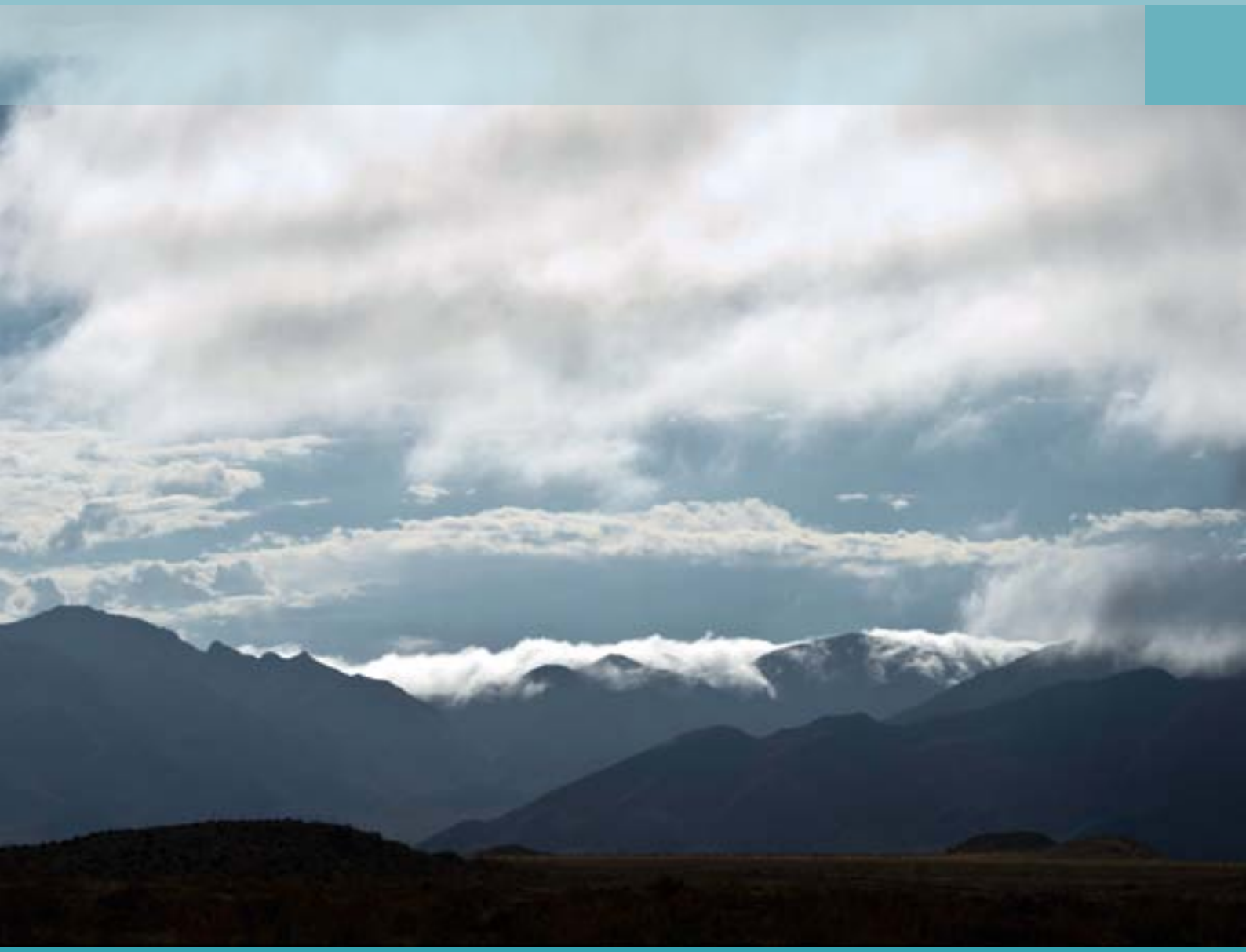

NAMIBIA ACTION PLAN FOR THE ORANGE–SENQU RIVER BASIN

ORANGE - SENQU RIVER COMMISSION
BOTSWANA LESOTHO NAMIBIA SOUTH AFRICA
ORASECOM
Established 2000

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The Orange–Senqu River Commission – ORASECOM – was established by the governments of Botswana, Lesotho, Namibia and South Africa to promote equitable and sustainable development and management of the resources of the Orange–Senqu River. This joint commitment was sealed through an Agreement on the Establishment of the Orange–Senqu River Commission signed in November 2000 in Windhoek, which conforms with best international practices regarding the joint management of shared rivers.

The highest body of ORASECOM is the Council, consisting of delegations from each country, supported by various 'Task Teams' that manage projects, and a Secretariat. The Council serves as technical advisor to the member states on matters related to development, utilisation and conservation of water resources of the Orange–Senqu River system. The Secretariat, established by agreement with South Africa in 2006 and hosted there, coordinates ORASECOM activities, implements ORASECOM decisions and is the focal point of the institution.

Namibia Action Plan for the Orange–Senqu River Basin. ORASECOM Report 005/2014.

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NAMIBIA ACTION PLAN FOR THE ORANGE–SENQU RIVER BASIN

Verdant vineyards of Aussenkehr in southern Namibia irrigated with waters from the lower Orange River contrast against the stark landscape of this hyperarid area.

CONTENTS

FOREWORD

The Scorpion Zinc mine has established a pond with clean reclaimed water for local birds, which thrive in this little desert oasis.

The Orange–Senqu River Commission (ORASECOM) was established by the governments of Botswana, Lesotho, Namibia and South Africa to advise them on water-related issues towards promoting equitable and sustainable development and management of the resources of the Orange–Senqu River basin.

ORASECOM and its four basin states have been supported by a United Nations Development Programme–Global Environmental Facility (UNDP–GEF) programme in the development of a basin-wide Strategic Action Programme (SAP) and an Action Plan for each basin country to address a variety of identified water-related environmental concerns. The SAP is a negotiated document that provides a basin-wide framework for the implementation of a prioritised set of national and joint transboundary actions and investments. In the context of the Orange–Senqu River Basin Integrated Water Resources Management (IWRM) Plan, the SAP is specifically focused on addressing priority environmental concerns. At national level, the SAP initiatives are integrated into the respective Action Plan of each basin state.

The Namibia Action Plan for the Orange–Senqu River Basin is based on an assessment of the priority environmental concerns as identified by the Orange–Senqu Transboundary Diagnostic Analysis (TDA), a scientific and technical assessment of the priority environmental concerns and shared management issues in the basin. For the priority issues, the analysis identifies the scale and distribution of environmental and socio-economic impacts at national and basin levels and, through an analysis of the root causes, identifies potential remedial and/or preventative actions. The Namibia Action Plan defines technical and management interventions to address these priority concerns at national level. It was developed through an extensive consultation process and has been validated at national level in order to ensure that it reflects the priorities of the country. It is well aligned with the country's national development and sector plans, as well as the institutional frameworks at national and local level.

