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Report No: PAD907

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 50.6 MILLION
(US\$75 MILLION EQUIVALENT)

AND A

PROPOSED SWEDISH GRANT

IN THE AMOUNT OF US\$25 MILLION
(SWK 200 MILLION EQUIVALENT)

TO THE

REPUBLIC OF ZAMBIA

FOR A

KARIBA DAM REHABILITATION PROJECT

November 24, 2014

Global Water Practice (GWADR)
Regional Integration Department
Africa Region

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CURRENCY EQUIVALENTS
(Exchange Rate Effective September 30, 2014)

Currency Unit = New Zambian Kwacha
ZMW 6.26 = US\$1
US\$ 1.48 = SDR 1

FISCAL YEAR
January 01 – December 31

ABBREVIATIONS AND ACRONYMS

3D	3-Dimensional	IWRM	Integrated Water Resources Management
AAR	Alkali Aggregate Reaction	kWh	Kilowatt Hours
ADF	African Development Fund	LCS	Least Cost Selection
AfDB	African Development Bank	LEAP	Long-range Energy Alternatives Planning
ASO	Assistant Supplies Officer	masl	Meters above sea level
BP	Bank Policy	MDTF	Multi-Donor Trust Fund
CAPCO	Central African Power Corporation	MSIOA	Multi-Sector Investment Opportunity Analysis
CCC	Co-financiers' Coordination Committee	MW	Megawatt
CIWA	Cooperation in International Waters in Africa	NAO	National Authorizing Officer
CPI	Consumer Price Index	NPV	Net Present Value
CQS	Consultants' Qualifications Selection	O&M	Operation and Maintenance
CSQA	Construction Supervision & Quality Assurance	OP	Operational Policy
DAB	Dispute Adjudication Board	ORAF	Operational Risk Assessment Framework
DSCR	Debt Service Coverage Ratio	PDO	Project Development Objective
EDF	European Development Fund	PoE	Panel of Experts
EPP	Emergency Preparedness Plan	PPA	Public Procurement Act
ESIA	Environmental & Social Impact Assessment	PPRS	Procurement Post Reviews
ESMPs	Environmental & Social Management Plans	QCBS	Quality and Cost-Based Selection
EU	European Union	RFP	Request for Proposals
FEM	Fine Element Model	RIDMP	Regional Infrastructure Development Master Plan
FIRR	Financial Internal Rate of Return	RPF	Resettlement Policy Framework
FRR	Financial Rate of Return	SADC	Southern African Development Community
GDP	Gross Domestic Product	SAPP	Southern African Power Pool
GHG	Greenhouse Gas	SBD	Standard Bidding Documents
GoZ	Government of the Republic of Zimbabwe	SOP	Standing Operations Procedures
GRZ	Government of the Republic of Zambia	ToRs	Terms of Reference
GWh	Gigawatt Hours	TS&S	Technical Services & Supervision
ha	Hectares	TTL	Task Team Leader
HCB	Hydroelectrica Cahora Bassa	USD	United States Dollars
HES	Hydro-Electric Scheme	WEAP	Water Evaluation and Planning
IBRD	International Bank for Reconstruction & Development	ZAMCOM	Zambezi Watercourse Commission
IC	Individual Consultants	ZAMSTRAT	Zambezi River Basin IWRM Strategy
ICOLD	International Commission on Large Dams	ZAMWIS	Zambezi Water Information System
IDA	International Development Association	ZESCO	Zambia Electricity Supply Corporation
IPCC	Intergovernmental Panel on Climate Change	ZETDC	Zimbabwe Electricity Transmission and Distribution Company
IPRs	Independent Procurement Reviews	ZPC	Zimbabwe Power Corporation
IRR	Internal Rate of Return	ZRA	Zambezi River Authority
ITCZ	Inter-Tropical Convergence Zone	ZVDF	Zambezi Valley Development Fund

Regional Vice President:	Makhtar Diop
Regional Director:	Colin Bruce
Senior Global Practice Director:	Junaid Ahmad
Practice Manager:	Jonathan Kamkwala
Task Team Leader:	Marcus Wishart

AFRICA
Kariba Dam Rehabilitation Project

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PAD DATA SHEET

Africa

Kariba Dam Rehabilitation Project (P146515)

PROJECT APPRAISAL DOCUMENT

AFRICA

Report No.: PAD907

Basic Information			
Project ID P146515	EA Category A - Full Assessment	Team Leader Marcus J. Wishart	
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints []		
	Financial Intermediaries []		
	Series of Projects [X]		
Project Implementation Start Date 09-Dec-2014	Project Implementation End Date 28-Feb-2025		
Expected Effectiveness Date 27-Feb-2015	Expected Closing Date 28-Aug-2025		
Joint IFC No			
Practice Manager/Manager	Senior Global Practice Director	Country Director	Regional Vice President
Jonathan S. Kamkwalala	Junaid Kamal Ahmad	Colin Bruce	Makhtar Diop
Borrower: Republic of Zambia			
Responsible Agency: Zambezi River Authority			
Contact:	Munyaradzi Munodawafa	Title:	Chief Executive
Telephone No.:	+260 211 228401/02	Email:	zaraho@coppernet.zm
Project Financing Data(in USD Million)			
[] Loan	[] IDA Grant	[] Guarantee	
[X] Credit	[X] Grant	[] Other	
Total Project Cost:	294.20	Total Bank Financing:	75.00
Financing Gap:	0.00		

Financing Source	Amount
BORROWER/RECIPIENT	19.20
International Development Association (IDA)	75.00
African Development Bank	75.00
European Development Fund	100.00
Swedish Trust Fund	25.00
Total	294.20

Expected Disbursements (in USD Million)

Fiscal Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
IDA Financing										
Annual	1.65	1.75	20.00	15.00	5.00	5.00	12.00	5.00	5.00	4.60
Cumulative	1.65	3.40	23.40	38.40	43.40	48.40	60.40	65.40	70.40	75.00
Swedish Grant										
Annual	0.80	3.30	17.90	2.00	1.00	-	-	-	-	-
Cumulative	0.80	4.10	22.00	24.00	25.00	-	-	-	-	-

Proposed Development Objective(s)

The Project Development Objective is to assist in improving the safety and reliability of the Kariba Dam.

Components

Component Name	Cost (USD Millions)
Component 1: Institutional and Project Management	69.60
Component 2: Plunge Pool Reshaping	100.00
Component 3: Spillway Refurbishment	124.60

Institutional Data

Practice Area / Cross Cutting Solution Area

Water

Cross Cutting Areas

- 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	Mitigation
--------------	--------	---	------------	------------

			Co-benefits %	Co-benefits %
Energy and mining	Hydropower	60		
Water, sanitation and flood protection	Flood protection	20		
Water, sanitation and flood protection	General water, sanitation and flood protection sector	20		
Total		100		

I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Environment and natural resources management	Water resource management	60
Social protection and risk management	Natural disaster management	40
Total		100

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes []	No [X]
Does the project require any waivers of Bank policies?	Yes []	No [X]
Have these been approved by Bank management?	Yes []	No []
Is approval for any policy waiver sought from the Board?	Yes []	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No []

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	X	
Natural Habitats OP/BP 4.04		X
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11	X	
Indigenous Peoples OP/BP 4.10		X
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37	X	
Projects on International Waterways OP/BP 7.50	X	

Projects in Disputed Areas OP/BP 7.60			X
Legal Covenants			
Name	Recurrent	Due Date	Frequency
Safeguard Instruments: Preparation		30-Mar-2015	
Description of Covenant			
Not later than March 30, 2015 and in any event prior to the carrying out of any rehabilitation works under the Project, cause the Project Implementing Entity to: (i) in accordance with terms of reference and process acceptable to the Association, prepare the safeguard instruments and furnish said instruments to the Association for its review and approval ("Safeguard Instruments").			
Name	Recurrent	Due Date	Frequency
European Union Co-financing		30-July-2015	
Description of Covenant			
The Co-financing Deadline for the effectiveness of the European Union Co-financing Agreement is July 30, 2015.			
Name	Recurrent	Due Date	Frequency
Safeguard Instruments: Implementation	X		CONTINUOUS
Description of Covenant			
The Recipient shall cause the Project Implementing Entity to disclose the Safeguard Instruments in country and at the Infoshop and implement the Project in accordance with the Safeguard Instruments.			
Name	Recurrent	Due Date	Frequency
Land Acquisition and Cash Compensation	X		CONTINUOUS
Description of Covenant			
The Recipient shall cause the Project Implementing Entity, from its own non-Project resources to finance all costs associated to land acquisition and cash compensation under Parts B and C of the Project, before any displacement.			
Name	Recurrent	Due Date	Frequency
Panel of Experts: Environment and Social	X		SemiAnnual
Description of Covenant			
The Recipient shall cause the Project Implementing Entity to appoint and thereafter maintain with at least two visits per year until one year after the Closing date of the Project, an independent Environmental and Social Panel of Experts with qualifications, experience and terms of reference satisfactory to the Association.			
Name	Recurrent	Due Date	Frequency
Pane of Experts: Dam Safety	X		SemiAnnual
Description of Covenant			
The Recipient shall cause the Project Implementing Entity to appoint and thereafter maintain until one (1) year after the Closing date of the Project, an independent Panel of Experts with qualifications,			

experience and terms of reference satisfactory to the Association.

Name	Recurrent	Due Date	Frequency
Dam Safety Reports	X		CONTINUOUS

Description of Covenant

Furnish to the Association for review and thereafter take all necessary measures required to address the conclusions and recommendations of the review and update or adopt Dam Safety Plans, in form and substance acceptable to the Association, and reflecting the conclusions and recommendations of the Panel.

Name	Recurrent	Due Date	Frequency
Dam Construction Supervision and Quality Assurance Plan	X		CONTINUOUS

Description of Covenant

Prepare a Dam Construction Supervision and Quality Assurance Plan and an estimate of funds needed to prepare and implement such plan in detail prior to bid tendering of the rehabilitation works under the Project.

Name	Recurrent	Due Date	Frequency
Operation and Maintenance Plan and Dam Instrumentation Plan	X		CONTINUOUS

Description of Covenant

Prepare an updated Dam Operation and Maintenance Plan and a Dam Instrumentation Plan prior to bid tendering of the rehabilitation works under the Project; and a final Dam Operation and Maintenance Plan and a Dam Instrumentation Plan not later than one (1) year prior to the completion of the rehabilitation works.

Name	Recurrent	Due Date	Frequency
Emergency Preparedness Plan	X		CONTINUOUS

Description of Covenant

Prepare an updated Dam Emergency Preparedness Plan prior to bid tendering of the rehabilitation works under the Project; and a final Dam Emergency Preparedness Plan not later than one (1) year prior to the completion of the rehabilitation works.

Name	Recurrent	Due Date	Frequency
Dam Safety Inspections	X		CONTINUOUS

Description of Covenant

The Recipient shall cause the Project Implementing Entity to have periodic dam safety inspections performed by independent professionals, with qualifications, experience, and terms of reference satisfactory to the Association.

Name	Recurrent	Due Date	Frequency
Annual Work Plan	X		CONTINUOUS

Description of Covenant

The Recipient shall cause the Project Implementing Entity, not later than December 15 of each year, to prepare and furnish to the Association, an annual program of activities proposed for implementation under the Project during the following Fiscal Year, together with a proposed budget for the purpose.

Name	Recurrent	Due Date	Frequency
Project Implementing Entity	X		Continuous
Description of Covenant			
The Recipient shall take all action necessary on its part to ensure that the Project Implementing Entity is maintained through-out the implementation of the Project, with: (i) mandate, functions and resources satisfactory to the Association; and (ii) adequate staff with qualifications and experience satisfactory to the Association, all for purposes of ensuring the prompt and efficient implementation of the Project.			
Name	Recurrent	Due Date	Frequency
Operating Revenue	X		Continuous
Description of Covenant			
The Recipient shall take all action necessary on its part to ensure that the Project Implementing Entity's Operating Revenue shall reflect the principles of Cost Recovery and be sufficient to cover Operating Expenses and Debt Service.			
Conditions			
Source Of Fund	Name	Type	
IDA	Subsidiary Agreement	Effectiveness	
Description of Condition			
The Subsidiary Agreement has been executed on behalf of the Recipient and the Project Implementing Entity.			
Source Of Fund	Name	Type	
IDA	Project Implementation Manual	Effectiveness	
Description of Condition			
The Project Implementing Entity has adopted the Project Implementation Manual			
Source Of Fund	Name	Type	
IDA	Project Steering Committee	Effectiveness	
Description of Condition			
The Project Implementing Entity has established a Project Steering Committee			
Source Of Fund	Name	Type	
ZRA	Project Manager	Effectiveness	
Description of Condition			
The Project Implementing Entity has appointed a Project Manager			
Source Of Fund	Name	Type	
IDA	Co-financing Agreement	Effectiveness	
Description of Condition			
The AFDB Co-financing Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under it (other than the effectiveness			

of this Agreement) have been fulfilled

Source Of Fund	Name	Type
IDA	Co-financing Agreement	Effectiveness

Description of Condition

The Swedish Grant Agreement and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under the Grant Agreement (other than the effectiveness of this Agreement) have been fulfilled

Team Composition

Bank Staff

Name	Title	Specialization	Unit
Katharine Baragona	Sr Infrastructure Finance Spect	Sr Infrastructure Finance Spect	GEEDR
Sipiwe Janet Chihame	Program Assistant	Program Assistant	AFCS3
Lingson Chikoti	E T Consultant	Financial Management	GGODR
Faith Babalwa Chirwa	Program Assistant	Team Assistant	AFCS1
Louise E. M. Croneborg	Water Resources Mgmt. Spec.	Water Resources Mgmt. Spec.	GWADR
Patrice R. Diakite	Program Assistant	Information Assistant	AFTN2
Ijeoma Emenanjo	Natural Resources Mgmt.	Natural Resources Mgmt.	GAGDR
Wedex Ilunga	Senior Procurement Specialist	Senior Procurement Specialist	GGODR
Joseph Mwelwa Kapika	Senior Energy Specialist	Senior Energy Specialist	GEEDR
Zoe Kolovou	Lead Counsel	Lead Counsel	LEGAM
Rikard Liden	Senior Hydropower Specialist	Senior Hydropower Specialist	GWADR
Maiada Kassem	Finance Officer	Finance Officer	CTRLA
Komana Lubinda	Consultant	Procurement Specialist	GGODR
Kisa Mfalila	Sr Environmental Specialist	Sr Environmental Specialist	GENDR
Sameh I. Mobarek	Senior Counsel	Senior Counsel	LEGAM
Stephen Mukaindo	Counsel	Counsel	LEGAM
Cecil Nundwe	E T Consultant	E T Consultant	GWADR
Lucson Pierre-Charles	Program Assistant	Program Assistant	GWADR
Bernadette Milunga	Program Assistant	Program Assistant	GEEDR
Lucy Mukuka	Program Assistant	Program Assistant	OPSVP
Lozi S. Sapele	Program Assistant	Program Assistant	AFCS3
Kristine Schwebach	Social Development Specialist	Social Development Specialist	GURDR
Elisabeth Sherwood	Consultant	Financial Analyst	GURDR
Sanjay Srivastava	Lead Environment Specialist	Lead Environment Specialist	GENDR
Casey Torgusson	Operations Officer	Operations Officer	AFCRI
Satoru Ueda	Lead Dam Specialist	Lead Water Resource	GWADR

			Specialist		
Regassa Namara	Sr. Water Economist	Economist		GWADR	
Marcus Wishart	Sr. Water Resources Spec.	Team Lead		GWADR	
Non Bank Staff					
Name	Title	City			
Locations					
Country	First Administrative Division	Location	Planned	Actual	Comments
Zambia	Southern	Siavonga		X	The Kariba Dam wall is located at grid reference 28.74778° East and 16.51222° South.
Zimbabwe	Mashonaland West	Kariba		X	

I. STRATEGIC CONTEXT

A. Regional Context

1. The southern African region has experienced sustained economic growth and increasing prosperity over the past decade. The annual rate of GDP growth in 2011 averaged around 5.14 percent, with GDP for the region estimated at around US\$575.5 billion. This has been largely driven by increasing demand for natural resource based commodities facilitated by increased peace and stability. With the population of the Southern African Development Community (SADC) region expected to more than double from around 280 million people in 2012 to more than 560 million over the next 30 years, and as the SADC region industrializes on its path to improved human development, the demand for power is likely to increase by 40 percent over the next decade. As a result, the electricity sector is seen as central to catalyzing infrastructure projects that drive both regional integration and economic growth, with energy security increasingly important to continued development across southern Africa.
2. Recognizing the importance of the energy sector to regional growth prospects, the SADC has developed and implemented a comprehensive framework to facilitate integration. Energy plays a central role in this ambitious agenda through the Southern African Power Pool (SAPP). The SAPP was established in 1995 to provide a forum for regional solutions to electricity generation and provides for coordinated planning and operation of the regional power system. The current operations of the SAPP build on a concerted effort to establish a regional framework for energy security based on several regional strategic plans for energy development. These include the SADC Energy Cooperation Policy and Strategy in 1996, followed by the SADC Energy Action Plan in 1997 and the SADC Energy Activity Plan in 2000. Most recently, the Regional Infrastructure Development Master Plan (RIDMP) and its Energy Sector Plan in 2012 have been adopted by the SADC Member States. These development strategies set out specific objectives for infrastructure development in energy and its subsectors, with the Energy Sector Plan and the RIDMP defining the regional infrastructure requirements and conditions to facilitate the realization of key infrastructure by 2027.
3. The long-term growth prospects and security of the SAPP are heavily dependent upon availability of the hydropower resources of the Zambezi River basin. Hydropower remains an important but under-represented contributor to the SAPP, accounting for 17 percent (9,474 MW) of the overall generation capacity. The Zambezi River basin accounts for roughly 50 percent of this, with close to 5,000 MW of installed capacity and a similar amount planned for further development. In addition to the provision of firm energy, the centrality of the Zambezi River basin within the SAPP means that the hydropower schemes provide an important balancing element in the overall regional energy mix. Securing these hydropower resources is therefore critical to ensuring regional energy security and stability, and avoiding the regional blackouts that have undermined growth prospects in recent years as demand exceeds supply.
4. The peak demand of the SAPP was 45,315 MW in 2012 against an available capacity of 49,877 MW. Considering a 10.2 percent reserve requirement this is equivalent to a 173 MW shortfall for the southern African region. Aging infrastructure, decommissioning of some plants and limited investments in new generation have reduced the available capacity leading to a regional supply deficit between 2007 and 2012/13 manifested through rolling regional blackouts. In Zimbabwe, energy demand is estimated at over 2,000 MW with installed generation capacity approximately 1,960MW, of which only around 1,200MW is presently available for production.

The result is a significant supply/demand gap of around 700MW, rising to 1,000MW during the winter season. There is also extensive suppressed energy demand that further dampens recovery and growth. In Zambia, demand is projected to increase from 1,600 MW in 2010 to about 2,400 MW in 2020. Investment needs in generation alone to provide required supply are estimated to be about US\$6 billion in the next 10 years.

B. Sectoral and Institutional Context

5. The Kariba Dam and Hydro-Electric Scheme (HES) was constructed across the Zambezi River between 1956 and 1959 and has been central to energy security and supporting economic development in both Zambia and Zimbabwe. With a total installed capacity of 1,830 MW it is the second largest hydro-electric scheme in the Zambezi River basin after the Cahora Bassa complex (2,075 MW) situated downstream in Mozambique. While originally built to provide power to the rapidly developing mining economies of the then Federation of Rhodesia and Nyasaland (modern day Malawi, Zambia and Zimbabwe), the reservoir today has an important role in ensuring the stability of the SAPP and in regulating flows on the Zambezi River. Although the Zambezi River Authority derives no direct revenue, the reservoir also supports important commercial and subsistence fisheries, tourism operations and small scale water supply for local towns and villages.

6. The Kariba Dam is a double curvature concrete arch dam, standing at 128m tall with a crest length of 617m and a reservoir capacity of 181km³. This makes it one of the largest reservoirs in the world. The submerged orifice gated spillway comprises six submerged flood sluices located in the central part of the dam wall, with a lower level of +455.37 m. The minimum operating level of the reservoir is +475.5 m. The maximum discharge capacity of the spillway is approximately 9,000 cubic meters per second. The highest recorded discharge from the dam was 7,300 cubic meters per second for flood control in 1978 (combined outflow through four fully open gates and the power stations). The active storage at the Full Supply Level of +488.5m is 64.5 km³. This includes 23.2 km³ of flood control capacity that has to be made available at the beginning of each flood season (February to April) for flood attenuation.

7. The Kariba Reservoir supplies water to two underground hydropower stations located on the North (left) bank in Zambia and on the South (right) bank in Zimbabwe. The two power stations were constructed with a combined capacity of 1,200 MW, later upgraded to 1,226 MW and more recently increased to 1,830 MW, generating approximately 10,035 GWh annually under normal operating conditions. Each country has its own power station operated by the respective national power utility and current expansion programs are expected to increase the installed capacity to a total of 2,130 MW by 2017. The Kariba North Bank Power Station in Zambia, built and commissioned between 1975 and 1977 with four turbines uprated over the years to provide 720 MW, is now operated by Zambia Electricity Supply Corporation (ZESCO), the national utility. The recently completed expansion project has installed two 180 MW turbines on the North Bank, increasing the total capacity of the North Bank Power Station to 1,080 MW. The Kariba South Bank Power Station in Zimbabwe was commissioned in 1960 with six turbines that have been uprated over the years to have a current capacity of 750 MW and is now operated by Zimbabwe Power Corporation (ZPC), the national utility. In 2013, Zimbabwe signed a US\$319 million non-concessional loan with China Eximbank to finance the expansion of the Kariba South Bank Power Station with two additional 150 MW turbines, increasing the total capacity to 1,050 MW.

8. After 50 years of operation serving the southern African region, the Kariba Dam now requires a series of rehabilitation works for its continued safe operation. A failure to invest in the timely rehabilitation of the dam will result in the gradual degradation of key dam safety features associated with the structure to a level that is not acceptable in accordance to international standards. These works include: 1.a) the design, fabrication and installation of an emergency spillway gate and a new gantry to prevent uncontrolled loss of water in the event of floodgate failure, which would result in water levels dropping below the minimum operational levels and interrupting power production; 1.b) the refurbishment of the upstream emergency gate/stop-beam guides and replacement of secondary concrete to secure their smooth operation and, 2) reshaping of the plunge pool downstream of the dam to limit scouring and erosion that could potentially undermine the dam foundations, leading to dam failure.

C. Situations of Urgent Need of Assistance

9. The Kariba Dam Rehabilitation Project is urgently required to avoid a potential emergency situation. The most recent dam safety assessment completed in 2010 has identified the proposed measures as Category I interventions requiring immediate attention. Given the large reservoir capacity (181 km³) a possible catastrophic failure of the dam would result in devastating regional flooding, significant loss of human life, and unprecedented economic damage downstream in the Zambezi River, with an estimated 3 million people living in the potential impact area. The economic value of assets at risk in excess of US\$8 billion.

10. The largest ever flood on record in the Zambezi River was estimated at 61 km³ over 90 days during construction in 1958/59, with a flood peak of 16,000 cubic metres per second. A catastrophic failure of the Kariba Dam would likely result in a flood volume four times larger than this, with the combined storage of the Kariba and Cahora Bassa reservoirs equal to 237km³ (Kariba: 185km³ and Cahora Bassa: 52km³). This would result in the loss of roughly 40 percent of the SAPP generation capacity (excluding RSA), with 1,830 MW at Kariba (increasing to 2,130 MW by 2017) and 2,075 MW at Cahora Bassa. In comparison, the 2001 floods from January through April had an estimated discharge of 8,000 cubic metres per second that resulted in more than US\$40 million in damages, the displacement of an estimated 500,000 people and an estimated 150 fatalities, with around 100,000 ha flooded in Mozambique alone.

11. In response to the identified rehabilitation works, the Zambezi River Authority has been advancing a series of studies and assessments to detail the underlying problems associated with the spillway and the dam, along with identification of the measures required to secure the safety in accordance with international dam safety standards. This has been coupled with modifications to the operating regime as an interim measure to ensure continued safe operations. The proposed financing for the Kariba Dam Rehabilitation Project follows preparation of advanced designs. These have been subject to an independent review process. The advanced design work has outlined a program of civil works over the next ten years to provide a clear, predictable and measured response that takes into due consideration the continued operational safety of the dam and associated infrastructure, including minimum interruptions to power generation.

D. Higher Level Objectives to which the Project Contributes

12. The World Bank has had a long-standing commitment to global priorities and region-wide programs and the project makes a direct contribution to secure the livelihoods thus ensuring continued prosperity through energy security for the southern African region. The 2008 Regional Integration Strategy for Africa provides a coherent and strategically focused framework to guide

the Bank Group's assistance in support of regional integration and regional programs in the provision of regional public goods. The strategy acknowledges that regional approaches to the management of shared waters can provide improved water security and more sustainable management of these resources than is achievable through national action alone. It further recognizes that effective management is all the more urgent given the potentially disruptive impact of climate change on water resource availability and increasing water demand resulting in potential conflicts arising from limited supplies. The Bank's 2010 Strategy for Africa also recognizes that many challenges, such as climate change and water resource management, are best addressed through cooperation and integration at the regional level.

13. The World Bank Group Strategy of October 2013 lends further emphasis to the strengthening of regional initiatives and institutions as a way to improve on development impact and fostering collective action and delivering the two WBG goals of ending extreme poverty and promoting shared prosperity. This project contributes to securing the availability and reliability of electricity supplies to countries associated with the SAPP, and in doing so providing the essential foundations for expanded economic growth, prosperity and poverty alleviation. By ensuring the continued safe operation of the Kariba Dam, the project will further contribute to safeguarding the lives of millions living in the floodplain and largely dependent on the subsistence economy derived from environmental services provided by the river.

14. The project is an integral part of the broader program of support to the riparian states and regional bodies within the context of the Zambezi River Basin. This includes a portfolio of projects supporting multi-sectoral interventions in energy, agriculture, water supply, disaster risk reduction and management, climate change adaptation and mitigation, among others. The projects are intended to provide a broad program of support in response to the common development goals of the riparian states and regional organizations relating to the integrated, cooperative development and management of water resources in the Zambezi River basin. These are founded on the underlying principles of integrated water resource development and management to facilitate sustainable, climate resilient economic growth and development.

II. PROJECT DEVELOPMENT OBJECTIVE(S)

A. PDO

15. The Program Development Objective guiding the Series of Projects is to strengthen cooperative management and development within the Zambezi River Basin to facilitate sustainable, climate resilient growth.

16. The Project Development Objective of the IDA Credit is to assist in improving the safety and reliability of the Kariba Dam. This will be done by supporting the reshaping of the plunge pool, refurbishment of the spillway and enhancing operations to bring them in line with international dam safety standards.

B. Project Beneficiaries

17. Beneficiaries of the interventions under the Kariba Dam Rehabilitation Project include:

- (a) The Zambezi River Authority, jointly owned by Zambia and Zimbabwe, will benefit from securing the Kariba Dam and the national power utilities (ZESCO and ZPC) will benefit through improved security of the generation capacity associated with continued operation of the dam.

(b) Benefits will accrue directly within the regional context of the Zambezi River basin, particularly to the downstream riparian states of Mozambique and Malawi. The Zambezi River basin is shared among eight riparian states, including Zambia and Zimbabwe. The Kariba Dam is part of an integrated infrastructure platform within the basin, that includes the Cahora Bassa Dam operated by HCB in Mozambique. The benefits through avoided disaster are substantial, given the estimated 3 million people living in the potential impact area and the economic value of assets at risk in excess of US\$8 billion.

(c) Regional benefits will be substantial. These will be realized through avoided catastrophe in the Zambezi River basin and continued power production. The contribution of the Kariba Dam Hydro-Electric Scheme to the Southern African Power Pool, both in terms of generation capacity and stability of the system, will be assured through the rehabilitation works and continued safe operation of the dam. The Southern African Development Community will continue to benefit from the economic gains supported through the contribution of the continued operation of the Kariba Dam Hydro-Electric Scheme.

C. PDO Level Results Indicators

18. Progress toward achieving the project outcomes will be measured against the following:
 - i. Number of people benefitting in the project area through risk reduction and avoided disaster
 - ii. Emergency Preparedness Plan adopted and operationalized.

