INTEGRATED WATER RESOURCES MANAGEMENT PLAN FOR NAMIBIA

AUGUST 2010

PREPARED FOR:	FUNDED BY:
MINISTRY OF AGRICULTURE, WATER AND FORESTRY	AFRICAN WATER FACILITY

African Water Facility

GOVERNMENT OF THE REPUBLIC OF NAMIBIA

INTEGRATED WATER RESOURCES MANAGEMENT PLAN FOR NAMIBIA

Funded by: African Water Facility

Prepared for: Ministry of Agriculture, Water and Forestry

Prepared by: IWRM Plan Joint Venture Namibia

ENVES

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ENVIRONMENTAL EVALUATION ASSOCIATES OF NAMIBIA

DYNAMIC Water Resources MANAGEMENT

AUGUST 2010

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ACRONYMS

AMCOW	African Minister's Council on Water
BMC	Basin Management Committee
DWAF	Department of Water Affairs and Forestry
DWSSC	Directorate of Water Supply and Sanitation Coordination
GDP	Gross Domestic Product
GROWAS	Groundwater Information System
GWP	Global Water Partnership
IT	Information Technology
IWRM	Integrated Water Resources Management
IWRMP	Integrated Water Resources Management Plan
K&I	Knowledge and Information
KBMC	Kunene Basin Management Committee
KWMB	Karst Water Management Body
LCE	Lund Consulting Engineers
M&E	Monitoring and Evaluation
MAWF	Ministry of Agriculture, Water and Forestry
MDG	Millennium Development Goals
MET	Ministry of Environment and Tourism
MLR	Ministry of Lands and Resettlement
MoF	Ministry of Finance
MRLGH	Ministry of Regional and Local Government and Housing
MRLGHRD	Ministry of Regional and Local Government and Housing and Rural Development
MS	Microsoft
MTEF	Medium Term Expenditure Framework
NDP	National Development Plan
NGO	Non Governmental Organisation
NHIES	Namibia Household Income and Expenditure Survey
NIWEG	National Irrigation Water Efficiency Group
NPC	National Planning Commission
NWP	Namibia Water Partnership
NWP	National Water Policy
O&M	Operation and Maintenance
OKACOM	Okavango River Basin Water Commission
ORASECOM	Orange-Senqu River Commission

PET	Potential Evapotranspiration
PJTC	Kunene Permanent Joint Technical Commission
PST	Performance Support Team
RUWIS	Rural Water Information System
S&AP	Strategy and Action Plan
SADC	Southern Africa Development Council
SIDA	Swedish International Development Agency
SOE	State Owned Enterprise
UNDP	United Nations Development Program
UNESCO	United Nations Education Scientific and Cultural Organisation
URV	Unit Reference Value
WaSAC	Water (and Sanitation) Advisory Council
WDM	Water Demand Management
WHO	World Health Organisation
WPC	Water Point Committee
WR	Water Regulator
WRC	Water Research Council
WRMA	Water Resources Management Act
WSASP	Water Supply and Sanitation Sector Policy
WSS	Water and Sanitation Sector
WSSD	World Summit on Sustainable Development
ZAMCOM	Zambezi Watercourse Commission

INTEGRATED WATER RESOURCES MANAGEMENT PLAN FOR NAMIBIA

1. BACKGROUND

Integrated Water Resources Management (IWRM) has been identified as essential for the management of the Water Sector in Namibia. The original call for IWRM worldwide was made at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002, where the international community took an important step towards more sustainable patterns of water management. This call, included in the WSSD Plan of Implementation, was for all countries to "develop integrated water resource management and water efficiency plans, with support to developing countries."

In April 2006 Namibia was represented at a meeting of the African Minister's Council on Water (AMCOW) where one of the main points of discussion was the importance of integrated water resources management. This was recognised as an important link that was missing in the management of the Namibian water sector. This planning workshop confirmed the need to establish an IWRM plan for Namibia, to integrate partners, to share information and to encompass all relevant legislation. The proposed IWRM plan was described as needing to be concrete, realistic, feasible, supported by all stakeholders (with ownership and clear roles and responsibilities), funded and affordable, executable, practical, addressing capacity building and that it will make a difference.

Following this meeting the Africa Water Facility, through the African Development Bank, offered funding to Namibia's Ministry of Agriculture, Water and Forestry (MAWF) to develop an Integrated Water Resources Management Plan for Namibia.

Historically a vast array of developments in Namibia have resulted in numerous plans, strategies and approaches, all of which are attempting to reach the same overall goals, namely, integrated and sustainable water use and management. The Water Resources Management Bill, currently being drafted, is based on IWRM principles and provides overall guidance, but is not yet implemented. As a result, a variety of *ad hoc* interventions are undertaken by government and other stakeholders, together and separately, all heading in the same general direction.

To address these issues, the Ministry of Agriculture, Water and Forestry, on 17 February 2009, appointed a consultant team comprising expertise from different disciplines within the Namibian Water Sector, called IWRM Plan Joint Venture Namibia, to commence with the development of the Namibian IWRM Plan.

The study was guided by a Project Steering Committee appointed by MAWF and comprising the following members:

- Chair: MAWF
- Members: MAWF, National Planning Commission (NPC), City of Windhoek, NamWater, Namibia Water Partnership (NWP), UNESCO and UNDP.

2. INTRODUCTION TO INTEGRATED WATER RESOURCES MANAGEMENT

Integrated Water Resources Management means that all the different uses of water resources are considered together. Water allocations and management decisions consider the effects of each use on the others. They take account of overall social and economic goals, including the achievement of sustainable development. The basic IWRM concept includes participatory decision-making. Different user groups such as farmers, communities and environmentalists, can influence strategies for water resource development and management. Additional benefits will accrue as informed users apply local

self-regulation to issues such as water conservation and catchment protection far more effectively than central regulation and surveillance can achieve.

Integrated water resources management is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives.

The basis for IWRM is that the many different uses of finite water resources are interdependent.

2.1 IWRM PRINCIPLES

A meeting in Dublin in 1992 gave rise to four principles that have been the basis for much of the subsequent water sector reform. *The International Conference on Water and Environment, Dublin, Ireland, January 1992.*

The four Dublin principles:

(i) Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

(ii) Water development and management should be based on a participatory approach, involving users, planners and policy markers at all levels

(iii) Women play a central part in the provision, management and safeguarding of water.

(iv) Water has an economic value in all its competing uses and should be recognized as an economic good.

Challenges and constraints arise in each water use area, but the willingness and ability to address these issues in a coordinated way is affected by the governance structure of water. Recognising the inter-related nature of different sources of water and thus also the inter-related nature and impacts of the various water uses is a major step to the introduction of IWRM.

3. IWRM – THE NAMIBIAN PERSPECTIVE

Namibia is the most arid African country south of the Sahara with low and varied precipitation, from a maximum of ± 650mm in the north east to less than 50mm per year along the coast. It is estimated that only 2% of the rainfall ends up as surface run-off and a mere 1% becomes available to recharge groundwater. The balance of 97% is lost through evaporation (83%) and evapo-transpiration (14%), as illustrated by

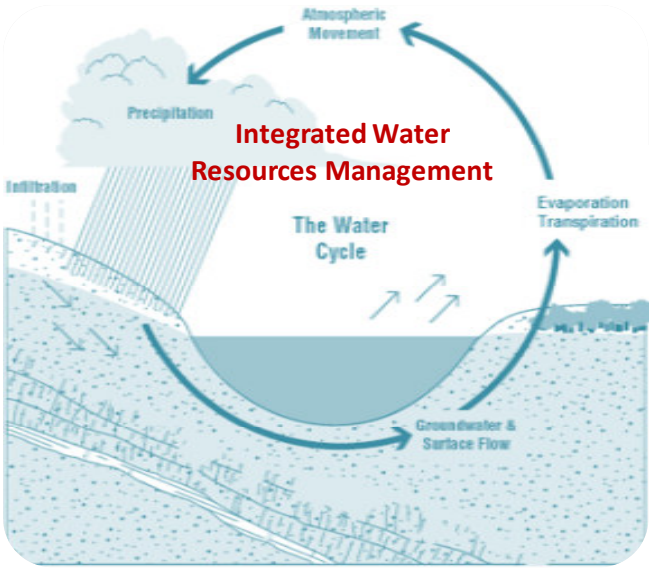

Figure 3.1: Hydrological Cycle of Namibia.

Namibia's rainfall is skewed, with the northeast getting more than the west and south-western parts of the country. Namibia's international boundaries, both northern and southern are marked by the Kunene River in the northwest, the Okavango River in the central north and the Zambezi and Kwando Rivers in the northeast. The Orange River marks Namibia's southern border. It is only in these rivers that perennial surface water resources are found. These rivers are all

shared with neighbouring riparian states with an obligation for them to be managed and used in terms of the relevant rules of International Water Law.

3.1 INTEGRATED WATER RESOURCES MANAGEMENT FOR NAMIBIA

This Integrated Water Resources Management Plan (IWRMP) for Namibia addresses IWRM defined as: '*A process that promotes the co-ordinated development, management and use of water, land and related natural resources in order to optimize the resultant economic, social and environmental welfare in an equitable manner without compromising the sustainability of vital ecosystems* (adapted from Global Water Partnership).

The overall long-term goal of IWRM in Namibia is to achieve a sustainable water resources management regime contributing to social equity, economic efficiency and environmental sustainability.

IWRM is accepted globally as an essential component of sustainable development in which water is recognised as a key national asset. Nevertheless, the implementation of IWRM is a time consuming process, requires strong leadership and ongoing political endorsement of its goals and activities. IWRM is particularly important in Namibia with its low and varied rainfall coupled to extremely high evaporation. The internal annual renewable water resources available from ephemeral rivers and groundwater sources are estimated at 600 million cubic metres. Namibia also has access to internationally shared perennial and ephemeral water resources on its northern and southern borders.

In 2004 the government launched Namibia's Vision 2030 which provides the overarching framework for the development of Namibia with the main goals of improving the quality of life of its people and achieving the status of a developed country by the year 2030. Water resources development will significantly contribute to the achievement of the Vision goals and in this respect will provide the framework for the water sector policy and strategy goals and objectives. The overarching goals for the water sector are fully aligned to meeting the Millennium Development Goals (MDG) and the sub regional goals articulated in the SADC protocol.

Good progress regarding water supply coverage has been made since independence. If implementation continues at the current rate, and with steady financial and human resources backing the programme,100 per cent coverage for both urban and rural areas could be achieved by the year 2030. See **Table 3.1** for projected rural water supply progress in terms of the Millennium Development Goals.

Table 3.1: MDG Targets

TEN YEAR DEVELOPMENT FRAMEWORK	1996 - 2005	2006 – 2015		2016 - 2025		2026 - 2035
National Development Plan	NDP 2	NDP 3	NDP 4	NDP 5	NDP 6	NDP 7
End date of NDP	2005/06	2010/11	2015/16	2020/21	2025/26	2030/31
Rural water coverage	80%	85%	90%	95%	-	100%
Full cost recovery	50%	60%	70%	80%	90%	100%
Decentralisation	Delegation 95%	Devolution 100%				
Gender policy implemented	100%					
Recurrent Budget (N$ million)	423, 668	490, 000	560	650	740	850
Development Budget (N$ million)	294, 533	338, 947	400	455	525	600

Progress regarding appropriate sanitation coverage has been less comprehensive since Independence and focus on this part of the sector is required. See **Table 3.2** and **Table 3.3**.

Table 3.2: Vision 2030 Sanitation Coverage*

AREA	YEARLY PERCENTAGE COVERAGE ACHIEVED OR PROJECTED							
	1991	1992	1996	2000	2006	2010	2020	2030
Urban	85	78	92	91	100	95	100	100
Rural	10	10	20	20	60	30	40	50
Total	22	22	50	41	70	60	70	80

*Adapted from Vision 2030, Figure 4.3.1

Table 3.3: MDG Sanitation Coverage*

AREA	YEARLY PERCENTAGE AND COVERAGE PROJECTED			
	1991	2001	2006	2015
Urban	89	82	80	98
Rural	15	21	50	65

*Adapted from MDG report

In 2008 the African Development Bank funded a Project for a Rapid Assessment of the Water Supply and Sanitation sector in Namibia. In the Report the investment gaps for the water supply and sanitation sectors were estimated in relation to the coverage required to attain the Vision 2030 targets for Namibia. The water supply and sanitation coverage requirements proposed, as well as the investments required to achieve those targets are shown in **Table 3.4** below. An estimated gap of US$ 92 million should be provided for water supply and US$ 288 million for sanitation to meet the goals for 2030.

Table 3.4: Anticipated Coverage and Investment Requirements

COVERAGE TARGETS AND CAPITAL INVESTMENT REQUIREMENTS							
SUB-SECTOR	AREA	2006/7 Access (%)	2010 Target (%)	2015 Target (%)	INVESTMENTS (MILLION USD)		
					REQUIREMENTS	AVAILABLE 2008/09	GAP
Water	Rural	80	85	90	74	9,6	64,4
	Urban	98	99	100	29	1,0	28,0
	Total	86	91	96	103	10,6	92,4
Sanitation	Rural	25	30	65	30	0,1	29,9
	Urban	76	95	98	260	2,1	257,9
	Total	51	62	85	290	2,2	287,8

From the above it is clear that there are different assessments of the present coverage of sanitation, but with the newly established responsibility for the DWAF to manage sanitation development in Namibia, it is clear that more accurate assessments of the coverage and investments required will have to be made to address the situation properly. To achieve the targets for water and sanitation the strategy to be followed is the encouragement of the active participation of users and beneficiaries in regulating water access and management, as well as sanitation, in rural areas through the further extension of responsibilities of the rural Water Point Committees.

3.2 OBJECTIVE OF THE IWRM PLAN FOR NAMIBIA

As stated above, the overall long term objective of the IWRM Plan for Namibia is to enable Namibia to achieve a sustainable water resource management regime contributing to social equity, economic efficiency and environmental sustainability in the country. This will result in improved health and sanitary conditions of communities, improved water related livelihoods, gains to agriculture from improved land and water management, reduced risk of floods and droughts. Transboundary cooperation on beneficial use of shared water resources will be greatly enhanced leading to joint project implementation and operational management.

The following issues drive the need for IWRM:

- Shortcomings in the management of water; a focus on developing new sources rather than managing existing ones better, and top-down sector approaches to water management result in uncoordinated development and management of the resource;
- Growth in population, increased economic activity and improved standards of living lead to increased competition for and conflicts over the limited freshwater resource
- A combination of social inequity and economic marginalisation forces people living in poverty to overexploit land and other natural resources, with damaging impacts on water resources
- Water demand has increased faster than the growth in population in many places
- The threat of pollution increases the risk of water scarcity
- More and more development means greater impacts on the environment

- Current concerns about climate variability and climate change demand improved management of water resources to cope with potentially more intense floods and droughts.

3.3 THE WATER SECTOR IN NAMIBIA

Due its dry climate and unpredictable rainfall water resources challenges in Namibia can only be addressed through a high degree of efficient water resources management. The key challenges of the water sector will be to address the technical, institutional, financial and socio-economic issues under a consolidated National IWRM Plan.

3.4 SECTOR PRIORITIES

Sector priorities are guided by a number of policies developed within the Ministry of Agriculture, Water and Forestry. With reference to these policies it was concluded that the existing key water policies, namely the 2000 National Water Policy (NWP) and the 2008 Water Supply and Sanitation Sector Policy (WSASP), are in harmony with the IWRM principles. However, some aspects of the policies have not yet been completely implemented and should be implemented as soon as possible. It is also clear that new policies will evolve over time and that ongoing policy analyses will lead to the revision and amendment of current policies. New policies that are most urgently required must address the issues of bulk water and end user tariffs, water tariff subsidies and the reduction of bush encroachment to enhance groundwater recharge.

The broad objectives of the Namibian water sector is to achieve the efficient supply and allocation of water to ensure equitable access to water resources and sanitation and contribute to the long-term social and economic development of Namibia. This is based on ensuring the environmental sustainability of water use and re-use; full participation of the stakeholders and a strong institutional capacity from local to national level. The perennial rivers of Namibia are transboundary in nature and their sustainable and judicious use requires agreements between the basin states due to their trans-boundary and shared nature. Cooperation with riparian countries is facilitated under the framework of the Revised SADC Protocol on Shared Watercourses.

The sector priorities focus on providing basic water supply and sanitation services to all Namibians, at an affordable cost. This will be achieved through the combined efforts of the government and the beneficiaries, based on community participation and the acceptance of mutual responsibility.

4. THE IWRM PLAN FOR NAMIBIA

4.1 APPROACH AND METHODOLOGY FOLLOWED IN THE DEVELOPMENT OF THE IWRM PLAN FOR NAMIBIA

As stated by the Global Water Partnership: *"IWRM is a challenge to conventional practices, attitudes and professional certainties. It confronts entrenched sectoral interests and requires that the water resource is managed holistically for the benefits of all. No one pretends that meeting the IWRM challenge will be easy but it is vital that a start is made now to avert the burgeoning crisis."*

IWRM can be considered a philosophy. It offers a guiding conceptual framework rather than a concrete blue-print. Implementing IWRM does not require that a new super-ministry be created. What it does demand is an understanding of the bigger picture where the actions of one party do not occur independently of the actions of others. IWRM places an emphasis on stakeholder participation and decision making at the lowest appropriate level.

As stated in the project Terms of Reference;

> *"Inadequate or non-existent infrastructure, limited technological and human capabilities for hydrological and ecological assessments, database management, continuous monitoring and updating, and purification and recycling of water pose challenges to the full implementation of IWRM. This is further compounded by the lack of institutional and human capacity for effective data collection, service delivery, coordination, regulation, monitoring, inadequate mechanisms for addressing gender issues and enforcement of IWRM practices. Finally limited 'political will' to implement IWRM remains a serious challenge. Without addressing this, any new initiative risks failure*
>
> *Effective stakeholder participation at all levels will be required in all decisions concerning water resources allocations and management, with the focus of capacitating stakeholders for managing specific water resources activities, thus ensuring ownership and overall responsibility. The cooperative process under the SADC shared water protocol will be facilitated through the IWRM plan and will provide an opportunity for a win win use of the water resources shared with other countries. The IWRM plan will facilitate the long-term engagements of regional and international development partners and stakeholders in the development of Namibia's water resources."*

In view of the arid nature of the climate of the country, a vast array of activities have taken place over many years to ensure water security. These have resulted in the development of policies, legislation, plans and strategies in an endeavour to achieve the overall goals of water resource management and sustainable water use in Namibia. Although these activities met with considerable success, they did not always embody the basic philosophy of IWRM which places an emphasis on stakeholder participation and decision making at the lowest appropriate level. In order to embody the accepted IWRM principles and to consolidate these activities in a comprehensive IWRMP for the future, the Project to develop the plan was designed in such a way that eight thematic reports were prepared which lay the foundation for the proposed IWRM Plan.

The eight thematic reports that were prepared are:

- Theme Report 1: Review and Assessment of the Existing Situation
- Theme Report 2: The Assessment of Resources Potential and Development Needs
- Theme Report 3: Formulation of a Water Demand Management Strategy
- Theme Report 4: The Formulation of Information and Knowledge systems
- Theme Report 5: Long Term Monitoring and Evaluation Framework
- Theme Report 6: Integrated Framework for Institutional Development and Human Resources Capacity Building
- Theme Report 7: Strategy for Funding the Implementation of the Integrated Water Resources Management Plan
- Theme Report 8: National Water Development Strategy and Action Plan.

After completion of the evaluations and analyses covered in the first three thematic reports, the draft Strategy and Action Plan was prepared and submitted for consideration at a number of consultative workshops held in the thirteen Regions of the country. The first workshop was held in Windhoek, Khomas Region, in September 2009. The purpose of this workshop was to obtain the participation and engagement of stakeholders and to ensure that their views, opinions and suggestions were incorporated in the planning process. The results of this workshop were then taken forward to

workshops in the rest of the country and considered in Regional Workshops and Focus Group Discussions for further improvement.

In parallel with the development of the Strategy and Action Plan, Theme Reports 5 to 7 were also prepared. Information from these reports was incorporated into the Strategy and Action Plan which was further adapted and developed following the inputs received from each of the regional consultations.

The Theme Reports will now be discussed below. This will be followed by a presentation of the recommendations of the Strategy and Action Plan. In the discussion of the Theme Reports only the most important issues identified in the reports are highlighted. Readers are advised to refer to the Theme Reports for full details.