Developed under the auspices of ORASECOM, this Action Plan – together with the Action Plans of the other three basin states and the SAP – forms the environmental component of the Orange–Senqu River basin IWRM Plan.

ABBREVIATIONS AND ACRONYMS

DEES	Directorate of Extension and Engineering Services
DRFN	Desert Research Foundation of Namibia
DWAF	Department of Water Affairs and Forestry
DWSSC	Directorate of Water Supply and Sanitation Coordination
GEF	Global Environment Facility
kg	kilogram
ha	hectare(s)
HIV/Aids	human immunodeficiency virus/acquired immune deficiency syndrome
IWRM	Integrated Water Resources Management
JV	joint venture
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
Mm^3/a	million cubic metres per year
NamPower	Namibian power utility
NamWater	Namibia Water Corporation
NDP4	Fourth National Development Plan
ORASECOM	Orange–Senqu River Commission
SADC	Southern African Development Community
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
UNDP–GEF	United Nations Development Programme–Global Environmental Facility
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNOPS	United Nations Office for Project Services
USD	United States Dollar

A Cape sparrow (*Passer melanurus*)

EXECUTIVE SUMMARY

The Namibia Action Plan for the Orange–Senqu River Basin is a strategic implementation plan to address priority environmental concerns in the Namibia part of the Orange–Senqu River basin. It is closely aligned with the Orange–Senqu Strategic Action Programme (SAP), a programme addressing priority environmental concerns at the basin-wide level. In the context of the Orange–Senqu River basin, the Action Plans (and the SAP) are closely linked with the basin-wide Orange–Senqu Integrated Water Resources Management (IWRM) Plan, together forming the environmental component of the IWRM Plan. The Action Plans and SAP, like the IWRM Plan, are developed for a ten-year planning time span with targets set for that period.

The Namibia Action Plan was developed through an intensive stakeholder consultation process. This process involved intersectoral dialogue to achieve integration in water resources management and most importantly national endorsement of the Namibia Action Plan. The political and technical guidance for the Action Plan came from Namibia, through an Action Plan Working Group as well as a broader National Stakeholder Platform, each structure specifically set up for the purpose of Action Plan (and SAP) development. Namibia's delegate to the Orange–Senqu River Commission (ORASECOM) Technical Task Team was appointed as the national coordinator of the Action Plan/SAP process. The National Stakeholder Platforms comprised stakeholders representing a wide range of relevant role-players, including both state and non-state participants. While established initially for the purposes of Action Plan/SAP development, the aim is that the National Stakeholder Platforms and the Action Plan Working Groups are maintained in the long term and become permanent national counterparts for ORASECOM.

The Namibia Action Plan is based on an assessment of the priority environmental concerns as identified by the Orange–Senqu Transboundary Diagnostic Analysis (TDA), a scientific and technical assessment of the priority environmental concerns and shared management issues in the basin. For the priority issues, the analysis identifies the scale and distribution of environmental and socio-economic impacts at national and basin levels and, through an analysis of the root causes, identifies potential remedial and/or preventative actions. The Namibia Action Plan is based on the findings of the Orange–Senqu TDA and is closely integrated with the basin-wide Orange–Senqu SAP.

The Namibia Action Plan is structured around the four environmental priority areas of concern identified in the TDA: increasing water demand, declining water resources quality, changes to the hydrological regime and land degradation. Through the Action Plan consultation process the stakeholders ranked them in order of priority from their national perspective. In Namibia, the following order of priority was determined.

1 Increasing water demand

The main water-use sectors in the basin are irrigation, livestock, mining, urban centres, domestic and the environment. Demands are steadily increasing with little surplus to increase abstraction. While surface water is available at the major dams within the basin, the greater basin area has limited access to surface water and relies on groundwater for domestic use, stock watering and even some irrigation. Although Namibia is an arid to semi-arid country, water is poorly managed, particularly by local authorities, largely due to limited technical and managerial capacity. This results in increasing numbers of consumers owing local authorities and local authorities in turn owing Namibia Water Corporation (NamWater). Limited capacity also leads to wastage of water due to unmaintained and aging water infrastructure.

Gondwana Cañon Park in southern Namibia is a privately owned nature park situated in the Nama Karoo just 20 km from the Fish River Canyon and covering an area of 1,260 km^2.

Opposite page: The arid landscape close to the Fish River canyon on the road from Rosh Pinah down to the Orange River

The town of Rosh Pinah in southern Namibia is centred around two mines that produce base metals. Water to sustain the town and mining operations is piped from the Orange River.

2 Declining water resources quality

The key water resources quality issues in the Namibian part of the basin are high nitrite/nitrate and fluoride concentrations, groundwater salinity, and potential pollution from improper sanitation facilities and irrigation. Improper sanitation facilities, including a lack of sanitation facilities and improperly managed sewerage systems in almost all local authorities, is believed to contribute to pollution of both surface and groundwater sources, and consequently poses a threat to human health. Irrigation return flows are also adding to the problem.

3 Changes to the hydrological regime

The hydrological regime of the river, especially downstream of the Vanderkloof Dam, has changed dramatically as a result of upstream development. Apart from the mean annual runoff being reduced to half the estimated natural flow, the pattern of flow is very different from that of the natural river. There is less variability in flow from one year to the next and, within the year, there is a less distinct seasonal pattern. The frequency of smaller floods has also been reduced, with most being absorbed by upstream abstraction and storage. These changes in the hydrological regime of the river impact downstream ecosystems, especially at the estuary, which is a Ramsar site.

4 Land degradation

Land degradation in the basin is a consequence of overstocking, lack of mobility due to land being divided into farming units, drought subsidies, unsuitable distribution of water and boreholes, and poverty. Loss of vegetation cover is perhaps the most obvious indicator of rangeland degradation, i.e. the loss of grass species diversity and perennial grasses, loss of grass vigour, loss of ground cover and land productivity all increase vulnerability to drought and facilitate the encroachment of undesirable plants. Increases in the distribution and abundance of alien species contribute to a loss of biodiversity, changes in the flow of rivers, loss of water yields (surface and ground) and general environmental degradation. Some alien invasives are pioneer species taking advantage of disturbed areas and outcompeting with indigenous species.

In response to each priority area of concern, national targets were set to address the concerns over a ten-year time period. Interventions were then identified to meet the targets. In line with national policies, strategies, plans and project concepts were developed that package the proposed interventions into structured, implementable projects.