III. PROJECT DESCRIPTION

A. Project Components

19. The Kariba Dam Rehabilitation Project will assist ZRA in financing implementation and oversight of those components required for the rehabilitation of the Kariba Dam. A more detailed description of each of the activities under the components is provided in Annex 2.

Component 1: Institutional Project Support (estimated cost US\$69.6 million of which IDA US\$20.2m, Sweden US\$10.0m, AfDB US\$20.2m and ZRA US\$19.2m)

20. The objective of this component is to provide the necessary support to assist the Zambezi River Authority in securing the long-term safety and reliability of the Kariba Dam Hydro-Electric Scheme.

21. This component would be co-financed by IDA, Sweden and the African Development Bank through a combination of joint co-financing and parallel co-financing of individual activities. Activities to be financed include: (i) Technical Services and Supervision Consultant; (ii) Dam Break Analysis; (iii) Panel of Experts; (iv) Dispute Adjudication Board; (v) Environmental and Social Assessment; and, (vi) Audits, Evaluations and other Studies. Financing under this component would be used for: (i) consultants services; (ii) goods, equipment and non-consulting services; and, (iii) operating costs associated with enhanced project implementation, management and monitoring.

Component 2: Plunge Pool Reshaping (estimated cost US\$100.0 million of which EDF US\$100.0m)

22. The objective of this component is to stabilize the plunge pool and prevent further scouring, particularly along the weak fault/seam zone towards the dam foundations. While the plunge pool was originally intended to be formed from the natural scour, the hole has progressively widened and deepened vertically to create an 80m deep scour hole in the bedrock immediately downstream of the dam foundations. A 3D Fine Element Model (FEM) model has been established to assess how the plunge pool scouring progress and excavation works would affect the stress field of the dam foundation. In the absence of measures to prevent the current trend, the scouring would only be controlled if the spillway is operated with no more than three, non-adjacent gates open, which would however limit the spillway discharge capacity during large floods. The limit on the number of useable gates requires lowering of the maximum safe reservoir level, which in turn reduces power generation capacity from the dam.

23. This component would be financed by the European Development Fund (EDF11) in parallel to the other components of the Kariba Dam Rehabilitation Project. Activities to be financed include: (i) Plunge Pool Reshaping Civil Works; (ii) carrying out of additional engineering studies, investigations and surveys, and supply of equipment as might be needed during implementation; (iii) provision of technical services for the monitoring of the plunge pool reshaping; and, (iv) carrying out of visibility and communications activities. The measures required to reshape the plunge pool include construction of a downstream cofferdam to enable the blasting and excavation of an estimated volume of 300,000 m³ of rock from the downstream face and north and south bank sides of the pool in the dry. This will create a new, stepped profile that will improve energy dissipation and guide the spilling water in the downstream direction, away from the dam foundations. The Technical Audit Consultant to the EU is responsible for undertaking regular missions to provide factual reporting and technical advices during implementation. This will be achieved through the audit of the organizational, technical, contractual and financial aspects of the plunge pool, along with the results achieved during implementation. Financing under this component would be used for: (i) goods, works and non-consulting services; and (ii) consultants services.

Component 3: Spillway Refurbishment (estimated cost US\$124.6 million of which IDA US\$54.8m, Sweden US\$15.0m and AfDB US\$54.8m)

24. The objective of this component is to improve the operation and prevent potential failure of the spillway control facility. Advanced deterioration of the built-in structures and secondary concrete due to Alkali-Aggregate Reaction and the lack of reinforcement in the secondary concrete have the potential to limit the function of the spillway gates. The current stop beams cannot be used to close the upstream sluice opening in the event of a downstream flood gate failure in the open position. In the event that the downstream flood gate jams and cannot be closed there would be no way to stop water flow. The water level in such case may go down to the sill of the spillway, well below the minimum operating level, during which period no power production would be possible. If the stop logs were to jam in the sluice during a large flood, it could limit the ability to ensure safe passage of the flood waters and result in overtopping of the dam.

25. This component would be jointly co-financed by IDA, Sweden and the African Development Bank. The activities to be financed include: (i) Spillway Refurbishment Contract; and (ii)

Additional Engineering Studies, Investigations, Surveys and Equipment as may be required. The Spillway Refurbishment would include the fabrication and installation of a set of new stopbeams, with refurbishment of associated built-in parts and replacement and reinforcement of secondary concrete. This component would also include installing an emergency roller gate that would have an independent opening/closing function for the upstream sluice opening irrespective of downstream gate position/flow condition. The current stopbeams cannot be lowered under flow conditions. The existing gantry crane will also be replaced with a higher capacity gantry in order to operate the new emergency gate under water flow conditions. Financing under this component would be used for: (i) goods (supply and installation of hydro-mechanical equipment), civil works and non-consulting services associated with the refurbishment of the spillway upstream facility; and, (ii) consulting services.

B. Project Financing

26. The Governments of Zambia and Zimbabwe have requested support from the World Bank, the African Development Bank and the European Commission in exploring viable options for financing and raising resources for the Kariba Dam Rehabilitation Program. The Government of Zimbabwe is currently limited in its access to concessional financing until settlement of outstanding arrears to the multi-lateral development banks, but is able to access grant resources and contribute to the project through the AfDB Transitional States Facility and regional window.

27. At the request of the Government of the Republic of Zambia, the International Development Association has confirmed an allocation of US\$25 million from Zambia's national IDA envelope to support the project with an additional allocation of US\$50 million from the Regional IDA envelope. The project meets IDA's regional eligibility criteria with clearly demonstrated externalities across the 12 countries and 16 members of the SAPP, along with the benefits derived by the eight riparian states in the Zambezi River from improved dam safety and advanced disaster risk reduction measures. Given the important role of the Kariba complex, securing continued safe operation is a regional priority. There is broad consensus that IDA is well positioned to play a catalytic role in helping capture the benefits of regional integration and cooperation afforded by the proposed rehabilitation. This project is one of a number in the Zambezi River basin that provides a platform for a high level of policy harmonization between countries as part of a well-developed and broadly-supported regional strategy within the framework of the newly established Zambezi Watercourse Commission (ZAMCOM).

28. Co-financing from Sweden through a dedicated trust fund administered by the World Bank is to be fully blended with the IDA resources. A stand-alone, hybrid trust fund that is capable of supporting both Recipient Executed (i.e. ZRA) and Bank Executed activities has been established. There will be a Grant Agreement between the Republic of Zambia and the Bank as administrator of the Swedish trust fund and a Project Agreement between the Bank and the ZRA. The funds will be passed on to ZRA through a Subsidiary Agreement between the Republic of Zambia and ZRA.

29. The World Bank financing for the project is being processed in accordance with OP 10.00 Investment Project Financing Paragraph 12 for Projects in Situations of Urgent Need of Assistance. The Bank may provide a rapid response to a member country's request for urgent assistance in respect of an event that has caused, or is likely to imminently cause, a major adverse economic and/or social impact associated with natural or man-made crises or disasters.

30. The financial resources are being provided in the form of a credit from the International Development Association to the Republic of Zambia on standard terms. The maturity period will be 38 years, the grace period 6 years and principal repayments will be 3.125 percent of the principal amount borrowed from year 7 to 38 (a straight line amortization profile). The service charge will be 0.75 percent for the disbursed and outstanding balance, with the commitment charge on undisbursed balances reviewed annually. The Republic of Zambia is assuming full responsibility for repayment of the IDA credit. Zambia will on-lend funds to the ZRA for project implementation; ZRA will repay Zambia, paid for through its water tariffs charged to ZESCO and ZPC for the use of water from the Kariba Dam. The Financing Agreement between IDA and the Republic of Zambia is supplemented by a Project Agreement between the Association and the ZRA, with a Subsidiary Agreement between the Republic of Zambia and the ZRA.

31. The IDA Articles of Agreement do not prohibit making a credit to Zambia for activities to be implemented in Zimbabwe. The fact that Zimbabwe would benefit from the project does not trigger the Bank's non-accrual policy as IDA would not be providing financing directly to, or guaranteed by, Zimbabwe. The framework for regional projects contemplated the possibility that a country in non-accrual status may benefit from a regional project, if such country's participation is crucial to the region. In such cases, suitable implementation arrangements would be put in place, such as using a regional bank or having one of the participating countries take on the obligations of the country in non-accrual status and implement the project on behalf of that country (see paragraph 17 of the Pilot Program for Regional Projects – IDA/SecM2003-0532/1). Further, there is precedence for a regional program benefitting a country in arrears to IDA. For example, Togo (in non-accrual status), was a beneficiary of a regional HIV/AIDS Transport Corridor Project.

32. The African Development Bank concept review on August 05, 2014 confirmed co-financing in equal contributions with those of the World Bank Group. The concept includes provision of a US\$39 million loan from the ADF to Zambia (US\$16m from national envelope and US\$23m through the regional operations envelope) and US\$36 million in grants to Zimbabwe (US\$12m through the Transitional State Facility and US\$24m from the ADF through the regional operations envelope).

33. The European Union has submitted an application to use EUR74 million (~US\$100m) from the 11th European Development Fund National Indicative Programme for Zambia. This will be governed by the provisions of the Cotonou Agreement with the EU entering into an agreement with the Republic of Zambia.

34. The total cost of the Kariba Dam Rehabilitation Project is estimated to be US\$294.2 million. The estimates are based on a series of feasibility and design studies commissioned by the Zambezi River Authority. The Design Reports for "Plunge Pool Reshaping" and "Emergency Gate and New Gantry" were prepared by the consulting firm that conducted the 2010 5-year dam safety inspection and were submitted in July 2012. These reports were reviewed by a separate firm in November, 2012, which confirmed the overall design of the rehabilitation project. The cost estimates were escalated to account for possible advanced infrastructure, tendering, supervision and engineering costs from 2012, along with the owner's own costs and provisional sums, with provision for a two year contingency on those consulting assignments required for implementation of the full set of project activities. Further, the cost estimates and construction schedule have been prepared based on a conservative estimate of the hydrological conditions.

Project Components	Cost (US\$m)	Financing (US\$m)				
		ZRA	IDA	Sweden	AfDB	EDF
1: Institutional Project Support	69.6	19.2	20.2	10	20.2	0
2: Plunge Pool Reshaping	100.0	0	0	0	0	100.0
3: Spillway Refurbishment	124.6	0	54.8	15	54.8	0
Total Costs	294.2	19.2	75.0	25.0	75.0	100.0

Project Components	Cost (%)	Financing (%)				
		ZRA	IDA	Sweden	AfDB	EDF
1: Institutional Project Support	24	28	29	14	29	0
2: Plunge Pool Reshaping	34	0	0	0	0	100
3: Spillway Refurbishment	42	0	44	12	44	0
Total Costs	100	7	25	9	25	34

C. Series of Project Objective and Phases

35. The Kariba Dam Rehabilitation Project is one in a Series of Projects that is seen as an integral and important part of the overall program of support to the riparian states and regional bodies in the Zambezi River Basin, balancing the institutional and policy directed measures being supported under the complementary Cooperation in International Waters in Africa (CIWA) support to the Zambezi Watercourse Commission. This program is being financed through the World Bank Group, the multi-donor trust fund for Cooperation in International Waters in Africa (CIWA MDTF) and other resources as available. The Bank portfolio focused on areas of sustainable development amounts to more than US\$2 billion, with national IDA financed water projects in six of the eight riparian states, an IBRD program under preparation in Botswana and grant support to Namibia and the SADC Water Division accounts for a large share of this.

36. The program is envisaged as a Series of Projects at various levels, across different sectors within the basin aimed at promoting the equitable and reasonable utilization of the water resources of the Zambezi River basin as well as the efficient management and sustainable development thereof. This includes projects at the country level, among sub-regional clusters, and across the basin through a mix of instruments that are supporting: i) a platform for continued dialogue and high level of policy harmonization, ii) analytical work and technical assistance, iii) preparation of a pipeline of projects, and iv) investment financing, all within the guiding principles of the Integrated Water Resources Management (IWRM) Strategy for the Zambezi River basin.

37. The projects envisaged within the program are aimed at providing sustained support within the Zambezi River basin over a 10 to 15 year period, with the programmatic objectives of: i) reducing the obstacles to cooperation and advancing investments; ii) support in the identification and preparation of strategic investment opportunities; iii) supporting improved management of water resources to ensure sustainability and optimum utilization; iv) supporting national level activities which relate to the development or management of shared waters; and v) consolidating financing from Cooperating Partners behind an ambitious program of infrastructure development and water resource management. Further information on the overall program and the approach to the Series of Projects is provided in Annex 2.

D. Lessons Learned and Reflected in the Project Design

38. The project design reflects a long history of lessons learned from World Bank engagement in the rehabilitation and development of large dams in complex transboundary contexts. Lessons from similar large dam rehabilitation projects include: (a) independent technical review and supervision; (b) definition of civil works procurement packaging; (c) initiating procurement during preparation to minimize delays and potential cost overruns; and (d) stringent prequalification criteria to ensure all partners of foreign and local joint ventures are adequately qualified to fulfill their responsibilities. The technical review and construction supervision will be provided by an independent consulting firm and supported during preparation and implementation by a dam safety panel of experts. These arrangements have been agreed with the client and development partners, with the procurement progressing to provide timely and critical feedback to the finalization of detailed design and bidding documents. The project design has also been informed by other World Bank financed dam safety and rehabilitation projects with regard to a comprehensive approach covering hardware elements (including structural rehabilitation works and upgrade/refurbishment of equipment) and software elements (upgrading of the Operation & Maintenance Plan and review and revision of the Emergency Preparedness Plan, etc.). The dam safety risk assessment and design of the rehabilitation works have followed international practices as directed by the International Commission on Large Dams and other global benchmarks.

39. The design of the program has also been informed by lessons learned from World Bank involvement in transboundary water issues. This includes support across Africa in the Nile, Niger, and Senegal River basins, along with various programs and initiatives in international waters across other regions. A Multi-Sector Investment Opportunities Analysis (MSIOA) for the Zambezi River basin completed in 2010 illustrates the benefits of cooperation among the riparian countries in the Zambezi River basin through a multi-sectoral economic evaluation of water resources development, management options and scenarios. This was undertaken from both the national and basin-wide perspectives through a highly consultative and iterative process with relevant stakeholders from the private and public sector. This process has informed the design of the project which has drawn on the consultative structures under the Zambezi Watercourse Commission and the Bank's ongoing support to various national activities in the riparian states.

40. Some of the key lessons that have been incorporated are: i) the importance of riparian ownership and early stakeholder engagement, with close consultative mechanisms supported through the Technical Committee of riparian states and the CIWA Basin Advisory Committee; ii) flexible levels of engagement capitalizing on a range of World Bank-supported programs and trust fund resources; iii) clear goals and results focus aligned with the agreed basin indicators and overall CIWA program; iv) the need to communicate results and outcomes to stakeholders and development partners in order to build support, with project level support to specific communication activities; and, v) the importance of donor coordination to increase program effectiveness.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

41. The Zambezi River Authority is responsible for implementation of the Kariba Dam Rehabilitation Project. The ZRA was established by Zambia and Zimbabwe in 1989 as a bi-lateral organization with responsibility for the development and management of the shared

sections of the Zambezi River between the two countries. Four main strategic functions are outlined in the schedule to the Zambezi River Authority Acts Nos. 17 and 19 of 1987 of Zambia and Zimbabwe, respectively. Included among these responsibilities are operating, monitoring and maintaining dams on the Zambezi River and submitting development plans and programmes to the ZRA Council of Ministers for approval.

42. The ZRA is governed by a Council of Ministers consisting of four Ministers, including those responsible for Finance and Energy from both the Governments of the Republic of Zambia and Zimbabwe. A Board oversees operations and is comprised of the Permanent Secretaries of the Ministries of Energy and Finance, along with two independent Board members from each of the contracting states.

43. Implementation arrangements for the Kariba Dam Rehabilitation Project have been formalized by the Council of Ministers. A Project Steering Committee is responsible to: (a) endorsing all Project plans and budgets; (b) facilitating communication between Contracting States and coordinating all inter-governmental matters; (c) facilitating obtaining consents, permits and approvals required from the Contracting States; (d) facilitating the integration of the Project into the national plans and public sector investor programs of Contracting States; and (e) providing overall strategic guidance over the implementation of the Project.

44. A Resource Mobilization Committee comprised of representatives from Zambia and Zimbabwe has been constituted to raise funds for the project during preparation and a Project Coordinating Committee has been constituted to coordinate all inter-governmental matters. A Project Manager has been designated and is supported by the Projects and Dam Safety section of ZRA, who are responsible for all project management and coordination. Details are provided in Annex 3.

45. The ZRA will be supported in implementation of the Kariba Dam Rehabilitation Project by continued service of the Technical Advisors. Tractebel Engineering, which is an international engineering firm, which specializes in large dam projects and has been appointed by ZRA through their own resources. The firm is the designer of record and has continued to provide technical advice on operation and maintenance. Implementation will benefit further from an independent Panel of Experts, which will provide review and advisory functions, and a Dispute Adjudication Board, which will provide non-binding advice and opinions on matters relevant to the various works contracts.

46. A Technical Services and Supervision Consultant (TS&S) is being procured and will be responsible for confirming the design criteria, reviewing the design reports and drawings, assisting the ZRA in preparation and implementation of the tendering processes, and supervision of the works, including final commissioning after the defects period. The TS&S Consultant will include dedicated Blasting Operations Monitoring for ensuring the risks arising from blasting operations are properly evaluated and mitigated during the plunge pool reshaping. The TS&S Consultant will be further responsible for ensuring integration of both works contracts. The works themselves will be executed through two large contracts for the plunge pool and the spillway, respectively.

B. Results Monitoring and Evaluation

47. The Results Framework outlined in Annex 1 has been designed to provide the basis for monitoring progress of the project and is aligned with the broader outcomes for the Series of

Projects. Monitoring and Evaluation will be undertaken through the normal operations of World Bank project support and evaluation processes. The partners have agreed on a core set of indicators and reporting framework. The agreed indicators are part of an effort to align the results, indicators and reporting requirements, to the extent possible, in order to reduce the transaction cost associated with the requirements of three different development partners. The Zambezi River Authority will provide regular updates on progress toward the indicators through regular quarterly reporting to the Bank in accordance with provisions of the Financing Agreements.

C. Sustainability

48. Sustainability of the dam maintenance program is assured through the tariff framework. Commitment from both Zambia and Zimbabwe to continue supporting tariff increases that allow levels to be maintained above or near cost reflective levels have been previously demonstrated by the two contracting states as part of their commitment to ensuring sustainability. The current tariff levels can accommodate the proposed lending and projected debt service. However, at these levels there is no cash cushion for any extraordinary expenses or reductions in revenues. In contrast, a one-time, 20 percent increase in the fixed water charge would enable ZRA to maintain a minimum 1.2 debt-service coverage ratio throughout the life of the loan. Provisions have been included to ensure that the operating revenue of ZRA reflects the principles of cost recovery and is sufficient to meet the debt service obligations and ensure continued operation and maintenance of the dam and associated facilities.

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

Risk Category	Rating
Stakeholder Risk	H
Implementing Agency Risk	
- Capacity	M
- Governance	M
Project Risk	
- Design	M
- Social and Environmental	S
- Program and Donor	M
- Delivery Monitoring and Sustainability	M
- Hydrological	M
- Geotechnical	M
- Construction	H
- Donor coordination	M
- Climate Change	M
Overall Implementation Risk	High

B. Overall Risk Rating Explanation

49. The Kariba Dam Rehabilitation Program is considered a High Risk project with a number of important considerations. The risk is considered to be informed by the probability of failure and the impacts associated with any such failure. While the probability of a catastrophic failure is considered to be relatively low, the impacts would be unprecedented. The risk profile will change during implementation of the project, particularly upon completion of the reshaping of plunge pool and incrementally as each of the individual gates is refurbished. Key risks, their possible impact, and the key mitigation measures to address them, include the following:

(a) ***The Risk of Inaction*** is one of the critical time-bound risks associated with the dam. Failure to implement rehabilitation of key elements of the Kariba Dam would result in exposure of the dam to major safety risks as per the international dam safety guidelines and practices and increase the risk of catastrophic failure with the number of potentially affected people in the order of 3 million. Such failure would not only result in the loss of human lives and large economic losses, but would also severely undermine regional energy security and supplies, with impacts on economic growth and development prospects across the southern African region.

(b) ***Riparian Commitment*** among the riparian states may be a risk and an objection could delay implementation and increase overall risk. The two contracting states have requested support from development partners, and the ZRA has notified other riparian states and is embarking upon a range of consultations and site visits with them to outline proposed measures. The Protocol Regarding the Kariba Dam Rehabilitation Project addresses issues between the two states. In the case of the World Bank the Statutory Committee Report will be signed by both States in accordance with the Articles of Agreement.

(c) ***Hydrological Risks*** could increase the risks associated with works required to be undertaken on both the spillway and the plunge pool. High flows during implementation of the project could delay the implementation period, to ensure that the works would not undermine the safety of the works and the dam. However, the current schedule and cost estimates are based on a conservative scenario assuming spillage for 7 months per year. Also, measures will be implemented to ensure protective structures are in place, which, with monitoring and forecasting will provide sufficient lead time to allow for interventions in the face of changing hydrological conditions.

(d) ***Geotechnical Risks*** associated with larger fault/seam zones in the center of the dam foundation and sub-horizontal joints/seams on both sides of the plunge pool, which could require more intensive protection works, such as concrete slab coverage with deeper anchoring and grouting works. The cofferdam may also require deeper foundation works. Additional geotechnical investigation works are to be undertaken and reflected in detailed design with guidance of the Panel of Experts (PoE).

(e) ***Construction Risks*** associated with rock-blasting near the foundations of the dam and the variation of pore-water pressures during lowering of the water level in the plunge pool. Blasting will be according to carefully specified procedures that will not impact the dam foundations. The drawdown of the plunge pool will be controlled to comply with pore-water pressure stability requirements.

(f) **Implementation capacity** will be enhanced through an international engineering firm to assist with the technical support the overall project design, preparation of procurement documents, and supervision of construction. An independent Panel of Experts will also be retained to support ZRA with review of investigations, design, and implementation of the rehabilitation works.

(g) **Sustainability** of the dam maintenance program is a risk but mitigated through the tariff framework. Commitment from both Governments to continue supporting tariff increases that allow levels to be maintained above or at near cost reflective levels will be required to ensure sustainability. The tariff increases required to meet the repayment obligations will need to be incorporated into these tariff migration plans to ensure a smooth transition and ensure the ability of ZRA to repay lenders for debt financing and proper maintenance of the rehabilitated dam facilities.

(h) **Sedimentation** is often a risk associated with reservoir management and dam safety. However, sedimentation deposit is not a concern given a large dead storage volume of 115.8 km³ out of the total storage of 180.3 km³ and the elevation of the spillway sill (455.4 masl) much below the minimum operation level (475.5 masl).

(i) **Historical issues** associated with the original construction may pose a significant risk. The initial development of the Kariba Dam between 1954 and 1959 was supported through an IBRD loan to the Federation of Rhodesia and Nyasaland (Malawi, Zambia and Zimbabwe) and involved the resettlement of 57,000 Tonga people. The associated impacts have been well documented and subsequent efforts have been implemented to improve the life of affected people through the Zambezi Valley Development Fund. A series of multi-sectoral activities, designed through consultative processes, have attempted to balance infrastructure needs with food production activities. However, significant challenges still remain and may emerge during implementation of any rehabilitation measures. A review and assessment of the ZVDF is underway to inform recommendations, improve the impact and identify opportunities to enhance livelihoods.

(j) **Donor Coordination** could result in delays in implementation given the inter-linkages between the various financing. Cross conditions for effectiveness have been included with consensus on covenants that will help reinforce implementation. However, the effective coordination will be required during implementation to ensure alignment.

(k) **Climate Change** presents a significant risk, with the Zambezi River basin highly vulnerable to extreme, cyclical weather events. The project will draw on support from the Bank executed Climate Change Assessment of the Energy-Water Nexus in the Zambezi River Basin, as well as the recently completed Climate Vulnerability of African Infrastructure Study.

VI. APPRAISAL SUMMARY

A. Financial and Economic Analysis

50. The Kariba Dam was originally constructed primarily for the purpose of hydropower generation and has been a major contributor to the economies of Zambia and Zimbabwe. The dam provides water to the north and south bank power stations, which produce approximately 46 and 50 percent of electricity in Zambia and Zimbabwe, respectively. The dam has also played a major role in flood control and river flow management in the Zambezi River basin. Although the

ZRA derives no direct revenue, the reservoir also supports important commercial and subsistence fisheries, tourism operations and small-scale water supply for local towns and villages and irrigated agriculture.

51. The technical and economic appraisal of the project consists of four core financial and economic analyses: (i) a financial analysis estimating the financial impact of the project on ZRA; (ii) a debt sustainability analysis which reviews ZRA's capacity to repay the debt financing for the project; (iii) an analysis of the impact on end-user electricity tariffs in each country; and (iv) an economic cost-benefit analysis, taking into consideration the with and without project financial and operational impacts on ZRA and on the Kariba-related hydropower plants.

52. While the economic impacts of a catastrophic failure would result in devastating regional flooding, significant loss of human life and unprecedented economic damage, an estimate of the worst-case scenario has not been undertaken due to the number of inter-dependent factors that would need to contribute to such a scenario and the difficulties in assessing these with any accuracy and confidence. The risk associated with a catastrophic failure is informed by the probability of such an event and the associated impacts. These impacts would result in flooding at least four times larger than the largest recorded flooding in the area, with more than US\$8 billion in assets at risk and an estimated 3 million people living in the potential impact area. These impacts, combined with the potential loss of 40 percent of the generation capacity within the SAPP (excluding South African generation) from Kariba and Cahora Bassa, would result in unprecedented economic impacts across the southern African region.

53. Project Financial Analysis. Pro-forma profit-and-loss and simplified cash-flow statements incorporating the non-grant-financed capital expenditures as well as estimated impacts on operations over a 30-year period were prepared on a with and without project basis in order to estimate the direct financial returns of the project to ZRA. It is important to note that positive financial returns to ZRA were unlikely due to several factors. These include: (i) the very large benefits of the Kariba Dam (inexpensive generation of electricity) accrue entirely to other institutions and the economies of Zambia and Zimbabwe; (ii) project capital expenditures are very high relative to ZRA's revenues and expenses; and (iii) reductions in water sales in the without-project scenario are relatively small and are not expected to have an impact until year 30 of the project.

54. The results of the financial analysis point to a negative 0.18 percent rate of return on the project. At a discount rate of two percent (ZRA's cost of borrowing from the Government of Zambia) the project has a net present value of negative US\$44.1 million. Additional information on the financial analysis is provided in Annex 5.

55. ZRA Debt Sustainability. The ZRA is a financially autonomous organization that generates revenue for its operations through water tariffs charged to ZESCO and ZPC for water consumed in the generation of electricity. Coverage of full operational expenses has varied over the life of the dam and for a period, revenues were appreciably below levels that would have enabled timely, periodic rehabilitation; extraordinary maintenance expenses were generally paid for by transfers from the respective governments. However, tariffs have recently been raised to enable excess cash generation, which has been used in particular to finance preparation of the rehabilitation to be financed through this operation.

56. Pro-forma profit-and-loss and cash-flow statements incorporating the proposed US\$114.0 million in IDA and AfDB lending were prepared in order to estimate (i) whether

ZRA's current revenue levels can support debt service obligations, and (ii) what level of tariff increase may be required in order for ZRA to safely maintain a minimum debt-service coverage ratio of 1.2. The exercise assumed that IDA and AfDB funds would be on-lent to ZRA at 2 percent interest for a 30 year repayment period, with fully amortizing repayments. In addition, existing tariff levels were used, with an assumption of annual 2 percent tariff and operational cost increases (in line with long-term U.S. Dollar-based inflation).

57. A 15% tariff increase approved for 2014, coupled with a further 15% increase agreed for 2015, provides sufficient revenue for ZRA to cover its projected operating costs and the debt service for a 2% on-lending arrangement from the GRZ to ZRA over a 30-year repayment period with payments starting in year 2. This assumes that operating costs remain in line with the 2013 actual operating costs. A minimum Debt Service Coverage Ratio (DSCR) of 1.67 is projected given water sales of 39,000 MCM. If water sales increase to 42,000 MCM (as expected given the construction of the extension power stations), projections indicate a DSCR of 1.94.

