



Transboundary Water Management in SADC DAM SYNCHRONISATION AND FLOOD RELEASES IN THE ZAMBEZI RIVER BASIN PROJECT



Annex 1

Summary Report of Compiled Literature and Existing Studies,
Geodata, Measuring / Gauging Stations and Available Data

31 March 2011



SWRSD Zambezi Basin Joint Venture



This report is part of the Dam Synchronisation and Flood Releases in the Zambezi River Basin project (2010-2011), which is part of the programme on Transboundary Water Management in SADC. To obtain further information on this project and/or programme, please contact:

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List of Acronyms

AG	Advisory Group
ARA Zambeze	Regional Water Administration for Zambezi
ARS	Automatic Rainfall System
CBO	Community Based Organization
CDM	Clean Development Mechanism
CPC	Climate Prediction Centre
DANIDA	Danish International Development Assistance
DNA	Direcção Nacional de Águas (Department of Water Affairs in Mozambique)
DWA	Department of Water Affairs, Zambia
ECMWF	European Centre for Medium-Range Weather Forecasts
EDM	Electricity de Mozambique
EFR	Environmental Flow Requirements
ESCOM	Electricity Supply Commission of Malawi
EU	European Union
GIZ	Deutsche Gesellschaft für Intenationale Zusammenarbeit GmbH (German International Cooperation)
HCB	Hidroeléctrica Cahora Bassa
HYCOS	Hydrological Cycle Observation Station
ICOLD	International Commission of Large Dams
ICP	International Cooperating Partner
IFR	Instream Flow Requirements
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standard Organization
IUCN	International Union for Conservation of Nature
MAR	Mean Annual Runoff
METEOSAT	Meteorological Satellites
MoU	Memorandum of Understanding
MIWD	Ministry of Irrigation and Water Development, Malawi
NCAR	National Centre for Atmospheric Research
NCEP	National Centres for Environmental Prediction
NGO	Non Governmental Organization
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
PC	Policy Committee
PMC	Project Management Committee
PMS	Performance Management System
PSC	Project Steering Committee
RBO	River Basin Organization
RSAP	Regional Strategic Action Plan
RSMC	Regional Specialised Meteorological Center, Tshwane
SADC	Southern African Development Community
SAPP	Southern Africa Power Pool
SARCOF	Southern Africa Regional Climate Outlook Forum
SAWS	South African Weather Service
SIDA	Swedish International Development Agency
SWRSD JV	SSI, WRNA, Rankin, SEED, Deltares Joint Venture (the Joint Venture of Consulting Firms for this Project)
ToR	Terms of Reference

TRMM	Topical Rainfall Measuring Mission
TTWW	Think Tank Work Week
TWM	Transboundary Water Management
UNFCC	United Nations Framework Convention on Climate Change
UNZA	University of Zambia
USAID	United States Agency for International Development
USGS	US Geological Survey
UTIP	Inidade Técnica de Implementação de Projectos Hidroeléctricos
WB	World Bank
WMO	World Meteorological Organization
WWF	World Wide Fund for Nature
ZACPLAN	Zambezi Action Plan
ZAMCOM	Zambezi Watercourse Commission
ZAMWIS	Zambezi Water Information System
ZESA	Zimbabwe Electricity Supply Authority
ZESCO	Zambia Electricity Supply Company
ZINWA	Zimbabwe National Water Authority
ZMSD	Zimbabwe Meteorological Services Department
ZPC	Zimbabwe Power Company
ZRA	Zambezi River Authority

Executive Summary

This Annex supports the Main Report of the Dam Synchronisation and Flood Releases in the Zambezi River Basin Project, entitled “Concepts and Recommendations for Improved Basin-Wide Management”. The aim of the overall study was to provide a comprehensive response to the question: “How can dams and measures of water management in the whole Zambezi River Basin contribute to safeguarding lives, livelihoods and nature while giving room for further sustainable development with due regard for the costs?” To address this issue, the consultancy team carried out an in-depth study which was composed of eleven tasks resulting in five outputs. This Annex summarizes the first of these Outputs, relating to literature and data.

Several attempts have been made in the past to compile information related to the Zambezi River Basin. This includes the Zambezi River Basin Information System (ZACBASE) developed under ZACPRO 6.1, which was lost due to hardware complications. Its successor, the Zambezi Water Information System (ZAMWIS) was formalized in the 2nd Phase of the ZACPRO 6 Project. While this is presently dormant as it awaits the formalization of its host, the Interim ZAMCOM secretariat, the information is available on DVD. The literature, data and maps which it contains were carefully reviewed as part of the assignment. Strengths and deficiencies within the package were identified and are presented in this report. In addition, supplementary literature, data and maps which were obtained or produced during the course of this project have been compiled in this report and handed over in soft copy to the Client, along with the appropriate metadata files. This Annex also contains a summary of all the models that are presently in use in the upper, middle, lower and total Zambezi River basin.

To ensure that data is effectively managed and systems are in place for its collection, storage and sharing, this Annex proposes that a centralized system should be adopted by the Zambezi riparian states, which is hosted and managed by ZAMCOM, a central organization to which all member-states fully subscribe. It is therefore assumed that ZAMCOM will come into effect, and that they will be responsible for the central management of data.

The Concept presented in this report for data information and sharing is that ZAMWIS, the most recent information management system prepared for basin wide data, should be resuscitated, improved and integrated into the operation of all stakeholders, with mechanisms in place to regularly update it with geodata, literature & reports, as well as maps, and any other relevant information. The following specific recommendations have therefore been made.

- Institutionalize the collection, management and sharing of data and information, and resuscitate the ZAMWIS database at the Interim ZAMCOM premises that are presently being established.
- Convert ZAMWIS database to store agreed standardized data formats, and link regional systems such as SADC-HYCOS to ZAMWIS.
- Engage professionals to enhance or completely re-configure the current windows-based interface of ZAMWIS, allowing for ease of access to data and updating of information. ZAMWIS should be converted into a system that is server-hosted, and accessible through the Internet. Security features should be built in to allow for access from different stakeholders, who will be permitted to provide updates to information, while any other entities will be able to log in and enter the web-based system and collect data as required.
- Future projects should have a requirement specified in the ToRs that specifically requires them to contribute to ZAMWIS and SADC-HYCOS by preparing maps, data, etc in similar format. These should be provided to ZAMCOM for integration into the system, or if the web-based system is in operation, should be uploaded directly.

- Provide for a study to clean, patch and extend available observed data and carry out statistical analysis of stream flows to inform dam operations. Provide for on-going service as the data provided often has gaps that need to be filled.
- Carry out verification of existing data from different stations to assess the consistency and quality of information.
- Put in place systems which require the regular updating of rating curves and calculate flows from observed gauge records.

1 Introduction

The Zambezi River Basin extends over 1,350,000 km² and is the largest river system in southern Africa. Rising in the North Western Province of Zambia, the river flows approximately 2,650km until it reaches the Indian Ocean. The extensive catchment area drains eight nations namely: Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe (see Figure 1.1). Due to its sheer geographical expanse and its transnational nature, the Zambezi River Basin is complex to manage in the face of sometimes competing economic and political interests of the different countries that make up the basin, as well as varied requirements from the environment, flood control, hydropower production, agriculture, fisheries, manufacturing, mining and tourism.

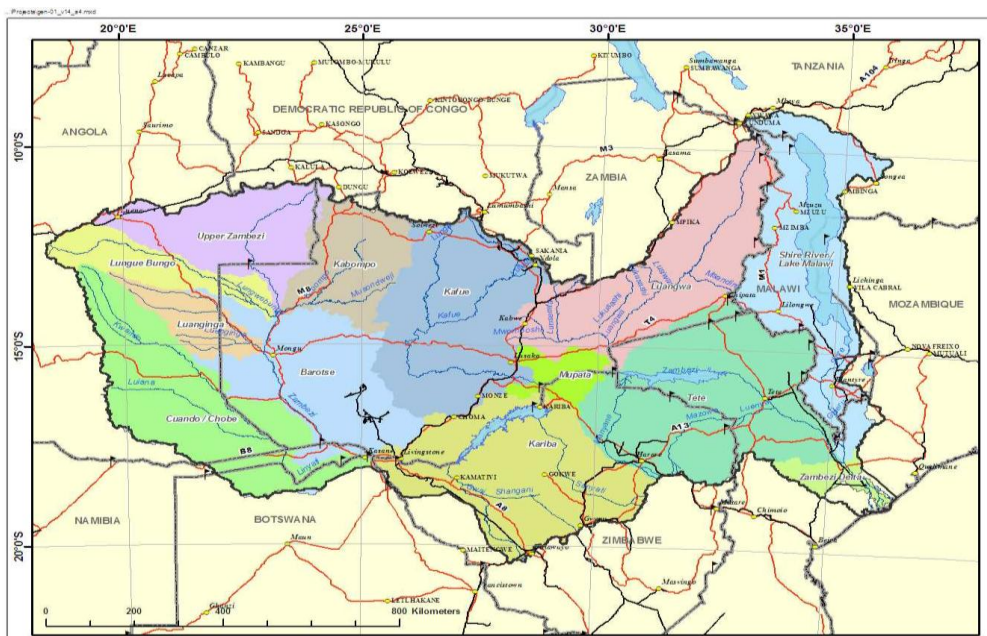


Figure 1.1: The Zambezi River Basin (Source: ZAMWIS)

The concept of integrated water resources management (IWRM) in river basins has been a key field of interest and support in GIZ cooperation for many years, and is also an issue which has been prioritized by the SADC Water Division. In its efforts to improve transboundary water management in the region, GIZ has agreed to support this Project on “Dam Synchronization and Flood Releases in the Zambezi River Basin”, which was commissioned by the Federal Ministry for Economic Cooperation and Development, in delegated cooperation with UKAid and the Australian Government Aid Program. The aim of this Project is the drafting of constructive recommendations for implementing water management measures in the basin to safeguard lives, livelihoods and the environment while giving room for further sustainable development with due regard to costs.

A wide range of studies have been carried out over past decades on the Zambezi River and its tributaries. These have covered a wide range of technical, social, economic and policy issues relating to the management of water resources in the Zambezi basin. Many of these previous reports have been used as reference material for this study. The first task in this assignment was the compilation of all data and information from these previous studies. This reference material includes a comprehensive digital and hard copy databases of a wide range of variables.

2 Purpose and Structure of this Report

The outcome of the Project carried out was to provide a comprehensive response to the question: “How can dams and measures of water management in the whole Zambezi River Basin contribute to safeguarding lives, livelihoods and nature while giving room for further sustainable development with due regard for the costs?” To address this issue, the consultancy team carried out an in-depth study which was composed of eleven tasks which led to five outputs.

The Executive Summary and Main Report (bound separately) provide an overview of the Project findings, and the necessary level of detail. The Annexes to the Main Report provide further information and more in-depth detail for those who may be interested in a particular aspect of the project.

The purpose of this Annex is to summarize all literature and data which has been compiled and which is of relevance to the overall aim of the project. Figure 2.1 below shows the structure of the entire Report, composed of the Executive Summary, Main Report and four Annexes, each bound separately.

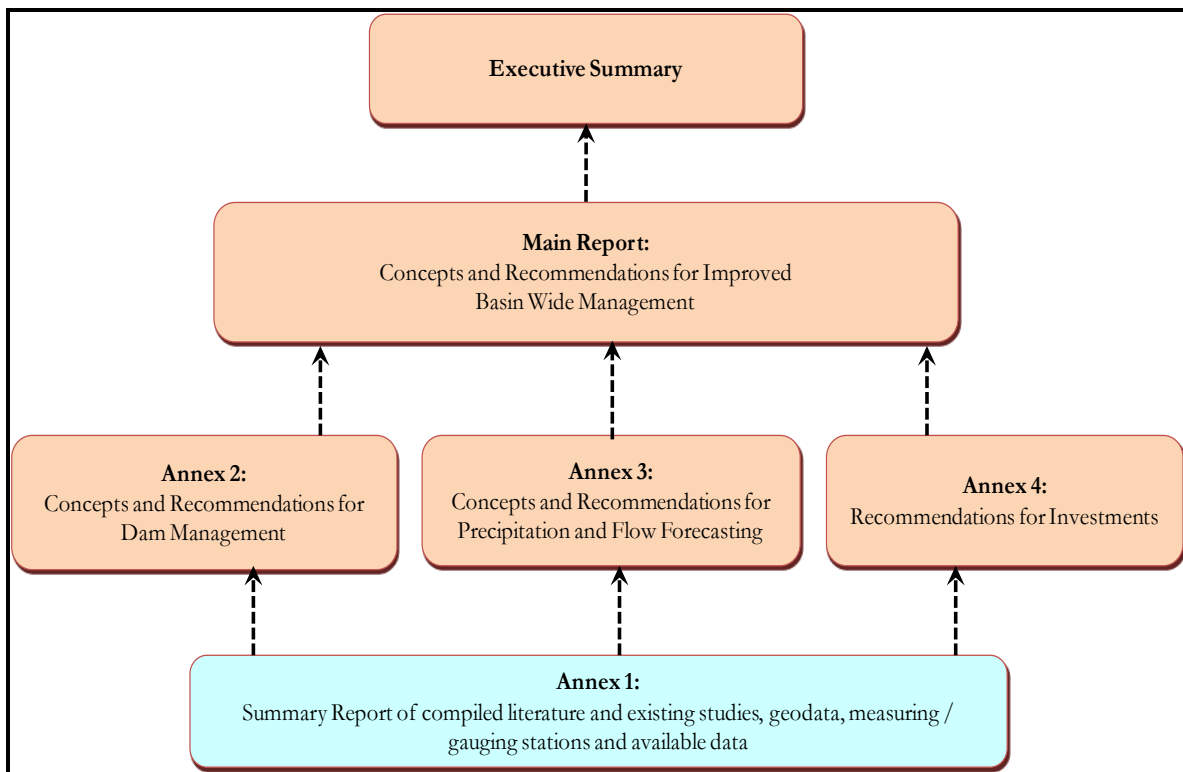


Figure 2.1: Alignment of project reports

A comprehensive database of the water resources of the Zambezi basin, ZAMWIS, has been previously compiled and is to be managed by the Interim ZAMCOM Secretariat. Chapter 3 of this Report is dedicated to an in-depth review of ZAMWIS. In addition, details of additional literature and data accumulated in the course of the project, which are not as yet included in ZAMWIS, have been highlighted in Chapter 4. Chapters 5 and 6 provide details of existing models which are in use in the Zambezi River Basin and the details of the metadata files, respectively. The final Chapter examines Concepts and Recommendations for improved data management and information sharing for the purpose of enhancing the synchronized management of dams and improved flood control.

3 ZAMWIS Database

The Zambezi Water Information System (ZAMWIS) is a “Geographical Information System (GIS) based database which contains a repository of digitally available reports. These have been catalogued by country and sub-sector.”(MM, 2008) It is supposed to be an internet-based database that is accessible to all the Zambezi riparian states. However, due to challenges related to poor internet connection in the region and other operational difficulties, this is not yet the case. Some information has been transferred to the Interim ZAMCOM Secretariat which is not yet fully established. Prior to this, ZAMWIS was hosted by Zambezi River Authority (ZRA) in Lusaka, Zambia.

A precursor to the ZAMWIS was the Zambezi River Basin Information System (ZACBASE) developed under ZACPRO 6.1. Unfortunately, the ZACBASE database was corrupted in a computer crash and other IT complications and was not fully recovered (MM, 2007). As a starting point in the compilation of data for ZACBASE, visits were made to the relevant institutions in the Zambezi riparian states to secure and obtain whatever material was available. ZAMWIS was then formalized in the 2nd Phase of the ZACPRO 6 Project under a study that was conducted by Euroconsult and Mott MacDonald.

While the internet-based database was not available, a DVD copy was obtained and all information within it reviewed. To operate well, ZAMWIS is supposed to have interfaces within which the user can interact with the information, and identify what data is available. This is not fully operational on the DVD. Maps and documents can be accessed relatively easily, while there was no interface identified for the data.

To fully understand what information was available in ZAMWIS, its root directory was investigated. Hydrological and meteorological data have been listed according to country and data-type, while documents are categorized according to their countries. Besides containing useful data and literature, ZAMWIS has proven to be a very useful tool with respect to interactive maps. These provide a significant amount of graphical information which is of relevance to the present Project and which is of value to any stakeholder in the Basin. These are viewed through software that is provided on the DVD.

This study found that the database offers three main categories of information as:

1. Literature, in the form of publications and consultancy reports.
2. Data in the form of time series of hydro-meteorological variables such as rainfall, temperature, water levels and rated discharges, most on a daily or monthly basis.
3. Spatial data in the form of geographical maps.

3.1 Literature

A comprehensive list of literature is available through the ZAMWIS database. Soft copies are contained within the DVD, and a catalogue of reports only available in hard copy format has been compiled. An interface referred to as the ZAMWIS Electronic Library provides easy access to the digital documents. This interface provides some basic information on each document, stating the full title, category(s) in which it falls, the file location as well as other information such as whether it is in hard or soft copy, and what the nature of the document is (study, policy, time-series, etc). Tables 3.1-3.9 below provide a full list of all documents included within the ZAMWIS database, sorted by country.