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These project concept notes (PCNs) form the backbone of the Namibia Action Plan. The proposed projects identified for Namibia are:

Addressing: Increasing water demand
- PCN 1: Improving groundwater resources management to enhance water supply in the Nossob–Auob sub-basin
- PCN 2: Improving water-use efficiency and demand management in local authorities
- PCN 3: Water conservation and demand management in the irrigation sector

Addressing: Declining water resources quality
- PCN 4: Improvement of water quality management and pollution control

Addressing: Changes to the hydrological regime
- SAP PCN 3: Basin-wide environmental flow regime
- SAP PCN 4: Orange–Senqu River mouth management

Addressing: Land degradation
- PCN 5: Control of invasive species through integrated management in a pilot area in the Orange–Fish River basin, Namibia
- PCN 6: Alternative land-use options for improved rangeland conditions and sustainable livelihoods

The implementation of the Namibia Action Plan is project-specific. The mechanism of implementation of a project is determined by the requirements of the lead implementing agent of that project. Overall coordination and monitoring of the Action Plan is through national government structures using their established structures and systems. Therefore, close collaboration between the ORASECOM Secretariat and responsible national structures is necessary to ensure coordination and monitoring between the implementation of SAP and Action Plan activities in the four basin states.

Funding is sought for each project, either individually or for a combination of projects. Potential funding sources are primarily national governments, international cooperation partners and, to some extent, the private sector. Importantly, given the extensive consultation process through which the Action Plan has been developed and its close alignment with national policies and strategic planning priorities, the Botswana Action Plan also provides valuable guidance for targeted budget decision-making and spending at national level.

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1. INTRODUCTION

1.1 PURPOSE OF THE ACTION PLANS

The Action Plans are strategic implementation plans for addressing priority environmental concerns in the national part of the Orange–Senqu River basin. They are closely aligned with the Orange–Senqu Strategic Action Programme (SAP), a programme addressing priority environmental concerns at the basin-wide level. The Action Plans are critical tools for the implementation of SAP priority actions at national level and the integration of transboundary and basin concerns into national legislative, policy and budget decision-making processes.

In the context of the Orange–Senqu River, the Action Plans (and the SAP) are closely linked with the basin-wide Orange–Senqu IWRM Plan, together essentially forming the environmental component of the IWRM Plan. The Action Plans and SAP, like the IWRM Plan, are developed for a ten-year planning time span with targets set for that period. Thus, while the IWRM Plan is a comprehensive plan dealing with a wide aspect of water resources management (including water allocation) and economic development aspects pertinent to the basin, the SAP and related Action Plans primarily concentrate on priority environmental issues and form the environmental core component of the IWRM Plan.

The Namibia Action Plan for the Orange–Senqu River Basin was developed through an extensive consultation process in order to ensure that it reflects the priorities of the country. It is well aligned with the country's national development and sector plans as well as the institutional frameworks at national and local level.

1.2 RELATIONSHIP OF THE ACTION PLAN TO THE TDA, SAP AND ORANGE–SENQU BASIN IWRM PLAN

The Action Plan is based on an assessment of the priority environmental concerns as identified by the Orange–Senqu Transboundary Diagnostic Analysis (TDA) and defines technical and management interventions to address them. The TDA is a scientific and technical assessment of the priority environmental concerns and shared management issues in the basin. For the priority issues, the analysis identifies the scale and distribution of environmental and socio-economic impacts at national and basin levels and, through an analysis of the root causes, identifies potential remedial and/or preventative actions. This Action Plan is based on the findings of the Orange–Senqu TDA and is closely integrated with the basin-wide Orange–Senqu SAP.

Opposite page: The Nossob aquifer is mostly confined. However, in the Nossob valley around Leonardville, it is artesian: a natural spring pours out warm water, which the local farming community has dammed.

Below: Rehoboth lies on a high plateau and has a number of hot-water springs. In the past, people would come to this one in the centre of town to do their washing and collect warm water; some residents still use it today.

Like the Action Plan at national level, the SAP is a negotiated document that provides a basin-wide framework for the implementation of a prioritised set of national and joint transboundary actions and investments. At national level, the SAP initiatives are based on and integrated into the respective Action Plan. Neither the Action Plans nor the SAP work independently – the SAP reflects basin-wide priorities identified through the Action Plan development processes in the four states, while the Action Plans provide the framework for the national level implementation.

1.3 RELATIONSHIP OF THE ACTION PLAN TO EXISTING RELEVANT NATIONAL POLICIES AND PLANS

Namibia's Vision 2030 provides the long-term development framework for the country, aimed at improving the quality of life of its people and achieving the status of an industrialised nation by the year 2030. The national development plans are the main vehicles to translate the vision into action and make progress towards its realisation by 2030. In this regard, the Fourth National Development Plan (NDP4) 2012–2017 was launched in 2012. All the national planning documents should support Namibia's Vision 2030 and NDPs.

Water sector priorities are guided by a number of policies developed by the Ministry of Agriculture, Water and Forestry (MAWF). The water sector vision was reviewed in 2006 as part of the Water Sector Strategic Plan 2007/08–2011/12. The sector vision aimed 'to achieve equitable access to sufficient, appropriate, safe, sustainable and affordable water for all Namibian users for improved quality of life'. The guiding documents are the national Integrated Water Resources Management Plan that was adopted by Cabinet in 2012, the National Water Policy (2000) and the Water Supply and Sanitation Policy (2008). MAWF is also working on the Water Resources Management Bill; meanwhile, until the implementation of the new Act, the Water Act of 1956 and its regulations remain in force.

The Action Plan is developed to address specific concerns within the Namibian part of the Orange–Senqu River basin, in line with these national guiding documents.

1.4 GEOGRAPHIC COVERAGE

The Namibian part of the basin includes the Orange–Fish River basin and the Nossob–Auob basins.

The Orange–Fish River basin covers an extensive area of southern Namibia, draining nearly 120,000 km^2 (Swart, 2008), which represents 15 per cent of Namibia's surface area. The Orange–Fish basin is defined mainly by the surface catchments of the Orange and Fish rivers in Namibia. The Fish River originates in the Rehoboth plateau north-west of Maltahöhe, and flows initially in a northerly and then in a southerly direction towards the perennial Orange River. The confluence of both rivers is some 35 km south-west of /Ai-/Ais within the /Ai-/Ais–Richtersveld Transfrontier Park. In some areas, mostly along the eastern basin margin, the boundary deviates slightly from the surface water catchment, where groundwater basins and geological formations are considered to be more critical criteria for the definition of the basin (DWAF, 2004).

