ per day, which will be the case up to 2020 when water from the Mwache Dam is expected to be available. Based on the last quarter information included in the VEI Project Initiation Document, the average billed water was 18,887 m³ per day which results in 61 percent NRW. Starting from this baseline, the options to be analyzed are as follows:

- **Option 1: A technology that delivers 39 percent NRW at US\$145 cost per connection.** Under this option, with an investment budget of US\$20 million, 137,931 water connections (accounts) can be implemented in all areas of MOWASCO by rehabilitating and expanding tertiary distribution networks as much as possible. Also, all registered connections (including active ones) are refurbished and counted as part of the 137,931 connections. Note here that many ‘new connections’ will be made in this option, including the registration of illegal connections implemented under the ‘spaghetti’ system as well as new connections, provided tertiary connections can be made to existing secondary mains. In this option, NRW can go from 61 percent down to 39 percent and water billed could go from 18,887 up to 29,280 m³ per day by the 2019. As so many

connections are implemented in this option, water distributed per connection is about 0.21 m³ per day or about 41 liters per capita per day (lpcd).

- **Option 2: A technology that delivers 29 percent NRW at US\$265 cost per connection.** Under this option, with an investment budget of US\$20 million, 75,472 water connections can be implemented in all areas currently served by MOWASCO. Rehabilitation and limited expansion of tertiary distribution networks is assumed along with rehabilitation and expansion of primary and secondary pipelines, as needed. It is also expected that deeper trenches are used to deploy tertiary distribution networks to prevent recurrence of illegal connections. In this option, about 14,058 active connections are not refurbished and hence not counted as part of the 75,472 connections; taking this into account, the total number of registered connections will be 89,531. In this option, NRW will go from 61 percent down to 29 percent, and water billed could go from 18,887 up to 34,080 m³ per day by 2019. Water distributed per connection is about 0.38 m³ per day or about 76 lpcd.
- **Option 3: A technology that delivers 9 percent NRW at US\$365 cost per connection.** Under this option, with an investment budget of US\$20 million, 54,795 water connections can be implemented in selected areas currently served by MOWASCO. Rehabilitation and limited expansion of tertiary distribution networks is assumed along with rehabilitation and expansion of primary and secondary pipelines, as needed. Deeper trenches will be used in the deployment of tertiary distribution networks to prevent recurrence of illegal connections. In addition, an ICT investment component is included to deal with recurrence of meter tampering and to manage hydraulic pressure, thereby reducing the cost of energy and preventing pipes from bursting. In this option, NRW can go from 61 percent down to 9 percent and water billed could go from 18,887 up to 43,680 m³ per day by 2019. Water distributed per connection is about 0.594 m³ per day or about 119 lpcd. Also, service provision could be 24 hours a day and 7 days a week in the areas of intervention.

48. Technology option 2, which delivers 29 percent NRW at US\$265 cost per connection, will be analyzed in detail in sections 4 and 5 using incremental cost-benefit methodology. In section 6, the results of the incremental cost-benefit analysis for technology options 1 and 3 will be presented and compared with the result for technology option 2. Furthermore, a sensitivity to investment cost escalation for all technology options will be analyzed in section 7.

49. In technology option 2, the number of connections financed by the project is 75,472 deployed as outlined in table 6.13. Out of the 75,472 connections, 16,981 existing connections will be refurbished and incorporated into the DMAs, which must be subtracted from the number of connections financed by the project to find out the net additional number of connections. Thus, during the period 2015–19, the project will finance 75,472 connections, of which 58,491 constitute the net additional number of connections.

Table 6.13: Connections Financed by Project and Net Additional Number of Connections

	2015	2016	2017	2018	2019	2015-19
Number of DMA connections per year financed by project	3,774	15,094	15,094	22,642	18,868	75,472
of which existing connections incorporated into DMAs	1,887	6,038	4,528	4,528	0	16,981
Net additional number of connection	1,887	9,057	10,566	18,113	18,868	58,491

The ‘Without Project’ Scenario and Estimation of Incremental Costs and Benefits

50. **The ‘without project’ scenario.** VEI is assumed to continue implementing its WOP. In this case, VEI is assumed to continue delivering technical assistance to MOWASCO and it is assumed to implement limited DMAs with a total of 6,000 new connections; that is, MOWASCO will increase its number of active connection from the current 31,040 to 37,040 by 2019, as outlined in table 6.14. This scenario is considered very likely; that is, VEI efforts have demonstrated that without significant investments in DMA the effectivity of its management turnaround activities will have a limited impact.