4.2 THE EXISTING SITUATION IN NAMIBIA

LEGISLATION	
Water Policy, Legislation and Regulation	Existing key water policies, namely the 2000 National Water Policy (NWP) and the 2008 Water Supply and Sanitation Sector Policy (WSASP), are in harmony with the IWRM principles. However, some aspects of the policies have not yet been completely implemented.
	The revised Water Resources Management Act (WRMA) has not yet been promulgated. This is a major constraint to the implementation of IWRM.
	Regulation within the Water Sector, particularly with respect to tariff setting, the performance of service providers and the prioritization of capital projects and funding, is currently weak.
	An independent body to advise the Minister on issues relating to the Water Sector in general and IWRM in particular does not yet exist.
	Regulations in terms of the WRMA which can guide the management of the Water Sector, particularly with respect to monitoring of performance and support to service providers, the implementation of water demand management and water conservation strategies are lacking
	Legislation to provide continuous financial and managerial support to Basin Management Committees does not exist
International Water Cooperation	The Revised SADC Protocol on Shared Watercourses which was adopted at a SADC Ministers Summit on 7 August 2000 has been signed and ratified by Namibia.
	Namibia is currently actively involved in the activities of the Basin Commissions on all the Internationally Shared Border Rivers. These include: - Orange-Senqu River Commission (ORASECOM) - Permanent Okavango River Basin Water Commission (OKACOM) - Kunene Permanent Joint Technical Commission (PJTC) - Zambezi Watercourse Commission (ZAMCOM) Namibia is also party to a number of bi-lateral agreements with its neighbours.
	Specific international committees to manage appropriately delineated shared groundwater basins do not exist, but fall under the umbrella of the existing Commissions.
INSTITUTIONAL DEVELOPMENT	
Institutions Responsible for Water Infrastructure Planning and Development	A number of water service providers with different responsibilities are involved in water and sanitation infrastructure planning and development. Communication and cooperation between these bodies are weak. These include - NamWater, responsible for bulk water supply, - Department of Water Affairs and Forestry, responsible for resource management and rural water supply - Regional Authorities, responsible for small scale water supply to small communities

	↓ Local Authorities, some responsible for water supply, water reticulation and sanitation while others are just responsible for water reticulation and sanitation, ↓ Private Sector, responsible for water supply in agriculture, mining and tourism.
Water Institutional Development	The DWAF institutional structure is not fully aligned with IWRM and capacity within DWAF to manage IWRM is limited.
	Coordination between central and decentralised structures concerning water management needs improvement.
	Basin Management Committees (BMCs) have not been establishment in all areas defined as Water Basins.
CAPACITY FOR IWRM	
Government Capacity for IWRM	Capacity for data collection, processing and storage is weak
	Capacity for data base management and making data available to other parties is weak
	Capacity for monitoring and evaluation of IWRM related issues within MAWF is weak
	Capacity to implement water demand management and conservation is weak
	Knowledge of sanitation technologies, particularly alternative systems such as dry sanitation is weak
	Water demand management plans do not exist within MAWF and most service providers
	Funding for water demand management and sanitation capacity building and research is not available
	Capacity for environmental resource management is weak. This includes: ↓ Water resource conservation, ↓ Regular groundwater level monitoring, ↓ Resource security, ↓ Effective and efficient resource use, ↓ Reduction of water wastage in all sectors, ↓ Land use and rangeland management, ↓ Control over bush encroachment to enhance groundwater recharge.
	Capacity to design and develop unconventional water resources is limited e.g. ↓ artificial aquifer recharge, ↓ wetland treatment systems for wastewater disposal and ↓ grey water recycling for reuse in agriculture and agro-forestry
Service Provider Capacity	Service providers generally lack capacity to implement IWRM to an acceptable level. This includes capacity for activities such as: ↓ Development of service master plans ↓ Establishment of a fair tariff structure based on principles of cost recovery and social responsibility ↓ Introducing well managed credit control and cost recovery initiatives ↓ Funding and training to actively pursue water demand management ↓ Development and sourcing of human and capital resources to provide water and sanitation services ↓ Training to improve skills levels, particularly at the lower levels ↓ Establish capacity in water demand management at all levels ↓ Development of water demand management plans ↓ Performance assessment based on identified indicators.
Stakeholder Capacity Building	Areas where strengthening of stakeholder capacity is essential include: ↓ Management capacity of BMCs ↓ Pollution prevention and source protection. ↓ Community engagement in BMCs and WPCs ↓ Legal empowerment of BMCs with clarification of the legal role of BMCs and their

	obligations - Advisory role of BMCs - Financial resources of BMCs.
Formal Education and Training	Academic education of water professionals and technicians, training, mentoring programmes and gaining experience over time are critical requirements for the successful implementation of IWRM: - IWRM issues are not adequately included in curricula of tertiary institutions - Basic and higher education do not continuously offer IWRM related community services through extracurricular education programmes - IWRM/WDM research and technology is not adequately catered for - Bursaries for academic and technical education and training in IWRM are limited - Government approval for work permits for trained people, experienced in IWRM, within SADC are too strict and cumbersome.
Staff retention	Staff retention is a difficult issue for all government and private water institutions and service providers because there is a lack of skilled people resulting in a continuous movement of skilled persons between institutions. The following aspects need strengthening: - Development of career paths within the Water Sector - Improved salaries to retain expertise, - Critical skills sharing.
DATA	
Baseline Data for Rainfall	Accessing rainfall and evaporation data that has been collected and processed over a long period of time, and which is stored in existing data bases, is difficult. Major areas requiring improvement include: - The data collection network with better distribution and coverage for rainfall in many areas. - Data processing - Data base management with ready access to data and information - Climate monitoring in order to track and plan for possible climate change. - Monitoring of catchment conditions by using satellite imagery.
Data for surface water	As far as surface water resources are concerned, the main priorities for improved data management are: - Human and financial resources to ensure that the existing hydrological surface water network can be operated efficiently and that the capture and processing of reliable data can continue. - Data base management with improved access to data and information - More gauging stations to measure ephemeral flows during the rainy season - More field visits during times of floods in the more heavily populated river systems prone to flooding, such as the Cuvelai, Okavango and Zambezi river systems. - Improved flow rating of gauging stations.
Data for groundwater	Issues that need attention for better data management include: - Mandates and responsibilities for groundwater management. - The human capacity to investigate, manage and monitor groundwater resources. - Establishment of management bodies in all the large groundwater abstraction areas in the country. - Rural groundwater monitoring. - The accuracy of the groundwater production data collected by NamWater - Regular submission of NamWater data to the DWAF. - Routine, annual groundwater quality sampling and analysis by NamWater. - Water quality monitoring by large scale groundwater users. - Investigations to estimate natural recharge, especially to the strategic aquifers.

General data related issues	Other issues requiring attention in the IWRMP include: - All water use should be monitored and recorded - All irrigation water use must be metered. (At least 41% of the water used in Namibia in 2008 was for irrigation) - Water metering and reporting by service providers and users who abstract their own water (rest water levels and abstracted volumes). - Water quality standards and regulations - Monitoring of water quality - Knowledge of decision makers to understand the implications and opportunities of alternative sanitation options. - Good solid waste management, waste minimization and waste recycling
DATA AND INFORMATION GAPS IN THE WATER SECTOR	
Division of Geohydrology	No link between allocated abstraction volumes and actual abstraction figures reported by permit holders
	Loggers used are prone to failure, leading to loss of data
	Manual water level readings are recorded in Excel spread sheets
	Analogue charts are not digitized at all
	No programme for standard chemical analyses in place
	Lack of time series data for water quality
	No readily available data to estimate natural recharge of groundwater
Division of Hydrology	Rainfall loggers fail, loss of data
	Back log in entering data due to database issues
	Data loss in ephemeral rivers
	Poorly qualified data collectors leads to poor data quality
	Data collection low priority within Department
	Lack of volunteers collecting data for the Division
Division of Water Environment	Insufficient staff to conduct sufficient monitoring and interaction with clients
	Ecological data stored on a desk top computer, MS Access database
Directorate of Rural Water Supply	Internal databases, RUWIS and database with infrastructure info not linked to GROWAS or internally, limited compatibility
Namibia Meteorological Services	Backlog in processing collected data due to insufficient staff
	Low reliability/high maintenance of automatic climate stations, poor data quality
	Complex database solution for storage and analysis of data
NamWater	Most data stored in Excel sheets
	No use of GROWAS database
	No continuous sampling of water quality at production boreholes
Local Authorities	Limited monitoring of abstraction volumes, water levels and groundwater quality
	Data storage on paper
	Many local authorities do not provide abstraction figures in line with requirements in abstraction permits
Regional Councils	No information provided
Permit holders, general	Only 50-60% of permit holders report their abstraction figures to DWAF
	Data stored in Excel sheets
	Not clear quality of data provided by permit holders
	Limited historical data available

Mining sector	No/limited feedback from DWAF to mines after submission of reports according to permit conditions
Tourism sector	No/Limited reporting on consumption
Irrigation sector	No/Limited sampling of water quality before and after irrigation
Basin management committees	Currently no structured monitoring programmes in place
	Only KBMC has a water resources management plan, including guidelines for data, information and knowledge management
STAKEHOLDER ENGAGEMENT AND GENDER	
Stakeholder Engagement and Gender issues	Stakeholder awareness, engagement and capacity are recognized as the long term keys to resource security. Many stakeholder engagement issues were identified that need attention in the IWRMP. These include *inter alia*: - Access to database to identify and capture data - Lack of a sound communication strategy in the water and sanitation sector. - Limited availability of water related data, information and reports - Lack of stakeholder engagement platforms such as Basin Management Committees in most basins. - Awareness raising to obtain participation in integrated water resources management from all users. - Lack of stakeholder involvement in decision making and delegation of responsibility for integrated water resources management, water demand management and water conservation in particular - Lack of focus group discussion platforms on critical issues. - Integrate women into integrated water resources management, water demand management and water conservation related work places - Integration of women in water management committees and water sector institutions at all levels. - Lack of appropriate sanitation awareness and engagement programmes for rural and peri-urban communities.
INVESTMENT IN WATER SERVICES	
Capital Investments in Infrastructure	Issues requiring ongoing attention for IWRM include: - Appropriate water infrastructure designs - Harmonize investment plans with policies - Funding to enhance groundwater recharge and water banking - Make investments in the practice of conjunctive water use, also to optimise operating rules in times of high water availability - Capital and operational investment plans developed to optimise the efficient management of water resources - Private participation in water infrastructure investments should be encouraged. The mining industry and commercial irrigation are good examples (Areva desalination, Okoruso Mine, Namdeb, irrigation along the Orange River, the Karst Area and the Stampriet Basin).
Cost recovery	In the context of IWRM water is both an economic and social good and therefore the cost of water and sanitation services must be recovered to ensure performance and make those services financially viable. - Life cycle costs of water supply infrastructure must be determined before capital investments are made - Ensure that tariff structures and pricing of water services are equitable, affordable and reasonable - Revenue collection must takes place - Income must be appropriated correctly to maintain services - Income generated through water sales must be maintained in the water sector

Investments in Resource Management	Issues requiring ongoing attention for IWRM include:
	- Funding for water resource investigations should be increased
	- Funding water resource conservation should be included in all policies and programmes for the management and use of water resources
	- Fund the drought management strategy
	- To address consequences of climate change, integrate investments in:
	  - Improved flood management,
	  - Extended hydrological gauging networks,
	  - Improved hydrological modelling,
	  - Improved groundwater modelling,
	  - Improved data processing,
	  - Appropriate drought management
	  - Enhanced disaster risk management
	  - Improved communication and transfer of information.

Economic Analysis	To establish economic responsibility in the water sector, issues concerning affordability, value creation, cost recovery, financial liquidity for service providers, manageability of processes and appropriate infrastructure development should be done on an integrated basis.
	In allocating funds to the water sector decision makers should not only consider the cost of infrastructure and maintenance, they must also consider the financial consequences to the country should there be a failure to supply water, in particular to industries. The apparent resistance to funding the water banking scheme for Windhoek is a prime example. A further example was the interruption, of approximately 4 weeks, to the water supply of Walvis Bay in 2008 during floods in the Kuiseb Delta, mainly as a result of a lack of investment in infrastructure and maintenance.
CONCLUSION	
The development and implementation of an Integrated Water Resources Management Plan should not only accelerate the existing momentum in water resources management towards the achievement of the Millennium Development Goals and Vision 2030, but is a major challenge and must also be tailored to mobilize human resources, technology and financial support to achieve this goal.	

4.3 DISCUSSION OF ISSUES CRITICAL TO INTEGRATED WATER RESOURCES MANAGEMENT

4.3.1 Water Demand

According to the World Bank water demand is determined by four major driving forces, population, technology, trade and the environment.

Future water demand will be influenced to a very large extent by future price increases (price elasticity of demand).

Figure 4.1 is a population density map of Namibia. The map clearly shows which basins support large numbers of people, and which are sparsely populated.

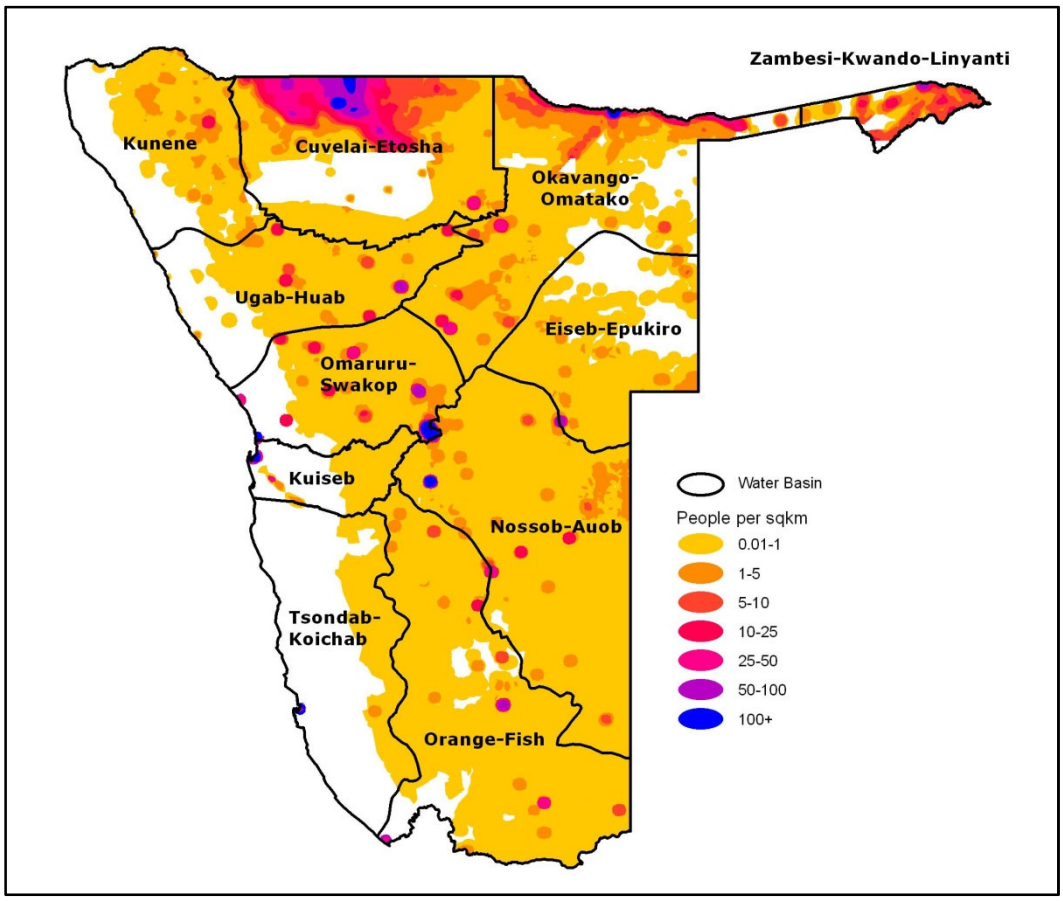

Figure 4.1: Population Density Map of Namibia

Over the next 30 years, water demand in Namibia will increase rapidly in some areas (in particular, all expanding urban areas) and only moderately in others. The current problem of distributing the available water to where it will be most needed will be exacerbated and, due to full exploitation of developed resources close to demand centres, expensive new water sources (for example desalination plants, new dams, long pipelines and water from international water courses) will have to be developed. The quantity of water used for high value uses, e.g. tourism (N$ 574/ m^3), other service sectors and high value crops (e.g. grapes and dates), should increase relative to the quantity used for low value uses, e.g. irrigation of low value crops (N$ 7.2/ m^3), such as maize.

EQUITABLE ACCESS TO WATER

By 2030, equitable access to water should be supported by:

- water pricing that reflects the cost of water supply, with
- subsidies being fully transparent and mainly restricted to lifeline amounts for low income users.
- greater dissemination and use of Namibia's Natural Resource Accounting programme, to inform policies and future development.
- an increase in the reuse and recycling of water
- an increase in the use of alternative water sources such as water derived from desalination and other unconventional sources.
- an increase in the number of basin management committees that are established and functioning.

The following trend in water demand increases are foreseen if Vision 2030 is realised:

FUTURE TRENDS IN WATER DEMAND INCREASES	
Urban Sector	The urban population will increase dramatically from 610 000 (33%) in 2001 to 2.24 million (75%) in 2030. The high rate of urbanization in combination with rising income and industrial development will increase urban water demand significantly. The rural urban migration requires major capital investment to provide access to water and sanitation services especially to the poor that cannot afford to pay for these services.
Rural Domestic Water Sector	With the high rate of urbanization, the rural population will not increase significantly.
Irrigation Water Sector	According to the Green Scheme, most new irrigation schemes will be concentrated along the perennial rivers which will increase the water requirements in these areas significantly. Water use efficiency and pollution will be major focus areas for proper water management to prevent international conflicts.
Livestock Water Sector	Due to the limited livestock carrying capacity of the soil it is foreseen that the water demand of livestock will remain stable, influenced mainly by annual rainfall and availability of grazing. The policy of value addition within the meat industry will require an increase in the number and capacity of abattoirs. This may contaminate water resources if not carefully managed. The biggest threat to water resources as a result of overgrazing is bush encroachment which reduces the recharge of groundwater sources..
Mining Sector	Large mines can consume vast quantities of water. In the latest developments along the coast, desalination of seawater has been developed to supply uranium mines in the desert. This is a welcome initiative. Mines can constitute a serious pollution threat in karst and other secondary aquifers if not properly managed and controlled
Tourism Sector	The tourism sector was identified as one of the major growth sectors. The development of high quality, low impact consumptive and non-consumptive tourism is encouraged. The large number of lodges established in Namibia (500+) may increase the water requirement in the sector significantly. Care must be taken that abstraction of water for lodges in ecologically sensitive areas does not lead to over abstraction of water. If not properly managed, inadequate wastewater and refuse disposal may cause groundwater pollution

The water demands per sector are illustrated in **Table 4.1** and **Figure 4.2**. In the pie-charts the demands are presented as percentages of the total annual demand and as annual demands in Mm^3 per annum.

Table 4.1: Projected Water Demand for Namibia

CONSUMER GROUP	DEMAND IN Mm^3/a				
	2008	2015	2020	2025	2030
Urban	66.0	80.0	91.1	103.5	117.2
Rural Domestic	10.3	10.6	10.9	11.1	11.4
Livestock	86.8	86.8	86.8	86.8	86.8
Irrigation	135.3	204.6	344.6	379.8	497.2
Mining	16.1	17.2	18.1	19.1	20.3
Tourism	19.6	27.5	31.9	35.2	38.9
TOTAL	334.1	426.7	583.4	635.6	771.7

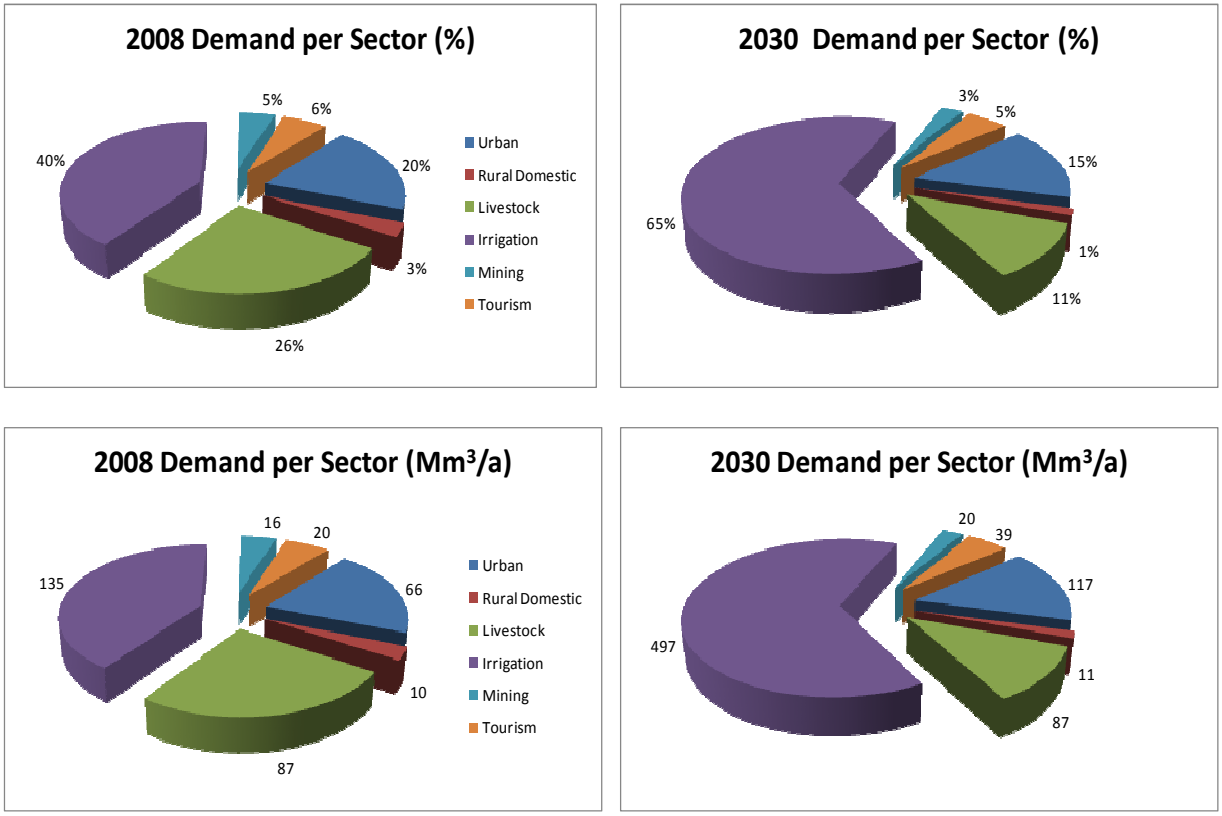

Figure 4.2: Water Demands for Namibia (2008 – 2030)

4.3.2 Climate

It is well known that the distribution of rain over time and space is much more variable in dry climates compared to wetter climates. Rainfall in Namibia commonly falls as intense local showers. This leads to a high spatial and temporal variability of rainfall, both within and between years. Another feature of the dry Namibian climate is the severe impacts drought has on the biological production. The majority of the population is rural and very dependent on the climate for their livelihoods. The urban population depends on good rainfall and runoff in the rivers that feed water supply dams and aquifers to sustain their water needs. During multi-year droughts the biological production commonly drops dramatically and reserves of food, grazing for livestock, livestock numbers and water are severely depleted (Moorsom 1995).