The Nossob–Auob basin comprises the surface catchments of the south-east-flowing Black and White Nossob rivers, and the Olifants, Seeis, Skaap, Oanob and Auob rivers (DWAF, 2004). The Stampriet artesian aquifer also falls within this basin.

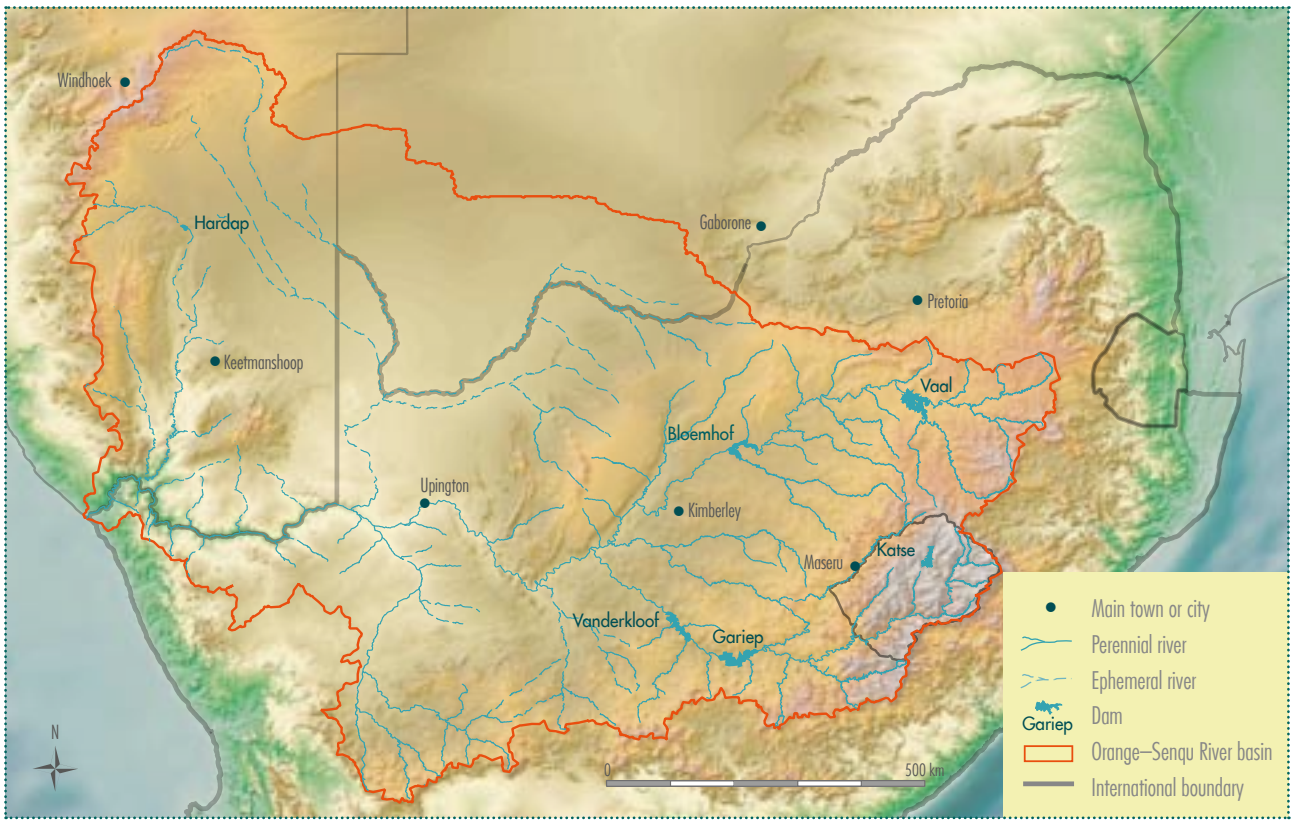

Figure 1: Map of Orange–Senqu River basin

2. GOVERNANCE FRAMEWORK

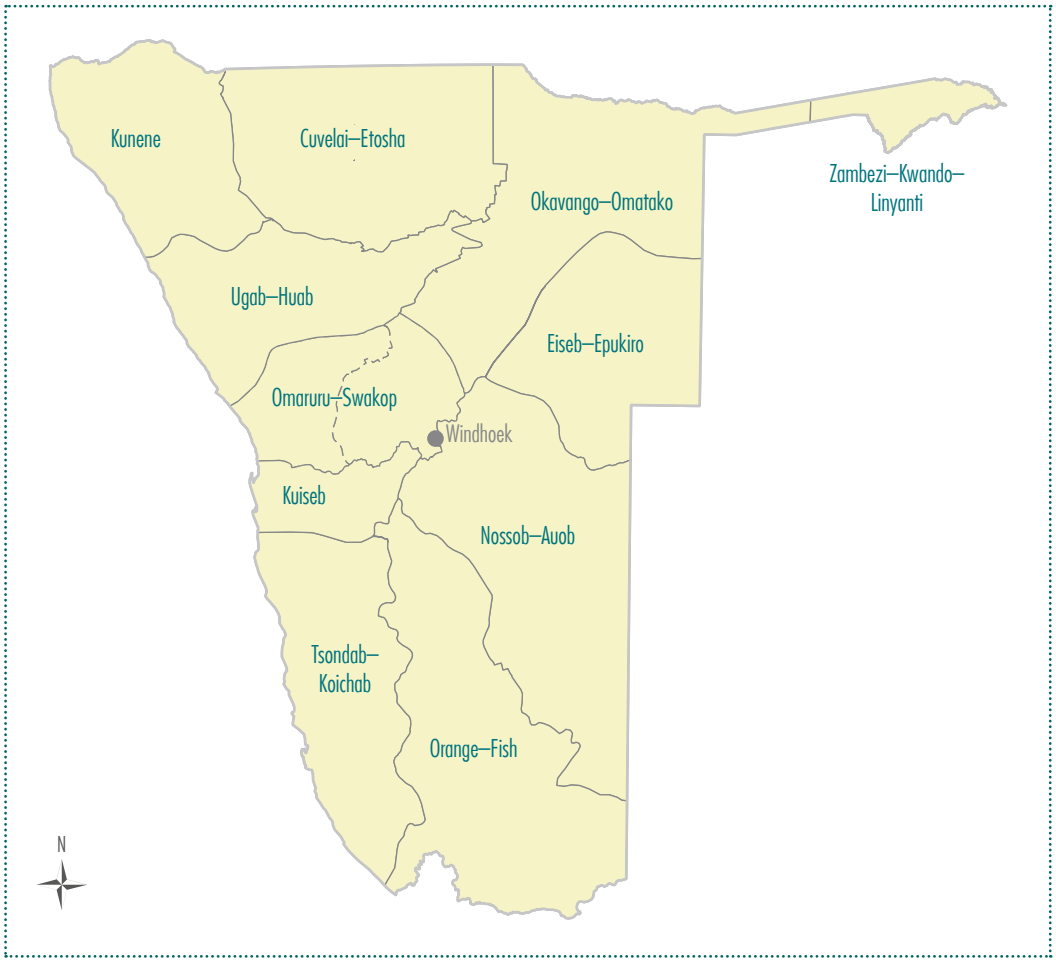

Figure 2: Water basins in Namibia
Source: DWAF, 2004

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2.1 LEGAL AND POLICY FRAMEWORK