51. **The ‘with project’ scenario.** This scenario assumes that the number of active connections will increase by 58,491, taking the number of active connections from 31,040 up to 89,531 as outlined in table 6.14. Subtracting the ‘without project’ scenario gives the incremental number of connections.

Table 6.14: Incremental Number of Active Connections

	Baseline	Projection of active connections				
	2014	2015	2016	2017	2018	2019
"With project" number of active connections	31,040	32,927	41,983	52,549	70,663	89,531
"Without project" number of active connections	31,040	32,240	33,440	34,640	35,840	37,040
Incremental number of connections (cumulative)	0	687	8,543	17,909	34,823	52,491

52. **Incremental investment and O&M costs.** The ‘without project’ scenario assumes that investment cost will be limited to current WOP/VEI investments committed (remaining US\$3.5 million) to be completed by 2016. In the ‘with project’ scenario, WOP investments will go up to US\$8 million (an additional 4.5 million) and time will be extended to 2019. In addition, the KWSCR-1 AF investment contribution will be US\$25 million, including finance for works (US\$20 million) and finance for utility turnaround (US\$5 million). Table 6.15 presents a summary of investments under the ‘with project’ and ‘without project’ scenarios and the estimated incremental investment cost.

Table 6.15: Summary of Incremental Investment and O&M Costs (US\$, millions)

	2015	2016	2017	2018	2019	2015-19
"with project" investment costs	3.20	6.20	6.20	8.20	7.20	31.00
<i>of which: Works and goods (KWSCR-1 AF)</i>	1.00	4.00	4.00	6.00	5.00	20.00
<i>Turnaround related expenses (KWSCR-1 AF)</i>	0.60	0.60	0.60	0.60	0.60	3.00
<i>Financed by VEI & Dutch Embassy/Nairobi</i>	1.60	1.60	1.60	1.60	1.60	8.00
"without project" investment cost	1.75	1.75	0.00	0.00	0.00	3.50
Incremental investment costs	1.45	4.45	6.20	8.20	7.20	27.50
Incremental O&M costs	0.09	0.45	0.82	1.36	1.81	4.53

53. Incremental operating costs are estimated taking into account improvements in operating efficiency through implementation of DMAs; as such, an annual US\$24 incremental O&M cost per connection is estimated. This incremental cost per connection is applied to all connections in DMAs and is included in table 6.15.

54. **Incremental benefits.** From a financial perspective, MOWASCO’s benefits are represented by its net revenue out of water purchases by customers. Table 6.16 outlines a projection of benefits under ‘with project’ and ‘without project’ scenarios. Under the ‘with

project' scenario, net revenue is represented by earnings before interest, taxes, depreciation, and amortization, which is a usual proxy of the cash flow from operations.

Table 6.16: Summary of Incremental Benefits

	2015	2016	2017	2018	2019	2015-19
"With project" EBITDA (US\$ m)	0.13	1.43	2.73	4.80	6.45	15.54
"Without project EBITDA (US\$ m)	0.09	0.18	0.18	0.18	0.18	0.81
Incremental Benefits	0.04	1.25	2.55	4.62	6.27	14.73

55. **Main assumptions to estimate incremental benefits.** At baseline (year 2014), there is extremely limited supply of water, estimated at 48,000 m³ per day, which will continue to be the case during project implementation. At baseline, accounted-for water is only 18,887 m³ per day which results in the high figure of 61 percent NRW. The available supply of water was established during discussions with MOWASCO management at appraisal. As DMAs are implemented, accounted-for water will go from about 18,887 m³ per day up to about 34,022 m³ per day, taking NRW from 61 percent down to 29 percent (see table 6.17). During project implementation, as there is extreme water scarcity, it is also assumed that the per capita consumption of water will reduce from 122 lpcd down to 76 lpcd as a result of water saving awareness building campaigns and rationing (it should be noted that as a result of rationing, at the beginning of the project, during 2015 there will be a small decline in water billed). Achieving the billing targets might also require the use of economic incentives for households that consume less water at least up to the point when Mwache Dam water is available. Tariffs are assumed to be constant at K Sh 105 per m³ and the average cost of water supplied to the system is assumed to remain constant at K Sh 25 per m³.