3.1.1 Angola

Table 3.1: ZAMWIS Literature Database for Angola (Source: Zamwis)

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
An-1	Africonsult (1998). <i>Management and Development of the Water Resources. Report of Country Situation. Final Report. Round Table about the Integrated Development of Water Resources in SADC.</i> Ministry of Energy and Water. Luanda, Angola.	Hard copy	-	-	-	-
An-2	Arnt Bjøru. (2003). <i>Quality Check - Historical Hydrological Data in Angola.</i> NVE, Norway.	Soft copy		Hydrology, Water Development	Study	Please copy the 'Full document title' as is given in the 'document title' column
An-3	Global Water Partnership Southern Africa (2003). <i>Status of National Integrated Water Resources Management Processes in Southern Africa.</i> Harare, Zimbabwe.	Soft copy		Water development, Institutional, Population and social, financial, environmental	Study	Full document title
An-4	Government of the Republic of Angola (2003). <i>Planning. Strategy to Combat Poverty, Social Reinsertion, Rehabilitation and Reconstruction and Economics Stabilisation.</i> Ministry of Planning. Luanda, Angola.	Hard copy	-	-	-	-
An-5	Government of the Republic of Angola (2003). <i>Strategy for the Development of the Water Sector.</i> Ministry of Energy and Water. Luanda, Angola.	Soft copy		Water development, Institutional, Population and social, financial, environmental	Policy	Full document title
An-6	Government of the Republic of Angola (2003). <i>Water Administration and Status of Hydrological Data Collection, Processing, Storing and Distribution.</i> Ministry of Energy and Water Affairs. Luanda, Angola.	Hard copy	-	-	-	-
An-7	Government of the Republic of Angola (2004). <i>Angola: TCP/ANG/2908 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP).</i> Ministry of Agriculture and Rural Development/ Food and Agricultural Organization of the United Nations. Luanda, Angola.	Soft copy	N	Agriculture, Institutional, Population and social, financial	Policy	Full document title
An-7	Government of the Republic of Angola (2004). <i>Angola: TCP/ANG/2908 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP).</i> Ministry of Agriculture and Rural Development/ Food and Agricultural Organization of the United Nations. Luanda, Angola.	Soft copy	N	Agriculture, Institutional, Population and social, financial	Policy	Full document title -PORTUGUESE-

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
An-8	Government of the Republic of Angola (2004). <i>National Water Sector Management Project (NAWASMA). Mid-Term Review Final Report</i> . Ministry of Energy and Water. National Directorate for Water. Luanda. Angola	Soft copy		Water development, institutional	Report	Full document title
An-9	Government of the Republic of Angola (2004). <i>Review of Agricultural Sector and Food Security. Strategy and Investment Priority Setting (TCP/ANG/207) Volume I, III, IV, V</i> . Ministry of Agriculture and Rural Development/Food and Agricultural Organization of the United Nations. Luanda, Angola.	Soft copy	N	Agricultural, Water development, Institutional, Population and social, financial, environmental	Policy	Full document title
An-9	Government of the Republic of Angola (2004). <i>Review of Agricultural Sector and Food Security. Strategy and Investment Priority Setting (TCP/ANG/207) Volume I, III, IV, V</i> . Ministry of Agriculture and Rural Development/Food and Agricultural Organization of the United Nations. Luanda, Angola.	Soft copy	N	Agricultural, Water development, Institutional, Population and social, financial, environmental	Policy	Full document title PORTUGUESE-
An-10	Government of the Republic of Angola (2005). <i>National Directorate of Water (DNA). Final Report. National Water Sector Management Project, Activity C. A Rapid Water Resources and Water Use Assessment for Angola</i> . Ministry of Energy and Water Affairs. Angola.	Soft copy		Water development, Institutional, Population and social, financial, environmental	Study	Full document title
An-10	Government of the Republic of Angola (2005). <i>National Directorate of Water (DNA). Final Report. National Water Sector Management Project, Activity C. A Rapid Water Resources and Water Use Assessment for Angola</i> . Ministry of Energy and Water Affairs. Angola	Soft copy		Water development, Institutional, Population and social, financial, environmental	Study	Full document title - PORTUGUESE-
An-11	Governo de Angola (2006). <i>Programa de Investimento Ambiental. Relatório de Estado Geral do Ambiente em Angola</i> . Ministério do Urbanismo e Ambiente. Luanda, Angola.	Soft copy		Environmental	Policy	Full document title - PORTUGUESE
An-12	Peter Robinson (2003). <i>SADC Water Sector. RSAP Projects 9&10. Guidelines for Water Policy Review and Development of National Water Policies and Strategies in Selected Member States. Angola Water Policy Review. Final Report</i> . Harare, Zimbabwe.	Soft copy		Water development, institutional	Policy	Full document title
An-13	Pierre Van Roosbroeck, José de Bettencourt, Abias Huongo (2007). <i>Perfil ambiental de Angola. Draft</i> . Angola.	Soft copy		Environmental	Study	Full document title
An-14	República de Angola (2004). <i>Estratégia de Combat e à Pobreza. Reiserção e Reconstrução e Estabilização Económica</i> . Ministerio do Planeamento Direcção de Estudos e Planeamento. Angola	Soft copy		Population and social, financial	Policy	Full document title
An-15	República de Angola (2006). <i>Projecto 00011125-Estratégia e Plano de Acção Nacionais para a Biodiversidade (NBSAP)</i> . Documento Final. Ministério do Urbanismo e Ambiente. Luanda, Angola.	Soft copy		Environmental	Policy	Full document title

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
An-16	Sir M MacDonald & Partners Ltd/Hidroprojecto-Consultantores de Hidráulica e Salubridade, S.A. (1990). <i>Banco Mundial. Programa das Desenvolvimento das Nações Unidas. Serviços de Consultoria. Para. Inventário Hidrológico para os países ao Sul do Sabara (Países do SADC). Relatório Por País: Angola. Minute.</i> Lisboa, Portugal.	Hard copy	-	-	-	-
An-17	SWECO Groner AS (2003). <i>Solutions Harmonising Technology and Environment.</i> Angola.	Soft copy		Environmental, water development	study	Full document title
An-18	The World Bank (2005). <i>Towards a Strategy for Agricultural Development in Angola – Issues and Options.</i> Angola www.gwpsatac.org.zw	Soft copy		Agricultural	Study	Full document title
An-19	Government of the Republic of Angola (2003). <i>Strategy to combat poverty. Social reinsertion, rehabilitation and reconstruction and economics stabilisation.</i> Angola	Soft copy	N	Population and social, financial	Policy	Full document title

3.1.2 Botswana

Table 3.2: ZAMWIS Literature Database for Botswana(Source: Zamwis)

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Bo-1	Government of the Republic of Botswana (2003). <i>National Development Plan 9: 2003/04-2008/09.</i> Ministry of Finance and Development Planning. Gaborone, Botswana.	Hard copy	-	-	-	-
Bo-2	Government of the Republic of Botswana (2005). <i>Population Projections for Botswana. 2001-2031.</i> Central Statistics Office. Gaborone, Botswana.	Hard copy	-	-	-	-
Bo-3	Government of the Republic of Botswana (2006). <i>2006 Annual Economic Report. Published as a Supplement to the 2006 Budget Speech.</i> Ministry of Finance and Development Planning. Gaborone, Botswana.	Hard copy	-	-	-	-
Bo-4	Government of the Republic of Botswana (2006). <i>A list of Government Publications.</i> Ministry of Communications, Science and Technology. Gaborone, Botswana.	Hard copy	-	-	-	-

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Bo-5	<p>Government of the Republic of Botswana (2006). <i>National Water Master Plan Review. Final Report:</i></p> <ul style="list-style-type: none"> - <i>Volume 3: Surface Water Resources</i> - <i>Volume 4: Ground Water Resources</i> - <i>Volume 5: Water Demand, Demand Management & NRA</i> - <i>Volume 6: Rural Water Supply</i> - <i>Volume 7: Sanitation and Waste Water</i> - <i>Volume 8: Agriculture</i> - <i>Volume 9: Environmental, Wildlife and Tourism</i> - <i>Volume 10: Institutions and Legislation Reform</i> - <i>Volume 11: Water Development Modeling</i> <p>Ministry of Minerals, Energy & Water Resources. Department of Water Affairs. Gaborone, Botswana.</p>	Hard copy	-	-	-	Annexes available on request in soft copy
Bo-6	Government of the Republic of Botswana (2006). <i>Strategic Plan, 2001 to 2006</i> . Department of Water Affairs. Gaborone, Botswana.	Hard copy	-	-	-	-
Bo-7	Government of the Republic of Botswana (n.d). <i>A Framework for a Long Term Vision for Botswana</i> . Presidential Task Group for a Long Term Vision for Botswana. Gaborone, Botswana. http://www.dcita.gov.au/cca .	Hard copy	-	-	-	-
Bo-8	Tahal Consulting Engineers Ltd (2000). <i>National Master Plan for Agricultural Development. Final Report. Volume 1. Main Report</i> . Republic of Botswana. Ministry of Agriculture. Gaborone, Botswana.	Hard copy	-	-	-	-

3.1.3 General

Table 3.3: General ZAMWIS Literature Database (not country specific) (Source: Zamwis)

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ge-1	Denconsult (1998). <i>Sector Studies under ZACPLAN, Introductory Volume, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		all	Study	Full document title
Ge-2	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 1. Water Consumption and Effluent from Urban and Rural Areas, Manufacturing and Service, Industries and Mining Industry, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-3	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 2. Water Consumption and Effluent from Food and Agricultural Sector including Fisheries and Livestock, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-4	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 3. Patterns of Land Use and Conservation Practices, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-5	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 4. Impacts of Development within Tourism, Recreation and Wildlife, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-6	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 5. Water Consumption, Losses and Downstream Impact Associated with Hydroelectric Power Generation, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-7	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 6. Utilization of Waterways and Lake Transport Systems - River/ Lake Navigation and the Potential Impacts, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		All	Study	Full document title
Ge-8	Denconsult (1998). <i>Sector Studies under ZACPLAN, Sector Study No. 7. Environmental Impact of Expanding Utilization of Water Resources from the Basin, Volume I, Final Report</i> . Zambezi River Authority. Lusaka, Zambia.	Soft copy		all	Study	Full document title
Ge-9	Hirji, R., Johnson, P., Mario, P. and Matiza Chiuta, T. (eds) 2002. <i>Defining and Mainstreaming Environmental Sustainability in Water Resources Management in Southern Africa</i> . SADC, IUCN, SARDC, World Bank: Maseru/Harare/Washington Dc.	Hard copy	-	-	-	-

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ge-10	IRB-BRL-ZRA (2004). <i>Pollution Monitoring and Management on the Zambezi River, Technical Report n° 2, Description of Completed Hydrological Gauging Stations with special Reference to the Instrumentation Supplied.</i> French Fund for Global Environment. Lusaka, Zambia.	Soft copy		Water Quality, environmental, surface water, hydrology, groundwater	study	Full document title
Ge-11	IRB-BRL-ZRA (2005). <i>Pollution Monitoring and Management on the Zambezi River, Final Report.</i> French Fund for Global Environment. Lusaka, Zambia.	Soft copy		Water Quality, environmental, surface water, hydrology, groundwater	study	Full document title
Ge-12	IRB-BRL-ZRA (2005). <i>Pollution Monitoring and Management on the Zambezi River, Technical Report, Using Earth Observation Data for the Monitoring and Management of Lake Kariba and its Watershed.</i> French Fund for Global Environment. Lusaka, Zambia.	Soft copy		Water Quality, environmental, surface water, hydrology, groundwater	study	Full document title
Ge-13	IRB-BRL-ZRA (2005). <i>Pollution Monitoring and Management on the Zambezi River, Technical Report, Water Quality Analyses.</i> French Fund for Global Environment. Lusaka, Zambia	Soft copy		Water Quality, environmental, surface water, hydrology, groundwater	study	Full document title
Ge-14	Munyaradzi Chenje (2000). <i>State of the Environment 2000. Zambezi Basin. Summary.</i> SADC/IUCN/ZRA/SARDC 2000. Maseru/Harare/Lusaka.	Hard copy	-	-	-	-
Ge-15	New Partnership for Africa's Development (NEPAD) (2003). <i>Action plan of the environment initiative.</i> NEPAD, South Africa.	Soft copy		Environmental, water development	Study	Full document title
Ge-16	New Partnership for Africa's Development (NEPAD) (2007). <i>The comprehensive Africa agricultural development programme (CAADP) quarterly report.</i> NEPAD, South Africa.	Soft copy		Agriculture	Study	Full document title
Ge-17	Collier, U. (2006). <i>Meeting Africa's energy needs. The costs and benefits of hydropower.</i> WWF, WaterAid, Oxfam, The Netherlands.	Soft copy		Environmental, water development, water use/ demand	Study	Full document title
Ge-18	ID 21 Insights (2006). <i>Achieving food security. What next for sub-Saharan Africa?</i> Institute of Development Studies, Sussex, UK.	Soft copy		Agriculture, water demand/ use, population	Documents	Full document title
Ge-19	Mhalange, S.Z. (2006). <i>The hydropower potential of the Zambezi River from Kazungula to the Indian Ocean.</i> Zambezi River Authority, Lusaka, Zambia.	Soft copy		Water development, water demand/ use	Paper	Full document title
Ge-20	Tumbare, M.J. (2004). <i>The Zambezi River: its threats and opportunities.</i> Zambezi River Authority, Lusaka, Zambia.	Soft copy		Water development, water demand/ use	Paper	Full document title
Ge-21	Hoekstra, A. <i>et al</i> (2001). <i>The value of freshwater wetlands in the Zambezi River.</i> Value of Water Research Report Series No. 7, IHE Delft, The Netherlands	Soft copy		Environmental, surface water, water quality	Study	Full document title
Ge-22	Nexant (2007). <i>SAPP Regional generation and transition expansion plan study. Draft final report, Volume 1, Executive summary.</i> Southern Africa Power Pool Coordination Centre (SAPP).	Soft copy		Water demand/ use	Study	Full document title

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ge-23	Republic of Zambia (2004). <i>Proceedings of the International workshop on the Fisheries in the Zambezi Basin</i>	Soft copy		Water demand/ use, water quality, environmental, population, social	Documents	Full document title

3.1.4 Malawi

Table 3.4: ZAMWIS Literature Database for Malawi (Source: Zamwis)

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ma-1	Bootsma, H.A. & Hecky, R.E. (1999). <i>Water Quality Report Lake Malawi/Nyasa</i> . Biodiversity Conservation Project. Senga Bay, Malawi.	Soft copy		Environmental, water quality, water development	Study	Full document title
Ma-2	British Geological Survey 2004). <i>Groundwater Quality: Malawi</i> . Natural Environmental Research Council. Malawi.	Soft copy		Groundwater, water quality, environmental	Study	Full document title
Ma-3	Chirwa, A.B. (2004). <i>Presentation on the Future of Dams and Development in Malawi at Malawi National Consultative Meeting on the World Commission on Dams (WCD) Report Dams and Development: A New Framework for Decision Making</i> . Salima, Malawi.	Soft copy		Water development	Study	Full document title
Ma-4	Government of the Republic of Malawi (2000). <i>Irrigation Development Progress Report (1994 – 1999)</i> . Ministry of Agriculture and Irrigation. Malawi.	Soft copy		Water development, Water demand/ use	Study	Full document title
Ma-5	Government of the Republic of Malawi (2000). <i>Lake Chilwa Wetland: State of the Environment</i> . Ministry of Natural Resources and Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-5	Government of the Republic of Malawi (2001). <i>Lake Chilwa Management Plan</i> . Ministry of Natural Resources and Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Policy	Full document title
Ma-6	Government of the Republic of Malawi (2000). <i>National Irrigation Policy and Development Strategy</i> . Ministry of Agriculture and Irrigation. Lilongwe, Malawi.	Soft copy	Y	Water Development, Water demand/ use	Policy	Full document title
Ma-7	Government of the Republic of Malawi (2000). <i>State of the Environment Report for Chipata, Zomba, Karonga District</i> . Department of Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ma-8	Government of the Republic of Malawi (2001). <i>Fast Track Urban State of the Environment Reports and Urban Environment Action Plans for Nkhobotakota Boma, Nkhobata Bay Boma, Mangochi Town Assembly. Draft Report.</i> Ministry of Natural Resources and Environmental Affairs/Office of the President and Cabinet. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-9	Government of the Republic of Malawi (2001). <i>State of the Environment Report for Bakala District.</i> Department of Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-10	Government of the Republic of Malawi (2003). <i>Revised National Environment Policy.</i> Ministry of Natural Resources and Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Policy	Full document title
Ma-11	Government of the Republic of Malawi (2004). <i>A Synopsis of the Organisation of Environmental Health under Ministry of Health in Malawi.</i> Ministry of Health., Lilongwe, Malawi.	Soft copy		Institutional, Population and social	Document	Full document title
Ma-12	Government of the Republic of Malawi (2004). <i>Machinga, Mchinji, Mwanza, Mzimba, Nkhobotakota, Thyolo, Kasungu Districts State of the Environment Report (DSOER) 2004.</i> Environmental Affairs Department. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-13	Government of the Republic of Malawi (2005). <i>National Water Policy.</i> Ministry of Irrigation and Water Development. Lilongwe, Malawi.	Soft copy	Y	Water development, Water demand/ use	Policy	Full document title
Ma-14	Government of the Republic of Malawi (2006). <i>Strategic Plan from July 2006 – June 2010.</i> Ministry of Irrigation and Water Development. Lilongwe, Malawi.	Soft copy		Water development, Water demand/ use	Policy	Full document title
Ma-15	Government of the Republic of Malawi (2006). <i>Description of Multi-Purpose Dam Projects.</i> Ministry of Irrigation and Water Development Lilongwe, Malawi.	Soft copy		Water development, Water demand/ use	study	Full document title
Ma-16	Government of the Republic of Malawi (2006). <i>Semi-Annual Report, July 2006 to December 2006.</i> Ministry of Irrigation and Water Development. Lilongwe, Malawi.	Soft copy		Water development, Water demand/ use	Study	Full document title
Ma-17	Government of the Republic Of Malawi (2007). <i>The National Sanitation Policy Revised. Final Draft.</i> Ministry of Irrigation and Water Development. Lilongwe, Malawi.	Soft copy		Water development, Water demand/ use	Policy	Full document title
Ma-18	Government of the Republic of Malawi (n.d). <i>Likoma District State of Environment Report.</i> District Development Planning Framework. Department of Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ma-19	Government of the Republic of Malawi (n.d). <i>Mangochi District State of the Environment Report (DSOER) 2004</i> Department of Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-20	Government of the Republic of Malawi (n.d). <i>State of the Environment Report for f, Rumpfi, Salima District.</i> Department of Environmental Affairs. Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-21	Government of the Republic of Malawi (n.d). <i>State of the Environment Report for Blantyre District.</i> Blantyre District Environment Action Plan. Department of Environmental Affairs. Lilongwe, Malawi. Phalombe District Assembly (2005). <i>Phalombe District State of the Environment Report.</i> Lilongwe, Malawi.	Soft copy		Population and social, Water development, Environmental	Study	Full document title
Ma-22	Snoeks, J. (n.d). <i>Technical Report on the Systematic and Taxonomic Component of the SADC/GEF Lake Malawi/Nyasa Biodiversity Conservation Project.</i> Malawi.	Soft copy				Full document title
Ma-23	Sugden, S. (2003). <i>One Step Closer to Sustainable Sanitation Experiences of an Ecological Sanitation Project in Malawi.</i> WaterAid. Malawi.	Soft copy		Water demand/ use	Study	Full document title
Ma-24	Welle, K. (2005). <i>Learning for Advocacy and Good Practice –WaterAid Water Point Mapping Report.</i> WaterAid. Malawi.	Soft copy		Institutional	Study	Full document title
Ma-25	Government of the Republic of Malawi (2004). <i>TCP/MLW/2906 (I) NEPAD–CAADP National Medium–Term Investment Programme (NMTIP).</i> Food and Agricultural Organization of the United Nations. Malawi.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title
Ma-26	Hill, G. <i>et al.</i> (n.d). <i>Water Hyacinth biological control in the Shire River, Malawi.</i> Proc. Ist IOBC Water hyacinth working group.	Soft copy		Environmental, water quality	paper	Full document title

3.1.5 Mozambique

Table 3.5: ZAMWIS Literature Database for Mozambique (Source: Zamwis)

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Mo-1	Carr Foundation-USA and International Crane Foundation/Southern Water Ecological Research and Consulting-South Africa (2006). <i>Assessing Environmental Flow Requirements for the Marromeu Complex of the Zambezi Delta: Application of the Drift Model (Downstream Response to Imposed Flow transformations)</i> . Maputo, Mozambique. Following papers are available in soft copy: <ul style="list-style-type: none"> • Beilfuss <i>et al.</i> <i>Natural and dam induced patterns of hydrological change</i> • Beilfuss <i>et al.</i> <i>Zambezi delta flooding patterns and water balance</i> • Beilfuss <i>et al.</i> <i>Indicators of hydrological change in the Lower Zambezi River</i> • Beilfuss <i>et al.</i> <i>Understanding extreme floods in the Lower Zambezi River</i> • <i>References cites in background hydrology papers</i> 	Soft copy	-	Water development, environmental, hydrology. Surface water	Study	Full document title.
Mo-2	Government of the Republic of Mozambique (2005). <i>The National Water Resources Management Strategy</i> . Ministry of Public Works and Housing. National Directorate of Water. Maputo, Mozambique.	Soft copy		Water development	Policy	Full document title
Mo-3	Government of the Republic of Mozambique (n.d). <i>Mepanda Uncua and Bassa North Project. Feasibility Study. Final Economic Analysis Report</i> . Technical Unit for the Implementation of Hydropower Projects (UTIP). Maputo, Mozambique.	Soft copy		Hydropower, water development, financial	Study	Full document title
Mo-4	Government of the Republic of Mozambique (2004) <i>The First National Water Development Project (NWDP-1) Institutional Capacity Building and Human Resource Development Mozambique Building Block 2 (Phase 1 and 2)</i> . Ministry of Public Works and Housing, National Directorate of Water, Mozambique	Soft copy		Institutional, population and social, water development	Study	Full document title. Available in Portuguese and English
Mo-5	Government of the Republic of Mozambique (2004) <i>The First National Water Development Project (NWDP-1) Water Resources Development Mozambique Building Block 4 (Phase 1 and 2)</i> . Ministry of Public Works and Housing, National Directorate of Water, Mozambique	Soft copy		Water development	Study	Full document title
Mo-6	Government of the Republic of Mozambique (2004) <i>The First National Water Development Project (NWDP-1) National Economy, Investment and Finance, Building Block 5 (Phase 1 and 2)</i> . Ministry of Public Works and Housing, National Directorate of Water, Mozambique	Soft copy		Water development, Finance	Study	Full document title