Namibia initiated a process to review the water sector in the early 1990s, shortly after independence. The review led to the National Water Policy in 2000, which adopted the IWRM approach for water resources management in Namibia. Following this policy, the Water Resources Management Act No. 24 was promulgated in 2004, but it never commenced officially as a further revision was found necessary. In the absence of the new Act, the water sector was legally administered through the South Africa Water Act of 1956, although some elements of the 2004 Act were implemented in practice, for example the basin management approach through the establishment of Basin Management Committees. The water sector is guided by several more recent sector policies and plans, among them the national Integrated Water Resources Management Plan, which was approved by Cabinet in 2012. It provides overall guidance to planning, development and management for the water sector. The new Water Resources Management Act (No. 11 of 2013), which was promulgated in December 2013, replaces the 1956 South Africa Water Act and now forms the legal basis for water resources management in the country. Regulations for the water sector are being formulated and will be passed based on the new Act.

In agreement with and supporting the National Water Policy and water and environmental Acts, Namibia is a signatory to and ratified the UN Convention on Wetlands of International Importance (the Ramsar Convention), the UN Convention on the Law of the Non-navigational Uses of International Watercourses, the Revised Southern African Development Community (SADC) Protocol on Shared Watercourses, as well as the UN Conventions to Combat Desertification, on Biological Diversity and the Framework Convention on Climate Change. Since the country shares all its perennial rivers with its neighbouring countries, transboundary cooperation is important and both the National Water Policy and Act address transboundary water management. Namibia is a member and signatory to the Zambezi Watercourse Commission, the Permanent Okavango River Basin Water Commission and the Orange–Senqu River Commission (ORASECOM) and it is represented on the Permanent Joint Technical Commission for the Kunene River.

A Permanent Water Commission between Namibia and South Africa was established in 1992 to attend to the mutual interests of the two countries concerning water matters on the Orange–Senqu River. Since then, a number of studies have been carried out on the potential of and demand on the system. The Commission operates at the advisory, policy-making and supervisory level, but it does not have the capacity or authority to regulate or manage water resource structures and systems.

The Water Supply and Sanitation Sector Policy of 1993 was reviewed in 2008 to incorporate new developments in the water sector and to better address gaps, particularly in sanitation. The government recognised that it was realising its water supply goals, whereas the sanitation targets lagged behind. The revised Water Supply and Sanitation Sector Policy was adopted in 2008, replacing the 1993 policy and the National Water Strategy of 2010.

In addition to the above, there are several other pieces of legislation and policies that support and are relevant to the existing water law and policies. These include:

- Constitution of the Republic of Namibia
- Namibia Water Corporation Act (1997)
- Environmental Assessment Policy (1996)
- Environmental Management Act (2007)
- National Strategy for Rural Sanitation (2004)
- Green Scheme Irrigation Policy (2005)
- Local Authorities Act (1992)
- Regional Councils Act (1992)

Oanob Dam is a double-curvature arch dam on the Oanob River, Namibia, which supplies the town of Rehoboth via a four-kilometre pipeline.

Opposite page: Cape wagtail (*Motacilla capensis*), often found near open water sources

Flooding of Mariental in 2000 and 2006 was, in part, attributed to the dense reed growth in the Fish River below the dam at Hardap Irrigation Scheme. The growth of the reeds is an indication that the return flows from the irrigation scheme are high in nutrients. One initiative to help avoid flooding of the town again has been to clear the watercourse of reeds.

2.2 INSTITUTIONAL FRAMEWORK

The MAWF is the custodian of all water resources in Namibia. The Department of Water Affairs and Forestry (DWAF) in the MAWF is responsible for water allocation and water resources management. The Water Supply and Sanitation Sector Policy in 2008 also gave DWAF responsibility for coordinating sanitation services. The department is divided into three directorates: the Directorate of Resource Management; the Directorate of Water Supply and Sanitation Coordination (DWSSC); and the Directorate of Forestry. The Directorate of Forestry has indirect influence on water resources. Within the MAWF, the Department of Agriculture has indirect influence on water resources management as it is mandated to advise on the development of farm dams, irrigation schemes and soil conservation practices. However, the Directorate of Forestry and the Department of Agriculture have direct influence on water use for livestock and crops.

Even though water supply and resource management institutions are presented separately below, there are clear linkages and dependencies between the two structures.

Water resources management

The Directorate of Resource Management within DWAF is responsible for the assessment of water resource potential, long-term strategic planning, and water resources protection and conservation, including elements of water demand management. The directorate is also responsible for capacity-building and awareness-raising. The directorate has five divisions, namely:

- Geohydrology carries out research, investigation and monitoring of groundwater resources, and oversees management of 'controlled' aquifers (those that are strategically important, such as Stampriet). It provides technical advice and guidance to the Division of Law Administration which administers abstraction permits.
- Hydrology investigates, researches, monitors and manages surface-water resources and floods, and oversees basin management institutional development.
- Planning is responsible for long-term strategic planning, transboundary water agreements and resource accounting.
- Water Environment is responsible for water quality and pollution control. This division is tasked with the assessment, approval and advice of permits for effluent discharge to

© Carole Roberts

In 2012, after a spraying programme was put in place, the reed growth is greatly reduced.

water bodies and the environment, as well as monitoring water quality of rivers and other wetlands. It also assumes responsibility for water-awareness activities.

- Water Law and Administration administers water abstraction and wastewater discharge.

Water supply and sanitation

The Water Supply and Sanitation Policy of 1993 led to the establishment of the Namibia Water Corporation (NamWater) as a state-owned enterprise based on the Namibia Water Corporation Act (Act 12 of 1997) and the Directorate of Rural Water Supply which supplies water to rural communal areas. The mandate for rural sanitation in communal areas was allocated to the Ministry of Health and Social Services. The revised Water Supply and Sanitation Policy of 2008 recommended the establishment of the Directorate of Water Supply and Sanitation Coordination (DWSSC). This new directorate integrates water supply and sanitation within one sector to ensure coordination among all the participants. It further coordinates water supply and sanitation services in rural and urban areas through existing institutional structures.