58. Impact on End-User Electricity Tariffs: The ZRA water tariffs comprise a relatively small proportion of the total cost of providing electricity to consumers in Zambia and Zimbabwe. Given that already-agreed tariff increases for 2014 and 2015 enable full coverage of projected debt service, it is not expected that the project will have any appreciable impact on end-user electricity tariffs. In the case of ZESCO, overall revenue from electricity sales was approximately US\$505 million equivalent in 2013, based on total electricity sales of 11,903 GWh with an average end-user tariff of roughly US\$6.6 equivalent. The ZRA water charges to ZESCO for 2014 are expected to be approximately US\$9.1 million, or 1.8 percent of total revenues. With respect to ZPC, their operations are limited to energy production only; it sells power to the Zimbabwe Electricity Transmission and Distribution Company (ZETDC), the cost of which is reflected in ZETDC's total costs. ZETDC's overall revenues for 2013 were US\$ 847 million, based on total electricity sales of 8,107 GWh with an average end-user tariff of roughly US\$ 10.45. The ZRA water charges as a percentage of overall electricity costs in Zimbabwe are approximately 1.1 percent. As no further increase in tariffs is expected to be needed as a result of the project, no impact on end-user tariffs is anticipated. Even doubling ZRA's water charges to the two utilities, which is not anticipated, would have at worst, the effect of increasing end-user tariffs by 1 percent in Zimbabwe and less than 2 percent in Zambia.

59. Economic Analysis. A with and without project cost-benefit analysis was undertaken to estimate the net economic benefits of the project. The analysis included the direct financial impacts of the project on both the ZRA and on ZESCO and ZPC. In practice, however, those impacts would be passed on to electricity consumers, and therefore can be considered to be the direct impacts on the economy as a whole. The analysis has not included the significantly higher costs of potential dam failure, or the secondary economic benefits of the dam and reservoir (fisheries, tourism, etc.). Project costs are clear, consisting of the project-related capital expenditures as well as of ongoing maintenance costs for the rehabilitated assets. However, the costs of the without-project scenario accrue to ZESCO and ZPC (and, by extension, to the Zambian and Zimbabwean economies). Currently, power generation at the Kariba North Bank (ZESCO) and South Bank (ZPC) power stations are among the least expensive in the region, with the cost of electricity at the Kariba North Bank Power Station estimated at less than US\$0.01/kWh, and the cost at Kariba South Bank Power Station estimated at US\$0.02593/kWh. At the dam's normal rule curve, the two stations together generate approximately 10,035 GWh of electricity annually. The Kariba North Bank Power Station generates approximately 45 percent

of Zambia's total power generation, while Kariba South Bank Power Station, although only 36 percent of Zimbabwe's installed capacity, generates an estimated 50 percent of Zimbabwe's total generation.

60. Given the required rehabilitation of the plunge pool and spillway, a lower rule curve has been recommended for dam operations. While the recommended rule curve currently does not have an impact on the delivery of water, it does result in lower energy production. There is estimated to be at least an 11 percent reduction in energy generation at the current recommended rule curve. Future additional lowering of the rule curve to accommodate further deterioration of the plunge pool and the spillway would result in further reductions in generation, as well as much greater likelihood of the lowering of reservoir levels below the minimum operating level during particular months of the year. In order to avoid significant impacts on the respective economies, lost power would need to be replaced with power purchased elsewhere. The base-case assumption for the cost of replacement power is US\$0.165/kWh, based on current prices for recently completed public-private partnerships in energy generation in Zambia. The lowest possible cost of replacement power may be as low as US\$0.0626/kWh, based on recent trading prices within the SAPP. However, amounts traded are a small percentage of the amounts needed to replace lost electricity generation from the Kariba complex. At the highest extreme – the cost for oil-fired, medium-speed diesel generation electricity (potentially the only viable option for replacement power in the amounts required) – is estimated at US\$0.27kWh, but can be even higher.

61. The economic analysis calculates the difference between the with-project costs (capital expenditures over years 1 through 10 as well as ongoing maintenance costs) and without-project costs (net costs to ZESCO and ZPC for the purchase of power to replace power lost at the Kariba stations) over a period of 40 years. Net power losses in the without-project scenario are estimated to be relatively low in the early years, increasing gradually over time. The base case assumes that the Kariba reservoir would have to be lowered below the minimum production level in year 30 of the analysis, at which point the full amount of power production would have to be purchased elsewhere.

62. Given the high cost of replacing power currently being generated through the Kariba power stations, the with and without project financial benefit flows are highly positive even with very conservative estimates for power generation losses. The Net Present Value is calculated at approximately US\$3.5 billion at a discount rate of 6 percent, reflecting the long-lived nature of the dam and the rehabilitation works. The internal rate of return (IRR) is estimated at 33 percent. Sensitivity analyses incorporating higher project costs and longer implementation period indicate that these returns are quite robust. Additional information is provided in Annex 5.

B. Technical

63. The ZRA has maintained regular five-yearly dam safety monitoring and periodic inspections since commissioning of the dam. These have been supplemented by interim inspections and the ZRA routinely executes preventive maintenance in line with the Standing Operating Procedures for the Kariba Dam and Reservoir, as well as the recommendations of the regular, five-yearly dam safety inspections. The design stage consultants have been retained by the ZRA to provide services in connection with the inspection and to advise on maintenance of the dam and appurtenant works as part of a commitment to ensuring a long-term, continuous process of operation and maintenance. The dam safety inspections, monitoring and maintenance work

follow international good practice, informed by the dam safety guidelines from the International Commission on Large Dams (ICOLD). The 2010 Inspection Report noted that the operation procedures are generally well known and applied, and that the staff demonstrates excellent professionalism and a high quality of service.

64. In addition, the ZRA has carried out tasks related to surveillance of the plunge pool, spillway maintenance and monitoring of the concrete swelling by Alkali Aggregate Reaction (AAR), along with upgrading and extension of monitoring devices, data management and results evaluation. For example, the stability of the south bank has been a major concern in the past and the ZRA undertook a series of stabilization works on a regular basis throughout the 1960s and 70s. A major stabilization program was implemented in 1993 to ensure stability of the south bank. This included construction of an additional drainage adit, redrilling of aged foundation drain holes and extending the surface slope sealing.

65. A comprehensive Dam Safety Study was financed by the World Bank in 1998 to compliment the regular dam safety inspections. The objective was to carry out an “overall review and assessment of dam safety along with the needed safety measures”. The safety measures and long term monitoring to ensure the dam stability identified included the erosion of the plunge pool and various other issues relating to the operation of the spillway, along with behavior of the dam wall and concrete design. This included the implications of AAR and the rehabilitation of concrete surfaces and associated works for securing clearance and safe operation of the spillway gates. The technical assessments did not identify any additional problems with the foundations or other issues in the reservoir area.

66. Following the 1998 study, an enhanced program of monitoring, regular inspections and specific investigations were conducted. The 2010 regular 5-yearly inspections highlighted the urgent need for enhancing dam safety, including the need for rehabilitation of the plunge pool and upstream spillway gates. These were classified as Category I interventions, which are acknowledged as severe deficiencies where urgent and immediate responsive action is required. In response, the ZRA commissioned a series of detailed diagnostic and feasibility studies relating to the plunge pool, including a detailed hydraulic model, geotechnical investigations, etc.. These were accompanied by detailed diagnostic and feasibility studies relating to the hydro-mechanical facility associated with the spillway. These diagnostic reports and feasibility studies were reviewed by a separate firm in 2012 which confirmed the overall proposed approach to the rehabilitation works. This includes reshaping of the plunge pool and refurbishment of the spillway to secure the continued safe operation of the dam in accordance to international standards.

67. Reshaping of the Plunge Pool is aimed at facilitating the evacuation of spillage flows in the downstream direction in order to avoid the concentration of turbulence in a restricted and confined area. The dam was constructed with the intention that the plunge pool would form naturally through scouring. However, the free fall water from the spillway has scoured the plunge pool to a depth of 80 meters from the foundation level. This is much deeper than originally anticipated and could progress to the upstream toe area of the dam and affect the foundation rock supporting the dam. The reshaping is urgently needed to prevent any potential further regression and to protect the dam from catastrophic failure due to lack of foundation support. Further, operation of the spillway flood gates is constrained due to the condition of the plunge pool. In the absence of the reshaping, the dam can only open three, non-adjacent gates due to excessive scouring and erosion.

68. The works include excavation of an estimated 300,000 m³ of material to enlarge the scour hole, mainly in the downstream direction, but also both toward the North and South banks, to improve the symmetry. This will limit scouring and erosion that could potentially undermine the dam foundations. In the absence of any intervention to stop the current trend, the scour hole will not be stable if the spillway needs to be operated with more than three of the six gates opened. The schedule of works will be carried out over three years. Given that the works area is located right under the spillway gates, the reshaping works can only be carried during “non-spillage” periods, creating a reduced window within which to carry out the works. While the normal spillage usually occurs from January to end of August, the non-spillage period can be increased by lowering the lake level below the rule curve and creating an additional storage volume that will be used as a buffer volume against flood. This volume allows storing the flood inflows while the lake level is rising but would have implications for energy security.

69. Refurbishment of the spillway will address the effects of the concrete Alkaline Aggregate Reaction expansion and the ageing of the spillway equipment. This includes the design, fabrication and installation of an emergency gate, refurbishment of built-in structures and secondary concrete, and a new gantry. In the absence of the refurbishment, ZRA will be faced with increasingly frequent maintenance operations and potential limitations on the operational control of the reservoir. The general degradation of the existing works also presents an increasing probability of major default on the spillway, leading to unplanned and urgent maintenance operations. The works will therefore help prevent uncontrolled loss of water in the event of floodgate failure, which would result in water levels dropping below the minimum operational levels. and uncontrolled interruptions to power production. The intervention would also allow timely fixation of the flood gate in case of jamming in the milled/closed position. The refurbishment is estimated to take eight years from the award of contract. This includes two years for the contractor’s studies, supply, fabrication and transport and seven years for the on-site works. These would commence roughly one year after the award of contract and allow for the refurbishment of one sluice per year. The refurbishment will be facilitated by a floating cofferdam that will be put into place in front of the sluice and by applying hydrostatic loads on three lines of support (on the upstream nose, above the lintel and below the crest) supported by two axles on the top of the piers. The cofferdam will be assembled in ten elements on a slipway, pushed on the lake by boat and put on its axles by a mobile crane on the crest.

70. The integration of the work on the spillway and the reshaping of the plunge pool will be ensured through the appointment of a Technical Services and Supervision (TS&S) Consultant. Given that the project extends over 10 years, and that the EDF (EU) funding will be available for a fixed 5-year period, the TS&S Consultant will be jointly co-financed by the AfDB and the World Bank. The TS&S Consultant will carry out a detailed review of the existing studies, design work and draft tender documents. The scope of work for the TS&S Consultant has been agreed among the partners and the ZRA has launched the procurement process. This timing will help ensure that the TS&S Consultant is available to review the design criteria for the plunge pool and the refurbishment of the spillway in a timely manner prior to issuing tender documents.

71. A Dam Safety Panel of Experts (PoE) is currently being procured and individual experts on the relevant technical aspects of the rehabilitation works (overall dam safety, hydrology/hydraulics, geology/geotechnics, hydro-mechanical, and concrete expertise) are expected to be in place for a first review of the proposed work and detailed design in December, 2014. The ToRs have been discussed and agreed. The PoE will oversee the review and update of

the detailed design and tender documents by the TS&S Consultant during the first year, along with the procurement of the Contractors, the review and updating of the Emergency Preparedness Plan (EPP), including the dam break analysis, the O&M Plan, and the commencement of the works. The PoE will then oversee the works execution on a regular basis through regular bi-annual site visits and the review of progress throughout the project implementation period.

72. The ZRA has an existing Emergency Preparedness Plan, that was prepared in January 2014 to aid the Dam Safety Monitoring Team during an emergency situation, and an Operation and Maintenance Plan, that covers the reservoir operation procedure, instrumentation plan and operation and maintenance procedure of equipment, etc.. The EPP is considered a framework plan that is sufficient for appraisal. Both documents are to be reviewed and revised, as needed, by the TS&S Consultant in preparation for the implementation of the works. Both documents will be updated again and finalized six months (O&M part) and 12 months (EPP part) before commissioning of all refurbishment works. A Dam Break Analysis is currently under procurement by the ZRA and will further inform the update of the Emergency Preparedness Plan during implementation of rehabilitation works and for future dam operations.

C. Financial Management

73. A Financial Management Assessment of the Zambezi River Authority was carried out jointly by financial management specialists from the World Bank and the African Development Bank in August 2014. The objective of the assessment was to determine whether the implementing agency, ZRA has adequate financial management arrangements, to ensure that: (1) the funds are properly accounted for and used only for the intended purposes in an efficient and economical way; (2) capability exists for the preparation of accurate, reliable and timely periodic financial reports; (3) internal controls exist which allow early detection of errors or unusual practices as a deterrent to fraud and corruption, (4) the assets are safeguarded.

74. The conclusion of the assessment is that the ZRA, which will be in charge of administering the Credit, satisfies the minimum financial management requirements as per the World Bank's OP/BP 10.00. The risk rating for the ZRA financial management arrangements has been assessed as Moderate. The details of the assessment are provided in Annex 3.

75. The funds under the European Development Fund will be administered through the Ministry of Finance by the National Authorizing Officer (NAO). These funds will be limited to the works contract for the plunge pool, any additional engineering studies that may be required, along with associated monitoring, evaluation, visual and communications measures. Funds will not flow directly into the ZRA and there will be no additional financial management requirements.

D. Procurement

76. A Procurement Capacity Assessment of the Zambezi River Authority was carried out jointly by the African Development Bank and the World Bank. It was agreed that the World Bank Procurement Guidelines will be used for all jointly co-financed activities. The partners are finalizing a Memorandum of Understanding to outline the process of review, comment and no objection. This is detailed in Annex 3.

77. The assessment concluded that the ZRA has well-established fiduciary procedures and carries out its own procurement. The ZRA has successfully executed a series of procurements for large consulting assignments in accordance with World Bank procurement guidelines for the

Batoka Gorge Hydro-Electric Scheme under a Recipient Executed Grant from the multi-donor trust fund for Cooperation in International Waters in Africa (CIWA). The ZRA had also successfully implemented the Zambezi Action Program (ZACPRO 6.2) project that resulted in the Zambezi River Basin IWRM Strategy (ZAMSTRAT), Zambezi Water Information System (ZAMWIS) and establishment of the Interim ZAMCOM Secretariat.

78. Procurement under the project is limited to two large contracts, including one civil works contract for the plunge pool reshaping and one supply and installation contract (goods) for the emergency spillway gate and associated works. The project will also finance consulting firms for Technical Services and Supervision, Environmental and Social Assessment, Panel of Experts, Dispute Adjudication Board and minor individual assignments. Several of these have been initiated during preparation. Procurement of those activities being financed under EDF11 related to and including reshaping of the plunge pool, will be carried out by the EU in accordance with the EDF rules.

79. The ZRA has appointed a dedicated Procurement Manager. Typical procurement undertaken to date by the ZRA is limited to largely small value, non-complex assignments. The limited experience with large, complex competitive procurements relating to engineering assignments and large civil works programs will require enhanced mechanisms to strengthen the formal procurement arrangements and also to integrate the technical aspects with the procurement workflow processes under the management of the assigned procurement staff.

80. The ZRA has retained the services of a professional engineering company as a Technical Advisor. This company has prepared preliminary design documents and is expected to continue to assist ZRA in the preparation and review of technical specifications, evaluations, etc. It was agreed that ZRA would recruit a more integrated Technical Services and Supervision Consultant who would review and confirm the design and supervise all project elements. The consultant would also review the process of procurement planning and monitoring based on project objectives, reflecting justifiable quantities, realistic market prices, specific deliverables, etc. that are subject to formal approvals.

81. The Project Risk Rating in terms of procurement is assessed as “substantial.” Various mitigation measures have been identified to address the identified risks over the life of the project, following which the residual risk would reduce to “moderate”. The ZRA has identified dedicated project staff to manage the procurement and implementation of the key assignments; they will be supported by Technical Advisors. Details are outlined in Annex 3

82. The following procurement, consultant and anti-corruptions guidelines apply to this project:

- (a) “Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants”, dated October 15, 2006 and revised in January 2011.
- (b) “Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers” dated January 2011, revised July 01, 2014.
- (c) "Guidelines: Procurement of Goods, Works and Non consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers” dated January 2011, revised July 01, 2014.

E. Social (including Safeguards)

83. The project includes two rehabilitation components both of which require works in situ on existing infrastructure to secure operations in accordance with international dam safety standards and avoid a potential catastrophic failure of the dam. As a result, the rehabilitation measures are not expected to have any significant adverse social impacts. There is not expected to be any physical relocation and only limited, if any, land acquisition leading to involuntary resettlement and/or restrictions of access to resources or livelihoods. Nevertheless, the World Bank involuntary resettlement policy has been triggered and the ESIA consultants are preparing a Resettlement Policy Framework (RPF) to ensure prior agreement on a transparent mechanism in the event that any land acquisition is required for waste dumps, access routes or construction sites, etc.. As this project is being prepared by the World Bank in accordance with the operational policies for Projects in Situations of Urgent Need of Assistance, the RPF will be required prior to the commencement of any civil works.

84. The ZRA has identified a preferred spoils site and an existing work area option to use as an operations work camp associated with ZESCO's North Bank Station Extension Project. In order to reduce the amount of dumping, the spoils will be tested to determine if the material is suitable for use during rehabilitation. The ZRA is in the process of contacting the local Council Secretary in order to have the site designated as a dump site and working with the North Bank Power Station manager to receive the necessary approvals. If these sites are used, no new access roads will be needed. Instead, only a small portion of the current road will need to be upgraded in order to accommodate increased vehicle traffic. In the absence of the required authorizations, ZRA may be forced to acquire land in order to establish a new operations area.

85. The original construction of the Kariba Dam in the 1950s was supported through an IBRD loan to the Federation of Rhodesia and Nyasaland (Malawi, Zambia and Zimbabwe) and involved the resettlement of an estimated 57,000 people, 34,000 of which were resettled in Zambia. The historical context of resettlement during construction of the Kariba Dam predates the current operational safeguard policies but the ZRA has confirmed that there are no outstanding claims to the land in the project area and/or associated historical issues relating to the resettlement during construction of the Kariba Dam that would be directly related to implementation of the project. While the "Guidelines for Addressing Legacy Issues in World Bank Projects" issued in June 2009 are not applicable to the context of the original resettlement, the IDA financed Power Rehabilitation Project (1998) subsequently attempted to improve the life of affected people through the Tonga Rehabilitation and Development Program. Integrated, multi-sectoral activities, designed through a consultative process, attempted to balance infrastructure needs with food production activities. While the outcomes of all the components funded under the project were judged satisfactory, efforts at rehabilitation and environmental management for the people were considered partially achieved.

86. The ZRA established the Zambezi Valley Development Fund (ZVDF) in 1997 to enhance the socio-economic status of people displaced during the original construction of the Kariba Dam in the 1950s. The Batoka Gorge HES ESIA includes provisions to assess the efficacy of the ZVDF and this will be used to inform any Government response to associated historical issues. The ESIA Consultant for the Batoka Gorge Hydro-Electric Scheme, being undertaken in parallel by the same as that for the Kariba Dam Rehabilitation Project, is reviewing and assessing the operations and impact of the ZVDF. The assessment includes a review of the Operation Guidelines, the portfolio of projects financed to date, their effectiveness and impact, and revenue

mechanisms and finances. The consultant will make recommendations, based on the findings of the assessment and taking into consideration the socio-economic assessment of the Batoka Gorge HES, to improve the impact of the ZVDF and identify opportunities to enhance livelihoods. Their assessment will indicate any activities, responsibilities of the different stakeholders involved and include a clear timeframe and cost estimates.

87. A Panel of Experts is being convened to review project implementation and advise the Zambezi River Authority on international best practice. A social expert will be included in the Panel of Experts who will be able to advise the team with regards to project implementation impacts and provide guidance with regards to historical issues that may need to be addressed.

F. Environment (including Safeguards)

88. The project has been assigned Environmental category A due to the anticipated nature and scope of project activities. The Kariba Dam is located roughly in the middle of the Zambezi River basin, at the border of Zambia and Zimbabwe. The drainage basin area is approximately 663,848 km² of savannah-dry forest and lies in the territories of five of the eight riparian states: Angola, Botswana, Namibia, Zambia and Zimbabwe. With impoundment in 1958, it created the largest artificial reservoir in the world (181 cubic kilometers). The Kariba sub-catchment contributes an estimated 8,400 km³ per year to overall flow, with the three-month peak flood period usually taking place from February to April. In contrast, the spillage season for the Kariba Dam usually takes place from January to August due to the application of the reservoir rule curve which is applied to provide a sufficient dumping capacity to regulate high flows and floods. Limited amounts of water are usually spilled every now and then in order to closely match the reservoir level rule from January to August.

89. The project includes two rehabilitation components both of which require works in situ on existing infrastructure to secure operations in accordance with international dam safety standards and avoid a potential catastrophic failure of the dam. The rehabilitation measures are not expected to have any significant adverse environmental impacts with any potential impacts likely to be associated with site specific rehabilitation works temporary in nature. The construction period for the plunge pool refurbishment is limited to the non-spilling period seven out of twelve months of the year, over three-years, and will not affect the day-to-day operating conditions of the hydropower plants. The refurbishment of the spillway is to be carried out in situ and expected to have limited, if any, impact on the natural environment or long-term operations of the reservoir.

90. Given the urgency of the project, the preparation of the ESIA and RPF has been deferred to implementation after Board presentation. An ESIA Consultant has been appointed to evaluate the design of the Kariba Dam rehabilitation works, undertake the required Environmental and Social Impact Assessment and prepare an integrated Environmental and Social Management Plan, along with associated instruments to ensure the sustainability of project through appropriate preventive, mitigation and monitoring interventions. The ToRs were subjected to a consultative process with stakeholders in the project area with an emphasis on public participation and specific provisions to ensure that the procedure of data acquisition, analysis and interpretation is conducted in a transparent manner according to accepted international standards and practice. The consultancy is expected to be completed by March 2015, prior to commencement of any of the associated works, and will produce an ESIA for the Kariba dam rehabilitation works, along with Environmental and Social Management Plans (ESMPs) and Resettlement Policy Framework

(RPF). The Environmental and Social Management Plan is being prepared, along with quality assurance measures, and will be incorporated into the relevant bidding documents to govern the implementation phase. Given that the rehabilitation includes civil works, provisions will also be included for chance find procedures for physical and cultural heritage.

91. The main potential risk associated with the construction activities is the potential effects on the downstream environment due to reshaping of the plunge pool. It is proposed that the cofferdam to enable access for the excavation of the plunge pool be built immediately downstream of the plunge pool and upstream of the outlets from the power stations and be removed every year during the spillage period. The instream flows downstream of the outlet from the power stations are being assessed as part of the ESIA and it is expected that the historical flow regime under the current operations will be maintained. This will be possible through the continued release of water through the power station outlets which will enable water flows to be maintained below the cofferdam needed to protect the plunge pool works. Similarly, high sediment loads are expected in those areas immediately downstream of the plunge pool during construction activities. Lowering of the water level in the plunge pool by pumping will result in higher water turbidity during the non-spillage seasons (May-November). However, the highest pumping rate during the works is expected to be around 0.4 cubic meters per second, which is 0.1 percent of the mean downstream flow out of the power stations (1,160 cubic meters per second) and so not expected to have a significant impact.

92. Increased climate variability, including an increase in the incidence of extreme weather events, such as floods and droughts, has also been acknowledged as adding to the complexity. The Zambezi River Basin, the fourth largest catchment in Africa, is highly vulnerable to the impacts of climate change due to its strong seasonal hydro-climatic conditions and because of the resonance between increased temperature and decreased rainfall. The Zambezi River Basin and other stakeholders (national water ministries, regional departments, basin councils, and local river basin offices) will work together to integrate climate change adaptation into their operations.

G. Other Safeguards Policies Triggered

93. **Notification on International Waterways (OP/BP7.50).** The Zambezi River Authority notified the riparian states on the project in May, 2014 in compliance with the provisions of the 2000 SADC Revised Protocol on Shared Water Courses and the Agreement on Establishment of the Zambezi Watercourse Commission. The letter of notification meets the provisions under the World Bank OP 7.50 and indicated that the proposed works: (i) will not adversely change the quality or quantity of water flows to the other Watercourse States; (ii) will not adversely affect water use by other Watercourse States; and (iii) will not exceed the original scheme, change its nature, alter or expand its scope and extent so as to make it appear a new or different scheme. The ZRA has committed to ensure that adequate due consideration is afforded to third party effects and that the technical aspects of design and construction are subject to robust advice to inform sound decision making. Commitments are also given that relevant documentation, including the environmental impact assessment and emergency preparedness plans, will be shared in due course. The time provided for response and or comments by the riparian states has lapsed and neither response nor comments have been received.

94. **Dam Safety (OP/BP4.37).** The project is aimed at ensuring appropriate measures are implemented and sufficient resources provided for the continued safety of the Kariba Dam. The ZRA carries out five yearly inspections of the dam by internationally reputable consultants and the rehabilitation works will be carried out in compliance with the OP/BP. The regular inspection reports have been reviewed and ZRA has conducted or is conducting required actions as per the policy in a satisfactory manner. The ToRs for the TS&S Consultant, including construction supervision and quality assurance (CSQA) clause, have been reviewed and is currently under procurement. A detailed CSQA plan will be prepared by the TS&S consultant along with the tender document review and preparation. A current operation and maintenance plan has been reviewed. This will be reviewed, and revised as needed, as part of the preparations and then revised again upon successful completion of the works. The ZRA has an existing Emergency Preparedness Plan (EPP) that has been reviewed. This will be reviewed during the design phase and revised to align with the works schedule. It will subsequently be a subject to further review and updated upon completion of the project to reflect the outcome of the rehabilitation works. The TS&S Consultant will be responsible for the review, preparation and updating of these plans. The dam safety instrumentation has been reviewed as part of the five-year dam safety inspection and an updated instrumentation plan will be incorporated into the O&M Plan during project implementation. The ZRA is also establishing a PoE for Dam Safety to support ZRA in review of the investigations, design, and implementation of the rehabilitation works. The ToRs have been reviewed during preparation and are currently under procurement.

H. Communications

95. The complexity of the Kariba Dam Rehabilitation Project and the partnership among the two governments, the ZRA and the three financiers requires a clear, coordinated and consistent approach to communications. The ZRA has a public relations and communications office with two dedicated staff. A workplan has been prepared by the EU support to guide the preparation of appropriate instruments during the changing phases of implementation in collaboration with the ZRA, financing partners and the two governments. This will guide internal and external communications relating to the project within each of the respective institutions. It is being accompanied by a perception survey of key stakeholders that will serve as a benchmark for the project and provide a set of indicators against which to manage the expectations and measure the success of the communications strategy with respect to the safety of the Kariba Dam. A Communications Protocol to guide the partners is under discussion within the framework of agreed implementation arrangements. This is complimented by a press kit with a series of fact sheets providing easily accessible, factual information pertaining to a range of topics.

ANNEX 1: RESULTS FRAMEWORK AND MONITORING

Country: Africa

Project Name: Kariba Dam Rehabilitation Project (P146515)

Results Framework

Project Development Objectives

PDO Statement

The Project Development Objective is to assist in improving the safety and reliability of the Kariba Dam.

These results are at Project Level

Project Development Objective Indicators

Indicator Name	Baseline	Cumulative Target Values										
		YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9	End Target	
Number of people benefitting in the project area through risk reduction and avoided disaster	3,000,000 at risk from failure											3,000,000 people no longer at risk from failure
Emergency Preparedness Plan adopted and operationalized	Existing EPP requires operating rule curve to be lowered by 3.5m.	EPP reviewed to align with works schedule		Dam Break Analysis completed		EPP updated upon completion of PP reshaping						Updated EPP reflecting successful rehabilitation adopted and implementing operating rule curve.