S/N	Document title	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Mo-7	British Geological Survey, WaterAid (2002) <i>Groundwater Quality: Mozambique</i> . NERC	Soft copy		Groundwater, water quality	paper	Full document title
Mo-8	Government of the Republic of Mozambique (2004). <i>TCP/MOZ/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP)</i> . Food and Agricultural Organization of the United Nations. Mozambique.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title
Mo-9	Government of the Republic of Mozambique (2004). <i>TCP/MOZ/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP)</i> . <i>Small dams rehabilitation and construction project</i> . Food and Agricultural Organization of the United Nations. Mozambique.	Soft copy		Agriculture, Institutional, Population and social, financial	Study	Full document title
Mo-10	Government of the Republic of Mozambique (2004). <i>TCP/MOZ/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP)</i> . <i>Small dams rehabilitation and construction project. Summary</i> . Food and Agricultural Organization of the United Nations. Mozambique.	Soft copy		Agriculture, Institutional, Population and social, financial	Study	Full document title
Mo-11	Government of the Republic of Mozambique (2004). <i>TCP/MOZ/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP)</i> . <i>Small scale irrigation project II</i> . Food and Agricultural Organization of the United Nations. Mozambique.	Soft copy		Agriculture, Institutional, Population and social, financial	Study	Full document title
Mo-12	Government of the Republic of Mozambique (2004). <i>TCP/MOZ/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP)</i> . <i>Small scale irrigation project II. Summary</i> . Food and Agricultural Organization of the United Nations. Mozambique.	Soft copy		Agriculture, Institutional, Population and social, financial	Study	Full document title

3.1.6 Namibia

Table 3.6: ZAMWIS Literature Database for Namibia (Source: Zamwis)

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Na-1	Barnes, J.I., Nhuleipo, O., Macgregor, J., & Muteyauli, P.I. (2005). <i>Draft. Preliminary Economic Asset and Flow Accounts for Forest Resources in Namibia</i> . Environmental Economics Unit, DEA, MET. Namibia.	Soft copy	N	Environment	Document	Full document title. Draft
Na-2	Beukes, H. (2006). Presentation: <i>Groundwater Investigation in Eastern Caprivi 2006</i> . DWA – BGR Cooperation. Department of Water Affairs – Geohydrology Division: Ministry of Agriculture, Water and Forestry. Windhoek, Namibia.	Soft copy		groundwater	Document	Full document title
Na-3	Government of the Republic of Namibia (1999). <i>AGRICOLA 1998/99</i> . Ministry of Agriculture, Water and Rural Development. Windhoek, Namibia.	Hard copy	-	-	-	-
Na-4	Government of the Republic of Namibia (2003). <i>2001 Population and Housing Census. National Report. Basic Analysis with Highlights</i> . Central Bureau of Statistics. National Planning Commission. Windhoek, Namibia.	Hard copy	-	-	-	-
Na-5	Government of the Republic of Namibia (2003). <i>AGRICOLA</i> . Ministry of Agriculture, Water and Rural Development. Windhoek, Namibia.	Hard copy	-	-	-	-
Na-6	Government of the Republic of Namibia (2003). <i>Internal Memorandum Pollution Control and Compliance Monitoring Visits to Caprivi Region</i> . Section: Water Quality, Department of Water Affairs. Windhoek, Namibia.	Soft copy	N	Water quality	Paper	
Na-7	Government of the Republic of Namibia (2004). <i>Investigation of Groundwater Resources and Airborne-Geophysical Investigation of Selected Mineral Targets in Namibia. Main Hydrogeological Report. Volume Iv.Gw.2.1</i> . Department of Water Affairs (DWA) Technical Cooperation, Project No.: 2001.2137.6. Groundwater Investigations in the Eastern Caprivi Region. Documentation Compendium on the 2004 Drilling Campaign. Windhoek, Namibia.	Soft copy		Groundwater, Hydrology	Study	Full document title
Na-8	Government of the Republic of Namibia (2004). <i>Investigation of Groundwater Resources and Airborne-Geophysical Investigation of Selected Mineral Targets in Namibia. Mineral Targets in Namibia. Volume Iv.Gw.2.2</i> . Department of Water Affairs (DWA) Technical Cooperation, Project No.: 2001.2137.6. Groundwater Investigations in the Eastern Caprivi Region Documentation Compendium on the 2004 Drilling Campaign. Windhoek, Namibia.	Soft copy		Groundwater, Hydrology	Study	Full document title

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Na-9	Government of the Republic of Namibia (2004). <i>Investigation of Groundwater Resources and Airborne-Geophysical Investigation of Selected Mineral Targets in Namibia. Evaluation of Pumping Tests. Volume In.Gw.2.3.</i> Department of Water Affairs (DWA) Technical Cooperation, Project No.: 2001.2137.6. Groundwater Investigations in the Eastern Caprivi. Region Documentation Compendium on the 2004 Drilling Campaign. Windhoek, Namibia.	Soft copy		Groundwater, Hydrology	Study	Full document title
Na-10	Government of the Republic of Namibia (2004). <i>Draft Report on the 2004 Floods in the Upper Zambezi River.</i> Ministry of Agriculture, Water and Rural Development. Department of Water Affairs. Windhoek, Namibia.	Soft copy	N	Hydrology	Study	Full document title
Na-11	Government of the Republic of Namibia (2004). <i>National Accounts 1995-2003.</i> National Planning Commission. Central Bureau of Statistics. Windhoek, Namibia.	Hard copy	-	-	-	-
Na-12	Government of the Republic of Namibia (2004). <i>Water Resources Management Act, 2004.</i> Office of the Prime Minister. Windhoek, Namibia.	Soft copy	Y	Legal, water development	Policy	Full document title
Na-13	Hughes, J. & Clanahan, R. (2004). <i>Environmental Assessment Study for the Caprivi Agriculture Project and Lake Liambezi Rehabilitation, Namibia. Contract Number: E1/18/1 - 4/2000. Final; Volume 1-3, Supporting Reports 1-5, Task 2 Report.</i> Ministry of Agriculture Water and Rural Development. Namibia.	Soft copy		Agriculture, environment, water development, water use/ demand	Study	Full document title
Na-14	Namibia Early Warning and Food Information Unit (Newfiu), 2007. <i>Namibia, Crop Prospects and Food Situation.</i> Directorate of Planning, Ministry of agriculture, Water and Forestry. Windhoek, Namibia.	Soft copy		Agriculture	Study	Full document title
Na-15	Scholes, R.J, Van der Merwe, Landmann1, T., Venter, G., Basson, J., Klerk, N., Plessis, P., Burke, A. (2005). <i>Review of Greenhouse Gas Emission Factors for Namibia. Report to the Ministry of Environment and Tourism, Namibia.</i> Windhoek, Namibia.	Soft copy		Environment	Study	Full document title

3.1.7 Tanzania

Table 3.7: ZAMWIS Literature Database for Tanzania (Source: Zamwis)

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ta-1	Carl Bro/Cowiconsult. (1982). <i>Water Master Plans For Iringa, Ruvuma and Mbeya Regions. Hydrogeology. Volume 9.</i> The Republic of Tanzania/Danish International Development Agency.DANIDA. Dar es Salaam, Tanzania.	Hard copy	-	-	-	-
Ta-2	De Waal, D. & Nkongo, D. (2005). \$2 Billion Dollars- The Cost of Water and Sanitation, Millennium Developments for Targets of Tanzania. WaterAid. Tanzania.	Soft copy		Finance, Water development, water use/ demand, population	paper	Full document title
Ta-3	National Bureau of Statistics (NBS)/Iringa Regional Commissioner's Office (1997). <i>Iringa Region. Social Economic Profile.</i> The United Republic of Tanzania. Dar es Salaam, Tanzania.	Hard copy	-	-	-	-
Ta-4	National Bureau of Statistics (NBS)/Ruvuma Regional Commissioner's Office (1997). <i>Ruvuma Region. Social Economic Profile.</i> The United Republic of Tanzania. Dar es Salaam, Tanzania.	Hard copy	-	-	-	-
Ta-5	National Bureau of Statistics (NBS)/Mbeya Regional Commissioner's Office (2003). <i>Mbeya Region. Social Economic Profile.</i> The United Republic of Tanzania. Dar es Salaam, Tanzania.	Hard copy	-	-	-	-
Ta-6	SwedPower jv Norconsult (1998). <i>Tanzania Power VI Project Feasibility Studies for Hydropower Projects. Rubudji Hydropower Project Final Report. Volume RUH.1.</i> Tanzania.	Hard copy	-	-	-	-
Ta-7	SwedPower jv Norconsult (1998). <i>The Feasibility Report for the Rubudji Hydropower Project. Final Feasibility Report.</i> Tanzania.	Hard copy	-	-	-	-
Ta-8	The United Republic of Tanzania (1997). <i>Agricultural and Livestock Policy, 1997.</i> Ministry of Agriculture and Cooperatives. Dar es Salaam, Tanzania.	Soft copy	Y	Agriculture, water use/ demand	Policy	Full document title
Ta-9	The United Republic of Tanzania (2000). <i>National Water Policy (Internet Version).</i> Ministry of Water and Livestock Development. Dar es Salaam, Tanzania.	Soft copy	Y	Water development, water use/ demand	Policy	Full document title
Ta-10	The United Public of Tanzania (2004). <i>Tanzania Census 2002. Basic Demographic and Social-Economic Characteristics. Tanzania National Profile. Volume V (A).</i> Central Census Office. National Bureau of Statistics. President's Office. Planning and Privatization. Dar es Salaam, Tanzania.	Hard copy	-	-	-	-

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Ta-11	The United Republic of Tanzania (2006). <i>Analytical Report. Volume X. National Bureau of Statistics. Ministry of Planning, Economy and Empowerment. Dar es Salaam, Tanzania.</i>	Hard copy	-	-	-	-
Ta-12	The United Republic of Tanzania (2006). <i>Tanzania Census 2002. Tanzania National Projections. Volume VIII. National Bureau of Statistics. Ministry of Planning, Economy and Empowerment. Dar es Salaam, Tanzania.</i>	Hard copy	-	-	-	-
Ta-13	The United Republic of Tanzania (n.d). <i>Rapid Water Resources Assessment. Part V. Lake Nyasa Drainage Basin. Ministry of Water Energy and Minerals. Dar es salaam, Tanzania.</i>	Hard copy	-	-	-	-
Ta-14	The United Republic of Tanzania (n.d). <i>The Tanzania Development Vision 2025. Planning Commission. Dar es Salaam Tanzania.</i>	Soft copy	Y	Water development, water use/ demand	Study	Full document title

3.1.8 Zambia

Table 3.8: ZAMWIS Literature Database for Zambia (Source: Zamwis)

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-1	Environmental Council of Zambia (2000). <i>The State of Environment in Zambia 2000. Lusaka, Zambia. http://www.necz.org.zm</i>	Hard copy	-	-	-	-
Za-2	Government of the Republic of Zambia (2003). <i>2000 Census Atlas. Central Statistical Office. Lusaka, Zambia.</i>	Soft copy		Population and social	documents	Full document title
Za-3	Government of the Republic of Zambia (2003). <i>Summary Report 2000 Census. Zambia 2000 Census of Population and Housing. Central Statistical Office. Lusaka, Zambia.</i>	Soft copy		Population and social	study	Full document title
Za-4	Government of the Republic of Zambia (2003). <i>Zambia 2000 Census of Population and Housing. Projected Population, with and without AIDS, Zambia, 2000-2025. Population Projections Report. Central Statistical Office. Lusaka, Zambia.</i>	Hard copy	-	-	-	-
Za-5	Government of the Republic of Zambia (2003). <i>Zambia 2000 Census of Population and Housing. Agriculture Analytical Report. Central Statistical Office. Lusaka, Zambia.</i>	Soft copy		Population and social, agriculture	study	Full document title
Za-6	Government of the Republic of Zambia (2003). <i>Zambia 2000 Census of Population and Housing, Housing and Household Characteristics. Analytical Report. Central Statistical Office. Lusaka, Zambia.</i>	Soft copy		Population and social	study	Full document title

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-7	Government of the Republic of Zambia (2003). <i>Zambia 2000 Census of Population and Housing, Migration and Urbanization</i> . Central Statistical Office. Lusaka, Zambia.	Soft copy		Population and social	study	Full document title
Za-8	Government of the Republic of Zambia (2004). <i>Draft for Discussion. Proposal for the Legal and Institutional Framework for the Use, Development and Management of Water Resources in Zambia</i> . Ministry of Energy and Water Development. Lusaka, Zambia	Soft copy		Water development, legal, institutional	study	Full document title
Za-9	Government of the Republic of Zambia (2004). <i>Final Draft .Water Resources Action Programme. Financing of Water Resources Management in Zambia. Economics and Financing</i> . Ministry of Energy and Water Development. Lusaka, Zambia.	Soft copy		Water development, financial	Study	Full document title
Za-10	Government of the Republic of Zambia (2004). <i>Recommendations for Groundwater Development and Management in Zambia</i> . Water Resources Action Programme. Lusaka, Zambia.	Soft copy		Water development, ground water	Study	Full document title
Za-11	Government of the Republic of Zambia (2004). <i>The Water Resources Management Bill</i> . Ministry of Legal Affairs. Lusaka, Zambia.	Soft copy		Economic/ financial/ Water development	Document	Full document title
Za-12	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume Six. Northern Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-13	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume One. Central Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-14	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume Two. Copperbelt Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-15	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume Three. Eastern Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-16	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume Four. Luapula Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-17	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing. Volume Five. Lusaka Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-18	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing, Volume Seven. North-Western Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-19	Government of the Republic of Zambia (2004). <i>Zambia 2000 Census of Population and Housing, Volume Nine. Western Province. Analytical Report</i> . Central Statistical Office. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-20	Government of the Republic of Zambia (2005). <i>Agriculture Policy Zambia</i> . Ministry of Agriculture and Cooperatives. Lusaka, Zambia.	Soft copy		Agriculture, water demand/use	Policy	Full document title
Za-21	Government of the Republic of Zambia (2005). <i>National Irrigation Plan (NIP)</i> . Ministry of Agriculture and Cooperatives. Lusaka, Zambia	Soft copy		Agriculture, water demand/use	Policy	Full document title
Za-22	Government of the Republic of Zambia (2005). <i>National Policy on Environment, Final Draft</i> . Ministry of Tourism, Environment and Natural Resources. Environmental Policy Development Secretariat. Lusaka, Zambia.	Soft copy		Environmental	Policy	Full document title
Za-23	Government of the Republic of Zambia (2006). <i>2007-2009 Medium Term Expenditure Framework and the 2007 Budget, Green Paper</i> . Ministry of Finance and National Planning. Lusaka, Zambia.	Soft copy		Economic	Policy	Full document title
Za-24	Government of the Republic of Zambia (2006). <i>Fifth National Development Plan, 2006 – 2010</i> . Ministry of Finance and National Planning. Lusaka, Zambia.	Soft copy		Water development	Policy	Full document title
Za-25	Government of the Republic of Zambia (2006). <i>National Accounts Statistical Bulletin No.9. 1994-2005</i> . National Accounts Branch, Central Statistical Office. Lusaka, Zambia. http://www.zamstats.gov.zm	Hard copy	-	-	-	-
Za-26	Government of the Republic of Zambia (2006). <i>The National Water Policy. First Draft for Discussion</i> . Ministry of Energy and Water Development, Lusaka, Zambia.	Soft copy		Water development	Policy	Full document title
Za-27	Government of the Republic of Zambia (2006). <i>Vision 2030</i> . Ministry of Finance and National Planning. Lusaka, Zambia.	Soft copy		Water development	Policy	Full document title
Za-28	Kafue National Park Management Plan Project (1999). <i>National Park General Management Plan</i> . Ministry of Tourism. Lusaka, Zambia.	Soft copy		Environmental	Policy	Full document title
Za-29	Kampata, J.M. (2004). <i>Definition of Water Resources Information System</i> . Water Resources Action Programme. Ministry of Energy and Water Development. Lusaka, Zambia	Soft copy		Hydrology, water development	Study	Full document title

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-30	Mondoka, A. (2004). <i>Water Resources Action Programme "Challenges and Opportunities for Management of International Water in Zambia"</i> . Water Resources Action Programme. Ministry of Energy and Water Development. Lusaka, Zambia.	Soft copy		Water development, institutional	Study	Full document title
Za-31	NWASCO (2006). <i>Urban and Peri-Urban Water Supply and Sanitation Sector Report 2005/2006</i> . NWASCO. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-32	Scott Wilson Piésold (2003). <i>Integrated Kafue River Basin Environmental Impact Assessment Study, State of Environment Report, Volume 3, 4 & 6</i> . Ministry of Energy and Water Development, Lusaka, Zambia.	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title
Za-33	SGAB-SWECO-THOMRO-UNZA (2005). <i>Preparation of Phase 2 of a Consolidated Environmental Management Plan, Task 1: Scoping, Subtask 1a - Initial Report Summarizing Existing Information, Final</i> . ZCCM-IH, Lusaka, Zambia.	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title of Za-37
Za-34	SGAB-SWECO-THOMRO-UNZA (2005). <i>Preparation of Phase 2 of a Consolidated Environmental Management Plan, Task 4: Prioritization, Subtask 4a - Prioritization Criteria, Subtask 4b - Risk Assessment Methodology, Subtask 4c-4g - Ranking of Issues and Mitigation Measures, Final</i> . ZCCM-IH, Lusaka, Zambia.	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title of Za-37
Za-35	SGAB-SWECO-THOMRO-UNZA (2005). <i>Preparation of Phase 2 of a Consolidated Environmental Management Plan, CEMP II Task 3 - Mitigation Compilation Report, Final</i> . ZCCM-IH, Lusaka, Zambia.	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title of Za-37
Za-36	SGAB-SWECO-THOMRO-UNZA (2005). <i>Preparation of Phase 2 of a Consolidated Environmental Management Plan, Task 2: Modeling, Subtask 2b, 2c & 2e, Final</i> . ZCCM-IH, Lusaka, Zambia.	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title of Za-37

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-37	<p><i>SGAB-SWECO-THOMRO-UNZA (2005). Preparation of Phase 2 of a Consolidated Environmental Management Plan, Tasks reports and Topic Reports on:</i></p> <ul style="list-style-type: none"> - <i>Air Quality</i> - <i>Biodiversity</i> - <i>Chambishi.NFC</i> - <i>Chibuluma South</i> - <i>Environmental Standards and Guideline</i> - <i>Fruit and fish</i> - <i>Geochemical and Radiation Characteristics of Mineral</i> - <i>Geotechnical Issues</i> - <i>Groundwater in the Copperbelt</i> - <i>Luanshya</i> - <i>Metal accumulation in vegetable</i> - <i>Ndola Rural</i> - <i>Re-vegetation of Mining Waste Dumps</i> - <i>Socio-economic Consultations</i> - <i>Supplementary Baseli</i> - <i>Supplementary Baseline Study: Social Impact Assessment Study: Social Impact Assessment</i> - <i>Supplementary Field Studies: Bwana Mkubwa</i> - <i>Surface Water Resources and Water Quality in the Upper Kafue River.</i> - <i>Waste in the Copperbelt</i> <p>ZCCM-IH, Lusaka, Zambia.</p>	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title
Za-38	<p><i>SGAB-SWECO-THOMRO-UNZA (2005). Preparation of Phase 2 of a Consolidated Environmental Management Plan, CEMP II - Data and GIS Specifications.</i> ZCCM-IH, Lusaka, Zambia.</p>	Soft copy		Environmental, institutional, water development, water quality, water demand/ use, groundwater, surface water	Study	Full document title of Za-37
Za-39	<p>Yachiyo Engineering Co., Ltd (1995). <i>The Study on the National Water Resources Master Plan in the Republic of Zambia. Final Report Supporting (Volume-1).No.39, (Volume-2).No.39 & 57, (Volume-3).No.87.</i> Ministry of Energy and Water Development. Lusaka, Zambia.</p>	Hard copy	-	-	-	-
Za-40	<p>Yachiyo Engineering Co., Ltd (1995). <i>The Study on the National Water Resources Master Plan in the Republic of Zambia. Final Report. Main Report. No.39.</i> Ministry of Energy and Water Development. Lusaka, Zambia.</p>	Hard copy	-	-	-	-