The mandate for urban water supply and sanitation falls under the respective local authorities and regional councils which, inter alia, distribute water to consumers. This water is supplied to the authorities and councils, in most instances, by NamWater. Water supply and sanitation on freehold tenure farms and mining companies are the responsibility of the individual farmers or companies at full supply cost recovery, but under the coordination and control function of the DWSSC. The Ministry of Health and Social Services provides hygiene and health awareness and education on water and sanitation.

NamWater is responsible for the management of all large dams in the country, as well as groundwater and pipeline schemes that supply bulk water. There are a few cases where the relevant local authority operates and maintains water infrastructure, for example Windhoek Municipality, but none within the basin.

Great white pelicans (*Pelecanus onocrotalus*)

2.3 SOCIO-ECONOMIC CONTEXT

Namibia's population is approximately 2 million (2,104,900 million in Census 2011). It is a relatively youthful population: about 39 per cent is under 15 years of age and only 7 per cent is over 60. Despite rapid urbanisation, Namibia is still mainly rural, with only about 33 per cent of the population living in urban areas (IWRM JVN, 2010). The rate of urban growth for the whole country is about 6 per cent per annum. At this rate of urbanisation, between 75 per cent and 85 per cent of Namibians will be living in urban areas by 2020.

The Orange–Fish River basin and the Nossob–Auob basin cover areas of four administrative regions, namely: //Karas, Hardap, Omaheke and Khomas. Approximately 77,000 people live in the Orange–Fish River basin representing 56 per cent of the population of Hardap and Karas regions (IWRM JVN, 2010). In the Hardap and Karas regions, 46 per cent and 54 per cent of the population respectively, are classified as living in urban areas (IWRM JVN, 2010). In general, 72.4 per cent of the Orange–Fish River basin is privately-owned freehold land, while only 14.8 per cent falls under traditional authority (communal lands). Furthermore, 11.2 per cent of the basin is state-owned land while only 1.6 per cent is represented by the local authorities. A major part of communally owned land in Hardap and Karas regions lies within the Orange–Fish River basin, while poor informal settlements on townlands surround each of the urban centres.

The mining sector is the traditional backbone of the economy, contributing about 13 per cent to GDP, and it continues to generate the largest share of Namibia's foreign-exchange earnings. There are three major mining operations in the basin (Namdeb Diamond Corporation, Rosh Pinah Zinc Corporation and Scorpion Zinc) that rely directly on water from the Orange River. In addition to these three, there are smaller operations along the river which do not use as much water, and it is likely that they do not comply with environmental management plans. The agriculture sector continues to be one of the most important sectors, even though only half the country is suitable for farming and is highly susceptible to drought. The sector contributes about 8.4 per cent to GDP and it is a major source of income and employment for the bulk of the population.

Commercial and subsistence livestock farming are common land-use types in the Namibian part of the basin. Irrigation is practised along the Orange River and at the major dams (Hardap and Naute), as well as on the Stampriet aquifer. Irrigation and mining activities create employment and lead to migration to the otherwise sparsely populated southern parts of the country.

Tourism is also an important source of income in the basin. The basin offers spectacular landscapes and the establishment of conservancies has increased over the years. Commercial game farming is also common. The most well-known initiative in the Orange–Fish River basin is the Gondwana Cañon Park, which covers 102,000 ha of land. It converted a former sheep farming area into a conservation and tourism enterprise, offering accommodation in three lodges (Goldbeck and Olivier 2001:21, as cited by Werner, 2009). The /Ai-/Ais–Richtersveld Transfrontier Park includes South Africa and Namibia's biodiversity hotspots, i.e. the Richtersveld and the /Ai-/Ais Hot Springs Game Park, respectively (Montgomery and Pettersen, 2010). The basin also contains the Naute Dam Recreational Resort (mainly water sports), the Hardap and Oanob Dam resorts and the historic Duwisib Castle.

Since independence, the government's main policies have been aimed at achieving sustainable economic growth and a real-term increase in income per capita. The economic policy is expected to remain broadly unchanged, i.e. aimed at reducing poverty and income inequality, creating employment in the private sector, promoting black economic empowerment, achieving sustainable economic growth and diversification, and combating the spread of HIV/Aids. Privatisation was removed from the agenda during

2007/2008, as the government prefers to improve the performance of state-owned enterprises through better management and commercialisation.

2.4 STAKEHOLDER TYPOLOGY

The Action Plan is aimed at the management of water-related environmental problems for enhanced functioning of the Orange–Senqu River basin in Namibia. All land use, natural processes and environmental disturbances interact with the hydrological cycle and balance within the basin. For this reason, development and management strategies for natural resources will be more effective if implemented over the whole basin, reflecting the relation between people, water, land, vegetation and fauna, and the basin's ecosystem. The specific institutions and their roles in the basin are outlined in Table 1.

Table 1: Relevant stakeholders

Institutions	Roles
Ministry of Agriculture Water and Forestry (MAWF) – Directorate of Resource Management, DWSSC	Custodian for water resources, planning, development, resource management, water supply and sanitation services coordination, coordination at basin-wide level
MAWF – Agriculture	Advice to irrigation and livestock farmers
Ministry of Environment and Tourism (MET)	Management of protected areas, overall environmental protection, sustainable tourism
Ministry of Regional Local Government Housing Rural Development – Regional Councils and Town Councils	Responsible for development at regional level, water supply, sanitation and waste management
Ministry of Youth	Management of some irrigation farms
Ministry of Mines and Energy	Advice and control of mining activities
NamWater	Bulk water supply, development, operation and management of water infrastructure
NamPower	Possible development of Kudu Gas Project
Mines	Namdeb Diamond Corporation, Rosh Pinah Zinc Corporation, Scorpion Zinc and other smaller upcoming mines
Farmers – Aussenkehr, Hardap Farmers Association, Stampriet irrigation farmers, Namibia National Farmers Union, Namibia Agriculture Union, Noordoewer Joint Irrigation Scheme, Joint Irrigation Authority, Emerging Farmers Associations	Water users, influence on water usage and consequent impact
Non-governmental organisations, advisory bodies and projects – Orange River Management Interim Committee, Orange–Fish River Basin Management Committee, Benguela Current Commission, /Ai-/Ais–Richtersveld Transfrontier Park Joint Management Board, Permanent Water Commission, ORASECOM, Greater Fish River Landscape Committee	Advisory function, facilitation and piloting
International Cooperating Partners – the German Agency for International Cooperation, GEF, the United States Agency for International Development, the European Union	Supporting implementation of projects/activities
Polytechnic of Namibia, University of Namibia, and other regional and international universities and researchers	Research, access to knowledge/capacity-building, dissemination of scientific research

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Hardap Dam is currently the largest dam in Namibia, but is only a third of the size of the proposed Neckartal Dam.