Table 6.17: Summary of Assumptions

	Baseline	Projected Values for Key Cost Drivers				
	2014	2015	2016	2017	2018	2019
Volume of water supplied to system (m3/day)	48,000	48,000	48,000	48,000	48,000	48,000
Volume of water billed to customers (m3/day)	18,887	18,530	21,709	24,771	30,081	34,022
NRW	61%	61%	55%	48%	37%	29%
Consumption percapita (lpcd)	122	113	103	94	85	76
Average tariff (KSH/m3)	105	105	105	105	105	105
Average cost of water supplied to system (KSH/m3)	25	25	25	25	25	25
Constant Price Assumption, Rate of exchange (KSH/US\$)	89	89	89	89	89	89

56. **Project financial and economic appraisal.** A financial viability and an economic viability have been assessed using the IRR and NPV as indicators. The IRR is an estimate of the rate of return that can be achieved if the investment resources are allocated to this project. The NPV is an estimate of 'earnings' that the investment in the project can generate on top of the earnings of a theoretical alternative; the earnings of such an alternative are represented by the rate of discount used to estimate the NPV.

57. **Financial appraisal.** A Financial Internal Rate of Return (FIRR) is estimated using the free cash flow produced by the project investment activities. The outline of the free cash flow for the project is presented in table 6.18. No salvage value of the investment at the end of 2035 is considered; this means that asset life is 20 years.

Table 6.18: Summary Estimate of Free Cash Flow for Financial Appraisal (US\$, millions)

	2015	2016	2017	2018	2019	2020-35
Net cash flow from operations	0.04	1.25	2.55	4.62	6.27	6.27
Incremental investment costs	-1.45	-4.45	-6.20	-8.20	-7.20	0.00
Incremental O&M cost	-0.09	-0.45	-0.82	-1.36	-1.81	-1.81
Free financial cash flow	-1.51	-3.65	-4.46	-4.94	-2.74	4.46

58. With the information in table 6.18, the estimated FIRR is 18 percent and the estimated NPV using a discount rate of 12 percent is US\$5.54 million. According to the estimated FIRR, each dollar allocated to this project will generate US\$0.18 for MOWASCO. According to the estimated NPV, compared with an alternative that will produce 12 percent return, the additional earning the project will bring is US\$5.54 million for MOWASCO in present value (today) terms.

59. **Economic appraisal.** For the economic appraisal, the financial free cash flow was expanded to incorporate the following benefits and costs:

- **Benefits - Correction factors for skilled and unskilled labor.** It was assumed that the cost of labor takes about 25 percent of project costs, including 10 percent for unskilled labor and 15 percent for skilled. Labor costs were corrected with a 0.9 factor; consequently, 10 percent of the value of labor cost is added to economic cash flow. The market for goods and services was assumed to reflect economic prices; hence, they were not corrected.
- **Benefits - Gains for customers who previously paid high rationing prices** to vendors (that is, K Sh 400 per m³) is added to the economic cash flow. It was assumed that 20 percent of customers served by DMAs faced this hardship; the rest were mostly served by active and illegal connections.
- **Benefits - Taxes on corporate income (profit) made by contractors.** It is assumed that 30 percent of the contract value was net corporate income, to which a 30.8 percent tax is applied and added to the economic cash flow.
- **Costs - Water billed to customers previously illegally consumed.** In this case, the implementation of DMAs did not increase the service; hence, the economic free cash flow subtract this benefit.