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Za-41	Yachiyo Engineering Co., Ltd (1995). <i>The Study on the National Water Resources Master Plan in the Republic of Zambia. Final Report. Data. No.57.</i> Ministry of Energy and Water Development. Lusaka, Zambia.	Hard copy	-	-	-	-
Za-42	Government of the Republic of Zambia (2004). <i>TCP/ZAM/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP).</i> Food and Agricultural Organization of the United Nations. Zimbabwe.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title

3.1.9 Zimbabwe

Table 3.9: ZAMWIS Literature Database for Zimbabwe (Source: Zamwis)

S/N	Document	Type	ZAMWIS info fields			
			Public access	Category	Type	Comment
Zi-1	Department of Water Development/Zimbabwe National Water Authority (2006). <i>Assessment of Surface Water Resources of Zimbabwe and Guidelines for Planning.</i> Ministry of Water Resources and Development of Zimbabwe, Harare, Zimbabwe.	Soft copy		Water development	Study	Full document title
Zi-2	Interconsult A/S and NORAD (n.d). <i>National Master Plan for Rural Water Supply and Sanitation. Hydrogeology.</i> Ministry of Energy and Water Resources and Development. Harare, Zimbabwe.	Hard copy	-	-	-	-
Zi-3	Magadza, C.H.D. (n.d.) <i>Kariba Reservoir, experience and lessons learned brief.</i> University of Zimbabwe, Harare, Zimbabwe.	Soft copy		Water use/ demand, hydrology	Paper	Full document title
Zi-4	Government of the Republic of Zimbabwe (2004). <i>TCP/ZIM/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP).</i> Food and Agricultural Organization of the United Nations. Zimbabwe.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title
Zi-5	Government of the Republic of Zimbabwe (2004). <i>TCP/ZIM/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP). Rehabilitation of smallholder irrigation schemes.</i> Food and Agricultural Organization of the United Nations. Zimbabwe.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title
Zi-6	Government of the Republic of Zimbabwe (2004). <i>TCP/ZIM/2905 (I) NEPAD-CAADP National Medium-Term Investment Programme (NMTIP). Smallholder irrigation development.</i> Food and Agricultural Organization of the United Nations. Zimbabwe.	Soft copy		Agriculture, Institutional, Population and social, financial	Policy	Full document title

3.2 Data

ZAMWIS contains large quantities of data related to daily flows, rainfall, evaporation, temperature, and other aspects of the biophysical environment in the basin. However, the volume of information varies from country to country. In an attempt to standardize the format of data that has been stored, ZAMWIS contains the original files, as well as files in “*.zamwis” format. These are available for viewing through the ZAMWIS Electronic Library.

When the system was housed at ZRA, effort was made to update the database. This was done through ZRA’s information, as well as through contacting other stakeholders. The initial plan was to update the database every quarter, which was then revised to annually when flow of data into the database ebbed. Part of the reason why updates were not easily conducted was that data is captured manually in many gauging stations of the riparian states, which needs to be manually entered into Hydata or a similar software, before being sent on to ZAMWIS. As ZAMWIS is presently not being managed, pending the establishment of the Interim ZAMCOM Secretariat, updating the system is proving difficult.

A summary of the data available through ZAMWIS is presented in Tables 3.10 – 3.28 below.

3.2.1 Angola

Table 3.10: ZAMWIS- Average Monthly Rainfall - Angola

Station	Period	Latitude	Longitude	Altitude(m)
CAMEIA (LUMEJE)	1954-1970	11°35' S	11°35' E	1200
BUCACO	1954-1970	11°35' S	11°35' E	1300
CAFUNGO	1954-1970	10°42' S	22°12' E	??
CAMEIA	1954-1970	11°36' S	20°49' E	"
LEIA CFB	1954-1970	11°40' S	20°30' E	"
LEIA SAF	1954-1970	11°40' S	20°28' E	"
LUACANO	1954-1970	11°12' S	21°43' E	"
LUCULO	1954-1970	11°40' S	20°30' E	"
LUCUSSE	1954-1970	12°31' S	20°29' E	1200
LUENA	1954-1970	—	—	??
LUXIA SAF	1954-1970	11°38' S	19°45' E	"
SACASSANGE	1954-1970	11°54' S	19°59' E	"
CAIANDA	1954-1970	11°02' S	23°32' E	1200
CALUNDA	1954-1970	12°07' S	23°28' E	1500
CAVUNGO	1954-1970	11°31' S	23°01' E	1200
LUACANO (DILOLO)	1954-1970	11°32' S	22°02' E	1150
LUMBALA	1954-1970	12°39' S	22°34' E	1100
LOVUA	1954-1970	07°19' S	20°09' E	1300
MUCUSSUEJE	1954-1970	11°00' S	21°56' E	1054
NANA CADINDO	1954-1970	11°31' S	23°01' E	1180
CANGOMBE	1954-1970	14°24' S	19°59' E	1200
CANGUMBE CACHIPOQUE	1954-1970	11°56' S	19°22' E	1475
CASSAMBA	1954-1970	13°05' S	20°22' E	1300
CHIUME	1954-1970	15°01' S	21°12' E	1000

Table 3.11: ZAMWIS - Average Monthly Temperature, Precipitation, Relative Humidity and Cloud Cover - Angola

Station	Period of Study	Latitude	Longitude
CANGAMBA	1954-1970	13°42' S	19°52' E
CAVUNGO	1954-1970	11°31' S	23°01' E
CAZOMBO	1954-1970	11°53' S	22°58' E
LUMBALA	1954-1970	12°39' S	19°52' E
MUCUSSUEJE	1954-1970	11°01' S	21°56' E
VILA CAGO COUTINHO	1954-1970	14°06' S	21°26' E
V.TEIXERIA DE SOUSA	1954-1970	10°43' S	22°13' E

3.2.2 Botswana

Table 3.12: ZAMWIS - HYDATA Time Series - Botswana

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (km ²)
Chobe At Ngoma Bridge	6614	1996-2004	Rainfall (Mm)	17:55: 0 S	24:43: 0 E		
Chobe At Ngoma Bridge	6614	1997-2005	Water Level (M)	17:55: 0 S	24:43: 0 E		
Chobe River At Kasane	6624	1970-2005	"	17:48: 0 S	25:08: 0 E		
Kwando At Baites Camp	6125	1984-2006	Flow (Cumecs)	18:12: 0 S	23:24: 0 E		
Kwando At Baites Camp	6125	1984-2006	General (M)	18:12: 0 S	23:24: 0 E		
Kwando At James Camp	6135	1984-2006	Flow (Cumecs)	18:23: 0 S	23:33: 0 E		
Kwando At James Camp	6135	1981-2006	General (M)	18:23: 0 S	23:33: 0 E		
Kwando At Kwando Camp	6115	1985-1998	"	18:15: 0 S	23:24: 0 E		
Lake Liambezi At Satau	6514	1982-1985	"	18:08: 0 S	24:23: 0 E		
Linyati At Exploration Camp	6434	1984-2006	Flow (Cumecs)	18:23: 0 S	23:47: 0 E		
Linyati At Exploration Camp	6434	1976-2006	General (M)	18:23: 0 S	23:47: 0 E		
Linyati At Hunters Africa Camp	6414	1980-2006	"	18:29: 0 S	23:37: 0 E		
Linyati At Hunters Africa Camp	6414	1991-2006	Flow (Cumecs)	18:29: 0 S	23:37: 0 E		
Linyati At Shaile	6444	1984-1992	General (M)	18:07: 0 S	24:03: 0 E		
Savuti At Savuti Wildlife Camp	6325	1975-1982	"	18:34: 0 S	24:04: 0 E		
Saviti At Zebadianja	6315	1985-1992	Flow (Cumecs)	18:34: 0 S	23:33: 0 E		
Saviti At Zebadianja	6315	1982-1995	General (M)	18:34: 0 S	23:33: 0 E		
Selinda Sillway	6225	1982-1986	"	18:30: 0 S	23:25: 0 E		
Selinda Spillway At Seronga R/C	6215	1996-1999	Rainfall (Mm)	18:36: 0 S	23:18: 0 E		

3.2.3 Malawi

Table 3.13 ZAMWIS - River flow data and information - Malawi

Station Name	Period
BUA @ BUA DRIFT 5D1	1 Nov 1959 to 31 Oct 1998
BUA 2 OLD BUA BRIDGE 5D2	1 Nov 1953 to 31 Oct 1998
BUA @ S53 ROAD BRIDGE 5C1	1 Nov 1957 to 31 Oct 1996
CHAMBO @ CHIWONA 9A3	1 Nov 1985 to 31 Oct 1991
SOUTH RUKURU @ PHWEZI 7G14	1 Nov 1957 to 31 Oct 2000
DIAMPHWE @ CHILOWA NEW BRIDGE 4B4	1 Nov 1977 to 30 Sep 1983
DOMASI @ DOMASI TT COLLEGE 2C3	1 Nov 1957 to 31 Oct 1998
DWAMBAZI @ NTHANDA 16E6	1 Nov 1981 to 31 Oct 1991
DWANGWA @ S53 ROAD BRIDGE 6D10	1 Nov 1985 to 31 Oct 2002
HANGA @ DAVID KAMEME 9B5	1 Nov 1981 to 31 Oct 1991
KALENJE @ CHIPWERA 9A5	1 Nov 1970 to 31 Oct 2002
LAKE CHILWA	1 Nov 1983 to 31 Oct 2002
LAKE MALAWI	1 Nov 1945 to 31 Oct 2007
LAKE MALAWI	1 Nov 1970 to 31 Oct 2007
LICHENYA @ MILONDE 14C8	1 Nov 1959 to 31 Oct 1991
LILONGWE @ LILONGWE OLD TOWN 4D4	1 Nov 1952 to 31 Oct 2002
LILONGWE @ MALINGUNDE 4D6	1 Nov 1957 to 31 Oct 1990
LILONGWE @ MKWENEMBELE 4C2	1 Nov 1957 to 31 Oct 2000
LIMPHASA @ TIMBIRI 16 F1	1 Nov 1983 to 31 Oct 1991
LINGADZI @ M1 ROAD BRIDGE 4E1	1 Nov 1980 to 31 Oct 1988
LINTHIPE @ LINTHIPE 4B3	1 Nov 1975 to 30 Sep 1991
LIVULEZI @ KHWEKHWELELE 3 E3	1 Nov 1957 to 31 Oct 1991
LUCHELEMU @ MAZAMBA 16 F5	1 Nov 1958 to 31 Oct 1991
LUCHELEMU @ MAZAMBA ESTATE 16 F10	1 Nov 1958 to 31 Oct 1991
LUCHENZA @ LUCHENZA 14 A2	1 Nov 1954 to 31 Oct 1991
LWEYA @ MZENGA 16 F15	1 Nov 1987 to 31 Oct 2001
LWEYA @ ZAYUKA 16 F2	1 Nov 1952 to 31 July 1993
MLUNGUZI @ ZOMBA PLATEAU 2 B8	1 Nov 1954 to 31 Oct 1997
MPAMADZI @ GUMBU 1 R18	1 Nov 1963 to 31 Oct 1990
MZIMBA @ MUWERU BULUKUTU 7 A4	1 Nov 1981 to 31 Oct 1991
NADZIPOKWE @ MUA MISSION 3 E1	1 Nov 1953 to 31 Oct 2002
NAMIKOKWE @ MUA-LIVULEZI FR (3E2)	1 Nov 1956 to 31 Oct 2002
NKANDE @ THOBOLA	1 Nov 1959 to 31 Oct 1991
NORTH RUKURU @ MWAKIMEME 8 A5	1 Nov 1968 to 31 Oct 1997
NORTH RHUMPI @ CHIWELA 7 H3	1 Nov 1971 to 31 Oct 2001
RIVIRIVI @ BALAKA 1 R3	1 Nov 1952 to 31 Sep 1991
RUNYINA @ MFUMA	1 Nov 1970 to 31 Oct 1991
RUO @ M1 ROAD BRIDGE	1 Nov 1951 to 31 Oct 2002
SHIRE @ CHIKWA 1 L12	1 Nov 1976 to 31 Oct 1998
SHIRE @ LIWONDE 1 B1 FLOW	1 Nov 1948 to 31 Oct 2005
SHIRE @ MANGOCHI 1 T1	1 Nov 2002 to 31 Oct 2005
SHIRE @ TENGANI 1 G3	1 Nov 1970 to 31 Dec 2001
SONGWE @ ICHINGA 9 B4	1 Nov 1981 to 31 Oct 1994
SONGWE @ MWANDENGA 9 B7	1 Nov 1985 to 31 Oct 2003
SOUTH RUKURU @ MLOWE 7 G18	1 Nov 1985 to 31 Oct 2000
SOUTH RUKURU @ PHWEZI 7G14	1 July 1998 to 31 Oct 2006
SOUTH RHUMPI @ PHWEZI	1 Nov 1956 to 31 Oct 1987
THONDWE @ JALI 2 B22	1 Nov 1959 to 31 Oct 1985
THUCHILA @ CHONDE	1 Nov 1951 to 30 Sep 1990

Table 3.14: ZAMWIS - Maximum & Minimum Temperatures - Malawi

Station Name	Period
BOLERO	1982-2006
CHICHIRI	1965-2006
CHILEKA	1961-2007
CHITEDZE	1956-2006
CHITIPA	1965-2006
DEDZA	1965-2006
KARONGA	1966-2006
KASUNGA	1984-2006
KIA	1983-2006
MAKHONGA	1965-2002
MAKOKA	1969-2006
MANGOCHI	1956-2006
MEKANDA	1987-2000
MIMOSA	1956-2006
MONKEY BAY	1982-2006
MVUMBWE	1956-2007
MZIMBA	1965-2006
MZUZU	1966-2006
NGABU	1971-2006
NKHOTA KOTA	1965-2006
NKHATA BAY	1965-2006
NTAJA	1985-2006
SALIMA	1966-2006
THYOLO	1965-2002

Table 3.15: ZAMWIS - Rainfall Data and Information – Malawi

Station Name	Period
BOLERO	1983-2006
BVUMBWE	1940-2006
CHANCELLOR COLLEGE	1960-2006
CHICHIRI	1992-2006
CHIKANGAWA	1953-1989
CHIKWAKWA	1897-2006
CHIKWEO	1981-2006
CHILEKA	1938-2007
CHINGALE AGRIC. CENTER	1951-2006
CHINTHECHE AGRIC. CENTER	1960-1991
CHINTHECHE HOSPITAL	1905-2006
CHISENGA	1948-1999
CHITALA	1946-2006
CHITEDZE	1980-2006
CHITIPA	1986-2006
DEDZA	1984-2006
DOWA AGRIC. CENTER	1921-2006
DWANGWA	1972-2006
EUTHINI AGRIC. CENTER	1969-1990
KARONGA	1983-2006
KASUNGU	1985-2006
LIA	1985-2006
LIKOMA ISLAND	1974-2006
LIWONDE	1900-2006
LUJERI	1960-2005
LUPEMBE AGRIC. CENTER	1949-1989
MAKANJIRA AGRIC. CENTER	1957-1990
MAKHANGA	1949-2002
MAKOKA	1980-2006
MANGOCHI	1902-2006

Station Name	Period
NANKUMBA	1953-1991
MCHINJI BOMA	1920-2006
MIMOSA	1963-2006
MISUKU	1946-1990
MKANDA	1982-2006
MOMBEZI AGRIC. CENTER	1960-2006
MONKEY BAY	1960-2006
MPONELA	1936-1998
MWANZA	1922-2006
MWENITETE	1951-1986
MZIMBA	1990-2007
MZUMZU	1960-2006
NAMITETE	1960-1998
NCHENACHENA	1973-2007
NGABU	1960-2006
NKHATA BAY	1935-2006
NKHOTA KHOTA	1951-2006
NSANJE	1975-2000
NTAJA	1969-2006
NCHEU NKHANDE	1957-1999
NTCHISI FOREST	1960-2006
NYIKA	1960-2006
SALIMA	1952-2006
THYOLO	1961-2006
TOLEZA FARM	1940-2006
ZOMBWE	1944-1998

3.2.4 Mozambique

Table 3.16: ZAMWIS - Daily Water Levels – Mozambique

Station	Station No.	Period
LABO	E-66	1959-1970
DERRE	E-101	2005-2007
MILANGE (2)	E102	2004-2007
MARROMEU	E103	1961-1978
LICUARI (2)	E-104	2003-2006
MARROMEU (2)	E-285	1930-2007
CHIRE-BATELA (2)	E-288	2003-2006
BOCAGE	E-288	1954-2004
MEGAZA	E-289	1949-2007
ZANGUE (2)	E-290	2003-2004
CAIA	E-291	1993-2007
MUTARARA	E-293	1998-2007
CHIREMBA	E-295	1973-1976
LUENHA II (2)	E-296	1955-2007
TAMBARA (2)	E-299	1949-2007
REVUBUE	E-302	1997-2007
MUCHENA (2)	E-307	2003-2007
MUCHENA 2	E-308	1974-1982
MUCHENA 2(2)	E-308	1969-1981
ZUMBO	E-310	1948-2007
MAZOE I	E-315	1954-1977
TETE	E-320	1970-2007
LUPATA	E-322	1967-1968
LUIA 3	E-324	1958-1960
LUIA-MUENDE	E-326	1956-1958
MUENDE (2)	E-326	2004-2007

Station	Station No.	Period
LUPATA	E-327	1959-1984
LUPATA (2)	E-327	1968-1984
ARAUANGUA (2)	E-343	DATA NOT AVAILABLE
CAUERESI	E-346	1960-1972
LUENHA I	E-348	1959-2007
LUENHA I (2)	E-348	1959-2007
CAPOCHE III	E-361	1960-1968
LUANGUA (2)	E-363	DATA NOT AVAILABLE
NCONDEDZI (2)	E-365	1975-1982
NCONDEDZI (2)	E-365	2006-2007
MAUE (2)	E-367	1957-2007
MAUE-ANGONIA	E-367	1954-2007
LUFIDZI	E-368	1954-1982
M'PANDA UNCUA (2)	E-375	1962-2006
MATUNDO CAIS (2)	E-387	1969-2007
MOPEIRA (2)	E-403	2004-2007
LUA LUA	E-480	2003-2006
POSTO CAMPO LUA-LUA	E-480	2003-2007
MAZOE PONTE	E-548	1975-2003
BOROMA	E-610	1980-2006
BOROMA (2)	E-610	1962-2007
LUIA	E-645	2002-2007
CAPOCHE(2)	E-646	2003-2007
E 2005-2006		DATA NOT AVAILABLE
LUANGUA	E-325	1979-1982
CHICOA-1-A	E-CHICOA	1959-1974
CHICOA-1	E-CHICOA	1957-1983
CHICOA 1 (2)	E-CHICOA	1949-1963
CHICOA EMBOQUE	E-CHICOA	1975-1983
LUANGUA	E-LUANGUA	1957-1964
LUENHA III	E-LUENHA	1960-1972
LUENHA III (2)	E-LUENHA	1960-1972
MAZOE II FRONTEIRA	E-MAZOE	1960-1971
MAZOE II MONTANTE (2)	E-MAZOE	1954-1957
CHIMUARA	E-SN	2006