Intermediate Results Indicators

Indicator Name	Baseline	Cumulative Target Values										
		YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9	End Target	
Emergency Preparedness Plan Updated (Text)	Existing EPP limits operations due to dam safety concerns.	EPP reviewed to align with works schedule		Dam Break Analysis completed		EPP updated upon completion of PP reshaping						Updated EPP adopted and operationalized.
Dam Break Analysis Completed and Integrated into the EPP (Text)	Limited information available.	Consultants Appointed		Dam Break Analysis completed								Flood inundation and risk maps integrated into EPP.
Plunge Pool: Volume Excavated (Cubic Meter(m ³))	0.00	Cofferdam constructed	100,000	200,000	300,000	-	-	-	-	-		300,000
Spillway: Gates Refurbished (Text)	0 gates refurbished	-	Contractor	Cofferdam	Gate 1	Gate 2	Gate 3	Gate 4	Gate 5	Gate 6		6 gates refurbished
Spillway: Rule Curve (Text)	Rule curve reduced by 3.5m	3.5m	3.5m	3.5m	3.5m	3.5m	3.5m	3.5m	3.5m	3.5m		Rule curve restored to full supply level.

Indicator Description

Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Number of people benefitting in the project area through risk reduction and avoided disaster	Successful completion of the rehabilitation works will improve the safety and remove the threat of risks to downstream populations	Annually	Dam Safety Reports and Updated Dam Break Analysis	Zambezi River Authority
Emergency Preparedness Plan adopted and operationalized	Measures overall outcome in securing safety of Kariba Dam through restoration of operational curve governed by EPP	Annually	Dam Safety Reports	Zambezi River Authority

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Emergency Preparedness Plan Updated (Text)	Monitors progress in updating information for improvements to the EPP.	Annually	Standing Operating Procedures	Zambezi River Authority
Dam Break Analysis Completed and Integrated into the EPP (Text)	Monitors progress in updating information for improvements to the EPP	Annually	Analysis Reports	Zambezi River Authority
Plunge Pool: Volume Excavated (Cubic Meter(m ³))	Measures improved safety through physical interventions and stability of plunge pool.	Annually	Construction Reports	Zambezi River Authority
Spillway: Gates Refurbished (Text)	Measures improved reliability through improved operations via refurbishment of the spillway.	Annually	Construction Reports	Zambezi River Authority.
Spillway: Rule Curve	Measures impact of improved safety of the plunge pool and reliability of the spillway through restoration of full operational capacity reflected in the operating rule.	Annually	Dam Safety Reports	Zambezi River Authority

ANNEX 2: DETAILED PROJECT DESCRIPTION

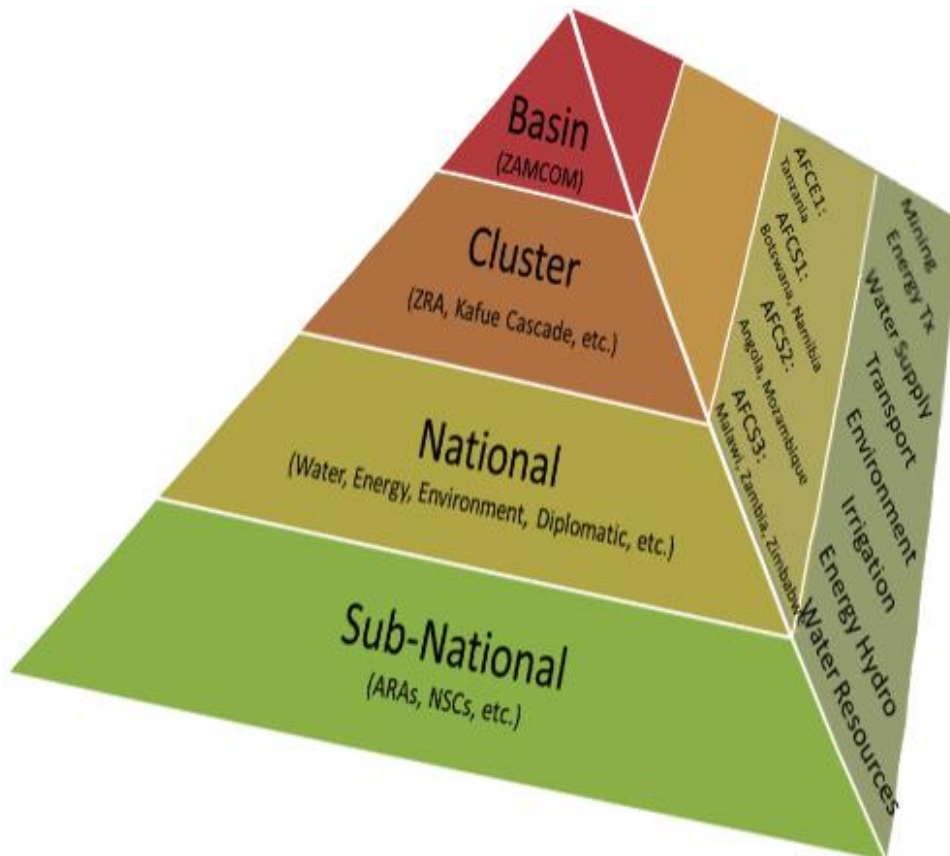
AFRICA: Kariba Dam Rehabilitation Project

1. The Kariba Dam Rehabilitation Project is one of a Series of Projects aimed at strengthening cooperative management and development within the Zambezi River Basin to facilitate sustainable, climate resilient growth. To achieve the Program Objective, the various projects are supporting the riparian states and regional bodies to facilitate growth focused investments aimed at the sustainable development of basins resources. It is also engaging the stakeholders to strengthen existing institutions and management regimes by supporting cooperative planning and development of water resources in the Zambezi River Basin.
2. The Zambezi River Basin Program is envisaged as a long-term engagement through a series of phases with projects at various levels across different sectors within the basin. To maximize the impact of the Zambezi River Basin Program, activities are being supported at three levels: i) at the country level, ii) among sub-regional clusters, and, iii) across the Basin, through a mix of different instruments. These are supporting: i) continued dialogue among the riparians and regional bodies, ii) analytical work and technical assistance, iii) preparation of a pipeline of projects, and iv) investment financing. The first phase of the program is supporting recipient-executed grants from the multi-donor trust fund for Cooperation in International Waters in Africa (CIWA) to the Zambezi Watercourse Commission and the Zambezi River Authority, along with a CIWA financed Bank-executed analytical program.
3. The Bank portfolio focused on sustainable development across the eight riparian states in the Zambezi River basin amounts to more than US\$2 billion. Specific water related programs in the active portfolio account for a large share of this, with national IDA financed water projects in six of the eight riparian states including an IBRD program under preparation in Botswana and grant support to Namibia and the SADC Water Division. A comprehensive analytical program has been developed over the years to set the foundation for complex investment programs. This program is supported through solid analytical foundation; Country Water Resources Assistance Strategies have been prepared for Malawi, Mozambique, Tanzania and Zambia. This analytical program is reflected in the Country Assistance Strategies and Interim Strategy Notes among the individual riparian states; all the strategies include a strong focus on water and recognition of the role that water plays in fostering the goals of economic cooperation.
4. The country level provides the foundation for enabling regional initiatives and cooperative ventures. Support toward realisation of the goals will include a focused effort to continue to support in energy, water, environment, transport, irrigation but with increased and better coordination within and among sectors to enhance the capacity and confidence of national and sub-national institutions to engage in the regional cooperative process. The Bank's country level engagement will help to correlate and capitalise on the WBG portfolio in key sectors. The program will help facilitate a discussion around increased alignment between the various instruments available to the riparian states to help them position themselves in relation to the broader commitments contained under regional frameworks, such as the SADC Protocol and ZAMCOM Agreement, and bilateral arrangements.
5. Sub-regional and sectoral support will assist organizations mandated with the development and operation of key infrastructure in the basin. This will be directed toward intensified engagement through technical assistance, support to feasibility studies to advance bilateral and

multilateral investment opportunities within the basin context. This approach is in recognition of the provisions within the ZAMCOM Agreement that acknowledge existing agreements, and is intended to re-enforce and facilitate alignment between existing institutions within the basin. This is exemplified by the Memorandum of Understanding between dam operators in Mozambique, Zambia, and Zimbabwe.

6. Basin level support to regional organizations, such as the Zambezi Watercourse Commission, will be directed toward sustaining the political process toward fostering commitments to cooperation. This will support processes aimed at realizing the gains through the equitable and reasonable utilization of water along with cooperative development through basin wide activities. These will build on the country level foundations, through incremental contributions and support to implementation of measures envisaged under the ZAMCOM Agreement and IWRM Strategy. This will be provided through technical assistance and analytical work to demonstrate the benefits of cooperation, with engagement informed by those areas where the Bank has a comparative advantage.

Organizing Framework for a Cooperative Support Program in the Zambezi River Basin.



7. The Kariba Dam Rehabilitation Project is seen as an integral and important part of the overall program of support in the Zambezi River Basin, complimenting the institutional and policy directed measures being supported under the complementary CIWA support to the Zambezi Watercourse Commission.

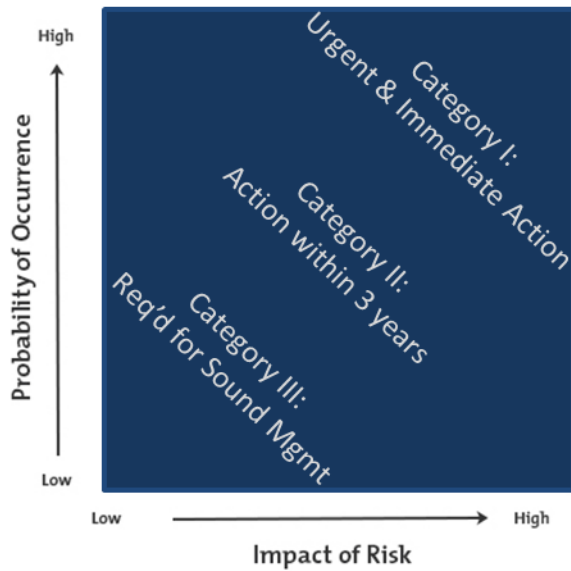
8. The double curvature concrete arch Kariba Dam stands at 128 meters tall with a crest length of 617 meters and a reservoir capacity of 181km³. This makes it one of the largest reservoirs in the world. The submerged orifice gated spillway comprises six submerged flood sluices located in the central part of the dam wall, with a lower level of +455.37 m. The minimum operating level of the reservoir is +475.5 m. The maximum discharge capacity of the spillway is approximately 9,000 cubic meters per second. The highest recorded discharge from the dam was 7,300 cubic meters per second for flood control in 1978 (combined outflow through four fully open gates and the power stations). The active storage at the Full Supply Level of +488.5m is 64.5 km³. This includes 23.2 km³ of flood control capacity that has to be made available at the beginning of each flood season (February to April) for flood attenuation.

9. The Kariba Reservoir supplies water to two underground hydropower stations located on the North (left) bank in Zambia and on the South (right) bank in Zimbabwe. The two power stations were constructed with a combined capacity of 1,200 MW, later upgraded to 1,226 MW and more recently increased to 1,830 MW, generating approximately 10,035 GWh annually under normal operating conditions. Each country has its own power station operated by the respective national power utility and current expansion programs are expected to increase the installed capacity to a total of 2,130 MW by 2017.

10. The Kariba North Bank Power Station in Zambia was built and commissioned between 1975 and 1977 with four turbines uprated over the years to provide 720 MW and is now operated by ZESCO, the national utility. The recently completed expansion project has installed two 180 MW turbines on the North Bank, increasing the total capacity of the North Bank Power Station to 1,080 MW. The Kariba South Bank Power Station in Zimbabwe was commissioned in 1960 with six turbines that have been uprated over the years to have a current capacity of 750 MW and is now operated by ZPC, the national utility. In 2013, Zimbabwe signed a US\$319 million non-concessional loan with China Eximbank to finance the expansion of the Kariba South Bank Power Station with two additional 150 MW turbines, increasing the total capacity to 1,050 MW.

11. After 50 years of operation serving the southern African region, the Kariba Dam now requires a series of urgent rehabilitation works for its continued safe operation as per the international design standards and practices. These have been classified as Category I interventions, which are acknowledged as severe deficiencies where urgent and immediate responsive action is required. Operations are currently limited to three of the six, non-adjacent gates to reduce the potential downstream erosion. To ensure compliance with safety standards, it has been recommended that the rule curve be lowered by 3.5m to adjust for spilling capacity, resulting in the loss of an estimated 19,000 MCM of water, or 31% of the reservoirs live capacity. This also limits the flood regulation capabilities and the water available for power production. A failure to invest in the timely implementation of these recommended measures will result in the gradual degradation of key dam safety features associated with the structure to a level that would pose unacceptable risks to downstream populations, economic and social infrastructure and regional power security. These risks are informed by both the Probability and the Impact of any event. While the probability is difficult to determine given the number of inter-dependent factors, the potential impacts associated with any failure would result in devastating regional flooding, significant loss of human life, and unprecedented economic damage.

12. In response, the ZRA has commissioned a series of detailed diagnostic and feasibility studies relating to the plunge pool, including a detailed hydraulic model, geotechnical investigations, etc.. These were accompanied by detailed diagnostic and feasibility studies relating to the hydro-mechanical facility associated with the spillway. These diagnostic reports and feasibility studies were reviewed by a separate firm in 2012 which confirmed the overall proposed approach to the rehabilitation works. This includes reshaping of the plunge pool and refurbishment of the spillway to secure the continued safe operation of the dam in accordance to international standards.



13. These recommended works include: 1.a) the design, fabrication and installation of an emergency gate and a new gantry to prevent uncontrolled loss of water in the event of floodgate failure, which would result in water levels dropping below the minimum operational levels and interrupting power production; 1.b) the refurbishment of the upstream stop-beam guides and replacement of secondary concrete to prevent failure during operation of stop-beams and, 2) reshaping of the plunge pool downstream of the dam to limit scouring and erosion that could potentially undermine the dam foundations, leading to dam failure.

Spillway Gates

14. The dam has six submerged spillway gates (9.1 m height and 8.8 m width) with the total discharge capacity of 9,000 cubic meters per second. The ZRA conducted refurbishment and upgrading of the operational system of the downstream flood gate including SCADA introduction in early 1990s. In particular, Alkali Aggregate Reaction (AAR) has swollen the concrete wall of the gate inspection chamber along which the spillway flood gates are stored. The clearance between the flood gates and concrete wall was significantly reduced to the extent that gate operation was negatively affected. ZRA scraped the swollen concrete wall and placed new concrete with steel mesh and fine surface finish in 1994-1995. It is reported that the flood gate does not have specific operational problems for now, but continuous careful monitoring is needed. It should be also mentioned that the flat caterpillar gates hoisted by cables tends to be susceptible to jamming compared to radial gates by hydraulic pressure cylinder under such a relatively high water pressure condition (surcharge level at 488.5 masl and spillway sill at 455.40 masl).

15. It should also be noted that the concrete swollen phenomenon caused by AAR raised the crest level of the dam up to 75 mm and shifted the dam structure up to 30 mm to the upstream as per the 5-year inspection report. The top of the gate piers also widened to both abutment directions by around 25-30 mm. The AAR expansion rate has gradually decreased, and the estimated remaining expansion potential is not considered to reach critical values to affect the structural safety of the dam according to the design consultant and an additional expert review. ZRA will however continuously conduct close monitoring and take precautionary measures if required.

16. In connection with the downstream flood gate, the ZRA expressed strong concerns over the limited function of the upstream stop beam for the downstream flood gates inspection and emergency use. The stop beam can be closed only under water balanced condition with the downstream flood gate closed. This means that there is no way to stop water flow if the downstream flood gate is jammed and cannot be closed at the opening position. The water level may go down to the sill level of the spillway at 455.40 meters above sea level (masl), well below the minimum operation level at 484.15 masl before the gates can be repaired. If this happens, it could take more than a year to restore the water level to the normal operational level, given the live storage volume of 64.5 km³ vis-à-vis the average annual runoff volume of around 43km³/year.

17. There is also a possibility that the gates could be jammed in the middle position and could not be fully opened when required to be opened during large floods. The concrete pier of the stop beam has shown cracks by ARA concrete swelling and distorted built-in parts for gate groove. Concrete reinforcement is lacking in built-in parts areas, and concrete in lintel has been eroded by cavitation. ZRA thus plans to upgrade the current stop beam (composed of 6 pieces) to a fixed roller gate which has independent opening/ closing function irrespective of downstream gate position/flow condition. The gantry crane also needs to be replaced with one of higher capacity in order to operate the new emergency gate under water flowing condition.

Plunge Pool

18. The plunge pool condition has also constrained the operation of the spillway flood gates. Currently, the dam can open only three out of the six flood gates (no adjacent gates but alternate ones) due to excessive scouring and erosion of the plunge pool over 50 years of operation. The free fall water from the spillway has scoured the plunge pool much deeper (around 80 m depth from the foundation level) than anticipated in the original plan, which could possibly progress to the upstream toe area of the dam and affect the foundation rock supporting the dam. It should be noted that the spillage has occurred more frequently since the year 2000 after almost no spillage periods in 1980s and 1990s, and it is possible that the dam would be forced to open all six gates in the case of very large floods.

19. The design consultant has studied the scouring phenomena using a 3D fine element model (FEM) numerical simulation model and physical hydraulic model in comparison with survey results. It also predicted the progress over the next 50 years and checked the effects of intervention works. Based on comparison of various options, the ZRA and the design consultant have chosen to reshape the plunge pool by excavating the downstream side of the pool in the amount of around 300,000 m³ to reshape the plunge pool slope in a stepped shape to increase the energy dissipation and guide the fallen flow to the downstream direction in a smoother manner.

20. It should be noted that fault/weak seam zones run through the center of the dam foundation and plunge pool. These areas have been greatly affected by scouring forces and would require additional protection works, such as a concrete slab along with anchoring, grouting and drainage works. Also, lowering the water level in the plunge pool during excavation works might affect the balance of pore water pressure and destabilize the slope of both banks where sub-horizontal joints and seams are reported. Additional geotechnical investigations will be undertaken for checking the weak zone and rock property values. Also, careful monitoring of the site condition, such as piezometer level and movement of the slopes will be conducted. The operational

procedure of rock blasting works and vibration monitoring would also be carefully designed and executed so as not to cause any negative impacts on the dam and power plants.

21. The foundation of the dam is mainly composed of sound rock (gneiss), but the upper south (right) abutment area in Zimbabwe side contains weathered gneiss and quartzite with micaceous seams, where four concrete thrust blocks/ foundation buttresses were added to stabilize the abutment in 1962. Several drainage adits at different levels were built in successive stages over the years, and a variety of works has been undertaken to stabilize the slope with monitoring devices. The weathered rock zone is not considered to continue to the fault/weak seam zones at the foundation and plunge pool; this however, will be confirmed by additional geotechnical investigations. Any signs of slide and creep would also be closely monitored on both abutments.

Component 1: Institutional Project Support (estimated cost US\$69.6 million)

22. This component would be co-financed by IDA, Sweden and the African Development Bank through a combination of joint co-financing and parallel co-financing of individual activities. Financing under this component would be used for: (i) consultants services; (ii) goods, equipment and non-consulting services; and, (iii) operating costs associated with enhanced project implementation, management and monitoring. Activities to be financed include the following.

- a) **Technical Services and Supervision (TS&S) Consultant.** This consultant will be jointly co-financed by the ADF and IDA for the duration of the project (10 years). The TS&S Consultant will serve as the Owner's Engineer during the civil works contracts and integrate the works schedule. The scope of work of the TS&S Consultant will include a review and confirmation of the initial design work carried out to date, assisting the ZRA in finalization of the tender documents, as well as supervision of the works during implementation and the defects liability period. The TS&S Consultant's scope will also include the supervision of the contractors' compliance with the Health & Safety Plan and Environmental and Social Management Plan.

The consultants are on the critical path and need to be appointed before the commencement of the civil works. The ToRs have been finalized, and a short-list of consultants is foreseen to be established in time to enable the RFP to be issued by December 2014. The consultant is expected to be contracted by April 2015.

- b) **Panel of Experts (PoE).** The independent Panel of Experts would comprise several individual consultants, each with considerable experience in the rehabilitation of large dams. The financing for the individual consultants will be co-financed by the AfDB and IDA. The independent PoE is expected to visit the site at least twice a year for a period of two weeks, at minimum, and will review and assess the program in order to provide advice to the ZRA on the Kariba Dam Rehabilitation project, as well as the future development of the Batoka Gorge Hydro-Electric Scheme. The studies for the Batoka Gorge HES are being undertaken in parallel through a grant from the multi-donor trust fund for Cooperation in International Waters in Africa (CIWA), administered by the World Bank.

The composition of the PoE will change during implementation, depending on the specific needs at the time, but will include the following expertise:

A. Dam Safety

- i) Concrete and Dam Safety Expert (Chair);
- ii) Hydrology and Hydraulics Expert;
- iii) Geotechnical Expert;
- iv) Hydro-Mechanical Expert;

B. Environment and Social

- v) Environmental Management and Rehabilitation Expert; and,
- vi) Social Development and Resettlement Expert.

The ToRs for the PoE Dam Safety have been discussed and agreed. The procurement of the four individual technical experts has been initiated to enable a first site visit and review of the design reports, and work plans for the civil works in January 2014. The PoE Environment and Social are planned to be procured to enable review of the ESIA and to advise the ZRA on implementation of the Kariba Dam Rehabilitation Project along with the development of the Batoka Gorge HES.

- c) **Dispute Adjudication Board.** The Dispute Adjudication Board would be an impartial and independent panel consisting of at least three individuals selected to provide decisions on any disputes between the Contractor/s and the ZRA as the Employer. The DAB would also be available to provide non-binding advice and opinions on any matter relevant to the various works contracts. The financing of the consultants for the DAB will be co-financed by the AfDB and IDA.

The main function of the DAB would be to periodically visit the site in order to familiarize with the details of the project; keep up to date with activities, progress, developments and any issues at the site; and encourage the resolution of disputes by the parties. If and as when a dispute is referred to the DAB, the members of the panel would hold a hearing, complete deliberations and prepare a decision in a professional and timely manner. With the agreement of the parties, the DAB would also be available to provide non-binding advice and opinions on any matter relevant to the various works contracts.

- d) **Environmental and Social Assessment.** This consultant will be financed by IDA. The ESIA is required by the national environmental authorities and the financiers prior to the commencement of the civil works. The Environmental and Social Service Provider currently undertaking the ESIA for the Batoka Gorge HES was appointed through a competitive procurement process in accordance with World Bank Guidelines and has been appointed on a fast track, single source basis to accelerate preparation of the necessary environmental and social instruments for the Kariba Dam Rehabilitation Project.

The proposed approach is intended to ensure economic efficiency through synergies between the two assignments, given the environmental and social baseline conditions are expected to be similar for both projects. This also affords ZRA the opportunity to leverage synergies relating to the review of the Zambezi Valley Development Fund (ZVDF), having a single stakeholder process and coordinated communication mechanisms, as well as facilitating the identification of any potential cumulative or related impacts that might exist between the Batoka and Kariba dam programs.

The ToRs for the ESIA have been subject to a series of public consultations in locations around the dam, reservoir and downstream areas. The Contract has since been signed and

the ESIA is due to be prepared over the next 5 months, with the first draft January 2015 and so well in advance of any civil works.

- e) **Dam Break Analysis.** A separate detailed dam break analysis will be conducted to inform the future emergency preparedness for all operators and national authorities in the Zambezi River. This is to be financed by Sweden. The Request for Proposals (RfP) for the dam break analysis has been issued and will include an analysis of the consequences of the unlikely event of a dam breach of the Kariba Dam. The analysis will determine the extent of flooding in downstream river stretches and the effects on downstream infrastructure, most notably the Cahora Bassa Dam. The results will provide the basis for updated emergency preparedness plans, including inundation mapping and identification of vulnerable downstream settlements.

The dam break analysis will further include a review of the computed historical design flood for Kariba in the scenario of potential climate change. The analysis will cover the downstream flooding simulation with return periods of 100, 200, 500, and 1,000 years in order to prepare required emergency action plans for large spillway discharges without involving dam break. The review will be informed by updated historical hydrological data and the latest Intergovernmental Panel on Climate Change (IPCC) climate change predictions for southern Africa. The results will inform the need for updating the future operation of the Kariba Dam. The 2001 flood, with its peak discharge of 8,000 cubic meters per second, caused displacement of around 500,000 people and an estimated 150 fatalities with around 100,000 ha flooded in Mozambique alone.

The objective of the dam break analysis is to conduct a comprehensive assessment of the potential consequences of a partial or full dam breach within the Zambezi River Basin. The specific objectives are to:

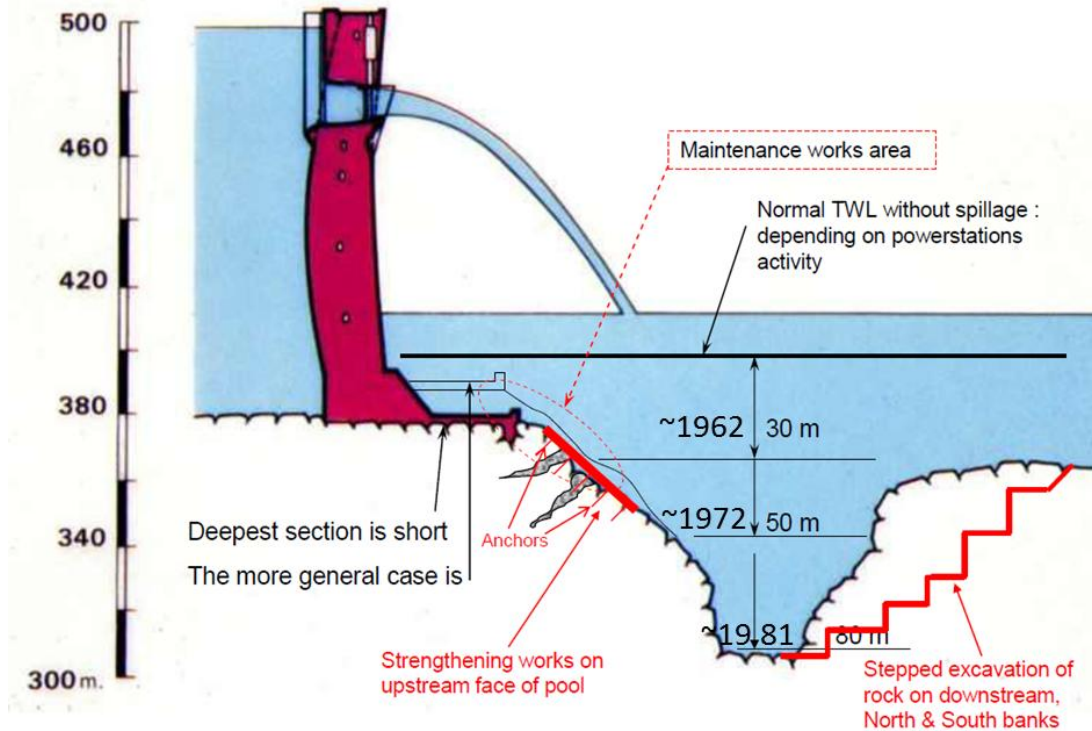
- Analyze potential flood hydrographs from plausible dam breach scenarios for the existing dams in Zambezi and Kafue rivers;
- Route such floods through the downstream river stretches to assess impacts and potential subsequent damage or breach of downstream dams;
- Identify the need for and carry out additional detailed topographical surveys for selected river stretches and flood-prone areas; and,
- Produce flood inundation maps and characteristics for floods generated through malfunctioned dam operations or dam failures.

- f) **Audits, Evaluations and other Studies.** In the event needed, these will be co-financed in parallel by ADF and IDA in accordance with the respective policies of the individual development partners. Where possible, and subject to approval from each of the respective financiers, audits will be undertaken jointly and as part of an extended scope within ZRA's existing arrangements.

Component 2: Plunge Pool Reshaping (estimated cost US\$100.0 million)

23. This component would be financed by the European Development Fund (EDF11) in parallel to the implementation of the other components as part of the Kariba Dam Rehabilitation Project. Financing under this component would be used for: (i) goods, works and non-consulting services; and (ii) consultants services. Activities to be financed include the following.

a) **Plunge Pool Reshaping Civil Works Contract.** An 80 m deep scour hole has formed in the bedrock immediately downstream of the dam foundations over the past 50 years. Fault/shear zones crossing the dam foundation and plunge pool have been greatly affected. In order to control scouring, ZRA has introduced a rule not to open more than three spillway adjacent gates out of six, but could be forced to open all gates in the case of very large floods. This work is unprecedented in dam history and is urgently needed to prevent any potential further regression and protect the dam from catastrophic failure due to lack of foundation support.