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3. DESCRIPTION OF THE NAMIBIAN PART OF THE BASIN

3.1 WATER AVAILABILITY

The water sources in the basin are surface water and groundwater. The only perennial river is the Orange which is significant for irrigation along the river. The volume of water reaching the mouth of the Orange River averages 5,500 Mm^3/a (TDA, 2014), but can vary considerably from year to year. This is a reduction of less than half of the natural flow due to abstraction upstream of the mouth (TDA, 2014).

The north-eastern part of the basin in Namibia is made of the Molopo River grouping consisting of the Auob (includes Oanob) and Nossob rivers. These rivers flow regularly in their upper reaches, but flows rarely (if ever) reach the Molopo River in South Africa. The Auob River basin has two distinctive parts: the Oanob River that occupies the top part of the basin and rises in the Khomas Hochland and flows in a south-easterly direction to the Oanob Dam; and the Aoub River which flows towards the South African border and eventual confluence with the Molopo River. Maximum rainfall over the catchment is close to 400 mm and this reduces to a minimum of 200 mm; the mean annual runoff ranges between 8.6 Mm^3/a and 12.4 Mm^3/a.

The Nossob River rises as two main tributaries: the White Nossob in the Otjihavera Mountains to the east of Windhoek and the Black Nossob further to the north-east. Mean annual precipitation in these areas is approximately 370 mm and mean annual runoff is about 3.50 Mm^3/a. Runoff potential of the upper parts of both rivers is significant, especially of the White Nossob. The potential of both streams, however, is significantly affected by the presence of farm dams in the headwaters. A large dam (Otjivero Dam) was built on the White Nossob in 1984, which has effectively reduced the frequency of flow further downstream from flow most years (90 per cent) to flow once in every four or five years. Further downstream at Gobabis, the Black Nossob is dammed. The mean annual runoff is estimated at 1.90 Mm^3/a.

The Fish River is Namibia's largest ephemeral river. Two large dams on the river at Hardap near Mariental, and Naute near Keetmanshoop provide water for human consumption, as well as for irrigation schemes. Despite the presence of these dams, mean annual runoff in the Fish River at /Ai-Ais/, near the confluence with the Orange River, is more than 450 Mm^3/a.

The uppermost parts of the Molopo group of catchments, i.e. the northern margin zone, are underlain mainly by rocks of the Damara Sequence. In order to increase water supply security for the town of Gobabis in the upper part of the Nossob catchment, a well field has been established in the Damara carbonate aquifers. The Oanob River alluvial aquifer historically supplied bulk water to the town of Rehoboth, but with the construction of the Oanob Dam the well field has been abandoned.

Most of the area covered by the Molopo grouping is underlain by the Stampriet artesian basin which extends eastwards into Botswana. This is the largest aquifer system in Namibia, covering about 65,000 km^2. This resource is used for domestic supply, livestock watering and irrigation by both commercial and communal farmers, and it also supplies the towns of Stampriet, Gochas, Aranos and Leonardville with bulk water. The Stampriet artesian basin is a subterranean water control area (from Strategic Water Resources Assessment: Theme Report of Namibia Water Resources Review).

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Stampriet village in the Hardap Region is located over an artesian aquifer. The groundwater from this aquifer not only supplies the village, but supports irrigation farming on the surrounding farmland.

Opposite page: Naute Dam on the Löwen River, a tributary to the Fish River, supplies a small irrigation scheme (270 ha) and the town of Keetmanshoop with water.

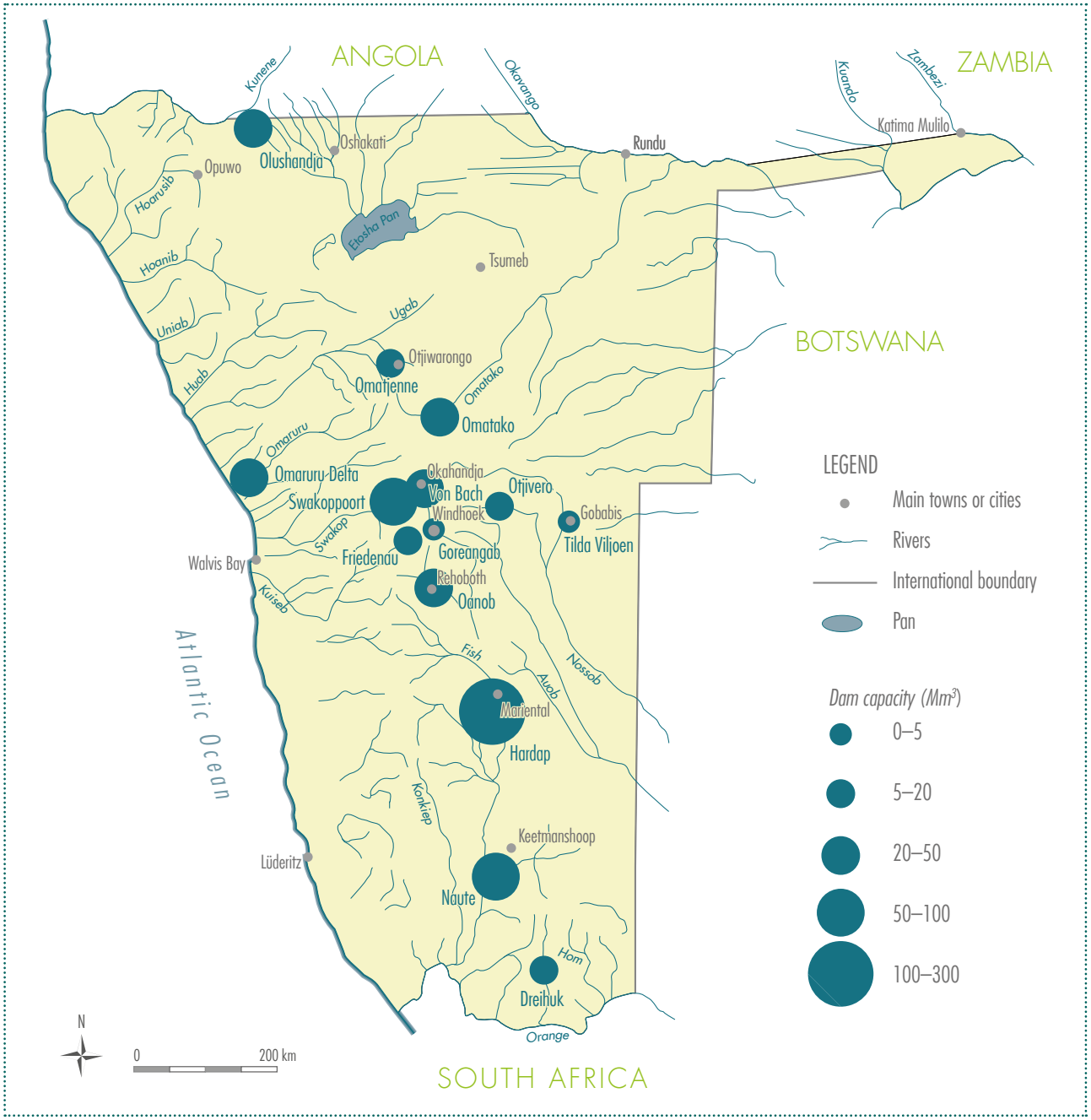

Figure 3: Location of main storage dams and river tributaries
Source: IWRM JV, 2010