Table 3.17: ZAMWIS - Daily Rainfall – Mozambique

Station	Station No.	Period
MUNGARI	P-834	NO DATA AVAILABLE
DONA ANA (2)	P-26	1929-1967
SONE (2)	P-27	1949-1965
CHIEMBA	P-28	1949-1968
CHIRAMBA	P-29	1949-2007
MEPANZO	P-29	2006-2007
CAMBALATSTSI (2)	P-29	1950-2007
TAMBARA	P-30	1950-2007
TAMBARA (2)	P-30	1949-2007
MAZOE PONTE	P-32	1981-2004
MAZOE (2)	P-32	1981-2007
MANDIE (2)	P-33	1949-1970
CHIOCO	P-34	DATA NOT AVAILABLE
BENGA	P-36	1953-1961
BOROMA	P-37	1892-1993
M'PANZO	P-38	1951-1987
MARARA	P-40	1954-2007
MAGOE	P-41	DATA NOT AVAILABLE
CARINDE	P-42	1966-1971
MUCANDADZI	P-42	1960-1979

Station	Station No.	Period
ZOBUE	P-43	1951-2007
ZUMBO	P-44	1957-2007
LIVIRANDZI	P-48	1958-1968
MAZOE I	P-48	1950-1981
CAIA	P-50	1990-2007
MEGAZA	P-51	2003-2007
MUCHENA	P-52	1954-2007
CHIRAMBA (2)	P-56	2006-2007
ZAMBUE	P-60	DATA NOT AVAILABLE
SENA	P-64	1950-1966
MORRUMBALA	P-66	1962-1965
MUTARARA	P-67	1962-1965
DONA ANA (MUTARARA)	P-69	1956-1967
INHANGOMA (2)	P-168	2003-2007
CHARREL (2)	P-171	2003-2007
CHAFUNDIRA(MUTARARA) (2)	P-173	1953-1974
GOMA	P-174	1953-1980
DOA	P-176	DATA NOT AVAILABLE
CHUEZA (2)	P-177	1953-1967
NECUNGAS (2)	P-180	1957-2007
CHITHATHA (2)	P-182	1953-1987
CATEME (2)	P-182	1953-1983
LUANGUA (2)	P-184	1955-1974
LIZIE	P-213	1953-1984
CHICOA (2)	P-274	1958-1974
SONGO	P-325	1955-1974
MAVUDZI	P-326	1953-1961
CHICOA	P-329	1958-1974
CHICOA EMBOQUE	P-329	1958-1987
ANGONIA	P-333	DATA NOT AVAILABLE
BOROMA (2)	P-333	2005-2007
MAUE (2)	P-333	DATA NOT AVAILABLE
LIFIDZI (2)	P-334	1955-1984
CAMUENJE (2)	P-335	2000-2007
CAMUENJE-BENE	P-335	1954-2007
CONDEDEZI	P-340	1955-2007
NCONDEDEZI (2)	P-340	2003-2007
CANXIXE	P-352	1959-2007
DERRE	P-363	2003-2007
BIRI BIRI	P-371	1956-1982
BENJA (MERULO)	P-387	1960-1967
MORURO	P-387	1956-1987
ENTACA	P-394	1957-1984
PUEPUA	P-401	DATA NOT AVAILABLE
MOPEIA	P-403	2004-2007
CAMBALANCAI	P-417	DATA NOT AVAILABLE
MOLIMA	P-419	1956-1966
CHIFISSE	P-431	1958-1973
CHIA-PULULA	P-432	1958-1982
ZIMETE	P-433	1958-1967
METENGO-MALAME	P-434	1974-2007
LIVIRANDEZE	P-436	DATA NOT AVAILABLE
CHINGODZI (2)	P-438	1958-2007
CAPOCHE (2)	P-439	1958-1968
CHINHANJE 1	P-440	1958-1982
CHINHANJE 1(2)	P-440	1958-1982
MULOMBA	P-447	1959-1977
NTEMANGAU	P-458	1958-1989

Station	Station No.	Period
BIRIRA	P-461	1959-1984
FOIA	P-470	1959-1976
LISULU	P-471	1958-2007
MACHERO	P-472	DATA NOT AVAILABLE
MAGASSO	P-473	1959-1984
MURUNGUJA	P-477	1958-1970
CATULENE	P-490	1959-1968
CAMIACULO	P-492	1959-1968
CHERIZE	P-493	1959-1984
CHOFOMBO	P-495	1959-1969
GURO	P-497	1959-2007
LUCUARI	P-505	2000-2007
MUZE	P-507	1959-2007
ACHIZA	P-508	1959-1963
CHINHANDA	P-511	1959-1970
CHITIMA	P-513	2004-2007
CHITIMA	P-514	1959-1986
LUNDO	P-517	1959-1966
MATAGE	P-520	1959-1963
SANDE JOAO	P-526	DATA NOT AVAILABLE
VILLA BOCAGE	P-528	1964-1972
MARGUETO	P-529	DATA NOT AVAILABLE
CATUNGUIRENE	P-531	1959-1967
LUPATA	P-567	1959-1984
CAHORA BASSA	P-574	1961-1971
CHINTOPO	P-588	1962-2007
MARROMEU	P-590	2003-2006
CHANGARA	P-595	1959-2002
CHANGARA (LUENHA II)	P-595	1959-2007
LUENHA II (2)	P-595	2001-2007
MUTARARA VELHA	P-624	1969-1962
MUTARA NOVA	P-624-A	1959-1971
PANTOE	P-629	1960-1970
ZINGA	P-631	1961-1983
MACUACUE	P-643	DATA NOT AVAILABLE
LUIA	P-645	1980-1981
FIDEZI	P-648	1960-1980
CALUMBE(SAMOA)	P-650	1960-1983
TJETIGA	P-652	1961-1964
MATAMBO	P-658	1960-1997
CHIPERA	P-663	1962-1976
LOPES	P-688	1960-1965
VENTURA	P-694	1960-1973
SILVA	P-695	1960-1967
CHIMBAMBE	P-697	1960-1968
NACHINANGA	P-699	1960-1984
LUENHA III	P-704	1960-1981
CAUERESI	P-709	1964-1968
CASSABONDOLA	P-710	1999-2007
CHIFINDE	P-714	1980-2007
CHIFINDE-SEDE (2)	P-714	1980-2007
CHENECA (LUIA II)	P-715	1960-1968
MESSERIZI,PADZA (MACANGA)	P-716	1960-1970
MANJE	P-717	1960-2007
BENE (2)	P-735	1999-2005
CHIREZE	P-736	1960-1985
CAPOCHE 4 CHIZAME (2)	P-737	1960-1963

Station	Station No.	Period
CAUZUZO	P-739	1960-1972
TARA	P-760	1961-1964
NHALUIRO	P-761	1963-1980
BOMA	P-763	1961-1964
MUANGA	P-766	1960-1964
CASULA (2)	P-774	1944-2006
CHIUTA	P-778	DATA NOT AVAILABLE
FINGOE	P-786	1934-2007
FURANCUNGO	P-788	2004-2007
MORRUMBALA	P-829	1955-2007
MUNGARI	P-832	1959-2007
MUTARARA	P-835	1999-2007
V.COUTINHO	P-860	1932-1973
V (2) MUALADZI	P-861	2000-2007
V.MUALAZE	P-861	1999-2007
CHIPUNE	P-863	1961-1964
CACHOMBA	P-883	1961-2007
INHAMITANGA	P-889	1960-1969
VILA COUTINHO	P-891	1960-1969
MUCUMBURA	P-893	1962-2007
MESSUCA (2)	P-901	1962-1971
TSANGANO	P-902	1963-2007
CHANGARA	P-966	1949-1961
GOBA (2)	P-1007	1970-1983
SABETA (2)	P-1009	1970-1976
MILANGE (2)	P-1071	2003-2007
TETE	P-S.N.	1956-2007
ZIMITE	P-ZIMITE	1965-1966
CADJIE	P-CADJIE	1960-1986
CHIOCO	P-CHIOCO	1951-1976
SEC DE TETE (2)	P-ESC.	2003-2007
MAJUA (2)	P-S.N.	2005-2007
M'PHULO (2)	P-M'PHULO	2003-2006
MULOMBA	P-MULOMBA	1959-1982
PUATO	P-PUATO	1959-1970
PANTOE	P-S.N.	1961-1968
CHITENGUENI	P-S.N.	1975-1977
CAHORA BASSA	P-S.N.	1958-1967
CAPOCHE	P-S.N.	1960-1967
MASSAMBA	P-S.N.	1958-1971
MESSECA	P-S.N.	1961-1970
MONTES-SILHIVIR	P-S.N.	1974-1977
NAMACURRA	P-S.N.	1955-1962
CHITENGUENI	P-S.N.	1975-1977
NMP	P-S.N.	2002-2006
MAINA (RIO MUZE) (2)	P-S.N.	1961-1962
NSA	P-S.N.	2006
ZAMBUE	P-ZAMBUE	1953-2007
TJETIGA	P-652	1961-1964
SHADZOPIRI	P-559	1961-1964
VILA COUTINHO	P-891	1960-1969

3.2.5 Namibia

Table 3.18: ZAMWIS - Rainfall, Flow and Water Level Data - Namibia

Station name	Site No.	Period	Data Type
KATIMA MULILO 1	1269510	1945-1978	Daily Rainfall
KATIMA MULILO 2	1269448	1987-2001	Daily Rainfall
ZAMBEZI @ KATIMA MULILO	2300M01	1942-2006	Daily Flow
ZAMBEZI @ KATIMA MULILO	2300M01	1942-2006	Daily Water Level
KWANDO @ KONGOLA	2400M01	1969-2003	Daily Flow
KWANDO @ KONGOLA	2400M01	1969-2003	Daily Water Level

3.2.6 Tanzania

Table 3.19: ZAMWIS - Daily Lake Levels - Tanzania

Station name	Period of Study
ITUNGI BAY	16 NOV 1963 - 31 DEC 1994
LAKE NYASA AT IPINDA	01 OCT 1958 - 30 DEC 1994
LAKE NYASA AT MBAMBA BAY	22 AUG 1973 - 31 JULY 2002
LAKE NYASA AT NSUNGU	24 SEP 1988 - 28 FEB 1994
LUHEKEI AT NANGOMBO	12 FEB 1986 - 30 NOV 2002
LUMECHA AT NGONJANGONJA	01 SEP 1978 - 30 SEP 1987
MTAKA AT MWAYA	01 OCT 1956 - 30 APR 1995
MBAWA AT MKALI	01 NOV 1989 - 30 SEP 2002
MBULI AT NG'OMBO	16 APR 1997 - 31 MAR 1999
MNGAKA AT ROAD BRIDGE	01 JAN 1977 - 30 NOV 2002
MNTAMAJI AT NGUMBO BRIDGE	07 OCT 1987 - 31 DEC 1998
MWINAMAJI AT ROAD BRIDGE	01 JAN 1977 - 31 AUG 1990
NYITULE AT IDOPE	01 JUL 1975 - 15 DEC 1994
RUFILIO AT RUFILIO	13 OCT 1974 - 31 DEC 1994
RUHUU AT KIKONGE	02 NOV 1971 - 31 DEC 2002
RUMAKALI AT RAMAGE	01 AUG 1974 - 31 DEC 1994
RUMAKALI AT RWAMAUTU	01 JAN 1975 - 30 SEP 1994
RUTIKILA AT RUTIMBA	01 JAN 1993 - 30 NOV 2002
SONGWE AT KASUMULU - FLOW	01 DEC 1964 - 21 AUG 1990

Table 3.20: ZAMWIS - Daily River Flows - Tanzania

Station Name	Period of Study
KITEWAKA AT MABOGA	01 OCT 1975 - 30 SEP 1981
KIWIRA AT NATURAL BRIDGE	01 OCT 1956 - 30 SEP 1979
MBAKA AT MWAYA	01 OCT 1956 - 30 SEP 1981
MNGAKA AT NAMBUNJU	01 OCT 1976 - 30 SEP 1991
RUHUU AT MASIGIRA	01 OCT 1971 - 30 SEP 1991
LUMECHA AT NGONJANGONJA	01 SEP 1978 - 30 SEP 1987
RUHUU	01 OCT 1971 - 30 SEP 1979
RUMAKALI AT HAMUGE	01 OCT 1973 - 30 SEP 1991
RUTIKILA AT NEW BRIDGE	01 OCT 1975 - 30 SEP 1982
SONGWE AT IGALULA	01 OCT 1973 - 30 SEP 1980
SONGWE AT IGARULA	01 OCT 1973 - 31 DEC 1998

3.2.7 Zambia

Table 3.21: ZAMWIS - Hydata Time Series - Zambia

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Chobe At Ngoma Bridge	6614	1996-2004	Rainfall	17:55: 0 S	24:43: 0 E	-	122
Zambezi @ Kaleni Hill Road	1080	1977-1992	"	11:08:0 S	24:15:0 E	-	764
Zambezi @ Chavuma Pump House	1105	1958-2005	"	13:05:0 S	22:41:0 E	-	75967
Lukunyi @ Lukunyi School	1130	1971-1992	"	13:12:0 S	23:00:0 E	-	1
Makonde @ Diplata Mission	1138	1971-2005	"	13:18:0 S	28:13:0 E	-	749
Lunyiwu @ Diplata School	1143	1971-2005	"	13:20:0 S	23:13:0 E	-	1662
Makonde @ Chivatu Village	1145	1961-1997	"	13:20:0 S	23:09:0 E	-	3354
Zambezi @ Zambezi Pump House	1150	1989-2008	"	13:33:0 S	23:06:0 E	-	87275
Kabompo @ Solwezi-Mwinilunga Br.	1205	1972-1992	"	11:54:0 S	25:15:0 E	-	1075
West Lumwana @ Sol-Mwini Rd./Br	1305	1975-1988	"	11:50:0 S	25:09:0 E	-	469
Mwombezi @Solwezi-Mwinilunga	1310	1971-2005	"	12:15:0 S	25:07:0 E	-	3041
Chimmiwungo River @ Lumwana	1313	1976-1978	"	00:00:0 N	00:00:0 E	-	1
East Lumwana @ Lumwana Camp	1314	1975-1979	"	00:00:0 N	00:00:0 E	-	1
East Lumwana @ Sol-Mwinilunga	1315	1971-1983	"	12:15:0 S	25:12:0 E	-	640
West Lunga @ Mwinilunga	1430	1960-2004	"	11:44:0 S	24:27:0 E	-	1
Kabompo @ Manyinga Road/Bridge	1610	1971-1992	"	13:25:0 S	24:25:0 E	-	1
Manyinga @ Manyinga	1630	1970-2004	"	13:26:0 S	24:20:0 E	-	1
Kabompo @ Kabompo Boma	1650	1989-2006	"	13:36:0 S	24:13:0 E	-	42740
Kabompo @ Kabompo Old Pontoon	1670	1959-1972	"	00:00:0 N	00:00:0 E	-	44356
Kabompo @ Watopa Pontoon	1950	1957-2004	"	14:01:0 S	23:36:0 E	-	67261
Zambezi @ Lukulu	2030	1989-1999	"	14:23:0 S	23:14:0 E	-	206531
Luena @ Longwe	2120	1976-2003	Water Level (m)	00:00:0 N	00:00:0 E	-	1
Luena River @ Kasambamezi	2150	1960-2005	Flow (Cumecs)	00:00:0 N	00:00:0 E	-	1

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Namitome @ Namitome	2320	1961-1993	"	15:45:0 S	23:12:0 E	-	831
Sefula @ Sefula Road/Bridge	2340	1971-1992	"	15:27:0 S	23:12:0 E	-	140
Kataba @ Siandi Road/Bridge	2360	1970-1987	"	15:34:0 S	23:16:0 E	-	206531
Zambezi River @ Senanga	2400	1947-2008	"	16:07:0 S	23:15:0 E	1,000.00	284538
Lui @ Luatambo School	2475	1961-1987	"	15:16:0 S	23:49:0 E	-	1854
Zambezi @ Nana's Farm	3045	1990-2005	"	17:49:13 S	25:39:5 E	-	359783
Zambezi @ Livingstone Pump House	3050	1960-1997	"	17:53:0 S	25:50:0 E	-	13900
Kalomo @ Kalomo Dam Site	3130	1958-1984	"	17:13:5 S	26:29:0 E	-	1899
Muzuma @ Mwazia School	3335	1970-1992	"	17:16:0 S	27:22:0 E	-	940
Nang'ombe Near Tobonte's Village	3370	1969-1993	"	17:07:0 S	27:32:0 E	-	228
Zambezi @ Chirundu Bridge	3980	1963-2005	"	16:02:0 S	28:51:0 E	-	667715
Kafue River @ Kipushi Road	4005	1963-2005	"	11:47:0 N	27:10:0 E	-	170
Muchindamu River @ Muchindamu	4015	1963-2005	"	11:52:0 N	27:08:0 E	-	110
Kafue River @ Ngosa Farm	4040	1963-1976	"	00:00:0 E	00:00:0 E	-	1
Kafue River @ Raglan Farm	4050	1960-1961	"	12:25:0 N	27:44:0 E	-	1
Kafue River @ Babncroft	4060	1958-1975	"	00:00:0 N	00:00:0 E	-	1
Kafue @ Kafironda	4090	1959-2005	"	12:25:0 N	27:44:0 E	-	5775
Kafironda River @ Kafironda	4095	1973-1977	"	12:37:0 N	28:10:0 E	-	27
Mutundu River @ Mutundu	4100	1961-1989	"	12:37:0 N	28:20:0 E	-	116
Mwambashi River @ Mwambashi	4120	1959-2005	"	12:43:0 N	28:13:0 E	-	827
Kafue River @ Smith Bridge	4130	1959-2005	"	12:45:0 N	28:14:0 E	-	8914
Kafue River @ Wusakile Bridge	4150	1959-2005	"	12:53:0 S	28:15:0 E	-	9195
Kamfinsa River @ Kamfinsa	4152	1971-1987	"	12:25:0 N	28:22:0 E	-	1920
Baluba River @ Baluba	4170	1967-1968	"	12:52:0 S	28:22:0 E	-	339
Chapula River @ St.Joseph's Mission	4180	1970-2005	"	12:53:0 S	28:01:0 E	-	18
Kafue River @ Mpatamato	4200	1951-2005	"	12:53:0 S	28:08:0 E	1,132.00	12001
Kafulafuta Ndola-Kapiri Road	4203	1986-1987	"	00:00:0 N	00:00:0 E	-	1
Kafulafuta @ Ibenga Mission	4205	1970-2005	"	13:21:0 S	28:38:0 E	40.00	2470
Kafubu River @ Itawa Dambo	4210	1974-1984	"	12:59:0 S	28:38:0 E	-	302
Munkulungwe River @ Kaposi	4239	1972-1987	"	13:09:0 S	28:35:0 E	-	210
Kafubu River @ Masaiti Boma	4245	1971-2005	"	13:13:0 N	28:24:0 E	-	531
Kafulafuta @ Miputu Hills	4250	1966-1990	"	13:15:0 N	28:13:0 E	-	4762