Given these issues, i.e. extremely dry climate, high variability and a large dependency on rainfall to sustain both rural and urban livelihoods, an accurate understanding of Namibia's climate as well as the interaction between climatic and physical determinants is essential for sustainable planning and management of the water sector (Heyns et al. 2009).

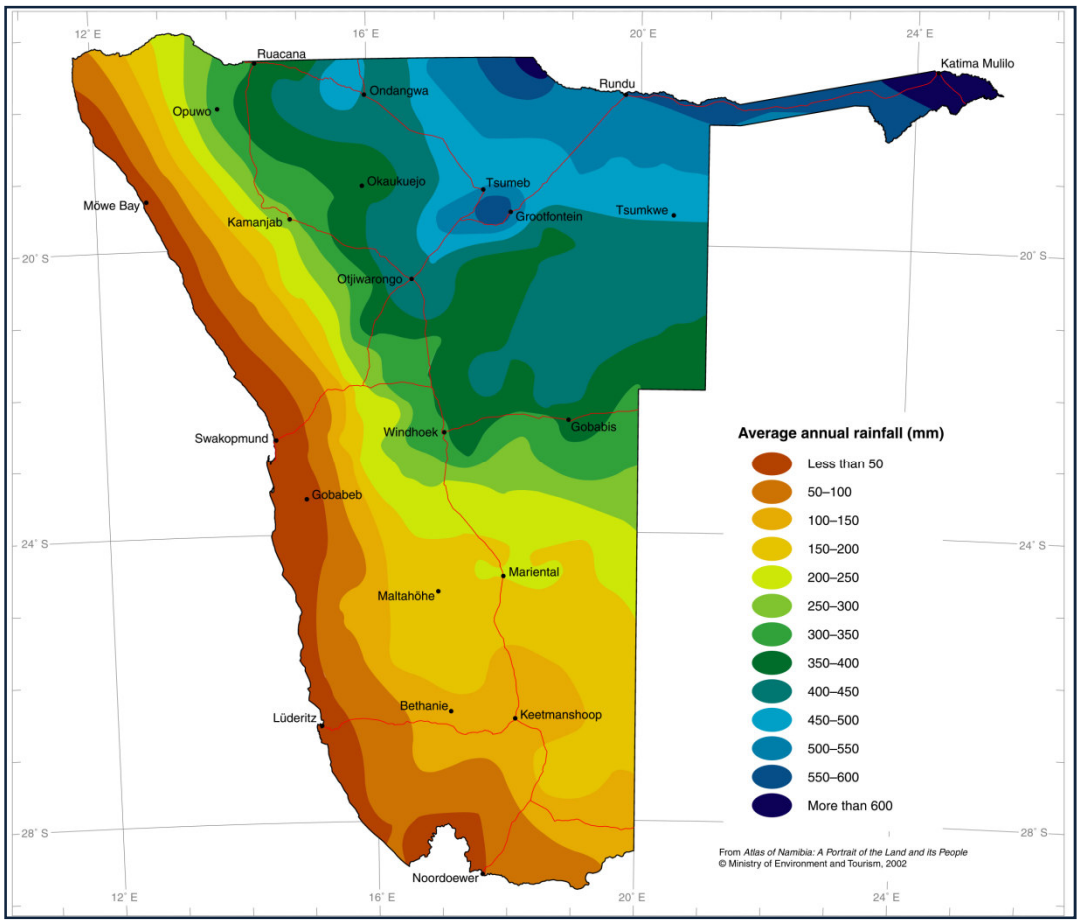

Figure 4.3: Distribution of average annual total rainfall in Namibia

In areas of water deficiency, Potential Evaporation or Potential Evapotranspiration (PET) is an important measure, usually calculated in the unit of rainfall, i.e. mm. PET is defined as the amount of water which would evaporate from the soil and transpire from standard vegetation coverage, provided there is an unrestricted amount of water in the soil,

PET depends on several meteorological elements, i.e. air temperature, air humidity, wind speed and solar radiation. Throughout Namibia PET exceeds rainfall for the year, with some areas in the south exceeding 2000 mm. In **Figure 4.4** the annual average potential evaporation in Namibia is presented. This is an important consideration in the annual water balance, for example for dams and other water related works and activities.

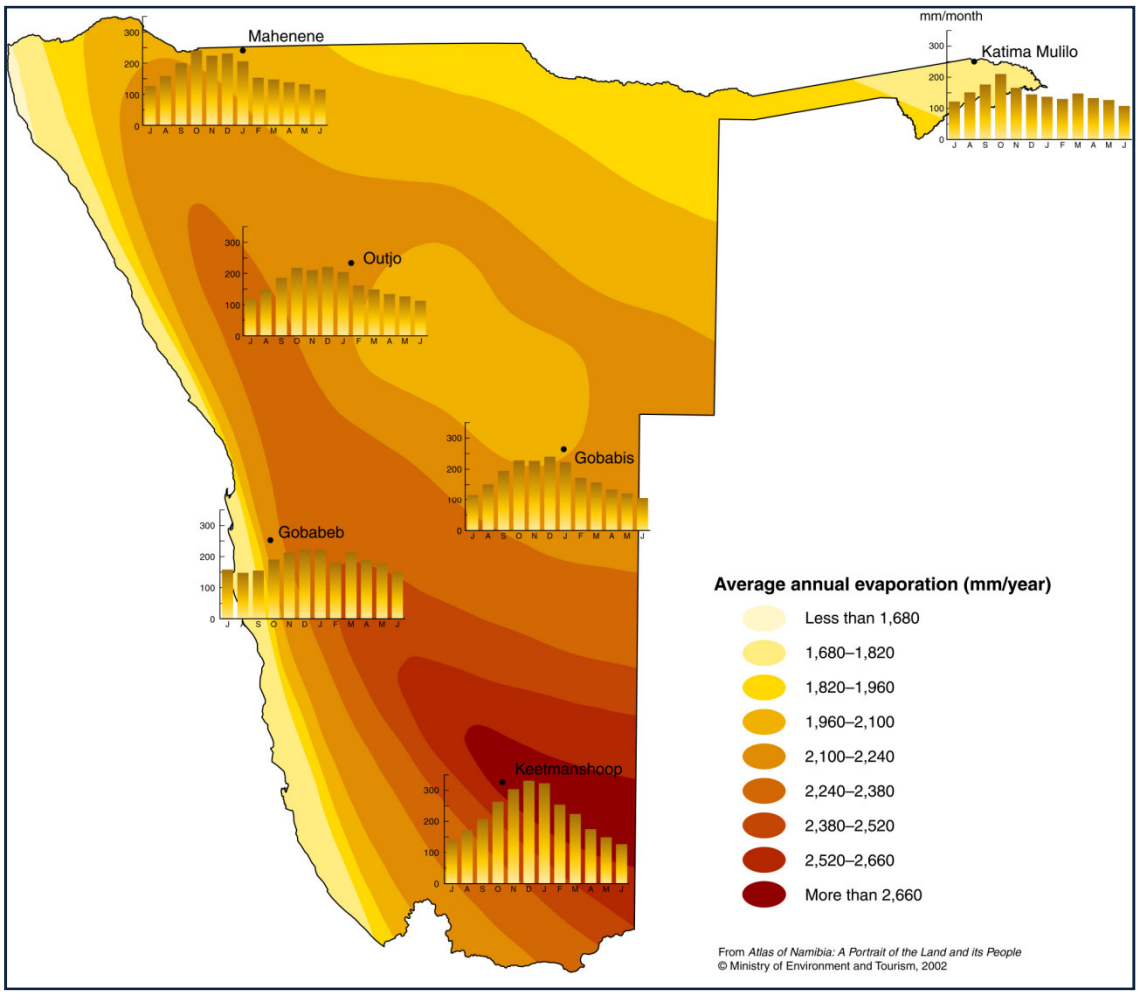

Figure 4.4: Average Annual Evaporation in Namibia

Perceptions of drought

The general climate of an area influences the perceptions of drought. In the northern sub-humid zone the most critical rainfall shortage is the lack of sustainable rainfall during the main planting and growing season. In the more arid southern Namibia, rain events are few, isolated and extremely variable. In response, the vegetation is adapted to prolonged dry spells, making it difficult to distinguish unusually long dry spells from the normal arid conditions. Environmental degradation of arid lands, especially pastures, may generate a similar perception, where drought becomes a synonym for normal living conditions in a harsh and degraded landscape, relieved only by rare good rains.

Time is another factor influencing the perception of drought. Urban dwellers and industry experience drought when the demand of water is higher than the supply for an extended time, resulting in levels of water reserves dropping so low that supply has to be restricted. On the other hand, a single good rainfall season, filling the reservoirs can often insure the urban dwellers against direct impacts of drought for several years to come, independent of the amount of rainfall.

For the rural communities and especially farmers, drought time scales also vary widely, from the critical short weeks of growing field crops for crop farmers to the more extended cycles of browsing and grazing vegetation growth for stock farmers. Countrywide, the early summer period of dry heat is taxing on livestock after the rainless winter, although normal during average rainfall. However, there

are cumulative effects such as serious drought that one year lowers the threshold of hardship and even survival during the next year, especially for small farmers and vulnerable rural groups.

The Influence of Climate on the Namibian Water Sector

The hydrological cycle is central to the way water resources are supplied and can be utilised. The hydrological cycle in Namibia is strongly influenced by the arid and semi-arid climate characterising most of the country.

Figure 4.5 illustrates the hydrological cycle.

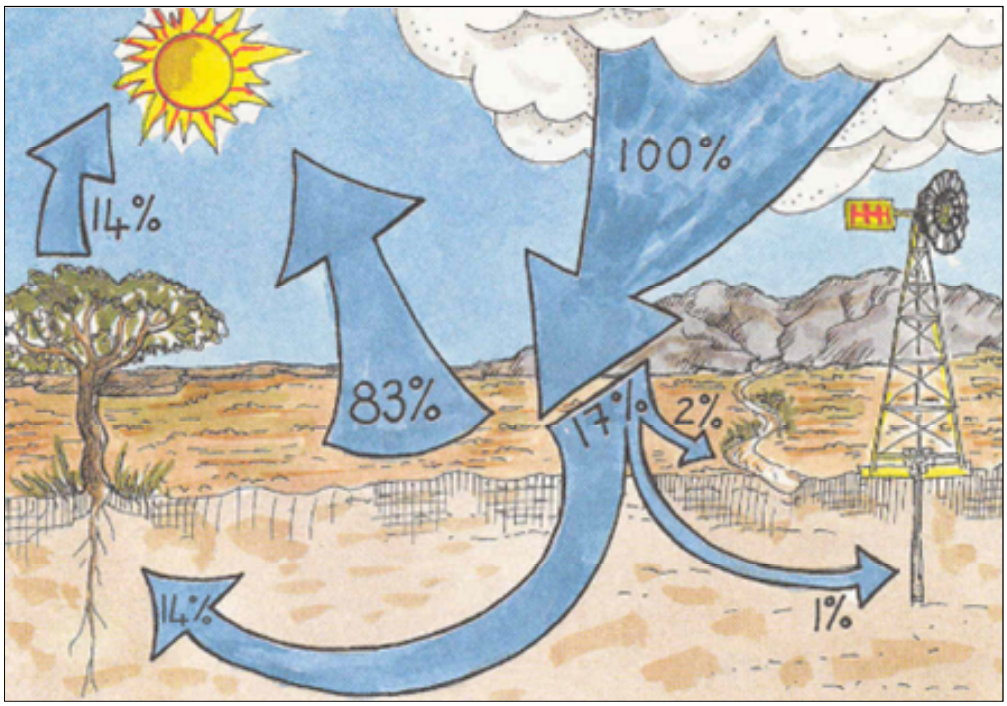

Figure 4.5: Hydrological Cycle

Due to the aridity of the Namibian climate all rivers in the interior of the country are ephemeral, meaning that they only flow when rainfall is sufficient, normally only for short periods during the rainfall season. This limits the potential of the surface water sources and the recharge of groundwater.

As far as the geo-hydrology of Namibia is concerned all water available as groundwater originates from rainfall, whether from recent precipitation or rain that fell in prehistoric times. The occurrence of groundwater depends on a combination of sufficient rainfall and favourable geo-hydrological conditions. The largest part of the country is covered by geological ancient rocks which are inherently impervious. Groundwater is found in secondary structures along joints, bedding planes, shear zones and faults.

Even though predictions of the future climate in Namibia are still uncertain when it comes to the finer details, most models predict:

1. Increased maximum temperatures
2. A longer dry season
3. Increased humidity and convection, and
4. More intense rainfall.

Conclusion and Implications for IWRM

This study has reiterated that most of Namibia has an arid to semi-arid climate. Significant features of this climate are high maximum temperatures and high spatial and temporal variability of rainfall, both within and between years. For the future it has been predicted that maximum temperatures will increase and less rainfall will fall during a shorter rainfall season. However, when it rains the rainfall will be more intense due to increased frequency of convective storms, coupled to increased humidity and temperatures. A number of approaches have been developed / tested / proposed to enhance our ability to cope with these present and future water demands under highly variable climatic conditions, these are illustrated in **Figure 4.6**.

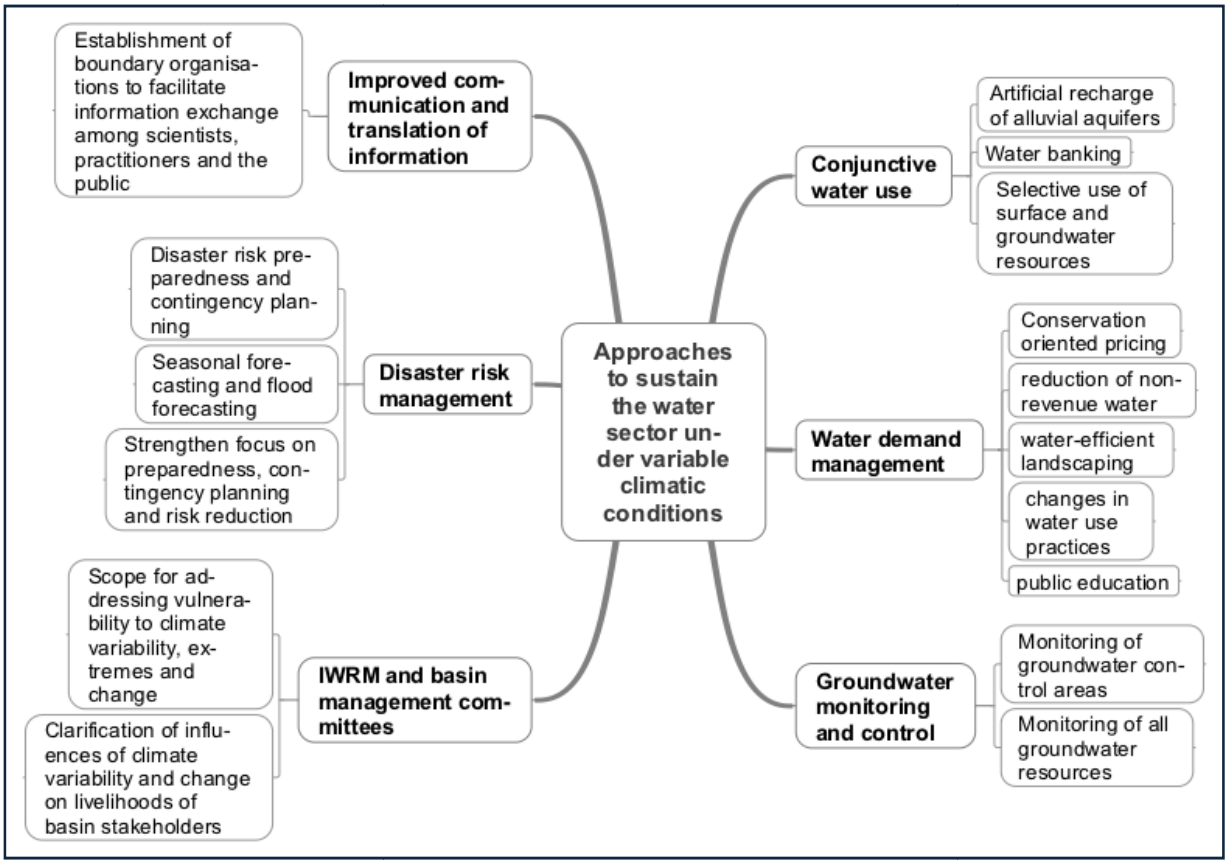

Figure 4.6: Approaches to enhance our ability to sustain the water sector under increasingly variable climatic conditions and climate change.

It is suggested that the six main approaches are incorporated into the IWRM-Plan for Namibia as they all have the potential to contribute to improved water management. This is necessary to ensure continued water provision to an increasing population with increasing demands for water under current climate variability and predicted future climate change.

4.3.3 Water Resource Potential and Utilization per Basin

88% of Namibia's water potential lies in its perennial rivers on its northern and southern borders, while 80+% of its land area relies solely on groundwater.

Figure 4.7 presents the water potential of each Water Basin, split into surface water and groundwater potential. **Figure 4.8** and **Figure 4.9** show the distribution of boreholes in Namibia and the groundwater potential map indicating the major aquifers of the country.