24. The measures are required to reshape the plunge pool through excavation of the downstream face and north and south bank sides of the pool. An estimated volume of 300,000 m³ of rock is required to be excavated from the plunge pool resulting in a stepped profile to increase the energy dissipation and guide the spilling water in the downstream direction, away from the dam foundations. A 3D FEM model has been established to assess how the plunge pool scouring progress and excavation works would affect the stress field of the dam foundation. Further geological investigations will be undertaken to assess the fault/weak zones at the foundation and sub-horizontal joints/seams of the plunge pool banks by January 2015 under the guidance of the POE so that TSSC would reflect the results in the final detailed design/ bidding documents.

25. The plunge pool work will be conducted during the periods of low inflow when there is no risk for spill through the spillway gates between May and November (7 months). This will allow power production to proceed without interruption during the rehabilitation work. A downstream cofferdam will be constructed just upstream of the tailwater outlets to enable the plunge pool to be drained in between the flood season and so that excavation and protection of the rock can be conducted. Stop beams of the cofferdam will be removed during the 5 months flood season. With this work plan the time schedule is three years to complete the rehabilitation.

26. The plunge pool work will be conducted as a traditional contract arrangements, with the Technical Service & Supervision Consultant (Owner's Engineer) having the responsibility for the Detailed Design and Supervision. The TS&S Consultant will review and approve all method statements, construction, drawings, etc. proposed by the Contractor(s) for permanent and temporary works to ensure conformity with construction contracts and that the work can be carried out safely and in accordance with recognized and accepted practices.

b) Additional Engineering Studies. The EDF proposal includes a provision for engagement of independent consultants as needed during implementation.

c) Monitoring Services Contract. Engagement of a consultant to provide factual reporting following regular site visits, including findings with regard to the organizational, technical, contractual and financial aspects and results achieved during the implementation.

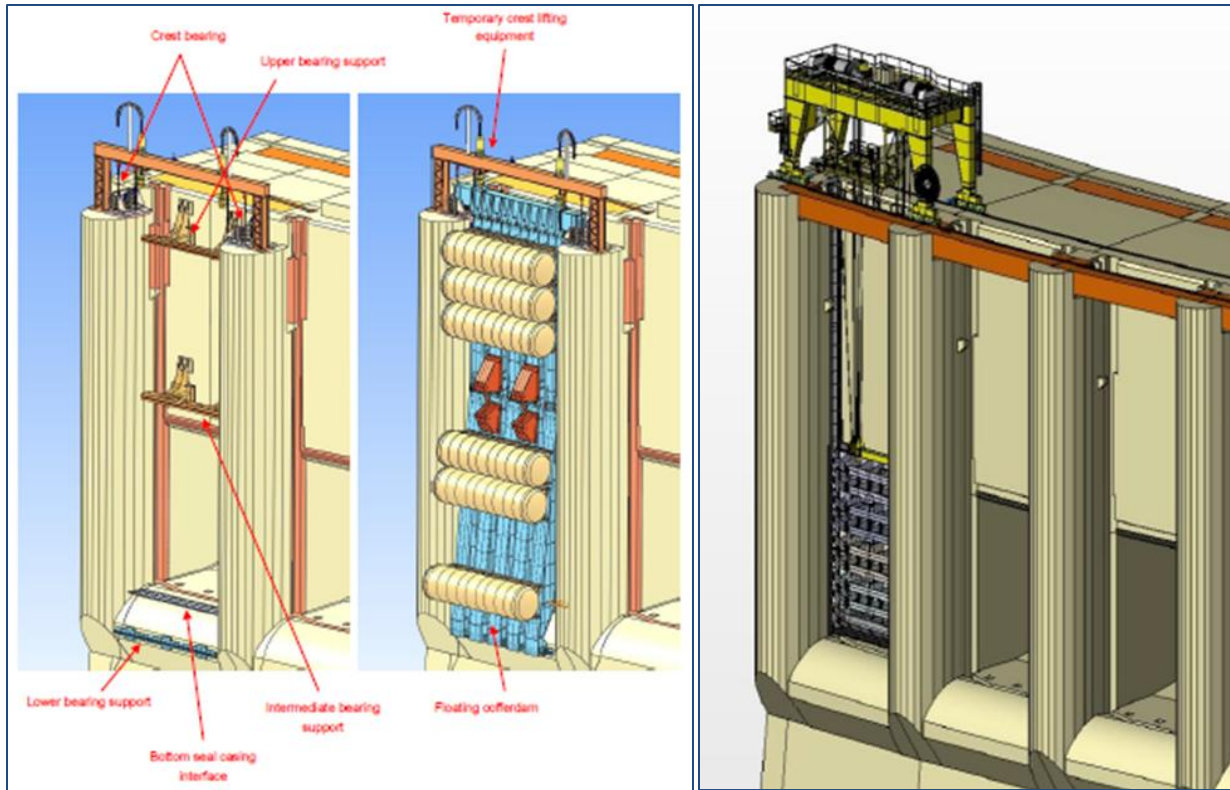
d) Visibility & Communications. This will be financed by the EDF during the implementation of the works for the Plunge Pool. The details of the activities to include are to be worked out jointly by the media/communications staff of ZRA, AfDB, EU, Sweden and World Bank.

Component 3: Spillway Refurbishment (estimated cost US\$124.6 million)

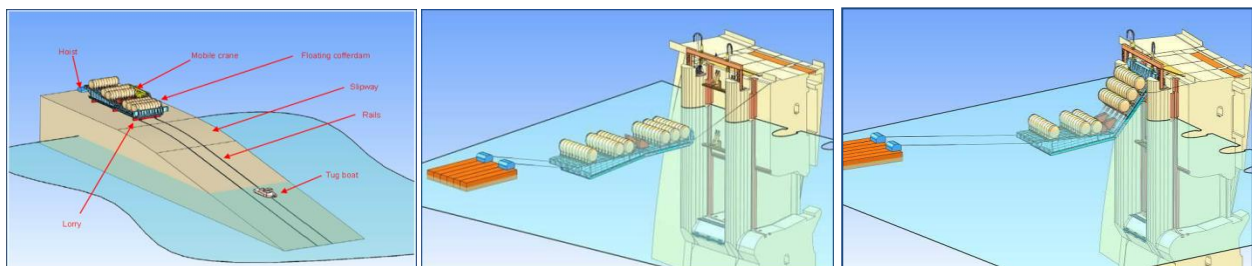
27. This component would be co-financed in parallel to the implementation of the other components as part of the Kariba Dam Rehabilitation Project by the African Development Bank and the World Bank for the full duration of the project and by Sweden for the first five years up to an amount of US\$ 15 million. Financing under this component would be used for: (i) goods, works and non-consulting services associated with the refurbishment of the spillway. Activities to be financed include the following.

a) Spillway Refurbishment Contract (Supply and Installation of Hydro-Mechanical Equipment including associated civil works). This will include capital expenditures related to the design, fabrication and installation of an emergency gate and a new gantry, with refurbishment of associated civil works, including replacement of secondary concrete, stopbeams, and built-in-parts, aimed at preventing failure of the spillway control facility.

28. The works will be conducted at one gate at a time, in a sequenced manner starting with the gates that today show the largest need for rehabilitation. Because the spillway gates are located below the minimum operating levels, the works will have to be made without emptying the reservoir, in order to continue operating the power stations. Rehabilitation works will be enabled through a floating cofferdam that will enable draining an area surrounding one gate at a time, with the exception of No 2 gate where the cofferdam will be built using stop beams along additional grooves in the protruding concrete pier. To secure management of an extreme flood during the works, temporary operation rules will be applied during the construction period that will make the remaining five gates sufficient for discharging a design flood. As an additional safety margin the cofferdam can be removed in short notice to allow all six gates to operate. With this construction procedure, it will take around 8 years for completing the works, including the site preparation, floating cofferdam fabrication and slip way construction.



29. Roughly 70 percent of the financing, including the 60% of the IDA resources and 100% of the Swedish Grant, will be disbursed in the first five years to support construction of the floating cofferdam and allow the works to be carried out during the following six years. The civil works will consist of replacing deteriorated concrete due to cavitation and AAR with sufficient reinforcement and built-in structures for the grooves, sills and lintels to allow the new emergency fixed roller gate and stop beams to be lowered and raised without jamming. The 55 year old stop beams will be replaced.



30. To further improve the safety level of the Kariba spillway system, the new emergency gate will allow closure of the upstream gates in case a downstream flood gate is jammed in open position during spill. A new gantry crane at the upstream gates will be installed to allow the emergency gate to be transported and lowered at any of the six upstream gates in such an emergency situation. The downstream flood gate could also be jammed in the middle position, constraining the spillway discharge capacity; the new emergency gate would allow smooth fixation of the downstream gate under such a situation. The downstream flood gate is a flat caterpillar type operated by cables hoisting, which is more susceptible to jamming compared to

radial gates operated by hydraulic pressure cylinder, under more than 30m hydraulic head. Close monitoring and regular maintenance of the downstream gate will be undertaken.

31. The spillway works will be conducted by a contractor for supply and installation of hydro-mechanical equipment (goods) including associated civil works. A joint venture is expected between the equipment supplier and the civil work contractor. The Technical Service & Supervision Consultant (Owner's Engineer) will prepare the Detailed Design and tendering documents, and review and approve all method statements, construction drawings, etc. including variations proposed by the contractor to ensure conformity with construction contracts and that the work can be carried out safely and in accordance with recognized and accepted practices.

32. **Additional Engineering Studies.** These would be financed jointly by the African Development Bank and the World Bank and include the procurement of independent engineering consultants on an as need basis during implementation to support the works.

Project Financing, US\$ million

	Project Cost	ZRA	EDF	AfDB ADF		AfDB FSF		IDA		Sweden
				National	Regional	National	Regional	National	Regional	
1. Institutional Project Support	69.6	19.2	0	4.3	6.2	3.2	6.5	6.7	13.5	10.0
2. Plunge Pool Reshaping	100.0		100.0							
3. Spillway Refurbishment	124.6			11.7	16.8	8.8	17.5	18.3	36.5	15.0
Total Costs	294.2	19.2	100.0	16.0	23.0	12.0	24.0	25.0	50.0	25.0

Project Financing, %

	Project Cost	ZRA	EDF	AfDB ADF		AfDB FSF		IDA		Sweden
				National	Regional	National	Regional	National	Regional	
1. Institutional Project Support	24	28	0	6	9	5	9	10	19	14
2. Plunge Pool Reshaping	34	0	100	0	0	0	0	0	0	0
3. Spillway Refurbishment	42	0	0	9	14	7	14	15	29	12
Total Cost (% of Costs)	100	7	34	5	8	4	8	8	17	9
Total Cost (US\$ M)	294.2	19.2	100.0	16.0	23.0	12.0	24.0	25.0	50.0	25.0

ANNEX 3: IMPLEMENTATION ARRANGEMENTS

AFRICA: Kariba Dam Rehabilitation Project

Project Institutional and Implementation Arrangements

1. The Kariba Dam Rehabilitation Program will be implemented by the Zambezi River Authority (ZRA). The ZRA is a statutory body jointly owned by the Governments of Zambia and Zimbabwe. The ZRA came into being on October 01, 1989 as a result of parallel legislation tabled before the parliaments of the Republics of Zambia and Zimbabwe. This followed the reconstitution of its predecessor, the Central African Power Corporation (CAPCO). The generating assets were subsequently handed over to the two national power utilities, the Zambia Electricity Supply Corporation (ZESCO) and the Zimbabwe Power Corporation (ZPC). These two utilities now account for about 90 percent of ZRAs revenue. The ZRA has responsibility for the operation and maintenance of Kariba Dam Complex, investigation and development of new dam sites on the Zambezi River and analysis and dissemination of hydrological and environmental information pertaining to the Zambezi River and Lake Kariba.

2. The ZRA is governed by a Council of Ministers consisting of four members from the two contracting states. The common Ministries in the council are those responsible for Energy and Finance. In terms of the Zambezi River Authority Acts, the Council of Ministers gives direction, through the ZRA Board of Directors, to the Authority to ensure the most efficient use of the Zambezi River and any other infrastructure developed on it. The Council may also prescribe anything which in its opinion is necessary or convenient for the better exercise of the functions of the ZRA.

3. The ZRA has four main strategic functions, which are outlined in the schedule to the Zambezi River Authority Acts Nos. 17 and 19 of 1987 of Zambia and Zimbabwe, respectively. These are:

- (a) In consultation with the national electricity undertaking, investigate the desirability of constructing new dams on the Zambezi River and make recommendations thereon to the Council;
- (b) Subject to the approval of the Council, construct, operate, monitor and maintain any other dams on the Zambezi River;
- (c) Make such recommendations to the Council as will ensure the effective and efficient use of waters and other resources of the Zambezi River; and,
- (d) Submit development plans and programmes to the Council for approval.

Project Administration Mechanisms

4. **The implementation structure for the Kariba Rehabilitation Project** as directed by the Council of Ministers includes the following: i) A Project Steering Committee; ii) a Resource Mobilization Committee; and, iii) Projects and Dam Safety Section Team. The composition and functions of these are detailed below.

5. The Project Steering Committee is responsible for the following:

- (a) endorsing all Project plans and budgets;

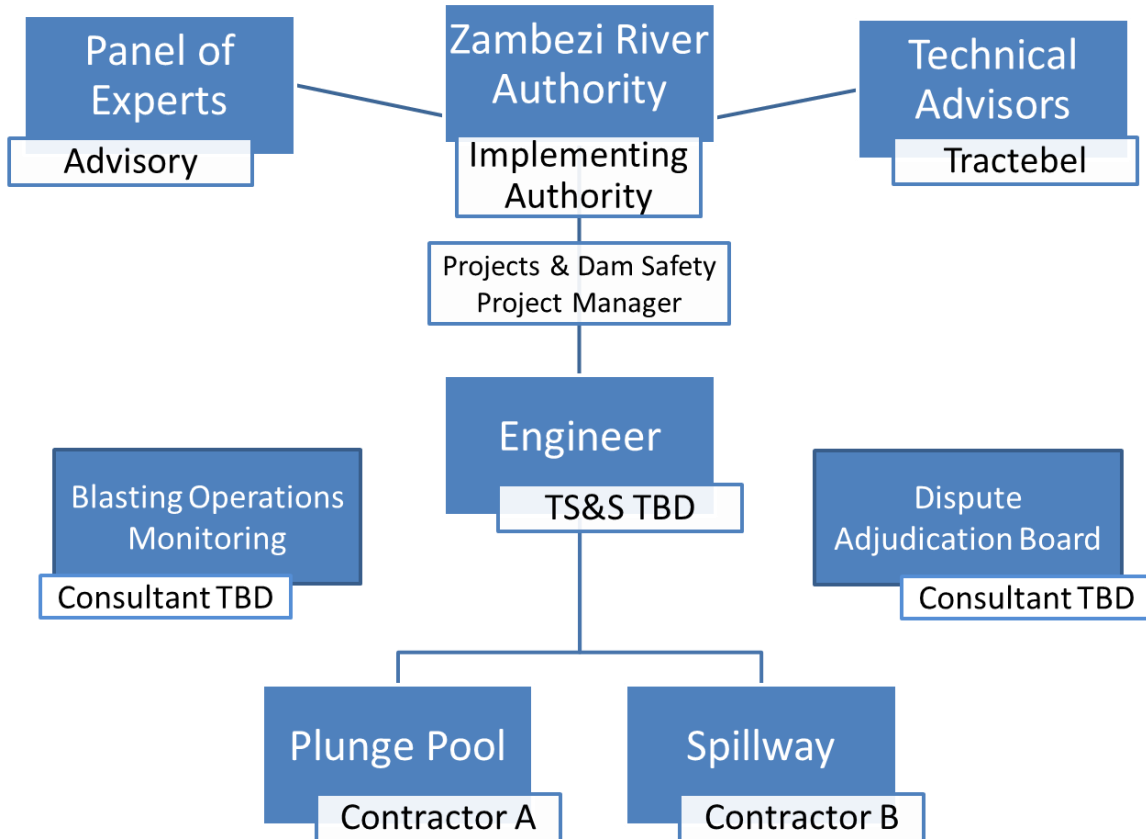
- (b) facilitating communication between Contracting States and coordinating all inter-governmental matters;
- (c) facilitating obtaining consents, permits and approvals required from the Contracting States;
- (d) facilitating the integration of the Project into the national plans and public sector investor programs of Contracting States; and,
- (e) providing overall strategic guidance over the implementation of the Project.

6. The Projects and Dam Safety Section Team is made up of ZRA's Engineering Projects and Dam Safety Section and other members including Communication, Financial Management and Procurement will be responsible for development and coordination of the overall project. The team is chaired by the ZRA Chief Executive and the ZRA Projects and Dam Safety Manager serves as the overall Project Manager. The functions of the team are:

- (a) Develop, coordinate and facilitate the implementation of the overall project plan;
- (b) Promote the project to all key stakeholders;
- (c) Provide secretarial services to the Project Coordinating Committee;
- (d) Propose resources required for project execution;
- (e) Provide adequate human resources to meet project objectives and;
- (f) Facilitate the implementation of an effective communication Strategy

7. The ZRA will be supported in implementation of the Kariba Dam Rehabilitation Project by continued service of the Technical Advisors. Tractebel Engineering is an international engineering firm which specializes in large dam projects and has been appointed by ZRA through their own resources. The firm is the designer of record and has continued to provide technical advice on operation and maintenance. Implementation will benefit further from an independent Panel of Experts, which will provide review and advisory functions during implementation, and a Dispute Adjudication Board, which will be appointed prior to commencement of the works.

8. A Technical Services and Supervision Consultant (TS&S) will be responsible for confirming the design criteria, reviewing the design reports and drawings, assisting the ZRA in preparation and implementation of the tendering processes, and supervision of the works, including final commissioning after the defects period. The TS&S Consultant will be further responsible for ensuring integration of both works contracts. The works themselves will be executed through two large works contracts for the plunge pool and the spillway, respectively.



Project Legal Arrangements

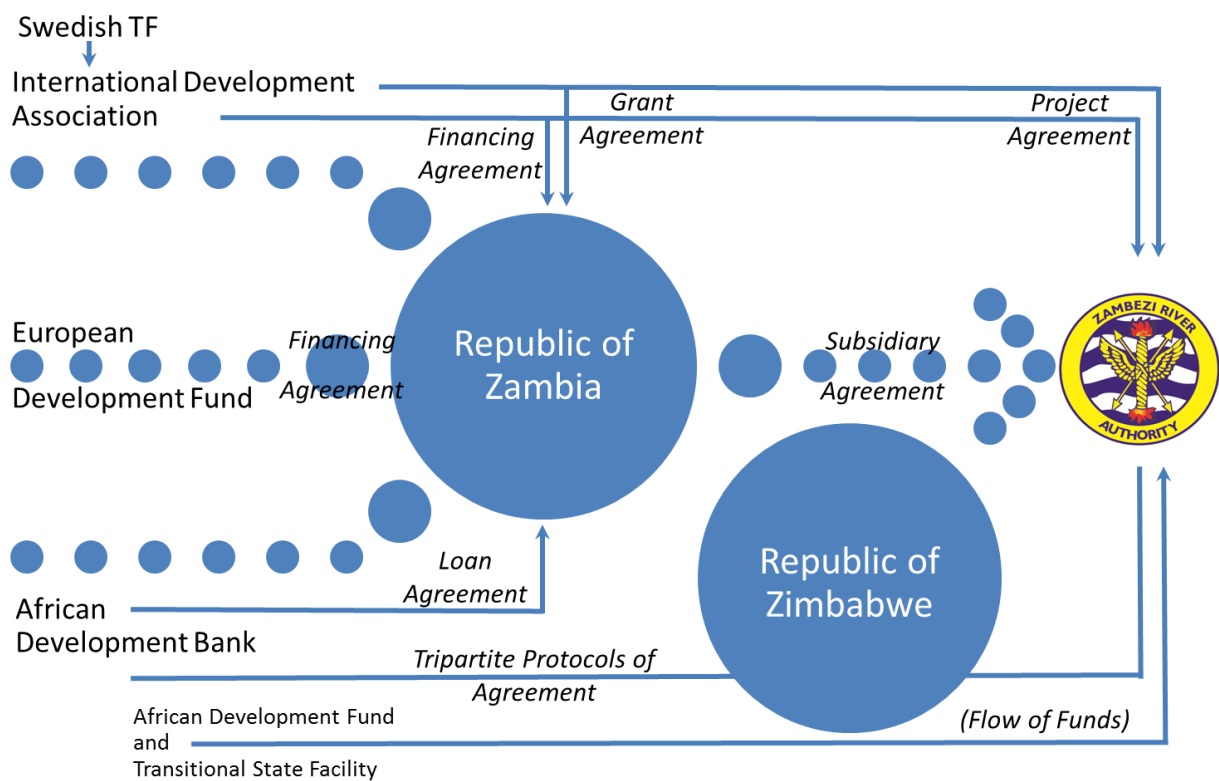
9. The World Bank financing will be provided through the International Development Association. IDA will enter into a Financing Agreement between the Association and the Republic of Zambia, a Project Agreement between the Association and the ZRA, and there will be a Subsidiary Agreement between the Republic of Zambia and the ZRA.

10. The Grant co-financing from Sweden is to be provided through a stand-alone, hybrid trust fund that is capable of supporting both Recipient Executed (i.e. ZRA) and Bank Executed activities. The co-financing is fully blended with the IDA resources to ensure that the resources are processed in parallel and not resulting in delays to the processing schedule. The Trust Fund has been established within the World Bank system and there will be a Grant Agreement between the Republic of Zambia and the Bank as administrator of the Swedish trust fund and a Project Agreement between the Bank and the ZRA. The funds will be passed on to ZRA through a Subsidiary Agreement between the Republic of Zambia and ZRA

11. The African Development Bank Group will provide financing through the African Development Fund (ADF), the Transitional State Facility and the regional resources envelope as indicated above. A loan agreement will be signed between the Republic of Zambia and the ADF. An on-lending agreement will be signed between the Republic of Zambia and ZRA setting out the terms and conditions pursuant to which the proceeds of the ADF's loan to Zambia will be on-lent to ZRA for purposes of the project.

12. With respect of Zimbabwe, (i) a protocol of agreement will be entered into between the Republic of Zimbabwe and the ADF for the resources from the regional operations envelope and (ii) a protocol of agreement will be signed between the Republic of Zimbabwe and the AfDB and the Fund for the TSF resources. An implementation agreement will be signed between the Republic of Zimbabwe and ZRA, which will set out the arrangements for ZRA to implement the project and undertake financial management of the grant resources on behalf of Zimbabwe.

13. The European Union funds to be provided through the 11th European Development Fund National Indicative Programme for Zambia will be governed by the provisions of the Cotonou Agreement. The EU will enter into a Financing Agreement with the Republic of Zambia. There are no other formal legal agreements with provisions for implementation of the project supported by the Protocol Regarding the Kariba Dam Rehabilitation Project signed by both Zambia and Zimbabwe (the Contracting States) in July / August, 2014.



14. A Protocol Regarding the Kariba Dam Rehabilitation Project has been signed by the Council of Ministers, including the Ministers responsible for Finance and Energy from both of the Contracting States, in June/July 2014. The Protocol will form an integral part of the overall legal framework for the implementation of the project and provides that the Republic of Zambia and the Republic Zimbabwe agree to the following:

- a) The Project is of high priority to the Contracting States and each Contracting State declares that it has no objection to the Project.
- b) The Contracting States shall afford all reasonable opportunity to the representatives of the International Development Partners and all consultants and personnel involved in the implementation of the Project to visit any part of their respective territories for purposes related to the Project, and shall ensure and facilitate the free and unhindered movement

between and within their respective territories of goods, including motor vehicles, equipment, apparatus, vessels and aircraft required for the Project.

- c) The Contracting States shall comply with all environmental and social safeguards requirements under the Project including any safeguard instruments to that effect.
- d) The Contracting States undertake to exempt, on a high priority basis, from the payment of import and excise duties, taxes and other equivalent charges levied on goods, works, non-consulting services and consultants' services required for purposes of the Project.

Financial Management, Disbursements and Procurement

Financial Management

15. A financial management assessment of the Zambezi River Authority (ZRA), the implementing entity, was carried out in accordance with the Financial Management Manual for World Bank-Financed Investment Operations, issued by the Financial Management Sector Board on March 1, 2010 and the Operational Risk Assessment Framework (ORAF) Financial Management Draft Interim Guidance Note issued by the AFTFM unit on September 30, 2010 as part of the preparations for the CIWA Grant for the Batoka Gorge Hydro-Electric Scheme. This assessment was carried out in May 2014 and was updated in August 2014 as part of the joint appraisal by the African Development Bank and the World Bank.

16. The objective of the assessment was to determine whether the implementing agency, ZRA has adequate financial management arrangements, to ensure that: (1) the funds are properly accounted for and used only for the intended purposes, in an efficient and economical way; (2) capability exists for the preparation of accurate, reliable and timely periodic financial reports; (3) internal controls exist which allow early detection of errors or unusual practices as a deterrent to fraud and corruption, (4) the assets are safeguarded. This FM assessment was carried out jointly between the Bank and African Development Bank Financial Management Specialist. The results of the review are documented below.

17. The overall conclusion of the assessment was that the ZRA, which will be in charge of administering the Credit, satisfies the financial management minimum requirements as per the Bank's OP/BP 10.0. The risk rating for the ZRA financial management arrangements has been assessed as Moderate.

Risk Assessment and mitigation

18. The overall financial management residual risk rating for the ZRA is assessed as Moderate. The table below summarizes the risks identified, the risk rating and mitigating measures, if any.

Risk	Initial Risk Rating	Risk Mitigating Measures	Residual Risk Rating
Inherent Risk			
Country Level.	N/A	<ul style="list-style-type: none"> • ZRA is a body corporate established by an Act by two states, Zambia and Zimbabwe. ZRA operates as an independent body. 	N/A

Risk	Initial Risk Rating	Risk Mitigating Measures	Residual Risk Rating
Entity Level: ZRA lacks experience with implementing projects financed by Development Partners and therefore is unfamiliar with the disbursement procedures.	M	<ul style="list-style-type: none"> The project will be closely supervised by a joint team from the AfDB, EU and IDA and the use of funds will be strictly monitored through the quarterly submission of interim financial reports, which should be adequate to detect any funds diversions. Accounting staff in ZRA have been trained in financial management and disbursement arrangements in IDA assisted projects. 	M
Project Level: The nature, size and design of the project.	M	<ul style="list-style-type: none"> The activities to be funded have been clearly identified and are fully supported by the procurement plan as well as identifiable codes in the entity's accounting system and therefore will be easy to monitor. 	L
Overall Inherent Risk	M		M
Control Risks			
Budgeting: Lack of enough details and a system to monitor budget performance.	M	<ul style="list-style-type: none"> The total project cost will be fully allocated and budgeted for and all activities will be identified and supported by an approved procurement plan before implementation and any budget variations will require prior approval by AfDB, EU and IDA. Quarterly interim financial reports that will include comparisons of budget to actual with explanations for variations will be a requirement for reporting purposes. 	L
Accounting: Inadequate staff capacity to perform project accounting functions.	M	<ul style="list-style-type: none"> The accounting functions of the project will be stream lined within the accounting department of ZRA which will ensure existence of adequate segregation of duties and counter checking of transactions by other staff. ZRA has adequate numbers of qualified and experienced accounting staff at higher levels who are able to supervise the lower 	L

Risk	Initial Risk Rating	Risk Mitigating Measures	Residual Risk Rating
		<p>level technicians who are not technically qualified but have the necessary experience</p> <ul style="list-style-type: none"> • ZRA will put in place a plan to upgrade the skills of the accounting technicians • ZRA has an Accounting and Financial Procedures Manual which if properly enforced will reduce the risk. 	
<p>Internal Control: Weak control environment resulting from poor enforcement of procedures.</p>	M	<ul style="list-style-type: none"> • An Accounting and Financial Procedures Manual exists, to provide guidance to staff. • ZRA internal audit functions exist and are adequately staffed with a qualified Chief Internal Auditor who is assisted by an Internal Auditor. Internal auditors to undergo financial management and disbursement training for internal auditors in development funded projects 	L
<p>Funds Flow: ZRA does not have experience with the various disbursement procedures.</p>	M	<ul style="list-style-type: none"> • Training will be provided to ZRA staff in disbursements under AfDB and IDA assisted projects. 	M
<p>Financial Reporting: Untimely submission of the financial reports due to lack of experience with the various reporting requirements.</p>	M	<ul style="list-style-type: none"> • Accounting staff in ZRA have been trained in financial management and disbursement arrangements in IDA assisted projects, which includes financial reporting. • The quarterly financial reports formats & contents and the reporting timetables will be agreed with ZRA in advance. 	L
<p>Auditing: Unacceptable audit and untimely submission of the audit reports and lack of follow up on audit findings.</p>	L	<ul style="list-style-type: none"> • ZRA is up to date with the external audit reports and in the past three years unqualified audit opinions have been given; • The Bank will synchronize annual auditing requirements with those of co-financiers and ZRA's own annual audit to reduce reporting burden on ZRA to help facilitate 	L

Risk	Initial Risk Rating	Risk Mitigating Measures	Residual Risk Rating
		timely submission.	
Overall control risk:	M		L
Overall risk rating:	M		L

H-High S-Substantial M-Moderate L-Low

Strengths and Weaknesses

19. The main strength identified is that the project will use the existing financial management arrangements at ZRA including staff, financial regulations and procedures. The accounting system is computerized through the use of tested SUN Accounting software and the existence of a strict entity's reporting deadline, leading to timely completion of annual auditing. The ZRA Finance Director will have overall responsibility for the project's financial management. The weakness identified is the lack of qualified technicians at the lower levels. It is recommended that ZRA should come up with a plan to upgrade the accounting skills of its technical staff.