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Kafue River @ Ndubeni	4260	1962-2005	"	13:24:0 N	27:29:0 E	1,130.20	18509
Lufwanyama River @ Mutaba	4265	1965-1972	"	12:49:0 S	27:35:0 E	-	829
Mpopo @ Mpopo School	4266	1971-1985	"	12:52:0 S	27:36:0 E	-	68
Lufwanyama @ Mpopo School	4267	1971-1985	"	12:50:0 S	27:36:0 E	-	973
Katembula @ Katembula	4268	1971-1985	"	12:51:0 S	27:40:0 E	-	267
Lufwanyama @ Kanakila	4272	1973-1987	"	13:24:0 S	27:43:0 E	-	2890
Kafue @ Munkumpi	4275	1962-1970	"	00:00:0 N	00:00:0 E	-	1
Kafue @ Machiya Ferry	4280	1962-2005	"	13:39:0 S	27:37:0 E	1,117.00	23065
Imbumbu @ Machiya	4281	1971-1974	"	13:39:0 S	27:39:0 E	-	591
Luswishi @ Lwendo	4302	1971-2005	"	12:55:0 S	27:21:0 E	-	2668
Luswishi @ Kilundu	4310	1970-1987	"	13:09:0 S	27:44:0 E	-	3600
Luswishi @ Kangondi	4340	1971-2005	"	13:50:0 S	24:22:0 E	-	3708
Kafue @ Chilenga	4350	1961-2005	"	14:06:0 S	27:25:0 E	-	34451
Lukanda @ Chikanda	4375	1975-1997	"	13:55:0 S	28:33:0 E	-	80
Kafue @ M'swebi	4435	1953-2005	"	14:25:0 S	27:00:0 E	-	50479
Kafue @ Lubungu	4450	1959-2005	"	14:35:0 N	26:27:0 E	-	55962
Lungu River @ Konikombe Hills	4460	1969-1987	"	12:16:0 S	26:48:0 E	-	11655
Mutanda @ Mutanda Mission	4500	1963-1987	"	12:24:0 S	26:15:0 E	-	1704
Solwezi @ Solwezi Pump House	4505	1971-2003	"	12:11:0 S	26:25:0 E	-	427
Lunga @ Mujimanzovu	4510	1964-1987	"	0:12:48 N	0:26:32 E	-	1
Chifubwa @ Solwezi Road	4515	1980-2003	"	12:11:13 S	26:25:54 E	-	887
Lunga @ Kelongwa School	4550	1968-1997	"	0:13:42 N	0:26:20 E	-	1
Lunga @ Chifumpa Pontoon	4560	1959-2004	"	13:59:0 S	26:21:0 E	-	20999
Lunga @ Kasono Mine	4595	1973-1975	"	14:30:0 S	26:25:0 E	-	24268
Lufumpa Below Kasempa	4620	1964-2003	"	13:27:0 S	25:52:0 E	-	1062
Workshop Station	4667	1978-1981	"	14:56:0 S	25:55:0 E	-	96239
Kafue @ Kafue Hook Bridge	4669	1972-2004	"	14:56:0 S	25:55:0 E	-	96239
Kafue River At Itzhi-Tezhi	4710	1959-1992	"	15:46:0 S	26:01:0 E	-	105672
Kafue @ Namwala Pontoon	4760	1951-1997	"	15:41:0 S	26:27:0 E	-	1494433
Kafue @ Busangu Rapids	4780	1962-1987	Water Level (m)	15:40:0 S	26:44:0 E	-	120176
Munyeke @ Mapanza Mission	4821	1970-1986	Flow (Cumecs)	16:15:0 S	26:54:0 E	-	1787
Mutama @ Mutama Rapids	4850	1970-1987	"	16:28:5 S	27:07:0 E	-	1735
Nangome River @ Myooye	4880	1963-1992	"	15:13:0 S	27:20:0 E	-	777
Kafue @ Nyimba	4890	1972-2000	"	15:45:0 S	27:18:0 E	-	136234
Magoye @ Chibumba's Farm	4915	1970-2002	"	15:58:0 S	27:36:0 E	-	1865

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Mwembeshi @ Lusaka-Mumbwa Rd/Br	4937	1979-1993	"	15:16:0 S	27:50:0 E	-	2163
Mwembeshi @ Shibuyunji	4940	1962-1992	Water Level (m)	15:27:0 S	27:49:0 E	-	3885
Kaleya @ Kaleya Dam Site	4941	1952-2002	Flow (Cumecs)	00:00:0 N	00:00:0 E	-	45
Kaleya @ Water Valley Road/Bridge	4943	1958-2002	"	16:00:0 S	28:01:0 E	-	630
Kaleya @ Avilion Weir	4945	1974-1975	"	16:02:0 S	27:54:0 E	-	206
Kaleya River @ Kaleya Road/River	4949	1974-1980	"	15:54:0 S	27:41:0 E	-	549
Kaleya @ Heales Estate Weir	4950	1970-1986	"	15:53:0 S	27:39:0 E	-	596
Kafue River @ Ceres	4955	1951-1986	"	15:45:0 S	27:50:0 E	-	149
Mazabuka River @ Uruaff Farm	4958	1971-1992	"	15:52:0 S	27:51:0 E	-	140
Kafue @ Kasaka	4977	1963-2003	"	15:49:0 S	28:13:0 E	-	150971
Kafue River @ Farowe	4995	1958-1970	"	15:57:0 S	28:50:0 E	-	1
Kafue River @ Mafungozi	4999	1957-1970	Water Level (m)	15:56:0 S	28:54:0 E	-	152882
Chongwe River @ Ray's Dam	5013	1973-2003	Flow (Cumecs)	15:10:0 S	28:28:0 E	-	1
Ngwerere River @ Ngwerere Estate	5016	1955-2003	"	15:20:0 S	28:20:0 E	-	303
Chongwe River @ Ngwerere Conflu	5024	1976-2006	"	00:00:0 N	00:00:0 E	-	1
Chongwe River @ Chongwe Rd./Bridge	5025	1968-2006	"	15:19:0 S	28:42:0 E	-	1813
Chalimbana River @ Glencraig Farm	5028	1952-1972	Water Level (m)	15:25:0 S	28:26:0 E	-	30
Kapiriombwa @ Exchange Farm	5030	1969-1998	Flow (Cumecs)	15:21:0 S	28:20:0 E	-	107
Lutembwe / Lutembwe Weir	5555	1973-1995	"	13:40:0 S	32:40:0 E	-	152.8
Makungwa @ Great East Road/Bridge	5562	1971-1995	"	13:32:0 N	32:26:0 E	-	62
Lusiwasi / Masese	5670	1965-2003	"	13:13:0 N	31:02:0 E	-	995
Chifuwe / Mkushi Boma	5755	1962-2001	"	13:37:0 N	29:24:0 E	-	181
Luangwa / Ndevu Camp	5800	1980-2005	"	14:23:0 S	30:28:0 E	-	55488
Mulungushi / Great North Road/Bridge	5815	1962-2002	"	14:18:0 N	28:33:0 E	-	1448
Rufunsa Janeiro Village	5948	1975-1992	"	15:25:0 S	30:18:0 E	-	2134
Lufubu @ Green Water Falls	6020	1960-2003	"	00:00:0 N	00:00:0 E	-	1
Nakonde Dam Site	6130	1975-2002	"	00:00:0 N	00:00:0 E	-	1
Kabulukutu @ Chamfubu	6133	1986-1994	"	31:12:48 S	9:46:25 E	-	1

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Chamfubu With Kabulukutu	6135	1986-1994	"	00:00:0 N	00:00:0 E	-	1
Chambeshi @ Chandaweyaya	6140	1959-1992	"	09:47:0 S	31:41:0 E	-	6628
Chambeshi @ Mbesuma Pontoon	6145	1975-2001	"	10:00:0 N	32:10:0 E	-	2334
Masenke @ Nansala Falls	6160	1961-1992	"	00:10:6 N	0:32:33 E	-	1
Kalungu-Wiwa @ Chunga Ranch	6170	1960-1999	"	00:00:0 N	00:00:0 E	-	1
Chozi @ Chozi	6200	1959-1989	"	00:00:0 N	00:00:0 E	-	1
Mungwi @ Mungwi School	6224	1963-2002	"	10:08:0 N	31:22:0 E	-	39
Kalungu Bemba @ Kalungu	6235	1959-1992	"	10:00:0 N	31:54:0 E	-	810
Chipoma Falls	6242	1957-2003	"	10:44:0 N	32:00:0 E	-	247
Lubu @ Mundu Road / Bridge	6250	1959-1992	"	10:20:0 S	32:15:0 E	-	1096
Manshya @ Shiwa Ng'andu	6275	1963-1992	"	11:13:0 N	31:40:0 E	-	401
Chambeshi Pontoon	6289	1971-2002	"	10:57:0 N	31:04:0 E	-	34745
Chambeshi @ Chambeshi Road	6290	1959-1971	"	10:56:0 S	31:04:0 E	-	4026
Luombe @ Chishimba Falls	6330	1956-1998	"	10:70:0 S	30:55:0 E	-	2580
Lukupa @ Kateshi Coffee Estate	6335	1987-2002	"	00:00:0 N	00:00:0 E	-	550
Lukupa River @ Pump House	6337	1990-1998	"	00:00:0 N	00:00:0 E	-	1
Milima @ Milima Pump House	6340	1969-2002	"	10:09:0 S	31:15:0 E	-	67
Lukulu @ Kasama-Luwingu Road/Bridge	6350	1969-2002	"	10:11:0 S	30:58:0 E	-	6504
Lwitikila @ Lwitikila Falls	6480	1958-2003	"	11:44:0 S	31:29:0 E	-	179
Lwitikila River @ Mpika Road / Bridge	6486	1970-2330	"	11:50:0 N	31:23:0 E	-	324
Kanchibiya @ Mpika-Kasama Road/Br	6500	1969-2003	"	11:29:50 S	31:17:0 E	-	1215
Kanchibiya @ Kopa Road/Bridge	6510	1970-1995	"	11:46:50 S	30:49:50 E	-	992
Luapula @ Chembe	6670	1956-2005	"	11:50:0 S	28:44:0 E	-	123072
Luongo @ Mwendakashiba	6750	1970-1996	"	10:28:0 S	29:01:0 E	-	4170
Lufubu Near Chibote	6760	1977-2002	"	09:56:0 E	29:34:0 E	-	1
Lufubu River @ Chipili	6765	1970-2002	"	10:43:0 S	29:05:0 E	-	1220
Luapula @ Kashiba	6785	1955-1991	"	10:23:0 S	28:38:0 E	-	161275
Mutotoshi @ Kapuma Falls	6855	1970-2003	"	09:23:0 S	30:23:0 E	-	383
Kalungwishi @ Chimpempe Pontoon	6865	1972-1999	"	09:33:0 S	29:27:0 E	-	10218
Chisela @ Bwalya Pontoon	6910	1970-1992	"	08:32:0 S	30:07:0 E	-	2186

Station Name	Station No.	Period	Times-Series Type	Latitude	Longitude	Elevation (m)	Area (Sq.Km)
Choma River @ Kaputa	6920	1957-1993	"	00:00:0 N	00:00:0 E	-	489628.3
Mwambeshi River @ Nsama	6935	1959-2001	"	08:52:0 S	29:56:0 E	-	707
Mukubwe @ Kambasa	6955	1962-1985	"	09:02:0 S	29:32:0 E	-	1015
Lunzua River @ Kambole River / Bridge	7005	1970-1992	"	08:57:0 N	31:11:0 E	-	1
Lunzua River @ Lunzua Weir	7006	1956-1992	"	08:56:0 N	31:10:0 E	-	1
Lunzua @ Simumbele Village	7008	1997-2000	"	8:46:23 S	31:08:0 E	-	1
Izi @ Mbete Village	7015	1997-2000	"	8:46:23 S	31:08:49 E	-	1
Lucheche River Below Lake Chila	7021	1970-2003	"	08:50:0 S	30:23:0 E	-	22
Lucheche @ Kawe Village	7022	1997-2000	"	8:42:48 S	31:12:34 E	-	1
Kalambo @ Kalambo Village	7030	1998-2000	"	8:35:55 S	31:15:22 E	-	1
Lufubu @ Keso Falls	7750	1957-1992	"	08:41:0 S	30:36:0 E	-	6350
Lufubu River Near Kabyole Village	7755	1997-2000	"	8:35:51 S	34:44:9 E	-	1
Zambezi @ Katima Mulilo	320100	1967-1999	"	17:25:0 S	24:15:0 E	932.60	334730
Zambezi @ Victoria Falls-Big Tree	330090	1924-1999	"	17:55:0 S	25:50:0 E	-	316000

Table 3.22: ZAMWIS - Monthly and Annual Rainfall - Zambia

Station	Period	Comment
Chipata	1990 - 2006	
Chipepo	1993 - 2006	
Choma	1990 - 2006	
Isoka	1990 - 2005	
Kabompo	1990 - 2005	
Kabwe	1990 - 2006	
Kafironda	1990 - 2006	
Kafue	1990 - 2006	
Kalabo	1990 - 2003	
Kaoma	1990 - 2006	Data for some months in 2006 & 2006 missing
Kasama	1990 - 2005	Data for months 11 & 12 in 2005 missing
Kasempa	1990 - 2005	Data for some months missing
Kawambwa	1990 - 2004	Data for some months missing
Livingstone	1990 - 2006	
Lundazi	1991 - 2006	Data for some months missing
Lusaka 01	1990 - 2006	Data for months 10 of 2005 missing
Lusaka 02	1990 - 2006	Data for some months of 1993 & 1995 missing
Magoye	1990 - 2006	
Mansa	1990 - 2005	Data for some months of 1998,2000 & 2005 missing
Mbala	1990 - 2006	
Mfuwe	1990 - 2006	Data for some months of 2006 missing
Misamfo	1990 -2005	Data for some months of 1999 & 2005 missing
Mongu	1990 - 2006	
Mpika	1990 - 2006	Data for months 11 & 12 of 2006 missing
Msekera	1990 - 2003	Data for some months of 1993-1995,1999-2001 & 2003 missing
Mt.Makulu	1990 - 2006	Data for some months of 2005 & 2006 missing
Mumbwa	1990 - 2006	Data for months 7 & 8 of 2006 missing
Mwinilunga	1990 - 2006	Data for some months of 1997-1999,2001,2003,& 2005-06 missing
Ndola	1990 - 2006	
Petauke	1990 - 2006	Data for months 4,10,11 & 12 of 2006 missing
Senanga	1990 - 2006	Data for some months of 2001-2002 & 2005-2006 missing
Serenje	1990 - 2006	Data for month 4 of 2006 missing
Sesheke	1990 - 2006	
Solwezi	1990 - 2006	Data for months 8 & 10 of 2006 missing
Zambezi	1990 - 2006	Data for months 10,11 & 12 of 1998 missing

Table 3.23: ZAMWIS - Maximum Monthly Temperature - Zambia

Station	Period
Chipata	July 1990 - July 2006
Chipepo	Apr 1995 - January 2007
Choma	July 1990 - September 2006
Isoka	July 1990 - September 2006
Kabompo	July 1990 - January 2005
Kabwe	July 1990 - December 2006
Kafironda	July 1990 - September 2006
Kafue	July 1990 - January 2006
Kalabo	July 1990 - March 2006
Kaoma	July 1990 - January 2007
Kasama	July 1990 - May 2005
Kawambwa	July 1990 - April 2001
Livingstone	July 1990 - January 2007
Lundazi	July 1990 - August 2006
Lusaka	July 1990 - January 2007
Magoye	July 1990 - January 2007
Mansa	July 1990 - August 1999
Mbala	July 1990 - August 2006
Mfuwe	July 1990 - September 2006
Misamfo	July 1990 - December 2004
Mongu	July 1990 - August 2006
Mpika	July 1990 - March 2006
Mt.Makulu	July 1990 - September 2006
Mumbwa	July 1990 - September 2006
Mwinilunga	July 1990 - June 2006
Ndola	July 1990 - December 2006
Petauke	July 1990 - September 2006
Senanga	July 1990 - May 2005
Serenje	July 1990 - December 2006
Sesheke	July 1990 - September 2004
Solwezi	July 1990 - December 2006
Zambezi	July 1990 - June 2006

Table 3.24: ZAMWIS - Minimum Monthly Temperature - Zambia

Station	Period
Chipata	July 1990 - July 2006
Chipepo	Apr 1995 - January 2007
Choma	July 1990 - September 2006
Isoka	July 1990 - October 2004
Kabompo	July 1990 - January 2005
Kabwe	July 1990 - December 2006
Kafironda	July 1990 - September 2006
Kafue	July 1990 - January 2006
Kalabo	July 1990 - March 2006
Kaoma	July 1990 - January 2007
Kasama	July 1990 - May 2005
Kawambwa	July 1990 - April 2001
Livingstone	July 1990 - January 2007
Lundazi	July 1990 - August 2006
Lusaka	July 1990 - January 2007
Magoye	July 1990 - January 2007
Mansa	July 1990 - August 1999
Mbala	July 1990 - August 2008
Mfuwe	July 1990 - October 2005
Misamfo	July 1990 - May 2005
Mkushi	Jan 1993 - November 1998
Mongu	July 1990 - August 2006
Mpika	July 1990 - March 2006
Msekera	July 1990 - June 2003
Mt.Makulu	July 1990 - September 2006
Mumbwa	July 1990 - September 2006
Mwinilunga	July 1990 - June 2006
Ndola	July 1990 - December 2006
Petauke	July 1990 - September 2006
Senanga	July 1990 - May 2005
Serenje	July 1990 - December 2006
Sesheke	July 1990 - September 2004
Solwezi	July 1990 - December 2006
Zambezi	July 1990 - June 2006

Table 3.25: ZAMWIS - Monthly Evaporation - Zambia

Station	Period	Comment
Chipata	Jan 1991 - September 1996	
Choma	July 1990 - March 2006	
Kabompo	July 1990 - May 2001	
Kabwe	July 1990 - August 2006	
Kafironda	July 1990 - September 2004	
Kafue	July 1990 - December 2005	
Kaoma	Aug 1990 - February 2001	
Kasama		No Data Available
Kawambwa	Oct 1991 - November 1996	
Livingstone	July 1990 - September 2006	
Lundazi	July 1990 - July 1992	
Lusaka	July 1990 - July 2006	
Magoye	July 1990 - January 2007	
Mansa	July 1990 - August 1990	
Mbala	July 1990 - July 2007	
Mfuwe		No Data Available
Misamfo	July 1990 - Jan 1997	
Mongu	July 1990 - July 2005	
Mpika	Oct 1990 - July 1991	
Msekera		No Data Available
Mt.Makulu	July 1990 - March 2006	
Mumbwa	Aug 2006 - September 2006	
Mwinilunga	July 1990 - September 1997	
Ndola	July 1990 - May 2006	
Petauke	Sept 1990 - November 2005	
Senanga	July 1990 - February 1998	
Serenje	July 1990 - December 2006	
Sesheke	July 1990 - August 2002	
Solwezi	July 1990 - Jan 2006	
Zambezi	July 1990 - May 1997	