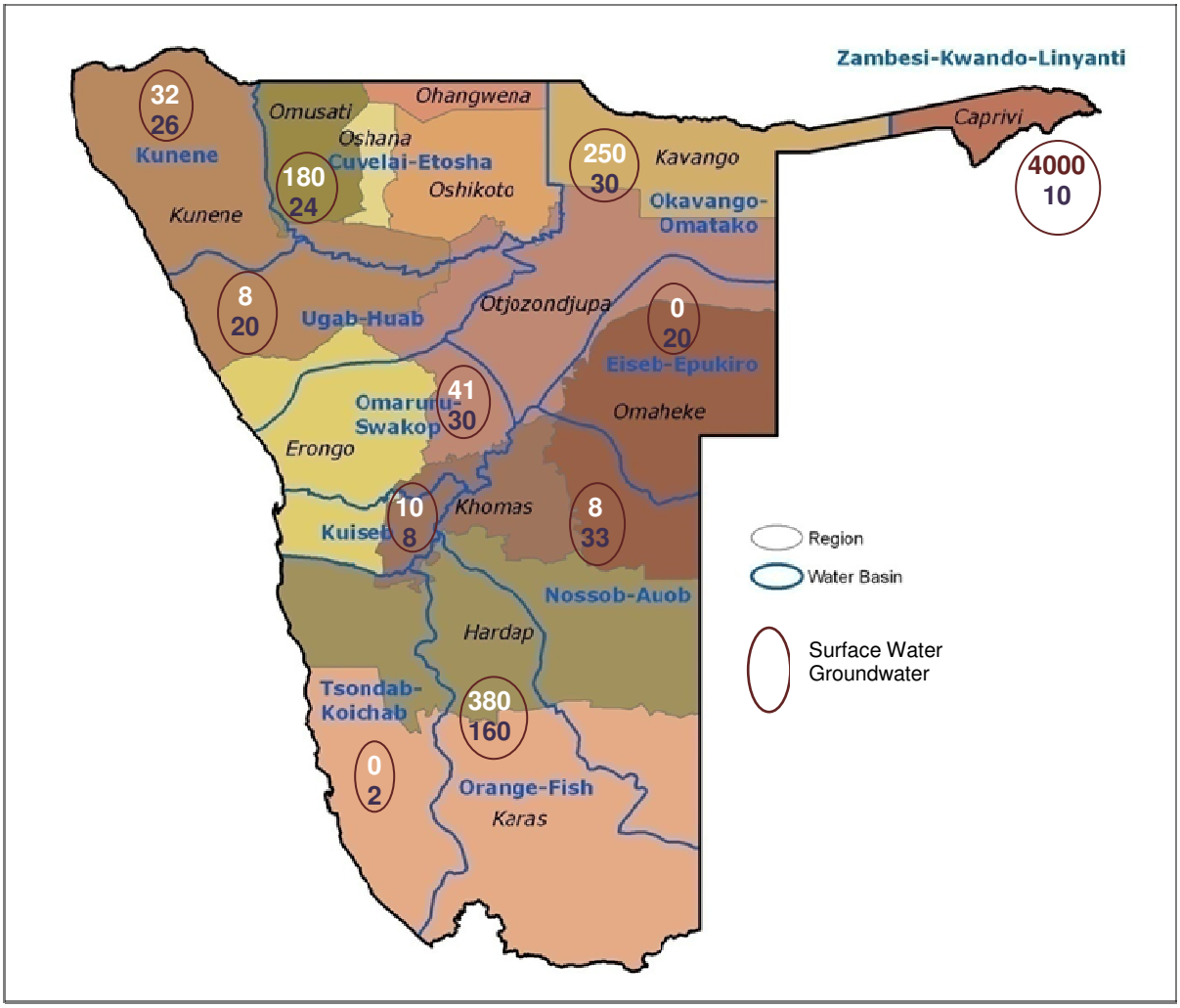

Figure 4.7: Water Potential of Namibia's Water Basins

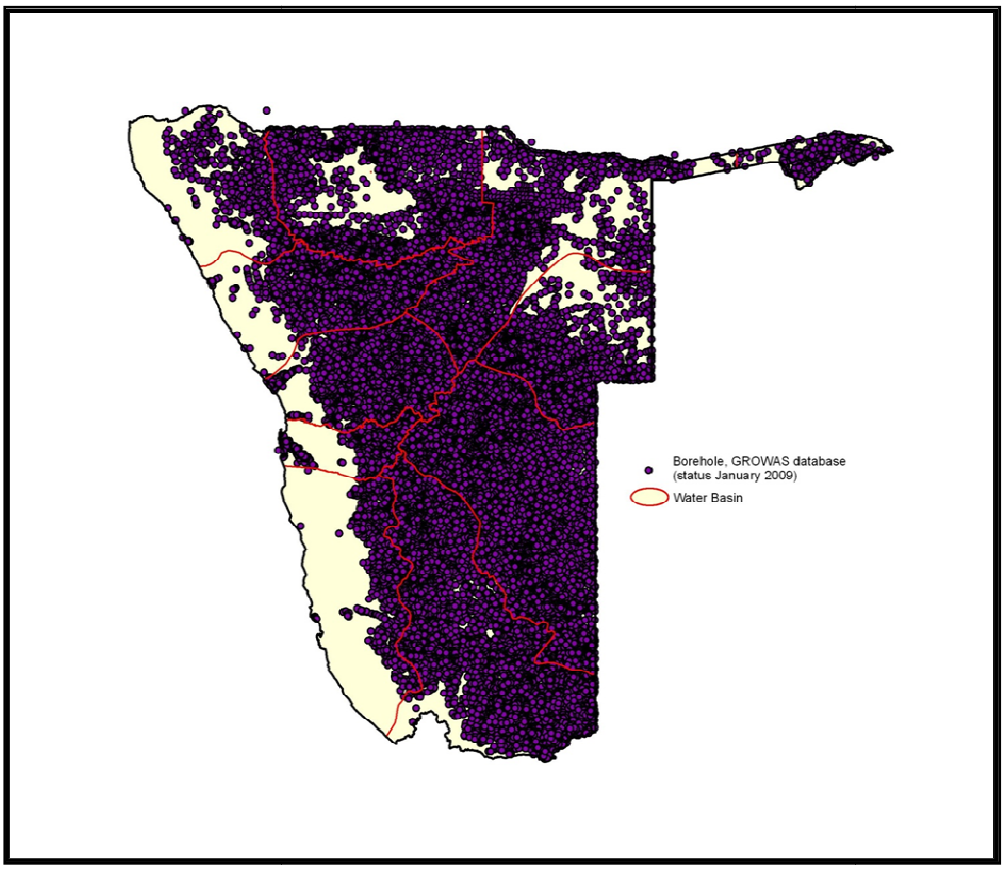

Figure 4.8: Distribution of Boreholes in Namibia

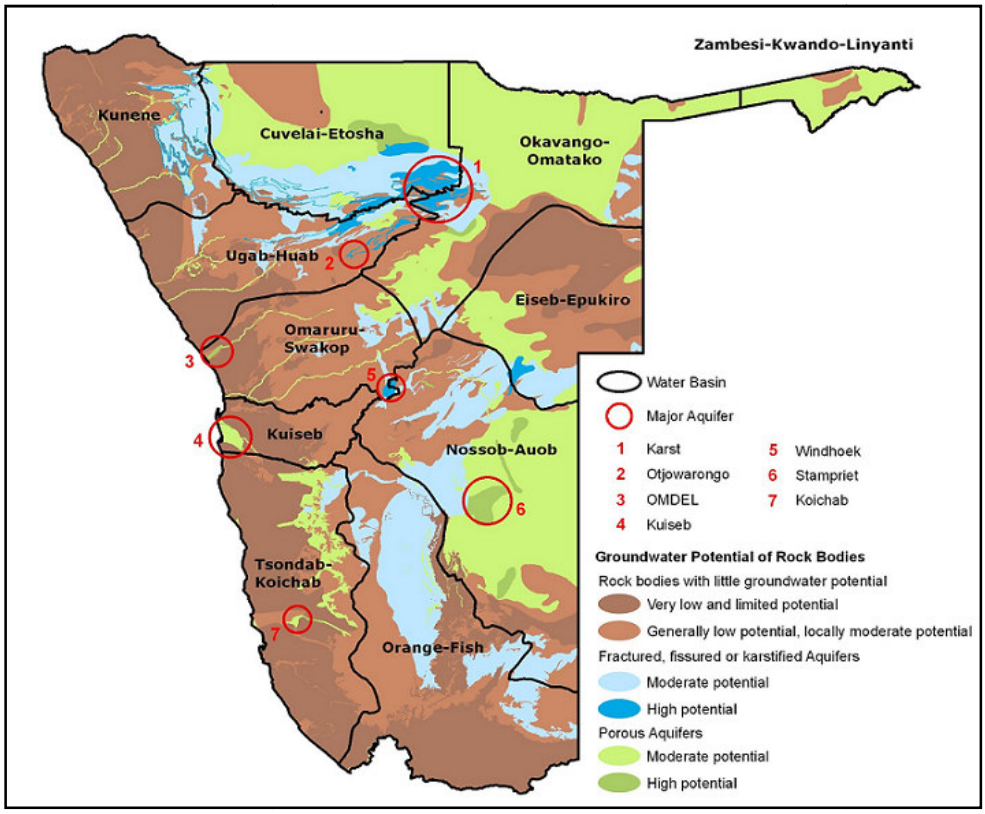

Figure 4.9: Groundwater Potential Map of Namibia, showing Major Aquifers

Table 4.2 presents an estimate of the surface water and groundwater potential of each basin, the current and future demands, the surplus or deficit that is likely to occur in each basin and the installed infrastructure capacity of each basin.

Care should be taken in the interpretation of this table. The figures quoted are for each basin as a whole. These are generally very positive. However, the abstraction and distribution of the water over large areas and supply to remote communities remains a major challenge. In many basins there is a need to upgrade or replace infrastructure which is reaching the limit of its capacity or has reached the end of its economic life. The maintenance of existing infrastructure also requires much attention, both for the provision of funds and the training of artisans to effect proper operation and maintenance.

RESOURCE POTENTIAL AND UTILIZATION OF THE WATER BASINS OF NAMIBIA	
Cuvelai – Etosha Water Basin	Very little potable water occurs naturally in the Cuvelai-Etosha Basin. Surface run-off is unreliable and the flat nature of the terrain presents no opportunities for major surface water impoundments. Groundwater over the greater part of the central basin contains prohibitive levels of salts which makes it unsuitable for human and stock drinking. Suitable groundwater does, however, occur in the east and south-east areas of the basin. Recent groundwater studies have indicated that fresh groundwater may occur at greater depths, below the saline water.
	Most of the water is imported from the Kunene River in Angola and distributed throughout the basin. The current capacity of the transfer system from the Calueque Dam is approximately 74 Mm^3/a. The demand in 2008 and the estimated demand in 2030 are 63,7 and 85,6 Mm^3/a respectively. It is foreseen that major increase in the future demand will be as a result of further irrigation development.
	There does not appear to be a major problem with the availability of water in the basin. The major challenge lies in upgrading and maintaining the vast distribution network, expanding the water services network and ensuring that water quality is maintained.
	Further developments are expected in groundwater abstraction. This will reduce the need for the expansion of more piped water schemes.
Eiseb-Epukiro Water Basin	The deep Kalahari sands and the flat terrain means that surface water potential is limited to small dams and the collection of run-off in seasonal pans. There is no potential for bulk water supply from surface water sources.
	Groundwater abstraction is currently 617 000 m^3/a while demand is 20 Mm^3/a. The deficit is imported from the Karst area.
	Recent groundwater studies have identified large groundwater reserves in the Eiseb Graben, estimated to be in the order of 700 000 m^3/a. Future development of water supply in the basin may, therefore, depend on the development of the Eiseb Graben and further imports from the Karst.
Kunene Water Basin	All the water consumed in the Kunene basin is groundwater. The biggest demand centre is Opuwo while most of the water in the basin is consumed by livestock. The challenge in the basin is to maintain the infrastructure of the isolated rural water supply and livestock drinking points which are spread over a vast area.
	The surface water potential of the basin should not be seen as a major source of water due to the practical and financial implications of harnessing and distributing it.
Kuiseb Water Basin	No major plans currently exist to harness the potential of the surface water run-off of the basin. The only dam in the basin is the Friedenau Dam. There is no major demand centre supplied from the Friedenau Dam. Potential dam sites have been identified on the Kuiseb. However, they are located too far from any major demand centre to be of any benefit.
	The major resource of the basin is the alluvial aquifers that lie in the lower Kuiseb (Dorop, Rooibank and Swartbank). Water abstracted from these reserves is used to supply Walvis Bay and the Central Namib Area. Abstraction by NamWater from the Kuiseb is currently 6.8 Mm^3/a while the 2008 consumption of Walvis Bay was 4.9 Mm^3/a. Water not required by Walvis Bay is transferred out of the basin to Swakopmund.
	Future increases in water demand in the Central Namib, and particularly the mines popping up all over the desert, mean that water is likely to be supplied from seawater

	desalination. This will enable the alluvial reserves in the Kuiseb to recover after many years of mining of the resource.
Nossob-Auob Water Basin	The only significant surface water resources of the basin are the Black and White Nossob Rivers and the Oanob Dam in the upper reaches of the Auob River. The Daan and Tilda Viljoen dams on the Black Nossob and the Otjivero dams on the White Nossob mainly supply the town of Gobabis, while the Oanob Dam supplies Rehoboth.
	The rest of the basin is mainly rural in nature and relies on groundwater. The major challenge is to find sustainable boreholes in the vast areas covered by Kalahari sand. Apart from the difficulty in siting successful boreholes, no major problems are foreseen in meeting the future demand in the basin.
Okavango-Omatako Water Basin	The major water resources of the basin are the Okavango River and the Grootfontein Karst aquifer. There are currently no major water supply issues in the basin, however, vast areas of the basin rely on groundwater that occurs in secondary fractured aquifers which makes water difficult to find. The basin is earmarked to transfer both surface and groundwater to the central areas of Namibia in future via the Eastern National Water Carrier, if required.
	The increase in water demand is mainly related to the development of irrigation projects along the Okavango River.
Omaruru-Swakop Water Basin	Uranium mines and urban demand are by far the biggest consumers in the basin with the towns of Windhoek, Swakopmund, Okahandja and Omaruru all located in the basin. Livestock and tourism are the next biggest consumers.
	Windhoek, which is also the biggest industrial and financial centre in Namibia relies mainly on three major dams, the Von Bach and Swakoppoort dams on the Swakop River and the Omatako Dam for its water supply. Future planning to provide sufficient security of supply for Windhoek is based on the integrated use of the three dams together with banking of groundwater in the Windhoek aquifer and the conjunctive use with the groundwater resources of the Karst Area. The Grootfontein Karst groundwater reserves serve as a major back-up to supply water in times of emergency drought conditions.
	Desalination of seawater is likely to become a major source of water for the west coast towns and the new uranium mines being developed in the desert. This will relieve the pressure of production from the Omaruru Delta alluvial aquifer.
	There are currently no major concerns for water supply in the basin. The major challenges are the timely development of the Windhoek aquifer recharge project which is currently lagging behind its programmed milestone dates as well as the development of the infrastructure capacity from Von Bach to Windhoek. The quality of water supplied from the Von Bach water treatment plant has been shown to be a concern. The life expectancy and possible replacement of the 30 year old prestressed concrete pipeline between Von Bach and Windhoek is a concern which needs to be closely monitored.
Orange-Fish Water Basin	The Orange-Fish Basin covers a huge area in which agriculture is the main consumer, and in particular irrigation along the Lower Orange River. Livestock demand is also significant.
	Urban demand in the basin should not present too much of a problem. The major challenges are for Namibia to come to an agreement with South Africa on the allocation of water from the Lower Orange. This includes the construction of a possible dam near Vioolsdrift to vest Namibian interests in access to a reasonable and equitable share in the water of the Orange.
	Boreholes are generally located in secondary fractured aquifers and the main challenge for water supply in the basin is to supply rural communities that are sparsely located over a huge area as well as the maintenance of rural water supply systems over the vast basin.
Tsondab-Koichab Water Basin	The Tsondab-Koichab Basin is covered by large tracts of desert with livestock and urban demand being the major consumers. This desert environment is ecologically sensitive and is also one of Namibia's major tourist attractions. The water resources need to be carefully managed and there is little or no capacity for further developing the water resources.
	The town of Lüderitz is supplied with groundwater from the Koichab Pan. The source has very little sustainable recharge and comprises fossil waters which are currently being

	mined. The major challenge of the basin is to develop water reclamation facilities or preferably seawater desalination to supply Lüderitz.
Ugab-Huab Water Basin	The major consumers in the basin are urban as it includes the towns of Otjiwarongo, Outjo, Otavi and Khorixas as well as agriculture, split between livestock and irrigation. Currently all water is supplied from groundwater sources
	There should be no major problems with water supply in the future if water demand management is properly applied, particularly in urban areas such as Khorixas
Zambezi-Kwando-Linyanti Water Basin	The basin is dominated by the Zambezi and Kwando river system. Although groundwater is found throughout the basin, borehole yields are not sufficient to sustain large demand centres. The major consumers are currently livestock and irrigation, although Katima Mulilo also is a significant consumer.
	The rural areas are extensively supplied with both surface and groundwater. Surface water is distributed through a network of pipelines supplied from the Zambezi and Kwando rivers.
	The increase in future demand will be determined largely by the development of irrigation. There should, however, be no major problems with water supply in the basin. The major challenge is the maintenance of water supply infrastructure.

Table 4.2: Water Resource Potential and Utilization per Basin

BASIN	WATER RESOURCE POTENTIAL Mm^3/a			DEMAND Mm^3/a		SURPLUS/(DEFICIT) Mm^3/a		INSTALLED INFRASTRUCTURE CAPACITY (Mm^3/a)	
	SURFACE	GROUND	TOTAL	2008	2030	2008	2030	SURFACE	GROUND
Cuvelai-Etosha	180.0[1]	24.0	204.0	63.7	85.6	140.3	118.4	74.0	13.0
Eiseb-Epukiro	0	20.0	20.0	8.6	11.2	11.4	8.8	0	5.8
Kuiseb	9,8	8.0	16.8	8.4	12.6	8.4	4.2	1.0	13,9
Kunene	31,5	26.2	57.7	10.0	11.2	47.7	46.5	0	7,9
Nossob-Auob	8.0	32.5	40.5	31.1	34.9	9.4	5.6	6.2	2,8
Okavango-Omatako	250.0[2]	29.6	279.6	58.1	215.1	221.5	64.5	36.7	2,2
Omaruru-Swakop	41.0	29.5	70.5	50.6	74.9	19.9	-4.4	27.5	18,1
Orange-Fish	379,9[3]	160.0	539.9	74.8	119.6	465.1	420.3	91.3	3,8
Tsondab-Koichab	0	1.8	1.8	3.9	5.1	-2.0	-3.3	0	5,8
Ugab-Huab	7,5	19.8	27.3	14.7	22.0	12.6	5.3	0	16,6
Zambezi-Kwando-Linyanti	4 000.0[4]	10.0	4 010.0	10.3	179.6	3 999.7	3 830.4	4.75	5,6
TOTAL				334.1	771.7				

Note 1. Agreed allocation with Angola from the Kunene River

2. Based on the irrigation of 16 550 ha @ 15 000 m^3/ha/a. Calculated on low flow conditions in the river and 25% of the flow reserved for environmental flow.

3. A recent study into the management of the Lower Orange River considered various options to increase the yield of the entire Orange River System. Should additional measures be implemented to increase the yield of the system an allocation of 224.4 Mm^3/a could be available to Namibia. This figure has been used in this study.

4. 10% of MAR at Katima Mulilo.

Conclusion

In general it can be concluded that Namibia has sufficient water to meet the goals of 2030. However, the demand centres are often located in remote areas that are long distances away from sustainable water sources. Some of the points that can be highlighted as challenges for sustainable and affordable water supply include:

CHALLENGES FOR SUSTAINABLE AND AFFORDABLE WATER SUPPLY
Upgrading of existing and construction of new infrastructure to meet growing demands.
Funds need to be provided to keep pace with demands.
Efficient operation of water supply schemes.
Implementation of Water Demand management with sufficient funding to realise the benefits.
Maintenance of existing infrastructure. Maintenance has fallen way behind what is required. There is a major backlog in capital replacement to replace infrastructure beyond its economic life time. Funding and capacity building are the main concerns here.
Research and investigations into new resources, particularly groundwater and artificial groundwater recharge.
Flood management.
Awareness raising on a continuous basis to ensure respect for water availability.
Capacity building in the skills to operate and manage new technologies such as seawater desalination. This is required at all skills levels.

4.3.4 Water Demand Management

Water Demand Management (WDM) is a fundamental part of an integrated approach to sustainable management of the water sector, especially in an arid country such as Namibia. "WDM involves measures that improve efficiency by reducing water use or altering patterns of water use after abstraction" (Beecher, 1995). Within the Namibian context the WDM strategy attempts to improve cost recovery, the management and maintenance of infrastructure and the reduction of inefficient consumer demand to reduce the pressure and reliance on conventional water resources and infrastructure. By reducing demand, through a variety of approaches, Water Demand Management provides an equivalent outcome to supply augmentation. This, in turn, results in a net financial benefit to the supplier as well as its customers and benefits to the environment.

The GINI coefficient for Namibia is 0.604 according to the results of the Namibia Household Income and Expenditure Survey for 2003/2004 (NHIES, 2003/2004). This indicates a high level of inequality in the distribution in income. Although the inequality in the distribution of income decreased from 0.701 in 1993/94 to 0.604 in 2003/2004 it is still among the highest in the world. Implementation of equitable tariffs and improved maintenance of infrastructure to prevent wastage will contribute to skills development, more employment opportunities and poverty alleviation. This is also a clear illustration of the need to introduce an equitable water tariff structure based, not only on the principles of cost recovery, but more importantly, social responsibility.

The previous South African Water Act, which is still applicable in Namibia, supported the provision of cheap access to water leading to the perception that it is the government's duty to provide water as a cheap and abundant commodity. Lack of recognition of the true value of water in an arid country such as Namibia resulted in an inefficient and unsustainable water demand.

Water Demand Management was included in the Namibian Water Policy in August 2000 for the first time. Although included in the revised Draft Water Resource Management Bill there are no legal mechanisms yet in place to apply WDM within the water sector. Most of the results reflected in this report are based on individual efforts by service providers and water users.

The Draft Water Resource Management Bill makes provision, inter alia, for a Water Regulator to harmonise and integrate the expectations of consumers and decision makers regarding the price of water supply and wastewater discharge services without compromising the financial viability of the service providers. The regulator will also address the development of water service plans and water conservation and water demand management strategies.

Tariff Setting and Subsidies

Nine principles were defined by NamWater (LCE 2008) which underpin the fundamental requirements of tariff structures, affordability and service delivery. It is suggested that the above principles be accepted as interim measures for tariffs to be set by Local Authorities. Experience in Namibia has shown that as soon as Local Authorities start addressing their billing and payment systems and increase the efficiency of these systems, and start addressing the integrity of their reticulation networks, water consumption drops dramatically.

As stated in the WSASP (2008): “Mechanisms for transparent subsidies and/or cross-subsidisation by means of rebates for those who are unable to pay for water supply and sanitation services should be pursued.” In the situation assessment for the determination of NamWater tariffs it was recommended that the following guideline be used as interim measure: “Cross subsidies within a region can handle a poverty component of up to 15%, and rural subsidies are required where the poverty index lies between 15% and 30%. Where the total poverty limit is above 30%, subsidies for both urban and rural areas may be required. Blanket subsidies are not recommended as they mainly benefit the rich. To conserve water it is important to apply the same tariff principles to all end consumers linked to the same water supply scheme”.

In a study conducted in Rehoboth in 2003 (ref Water Management Assistance for MRLGH, funded by SIDA) the relation between income level and water demand (income elasticity - family income versus water consumption) was used as an indicator of the number of poor families. It was established that approximately 27% of the consumers (mostly concentrated in the low income areas) consumed approximately 8% of the water. By introducing appropriate tariffs (rising block tariffs, which include an element of cross-subsidization) the cost of water to the low income group was reduced by more than 50% without industry, business, government and the middle and high income households having to pay much more (5%) for their water. However, this had a significant effect on the disposable income of poor households in Rehoboth.

Gender Related Issues

In the review and assessment of the existing situation report, a detailed analysis of the regulations in the draft revised Water Act was made with respect to opportunities for gender initiatives. The review shows that many of these regulations are gender neutral but some of them provide opportunities for gender initiatives to ensure that women and youth are involved on an equitable basis. Out of the five WDM instruments described in the WDM report, there is potential to mainstream gender and youth issues in two of these instruments; namely (i) education and information (ii) training.

Natural Resource Accounting

Natural resource accounting for the water sector was identified as an important tool in prioritising the allocation of water with competing uses and to measure economic and social efficiency in the use of water within the different sectors.