Budgeting

20. ZRA will budget for all its expenditures under the project using its own budgeting system in such detail as to allow for regular and effective implementation monitoring of all the activities to be funded. The total project cost will be agreed upfront with the Recipient and any variations will need prior approval by IDA.

Accounting

21. The ZRA will follow its existing accounting policies and use the existing Sun Accounting System to record and report on the project transactions. The Sun System is a tested reliable accounting.

Internal Control and Internal Auditing

22. **Staffing.** The Finance Director at ZRA will have overall responsibility to account for the funds using the existing accounting staff. The accounting functions will be mainstreamed in the accounting department, so that no one individual staff performs all project functions, to ensure adequate segregation of duties. All the accounting staff have job descriptions that define their functions.

23. **Internal Controls.** ZRA will apply the procedures as stipulated in the existing financial and administrative manuals.

24. **Internal Audit.** ZRA has an internal audit department that is adequately staffed with a qualified Chief Internal Auditor assisted by an Internal Auditor. However, there is a need to facilitate training in World Bank financial management and disbursement procedures.

Financial Reporting

25. The project will produce, on a quarterly basis, unaudited interim financial reports (IFRs) to manage and monitor the use of the funds. The IFRs should at the minimum show a statement of sources and uses of funds, with the uses of funds analyzed by activities, comparing actual expenditure with budget. The quarterly reports to be submitted to the development partners 45 days after the end of the quarter. The synchronized formats and contents of the IFRs (between the Bank and AfDB) were discussed and agreed with ZRA during appraisal.

Funds Flow and Disbursement Arrangements

26. All payments for activities to be financed by the Bank under the Kariba Dam Rehabilitation Project will be made using the Direct Payment method where the Bank will pay contractors/suppliers and consultants directly. Disbursements will be made upon preparation and submission of all appropriate documents by ZRA with the Ministry of Finance to the Bank. Therefore, no special account would be opened by the project. Other methods of disbursing to the Project will include reimbursements and use of special commitments (e.g., letters of credit).

27. Further disbursement details will be provided in the Disbursement Letter, the contents of which were discussed and agreed during negotiations. The financing agreement provides that the percentages for each disbursement shall be communicated by the Association in a Confirmation Letter. The Confirmation Letter will be sent on a semi-annual basis stipulating the percentage of financing for the project for the following six months as agreed amongst the financiers. These will be based on the following summary.

	ZRA	EDF	AfDB	IDA	Sweden
1. Institutional Project Support	19.2	0	20.2	20.2	10
Project Management	100%				
Tech Advisors	100%				
Technical Services & Supervision			50%	50%	
Panel of Experts: Engineering			50%	50%	
Panel of Experts: Hydraulics			50%	50%	
Panel of Experts: Electro-Mechanical			50%	50%	
Panel of Experts: Geotechnical			50%	50%	
Panel of Experts: Concrete			50%	50%	
Panel of Experts: Social			50%	50%	
Panel of Experts: Environment			50%	50%	
Environmental & Social Assessment				100%	
Dispute Resolution Board #1			50%	50%	
Dispute Resolution Board #2			50%	50%	
Dispute Resolution Board #3			50%	50%	
Dam Break Analysis					100%
Technical Audit Consultant		100%			
2. Plunge Pool Reshaping		100			
Visibility & Communications		100%			
Works		100%			
3. Spillway Refurbishment			54.8	54.8	15

Spillway Works 0-3 yrs			≥ 35%	≥ 35%	Up to \$15m
Spillway Works 4-10 yrs			50%	50%	0%

Retroactive Financing

28. Retroactive financing up to an aggregate amount not to exceed US\$5 million may be made for payments made on or after February 28, 2014 for Eligible Expenditures under the Project. Activities for retroactive financing are identified in the procurement plan. Retroactive financing will help advance necessary preparations, procurement packages and panel of experts in parallel to processing under the emergency procedures.

29. Other disbursement methods other than the Advance method such as direct payments and reimbursement of funds will also be available to the Project. Withdrawal Applications for such payment methods should be accompanied by adequate and relevant supporting documents such as copies of the contract, contractors' invoices, appropriate certifications and evidence of receipt of goods or services. The project will use the direct payment method for all contracts that meet the minimum threshold for this method to apply. Details of withdrawal conditions and requirements will be advised in the Disbursement Letter.

External Audit

30. It is a requirement that the audit scope and the terms of reference and the auditor and the audit standards to be applied will be acceptable to the development partners. An external audit will be carried out annually and the audited financial statements and audit report, together with the auditor's management letter and management response thereto, will be submitted to the development partners not later than 6 months after the end of the Recipient's financial year end. The audit will be carried out by the existing or other independent auditors and to reduce the burden of auditing requirements on ZRA, it has been agreed between the two co-financiers that the scope of the existing entity's auditor could be expanded to cover the activities of the Project; and a single annual audited financial statement would be prepared for the entity and the Project with separate pages showing separate project financing and expenditures from respective financiers, with separate independent audit opinions. In addition to the audit report, the auditors will also submit a management letter indicating any weakness in internal controls together with responses from management. Example terms of reference have been shared with ZRA to guide the appropriate inclusions.

Supervision Plan

31. The objective of the financial management supervision is to ensure the continued adequacy of the borrowers' FM arrangements, compliance with relevant legal covenants of the financing agreement, and that the funds are used only for the purposes for which the funds were intended, with due regard to economy and efficiency.

32. Financial management supervision will be carried out using the risk based model. The Financial Management risk for the project has been assessed as Moderate. Despite the moderate risk rating, financial management supervision intensity will be two field visits per year in the first year of operations to ensure proper start-off of the project FM activities. Other supervision activities would include desk reviews of the financial component of the unaudited quarterly IFRs, annual audit reviews, and management letters for follow-up actions. The outcome of these reviews would inform the intensity of subsequent FM supervisions.

Procurement

33. Procurement for those parts of the project jointly co-financed by the AfDB and IDA will be carried out in accordance with the “Guidelines: Procurement of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers” dated January 2011, and revised July 1, 2014. The selection of consultants will be carried out in accordance with the "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers” dated January 2011 revised July 1, 2014 as well as the provisions stipulated in the Financing Agreement. Procurement will be governed according to the following:

- (a) *Procurement of Works.* Two major works are expected to be procured under this project whose procurement will be undertaken using the Bank’s Standard Bidding Documents (SBDs).
- (b) *Procurement of Goods.* Goods procured under this project will include vehicles, computer hardware, software, data networking/communications, office equipment, office furniture and consumables. The procurement will be done using the Bank’s Standard Bidding Documents (SBD). Shopping may be used for contracts with estimates values of less than US\$100,000 in accordance with paragraph 3.4 of the Guidelines. Direct Contracting can be used to contract suppliers for contracts that meet the criteria set out under paragraphs 3.6 and 3.7 of the Guidelines.
- (c) *Procurement of non-consulting services.* The project includes provision under the Swedish Trust Fund to finance high resolution topographic surveys in support of the Dam Break Analysis. These will be procured as Non-Consultant Services in accordance with the “Guidelines: Procurement of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers” dated January 2011 revised July 1, 2014 using the Bank’s Standard Bidding Documents.
- (d) *Selection of Consultants:* The project is expected to finance a number of consultancies, including consulting firms and individual consultants to be hired on a long- and short-term basis. The selection of consultants will be undertaken using the Bank’s Standard Requests for Proposals (SRFPs) and other related documents. Consulting services estimated to cost US\$200,000 or more per contract will be procured through Quality and Cost-Based Selection (QCBS) described under Section II (2.1-2.31) of the Consultant Guidelines, using Bank’s Standard Request for Proposal Consulting services. Audit and other contracts of a standard routine nature may be procured under Least Cost Selection (LCS) method described under paragraph 3.6 of the Guidelines. Consulting Assignments costing less than US\$200,000 may be procured using Consultants’ Qualifications Selection (CQS) described under paragraph 3.7 of the Guidelines. Single Source Selection can be used, subject to the Bank’s prior review, to contract firms for assignments that meet the criteria set out under paragraphs 3.9 and 3.13 of the Guidelines. Contracts for Individual Consultants (IC) will be done by comparing the qualifications of at least three candidates, in accordance with Section V of the Guidelines. Short lists of consultants for services estimated to cost less than US\$200,000 equivalent per contract may be composed entirely of national consultants in accordance with provisions of paragraph 2.7 of the Consultant Guidelines. In the case of engineering

and civil works consulting assignments, the shortlists for assignments estimated to cost up to US\$300,000 may be entirely comprised of national consultants.

- (e) *Operating Costs.* For this project, the Bank has agreed with ZRA that the procurement methods for works, goods and non-consulting services as described in the Procurement Guidelines do not have to be followed for payments made for operating costs arising from the implementation of the project. Instead, the Bank has assessed the ZRA's own procurement procedures for these expenditures during appraisal and agrees that these procedures are adequate for procuring items of an operating cost nature. The operating costs will include office space maintenance, administrative and procurement/financial management support, support staff salaries, travel, logistical, communication, and other office expenses, and cost of banking services (bank charges), travel cost and transport of the staff associated with project implementation. These items will be procured using the ZRA's administrative procedures, which have been reviewed and found acceptable to the Bank. Contracts for these items should not be included in the procurement plan.
- (f) *Others.* Provisions have been included to fund workshops, meetings, training exercises and study tours that provide opportunities for learning and interactions for technical specialists, senior managers and stakeholders. The development partners will review the ZRA's work program and training plans annually as required. If the total amount of each activity above exceeds US\$50,000, then these will be approved by the development financiers. Budgets of such activities will be presented for the Bank's approval, and shall include the following information:
 - i. Workshop/training/study visit program envisaged;
 - ii. Personnel to attend the workshop/training/study visits;
 - iii. Selection method of institutions conducting such workshops/training/study tours;
 - iv. Duration of the workshop/training/study visit; and
 - v. Estimated detailed cost of the workshop/training/study visit.

34. ***Applicable legal and regulatory framework for National Competitive Bidding:*** All procurements under National Competitive Bidding procedures will be based on procedures acceptable to the World Bank as stipulated in the Zambia Public Procurement Act No. 12 of 2008, as amended by amendment No. 15 of 2011 and the Statutory instrument No. 63 of 2011 "Procurement Regulations" and the accompanying National Standard Bidding Documents of November 2012.

35. *Modifications to National Competitive Bidding procedures:* The modifications required to be made to the NCB procedures to make them acceptable for Bank-financed procurement are presented below.

36. The procurement procedure to be followed for National Competitive Bidding (NCB) shall be the open international bidding procedure set forth in the Public Procurement Act, 2008, Act No.12 of 2008, as amended by the Public Procurement (Amendment) Act, 2011, Act No. 15 of 2011 (the PPA), and the Public Procurement Regulations, 2011, Statutory Instrument No. 63 of 2011 (the Regulations); provided, however, that such procedure shall be subject to the provisions of Section I and Paragraphs 3.3 and 3.4 of Section III, and Appendix 1 of the "Guidelines for Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA

Credits & Grants by World Bank Borrowers” (January 2011 revised July 1, 2014) (the Procurement Guidelines), and the additional provisions in the following paragraphs:

- a. **Eligibility:** Eligibility to participate in a procurement process and to be awarded an Association-financed contract shall be as defined under Section I of the Procurement Guidelines; accordingly, no bidder or potential bidder shall be declared ineligible for contracts financed by the Association for reasons other than those provided in Section I of the Procurement Guidelines. No restriction based on nationality of bidders and/or origin of goods shall apply, and foreign bidders shall be allowed to participate in NCB without application of restrictive conditions, such as, but not limited to, mandatory partnering or subcontracting with national entities.
- b. **Domestic Preference:** No margins of preference of any sort shall be applied in the bid evaluation.
- c. **Bidding Documents:** Procuring entities shall use bidding documents acceptable to the Association.
- d. **Bid Validity:** An extension of bid validity, if justified by exceptional circumstances, may be requested in accordance with Appendix 1 of the Procurement Guidelines. A corresponding extension of any bid guarantee shall be required in all cases of extension of bid validity. A bidder may refuse a request for extension of bid validity without forfeiting its bid guarantee.
- e. **Qualification:** Qualification criteria shall be clearly specified in the bidding documents. All criteria so specified, and only such specified criteria, shall be used to determine whether a bidder is qualified. Qualification shall be assessed on a “pass or fail” basis, and merit points shall not be used. Such assessment shall be based entirely upon the bidder’s or prospective bidder’s capability and resources to effectively perform the contract, taking into account objective and measurable factors, including: (i) relevant general and specific experience, and satisfactory past performance and successful completion of similar contracts over a given period; (ii) financial position; and where relevant (iii) capability of construction and/or manufacturing facilities.

Prequalification procedures and documents acceptable to the World Bank shall be used for large, complex and/or specialized works. Verification of the information upon which a bidder was prequalified, including current commitments, shall be carried out at the time of contract award, along with the bidder’s capability with respect to personnel and equipment. Where pre-qualification is not used, the qualification of the bidder who is recommended for award of contract shall be assessed by post-qualification, applying the qualification criteria stated in the bidding documents.

- f. **Bid Evaluation:** All bid evaluation criteria other than price shall be quantifiable in monetary terms. Merit points shall not be used, and no minimum point or percentage value shall be assigned to the evaluation criteria or significance of price in bid evaluation. No negotiations shall be permitted.
- g. **Guarantees:** Guarantees shall be in the format, shall have the period of validity and shall be submitted when and as specified in the bidding documents.

- h. **Cost Estimates:** Detailed cost estimates shall be confidential and shall not be disclosed to prospective bidders. No bids shall be rejected on the basis of comparison with the cost estimates without the Association's prior written concurrence.
- i. **Rejection of bids and re-bidding:** No bid shall be rejected solely because it falls outside of a predetermined price range or exceeds the estimated cost. All bids (or the sole bid if only one bid is received) shall not be rejected, the procurement process shall not be cancelled, and new bids shall not be solicited without the Association's prior written concurrence.
- j. **Fraud and corruption:** In accordance with the Procurement Guidelines, each bidding document and contract shall include provisions stating the Association's policy to sanction firms or individuals found to have engaged in fraud and corruption as set forth in the Procurement Guidelines and the Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants.
- k. **Inspection and audit rights:** In accordance with the Procurement Guidelines, each bidding document and contract shall include provisions stating the Bank's policy with respect to inspection and audit of accounts, records and other documents relating to the submission of bids and contract performance.

37. The World Bank has not carried out a procurement legal review of the procurement legal framework in Zimbabwe. As such, all NCB procurement undertaken in Zimbabwe will be based on application of procedures contained in Bank's procurement guidelines using Bank's standard bidding documents.

a. Assessment of the Agencies capacity to implement procurement

38. *Procurement Capacity.* A procurement assessment of the ZRA was conducted by the procurement specialists of the World Bank in July, 2012 in preparation for an associated grant. This was updated as part of the joint assessment by the African Development Bank and the World Bank in August, 2014.

39. The ZRA Procurement Guidelines are integrated as part of the Financial Manual, reflecting the position within the Finance Directorate. The ZRA is staffed with a single Assistant Supplies Officer (ASO) within the Finance Department who reports up through a supervisor, to the Finance Manager under the Finance Director / Corporate Secretary. The procurement functions are managed from the headquarters in Lusaka and draw on expertise from other divisions as needed for specific assignments.

40. Procurement actions under the project are larger and more complex than the type and size generally performed by the ZRA in the course of its normal operations. Typical procurement under the responsibility of the ASO is limited to largely small value, non-complex assignments. The limited experience with large, complex competitive procurements relating to engineering assignments and large civil works programs will require enhanced mechanisms to strengthen the formal procurement arrangements, integrate the technical aspects with the procurement workflow processes under the management of the assigned procurement staff.

41. The Risk Rating for Procurement is assessed as "substantial." Various mitigation measures have been identified to address the identified risks over the life of the project, following which the residual risk would reduce to "Moderate".

42. The ZRA will receive advice and support on procurement actions through the World Bank’s Country Office but will also address the following measures:

- (a) Develop, publicize, update and monitor procurement plans.
- (b) Institutionalize involvement of technical staff in planning and implementation of procurement with option to outsource additional capacity.
- (c) Additional staff at higher level will be required for more complex and competitive bidding
- (d) Training and outsourcing skills to bridge gaps in and works (construction of dams and related consulting assignments) contracts generally (including works consultants)
- (e) Training plan and capacity enhancement needed for existing staff in competitive procurement and contract management and through establishment of additional staff position preferably at level 5 or 6 equivalent positions to Assistant Accountant or HR officer. The level could be higher if more procurement and complex procurement were to be undertaken on regular basis.
- (f) Improving the packaging and use of framework contracts. Include framework contracts in the procurement guidelines.

43. *Procurement Planning.* The ZRA has developed a procurement plan for the project. This plan has been shared with the various development partners. The procurement plan will be available in the project’s database and on the external websites of the different development financiers. The procurement plan will be updated by the Project Team and submitted for review and clearance by the development financiers at least on an annual basis to reflect the actual project implementation needs.

44. The project procurement plan provides the basis for developing a more integrated, formalized process of procurement planning and monitoring based on project objectives, reflecting justifiable quantities, realistic market prices, specific deliverables, etc. that are subject to formal approvals.

45. *Prior Review.* The World Bank will conduct a prior review for all the ZRA procurement, as per the table below:

Table 1. Prior Review Threshold

Expenditure category	Contract Value Threshold (US\$)	Procurement Method	Contracts Subject to Prior Review
1. Works	≥ 10,000,000	ICB	All
	≥ 200,000 - <10,000,000	NCB	As in procurement plan
	<200,000	Shopping	None
	All values	Direct Contracting	All
2. Goods and Services (other than Consultants’ Services)	≥ 3,000,000	ICB	All
	≥ 100,000 - <3,000,000	NCB	As in procurement plan
	<100,000	Shopping	None
	All values	Direct Contracting	All
	All values	UN Agency	All
3. Consulting Firms	≥ 200,000	QCBS	All
	<200,000	CQS, LCS, QBS	As in procurement plan
		Single Source	All

Expenditure category	Contract Value Threshold (US\$)	Procurement Method	Contracts Subject to Prior Review
4. Individual Consultants	≥ 100,000	IC	All
	<100,000	IC	None
		Single Source	All

NOTES:

1. Contracts selected on basis of CQS should not exceed US\$200,000 equivalent. This same value will constitute the limit up to which a short list of firms may comprise entirely national firms.
2. Short list comprising entirely of national consultants of Zambia and Zimbabwe: Short list of consultants for services, estimated to cost less than US\$200,000 equivalent per contract, may comprise entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. In the case of Engineering & Contract Supervision contracts the short list may comprise of entirely national firms from the participating countries of Zambia and Zimbabwe for cost estimates up to US\$300,000.
3. Contracts with a cost estimate below US\$200,000 for motor vehicles only may be procured on basis of Shopping procurement method, whilst for other goods use of shopping procurement method will be before contracts estimated below US\$100,000 and below US\$200,000 in the case of works contracts

46. *Procurement Post Reviews (PPRs) and Independent Procurement Reviews (IPRs)*. For compliance with procurement procedures and based on the assessment of procurement risk for this project which is substantial risk, the development financiers will carry out PPRs or IPRs based on a sample of contracts below the prior review threshold in the case of PPRs. The sample of contracts to be reviewed under IPRs will include some contracts which would have been subject to prior review. Such review (ex-post and procurement audit) of contracts will be based on a sample of 15 percent. Based on continuing assessment of risk and the success of risk mitigation measures implemented, the sample size may be reduced as risk mitigation measures are successfully implemented. Note that “High Risk” will represent a sample size of 20 percent, “Substantial risk” will represent a sample size of 15 percent, “Moderate risk” 10 percent, and “Low risk” 5 percent. These changes will be communicated to the ZRA as outcomes of the PPR / IPR exercise, which may also result in the revisions of the prior review and National Competitive Bidding thresholds.

47. Procurement post-reviews will be done on an annual basis.

b. Frequency of Procurement Supervision

48. In addition to the prior review supervision to be carried out by the development financiers, semi-annual implementation support missions to visit the ZRA and carry out post review of procurement actions are planned.

49. *Information sharing and disclosure requirements*. The ZRA will post on its website the following information: procurement plan, expressions of interest, request for proposals, and bid documents. The bidding results will be made available on the website within a specific period. The names of the evaluation committee members should also be made public through the website. Where works are being carried out, it is important to post visible signs containing the name of the contractor, scope of work being carried out, project cost, and completion dates. Information on all contracts implemented by the ZRA will be regularly updated on the website.

Monitoring & Evaluation

50. Monitoring and Evaluation will be undertaken through the normal operations of World Bank project implementation support and evaluation processes. The ZRA will be responsible for monitoring and evaluation of the agreed set of indicators for the project. The project level results framework has been discussed with partners in an attempt to align the results, indicators and reporting requirements to the extent possible.

Role of Partners

51. The project is to be co-financed by the African Development Bank, the European Union and the World Bank, with support from Sweden through a Bank administered Trust Fund fully blended with the IDA financing. The Resource Mobilization Committee has asked the World Bank to lead the preparation process and a number of joint missions have been undertaken with all three financing partners.

52. A draft Memorandum of Understanding among the three financing partners is being finalized. This provides for the establishment of a Co-financiers' Coordination Committee (CCC) composed of representatives of each of the financiers. The aim of the CCC is to ensure the smooth operation and efficient monitoring of project implementation. Within this context, the CCC is intended to oversee and monitor project implementation, and hold meetings as required to facilitate smooth implementation of the Project.

53. The World Bank has been appointed as the coordinating co-financier to serve as the point of coordination with the Zambezi River Authority and the two Governments in the context of those joint elements of the project.

ANNEX 4: ENVIRONMENTAL AND SOCIAL ACTION PLAN

AFRICA: Kariba Dam Rehabilitation Project

1. **Project Context.** The Kariba Dam is a double curvature concrete arch dam, standing at 128m tall with a crest length of 617m and a reservoir capacity of 181km³. This makes it one of the largest reservoirs in the world. The active storage at the Full Supply Level is 64.5 km³. This includes 23.2 km³ of flood control capacity that has to be made available at the beginning of each flood season (February to April) for flood attenuation. The Kariba Reservoir supplies water to two underground hydropower stations with a combined capacity of 1,830 MW generating approximately 10,035 GWh per year under normal operating conditions. Current expansion programs are expected to increase this further to a total installed capacity of 2,130 MW by 2017.

2. The rehabilitation works include: 1.a) the design, fabrication and installation of an emergency gate and a new gantry to prevent uncontrolled loss of water in the event of floodgate failure, which would result in water levels dropping below the minimum operational levels and interrupting power production; 1.b) the refurbishment of the upstream stop-beam guides and replacement of secondary concrete to prevent failure during operation of stop-beams and, 2) reshaping of the plunge pool downstream of the dam to limit scouring and erosion that could potentially undermine the dam foundations, leading to dam failure.

3. **Environmental and Social Assessment.** An environmental and social service provider has been appointed to carry out an Environmental and Social Impact Assessment and is to be financed by IDA under the project. The ESIA is required by the national environmental authorities and the financiers prior to the commencement of the civil works. The Environmental and Social Service Provider is currently undertaking the ESIA for the Batoka Gorge HES and was appointed through a competitive procurement process in accordance with World Bank Guidelines. The same service provider has been appointed by the ZRA to capitalize on the synergies between the two projects and accelerate preparation of the necessary environmental and social instruments for the Kariba Dam Rehabilitation Project. The ToRs for the ESIA were subjected to a series of public consultations in locations around the dam, reservoir and downstream areas in June and July, 2014. The Contract was signed in September 2014 and the ESIA is due to be prepared over a period of five months. The Scoping Report and updated Project Brief are due in November, 2014 and the first draft ESIA, Environmental and Social Management Plan and Resettlement Policy Framework in January 2015. The timeline will ensure that all safeguard instruments are disclosed, consulted, and completed well in advance of any civil works.

4. **Key Environment and Social Safeguards Issues.** The project includes two rehabilitation components both of which require works in situ on existing infrastructure to secure operations in accordance with international dam safety standards and avoid a potential catastrophic failure of the dam. The rehabilitation measures are not expected to have any significant adverse environment and social impacts, and it is not anticipated that there will be any physical relocation and only limited, if any, land acquisition leading to involuntary resettlement and/or restrictions of access to resources or livelihoods. Any potential environmental or social impacts are likely to be associated with site specific rehabilitation works and temporary in nature. The construction period for the plunge pool refurbishment is limited to the non-spilling period seven out of twelve months of the year, over three-years, and will not affect the day-to-day operating conditions of the hydropower plants, thereby allowing the continued release of water

downstream of the dam. The refurbishment of the spillway is to be carried out in situ and expected to have limited, if any, impact on the natural environment or long-term operations of the reservoir.

5. The project has been assigned environment Category A due to anticipated scope and nature of project activities. The Kariba Dam Rehabilitation Project is urgently required to avoid a potential emergency situation that would have major adverse economic and unprecedented humanitarian impacts. The most recent dam safety assessment has identified the proposed measures as Category I interventions requiring urgent and immediate attention. As such, the project is being processed in accordance with OP 10.00 Investment Project Financing Paragraph 12 for Projects in Situations of Urgent Need of Assistance. This provides for the environmental and social requirements set out in the following safeguard policies triggered by the Kariba Dam Rehabilitation Project that are normally applicable to the preparation phase to be deferred to the Project implementation phase: OP/BP 4.01 (Environmental Assessment), OP/BP 4.11 (Physical Cultural Resources), OP/BP 4.12 (Involuntary Resettlement).

6. An Environmental and Social Prospectus has been prepared by ZRA with support from the Technical Advisors. This outlines the broad context and provides the framework within which the ESIA must be undertaken. An ESIA Consultant has been appointed to evaluate the design of the Kariba Dam rehabilitation works, undertake the required Environmental and Social Impact Assessment and prepare an integrated Environmental and Social Management Plan, along with associated instruments to ensure the sustainability of project through appropriate preventive, mitigation and monitoring interventions. The ToRs were subjected to a consultative process with stakeholders in the project area with an emphasis on public participation and specific provisions to ensure that the procedure of data acquisition, analysis and interpretation is conducted in a transparent manner according to accepted international standards and practice.

7. The Environmental and Social Impact Assessment is expected to be completed by March 2015, prior to commencement of any of the associated works. The ESIA will include the Baseline Conditions through a review and assessment of the dimensions of the study area and description of the relevant physical, biological, chemical, socio-economic and cultural conditions, including any changes anticipated before the project commences. The Environmental and Social Impact Assessment itself will consider the impacts of a potential catastrophic failure during the rehabilitation measures, what environmental impact would result and how these would be addressed. This will also review the potential for enhancing project benefits including gender mainstreaming into project activities. Due diligence will be applied to ensure that in the unlikely event of any adverse impact, appropriate mitigation measures will be put in place in accordance with the ESMP and the Emergency Preparedness Plan. The existing EPP is to be reviewed, and revised as needed, by the Technical Services & Supervision Consultant prior to launch of the works to ensure that any construction specific provisions are adequately addressed. The EPP will be subject to further, and revision as needed, upon completion of the works.