3.2.8 Zimbabwe

Table 3.26: ZAMWIS - Sanyati River Monthly Runoffs - Zimbabwe

River	Location	Date Opened	Period Of Study	Code No.	Notch Capacity (M ³ /S)	Station No	Zone	Latitude	Longitude	Area (Km ²)
Munyati	Power Station Weir	13/10/49	1949-2005	3008 03	1354	C8	CUN2	1839 S	2947 E	5890
Munyati	Dyke G/W	29/09/52	1960-2006	3018 06 01 07	11.3	C18	CUN6	1849 S	3019 E	2631
Mukuvusi	Chivero Dam U/S	15/12/52	1953-2006	3022 22	76.3	C22	CH5	1757 S	3054 E	231
Manyame	Chivero Dam U/S	15/12/52	1957-2006	3021 01 12	95.1	C21	CH4	1758 S	3054 E	1510
Nyatsime	Edinbudgh G/W	09-10-53	1956-2003	3023 01 11	21.8	C23	CH5	1804 S	3104 E	500
Mukuvusi	Cleveland Dam D/S	16/02/54	1954-2003	3028 02	30.1	C28	CH5	1751 S	3109 E	20.1
Sabakwe	Sabakwe Dam D/S	30/08/54	1954-2006	3032 03	247	C32	CUN4	1901 S	3013 E	2640
Mupfure	Maynard Weir U/S	10-01-66	1966-2005	3067 02	55.4	C67	CUF3	1814 S	3030 E	3650
Musengezi	Aurelia Flumes	13/12/66	1966-2006	3068 02	80.7	C68	CUG2	1637 S	3105 E	951
Dande	Chitanha Flume	19/06/65	1967-1973	3069 01	553	C69	CH1	1631 S	3033 E	1279
Mupfure	Beatrice G/W	20/02/69	1969-2005	3070 01	202	C70	CUF4	1815 S	3046 E	1215
Mukwadzi	U/S Manyame Confl.	24/09/71	1971-2006	3075 02	35	C75	CH3	1706 S	3019 E	1730
Umfuli	Johannadale	11-09-72	1972-2002	3078 01 11	95.2	C78	CUF2	1752 S	2955 E	8240
Manyame	Harva Dam U/S	16/05/74	1975-2006	3081 01	78.7	C81	CH5	1800 S	3109 E	488
Gwebi	Darwedale Dam U/S	07-01-74	1974-2006	3083 02	105	C83	CH4	1737 S	3037 E	362
Umfuli	Copper Queen	26/06/74	1976-2005	3084 02 03	51.4	C84	CUF1	1730 S	2925 E	12100
Umsweswe	Claw Dam U/S G/W	10-01-76	1975-2006	3078 21	47.3	C87	CUS	1827 S	2959 E	1990
Umniati	Umniati Copper Queen	17/12/75	1976-2002	3088 01	54	C88	CUN1	1737 S	2920 E	24400
Munyati	Munyati Flume Power	27/07/77	1979-2005	3094 01	24.1	C94	CUN2	1839 S	2947 E	5906

Table 3.27: ZAMWIS - Gwayi River Monthly Runoffs - Zimbabwe

River	Location	Date Opened	Period Of Study	Code No	Notch Capacity (M ³ /S)	Station No	Zone	Latitude	Longitude	Area (Km ²)
Khame	Slights Weir	15/02/51	1951-2005	1008 04 12	296	A8	AG5	2005 S	2823 E	492
Ngwenya	Ngwenya Dam Spillway	08-08-51	1949-1993	1010 00 11	270	A10	AB3	1956 S	2852 E	38.9
Mukuvusi	Gweru River Cause Way	17/01/52	1952-2005	1013 01 11	142	A13	AS3	1843 S	2848 E	4559
Mgusa	Lower Mgusa Dam D/S	18/12/56	1956-2005	1024 02	43.1	A24	AG3	2001 S	2832 E	474
Matetsi	Railway Weir	04-12-58	1966-2005	1027 01	405	A27	AM	1815 S	2557 E	1740
Gwelo	Ambleside	02-11-58	1958-2005	1028 01 02	38.2	A28	AS3	1903 S	2921 E	1630
Shangani	SGH Bridge	12-04-59	1960-2004	1032 03	36.4	A32	AS4	1855 S	2852 E	5900
Shangani	Gwaayi Confluence	11-09-61	1961-2003	1036 01	212	A36	AS1	1830 S	2713 E	17200
Gwayi	Dahlia Control Section	24/12/67	1966-2006	1038 03	147	A38	AG1	1836 S	2710 E	21200
Bubi	Lupane G/W	22/01/65	1964-2006	1039 01	20.6	A39	AG1	1857 S	2746 E	4080
Tshongokwe	Kana Road	16/03/65	1965-2006	1041 02 03	16.2	A41	AS2	1840 S	2734 E	502
Bembesi	Siamakolo Pool	05-12-66	1965-2005	1046 01	31.8	A46	AB2	1909 S	2753 E	3570
Manzanyama	Mananda Dam U/S	07-08-67	1968-2004	1048 01	2.5	A48	AN	2014 S	2804 E	8240
Manzanyama	Mananda Dam SpillWay	28/10/67	1967-2005	1049 01	1314	A49	AN	2013 S	2803 E	383
Mgusa	Lower Mgusa Dam U/S	26/06/68	1967-2006	1050 01	45.1	A50	AG3	2003 S	2833 E	435
Mgusa	Upper Mgusa Dam	17/10/68	1968-2004	1051 01	39.6	A51	AG3	2005 S	2836 E	321
Lukosi	Victoria Falls Road	20/02/69	1968-2004	1052 02	46.4	A52	AL	1824 S	2636 E	1990

Table 3.28: ZAMWIS - Mazowe River Monthly Runoffs - Zimbabwe

River	Location	Date Opened	Period Of Study	Code No	Notch Capacity (M ³ /S)	Station No	Zone	Latitude	Longitude	Area (Km ²)
Shawanoya	Mutoko Road Bridge	10-03-49	1949-2006	4006 01 11 22	0	D6	DIY2	1738 S	3136 E	1166
Inyagui	Mtoko Road Bridge	28/10/49	1949-1979	4007 01	125.209	D7	DIY3	1738 S	3132 E	1600
Ruwidzi	Goromondozi Dam	29/07/54	1955-2006	4012 01	27.4	D12	DIY3	1752 S	3122 E	5.65
Murodzi	Kia Ora	23/08/57	1957-1983	4023 02	43.381	D23	DUR2	1720 S	3100 E	715
Munenga	Bally Vaughan	31/10/68	1969-2006	4045 01	6.1	D45	DIY1	1740 S	3123 E	137
Sawi	Mwenje Dam U/S	21/10/69	1969-2006	4049 11	80.1	D49	DUR1	1711 S	3059 E	109
Murodzi	Kilmur G/W	06-05-70	1970-2006	4051 02 02	3.7	D51	DUR2	1720 S	3102 E	777
Ruya	Upper Ruya U/S	19/12/69	1970-2006	4052 02	4.1	D52	DM2	1705 S	3057 E	59.59
Masawere	Upper Ruya U/S	01-02-70	1970-2006	4053 02	4.1	D53	DM2	1705 S	3056 E	951
Ruia	Frogmore	19/12/69	1970-2006	4054 03 11	10.7	D54	DM2	1707 S	3100 E	127
Dora	Mwarazi Dam U/S	18/09/69	1969-2006	4055 02	24.3	D55	DR5	1813 S	3213 E	63.29
Nyadire	Pirimengwe	10-06-70	1988-2006	4057 02	40.9	D57	DN2	1734 S	3201 E	510
Nyagui	Dip Flume & G/W	12-09-70	1982-2006	4058 03	70.1	D58	DIY3	1739 S	3132 E	98.3
Mazowe	Virginia	14/06/70	1971-2006	4060 02	85.4	D60	DM6	1721 S	3105 S	655
Mwenje	Mwenje Dam Outlet	14/06/71	1971-2006	4061 11	15	D61	DUR1	1716 S	3102 E	557
Chinyika	NorthField Flume	12-09-71	1971-2006	4062 03	6.3	D62	DIY3	1748 S	3130 E	158
Nyura	NorthField Flume	12-09-71	1975-2006	4063 02	4	D63	DIY3	1750 S	3130 E	329
Chinyika South	Chinwiri	12-10-71	1971-2006	4064 01	4.1	D64	DIY3	1758 S	3132 E	173
Nyumbuya	Chinwiri	12-10-71	1972-2000	4060 02	15.6	D65	DIY3	1759 S	3132 E	440
Nyagui	Chinwiri	14/12/71	1971-2006	4066 01	44.5	D66	DIY3	1758 S	3134 E	124
Nyakomberi	Seaton	19/04/72	1972-2006	4067 02	4.2	D67	DIY2	1803 S	3142 E	157
Nyamtorwa	Seaton	19/04/72	1971-2006	4068 02	3.7	D68	DIY2	1802 S	3142 E	55.09
Sambi	Sambi-Foothills G	12-04-74	1975-2006	4070 04	1.5	D70	DM6	1715 S	3117 E	316

3.3 Maps

One of the great strengths of the ZAMWIS database is the availability digital spatial data in the form of digitized maps. To view them, ZAMWIS has a Firefox based application called “Zamwis Basin Atlas” with which the user can interface with all the maps. There are three categories of maps presented, these being interactive maps, static maps and GIS projects and data. The interactive maps allow the user to turn on-and-off different layers, as well as zoom in on sub-sections of the Basin. The static maps are jpeg images which are static graphically depictions of a particular theme across the entire Basin. The GIS projects and data allow the user to access the *.mxd files when using ArcGIS.

In total there are 34 maps within ZAMWIS that offer a graphical display of numerous factors such as land use, ground and surface water, physiography, conservation, population distribution, flood prone areas, etc. Table 3.29 below presents a list of all maps within ZAMWIS.

Table 3.29: ZAMWIS - List of Maps Available in ZAMWIS

MapID	Theme	Map Title	Map No	Layers
GEN-01	General	Locality Map	1	cities (classified), countries, rivers, roads, rail, border posts
PHY-02	Physiography	Topography	2	sub-basins
GWR-01	Groundwater Resources	Lithology	3	SADC_geology_lithology
CLI-01	Climate	Mean Annual Rainfall	4	
CLI-02	Climate	Average Temperature in July	5	
CLI-03	Climate	Average Temperature in November	6	
LCU-02	Land Cover / Use	Year 2000 Land Cover	7	
SWR-03	Surface Water Resources	Mean Annual Runoff	8	
ENV-02	Environment	Wetlands	9	SADC_wetlands.shp
GWR-02	Groundwater Resources	Aquifer yields	10	SADC_geology_friend
SWR-04	Surface Water Resources	Flood Prone Areas	11	
CLI-05	Climate	Driest Year in 5	12	
CLI-06	Climate	Drought Index	13	
SEC-01	Socio-Economics	Population Distribution	14	
LCU-03	Land Cover / Use	Mining operations	15	Digitise mines from georeferenced map by Ashton
LCU-04	Land Cover / Use	Fishery Production	16	
SWR-01	Surface Water Resources	Streamflow Measuring Stations	17	
ENV-01	Environment	Conservation Worthy and Protected Areas	18	SADC_TFCACircles (show as hollow circles with green outline), sadc_protectedAreas
ENV-03	Environment	Ecoregions	19	SADC_wwf_ecor
PHY-01	Physiography	Soils	20	FAO Soils
SWR-02	Surface Water Resources	Water Balance : Distribution of Water Use (Ea)	21	
SEC-02a	Socio-Economics	Subbasin Characteristics - Zambezi Delta	22	
SEC-02b	Socio-Economics	Subbasin Characteristics - Tete	23	
SEC-02c	Socio-Economics	Subbasin Characteristics - Shire River / Lake Malawi	24	
SEC-02d	Socio-Economics	Subbasin Characteristics - Mupata	25	
SEC-02e	Socio-Economics	Subbasin Characteristics -	26	

MapID	Theme	Map Title	Map	Layers
		Luangwa		
SEC-02f	Socio-Economics	Subbasin Characteristics - Kariba	27	
SEC-02g	Socio-Economics	Subbasin Characteristics - Kafue	28	
SEC-02h	Socio-Economics	Subbasin Characteristics - Cuando / Chobe	29	
SEC-02i	Socio-Economics	Subbasin Characteristics - Barotse	30	
SEC-02j	Socio-Economics	Subbasin Characteristics - Luanginga	31	
SEC-02k	Socio-Economics	Subbasin Characteristics - Lungue Bungo	32	
SEC-02l	Socio-Economics	Subbasin Characteristics - Upper Zambezi	33	
SEC-02m	Socio-Economics	Subbasin Characteristics - Kabompo	34	

3.4 Observations on current ZAMWIS

As noted, the existing ZAMWIS is only available on DVD format. Although the intention has always been to host the database on a server and to allow internet access, it is hoped that this will be accomplished once the Interim ZAMCOM Secretariat begins operating, taking responsibility over the database and resuming the capture of critical data including stream flow, precipitation, maps, and literature to keep the system up to date.

The windows interface was also reviewed in this study and it was noted that there are some programming 'bugs' in the system that prevent easy access to data. With the evolving computer operating systems and programming options, it will be necessary to have the software structure of ZAMWIS reviewed to provide a more current and user-friendly interface, which is able to be server-hosted, accessed via Internet, and provide user management features that will enable rapid updating and access to information. Incorporation of a search-engine to assist in sifting through the literature and data will also prove handy.

Information is stored in many different formats. For example, streamflow data is not consistent from country-to-country. This makes the inter-linkage of information more challenging. Similarly, some literature is in pdf format, others in Microsoft Word, etc. To preserve security as well as maintain consistency, a standard format, such as pdf, would be recommended.

Metadata files are also not functioning in the way they are envisaged. Generally, these files are formatted in eXtensible Markup Language (XML) and follow a standard format defined by ISO or WMO. They should be accessible to the user through the ZAMWIS interface, to provide additional information and validate the source and authenticity of data. The revision of ZAMWIS will require the standardization of all metadata files for the different categories of information, for which all future additions should be generated. Entry forms at data input stage should be produced in the revised software interface, to capture all information required for the metadata files. This would then automatically be generated and stored along with the actual data.

4 Other Literature and data in hand

4.1 Literature

Extensive studies have been performed within the Zambezi River Basin relating to a wide range of interests. Many of these reports are already included in the ZAMWIS database. The current project identified numerous interesting and relevant documents that are not yet captured into the ZAMWIS database. A complete list of all such reports is presented in Table 4.1 and soft copies will be submitted to the Client along with this Annex. It is suggested that these be incorporated into the ZAMWIS database for future reference.

Table 4.1: Literature Compiled during the study, in addition to ZAMWIS documents

Doc #	Author	Title
DS-A-1	Aduah, M.S.	Multitemporal remote sensing for mapping and monitoring floods an approach towards validation of the KAFRIBA model, Kafue Flats, Zambia.
DS-A-2	Allen, R. G., Pereira, L.S., Raes, D, and Smith, M	Crop Evapotranspiration
DS-A-3	Asian Disaster Preparedness Center	Integrated Flood Risk Management in Asia A Primer 2
DS-B-1	Beilfuss, R., and dos Santos, D.	Patterns of hydrological change in the Zambezi Delta, Mozambique: Working paper 2, Program for the sustainable management of Cahora Bassa dam and the lower Zambezi
DS-B-2	Beilfuss, R. and A. Chilundo, A. Isaacman, W. Mulwafu	The impact of hydrological changes on subsistence production systems and socio-cultural values in the lower Zambezi Valley.
DS-B-3	Beilfuss, et. al. 2000 Paul Dutton & Dorn Moore 2000.	Land cover and land use change in the Zambezi Delta in Zambezi Basin Wetlands
DS-B-4	BirdLife International	Important Bird Area factsheet: Batoka Gorge, Zimbabwe
DS-B-5	Batoka Joint Venture Consultants	Batoka Gorge Hydro Electric Scheme Feasibility Study. Executive Summary. Final Report
DS-B-6	Beilfuss, R.	Prescribed flooding and restoration potential in the Zambezi delta, Working Paper #3.
DS-B-7	Beilfuss R, C. Bento, P. Hancock, B. Kamweneshe, K. McCann, M. Morrison, L. Rodwell	Water, wetlands & wattled cranes: A regional monitoring & conservation program for Southern Africa.
DS-B-8	Basson, G.	Hydropower Dams and Fluvial Morphological Impacts - An African Perspective
DS-B-9	R. Beilfuss, C. Brown	Assessing environmental flow requirements and trade-offs for the Lower Zambezi River and Delta, Mozambique
DS-C-1	Cani Anselmo	Cyclone shelters in reinforced cement & capacity building communities, for UN Habitat.
DS-C-2	Chimwala, M.	New efforts under way to restart Moz-Malawi power interconnector.
DS-D-1	Davies, B.R., R.D. Beilfuss, M.C. Thoms	Cahora Bassa Retrospective, 1974-1997: effects of flow regulation on the Lower Zambezi River
DS-D-2	Dyson, M., Bergkamp, G., Scanlon, J. (eds).	Flow. The Essentials of Environmental Flows
DS-F-1	Fauvet, P.	Mozambique: Cahora Bassa, a Year After the Takeover
DS-G-1	Government of Malawi. Ministry of Water Development,	The Integrated Water Resources Development Plan for Lake Malawi and Shire River System - " Lake Malawi Level Control" - Stage 2 - Volume II – Part B Technical Assessments of Alternative Dams at Kholombidzo
DS-G-2	Government of Malawi. Ministry of Water Development	Integrated Water Resources Development Plan for Lake Malawi and shire river system "Lake Malawi Level Control" Stage 2, Final Feasibility Report, Volume II – Part C – EIA of Upgraded Liwonde Barrage

Doc #	Author	Title
DS-G-3	Gopa / Decon	Formulation of the SADC regional Infrastructure Development Master Plan
DS-G-4	Guy, P.R.	River bank erosion in the mid-Zambezi valley, downstream of Lake Kariba
DS-G-5	Marco L.D. Gylstra Yousif Hussin Chris B. Mwasile	Remote Sensing for Integrated Water Resources Management in Kafue Flats, Zambia.
DS-H-1	Hudson, D.A. and R.G. Jones.	Regional climate model simulations of present day and future climates of Southern Africa
DS-H-2	HCB	Cahora Bassa North Bank Power Station
DS-I-1	IPCC	Third Assessment Report : Climate Change 2001 (TAR) : Impacts, Adaption and Vulnerability
DS-I-2	IPCC	Special Report on the Regional Impacts of Climate Change : An Assessment of Vulnerability
DS-I-3	IPCC	Fourth Assessment Report : Climate Change 2007 (TAR) : Impacts, Adaption and Vulnerability
DS-I-4	International Hydropower Association	Hydropower Sustainability Assessment Protocol - Background Document
DS-J-1	JA!	The Zambezi Valley - Damned By Dams
DS-K-1	Kizito Sikuka	Batoka hydro power station to light up southern Africa
DS-K-2	Klassen J.G.	Regulation and synchronisation of dam operation for environmental flows in the Zambezi River- Preliminary analysis
DS-L-1	Lahmeyer International, Electricité de France and Knight Piésold	Mphanda Nkuwa Hydropower Project Feasibility Study
DS-L-2	Lahmeyer International, Electricité de France and Knight Piésold	Mphanda Nkuwa Hydropower Project Feasibility Study
DS-L-3	Lindemann	Explaining success and failure in international river basin management Lessons from Southern Africa The 6th Open Meeting of the Human Dimensions of Global Environmental Change Research Community
DS-M-1	Makoni S. T., T. Roddingkjeldsen and D. Rosbjerg	Sustainable reservoir development—a case study from Zimbabwe
DS-M-2	Mazvimavi, D. and Wolski, P.	Long Term Variations of Annual Flows of the Okavango & Zambezi Rivers
DS-M-3	Ministry of Energy, Water Resources & Development, Zimbabwe	Gwayi Shangani Dam Site No AG 1/25 Design Report.
DS-M-4	Malo Sergio and Sesenado Marcelion	Mapeamento dos Comites Locais de Gestao de Risco nos Distritos de Mopeia e Morrumbala
DS-M-5	Mwelwa E.	The Application of the monthly time step Pitman Rainfall-Runoff Model to the Kafue River Basin of Zambia
DS-M-6	Mwelwa E., B. Sinkala and I. Phiri	Kafue Lower Gorge Project, Presentation at the Hydropower Sustainability Forum
DS-M-7	Mhlanga S. Z.	The Hydro-power Potential of the Zambezi River From Kazungula to the Indian Ocean
DS-M-8	Murwira, A., Mazvimavi, D. (not dated)	Strategic and Optimum Network Design for the SADC-HYCOS Phase II Project. Final Report.
DS-M-9	Mott MacDonald	Integrated Water Resources Management Strategy and Implementation Plan for the Zambezi River Basin
DS-M-10	Mott MacDonald	Integrated Water Resources Management Strategy and Implementation Plan for the Zambezi River Basin - Summary
DS-M-11	Mott MacDonald	Integrated Water Resources Management Strategy for the Zambezi River Basin
DS-N-1	New, M., Lister, D., Hulme, M., and Makin, I.	A high-resolution data set of surface climate over global land areas