Resource Protection

Bush encroachment influences surface runoff and groundwater recharge in Namibia. According to studies by the Department of Agriculture approximately 27 million ha of grazing in Namibia are affected by bush encroachment. In a pilot study in the Otjiwarongo Marble Aquifer it was estimated that the groundwater recharge of a de-bushed location was approximately 8%, while it was less than 1% at bush-invaded locations. This implies that if 100 farms of 5000 ha are affected by bush encroachment, the reduction in recharge is equivalent to the water requirement of all the cattle in Namibia.

Similar information for surface run-off is not available but there is consensus amongst scientists that bush encroachment reduces both run-off and groundwater recharge. Service providers such as NamWater and local authorities who abstract water for urban use can play an important role as facilitators to identify areas with water stress where bush encroachment influences surface runoff and groundwater recharge. Pilot projects such as in the Von Bach Catchment and the Otjiwarongo Marble, or Platveld Aquifers may be beneficial to quantify benefits over time and to improve security of supply.

The following issues are important for resource protection:

- Prevent over abstraction
- Sensitize users on pollution
- Check water quality free of charge
- Prevent pollution through human/animal activities (Large number of boreholes are polluted)
- Integrate management of land and water (surface and groundwater recharge)
- Important role of BMC's to collect information and give input in licensing.

The current status of WDM in Namibia is reflected below.

<table>
<tr><th colspan="2">STATUS OF WATER DEMAND MANAGEMENT IN BULK WATER SUPPLY</th></tr>
<tr><td colspan="2">The main challenges for NamWater is to recover debt amounting to N$ 270 million, reduce production losses on some schemes, improve maintenance, secure funding for much needed capital replacement as well as funding for new bulk infrastructure projects. Security of bulk supply linked to the condition of infrastructure and resources for the Central Coast (Walvis Bay, Swakopmund and uranium mines) and the Central Area of Namibia are major concerns. The cost of breakdowns in water supply to the economy of Namibia amounts to approximately N$ 17.1 million/day for the Central Coast and N$ 22.5 million/day for the Central Area of Namibia respectively.</td></tr>
<tr><th colspan="2">STATUS OF WATER DEMAND MANAGEMENT IN THE DIFFERENT SECTORS</th></tr>
<tr><td rowspan="2">Urban Water Sector</td><td>The biggest long-term benefit from WDM is keeping the annual growth in water consumption within acceptable limits (lower than 3% per annum) despite high economic growth rates. The ability of Windhoek residents to improve water efficiency is well evidenced by drought period responses. WDM can be a highly cost-effective means of extending water supplies. In most urban areas the water demand has dropped over the past few years despite an increase in population and economic activities.</td></tr>
<tr><td>During 2006 a project was completed at Arandis to reduce the non-revenue water which was in excess of 50%. The outcome of the project, which included the replacement of a main pipeline and the implementation of pressure reduction, was that non-revenue water was reduced to 15%. During the investigation phase of the project the following came to light:
- A consumer survey confirmed that 5% of the consumers were not recorded on the costing system.
- At least four major pipe leakages were indentified and repaired which reduced the night flow by 2.5 m^3/hour resulting in an estimated annual saving of N$ 130 000 per annum in bulk water supply costs.
A pressure reduction system was installed in December 2008 with the following results:
- The cost of the installation was N$ 250 000 while the estimated savings (based on</td></tr>
</table>

	night-flow measurement) in bulk water supply amounted to N$ 400 000/annum with a payback period of 8 months. - The bulk water supply decreased with 24% from 2006 to 2009 while sales increased with approximately 29%. The net effect of reduced bulk supply cost and increased sales amounted to N$ 1.24 million per annum based on 2010 tariffs
	In the case of Gibeon where pipelines were replaced and system leakages were fixed the reduction in bulk supply from 2002 (379 438m^3) to 2007 (123.507m^3) was 255 931m^3 (67.5% reduction) with a money value of N$ 1.45 million per annum based on 2010 NamWater tariffs.
	The inability of local authorities to recover costs through inappropriate tariffs, poor credit control, high non-revenue water and the lack in management skills, makes delivery of proper services with proper maintenance and capital replacement of infrastructure impossible in certain urban areas. The high cost of non-revenue water makes it almost impossible for local authorities to improve their financial position to improve service delivery.
	In most villages high water consumption can be attributed to one or more of the following factors: high losses at government buildings and institutions, inappropriate water tariffs, inefficient administration (infrequent meter reading, poor billing and credit control), low levels of infrastructure maintenance, no replacement of old infrastructure and inaccurate metering.
	The potential saving through water demand management interventions in urban centres varies from 4% to 85% while non-revenue water in urban areas varies from 5% to 50%. This indicates major scope for improvement.
Rural Domestic Water Sector	The main challenges for the water point committees/associations are: - To improve their financial and technical management. - To improve cost recovery. Recovery of costs by Water Point Committees to pay NamWater or for the operation and maintenance of the water points is not sufficient. Persons leaving rural areas create problems with continuity of committees while there is no subsidy scheme in place to assist the rural poor. - To recover costs due to technical problems. There is a need to devise a mechanism on how to bill water lost because of pipe bursts in branch lines. - To improve water security. Improved reliability of water supply schemes with fewer interruptions and proper maintenance of water infrastructure and in some cases replacement or upgrading of existing infrastructure are major challenges. - More frequent monitoring of water quality in schemes not supplied by NamWater is required.
	Rural consumers and water point committees need to be sensitised to prevent the pollution of water sources. During discussions with stakeholders more regular visits and assistance from DWSSC were requested.
Irrigation Water Sector	The current status of WDM within the irrigation sector can be summarised as follows: - Only a few irrigation farmers complete the annual returns to DWAF and the actual volumes of water used is unknown. - Because returns are not completed the over- or under-utilisation or resources cannot be assessed. - The extent of pollution resulting from irrigation practices is unknown. - Metering for proper scheduling as well the determination of volumes abstracted is inadequate. - The tariffs applied for irrigation do not provide incentives for water use efficiency; - Information to farmers for proper scheduling is inadequate. - Inadequate information is provided to farmers regarding improved crop yields which are linked to improved irrigation efficiency. - Maintenance of both canals and on-farm irrigation systems is inadequate. - The irrigation sector accounts for a relatively large percentage (41%) of the water used in Namibia in 2008 and offers potential savings within the sector of between 15 and 25% through the implementation of WDM initiatives.

Livestock Water Sector	The following challenges were identified in the livestock sector: - Payment for water as determined by the Water Point Committees are inconsistent, with some charging a fee per head of livestock while others pay a flat rate irrespective of the number of livestock. - Groundwater depletion and or pollution and the wider social effects that might result are highly relevant to rural water supply, most of which comes from boreholes. - Wastage at cattle troughs occurs mainly as a result of poor maintenance while the maintenance of water infrastructure on resettlement farms was neglected by beneficiaries to such extent that production on the farms was severely affected. - Bush encroachment has a negative effect on the availability of fodder and influences both surface run-off and groundwater recharge negatively. Controlled de-bushing is a proven method of increasing the availability of groundwater and surface run-off and thereby enhancing economic growth. It is suggested that service providers and farmers (both commercial and communal) combine efforts to address bush encroachment on a national basis.
	The extent of pollution of groundwater in both communal and commercial farming areas as a result of livestock farming is unknown.
Mining Sector	The mining industry is fairly diligent when it comes to the management of water. The main challenges for the implementation of WDM within the mining sector are: - Development of water management plans for each mine based on the principles as practiced by Rössing Uranium. - Most of the mines recycle water thereby realising significant savings in water demand. - Ground and surface water pollution was indentified and one of the major concerns.
Tourism Sector	Very little information is available on the potential of water savings in the tourism sector. The following challenges were indentified within the tourism sector: - Lack of maintenance at resorts operated by Namibia Wildlife Resorts is documented and at some resorts savings from 30 to 50% may be realised through improved maintenance. - Most lodges which supply their own water may be guilty of over-abstraction of the resource and regular monitoring is required. - Disposal of both solid and liquid waste must be properly managed so as not to pollute water resources.
	The situation assessment demonstrated that there are major opportunities in most of the sectors to implement WDM through better management of financial resources, revenue collection, infrastructure maintenance and replacement. This will reduce the water demand on limited resources.
	Prevention of pollution and monitoring of groundwater and surface water sources must be addressed by all sectors.

WATER DEMAND MANAGEMENT SECTOR STRATEGIES

The strategies for the different sectors to implement WDM were developed in consultation with service providers, focus groups and users in rural areas, irrigation, livestock farming, tourism and mining in all 13 regions of Namibia. The WDM strategies include legal, institutional, capacity building, financial and technical requirements as well as customer care. To ensure the success of WDM greater emphasis should be placed on ensuring broad participation and engagement of all stakeholders in water related activities.

The following steps were identified for the implementation of a WDM strategy in all water use sectors:

1. Carry out a situation assessment which covers:
   - Water use and conservation planning goals, historic water consumption, water use efficiency, infrastructure characteristics, non-revenue water, customer profiles, management practices and pollution potential of the water use;
   - Prepare a demand forecast without water savings to estimate the extent of supply augmentation required to satisfy the water demand including the estimated capital and operational costs;
   - Identify WDM initiatives, expected water savings and price them based on Unit Reference Values (URV);

↓ Determine required capital and human resources for implementation; ↓ Evaluate effect of savings on both the service provider and consumer; and ↓ The effect of sanitation provision in areas of jurisdiction.
2. Develop an implementation and monitoring programme for the performance indicators to measure the improved efficiency over time in relation to the target set in the implementation programme.

DISCUSSION OF 2008 DEMANDS AND SECTOR OBJECTIVES	
Bulk Water Supply	NamWater supplied approximately 66.9 Mm^3 (treated surface water and groundwater) to the urban water sector, mining sector, tourism facilities and rural water supply schemes as well as other minor consumers. NamWater also supplied water to a number of government institutions such as border posts, police stations, schools, hostels and clinics. Most of these government institutions use excessive amounts of water which is mainly a result of non-maintenance of plumbing systems in buildings.
	The overall objective for NamWater is to improve service delivery by ensuring efficient and effective bulk supply services at a high level of security of supply, with the necessary capacity (legislative, human and financial) to provide socially accepted services. These objectives must be met while not compromising the environment or the ability of NamWater to be financially self-sustaining.
Urban Sector	The urban water sector, which includes industries in urban areas, consumed approximately 66 Mm^3, which represents 20% of the total water requirement. In Vision 2030 the urban sector is earmarked to accommodate the majority of the population (75%) and significant industrialisation is foreseen. As a result the expected water demand will increase to 117.2 Mm^3. This represents only 15.2% of the total expected water requirements in 2030
	The overall objective for the urban water sector is to improve service delivery by ensuring that the service providers are efficient and effective and have the necessary capacity (legislative, human and financial) to provide financially viable and socially acceptable services
Rural Domestic Sector	The rural domestic water sector consumed approximately 10 Mm^3 which represented 3% of the total water requirement. In Vision 2030 it is not expected that the rural domestic sector will grow significantly. The expected water demand will increase to only 11 Mm^3 and will comprise only 1.5% of the total expected water requirements in 2030. The median per capita daily water consumption is 9.9 ℓ/capita/day, which is well below the acceptable minimum water consumption required for good health of 25 ℓ/capita/day (WHO)
	The overall objective for the rural domestic water sector is to improve service delivery by ensuring that the water point committees and water point associations are efficient and effective and have the necessary capacity (legislative, human and financial) to deliver affordable services with a high level of supply security provided that the environment and the long-term target of the committees/associations to become financially self-sustaining are not compromised.
Irrigation Sector	The irrigation water sector consumed approximately 135 Mm^3 which represents 41% of the total water requirement. In Vision 2030 the irrigation sector is earmarked for major development and the expected water demand will increase threefold to 497 Mm^3 which represents 65% of the total expected water requirements in 2030.
	The overall objective for the irrigation sector is to improve water use efficiency, crop production (more crop per drop) and value addition to enhance economic growth, increase food security and exports from Namibia provided that the environment and water resources are not compromised
Livestock Sector	The livestock sector used approximately 87 Mm^3 which represents 26% of the total water requirement. The water requirement of the livestock sector is expected to remain constant. In 2030 it will represent 11% of the total water demand
	The overall objective in the livestock sector is to improve water use efficiency and protein production to enhance economic growth in Namibia though increased exports and food security, provided that the range land environment and water resources are not compromised
Mining Sector	The mining sector used approximately 16 Mm^3 which represents 5% of the total water requirement. The expected water requirement will increase to 20.3 Mm^3 which represents only 2.6% of the total expected water requirements in 2030. The figure of 20.3 Mm^3

	excludes water provided from unconventional water sources such as brackish water, sea-water and desalination
	The overall objective for the mining sector is to improve water use efficiency and to enhance economic growth in Namibia through local processing and exports provided that the environment and water resources are not compromised
Tourism Sector	The tourism sector used approximately 19 Mm^3 which represents 6% of the total water consumption. The tourism sector was identified as a high growth sector in Vision 2030 and the expected water requirement is expected to increase to 39 Mm^3 that represents 5% of the total expected water requirements by 2030
	The overall objective for the tourism sector is to improve water use efficiency and to enhance economic growth in Namibia through increased tourism, provided that the integrity of the ecosystems on which tourism depends are protected and that water resources are not compromised
WDM CONCLUSION	
The development of end use water tariffs, subsidy or cross subsidisation policies and appropriate credit control policies are overdue, and no water demand management policy or strategy will succeed without it. Moreover, to implement WDM successfully it is important that the revisions of the Water Resource Management Bill and the Regulations be finalised as soon as possible in order to enable the promotion of water use efficiency, the prevention of water pollution and the controlling of water quality. The water use efficiency regulations must include the performance indicators required in the different water use sectors. It is important that all service providers are licensed in terms of the Act.	
In conclusion the issues in the water sectors can be summarised as: - Urban and irrigation sectors present the greatest potential for water savings through WDM and water use efficiency provided that sufficient resources (human and financial) are allocated to realise the benefits. - The mining sector must develop Water Management Plans to improve water use efficiency and take steps to prevent pollution - The rural domestic sector should concentrate on good financial management and maintenance of infrastructure. Further work needs to be done to adapt current policies to best meet the requirements of the sector. - The important issues for the livestock sector are bush encroachment, maintenance and pollution - For tourism the issues are wastage, over abstraction and pollution - NamWater needs to; recover debt of N$ 270 million, improve maintenance and develop a funding strategy for capital replacement and new bulk supply infrastructure.	

Examples of success in WDM

Water demand management has been successfully implemented in a number of towns in Namibia. The figures below illustrate how the implementation of WDM affected the water consumption in the towns of Rehoboth, Windhoek and Gibeon.

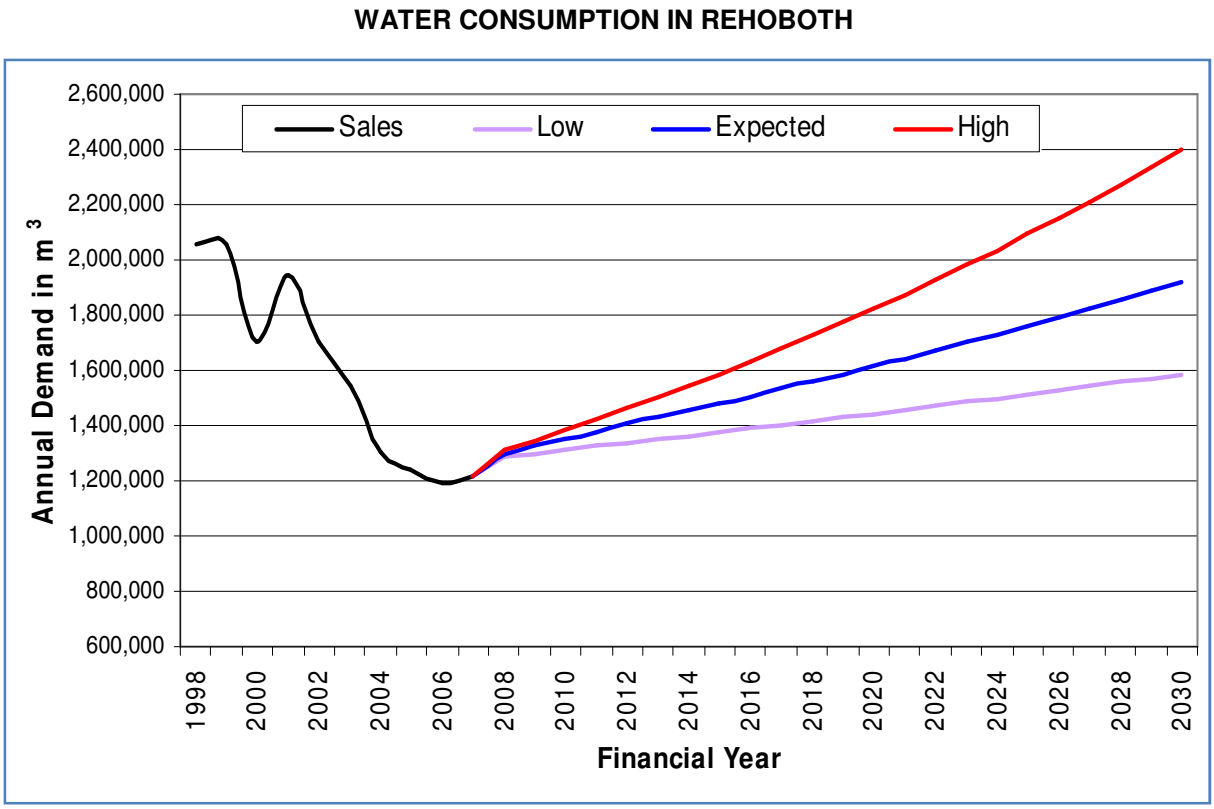

Figure 4.10: Results of WDM in Rehoboth

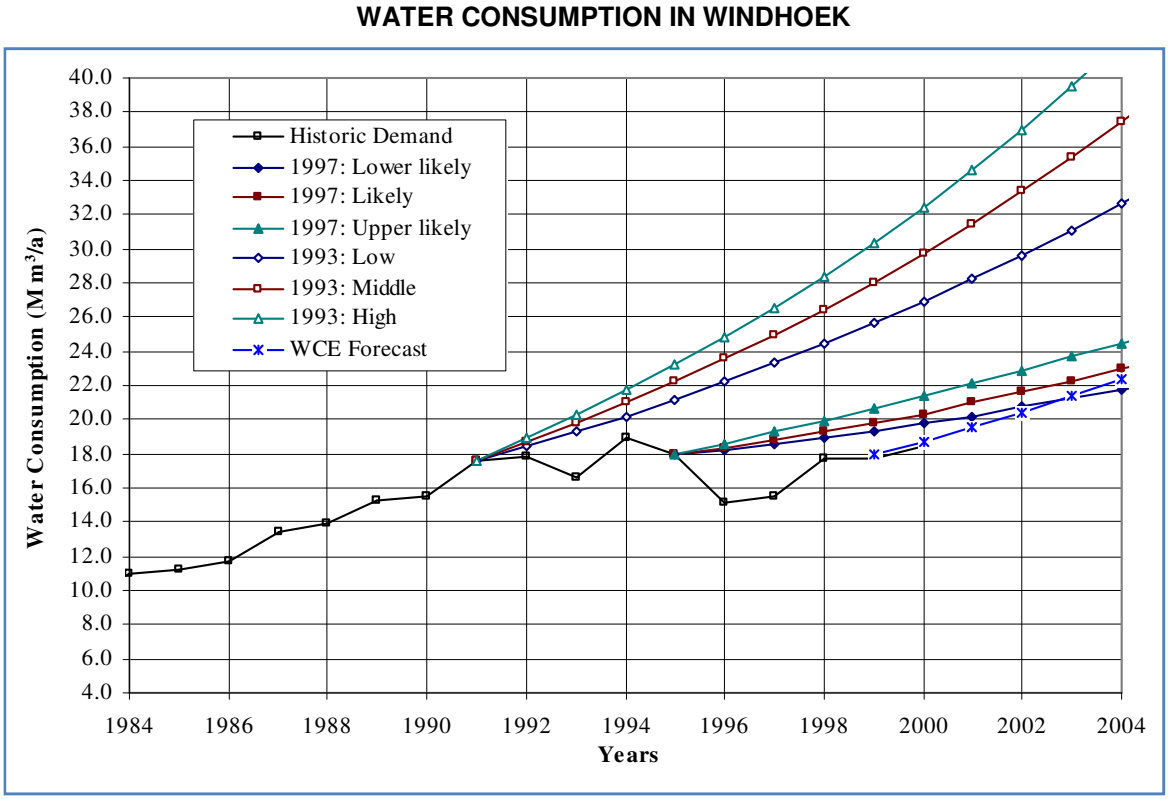

Figure 4.11: Results of WDM in Windhoek

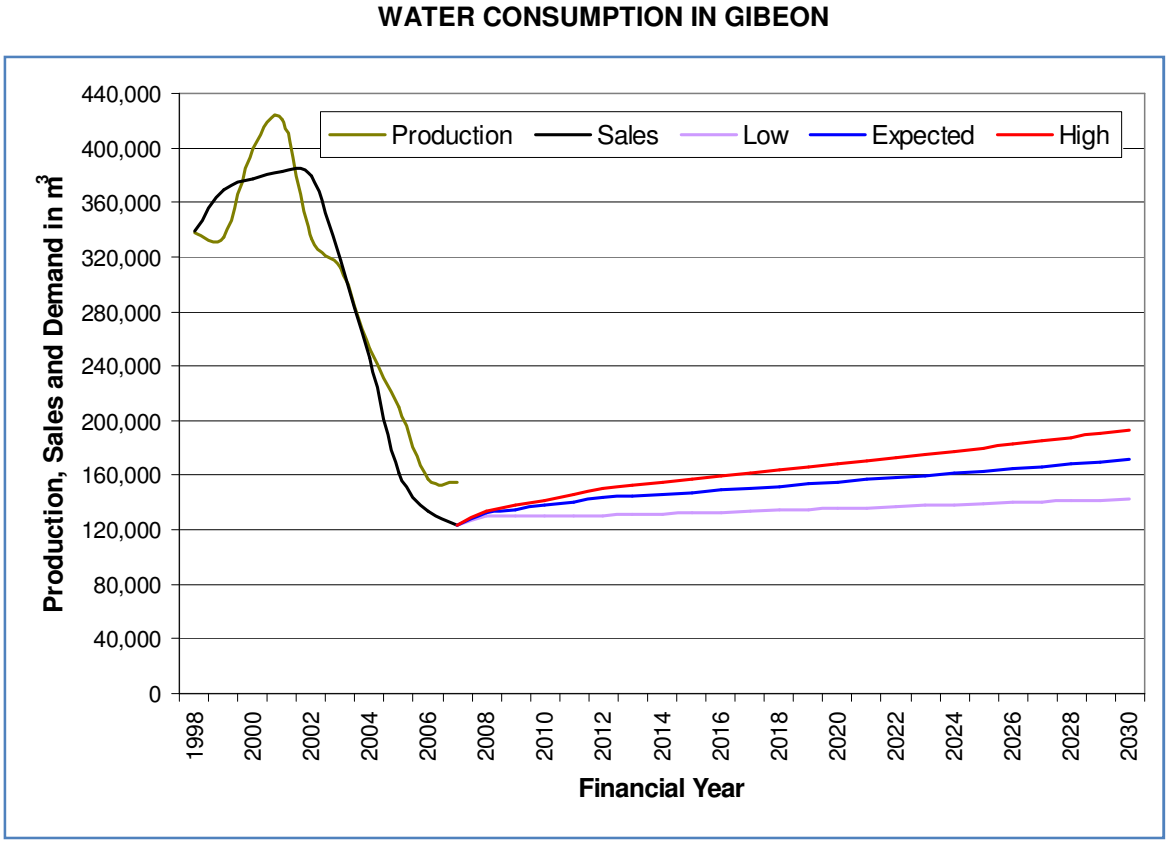

Figure 4.12: Results of WDM in Gibeon

4.3.5 Water from International Shared Water Courses

Namibia needs perennial river water in future for the augmentation of its internal surface and ground water resources. All the perennial rivers are on Namibia's borders and are shared with other basin states. The allocation of a reasonable and equitable share in the use of the water from a transboundary water resource must be negotiated between the basin states who have an obligation to manage them in terms of the relevant rules of International Law. These negotiations are based on certain underlying principles which are; to adopt a holistic approach with respect to their use, protection and regulation. The following principles should be adopted in such negotiations:

- A basin State has a right to use the water from a shared river
- The use of the water from shared river by one State cannot be denied by another State
- One State cannot reserve (claim) water from a shared river for a future use.