60. A summary of enhancements to arrive at the economic free cash flow is presented in table 6.19.

Table 6.19: Summary Estimate of the Economic Free Cash Flow

	2015	2016	2017	2018	2019	2020-35
Financial free cash flow	-1.51	-3.65	-4.46	-4.94	-2.74	4.46
+ taxes on profits paid by contractors to GoK	0.21	0.49	0.49	0.67	0.58	0.00
+ Correction of skilled and unskilled labor cost used in project	0.04	0.15	0.15	0.23	0.19	0.00
+ Gains for customers who previously got water from vendors	-0.03	0.22	0.46	0.87	1.18	1.18
- Water billed to customers previously illegally consumed	0.05	-0.37	-0.77	-1.47	-1.99	-1.99
Economic free cash flow	-1.24	-3.16	-4.14	-4.64	-2.77	3.66

61. With the information in table 6.19, the estimated EIRR is 16 percent and the estimated economic NPV using a discount rate of 12 percent is US\$3.38 million. According to the estimated EIRR, each dollar allocated to this project will generate US\$0.16 for the national economy. According to the estimated NPV, compared with an alternative that will produce 12

percent return, the additional expected earning that the project will bring to the national economy is US\$3.38 million in present value (today) terms.

62. **Cost-benefit analysis for technology option 1 (39 percent NRW at US\$145 per connection).** The financial free cash flow for technology option 1 is outlined in table 6.20.

Table 6.20: Free Financial Cash Flow for Technology Option 1 - 39% NRW at US\$145 per connection

	2015	2016	2017	2018	2019	2020-35
Net cash flow from operations	0.30	2.38	4.11	6.20	6.76	6.76
Incremental investment costs	-1.45	-4.45	-6.20	-8.20	-7.20	0.00
Incremental O&M cost	-0.17	-0.83	-1.49	-2.48	-3.31	-3.31
Free financial cash flow	-1.32	-2.89	-3.58	-4.48	-3.75	3.45

63. With the information in table 6.20, the estimated FIRR is 15 percent and the estimated NPV using a discount rate of 12 percent is US\$2.63 million. According to the estimated FIRR, each dollar allocated to this project will generate US\$0.15 for MOWASCO. From the estimated NPV, compared with an alternative that will produce 12 percent return, the additional earning the project will bring is US\$2.63 million for MOWASCO in present value terms.

64. The estimated EIRR is 14 percent and the estimated economic NPV using a discount rate of 12 percent is US\$1.51 million. According to the estimated EIRR, each dollar allocated to this project will generate US\$0.14 for the national economy. According to the estimated NPV, compared with an alternative that will produce 12 percent return, the expected benefit the project will bring to the national economy is US\$1.51 million in present value terms.

65. **Cost-benefit analysis for technology option 3 (9 percent NRW at US\$365 per connection).** The financial free cash flow for this option is outlined in table 6.21.

Table 6.21: Free Financial Cash Flow for Option 3 - US\$365 per connection

	2015	2016	2017	2018	2019	2020-35
Net cash flow from operations	-0.06	0.90	2.15	4.46	6.84	6.84
Incremental investment costs	-1.45	-4.45	-6.20	-8.20	-7.20	0.00
Incremental O&M cost	-0.07	-0.33	-0.59	-0.99	-1.32	-1.32
Free financial cash flow	-1.57	-3.88	-4.64	-4.73	-1.67	5.53

66. From the information in table 6.21, the estimated FIRR is 21 percent and the estimated NPV using a discount rate of 12 percent is US\$10.12 million. According to the estimated FIRR, each dollar allocated to this project will generate US\$0.21 for MOWASCO. According to the estimated NPV, compared with an alternative that will produce 12 percent return, the additional earning the project will bring is US\$10.12 million for MOWASCO in present value (today) terms.

67. The estimated EIRR is 17 percent and the estimated economic NPV using a discount rate of 12 percent is US\$5.17 million. According to the estimated EIRR, each dollar allocated to this project will generate US\$0.17 for the national economy. According to the estimated NPV, compared with an alternative that will produce 12 percent return, the additional expected earning the project will bring to the national economy is US\$5.17 million in present value (today) terms.