8. Specific provisions have been included in the financing agreement to ensure that no works will commence before the necessary safeguard instruments have been subject to review and approval by the World Bank, disclosed in country and through the World Bank's Infoshop and that the project is implemented in accordance with the Safeguard Instruments. The safeguard instruments under preparation include an ESIA for the Kariba Dam rehabilitation works, along with the necessary Environmental and Social Management Plans (ESMPs) and Resettlement Policy Frameworks (RPF) for both the plunge pool reshaping and the spillway refurbishment.

These will identify and recommend necessary measures required to prevent, minimize, mitigate, or compensate for any potential adverse impacts during implementation. This will include a review of the program for controlling communicable diseases such as malaria and HIV/AIDS and include provisions for chance find procedures for physical and cultural heritage. The Environmental and Social Management Plan is being prepared, along with quality assurance measures, and will be incorporated into the relevant bidding documents to govern the implementation phase. Given that the rehabilitation includes civil works, provisions will also be included provisions for chance find procedures for physical and cultural heritage.

9. The spillway refurbishment will include in situ refurbishment of the existing concrete works and any potential impacts are expected to be mitigated and managed through standard contract provisions. The main potential risk associated with the construction activities is the potential effects on the downstream environment due to reshaping of the plunge pool. It is proposed that the cofferdam to enable access for the excavation of the plunge pool be built immediately downstream of the plunge pool and upstream of the outlets from the power stations and will be removed every year during the spillage period. Environmental impacts are associated with the construction period, which is limited to seven out of twelve months over a three-year period and so, temporary in nature. The reshaping of the plunge pool will not affect the day-to-day operating conditions of the hydropower plants after the plunge pool is enlarged and so introduce any long-term negative impacts.

10. Impacts are highly site-specific and are mostly related to land use for the access road in the riverbed, worksite facilities, and the dumping site. Materials to be excavated from the plunge pool are typically rock and gravel, so inert materials, and are not expected to cause any pollution in the deposit area. Usual construction activities and specific techniques such as blasting will generate pollution (dust, soil disturbance, water turbidity, noise etc.) for the terrestrial and aquatic physical environment. The extension and intensity of impacts should remain local and low, especially for the terrestrial environment and will be governed by the provisions of the ESMP. The most significant pollution and disturbance issues associated with construction activities are related to the neighboring natural habitats and fauna, potential spillages of oil and other contaminants in the Zambezi River, and temporary limitations on traffic across the crest of the dam. These are common issues in construction activities that will be addressed through specific provisions in the ESMP and method statements to be prepared by the contractor.

11. The instream flows downstream of the outlet from the power stations are being assessed as part of the ESIA and it is expected that the historical flow regime under the current operations will be maintained. This will be possible through the continued release of water through the power station outlets which will enable water flows to be maintained below the cofferdam needed to protect the plunge pool works. Similarly, high sediment loads are expected in those areas immediately downstream of the plunge pool during construction activities. Lowering of the water level in the plunge pool by pumping will result in higher water turbidity during the non-spillage seasons (May-November). However, the highest pumping rate during the works is expected to be around 0.4 cubic meters per second, which is 0.1 percent of the mean downstream flow out of the power stations (1,160 cubic meters per second) and so not expected to have a significant impact.

12. The Zambezi River basin has one of the most variable climates of any major river basin in the world, with an extreme range of conditions across the catchment and through time, and is highly vulnerable to the impacts of climate change. The Zambezi River basin runoff is highly

sensitive to climate variability, since small changes in rainfall produce large changes in runoff. Over the next century, climate change is expected to increase the vulnerability of the basin to these changes. The Intergovernmental Panel on Climate Change (IPCC) has categorized the Zambezi River basin as the basin exhibiting the “worst” potential effects of climate change among the major African basins (IPCC, 2001).

13. Numerous basin-wide assessments of water management and development within the Zambezi River Basin provide an important context for the assessment of climate resilience and examining the potential cumulative impacts associated with infrastructure development. As part of the efforts to facilitate the process of establishing the Zambezi Watercourse Commission, an Integrated Water Resources Management Strategy was prepared for the Zambezi River Basin in 2007 with financial support from the Governments of Sweden, Denmark and Norway. The World Bank *Multi-Sector Investment Opportunities Analysis of the Zambezi River Basin* (2010) carried out in collaboration with regional bodies and riparian states conducted an economic analysis of the potential infrastructure development of the river basin. This process identified over US\$16b in investments at the pre-feasibility and feasibility stage. The analysis incorporated the results from a water balance modeling conducted in the recent and on-going investment scenarios, dam synchronization, climate change impact and water-energy nexus assessments. These both included an assessment of the water resources for the entire basin to provide a sound basis for development of strategies for effective management in line with the objectives of the ZAMCOM Agreement in promoting equitable and reasonable utilization and the efficient management and sustainable development of the waters of the Zambezi River.

14. The average annual rainfall in the Zambezi River basin is quite high (approx. 960 mm)¹; but it is unevenly distributed across the basin, with the southern and western parts receiving much less rainfall (World Bank, 2010). The warmest temperatures over the basin are experienced along the border of Zambia and Zimbabwe and the coolest temperatures are to the north, over interior sections of Zambia. The course of the Zambezi River follows along the stretch of warmest temperatures with a significantly buffered seasonality (World Bank, 2010). The Lake Kariba catchment area’s climate is controlled mainly by the movement of air masses linked to the Inter-Tropical Convergence Zone (ITCZ)². Normally the rainy season extends from November to March. The entire catchment is highly vulnerable to extreme weather events that occur nearly every decade, which have become more frequent and pronounced (Muchuru, Shepherd, et al. 2014). For example, the severe 1991-1992 drought resulted in an estimated US\$102 million reduction in GDP and the loss of 3,000 jobs (Beilfuss, 2012).

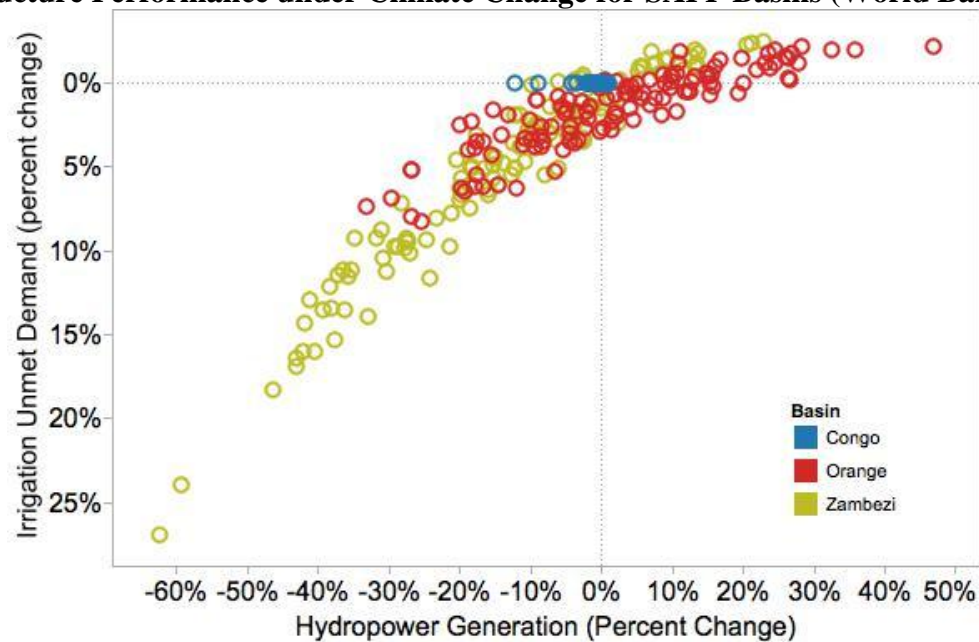
15. Over the next century, climate change is expected to increase this variability, and the vulnerability of the basin and the associated infrastructure to these changes. Results from a 2014 analysis undertaken by the World Bank shows that under the driest scenarios (see figure below) hydropower generation could decline by more than 60 percent, and unmet irrigation demand could decline by more than 25 percent in the Zambezi River basin. The benefits of wetter scenarios in the Zambezi River basin suggest an increase of up to 25 percent in hydropower production and a few percent in irrigation water provision. The results vary dramatically by

¹ Average annual rainfall, in the Zambezi River basin, varies from more than 1600 mm per year in some far northern highland areas to less than 550 mm per year in the water-stressed southern portion of the basin.

² The ITCZ appears as a band of clouds consisting of showers, with occasional thunderstorms, that encircles the globe near the equator. It exists because of the convergence of the trade winds.

basin, but show overall climate change could be an important factor in water and power infrastructure performance in the Zambezi River basin in particular.

Infrastructure Performance under Climate Change for SAPP Basins (World Bank, 2014)



16. To provide a well-informed risk assessment and risk management plan for the rehabilitation of the Kariba Dam, the project will draw on support from the World Bank study on *Addressing the Climate Vulnerability of African Infrastructure*. This builds on an earlier *Assessment of the Impacts of Climate Change on Multi-sector Investment Opportunities in the Zambezi River Basin* (2011), conducted by the World Bank, and is specifically assessing the economic impacts of climate change on large infrastructure, such as hydropower, in the seven largest river basins in Africa. The study further addresses the possibility of Robust Decision Making for the design of large hydropower schemes under deep uncertainty in inflows created by the array of climate change projections. The parallel Bank-executed CIWA support to the Zambezi River Basin is also undertaking a study focused on the *Water-Energy Nexus*, specifically in the context of the Zambezi River basin. The results will include Long-range Energy Alternatives Planning (LEAP) modeled power simulations of the SAPP, linked to the Water Evaluation and Planning (WEAP) model for Zambezi River Basin. The results will show the feedback mechanisms between the water management and development in the Zambezi River Basin and the power generation in Southern Africa, and will illustrate the tradeoffs between irrigation and hydropower due to limited water resources. The LEAP model will further give estimates of greenhouse gas (GHG) emissions under different development scenarios in the SAPP. These results will inform the feasibility and ESIA studies for Batoka Gorge HES on essential areas such as climate change mitigation potential and cumulative impacts of the proposed scheme.

Social (including safeguards)

17. The project includes two rehabilitation components both of which require works in situ on existing infrastructure to secure operations in accordance with international dam safety standards

and avoid a potential catastrophic failure of the dam. As a result, the rehabilitation measures are not expected to have any significant adverse social impacts. There is not expected to be any physical relocation and only limited, if any, land acquisition leading to involuntary resettlement and/or restrictions of access to resources or livelihoods.

18. The World Bank involuntary resettlement policy has been triggered and the ESIA consultants are preparing a Resettlement Policy Framework to ensure prior agreement on a transparent mechanism in the event that any land acquisition is required for waste dumps, access routes or construction sites, etc. As this project is being prepared by the World Bank in accordance with the operational policies for Projects in Situations of Urgent Need of Assistance, the RPF will be required prior to the commencement of any civil works and specific provisions have been included in the Financing Agreement to ensure that no works will commence before the necessary safeguard instruments have been subject to review and approval by the World Bank, disclosed in country and through the World Bank's Infoshop and that the project is implemented in accordance with the Safeguard Instruments.

19. The original construction of the Kariba Dam in the 1950s was supported through an IBRD loan to the Federation of Rhodesia and Nyasaland (Malawi, Zambia and Zimbabwe) and involved the resettlement of an estimated 57,000 Tonga peoples. It is estimated that 34,000 people were resettled in Zambia and 22,000 people in Zimbabwe. The historical context of resettlement during construction of the Kariba Dam predates the current operational safeguard policies and there were no social policies, standards, or good practice guides in how to conduct consultations, provide compensation, or restore standards of living for project affected persons. This notwithstanding, the historical context does not meet the criteria outlined in the World Bank's "Guidelines for Addressing Legacy issues in World Bank Projects".

20. Since then, the Governments of Zambia and Zimbabwe, as well as the Zambezi River Authority, together with the two power utilities, have initiated a community development program in an effort to alleviate the continuing challenges faced by impacted persons now living in areas far from their original homes. The IDA financed Power Rehabilitation Project (1998), which was implemented by ZESCO, provided support to these efforts aimed at improving the life of affected people through the Gwembe Tonga Rehabilitation and Development Program. Integrated, multi-sectoral activities, designed through a consultative process attempted to balance infrastructure needs with food production activities. The program rehabilitated a variety of infrastructure in the Gwembe Valley and Chikanta Chiefdom of Kalomo for people displaced during the original construction of the Kariba Dam. In Zimbabwe projects are not developed to specifically target peoples directly impacted by Kariba Dam. Instead, all Rural District Councils develop programs to improve the standard of living for all the constituents living within the District. To this end, however, Zimbabwe is aware that those impacted by Kariba Dam may have additional needs and concerns coping with their forced relocation. While the outcomes of all the components funded under the project were judged satisfactory, efforts at rehabilitation and environmental management for the people were considered partially achieved.

21. The ZRA established the Zambezi Valley Development Fund (ZVDF) in 1997 to raise funds for projects aimed at enhancing the socio-economic status of people displaced during the original construction of the Kariba Dam in the 1950s. The funds are used for developing projects in order to improve the standard of living of impacted communities. Funding sources include a 1 percent levy on water bills for the water used in power generation, donations, and fund-raising activities. Most communities state that they want to receive electricity produced from the hydropower dam

and to have access to water for household use and crop production. Towards this goal, the ZVDF has facilitated electrification of two rural centers – one in Gwembe District, Zambia and Msampakaruma in Nyaminyami District, Zimbabwe. A number of irrigation schemes have also been initiated through the ZVDF. Through the ZVDF, the ZRA has also provided flood relief, including the construction of a basic school at Kasaya in Kazungulu District, Zambia. The ZVDF has also equipped school laboratories to promote interest and advancement in science careers, supported livestock production, drilling of boreholes, and provision of grinding mills.

22. While the rehabilitation project is not directly addressing the historical issues associated with the original dam construction, and these do not meet the criteria outlined in the World Bank’s “Guidelines for Addressing Legacy issues in World Bank Projects”, the ZRA is undertaking an assessment of the impact and efficacy of the ZVDF. This is being carried out as part of the Batoka Gorge HES ESIA and will be used to inform any Government responses to associated historical issues. The ESIA for the Batoka Gorge Hydro-Electric Scheme, being carried out in parallel by the same service provider as that for the Kariba Dam Rehabilitation Project, is reviewing and assessing the operations and impact of the ZVDF. The assessment includes a review of the Operation Guidelines, the portfolio of projects financed to date, their effectiveness and impact, the revenue mechanisms and finances. The Consultant will make recommendations based on the findings of the assessment, taking into consideration the socio-economic assessment of the Batoka Gorge HES, to improve the impact of the ZVDF and identified opportunities to enhance livelihoods. This will indicate any activities, the responsibilities of the different stakeholders involved, a clear timeframe and cost estimates. This is part of a broader effort being advanced by the Zambezi River Authority to explore mechanisms for extending the benefits of project development to benefit local communities within the process of project formulation.

23. **Notification on International Waterways (OP/BP 7.50).** The Zambezi River Authority sent a letter of notification to the Zambezi River riparian states in May, 2014 in compliance with the provisions of the 2000 SADC Revised Protocol on Shared Water Courses and the Agreement on Establishment of the Zambezi Watercourse Commission. This was sent to SADC Secretariat and the ZAMCOM Secretariat, along with copies to the riparian states to inform them of the proposed measures in accordance with the respective provisions. The letter of notification meets the provisions under the World Bank OP 7.50 and indicates that the proposed works:

- will not adversely change the quality or quantity of water flows to the other Watercourse States;
- will not adversely affect water use by other Watercourse States; and
- will not exceed the original scheme, change its nature, alter or expand its scope and extent so as to make it appear a new or different scheme.

24. Further, the letter of notification indicates that preparations for the rehabilitation program include additional interventions to limit the risk of dam failure during the rehabilitation works. The interventions include:

- (i) preparation of an environmental impact assessment and associated management plan;

- (ii) updating of dam safety and emergency preparedness plans to enhance the existing dam safety management arrangements, including any specific issues required during construction;
- (iii) undertaking a dam break analysis to inform emergency preparedness arrangements and identify potential environmental impacts along the mainstem of the Zambezi River; and,
- (iv) engagement of an independent panel of experts.

25. The ZRA has committed to ensure that adequate due consideration is afforded to third party effects and that the technical aspects of design and construction are subject to robust advice to inform sound decision making. Commitments are also given that relevant documentation, including the environmental impact assessment and emergency preparedness plans, will be shared in due course.

26. The time provided for response and or comments by the riparian states has lapsed and neither response nor comments have been received.

27. Dam Safety (OP/BP4.37): The project is aimed at ensuring appropriate measures are implemented and sufficient resources provided for the continued safety of the Kariba Dam. The ZRA carries out five yearly inspections of the dam by internationally reputable consultants and the rehabilitation works will be carried out in compliance with the OP/BP. The regular inspection reports have been reviewed and ZRA has conducted or is conducting required actions as per the policy in a satisfactory manner. The ZRA has Standing Operations Procedures of the Kariba Dam and Reservoir that have been reviewed by the World Bank. The procedures are sufficient in terms of the provisions of the policy and cover the reservoir operation procedure, instrumentation plan, operation and maintenance procedure of equipment, etc. The EPP framework is also included in the procedures. The dam safety instrumentation has been reviewed as part of the five-year dam safety inspection and an updated instrumentation plan would be incorporated into the O&M Plan during project implementation.

28. The Standing Operations Procedures will be reviewed, and revised as needed, as part of the preparations for implementation of the works. These will be subject to further review and revision, as needed, upon successful completion of the works. This will include an initial review by the Technical Services and Supervision Consultant to align the procedures with the necessary actions during implementation of the works. Upon completion of the works the procedures will be revised further to finalize not later than six months before commissioning of all refurbishment works in the case of the Operation and Maintenance Plan, and 12 months before commissioning of all refurbishment works in the case of the Emergency Preparedness Procedures.

29. The Technical Services and Supervision Consultant will be responsible for preparation of the construction supervision and quality assurance (CSQA) plan along with the tender document review and preparation. The scope of work for the Technical Services and Supervision Consultant has been reviewed and the procurement process is underway. The agreed schedule would have the Technical Services and Supervision Consultant appointed by April 2015 in order to ensure sufficient time prior to commencement of the works in early 2016. The ZRA is also establishing a PoE for Dam Safety to support ZRA in review of the investigations, design, and implementation of the rehabilitation works. The ToRs have been

reviewed during preparation and the PoE is being procured in anticipation of the first visit in 2014.

30. Project Implementation Arrangements. The Zambezi River Authority has responsibility for the operation and maintenance of Kariba Dam Complex, along with the investigation and development of new dam sites on the Zambezi River, and analysing and disseminating hydrological and environmental information pertaining to the Zambezi River and Lake Kariba.

31. Among the responsibilities for implementation of the project, the ZRA will ensure that all safeguard policies are followed and safeguard instruments prepared in accordance with terms of reference and process acceptable to the World Bank. All the safeguard instruments are required to be furnished to the Bank for review and approval and thereafter disclosed in the country and through the Infoshop. The Financing Agreement and the Project Agreement both require that the Project subsequently be implemented in accordance with the Safeguard Instruments.

32. In the event that any Supplemental Social and Environmental Safeguard Instruments are required, the ZRA shall prepare these in accordance with the applicable Safeguard Instrument and submit these for review and approval by the Bank, following which they will be required to adopt and implement the project in full compliance with the requirements.

33. If any activity under the project involves Affected Persons, the ZRA will ensure that no displacement (including restriction of access to legally designated parks and protected areas) shall occur before resettlement measures are prepared. In the case of displacement, full payment of compensation and any other assistance required for relocation, will have to be implemented prior to any displacement taking place.

34. Key Actions:

(a) A Panel of Experts for Environment and Social is being constituted, and expected to be in place by January 2015 and will include the following expertise:

- (i) Environmental Management and Rehabilitation Expert; and,
- (ii) Social Development and Resettlement Expert

(b) A Panel of Experts for Dam Safety is being constituted, and expected to be in place by November 2014, including the following expertise:

- (i) Dam Safety
- (ii) Hydrology and Hydraulics
- (iii) Geology and Geotechnics
- (iv) Hydro-mechanical, and
- (v) Concrete specialist

(c) The Scoping Report and Updated Project Brief is to be submitted for review and comment by the environmental authorities, ZRA and financiers by November, 2014.

(d) The Draft Environmental and Social Impact Assessment is due to be disclosed for consultation by January, 2015.

(e) The Draft Environmental and Social Management Plan is to be disclosed for consultation in January, 2015.

(f) The Draft Resettlement Policy Framework is to be disclosed for consultation in January, 2015.

(g) The Environmental and Social Impact Assessment is due to be revised following consultations, completed and disclosed by March, 2015.

(h) The Environmental and Social Management Plan is due to be revised following consultations, completed and disclosed by March, 2015.

(i) The Resettlement Policy Framework is due to be revised following consultations, completed and disclosed by March, 2015.

ANNEX 5: FINANCIAL AND ECONOMIC ANALYSIS

AFRICA: Kariba Dam Rehabilitation Project

1. The Kariba Dam is a major contributor to the economies of Zambia and Zimbabwe, as well as a significant contributor to flood control and river flow management in the Zambezi River basin. The major economic impact is related to the dams provision of water to the hydropower plants on its north and south shores, which produce approximately 46 and 50 percent of electricity in Zambia and Zimbabwe, respectively. Although the ZRA derives no direct revenue, the reservoir also supports important commercial and subsistence fisheries, tourism operations and small-scale water supply for local towns and villages and irrigated agriculture.

2. While the economic impacts of a catastrophic failure would result in devastating regional flooding, significant loss of human life, and unprecedented economic damage, an estimate of the worst-case scenario has not been undertaken due to the number of inter-dependent factors that would need to contribute to such a scenario and the difficulties in assessing these with any accuracy and confidence. The risk associated with a catastrophic failure is informed by the probability of such an event and the associated impacts. These impacts would result in flooding at least four times larger than the largest recorded flooding in the area, with more than US\$8 billion in assets at risk and an estimated 3 million people living in the potential impact area. These impacts, combined with the potential loss of 40 percent of the generation capacity within the SAPP (excluding South African generation) from Kariba and Cahora Bassa, would result in unprecedented economic impacts across the southern African region.

3. The technical and economic appraisal of the project consists of four core financial and economic analyses, as follows: (i) a financial analysis, estimating the financial impact of the project on ZRA; (ii) a debt sustainability analysis, which reviews ZRA's capacity to repay the debt financing for the project; (iii) an analysis of the impact on end-user electricity tariffs in each country; and (iv) a with-and-without-project economic cost-benefit analysis, taking into consideration the with- and without-project financial and operational impacts on ZRA and on the Kariba-related hydropower generation plants. While there are significantly more economic benefits to the project, a calculation of direct expected losses to the two countries' power systems provides a robust estimate of the economic returns to the project. In addition, this annex reviews the financial impact on the Government of Zambia (as the borrower of record).

Financial Overview of ZRA

4. The ZRA is a financially autonomous organization that generates operating revenue through water tariffs charged to the Zambian and Zimbabwean power utilities (ZESCO and ZPC) for water consumed in the generation of electricity. The ZRA is not itself an electricity utility. The ZRA receives its revenues and records its expenses in US Dollars, which has also been used as the Zimbabwean currency for several years. This enables a relatively straightforward analysis of ZRA's finances and its repayment of the proposed debt. For the purposes of this analysis, it is assumed that ZESCO (which operates and records its finances in Zambian Kwacha), makes its payments at currently applicable exchange rates. The ZRA revenue formula agreed by all the parties is intended to provide the ZRA with sufficient revenues to carry out its mandated functions, including operations and general maintenance, but not to generate profits or to finance major rehabilitation works. The tariff structure includes two parts: a fixed monthly element, and

a volumetric charge, also billed monthly. The formula is reviewed every three years, with tariffs adjusted annually according to the Consumer Price Index (CPI) of the United States. The following summarizes ZRA's financial history as well as its current financial position.

- The ZRA has effectively operated on a non-commercial, non-profit basis for nearly 30 years. Prior to 1987, ZRA reports that it operated on a commercial basis and generated sufficient revenues to leverage borrowing for large investments.³ Beginning in 1987, however, ZRA began to operate on a "reimbursable" basis – i.e., ZESCO and ZPC paid ZRA enough to cover ZRA's operational costs. Between 1987 and 1997, ZESCO and ZPC also transferred, outside of the "reimbursable" arrangement, amounts sufficient to cover ZRA's debt service, but ZRA became unable to borrow on its own account. Funding for necessary new investments and rehabilitation came from accumulated capital and from transfers from ZESCO and ZPC, beginning a situation where ZRA was dependent on ZESCO and ZPC's full agreement to fund any investments.
- Beginning in 1997, a new tariff arrangement was instituted, fully on a non-profit basis, which meant that no capital or equity accumulations were possible to finance investments or enable borrowing. Agreements on the currency of record and of payment and of an inflationary index resulted in further deterioration of equity and postponement of rehabilitation works.
- Since 1998, tariff arrangements with ZESCO and ZPC have allowed ZRA to fully cover operational costs. Between 2008 and 2011, tariffs increased roughly 10 percent per annum, allowing ZRA to begin preparations for the major rehabilitation described in the PAD, as well as to accumulate a small net equity position.
- Despite the recent increases in tariffs and the ability of ZRA to accumulate equity and reserves for rehabilitation works, it is not realistic to expect ZRA to accumulate sufficient cash for works as extensive as those discussed here; the amounts needed are simply too large. It is also important to note that the required rehabilitation works are not due to deferred maintenance, but are instead expected, periodic rehabilitation of infrastructure this size and this age.
- ZRA's current and expected levels of net income are sufficient to service concessional debt. In theory, ZRA's water tariffs could be raised sufficiently to service market-rate debt; however, in practice the amount of borrowing required would not be available from local or regional banks or from the capital markets; the size of the borrowings and the perceived risks of the project make borrowing from the private sector highly unlikely. In addition, currency and interest-rate risks would result in significantly shorter loan maturities than international financial institutions can provide, increasing the debt burden on the ZRA beyond what reasonable tariff increases could accommodate.

Project Financial Analysis and ZRA Debt Sustainability

5. Two financial analyses have been undertaken with respect to the financial implications of the project on ZRA: (i) a project financial analysis, estimating the financial returns to ZRA in undertaking the project; and (ii) a debt sustainability analysis, calculating ZRA's debt service

³ Borrowings were still guaranteed by the governments of Zambia and Zimbabwe. In practice, ZRA rehabilitation expenditures averaged only US\$1 million (in today's US\$) per year. Major rehabilitation, such as that described in this document, was not yet necessary.

coverage ratio (DSCR) given its proposed borrowing and an estimated minimum tariff increase to maintain a minimum DSCR of 1.2. The following describes the information and assumptions used in the analyses.

6. **Project Financial Analysis:** The ZRA currently delivers approximately 39,000 MCM per year to the turbines on the north (ZESCO) and south (ZPC) banks of the Zambezi, and has the capacity to deliver 42,000 MCM. Currently, the gross fixed charge received by ZRA from the two utilities is US\$4.381 million. The volumetric charge is US\$0.3658 per 1,000 m³. For 2014, ZRA receipts from the volumetric charge are projected to be US\$14.3 million, for total annual revenues of US\$18.6 million. Note that the current (2014) tariff incorporated a 15 percent increase from the previous year, and a 15 percent increase has been agreed for 2015.

7. Based on actual expenses in 2013, ZRA's operating expenses for 2014 are expected to be approximately US\$12.4 million, excluding about US\$3.3 million in depreciation expenses. On a cash basis, therefore, net income is expected to be approximately US\$ 4.2 million.

8. Pro-forma profit-and-loss and simplified cash-flow statements, incorporating the non-grant-financed project capital expenditures as well as estimated impacts on operations over a 30-year period, were prepared on a with- and without-project basis in order to estimate the direct financial returns of the project to ZRA. It should be noted that, because (i) capital expenditures are very high relative to ZRA's revenues and expenses, (ii) negligible additional water sales are expected in the with-project scenario (and note that those are due to investments by ZESCO and ZRA in their own assets, not due to the project), and (iii) reductions in water sales in the without-project scenario are relatively small and are expected to have an impact only after approximately 30 years, it was not expected that the financial returns to the project would be positive.