A basin State must therefore use the water from a shared river to vest its interest in its right to the water.

4.3.6 Unconventional Sources

Traditional sources of water are either diminishing beyond the point of being accessible for increased development, or augmentation schemes are very expensive to develop**.** Alternative approaches must therefore be pursued.

Water conservation and water demand management can be assisted by using unconventional water resources to alleviate water supply deficiencies. These can include:

UNCONVENTIONAL WATER RESOURCES
Desalination of sea water and brackish groundwater;
Reuse of purified sewage effluent to water parks, golf courses and sports grounds;
Recycling of process water used in industry and mining;
Reclamation of water to potable standards from wastewater effluent;
Water banking in aquifers;
Artificial recharge enhancement of aquifers;
Mixing of potable water with brackish water to improve quality;
Similarly, alternatives to water borne sewage in the form of appropriate dry sanitation must be pursued.

Figure 4.13 illustrates the advantages in using unconventional water sources. In the graph water produced from boreholes and surface water (conventional resources) was the same or lower from 1994 to 2009 as indicated by the red line. This was as a result of WDM savings and the use of unconventional sources such as reclaimed water and the use of irrigation water (treated effluent for sports fields, parks and cemeteries) from the dual pipe system. At that stage there was no abstraction from the "bank water". The capital cost of developing the water banking project in Windhoek is approximately N$100 million less than the conventional augmentation scheme that would be required to provide sufficient water to Windhoek over the next 15 years.

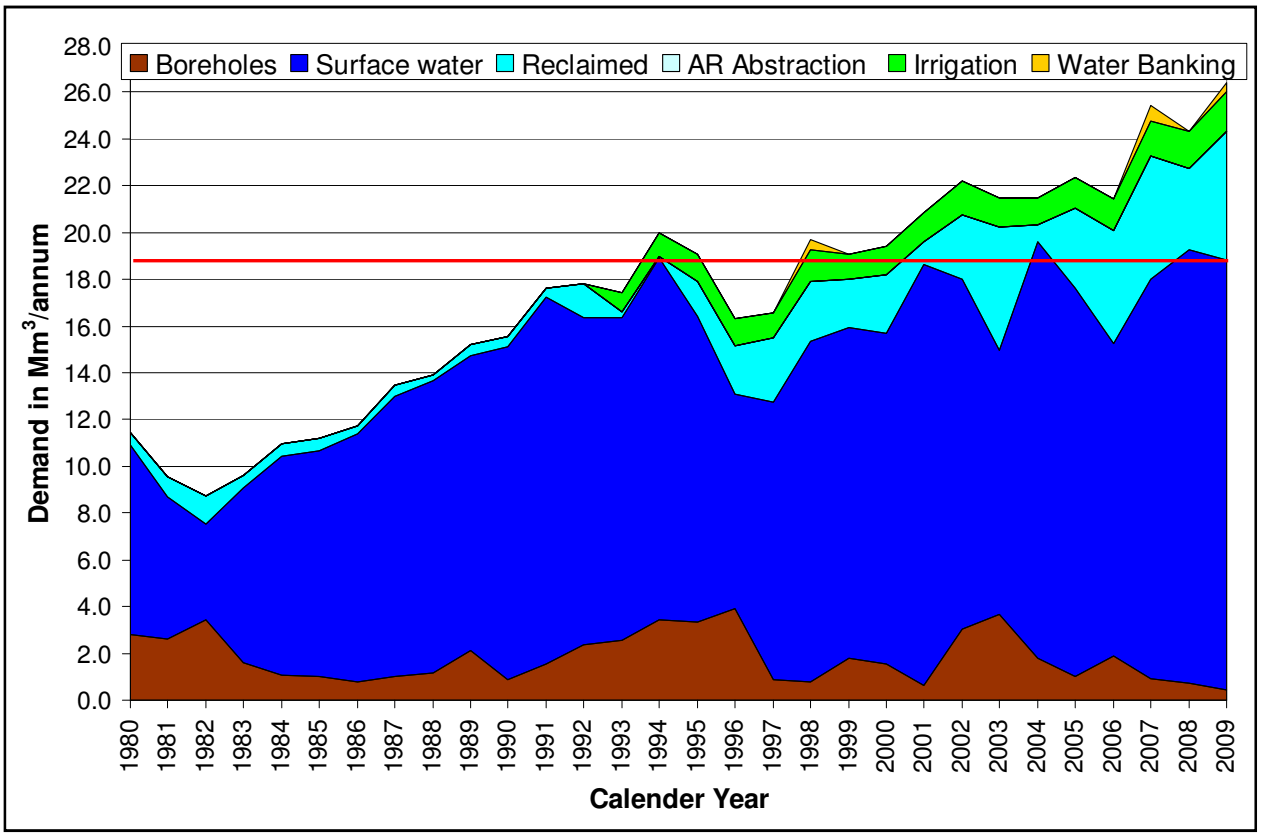

Figure 4.13: Illustration of the advantages of using unconventional water sources in Windhoek

All the alternatives for unconventional water need to be examined to determine their viability, affordability in terms of capital cost, the degree and sophistication of the technology involved,

operation and maintenance implications, the eventual unit cost of the water to the consumer and the environmental consequences.

4.3.7 Water Quality

In the revised Draft Water Resource Management Bill the "equitable access for all people to safe drinking water is an essential, basic human right to support a healthy productive life" was accepted as one of the fundamental principles.

Achievement of Vision 2030 will put a major strain on existing water resources and the protection of such resources from pollution by human activity, including industry and mining. Most of the wastewater treatment plants are overloaded and there are major backlogs in sanitation, both in urban and rural areas. The high rate of urbanisation has created a major strain on the capacity to treat wastewater to an acceptable standard and this situation needs to be addressed.

WATER QUALITY AS AN INDICATOR OF POTENTIAL PROBLEMS

The evaluation of the water quality gives an indication of potential problems such as:

- Groundwater pollution;
- The presence of unacceptably high concentrations of salinity, sulphate, fluoride and nitrate in some places;
- Possible negative health effects for consumers especially with respect to microbiological hazards which are not monitored in most water distribution systems;
- Important parameters such as arsenic, cyanide and radioactivity which are not measured in areas where such substances may occur as a result of rock or soil type;
- The negative effect that scaling and corrosive water has on the lifetime of infrastructure and the cost of maintenance.

PREVENTATIVE PRINCIPLES TO BE INCLUDED IN WATER QUALITY REGULATIONS

It is important that the water quality regulations be based on the preventative principle as advocated by the WHO and must stipulate:

- The required testing frequency of water quality, especially to prevent biological hazards;
- Frequency and format of mandatory reporting of water quality;
- The establishment of a national water quality and monitoring data base;
- Development of water safety plans, based on preventative management, to avoid the outbreak of disease; and
- Warning and consultation with consumers if water does not comply with basic health parameters

The pollution control regulations must include the necessary precautions for the protection of the water resources (surface and groundwater) in Namibia

EXAMPLES OF WATER QUALITY PROBLEMS CURRENTLY FACED IN NAMIBIA

- The raw water quality (salinity and other organic parameters) in the Swakoppoort Dam is much poorer than that of the Von Bach Dam mainly as a result of the discharge of effluent from the wastewater treatment plants and polluted stormwater run-off in Windhoek which make their way to the Swakoppoort Dam.
- The Goreangab Dam is polluted by blocked sewers and faeces from bush toilets which make the water unsuitable to treat even by the New Goreangab Water Reclamation Plant.
- In areas with high population densities such as in the central north, unfenced pond systems expose humans (mostly children) directly to major health risks when they swim in ponds or catch fish. Effluent in or from the pond systems is also not suitable as drinking water for animals.
- Seepage from unlined sewerage ponds creates an immediate threat to groundwater resources.
- Location of solid waste sites around towns may contribute to pollution. Water produced from boreholes in the immediate vicinity of the Kupferberg Dumping Site near Windhoek shows signs of pollution.

- In rural areas including tourism facilities, the location of facilities such as kraals, unlined pit latrines, septic tanks and solid waste disposal sites near boreholes can cause pollution of groundwater.
- The increased development of new mines creates another source of pollution. Mines discharge chemicals such as cyanide into the slimes dams and seepage from slimes dams, dust or overflows during severe storms can create major environmental pollution problems which may be detrimental to human health

4.3.8 Monitoring and Evaluation

The results-based monitoring and evaluation framework that is proposed for the monitoring of the IWRM Plan has got ten components (**Figure 4.14**). The framework has been adapted from a monitoring and evaluation system developed by the World Bank (Zall Kusek and Rist, 2004). The strategy is presented in a format that will provide guidance to managers in the different institutions in the water sector to develop their own monitoring and evaluation systems to assess their contributions to the IWRM Plan. Before the steps to establish a results-based monitoring and evaluation system for the IWRM Plan are presented, the role of MAWF, as the custodian of the M&E system is elaborated.

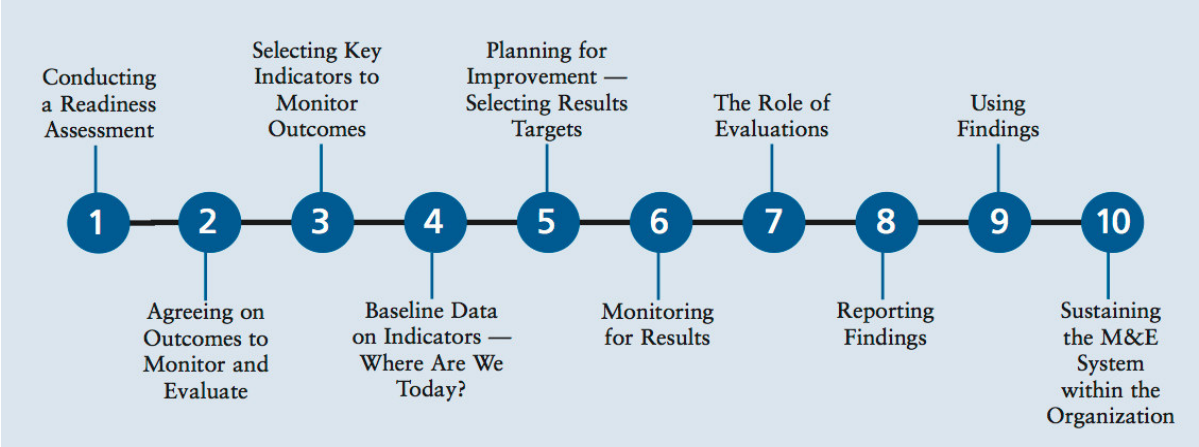

Figure 4.14: Ten steps to establish a monitoring and evaluation system

Role of MAWF in the monitoring and evaluation of the IWRM Plan

MAWF is the custodian of the IWRM Plan, and therefore should lead the development and implementation of the monitoring and evaluation of the Plan. It is recommended that DWAF, within MAWF takes the lead in this task with support and involvement of other relevant stakeholders. A number of indicators have been identified in the Strategy and Action Plan which forms the basis of the IWRM Plan. These indicators provide a basis for what should be monitored by the monitoring and evaluation system for the IWRM Plan. In addition, a large number of performance indicators have been identified for the Water Demand Management Strategy). These indicators are specific for each sector so data for these indicators would be collected by institutions within these different sectors, and then submitted to DWAF for reporting and evaluation purposes.

Table 4.3: Steps to establish a results-based monitoring and evaluation framework for the IWRM Plan

STEPS	ACTION
Readiness assessment	Identify champion within government
	Determine ownership of the system, and beneficiaries of the information generated
	Establish the Monitoring and Evaluation Unit as part of the Water Regulator in DWAF
	Identify current capacity and gaps that need to be filled in order to establish, utilise, and sustain the M&E system
	Determine what data and information are required to monitor the IWRM Plan, and who currently collects these data
Agreeing on outcomes to monitor and evaluate	Translate objectives/strategies defined in the S&AP and WDM Strategy into outcome statements
	Internalize the S&AP and the WDM Strategy to assess how the involved institutions will achieve these outcomes
	Initiate the development of a Performance Matrix as described in the Monitoring and Evaluation Framework Theme Report
Selecting key performance indicators to monitor outcomes	Develop outcome indicators for each outcome identified above, applying the checklist for good outcome indicators
Setting baselines and gathering data on indicators	Building baseline information by answering the eight key questions outlined in the Monitoring and Evaluation Framework Theme Report for each indicator
	Fill in the baseline for each indicator in the Performance Matrix
Selecting results targets	Based on the baseline information and the desired level of improvement, define targets for each outcome and its indicators
	Fill in the targets in the Performance Matrix
Monitoring for results	Establish data collection procedures in close cooperation with all stakeholders who are required to contribute data/information for the monitoring of the IWRM Plan
	Establish data/information management standards for storage and analysis of collected data
	Establish data quality control mechanisms
Evaluation of data/information	Apply the seven evaluation types on relevant data/information described in the Monitoring and Evaluation Framework Theme Report
Reporting findings	Based on the diagram in the Monitoring and Evaluation Framework Theme Report, develop reporting formats, and schedules for the different recipients of the information/knowledge generated
Using the findings	Develop mechanisms to ensure that the results of the M&E are used to improve performance of all stakeholders in the water sector towards the implementation of the IWRM Plan, e.g. policy assessment and development, tariff setting, compliance/enforcement of permits, quality of service delivery
Sustaining the M&E system	Develop a plan to sustain the long-term allocation of human and financial resources required to sustain the M&E system

4.3.9 Capacity Building

The key findings related to Capacity Building which were identified in the course of drafting the IWRM Plan for Namibia can be summarised in twenty-three points.

KEY POINTS FOR CAPACITY BUILDING TO IMPLEMENT THE IWRM PLAN FOR NAMIBIA	
1.	Integrated Water Resources Management is for all stakeholders in the water sector, i.e. for all water service providers and related management and governance entities and all water users in Namibia.
2.	Capacity building and institutional development were found to be the key elements for implementation of IWRM in Namibia.
3.	The key-objective of IWRM capacity building is informed and improved decision-taking, and the responsible implementation of these decisions
4.	IWRM capacity building brings sustainability to all four dimensions: economy, society, environment and technology
5.	IWRM capacity building for human resources and organisations is iterative in nature and is focused on all stakeholders to ensure water resource security. Managerial and technical capacity building is the pivotal goal ensuring that water demand management and integrated water resources management are central
6.	The IWRMP proposes bringing into force, strengthening or establishing the following institutions and water governance structures: - the revised WRM Act and Regulations - a Water Research Council (WRC) - the Water (and Sanitation) Advisory Council (WaSAC) - Performance Support Teams (PSTs) - the Water Regulator (WR)a National Irrigation Water Efficiency Group (NIWEG) - Basin Management Committees (BMCs) and - Water Point Committees (WPCs).
7.	During the IWRMP process and stakeholder consultations it was elaborated that the existing policy landscape is supportive to the revised WRM Act
8.	The IWRMP proposes to engage all stakeholders and the following set of enabling strategies to meet the goals of IWRM and the available policies: - an ephemeral river catchment and integrated basin management strategy, - a clear communal land and water use strategy, - a national water demand management strategy, - a strategy on national pollution control and effluent discharge quality and appropriate regulations, a groundwater protection strategy and management plan, - an effective strategy on tariff setting, - an effective strategy on water metering and data monitoring, - a strategy on integrated coastal management - an effective strategy on the reduction of bush encroachment to enhance groundwater recharge and surface run-off, - a strategy on gender participation and engagement on all levels in IWRM/WDM, - a suite of strategic planning and management support mechanisms.
9.	A series of technical and managerial training modules, including training manuals for developing and maintaining people's skills, are proposed to meet the goals of IWRM and to enhance our organisational capacity
10.	IWRM is a highly complex and interconnected system with numerous mutual and simultaneous impacts between critical issues. A broad skills mix is therefore needed to master such an interconnected system
11.	Four elementary capacity levels were identified:

KEY POINTS FOR CAPACITY BUILDING TO IMPLEMENT THE IWRM PLAN FOR NAMIBIA	
	▪ The system level addresses key requirements related to policies and the legal framework. ▪ The organisational level addresses managerial effectiveness with a specific focus on decision taking and responsibility allocation. For human resources capacity maintenance and building new capacity, the individual level was identified with key-requirements relating to a broad knowledge and skills mix. ▪ At the technical level required capacity ranges from integrated resource planning and demand management to maintenance management.
12.	From the key-required skills spectrum it can be noted that organisational and individual managerial effectiveness, a sound understanding and knowledge of policy application, Water Demand Management and integrated resource management are essential. However, these must be combined with engineering and science knowledge related to water infrastructure and resource conservation as well as budgeting and controlling skills
13.	A broad skills mix, with aggregated skills levels and the experts involved in IWRM performance, capacity maintenance and capacity building are required. A broad skills mix calls for balanced interdisciplinary cooperation between specialists based on well managed and competent teams which are carefully designed and their capacity maintained.
14.	The Polytechnic of Namibia is identified as one key-technical educator and capacity builder and was therefore chosen as an example for this report. The Polytechnic currently offers twenty-eight IWRM relevant formal study programmes
15.	The Polytechnic of Namibia for example provides research capacity building and support through: ▪ the Renewable Energy and Energy Efficiency Institute, ▪ the Centre for Applied Research and Technology, ▪ the Civil Engineering Laboratories for Materials Testing, the Water Engineering Laboratory for Hydraulics, ▪ a Mobile Water Quality Laboratory, ▪ Civil/ Mechanical/ Electrical Engineering Computer laboratories, ▪ the Polytechnic Resource Centre and Library
16.	IWRM anchoring and outreach is an important element of capacity building. The IWRMP process proposes development, re-activation and proactive use of the multiple, existing awareness raising materials to reach Namibian stakeholders in urban and rural areas on all levels
17.	Financial resources are essential to maintain and develop further the human resources capacity for Government/ Local Authorities/ Regional Councils and other service providers as well as industry. Financial estimates are provided for development of Namibian capacity *de novo*
18.	The financial resources estimate for human resources capacity building assumes that appropriate awareness is raised on all levels concerning the importance of the water sector and the opportunities for employment it offers.
19.	The financial resources estimate also assumes that DWAF, NamWater and other relevant institutions develop a career path programme to ensure that trained candidates are adequately integrated into appropriately rewarded professional development pathways and thus retained for a long time
20.	A fluctuation rate for human resources of 50% was assumed. The following number of people are required to be trained *de novo* per annum, for government and the private sector, over the coming 20 years (until 2030): ▪ 10 competent and committed engineers, ▪ 30 engineering technicians, ▪ 3 hydrologists, ▪ 3 geohydrologists, ▪ 4 water scientists and limnologists, ▪ 2 ecologists and biologists,

KEY POINTS FOR CAPACITY BUILDING TO IMPLEMENT THE IWRM PLAN FOR NAMIBIA	
	8 water laboratory technicians,160 artisans (building, plumbing, electrical, mechanical, etc.), 6 social scientists and related scientists, 15 accountants, 5 human resource managers, 5 economists/ planners/ controllers, 3 legal specialists, 40 diversely qualified general administrative and IT capable financial staff.
21.	IWRM-relevant human resources capacity building as estimated for the next 20 years, including an annual 7.5% cost escalation and a fluctuation rate of 50%, is estimated to be approximately N$ 54,000,000- for government and N$ 126,000,000- for the private sector, per annum
22.	Government, Local Authorities and Regional Councils and the private sector should engage on sharing the costs for human resources capacity building and maintenance of existing capacity. A proportion of 30% for the state and 70% for the private sector was estimated
23.	The private sector should be actively used for mentoring and capacity building and capacity maintenance

4.3.10 Funding

Following the Dublin principles as adopted in 1992, water has an economic value regardless of the sector in which it is utilised and water should be considered as an economic good. In addition, the water sector has many facets of which resource development, supply infrastructure and service delivery is the most important. This implies that there is more to the cost of water than just the cost of infrastructure. All costs should be considered when funding of the Water and Sanitation Sector is considered. There are also other challenges inherent to the WSS that make the bridging of the funding gap difficult. These are amongst others:

- the fact that service provision in this sector tends to be monopolistic in nature,
- investment in this sector is normally very costly
- there is usually a large sunken cost element associated with investments, and
- revenues generated are in local currency, which makes borrowing on overseas markets highly risky.