Doc #	Author	Title
DS-N-2	New, M.	Climate change and water resources in the south-western Cape, South Africa
DS-N-3	New Zimbabwe	Batoka Hydro-Power Project Revived
DS-N-4	Niras and BRL Ingénierie	Zambezi River Basin Multi-Sector Investment Opportunities Analysis : Preliminary Report
DS-N-5	Norconsult, Nire, Node and Niva	Final feasibility Report - Volume I - Main volume of the Integrated Water Resource Development Plan for Lake Malawi and the Shire River System
DS-N-6	Norconsult, Nire, Node and Niva	Paper III-C Final Feasibility Study: Flood Risks and Flood Warning in the Shire River System
DS-N-7	Norconsult, Nire, Node and Niva	Paper III-E Final Feasibility Study: Simulations and System Operations
DS-N-8	Norconsult	The integrated Water Resources Development Plan for Lake Malawi and Shire River System – “Lake Malawi Level Control” – Stage 2 – Volume III : Paper III-g : Hydrology - Past, Present and Future Conditions
DS-N-9	Norconsult, Nire, Node and Niva	Final Feasibility Study: Part E: Consequences for Lake Malawi of Operating a Pumping Barrage at Samama
DS-O-1	One World	A Tale of Three Rivers - Climate Change, Water & Development in Southern Africa
DS-R-1	Ragab, R. & Prudhomme, C.	Keynote paper: Climate Change and Water Resources Management in Arid and Semi-arid Regions: Prospective and Challenges for the 21st Century
DS-R-2	Ronco, Paolo, Giacomo Fasolato, Michael Nones, Giampaolo Di Silvio	Morphological effects of damming on lower Zambezi River
DS-R-3	Ruosteenoja, K., T.R. Carter, K. Jylhä and H. Tuomenvirt.	Future climate in world regions: an intercomparison of model-based projections for the new IPCC emissions scenarios
DS-R-4	Darius Gerald Rutashobya, Julius Wellens-Mensah	Project 7 ACP RPR 600. SADC-HYCOS Evaluation Mission Report
DS-S-1	Shongwe et al.	Projected Changes in Mean and Extreme Precipitation in Africa under Global Warming. Part I: Southern Africa
DS-S-2	Strzepek, K. and A. McCluskey.	District level hydro-climatic time series and scenario analysis to assess the impacts of climate change on regional water resources and agriculture in Africa
DS-S-3	Salvador Fernandes, J. and A. Molico, N. Henriques and J.M. Gonçalves Guedes	Cahora Bassa North Bank Power Plant, design review and economic evaluation
DS-S-4		Sediment Factsheet
DS-S-5	Sisala R.P., Zesco Managing Director	Challenges and Possible Solutions in the Power Sector in Zambia
DS-S-6	Seyam I. M, A. Y. Hoekstra, G. S. Ngabirano & H. H. G. Savenije.	Globalization & Water Resources Management: The changing value of water
DS-S-7	SADC Water Sector Coordinating Unit.	Consolidation and Expansion of the Hydrological Cycle Observing System in the SADC Sub-Region (SADC-HYCOS). Implementation Document.
DS-S-8	SADC	Revised Protocol on Shared Water Courses
DS-S-9	SADC, Directorate of Infrastructure and Services, Water Division	SADC Position on the World Commission on Dams and Development (WCD) Report
DS-S-10	Shawinigan Engineering	Wet Season Flow forecasting for Victoria Falls and Kariba - Draft Report
DS-S-11	Soils Incorporated (Pvt) Ltd, Harare, Zimbabwe in association with Chalo Environmental & Sustainable Development Consultants, Lusaka, Zambia	Kariba Dam - Zambia and Zimbabwe - Final Report
DS-T-1	Tadross, M.A., B.C. Hewitson and	The interannual variability of the onset of the maize growing

Doc #	Author	Title
	M.T. Usman.	season over South Africa and Zimbabwe
DS-T-2	Tumbare, M.J.	Infrastructure Management in a Changing Environment : The Case of Kariba Dam,' in Petermann T., (ed.), 2008, Towards Climate Change Adaptation - Building Adaptive Capacity in Managing African Transboundary River Basins
DS-T-3	Tumbare, M. J.	Cyclic Hydrological changes of the Zambezi River Basin : Effects and Migratory Measures' in Tumbare M. J. (ed), 2000, Management of River Basins and Dams: The Zambezi River Basin
DS-T-4	Tumbare, M.J.	An overview of the Southern African Power Pool, Powerpoint presentation for the international Training Programme in IWRM for the Zambezi Basin States
DS-T-5	Tumbare, M.J.	Batoka gorge Hydro-electric Scheme Project (SAAP Investment Conference, Windhoek)
DS-W-1	Winsemius, H.C.	Satellite data as complimentary information for hydrological models
DS-W-2	World Commission on Dams	Dams and Development - a New Framework for Decision Making
DS-Z-1	ZINWA	Existing and Proposed Dams Zimbabwe

4.2 Data

Some additional data has been collected which is of relevance to the Project. These include data from ZRA, data from the Department of Meteorology in Zambia and some additional data from Malawi. The Tables below summarize the data that has been secured to date.

Table 4.2: Data relating to the Kariba Dam Catchment

Data Set	Date
Kariba Daily Lake Levels	1960 – 2007
Kariba Total Monthly Outflows (Turbine & Spillage)	1961 – 2007
Kariba Total Monthly Evaporation (mm)	1961 – 2002
Kariba Total Monthly Evaporation (x10 ⁶ m ³)	1961 – 2007
Luanginga River at Kalabo Daily Water Levels	1957 – 2007
Zambezi River at Senanga Daily Water Levels	2000 – 2007
Zambezi River at Sesheke Daily Water Levels	2000 – 2007
Zambezi River at Victoria Falls, Big Tree Station, Daily Flows	1924 – 2007
Kabompo River at Watopa Pontoon, Daily Flows	1958 – 2007

Table 4.3: Daily Rainfall Data (Zambia)

Station	Dates
Chipata	1960 – 2007
Chipepo	1993 – 2006
Choma	1980 – 2006
Isoka	2000 – 2005
Kabompo	1980 – 2005
Kabwe-1	1980 – 2007
Kabwe-2	2000 – 2004
Kafironda	1980 – 2005
Kafue	1982 – 2006
Kalabo	1987 – 2005
Kaoma	1980 – 2005
Kasama	2000 – 2005
Kasempa	1980 – 2005
Kawambwa	2000 – 2004
Livingstone	1980 – 2006
Lundazi	1960 – 2007
Lusaka-01	1980 – 2007
Lusaka-02	1980 – 2007

Station	Dates
Magoye	1980 – 2006
Mansa-01	2000 – 2007
Mansa-02	2004 – 2005
Mbala	2000 – 2006
Mfuwe	1979 – 2007
Misamfu	1980 – 2007
Mongu	1980 – 2006
Mpika	1960 – 2007
Msekere	1982 – 2003
Mt Makulu	1980 – 2006
Mumbwa	1980 – 2006
Mwinilunga	1980 – 2006
Ndola	1980 – 2006
Petauke	1960 – 2007
Samfya	1960 – 1984
Senanaga	1980 – 2002
Serenje	1960 – 2007
Sesheke	1982 – 2005
Solwezi	1980 – 2006
Zambezi	1980 – 2006

Table 4.4: Data for Malawi¹

Data Set	Date
Shire at Liwonde – Daily Water Level	1968 – 2000
Shire at Watopa – Daily Water Level	1952 – 1999
Shire at Liwonde – Daily Flows	1950 – 2001
Lake Malawi Average Monthly Levels	1945 – 2000

4.3 Maps

Several maps have been developed during the life of the Project which is of significance. Digital copies of these have been included in the DVD submitted to the Client. The Table below provides a summary of the maps.

¹ Contained in the CD provided with the RfP from GIZ for the current Project.

Table 4.5: New Maps produced during Project

Map No	Details
DS-1	Forecasting locations in Basin with Medium Lead Time Requirements
DS-2	Forecasting locations in Basin with Seasonal Lead Time Requirements
DS-3	Forecasting locations in Basin with Short Lead Time Requirements
DS-4	Average Basin Response Time
DS-5	Concept map of Forecast Lead Times
DS-6	Existing Flow Gauges
DS-7	Proposed Stream flow Gauges for Flow forecasting
DS-8	Overview of Rainfall Station Locations
DS-9	Location of Assessed Investments
DS-10	Risk zone mapping - Namibia Flood Inundation
DS-11	Risk zone mapping - Namibia Community Education
DS-12	Risk zone mapping - Namibia Regulation of New Development
DS-13	Risk zone mapping - Namibia Warning and Rescue
DS-14	Risk zone mapping - Mozambique Flood Inundation
DS-15	Risk zone mapping - Mozambique Community Development
DS-16	Risk zone mapping - Mozambique Regulation of New Development
DS-17	Risk zone mapping - Mozambique Warning and Rescue

5 Models

In addition to the literature and data files that are available, several models have been developed within the basin, and it is important to have a compilation of this information as well. The table below summarises the most relevant models that are presently being developed or are already in use and comments are provided on their availability. For the Project, the models themselves are not required, but information on their characteristics has been used.

Table 5.1: Models created for the Zambezi River Basin

Model	Prepared by	Comment
Upper Zambezi		
No models available		
Middle Zambezi		
KAFRIBA	WWF	An Operational model - old version available for Kafue Flats, but recommended by DHV to shift to InfoWorks to comply with ZESCO System. (WRSM 2000 rainfall runoff model is part of Kariba)
Luangwa PCRaster model	H.C. Winsemius (Delft, University of Technology, Deltares)	A daily water balance model, capable to estimate flows from the Luangwa tributary. The shape and timing of the hydrograph has been calibrated on signatures from old discharge records and the water balance using remotely sensed evaporation estimates*. The model runs on daily rainfall and potential evaporation estimates.
Info Works (Wallingford)	ZESCO	An Operational model which ZESCO plans to use for operation of Itzhi-Tezhi and management of Kafue Flats.
Lower Zambezi		
HEC-5, Simulation of Flood Control and Conservation Systems	Beilfuss, Version 8.0, October 1998	This is a study model, prepared for the Zambezi system with the aim of improving environmental flows downstream of Cahora Bassa. The model domain covers the total Zambezi.
Mike Flood	ARA, Mozambique	An Operational model used by ARA Zambeze for flood prediction downstream Cahora Bassa.
Total Zambezi		
WRSM2000 Zambezi	Dr. Yamba - University of Zambia	Study model for the hydrology of the Zambezi in WRSM2000, aimed at assessing the Impacts of Climate Change on Hydropower Production.
HEC-3 Reservoir System Analysis for Conservation	BRL/NIRAS (World Bank Funded)	This model has been used for reservoir analysis for the Worldbank Study (2010). Beginning of 2011 the model will be handed over to the Interim Zamcom Secretariat.
HUGO model	Dr. Hugh Williams	Operational model. Monthly water-balance spreadsheet. Used to advise Cahora Bassa operations. All major dams in Zambezi are included.
WEAP Water resources management model	(Zamwis DVD) Copyright Tellus Institute, Stockholm Environmental Institute	A WEAP model of the full Zambezi basin is available, with the existing reservoirs and a number of demand sectors. The model is still limited in scope, with only a few years of hydrological data series, but can easily be extended.

* Reference: Winsemius, H.C., Schaeffli, B., Montanari, A., Savenije, H.H.G. (2009): On the calibration of hydrological models in ungauged basins: a framework for integrating hard and soft hydrological information. Water Resour. Res. 45, W12422, doi:10.1029/2009WR007706

6 Metadata files

As noted in the Inception Report, metadata files have been prepared for all information which has been collected in addition to the ZAMWIS database (see Chapter 4). This includes all literature, data and maps. The metadata files are formatted in eXtensible Markup Language (XML) which is a standard hierarchical format. They have been included in the DVD presented to the Client. Every effort was made to follow the relevant ISO and WMO format standards. To ensure the XML files are valid, XML Schema Definition (XSD) files are used for validation.

7 Concepts and Recommendations

After a thorough review of all literature, data and maps available for the Project, concepts and recommendations have been deduced to improve the management, availability, accessibility and flow of information. The concepts and recommendations have been prepared for the purpose of enhancing flood control and e-flows through synchronized management of dams in the Zambezi River Basin.

7.1 Concepts for data and information sharing

To ensure that data is effectively managed and systems are in place for its collection, storage and sharing, a centralized system should be adopted by the Zambezi riparian states. This will have to be hosted and managed by a central organization, to which all member-states fully subscribe. It is therefore assumed that the Interim ZAMCOM Secretariat will come into effect, and that they will be responsible for the central management of data.

The Concept for data information and sharing is that ZAMWIS, the most recent information management system prepared for basin wide data, should be resuscitated, improved and integrated into the operation of all stakeholders, with mechanisms in place to regularly update the database with geodata, literature & reports, as well as maps, and any other relevant information.

7.2 Recommendations for data and information sharing

To implement this Concept, the several recommendations are being made. These are:

- Institutionalize the collection, management and sharing of data and information, and resuscitate the ZAMWIS database at the Interim ZAMCOM premises that are presently being established.
- Convert ZAMWIS database to store agreed standardized data formats, and link regional systems such as SADC-HYCOS to ZAMWIS.
- Engage professionals to enhance or completely re-configure the current windows-based interface of ZAMWIS, allowing for ease of access to data and updating of information. ZAMWIS should be converted into a system that is server-hosted, and accessible through the Internet. Security features should be built in to allow for access from different stakeholders, who will be permitted to provide updates to information, while any other entities will be able to log in and enter the web-based system and collect data as required.
- Future projects should have a requirement specified in the ToRs that specifically requires them to contribute to ZAMWIS and SADC-HYCOS by preparing maps, data, etc in similar format. These should be provided to ZAMCOM for integration into the system, or if the web-based system is in operation, should be uploaded directly.
- Provide for a study to clean, patch and extend available observed data and carry out statistical analysis of stream flows to inform dam operations. Provide for ongoing service as the data provided often has gaps that need to be filled.
- Carry out verification of existing data from different stations to assess the consistency and quality of information.
- Put in place systems which require the regular updating of rating curves and calculate flows from observed gauge records.

OPERATIONALISE AND UPGRADE ZAMWIS TO A FULLY OPERATIONAL HYDROLOGICAL DATABASE			
Intervention #	1.1	Timeframe:	Short Term Budget range: <0.5 million USD
Linkages:	Intervention Sheet # 2.4, 2.10, 3.13		
Linkages:	Annex 1 Report, Section 3.4; Annex 2 Report, Sections 4.3 and 7.3; Annex 3 Report, Section 9.4		
Concept:	Basin-wide exchange of data and information between stakeholders can be achieved and sustained, providing more reliable and up-to-date information for decision making, thereby contributing to integrated dam management and improved flood control and environmental flows.		
Purpose:	To establish a framework amongst the stakeholders of the Zambezi River Basin that results in sustainable data/information sharing, including an operational system of centralized data management.		
Justification:	A basin-wide framework for data and information sharing would improve the current limited data/information exchange between stakeholders and enhance data and information exchange, trust and confidence amongst the stakeholders. A functional and centrally managed data management system with regional authorization would facilitate such a process.		
Actions/ Responsibilities:	<ul style="list-style-type: none"> ▪ Institutionalize the collection, management and sharing of data and information, and resuscitate the ZAMWIS database at the Interim ZAMCOM premises that are presently being established. ▪ Convert ZAMWIS database to store agreed standardized data formats, and link regional systems such as SADC-HYCOS to ZAMWIS. ▪ Engage professionals to enhance or completely re-configure the current windows-based interface of ZAMWIS, allowing for ease of access to data and updating of information. ZAMWIS should be converted into a system that is server-hosted, and accessible through the Internet. Security features should be built in to allow for access from different stakeholders, who will be permitted to provide updates to information, while any other entities will be able to log in and enter the web-based system and collect data as required. ▪ Future projects should have a requirement specified in the ToRs that specifically requires them to contribute to ZAMWIS and SADC-HYCOS by preparing maps, data, etc in similar format. These should be provided to ZAMCOM for integration into the system, or if the web-based system is in operation, should be uploaded directly. 	SADC/ ZAMCOM Secretariat	
		SADC/ ZAMCOM Secretariat	
		SADC/ ZAMCOM Secretariat	
		SADC/ Zambezi riparian states	
Benefits: / Beneficiaries	<p>Some of the benefits include:</p> <ul style="list-style-type: none"> • Improved access and accuracy of data • Improved ability to manage changing variability in water resources due to climate change • Effective mobilisation of disaster management units during floods • Improved water resources management, leading to enhanced flood control and e-flows. • Increased confidence and trust among stakeholders 	<ul style="list-style-type: none"> • SADC, ZAMCOM Secretariat, Dam Operators • DMMU • Basin-wide users 	
Means of implementation:	Consultancy services to engage IT professionals in the development and management of the proposed data interface and system.		
Specific assumptions/ risks:	Users in the basin will be willing to provide the data required to populate and update ZAMWIS.		
Comments:	Resuscitation of the ZAMWIS database at ZAMCOM must be a high priority, as data is presently not being captured centrally. The more time is lost, the larger the gap in data that needs to be filled.		

ANALYZE AND VERIFY EXISTING DATA IN ZAMWIS			
Intervention #	1.2	Timeframe:	Short Term Budget range: <0.5 million USD
Linkages:	Intervention Sheet # 2.4, 2.10, 3.13		
Concept:	Basin-wide exchange of data and information between stakeholders can be achieved and sustained, providing more reliable and up-to-date information for decision making, thereby contributing to integrated dam management and improved flood control and environmental flows.		
Purpose:	To establish a framework amongst the stakeholders of the Zambezi River Basin that results in sustainable data/information sharing, including an operational system of centralized data management.		
Justification:	Many of the years in which data has been reported are incomplete. In addition, rating curves used in certain gauging stations are insufficient to translate stage information into discharge. Data from many different sources, representing the same river basin, requires evaluation to ensure consistency and provide for confidence in the basin wide users that rely on this information.		
Actions/ Responsibilities:	<ul style="list-style-type: none"> • Provide for a study to clean, patch and extend available observed data and carry out statistical analysis of stream flows to inform dam operations. Provide for ongoing service as the data provided often has gaps that need to be filled. • Carry out verification of existing data from different stations to assess the consistency and quality of information. • Put in place systems which require the regular updating of rating curves and calculate flows from observed gauge records. 	SADC/ ZAMCOM Secretariat	
Benefits: / Beneficiaries	Some of the benefits include: <ul style="list-style-type: none"> • Increases the amount of reliable data available to stakeholders. • Increases confidence in the accuracy of data. • Ensures coherence in the data being collected and stored centrally. 	SADC and All Basin-wide users	
Means of implementation:	Engage Consultant to carry out the above actions.		
Specific assumptions/ risks:	ZAMWIS is centralized at ZAMCOM Secretariat and accepted as the data-store-house for the river basin.		
Comments:	It is critical to ensure that historical data is complete, and verification of its accuracy has been carried out. Building confidence in the stakeholders with regards to this is very important.		

References

- World Bank. 'Zambezi River Basin Multi-Sector Investment Opportunities Analysis: Interim Report', 2009.
- Mott MacDonald. 'Integrated Water Resources Management Strategy and Implementation Plan for the Zambezi River Basin', April 2008.
- Mott MacDonald. 'Rapid Assessment – Final Report - Integrated Water Resources Management Strategy for the Zambezi River Basin, Dec 2007.