68. Table 6.22 presents a summary of results for the three options assessed. With information from this table, one can see that the results for the three options, judged by the IRRs, are

significantly positive; that is, the IRR for the three options goes from 15 percent for the least expensive technology option to 21 percent in the most expensive technology option.

Table 6.22: Summary of Comparative Results for the Three Options Assessed

	Cost per connection		
	US\$145	US\$ 265	US\$ 365
NRW assumption	39%	29%	9%
Financial Internal Rate of Return (FIRR)	15%	18%	21%
Financial Net Present Value at 12% (US\$ million)	2.63	5.54	10.12
Economic Internal Rate of Return	14%	16%	17%
Economic Net Present Value (US\$ million)	1.51	3.38	5.17

69. **Conclusion from the compared assessment of technology options.** The three technology options are financially viable while option 3, the 9 percent NRW technology, provides the highest FIRR and EIRR. The technology used in this option provides a mechanism to prevent false meter readings and reduction of corruption.

Sensitivity Analysis

70. **The risk of cost escalation.** All technology options are subject to the risk of cost escalation; that is, as is typical of infrastructure projects, actual investment costs could be higher than planned costs. Sensitivity analysis reveals how high costs in each option can go up before getting adverse results for the national economy. An adverse result for the national economy is defined here as one that delivers a negative economic present value; that is, national investment resources allocated to other alternatives will definitely generate positive NPV at a rate of discount equal to 12 percent. To assess how high the investment cost per each option can go up, costs per connection are increased until a negative NPV is obtained. The results are outlined in table 6.23.

Table 6.23: Financial and Economic Results under a Cost Escalation Scenario

	Cost escalation per connection		
	US\$145 --> US\$254	US\$ 265 --> US\$ 380	US\$ 365 --> US\$500
NRW assumption	39%	29%	9%
Financial Internal Rate of Return (FIRR)	13%	14%	16%
Financial Net Present Value at 12% (US\$ million)	\$1.43	\$1.84	\$4.64
Economic Internal Rate of Return	12%	12%	12%
Economic Net Present Value (US\$ million)	-0.37	-0.30	-0.35
<i>Number of connections delivered under under cost escalation scenario</i>	78,740	52,632	40,000

- For option 1, the 39 percent NRW technology option, cost per connection can go up from US\$145 to about US\$253 before the economic NPV turns negative. At US\$254 per connection the economic NPV turns - US\$0.37 < 0; that is, cost can escalate to about US\$110 before adverse results for the national economy are manifest. At US\$254 per connection, the number of actual connections delivered under this option would be 78,000, just above the number of current registered connections and significantly lower compared with the original plan of 137,931 connections.
- For option 2, the 29 percent NRW technology option, cost per connection can go up from US\$265 to about US\$379 before the economic NPV turns negative. At US\$380 per connection the economic NPV turns - US\$0.30 < 0; that is, cost can escalate to about US\$115 before adverse results for the national economy are manifest. At US\$380 per

connection, the number of actual connections delivered under this option would be 52,000, significantly lower than the original plan of 75,472 connections.

- For option 3, the 9 percent NRW technology option, cost per connection can go up from US\$365 to about US\$499 before the economic NPV turns negative. At US\$500 per connection the economic NPV turns - US\$0.35 < 0; that is, cost can escalate to about US\$135 before adverse results for the national economic are manifest. At US\$500 per connection, the number of actual connections delivered under this option would be 40,000, significantly lower than the original plan of 54,795 connections.

71. **Conclusion from sensitivity analysis.** There is significant room for cost escalation in all three analyzed technology options. In the case of the 39 percent NRW technology option, costs can escalate in about 74 percent before resulting in an economically non-viable option. In the case of the 9 percent NRW technology option, costs can escalate in about 37 percent before resulting in an economically non-viable option. This can be interpreted as the 39 percent NRW technology option being less risky than the 9 percent NRW technology option; however, the 9 percent NRW technology option results in higher economic and financial results, which coincide with the high-risk high-return view of investors.

72. As in the previous section, these scenarios analyzed are options that could be used in the design of the proposed NRW program. Further economic analysis through the course of the design of the program will ensure decisions are taken based on solid engineering, financial, and economic criteria.