In order to develop a relevant funding strategy it would be necessary to, as accurately as possible, define the funding or investment gap that needs to be bridged. It would also be important to make a clear distinction between capital expenditure and recurrent costs as there are different strategies to fund these. In line with the themes of the IWRM Strategy and Action Plan, the following investment requirements have been identified:

Table 4.4: Summarised Investment Requirements

	2010/11 N$'000	2011/12 N$'000	2012/13 N$'000	Beyond N$'000	Total N$'000
WSS Governance	46,422	48,701	43,456		138,579
Resource Development	159,980	395,000	855,604	1,970,240	3,380,824
Water Supply	897,624	2,853,349	2,436,411	2,080,832	8,268,216
Sanitation	208,000	208,000	208,000	3,376,000	4,000,000
Capacity building	288,000	360,000	432,000	2,520,000	3,600,000
	1,600,026	**3,865,050**	**3,975,471**	**9,947,072**	**19,387,619**

If a conservative approach is adopted, it would be safe to estimate that the investment requirements for the WSS could be in the order of N$ 4,000 million per year at current prices. For the next 20 years until 2030, the total investment requirements for the sector would therefore be in the order of N$ 80,000 million.

The following statistics from the Central Bank of Namibia (2010) illustrate the major funding difficulties being experienced by the water sector. (The daily contribution was calculated at 6 days per week.)

GDP CONTRIBUTION 2010 (N$xBillion)	
Total GDP (6 day/w)	N$ 89.1 (285.6 m/d)
Electricity & Water	N$ 2.0 (6.4 m/d)
Agriculture	N$ 5.0 (16 m/d)
Meat processing	N$ 0.16 (0.5 m/d)
Other & Food Manufacture	N$ 9.9 (45 m/d)
Construction	N$ 4.7 (15 m/d)
Other mining	N$ 7.6 (24.5 m/d)
Hotels & Joes Beerhouse	N$ 1.3 (4.2 m/d)
Public Administration & Defence	N$ 8.2 (26.3 m/d)
Education	N$ 6.4 (20.5 m/d)
Post & Telecommunication	N$ 1.9 (6.1 m/d)

The GDP contribution of Electricity and Water is N$ 2.0 billion of which the water sector is estimated to contribute N$ 0.8 billion. This reinforces the serious situation in which the water sector finds itself when it comes to funding.

An interesting statistic is that the budget of a cell phone service provider in Namibia is greater than the entire water sector.

There are a number of instruments available that can be employed to bridge the funding gap faced by Namibia.

FUNDING INSTRUMENTS AVAILABLE
↓ Water and sanitation user charges or tariffs;
↓ National budgets;
↓ Financial intermediaries and development banks;
↓ External grants or Official Development Aid;
↓ Charities and NGOs; and
↓ Commercial loans, bonds and private equity.
Each instrument has its own advantages and disadvantages and developing a funding strategy appropriate for Namibia would require that each instrument be assessed on its merits. What should, however, never be forgotten in this process is that for the WSS to become self-sufficient and sustainable, all costs, current and future, ultimately need to be financed through user charges and tariffs. Any other option is merely deferring the immediate impact of the cost of the sector on society.
When developing a funding strategy, there are a few key principles that need to be considered.
KEY PRINCIPLES IN DEVELOPING A FUNDING STRATEGY
↓ Achieving full cost recovery (which may include subsidies or cross subsidies) is not an option, it is an absolute requirement;
↓ Public funding should be used for public goods and private funding for private goods;
↓ Water is an economic good with a social dimension. Although access to water is a basic human right, this should not preclude the payment for the service;
↓ There must be appropriate delegation of financial powers to sub-sovereign bodies;
↓ Self-financing by service providers should be encouraged; and
↓ Wherever possible, external grant funding should be optimised.

Developing a funding strategy for Namibia would go beyond merely deciding on what funding option or instrument to utilise to fund the different aspects of WSS investments. The following steps are necessary in developing an appropriate funding strategy:

STEPS TO DEVELOP AN APPROPRIATE FUNDING STRATEGY
↓ Create a conducive governance structure and set financing principles;
↓ Estimate the financial needs, potential cost recovery, and the affordability of services;
↓ Decide on the structure of central government funding;
↓ Explore external aid; and
↓ Decide on how much commercial funding need to be taken up and what type of funding would be most appropriate.

Namibia is fortunate to have a modern and flexible legislative environment that will allow various decentralised government institutions and SOEs involved in water and sanitation service delivery to independently explore alternative funding option to augment their development budgets.

Namibia has come a long way in creating the enabling environment necessary for ensuring that the investments to be made in the WSS can be mobilised, but there is however a number of issues that would be critical to the feasibility of any investment programme and associated funding strategy.

CRITICAL ISSUES TO AN INVESTMENT PROGRAMME
The development of tariff policies that will ensure that WSS can become self-sufficient and feasible, not only repaying the investment and financial charges linked to it, but also ensuring that reserves are generated to maintain and replace these assets at some point in future;.
Building the necessary planning and management capacity on the different decision making levels to ensure that whatever is planned is appropriate and feasible, that it is properly managed and maintained, and that the financial management would ensure that tariff setting is accurate and that the revenues from these tariffs are being collected and applied for the purpose it were intended for;
Create a revolving fund for short and longer term loans to realise the potential financial benefits and water savings through the implementation of WDM
Develop a culture of willingness to pay; and
Ensure that wherever public funds are applied, the investment made is the best possible choice made.

The biggest problem faced by the Namibia's WSS is not necessarily the availability of funding or the array of instruments that can be employed to structure a funding strategy, but it is rather an issue of the country's ability to effectively manage and utilise available resources. In order for the necessary financial resources to become available, the following is recommended:

CRITICAL REQUIREMENTS FOR NAMIBIA TO SUCCESSFULLY SOURCE FUNDS
A regulator that will oversee the financial aspects of the WSS is established. This regulator should without delay develop a framework in which financial and technical performance requirements of service providers are being established. The regulator should also facilitate the development of a national tariff/pricing policy, which will not only set the boundaries within which service providers will have to operate, but also provide the necessary insurance to potential investors that planned future revenue streams can be guaranteed.
The current underperformance of service providers in terms of financial and technical management is address as a matter of urgency. Namibia is wasting valuable scarce resources through financial mismanagement and improper maintenance. Funds from central government that could be utilised to finance WSS programmes and projects are being utilised to finance bad debt.
Through public outreach programmes, educate Namibians about the need to use water wisely, which could have a huge impact on capital investment and infrastructure replacement programmes, and to pay for the water they have used.

Most of the necessary ingredients for developing a feasible funding strategy are already there. Attending to the above recommendations will act as the catalyst that will give the necessary momentum to take the implementation of current WSS plans to the next level.

4.4 STRATEGY AND ACTION PLAN TO ADDRESS ASPECTS OF WATER RESOURCES MANAGEMENT THAT REQUIRE STRENGTHENING

4.4.1 Overview of the Strategy and Action Plan

The first draft of the Strategy and Action Plan was developed using the information gathered in the first phase of the study in which the first three theme reports were produced. These were (i) a review and assessment of the existing situation, (ii) an assessment of the resources potential and development needs, (iii) the formulation of a water demand strategy. The S&AP was continually developed and amended following the stakeholder workshops and focus group discussions. The final document was then discussed and endorsed at a National Workshop held on 11 August 2010.

The S&AP is divided into a number of Themes and Sub-themes:

- Theme 1: Policy and Legislative Support For IWRM
- Theme 2: Institutional Support and Capacity Building for IWRM
  - Sub Theme 2.1: Capacity Building for Management of IWRM including WDM
  - Sub Theme 2.2: Technical Skills and Management for IWRM
  - Sub Theme 2.3: Financial Skills and Management for IWRM Including WDM
- Theme 3: Stakeholder Involvement and Awareness
- Theme 4: Resources for IWRM
  - Sub Theme 4.1: Knowledge Management
  - Sub Theme 4.2: Water Resources Management
  - Sub Theme 4.3: Climate and Climate Change
  - Sub Theme 4.4: Water Supply
  - Sub Theme4.5: Water Demand Management and Water Use Efficiency
  - Sub Theme 4.6: Sanitation, Pollution Control and Protection
- Theme 5: Investment for IWRM.

Each of the Themes and Sub-themes are discussed in the Strategy and Action Plan under the headings; (i) Objectives, (ii) Strategy, (iii) Actions, Activities and Initiatives, (iv) Who is responsible? and (v) Indicators and Timelines.

Only the Objectives and Actions are discussed below and reference should be made to the source report (Theme Report 8: National Water Development Strategy and Action Plan) for the full detail.

An overview of the IWRM Plan for Namibia is presented diagrammatically in **Figure 4.15** below.

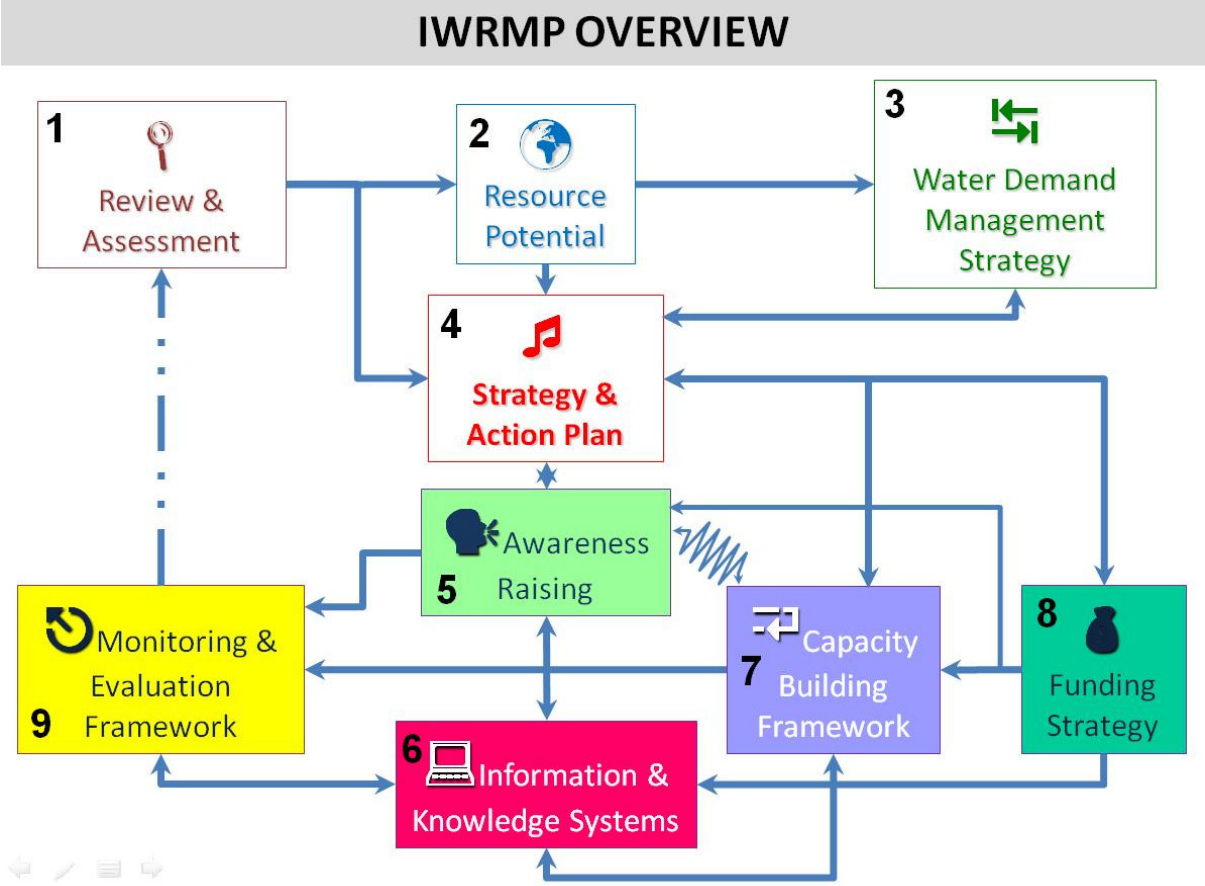

Figure 4.15: IWRMP Overview

ELEMENT	OVERVIEW	IMPORTANT FINDINGS
The IWRMP *overview diagram* shows nine essential elements connected in a basic system to enable its implementation and maintenance in a step-by-step approach as was agreed during the regional stakeholder consultations and during the National Workshop in August 2010. This simple step-by-step approach was used to develop the IWRM Plan and should be used for review and adaptation of the plan at yearly to five-yearly intervals.		
1 Review and Assessment	When the IWRMP was developed, it was assumed that all these nine essentials exist and that they are connected in one way or another. The process therefore started with a comprehensive *review and assessment of the existing situation* to discover strengths and weaknesses in the existing system regarding integrated water resources management. It is assumed that in future, periodic *reviews and assessments, of the then existing situation,* will be made to discover further needs for adaptation to cope with the expected increase in complexity of managing the water resources in Namibia.	- A wealth of knowledge and experience exists upon which to build - It is a requisite to enhance capacity within government, service providers and other stakeholders to maintain and improve what has been established - Adequate financial investment is required
2 Resource Potential and Development Needs	The *review and assessment* of the *resource potential* brought to light the opportunities and threats which include: - Upgrading of existing and construction of new infrastructure to meet growing demands. - Efficient operation of water supply schemes - Demand management as a foundation of IWRM - Maintenance of existing infrastructure.	- Alternative approaches to water supply and sanitation services for efficient and effective water use encouraged e.g. dry toilets, water recycling - Integrate economics into water planning (full cost

ELEMENT	OVERVIEW	IMPORTANT FINDINGS
	▪ Research and investigations into new resources, particularly groundwater and artificial groundwater recharge. ▪ Flood management ▪ Awareness raising on a continuous basis to ensure respect for water availability ▪ Funds need to be provided to keep pace with demands. ▪ Capacity building in the skills to operate and manage new technologies such as seawater desalination is required at all skills levels.	recovery, environmental and economic externalities and opportunity costs) ▪ Use holistic approach to demand and supply ▪ Consider the environmental water requirements
3 Water Demand Management	With both the existing situation and the potential known, the strengths and weaknesses in the water resources management system and the opportunities and threats connected to the resource potential, the central client protection mechanism WDM was assessed and further elaborated in a comprehensive strategy and a WDM toolbox was supplied to enable water managers and water users to successfully manage the country's water resources	▪ Six instruments for WDM: legal, institutional, capacity building, financial, technical & customer care ▪ End use water tariffs, subsidy or cross subsidy policies and appropriate credit control policies are overdue ▪ Water use efficiency regulations proposed ▪ Performance indicators for the different water use sectors identified and discussed
4 Strategy and Action Plan	Based on the three situational assessment steps the *National Water Development Strategy and Action Plan* was developed. This S&AP is bi-directionally connected to the WDM Strategy to enable system adaptation, i.e. findings related to manageability of the IWRMP must be interlinked with the WDM strategy and adaptive changes in the WDM strategy must be translated into manageable action.	▪ Capacity building is key to IWRM ▪ Awareness raising where stakeholder engagement is the key ▪ WDM is a critical element to IWRM ▪ A proper funding Strategy is crucial ▪ Doing nothing is more expensive than doing something!
5 Awareness Raising	The S&AP was discussed in regional workshops and focus groups of service providers and users in all 13 regions. Stakeholder input was integrated in an iterative way. Stakeholder awareness was raised to fully engage key water users in Namibia to contribute to sound water resources management and resource conservation.	▪ Promotion and dissemination of: Regional IWRM booklets Water demand management booklets ▪ Awareness raising must be a continuous activity
6 Information and Knowledge Systems	Stakeholder knowledge and experience is seen as the backbone of the national knowledge and information systems. The bi-directional connection between stakeholder awareness and the country's K&I Systems shows this critical and short feedback connection, i.e. anchoring existing capacity, knowledge and experience along the shortest possible pathways to make it accessible to all water users.	▪ What data and information is collected and by whom? ▪ How it is stored, used and made available to other institutions? ▪ What do they do with the data, information and knowledge? ▪ Challenges: ▪ Limited capacity to gather,

ELEMENT	OVERVIEW	IMPORTANT FINDINGS
		analyse, synthesize, manage - Limited standardisation of database systems and data formats - Limited data, information and knowledge exchange & learning
7 Capacity Building	The first key finding of the three situational assessment steps was capacity building in the sense of maintaining existing capacity and building new capacity to match the ever changing demand and challenges in complexity in water resources management. A *capacity building framework* is established to enhance organisational and human resources capacity in the country. The *S&AP* is the central coordinating mechanism to group and point out the fields of capacity building, providing appropriate strategies, assigning the actors and benchmarking the results. The CB framework is bi-directionally connected to the *knowledge and information systems* for short path mutual feedbacks and the 'squiggly' line connector represents the direct path to stakeholder awareness and engagement, i.e translating and attenuating capacity requirements and capacity enhancing measures into people's language on all levels.	- Key objective: informed and improved decision-taking and responsible implementation - Brings sustainability to economy, society, environment and technology - Strengthen or establish key institutions e.*g. Water Advisory Council, Water Regulator, Performance Support Teams et al.* - Key strategies identified for elaboration - Capacity at system, organisational, individual and technical levels - Mentoring approach strongly recommended - N$ 200,000,000- annually to 2030 needed to build and maintain capacity
8 Funding Strategy	A second key finding to integrated water resources management was the gap in funding and overall resource provision. A *funding strategy* for IWRM incl. WDM was developed and connected to three management essentials: *capacity building, knowledge and information systems and enhancement of stakeholder awareness and engagement*. The overview shows these three short-path connections to enable organisations and people to successfully manage the country's water resources.	- Water is an economic good with a social responsibility - Access to water is a basic human right but should not preclude payment for the service - Public funding should be used for public goods and private funding for private goods - Appropriate delegation of financial powers & responsibilities to lowest levels - Self-financing by service providers should be encouraged - The biggest challenge is the limited ability to effectively manage and use available resources.

ELEMENT	OVERVIEW	IMPORTANT FINDINGS
9 Monitoring and Evaluation	The third key finding to integrated water resources management was the need to enhance and maintain an effective *monitoring and evaluation system*. This M&E system primarily monitors managerial effectiveness and resource use efficiency of the three funded management essentials through a clear set of agreed performance indicators and performance targets: *capacity building, knowledge and information systems and stakeholder engagement*. The M&E system is the logical closure and triggers the periodic review of the IWRM system to enable timely adaptation for system viability.	↓ Provides framework for results based monitoring and evaluation of the IWRMP ↓ performance indicators from water demand management strategy ↓ Monitoring matrix established (results, indicators, targets, responsible institutions) ↓ Systemic closure (back to review and assessment)

4.4.1 Objectives and Recommended Actions of the Strategy and Action Plan

OBJECTIVES	ACTIONS
THEME 1: POLICY AND LEGISLATIVE SUPPORT FOR IWRM	
An enabling policy and legislative framework is established and enforced	Promulgate the revised WRM Act and identify required strategies
	Compile and circulate draft required regulations to stakeholders, including LAs, RCs, as they are formulated
	Undertake strategy gap analysis and compile strategies required for the implementation of IWRM in consultations with all stakeholders
	Compile and finalize the following strategies: ↓ Strategy on bulk and end-user tariffs; ↓ Strategy on subsidies and cross-subsidies; ↓ Strategy for Water Demand Management and water conservation; ↓ Strategy on the reduction of bush encroachment to enhance groundwater recharge potential ↓ Sanitation strategy
	Develop operation plans that promote self-regulatory systems
	Compile guidelines for harmonisation of decentralisation process and IWRM
	Develop strategies to introduce incentives for IWRM/WDM initiatives in communities, industry and Government
Water and Sanitation governance structures are established and functional	Establish the Water and Sanitation Advisory Council
	Establish the Water Regulator function to gather and manage relevant data, to evaluate and approve tariffs for water and sanitation services and to evaluate, using performance indicators, water and sanitation service delivery by service providers .
	Establish Basin Management Committees, Irrigation Water Efficiency Groups and other water area management institutions to promote ongoing efficient and effective engagement with other community-based and non-governmental organisations.
	Establish Performance Support Teams to assist Local Authorities and Regional Councils to provide water supply and sanitation services to meet performance indicators.
	Establish a Water Research Council.