9. The analysis and projections assume that without comprehensive rehabilitation of the plunge pool and spillway gates, the operating rule curve for the dam will have to be gradually lowered in order to safely operate the dam. While the current recommended lowering of the operating rule curve (by three meters) is not expected to have an impact on water sales, further lowering of the curve in the future to accommodate potential risks involved in the operations of the sluice gates increase the likelihood that there will be periods of time in which the reservoir level may fall below the minimum operating level. Assumptions regarding future reductions in water sales reflect a rough estimate of the increased risk of that happening. The following summarizes the core assumptions of the projections.

ZRA Financial and Operational Information	
Base-year operating revenues:	
Fixed charges	US\$4.38 million
Volumetric charges	US\$0.3658/1,000 m3
Water sales	39,000 MCM
Total operating revenue	US\$18.65 million
Base-year operating expenses (cash basis)	US\$12.38 million
Annual inflation adjustment of fixed and volumetric revenues and expenses	0% (real prices)

With-Project Assumptions	
Non-grant-funded project costs	US\$133.25 million
End-project water sales	42,000 MCM
Maintenance expense rate (% of value of rehabilitated assets)	1%
Annual avoided extraordinary expenses	US\$1 million
Project implementation period	10 years

Without-Project Assumptions	
Reduction in water sales due to lowering of the rule curve:	
Year 5	0%
Year 10	5%
Year 15	8%
Year 20	11%
Year 25	16%
Year 30 (decommissioning for the purpose of hydro-electric generation)	100%
Annual maintenance expenses following decommissioning	US\$2 million

10. The results of the with- and without-project financial analysis using the above information indicate a slightly negative rate of return on the project – negative 0.18 percent. At a discount rate of two percent (ZRA’s cost of borrowing from the Government of Zambia), the project has a net present value of - US\$44.1 million. As noted earlier, this is not unexpected, given that the capital expenditures are very high relative to ZRA’s revenues and expenses, that only minor additional water production or sales are expected in the with-project scenario (and note that those are due to investments by ZESCO and ZRA in their own assets, not due to the project), that reductions in water sales in the without-project scenario are relatively small, and that decommissioning of the dam would only take place after approximately 30 years. The following summarizes the Financial Rate of Return and NPV.

Results of With- and Without-Project Financial Analysis	
Financial Internal Rate of Return (FIRR):	- 0.18%
NPV (at a discount rate of 2%)	- US\$44.1 million

11. Given the results of the base analysis, only minimum sensitivity analysis was undertaken with respect to the financial analysis: (i) a 30 percent increase in non-grant-financed project costs; and (ii) a 3-year increase in the project implementation period. The results of this analysis are as follows:

Project Financial Analysis: Sensitivity Analysis	
Scenario 1: 30% increase in non-grant-financed project costs	
Financial Internal Rate of Return (FIRR):	- 2.3%
NPV (at a discount rate of 2%)	- US\$124.2 million
Scenario 2: 3-year increase in project implementation period (with increase in project management costs)	
Financial Internal Rate of Return (FIRR):	- 0.7%
NPV (at a discount rate of 2%)	- US\$53.6 million

12. **Debt Sustainability Analysis:** Pro-forma profit-and-loss and simplified cash-flow statements incorporating the proposed US\$114.0 million in IDA and AfDB lending were prepared in order to estimate (i) whether ZRA's current revenue levels can support debt service obligations, and, if not, (ii) what level of tariff increase may be required in order for ZRA to safely maintain a minimum debt-service coverage ratio of 1.2. The exercise used the same base-case assumptions as those in the above financial analysis; however, it also assumed annual inflationary adjustments of revenues and expenses of 2 percent. The analysis obviously only looks at the with-project scenario.

ZRA Financial and Operational Information	
Base-year operating revenues:	
Fixed charges	US\$4.38 million
Volumetric charges	US\$0.3658/1,000 m ³
Water sales	39,000 MCM
Total operating revenue	US\$18.65 million
Base-year operating expenses (cash basis)	US\$12.38 million
Annual inflation adjustment of fixed and volumetric revenues and expenses	2%
Maintenance expense rate (% of value of rehabilitated assets)	1%

Financing/ On-lending Information⁴	
On-lending amount	US\$114.0 million
Maturity	31 years
Grace period	1 year
Repayment period	30 years
Interest rate	2%
Annual repayment amount (interest + principal)	5.1 m (fully amortizing loan)

13. The following indicates the resulting net cash flows, debt service, and debt-service coverage ratios for the initial years of the project and repayment. Note that there is no assumption of a reduction in ZRA revenues, as it is assumed that ZRA will be able to continue to provide water to the generating plants at existing levels.

DSCR, only inflationary increases in water charges
US\$ million

	2015	2016	2017	2018	2019	2020	2021	2022	2023
Net Operating Income, not including interest expense or depreciation	9.1	9.3	9.4	9.6	8.5	8.6	8.7	8.7	8.8
Debt Service (Interest + Principal)	2.3	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Debt Service Coverage Ratio	4.0	1.8	1.9	1.9	1.7	1.7	1.7	1.7	1.7

14. The results of the projections indicate that currently agreed tariff levels can accommodate the proposed lending and projected debt service. Note that this assumes no extraordinary increases in operating expenses. It is important to note that ZRA is able to meet debt service requirements despite the project's negative financial returns due to (i) positive operating income, due to agreed tariff increases; (ii) inflationary increases in revenues and expenses; and (iii) an interest rate on the loan below the level of inflation.

15. It is important to note that this analysis by no means indicates that no further tariff increases in the water provided to ZESCO and ZPC will be required. Other factors may point toward an increase, in particular, a decision to enable the accumulation of reserves for periodic extraordinary maintenance. Incorporating depreciation of the rehabilitated assets as well as debt service into a calculation of minimum revenue requirements would accomplish this. This analysis reflects only the ability of ZRA to service the debt committed by ZRA for the project.

Impact on End-User Electricity Tariffs

16. The ZRA water tariffs comprise a very small proportion of the total cost of providing electricity to consumers in Zambia and Zimbabwe. It is not expected that the project will have

⁴ On-lending arrangements are governed by Statutory Instruments in Zambia, requiring the Government of the Republic of Zambia (GRZ) to onlend at 2% per annum. However, the final agreement may change, particularly with respect to the grace period and term of the loan. The assumed on-lending terms enable GRZ to fully recoup the principal of the IDA and AfDB loans prior to their maturity.

any appreciable impact on end-user electricity tariffs. In the case of ZESCO, overall revenue from electricity sales in 2013 was approximately US\$504 million equivalent; current average tariffs are reported to be USc 6.6 equivalent. ZRA water charges to ZESCO are expected to total approximately US\$9.1 million in 2014, or 1.8 percent of total 2013 revenues. The expected 15 percent increase in ZRA charges in 2015 will result in an average increase in end-user tariffs of 0.32 percent. Even doubling ZRA water charges, which is not anticipated, would result in an increase in end-user tariffs on the order of 2.1 percent.

17. The ZPC's operations are limited to energy production only; it sells power to the Zimbabwe Electricity Transmission and Distribution Company (ZETDC), the cost of which is reflected in ZETDC's total costs. ZETDC's overall revenues for 2013 were US\$847 million, based on total electricity sales of 8,107 GWh, bringing ZRA water charges as a percentage of overall electricity costs in Zimbabwe to approximately 1.1 percent. The planned 15 percent increase of ZRA charges in 2015 will result in a 0.16 percent increase in end-user tariffs.

18. Electricity regulators in both countries have stated that ZRA tariffs are considered pass-through costs in the calculation of utility revenue requirements. There is no indication that either utility would be required to absorb the cost of ZRA tariff increases through reductions in other costs or in net revenues.

Fiscal Impact on the Government of Zambia

19. Because ZRA is a revenue-generating agency, there is an implicit and explicit assumption that ZRA will be responsible for repayment of debt committed to by the Government of Zambia. While the Government of Zambia will be the borrower of record, the Government will on-lend the proceeds of the loan to ZRA under a sub-loan agreement with terms similar, though not identical, to the terms of the IDA and AfDB credits. It is assumed that the Government will incorporate a small margin on top of the interest rates charged by the international financial institutions in order to compensate for administrative costs of managing the loans. While the loan repayment terms may mirror those of the IFIs (i.e., grace periods of at least 6 years, flat repayment of principal over 30 to 32 years, and decreasing interest costs over the principal repayment period), the government is also considering slightly shorter maturity periods and a fully amortizing loan repayment structure (with even combined principal and interest payments). This would advance repayments somewhat to Government compared to Government's commitment to the IFIs, reducing the risk to the Government. No negative impacts on Government's finances are anticipated.

Economic Analysis: With- and Without-Project Cost-Benefit Analysis

20. A with- and without-project economic analysis has been undertaken to estimate the net economic benefits of the project. While the end beneficiaries of the power generated through the Kariba Dam infrastructure are the people and economies of Zambia and Zimbabwe, these benefits pass through the two national electricity utilities, ZESCO and ZPC. Because of this pass-through of economic benefits and costs, the analysis was structured in a straightforward manner that incorporates the direct impacts of the project on ZRA and on ZESCO and ZPC.

21. Project costs are quite clear, consisting of the project-related capital expenditures as well as ongoing maintenance costs for the rehabilitated assets. The analysis takes the view that the costs of the without-project scenario consist of the cost to replace electricity production that is

lost over time due to (i) the lowering of the operational rule curve and (ii) ultimate de-commissioning of the dam for hydroelectric purposes in the long term.

22. An alternative analysis could have tried to estimate the cost to the overall economy of the reduction and ultimate loss of electricity generation from the Kariba Dam. However, given the importance of said generation, approximately 46 percent of electricity production in Zambia and 50 percent in Zimbabwe,⁵ there is no question that the respective utilities and governments would have to identify and pay for replacement power.

23. Therefore, estimating the cost of replacement power compared to the current cost of electricity generation is the most straightforward calculation of cost to the economy of not undertaking the project. Currently, power generation at the Kariba North (ZESCO) and South (ZPC) power stations are among the least expensive in the region, with the cost of power generation at Kariba North Bank estimated at US\$0.0074 per kWh (less than USc 1 per kWh), and the cost at Kariba South Bank at US\$0.02593/kWh. At the dam's normal rule curve, the two power stations generate approximately 10,035 GWh per year under normal operating conditions.

24. Given the current condition of the Kariba plunge pool and spillways, dam engineers recommend a significantly lower rule curve for dam operations. While the recommended rule curve currently does not have an impact on the delivery of water, it does result in lower energy production; engineers estimate at least an 11 percent reduction in energy generation at the current recommended rule curve. Future additional lowering of the rule curve to accommodate worsening conditions of the plunge pool and the sluice gates would result in further reductions in energy generation, as well as much greater likelihood of the lowering of reservoir levels below the minimum operating level during particular months of the year. Because of the difficulty in predicting the likelihood of such periodic losses of generating power, this analysis assumes a percentage loss of generating capacity relative to full capacity that increases over time.

25. With- and without-project costs and benefits have been projected over a period of 40 years. In addition to figures provided with respect to ZRA's operational revenues and expenses, the following summarizes the core assumptions of the economic projections.

With-Project Assumptions	
Project Costs	US\$294.3 million
Project implementation period	10 years
Start-of-project water delivery	39,000 MCM
End-project water delivery	42,000 MCM
Loss of generation capacity at recommended operating rule curve	11%
Loss of generation capacity following completion of plunge-pool rehabilitation works	5%
Loss of generation capacity following completion of all works	0%
Cost of electricity generation at Kariba North	US\$0.00742

⁵ ZPC's Kariba South power station represents 36 percent of Zimbabwe's installed capacity, but because of ongoing repairs at ZPC's thermal generating plant (Hwange), it currently generates an estimated 50 percent of Zimbabwe's total generation.

(ZESCO), based on 100% generation capacity	
Cost of electricity generation at Kariba South (ZPC), based on 100% generation capacity	US\$0.02593

Without-Project Assumptions	
Start-of-period water delivery	39,000 MCM
Base annual electricity generation	9,720 GWh
Loss of generation capacity at year 1 recommended operating rule curve	11%
Estimated loss of generation capacity:	
In year 5	13%
In year 10	16%
In year 15	19%
In year 20	22%
In year 25	27%
In year 30 (decommissioning for the purpose of hydro-electric generation)	100%
Cost of electricity generation at Kariba North, based on 100% generation capacity	US\$0.00742/kWh
Cost of electricity generation at Kariba South, based on 100% generation capacity	US\$0.02593/kWh
Cost of replacement power	US\$0.165/kWh

26. The base-case assumption for the cost of replacement power (US\$0.165/kWh) is based on current prices for power generation at recently completely public-private partnerships in energy generation. The lowest possible cost of replacement power may be as low as US\$0.0626/kWh, which is based on recent trading prices within the SAPP. However, amounts traded are a tiny percentage of the amounts needed to replace lost electricity generation from Kariba. At the highest extreme, the cost for oil-fired, medium-speed diesel generation electricity – potentially the only viable option for replacement power in the amounts required – is estimated at US\$0.27/kWh, but can be even higher.

27. While we have not tried to model it due to uncertainty of the probability of occurrence, it is important to note that, if one of the gates failed in a manner that prevented its closure, the result would be the sudden loss of significant water volume and lowering of the reservoir below the minimum operating level. It is estimated that emergency repairs for such a failure would take at least a year, during which time no electricity generation from the Kariba plants would be possible. At a cost of replacement power of US\$0.16/kWh, the cost of replacement power over the course of a year would be US\$1.5 billion. This cost would have to be passed on to end consumers and the economies at large. In addition, it is doubtful that sufficient power at that price would be available, in which case emergency power generation at a significantly higher cost would need to be brought in. While economic analysis based on predictable scenarios of gradual future power losses provide sufficient justification for the project, the rehabilitation investments may also be considered as insurance against the unknown risk of the failure of one of the gates in the open position.

28. Given the high cost of replacing power now being generated through the Kariba power stations, the with- and without-project net economic benefits are highly positive even with very conservative estimates for power generation losses and best-case scenarios in terms of the cost of replacement power: the Net Present Value at a discount rate of 6 percent, reflecting the long-lived nature of the dam and the rehabilitation works, is calculated at approximately US\$3.5 billion. Using the traditional discount rate of 10 percent, the NPV is calculated at US\$1.3 billion. The internal rate of return (IRR) is estimated at 33 percent. It is important to note that, as neither ZESCO nor ZPC would be able to absorb the higher cost of power purchases and would have to pass those costs on to end users, these are direct economic benefits to end users and the economy as a whole.

Results of With- and Without-Project Economic Analysis	
Internal Rate of Return (IRR):	33%
NPV (at a discount rate of 6%)	US\$3.5 billion
NPV (at a discount rate of 10%)	US\$1.3 billion

29. Several scenarios were modeled to estimate the project's sensitivity to various risk factors and the robustness of the above results. Sensitivity factors were taken from the project's risk analysis, in particular, the risks of implementation delays and of cost escalations. In addition, a sensitivity analysis was run incorporating more optimistic (i.e., less expensive) estimates of the cost of replacement power, which would reduce the project's IRR and NPV. The results indicate that the economic returns to the project are highly robust. The results of the sensitivity analyses are as follows:

Project Economic Analysis: Sensitivity Analyses	
Scenario 1: 30% increase in project costs Total Project Costs: US\$382.5 million 10-year implementation period	
Internal Rate of Return (IRR):	28%
NPV (at a discount rate of 6%)	US\$3.5 billion
NPV (at a discount rate of 10%)	US\$1.2 billion
Scenario 2: 3-year increase in project implementation period (with increase in project management costs) Total project costs: US\$ 308.9 million 13-year implementation period	
Internal Rate of Return (IRR):	34%
NPV (at a discount rate of 6%)	US\$3.6 billion
NPV (at a discount rate of 10%)	US\$1.3 billion
Scenario 3: Scenarios 1 + 2 Total Project Costs: US\$401.6 million 13-year implementation period	
Internal Rate of Return (IRR):	28%

NPV (at a discount rate of 6%)	US\$3.5 billion
NPV (at a discount rate of 10%)	US\$1.2 billion
Scenario 4: Cost of replacement power falls to US\$ 0.12/kWh	
Internal Rate of Return (IRR):	25%
NPV (at a discount rate of 6%)	US\$2.3 billion
NPV (at a discount rate of 10%)	US\$771 million
Scenario 5: Cost of replacement power rises to US\$0.27/kWh	
Internal Rate of Return (IRR):	51%
NPV (at a discount rate of 6%)	US\$6.5 billion
NPV (at a discount rate of 10%)	US\$2.5 billion

30. The robustness of the results of the economic analysis is due almost entirely to the fact that the benefits of the project are the result of the relatively high cost of replacement power – the cost of replacement power is at least US\$0.165 per kWh, which is far higher than the current average cost of US\$0.017. In addition, the relatively long implementation period (10 years) means that an increase in the implementation period does not have a strong economic impact due to discounting, even at a relatively low discount rate of 6 percent. In economic terms, a compressed implementation schedule would likely affect the returns of the project more noticeably, due to the effect of discounting. More importantly, significant compression of project implementation would likely only be possible through lowering of the reservoir level below the minimum operating level, which would result in a complete shutdown of hydroelectric power generation at the Kariba plants and direct costs to the economy of at least US\$1.5 billion.

ANNEX 6: OPERATIONAL RISK ASSESSMENT FRAMEWORK (ORAF)

Africa: Kariba Dam Rehabilitation Project (P146515)

Project Stakeholder Risks						
Stakeholder Risk	Rating	High				
<p>Risk Description:</p> <p>The Kariba Dam has a long and emotive history and support to the rehabilitation will be of international interest. A number of misconceptions exist around the required rehabilitation works that could result in delays to the works program. There is also a risk that historical issues associated with the displacement of people during the original construction will have an impact with the potential to attract an international focus from NGOs working on large dams and resettlement issues.</p>	Risk Management:					
	<p>An effective communications strategy and stakeholder engagement process will be required to ensure transparent flow of information. The historical issues associated with the original construction are being addressed through a parallel process to assess development of the Batoka Gorge Hydro-Electric Scheme and broader benefit sharing mechanisms, including a review and assessment of the existing Zambezi Valley Development Fund.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Both	Not Yet Due	Both	<input checked="" type="checkbox"/>		CONTINUOUS
Implementing Agency (IA) Risks (including Fiduciary Risks)						
Capacity	Rating	Moderate				
<p>Risk Description:</p> <p>The ZRA has a demonstrated capacity for management of operations, but has not undertaken major rehabilitation or civil works and so could result in delays in implementation.</p>	Risk Management:					
	<p>Implementation capacity will be enhanced through an international engineering firm to assist with the technical support to the overall project design, preparation of procurement documents, and supervision of construction. An independent Panel of Experts will also be retained to support ZRA with review of investigations, design, and implementation of the rehabilitation works.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Client	In Progress	Both	<input type="checkbox"/>		
Governance	Rating	Moderate				
<p>Risk Description:</p> <p>Relatively large infrastructure works could be susceptible to governance risks that undermine quality, delivery and cost considerations. The governance arrangements involving different institutions from two different</p>	Risk Management:					
	<p>Governance structures have been established to ensure official oversight and there is a strong commitment to ensuring a transparent process, informed by previous experience, with Bank assistance to ensure international best practice.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:

countries with potentially different interests could accentuate tensions and undermine efficiencies.	Client	In Progress	Both	<input type="checkbox"/>		
Project Risks						
Design	Rating	Moderate				
<p>Risk Description:</p> <p>The project design is relatively simply, with discrete components addressing the rehabilitation needs. However, complexity of the civil works and the financial structure could result in delays to works program increasing risk to flooding or other natural disasters.</p>	Risk Management:					
	<p>Preparation has confirmed the arrangements and been undertaken jointly with AfDB, EU and WB to ensure a consistent approach. The simple project design and focus efforts on mitigation measures, including packaging of works, financing alignment and monitoring of baseline environmental conditions to inform flood forecasting, along with joint supervision missions among the partners, will help mitigate the risks.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Both	In Progress	Both	<input type="checkbox"/>		
Social and Environmental	Rating	Substantial				
<p>Risk Description:</p> <p>The rehabilitation measures are not expected to have any significant adverse environmental impacts or require any resettlement. The rehabilitation works are not expected to require the involuntary taking of land nor involuntary restrictions of access to legally designated parks and protected areas. However, historical issues associated the displacement of people during the original construction and general environmental concerns associated with large dam projects could divert attention away from the rehabilitation.</p>	Risk Management:					
	<p>An ESIA Consultant has been appointed and is currently undertaking the assessment. The ToRs were subject to a consultative process and the assessment will include an ESMP and RPF that will be completed, consulted and disclosed prior to commencement of any works.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Both	Not Yet Due	Both	<input type="checkbox"/>		
Program and Donor	Rating	Moderate				
<p>Risk Description:</p> <p>A joint financing program involving concessional donor funds is required to finance the rehabilitation program. Financing partners have agreed on the package of works and to proceed with a joint program.</p>	Risk Management:					
	<p>Joint preparation missions have helped to reach agreement among the financiers and all three financiers are scheduled to finalise approvals around the same time in preparation for a joint signing ceremony in January 2015. Cross conditions for effectiveness and agreement on covenants will help re-enforce implementation. Joint supervision missions and an MoU on procurement will help ensure continued alignment during implementation.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:

	Bank	In Progress	Preparation	<input type="checkbox"/>		
Delivery Monitoring and Sustainability	Rating	Moderate				
<p>Risk Description:</p> <p>Sustainability of the dam will continue be undermined in the absence of the rehabilitation program, resulting ultimately in catastrophic failure. The financial sustainability of the ZRA will be affected by the financing parameters, with a need to secure concessional financing to avoid significant tariff increases and equity injections.</p>	Risk Management:					
	<p>Sustainability of the dam maintenance program is assured through the tariff framework under concessional financing terms. Commitment from both Governments to continuing supporting tariff increases that allow levels to be maintained above or at near cost reflective levels will be required to ensure sustainability. The tariff increases required to meet the repayment obligations will need to be incorporated into these tariff migration plans to ensure a smooth transition and ensure the ability of ZRA to repay lenders for debt financing and proper maintenance of the rehabilitated dam facilities.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Client	In Progress	Both	<input type="checkbox"/>		
Other (Optional)	Rating	Moderate				
<p>Risk Description:</p> <p>The Risk of Inaction is one of the critical time-bound risks associated with the project. Failure to implement rehabilitation of key elements of the Kariba Dam would result in non-compliance with international dam safety measures and increase the risk of catastrophic failure. Such failure would not only result in the loss of human lives and large economic losses, but would also severely undermine regional energy security and supplies, with impacts on economic growth and development prospects across the southern African region.</p>	Risk Management:					
	<p>The required financing for the rehabilitation will be confirmed by January 2015 with agreement among the financiers. A number of key procurements have been initiated by the Client and a clear roadmap agreed among the partners to mitigate the risk of inaction.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Both	In Progress	Implementation	<input type="checkbox"/>		
Other (Optional)	Rating	Moderate				
<p>Risk Description:</p> <p>Hydrological Risks could increase the risks associated with works required to be undertaken on both the spillway and the plunge pool. High flows during implementation of the project could place these at risk and undermine the safety of the works and the dam. Measures will be implemented to ensure protective structures are in place, which with monitoring and forecasting will provide some comfort and lead time to allow for interventions in the</p>	Risk Management:					
	<p>Continuous monitoring of the inflows, and agreed operations for the reservoir during the works period will limit the instream works to the non-spill periods to reduce the risk. An independent panel of experts will also provide oversight and identify risk trajectories.</p>					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
	Client	Not Yet Due	Implementation	<input type="checkbox"/>		

face of changing hydrological conditions.

Overall Risk

Overall Implementation Risk:

Rating

High

Risk Description:

During implementation the "reputational risk" for the Bank associated with the bi-national nature of the ZRA could become an increasingly important consideration. The fact that Zimbabwe, a country in non-accrual status to IBRD/IDA, co-owns the entity indirectly benefiting from the financing to Zambia could be seen by the Rating Agencies as weakening the Bank's preferred creditor treatment, potentially requiring IBRD to hold more capital to maintain its AAA rating (even if there are no legal or policy impediments to such financing). However, in view of the potential massive loss of lives and power, and reputational aspects, a carefully structured operation with clear and transparent description of risks is considered to provide an appropriate balance of developmental, humanitarian and credit risk aspects.

There is also a risk that historical issues associated with the displacement of people during the original construction will impact on implementation of the rehabilitation works with the potential to attract an international focus from NGOs working on large dams and resettlement issues.

Cost escalations pose a significant risk to implementation, with the final cost of the works to be carried out under the project likely to be subject to a higher uncertainty than in the case of more conventional works due to various reasons.

ANNEX 7: IMPLEMENTATION SUPPORT PLAN

AFRICA: Kariba Dam Rehabilitation Project

Strategy and Approach for Implementation Support

1. The strategy for supporting implementation of the Kariba Dam Rehabilitation Project is integrated into the overall strategy for the Bank's support to the program of activities in the Zambezi River basin. This is guided by the basin level agreements and governance structures and has been developed based on the complex interaction between a series of projects among the riparian states and the corresponding risk profile.
2. The ORAF (Annex 6) rates the overall implementation risk high. The bi-national nature of the project, within the regional context of the eight riparian states of the Zambezi River basin, means that project support requires a high level of frequent engagement with a wide range of different stakeholders. This is supported by partnerships established among the riparian states within the context of the SADC structures and the basin level partnerships.
3. The risk profile of the project, coupled with the co-financing arrangements advocate for joint implementation support missions with the AfDB and the EU and close, sustained contact with Sweden who will participate as available. The multiple structures further advocate for a local presence and frequent engagement that informs development of the implementation support plan.

Implementation Support Plan

4. The first 18 months of implementation will continue to provide support to finalization of key procurements and timely implementation of activities on the critical path. This will be led through regionally based staff and regular interaction, supported by formal bi-annual missions with a larger, comprehensive team of technical specialists. This will help in providing guidance during preparation and mobilization of the consultants and contractors, while ensuring continuity in the process of addressing the key risks. It will also provide the time required for the engagement at the basin level to support other projects within the program series.
5. In order to provide timely implementation support through missions and on-demand guidance, the majority of the Bank task team, particularly fiduciary and safeguards staff, will continue to be based in the region. The table below indicates the level of effort required annually that will be needed from the Bank to provide implementation support for the project. The resource estimates are based on standard co-efficients for preparation and supervision of individual projects.

What would be the main focus in terms of support to implementation during:

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First six months	Finalizing approvals and appointment of consultants	Full complement outlined below	US\$150k	Coordination, advisory & alignment
First twelve months	Launching bids and mobilization of contractors	Full complement outlined below	US\$150k	Coordination, advisory & alignment
12-36 months	Implementation	Full complement	US\$300k	Coordination, advisory

	of Plunge Pool and tendering spillway	outlined below		& alignment
36 - 60 months	Completion of Plunge Pool, implementation of spillway, review of EPP	Full complement outlined below	US\$300k	Coordination, advisory & alignment
60 - 108 months	Implementation & completion of spillway	Full complement outlined below	US\$300k	Coordination, advisory & alignment
108 – 120 months	Finalization of EPP & operating Procedures	TTL, Dam Safety, Environment, Social and Fiduciary	US\$200k	Coordination, advisory & alignment

Skills Mix Required (annually)

<i>Skills Needed</i>	<i>Number of Staff Weeks</i>	<i>Number of Trips</i>	<i>Comments</i>
Task Team Leader	10	4	Regional based
Dam Specialist	8	2	Washington based
Hydropower Specialist	8	2	Washington based
International Water Resources	6	2	Washington based
Country Lawyer	3	1	Washington based
Environmental Specialist	8	2	Washington based
Social Specialist	8	2	Washington based
Procurement Specialist	4	2	Regional based
Financial Management Specialist	4	2	Regional based
Operations Analyst	6	2	Washington based
Program Assistant	4	1	Regional based
Program Assistant	4		Washington based

Partners

<i>Name</i>	<i>Role</i>
African Development Bank	Co-financier
European Union	Co-financier
Sweden	Trust Fund Contributor and Co-financier

ANNEX 8: MAP

AFRICA: Kariba Dam Rehabilitation Project