OBJECTIVES	ACTIONS
THEME 2: INSTITUTIONAL SUPPORT AND CAPACITY BUILDING FOR IWRM	
Institutional support programs established to strengthen management and governance structures	Establish institutional capacity needs for all organisations in the water sector
	Establish institutional capacity building programme according to Water Policy
	Provide management training to all levels as required
	Establish mentoring programme at institutional and individual levels
	Establish forums for mentored exchange of information and experience (e.g. Emerging Farmers programme, use Namibia Water Partnership as a forum for institutional support)
	Implement performance assessment programme
	Implement career development programs for institutions in the water sector
	Encourage and implement capacity building for IWRM implementation in all relevant instances and institutions
IWRM integrated and implemented within the context decentralisation	Establish a task team to analyse and integrate goals, objectives, strategies and actions of decentralisation and IWRM for operationalisation
	Establish training programme for basin level stakeholders such as WPCs, Local Authorities and Regional Councils
	Use available capacity, within and outside government, to implement the Act and IWRMP
	Bring certain sections of the Act into force step-wise when and after capacity becomes available or has been developed
BMCs are formalised and functional	Establish BMCs
	Develop and implement a sustainable source of funding for BMCs
	Encourage and facilitate community engagement in BMCs
	Recognise advisory/statutory role of BMCs
	Strengthen management capacity of BMCs
	Review delineation of BMCs as need arises, with stakeholders, with focus on functional and effective management
	Provide continuous support to BMCs and other relevant initiatives
Basic, vocational and higher education institutions have included IWRM into their curricula and extracurricular education programs	Provide IWRM curriculum support to the basic education and teacher training institutions
	Review applicability of training programme established under Namibia Water Resources Management Review
	Establish long-term education programs and delineate clear career paths in IWRM and encourage dual system training
	Establish regional and international partnerships for IWRM research and technology development
	Encourage implementing and educational institutions to undertake capacity building on all levels of IWRM implementation
	Offer continuous professional development in the fields of IWRM
	DWAF or a Water Research Council establish and manage a formal bursary scheme for young people to become professionals in water sciences, engineering, technology and policy analysis

OBJECTIVES	ACTIONS
SUB THEME 2.1: CAPACITY BUILDING FOR MANAGEMENT OF IWRM INCLUDING WDM	
Management capacity of stakeholders in the water sector is enhanced	Conduct an organisational assessment and development of stakeholders in the water sector
	Develop and implement demand based management and managerial effectiveness training
	Establish mentorship programs
	Formalize contract between NamWater and MAWF for water banking in Windhoek
DWAF management capacity for licensing and compliance control is in place and improved	Develop guidelines for licensing and compliance routines.
	Build human resources capacity for licensing and compliance monitoring within DWAF and all licensed water users (sufficient competent and skilled staff).
SUB THEME 2.2: TECHNICAL SKILLS AND MANAGEMENT FOR IWRM	
Capacity for effective and efficient infrastructure operation and maintenance is in place	Develop guidelines for the management, of infrastructures operation and maintenance.
	Implement permanent infrastructure maintenance programs for rural and urban domestic supply
	Build hands-on capacity to do preventative maintenance
	Develop Human Resources technical capacity for infrastructure O&M.
	Develop and apply capacities of performance support team and programme
Technical capacity for integrated land management, sanitation and irrigation is developed	Establish and strengthen existing training programmes for land use planning and management, and their linkages to IWRM.
	Establish and strengthen existing training programmes for sanitation and its linkages to IWRM.
	Support higher education institutions to provide research support for optimized crop production
	Develop materials and train farmers in irrigation scheduling and improved crop production
SUB THEME 2.3: FINANCIAL SKILLS AND MANAGEMENT FOR IWRM INCLUDING WDM	
Adequate capacity for efficient financial management in place	Develop operational manuals for financial management
	Develop and implement training and capacity building programs on financial management (including tariffs setting, pricing, cost recovery, etc)
THEME 3: STAKEHOLDER INVOLVEMENT AND AWARENESS	
All stakeholders are committed and actively engaged in IWRM	Carry out a comprehensive Stakeholders analysis/mapping
	Raise awareness on IWRM
	Design scenarios showing benefits of IWRM to stakeholders. Showcase best practices and success stories of benefits gained through IWRM (national and international). Facilitate formation of appropriate stakeholder engagement platforms as identified
	Develop stakeholder forums for efficient and effective engagement among implementing agencies such as DWAF, NamWater, Regional and Local Authorities, line Ministries such as MET, MLR, NPC, MoF and MRLGHRD.
	Strengthen the Namibia Water Partnership (NWP) to facilitate awareness, participation and engagement in particular
	Provide BMCs with appropriate material for awareness raising and encourage

OBJECTIVES	ACTIONS
	engagement.(regarding sanitation, water use efficiency and conservation, waste minimization)
	Train people to do process and infrastructure maintenance within their communities.
	Integrate BMCs in outreach programs to urban and rural schools
	Provide funding mechanisms for the NWP and the BMCs to take lead role in promoting awareness, participation and engagement in IWRM particularly on regional and local level
Women and youth are equitably involved at all levels in IWRM	Develop tailored information on IWRM for women and youth.
	Integrate women in committees on all levels
	Provide for IWRM skills training for women and youth
	Provide for general education options for women
THEME 4: RESOURCES FOR IWRM	
IWRM provides the framework and orientation for land use/ management plans	Provide professional assistance to the responsible land planning institutions to produce land use/management plans based on IWRM principles
	Integrate land use and respective management plans in IWRM
SUB THEME 4.1: KNOWLEDGE MANAGEMENT	
All necessary data for IWRM are available, accessible, translated to information and knowledge and appropriately managed	Conduct gap analysis of current and future data needs for mandated services by each institution in the water sector
	Establish a centralized knowledge management system, identify existing relevant databases, improve (operationalise) and harmonise them for inclusion.
	Identify existing hardcopy archives, re-organize and digitize them where appropriate.
	Identify viable options for data access by stakeholders on regional and local level.
	Make data, information and knowledge accessible to all water users.
	Produce informative reports and newsletters with key data processed and translated into a generally understandable format.
Knowledge acquisition programs are established and results are accessible to all stakeholders	Establish a Water Research Council to actively promote research, to provide appropriate access to research information, Namibian case studies and IWRM information in general for all stakeholders
	Develop data collection strategies and action plans and carry out necessary research and investigation programs.
	Provide appropriate funding mechanisms for establishing research, knowledge and information systems
SUB THEME 4.2: WATER RESOURCES MANAGEMENT	
Effective groundwater monitoring and control is fully established	Identify weaknesses and deficiencies of existing groundwater resources monitoring and control.
	Develop and implement a nationwide groundwater level and quality monitoring strategy.
	Improve the existing monitoring network.
	Apply guidelines for groundwater abstraction licensing and compliance.
	Establish a mandatory reporting scheme for service providers and users who abstract their own water (rest water levels and abstracted volumes) including water quality

OBJECTIVES	ACTIONS
	aspects.
	Install groundwater abstraction metering and establish appropriate reporting mechanisms.
	Develop real-time monitoring and modelling systems with results accessible to all parties (users, managers, service providers)
	Train BMCs to conduct groundwater monitoring spot checks
Groundwater resources sustainability and security is improved	Plan and implement artificial groundwater recharge schemes.
	Develop and implement programs for the reduction of bush encroachment.
	Investigate, quantify and manage groundwater resources of trans-boundary aquifers.
Effective surface water (perennial and ephemeral) monitoring and control is fully established	Identify weaknesses and deficiencies of existing monitoring and control strategy and infrastructures.
	Improve management of catchments to enhance both surface and groundwater sources
	Design and implement appropriate flood management plans
	Integrate stakeholders in monitoring and reporting of changes to surface water resource availability
	Implement existing Drought Policy and Strategy using national and community-based forums
	Review and strengthen fully informed representation and engagement in relevant international basin commissions.
SUB THEME 4.3: CLIMATE AND CLIMATE CHANGE	
Water resources are managed with full consideration of climate variability and climate change	Develop climate variability and climate change adaptation and mitigation strategies
	Integrate key potential impacts from climate variability and climate change into IWRM Plans
	Include climate variability and change parameters into the design and implementation of droughts and flood management plans
	Establish linkages between water resources and climate monitoring.
	Establish multi-directional communication platform to process data and information and interpret results
	Strengthen and maintain the capacity of the Directorate of Emergency Management
SUB THEME 4.4: WATER SUPPLY	
Access to quality water supply for all users is ensured	Assess weaknesses and shortages of water supply coverage
	Develop and implement water supply management master plans. (Identify water supply management related gaps by assessing existing water resources related policies and regional and national development and land use plans. Adjust water supply planning to regional land use and development plans).
	Define water supply targets and performance indicators (including quality standards and guidelines, and coverage).
	Develop and implement country wide quality monitoring strategy and network.
	Develop desalination plants for coastal water supply.
Water supply is	Define tariffs according to the existing Water Tariff Policy 2009

OBJECTIVES	ACTIONS
affordable and economically viable	Establish subsidies and cross-subsidies structures for low income groups.
	Develop and implement fair and effective credit control policies for service providers
	Determine financial performance indicators for economically viable service provision.
	Develop an effective system to collect payment for water services from Rural communities.
Water resources from perennial rivers are sustainably allocated	Establish priorities for water allocation during periods of shortage or extended periods of drought.
	Develop master plans for water allocation from international rivers.
	Establish parameters for water allocation from the perennial rivers.
	Make water abstraction metering from perennial rivers and reporting mandatory for big water users
Water supply infrastructure is adequately maintained, replaced, upgraded and extended	Identify weaknesses and deficiencies of existing schemes and infrastructures.
	Develop and implement infrastructure maintenance, replacement and extension plans
	Allocate adequate funding for the implementation of the plans
SUB THEME4.5: WATER DEMAND MANAGEMENT AND WATER USE EFFICIENCY	
Water use efficiency is increased through WDM	Assess the existing practices in water demand management and identify gaps and best practices
	Assess current water use efficiency of key water users in industry, agriculture, tourism, mining, Investigate, develop and implement unconventional resources, and reuse of treated wastewater
	Provide research funding to develop water saving technologies
	Facilitate forums for participation, engagement and knowledge sharing in WDM
	Facilitate and implement water metering and recording of results
	Educate the public in water saving strategies and promote water saving devices.
	Implement water infrastructure maintenance programs through WDM urban and rural areas with sufficient funding through a revolving fund and other instruments.
WDM Master Plans for urban and rural areas, the irrigation sector, industry, mining and tourism are developed and implemented.	Identify WDM related gaps by assessing existing sectoral policies (urban and rural areas, the irrigation sector, industry, mining and tourism)
	Carry out a situation assessment for each service provider at all levels which covers: - Water use and conservation, historic water requirements, water use efficiency, infrastructure characteristics, non-revenue water, customers profile management practices and pollution potential of the activity/entity; - Prepare a demand forecast without water savings to estimate the extent of supply augmentation required to satisfy the water demand including the estimated capital and operational costs; - Identify WDM initiatives, expected water savings and price them based on Unit Reference Values; - Determine required capital & human resources for implementation; - Evaluate effect of savings on both the service provider & consumer; and - The effect of sanitation provision in area of jurisdiction if applicable.
	Develop WDM master plans including goals and indicators.
	Develop an implementation and monitoring programme.

OBJECTIVES	ACTIONS
Irrigation management plans for improved efficiency are established and implemented	Fully implement metering for irrigation.
	Promote and introduce water saving technologies.
	Introduce and implement water recycling and reuse of treated wastewater for irrigation near urban areas
	Promote and conduct research on optimized crop selection and production.
	Develop irrigation management plans including setting of appropriate tariffs and fees, and M & E parameters
Innovative conjunctive water use and use of unconventional water sources is enhanced	Investigate and elaborate potential for conjunctive water use in all basins and regions
	Allocate adequate funding to implement conjunctive water use
	Investigate the application of diverse technologies for the treatment of wastewater (e.g. artificial wetland treatment systems for wastewater treatment, rapid oxygenation) and share best practices.
	Train water users in grey water recycling technology
	Build capacity for installation, operation and maintenance of grey water recycling technologies
	Further develop artificial aquifer recharge initiatives
	Test and implement appropriate water treatment technologies, such as desalination and defluoridation of groundwater
	Further implement desalination as solution for coastal water supply
SUB THEME 4.6: SANITATION, POLLUTION CONTROL AND PROTECTION	
Water resources are adequately protected	Assess water resources vulnerability and identify needs and measures for their protection.
	Develop special water resources protection and conservation rules.
	Implement and enforce water and effluent quality regulations.
	Promote understanding of interpretation and application of ‘polluter pays’ principle and precautionary principle
	Facilitate training in monitoring and enforcement of water resources protection and pollution prevention
	Design and implement water resources conservation programmes
	Maintain water resources protection on the agenda of international basin commissions
Sanitation facilities improved and management plans established and implemented	Define sanitation targets based on NDPs
	Assess rural and peri-urban conditions,
	Identify appropriate sanitation technologies.
	Develop and implement sanitation management plan and its M&E parameters.
	Provide information on benefits of sanitation and options for facilities, to inform users and managers at all levels
	Educate decision makers in different sanitation options to understand the benefits of sanitation and water resources conservation
	Establish training programmes for rural and peri-urban sanitation installation and

OBJECTIVES	ACTIONS
	maintenance
	Develop manuals for construction and maintenance of sanitation facilities, including description of regulations on design and location of sanitation facilities.
	Train rural people in installation, operation and maintenance of sanitation facilities
	Provide research funding for sanitation technology
	Provide funding for sanitation option installations and maintenance of sanitation facilities for Government owned infrastructure
Adequate solid and liquid waste management practices are established and enforced	Assess existing solid/liquid waste management policies.
	Assess existing solid/liquid waste management practices of key water users
	Provide support to regional and local authorities to develop solid/liquid management plans.
	Develop and implement national guideline for the disposal of solid waste by land filling.
	Develop and implement national guidelines for the treatment and disposal of hazardous waste.
	Make available good solid waste management practices to the public
	Integrate good solid waste management practices in all resource plans
	Promote and enforce the 'polluter pays' principle.
	Educate users in all sectors in good solid waste management practices such as waste minimisation and recycling
Wastewater and solid waste infrastructure is adequately maintained, replaced, upgraded and extended	Identify weaknesses and deficiencies of existing infrastructures.
	Develop and implement infrastructure maintenance, replacement and extension plans
	Train water users in infrastructure maintenance
	Allocate adequate funding for the implementation of the maintenance plans
THEME 5: INVESTMENT FOR IWRM	
Sustainable investment for IWRM is secured	Retain revenue from water services in the water services cost centre
	Develop a long-term investment plan with alternative investment inputs, including a revolving fund to facilitate the implementation of WDM projects
	Harmonize investment plan with water and sanitation related policies and strategies
	Communicate the investment plan to all stakeholders.
	Integrate investment plan into all relevant sector plans
	Establish a mentorship programme to support investment decisions and activities (WaSAC, PSTs, NIWEG)
	Connect the investment plan to the monitoring and evaluation systems to support timely feedback
	Integrate capacity building and capacity maintenance programmes into the investment plan
	Integrate resources for IWRM into all MTEF and NDPs

5. CONCLUSIONS

The overall goal in addressing water resources management is sustainability. Planning and implementation of IWRM is not a linear exercise but it is cyclical and must be accompanied by regular evaluation, assessment of progress and re-planning.

A wealth of knowledge exists about the climate, rainfall, runoff, surface water and groundwater resources. Information has been gathered over more than a hundred years including measurements, investigations and research by scientists and engineers. Namibia has been able to meet the growing demand for water to sustain development through innovation and exceptional ingenuity. There is no reason to believe that this could not be maintained with the proper development of human resources and adequate financial investments.

The country has a huge body of experience in water awareness training, water demand management, community participation and an acute awareness of the need to be on top of technological developments to maintain access to adequate supplies of water of an acceptable quality for different kinds of uses.

The practical implementation of the proposed IWRMP will ultimately depend on the organizational efficiency of the existing water sector institutions in place, the capacity of the human resources employed in those institutions and the financial resources made available. However, the implementation of water management activities at the community level should receive priority attention to succeed with the IWRMP.

It is essential that the legal framework be put in place and enacted. Although there are good policies in place, these need legal backing. Essential role players such as the Water (and Sanitation) Advisory Council and the Water Regulator are key to the success of IWRM.

Integrated Water Resources Management is a key responsibility of all stakeholders in the water sector, i.e. all water service providers and related management and governance entities and all water users in Namibia.

Effective stakeholder participation at all levels is required in all decisions concerning water resources allocations and management, with the focus of capacitating stakeholders for managing specific water resources activities, thus ensuring ownership and overall responsibility.

Water Demand Management is a fundamental part of an integrated approach to the sustainable management of the water sector. Within the Namibian context the WDM strategy attempts to improve cost recovery, the management and maintenance of infrastructure and the reduction of inefficient consumer demand to reduce the pressure and reliance on conventional water resources and infrastructure. This, in turn, results in a net financial benefit to the supplier as well as its customers and benefits to the environment.

Capacity building and institutional development are the key elements for implementation of IWRM in Namibia. IWRM capacity building must be focused on all stakeholders to ensure effective and balanced water use and water resource conservation for water resource security.

Information systems must be strengthened in order to keep them relevant and up to date.

Funding is crucial to a successful IWRM Plan. In analysing the possible options and instruments available to Namibia for developing a funding strategy it is clear that there are a number of approaches and instruments available, domestically as well as internationally. Namibia has come a long way in creating the enabling environment necessary for ensuring that the investments to be made in the WSS can be mobilised, but there are however a number of issues that are critical to the feasibility of any investment programme and associated funding strategy which must be incorporated into future financial planning.

The current underperformance of service providers in terms of financial management must be addressed as a matter of urgency. Namibia is wasting valuable and scarce resources through financial mismanagement. Funds from central government that could be utilised to finance WSS programmes and projects are being utilised to finance bad debt.

6. RECOMMENDATIONS

In order to successfully implement IWRM in Namibia the following actions must be undertaken as a matter of priority:

- Finalize the revised Water Resources Management Act;
- Formulate the Regulations in terms of the WRMA;
- Enact the establishment of the Water (and Sanitation) Advisory Council, because this forum is critical for stakeholder participation in water management;
- Enact the establishment of the Regulator to improve water and sanitation service delivery and cost recovery;
- Bring the WRMA into force as capacity to implement the Act is developed, in this respect DWAF should prioritize the activities according to financial and human resource capacity and implement over time;
- Revise the institutional structure in the DWAF to ensure that the establishment can to cope with the additional responsibilities created in terms of the WRMA;
- Build capacity and employ the required staff with the academic and technical capacity to be trained to implement the WRMA and the IWRMP;
- Provide financial resources to maintain and develop further the human resources capacity of Government/ Local Authorities/ Regional Councils and other service providers as well as industry.
- Engage the Government, Local Authorities, Regional Councils and the private sector on sharing the costs of human resources capacity building and maintenance of existing capacity. A proportion of 30% for the state and 70% for the private sector is estimated.
- Actively use the private sector for mentoring, capacity building and capacity maintenance
- DWAF, NamWater and other relevant institutions must develop a career path programme to ensure that trained candidates are adequately integrated into appropriately rewarded professional development pathways and thus retained for a long time.
- Establish water area management institutions;
- Implement stakeholder participation at all levels and in all decisions concerning water resources allocations and management;
- Involve women in decision making at all levels;
- Incorporate an acceptable strategy in the IWRMP to accommodate the development of infrastructure for vital water supply and sanitation service delivery by various actors such as NamWater, Regional and Local Authorities, the DWAF and the private sector through the use of;
  - Performance Support Teams (PSTs),
  - the Water Regulator (WR),
  - a Water Research Council (WRC),
  - a National Irrigation Water Efficiency Group (NIWEG),
  - Basin Management Committees (BMCs) and
  - Water Point Committees (WPCs).
- Prepare implementation plans to cover strategies for:
  - stakeholder engagement and participation,
  - national water demand management,
  - flood and drought management,
  - data acquisition and management,
  - access to internationally shared water resources,
  - capital investments to fund water development projects,
  - water environment management,
  - the harmonization of all the formal Government policies to be in line with the IWRMP.

- Engage all stakeholders and the following set of enabling strategies to meet the goals of IWRM and the available policies:
  - a groundwater protection strategy and management plan,
  - an ephemeral river catchment management strategy,
  - a clear communal land and water use strategy,
  - a national water demand management strategy,
  - a national pollution control and effluent discharge strategy and appropriate regulations,
  - an effective strategy on tariff setting,
  - an effective strategy on water metering and information management,
  - an effective strategy on the reduction of bush encroachment to enhance groundwater recharge and surface run-off,
  - a strategy on gender participation and engagement on all levels in IWRM/WDM,
  - a strategy for integrated coastal management,
  - a suite of strategic planning and management support mechanisms.
- Through public outreach programmes, educate Namibians about the need to use water wisely, which could have a huge impact on capital investment programmes, and to pay for the water they have used.

7. REFERENCES

For the references used in this report, the reference lists included in the Theme Reports should be consulted.