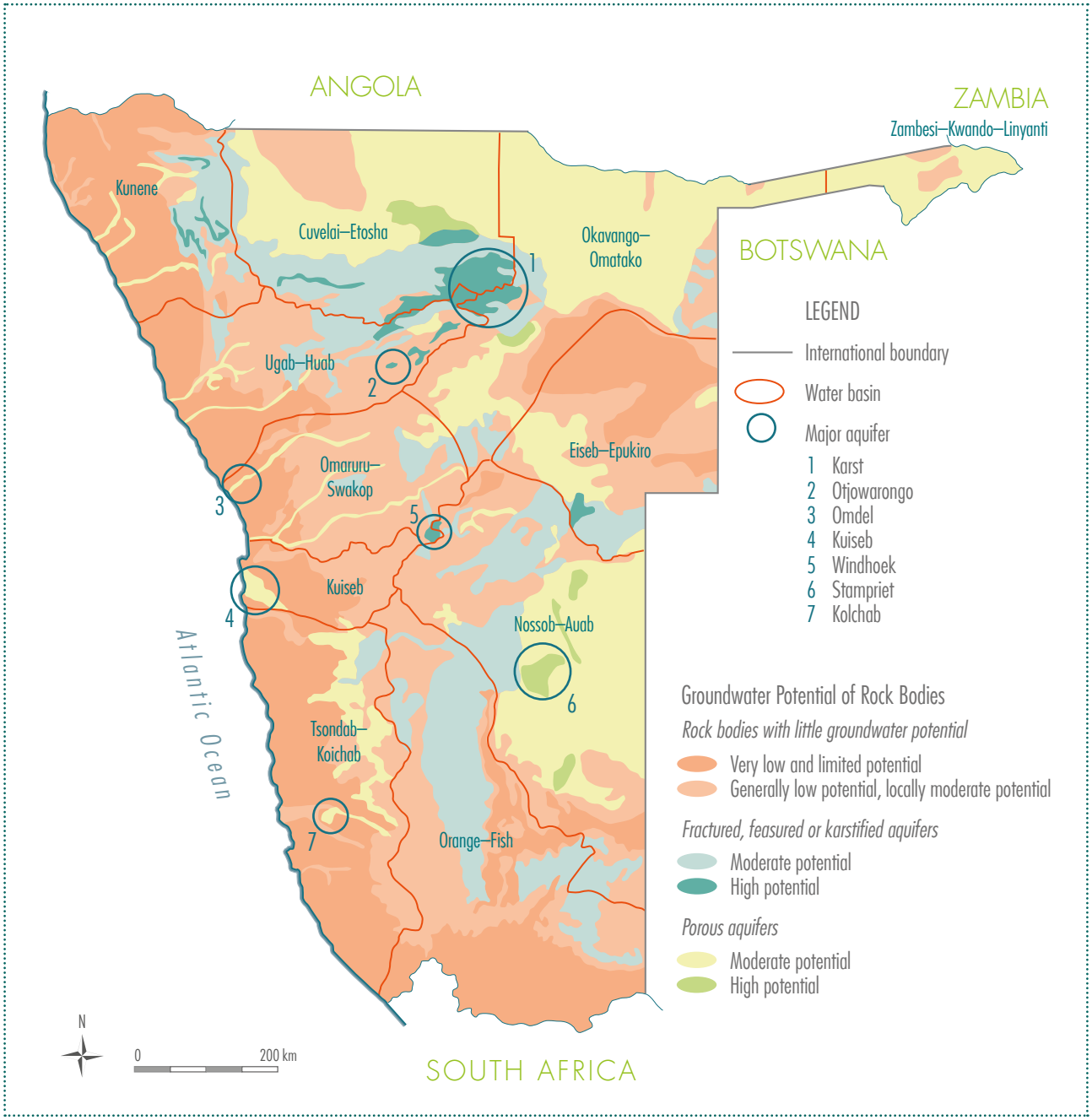

Figure 4: Groundwater potential in Namibia
Source: DWAF, 2004

Table 2: Major dams on rivers in the Namibian part of the basin

Basin	Rivers	Major dams	Capacity (Mm^3)	Yield at 98 per cent assurance (Mm^3/a)
Fish River sub-basin	Fish	Hardap	294.60	43.60
		Neckartal (construction phase)	857.00	116.00
	Loewen	Naute	83.60	12.00
	Hom	Dreihuk	15.50	0.10
Molopo–Nossob basin	Oanob	Oanob	34.50	4.30
	White Nossob	Otjivero	17.60	0.72
	Usib	Nauaspoort	3.19	unknown
	Black Nossob	Daan and Tilda Viljoen	1.70	unknown

Source: Adapted from IWRM Joint Venture, 2010

Groundwater is the most widely used resource in the Namibian part of the basin. Groundwater abstraction from the basin is estimated at 13.81 Mm^3/a (IWRM JVN, 2010). The Stampriet and Maltahoehe aquifers are two significant groundwater bodies which have been declared water control areas. However, in Namibia the groundwater potential or natural recharge of the country has not been fully determined. It is estimated that between one and two per cent of rainfall actively recharges the Namibian groundwater. The major challenges are finding sustainable boreholes in the vast areas covered by Kalahari sand and siting successful boreholes.

3.2 WATER QUALITY

NamWater supplies potable water of national drinking water standards and guidelines to almost all the urban centres in the basin. NamWater has a monitoring programme to ensure that drinking water is of acceptable standard. The rural areas rely on groundwater for domestic and livestock watering. Most of the groundwater resources in the basin are of good quality, and are suitable for domestic and livestock use as well as irrigation (Bockmühl, 2009). However, in some areas that rely on groundwater, high nitrate/nitrite concentrations exceed the limit for human consumption (Bockmühl, 2009). The scale of groundwater contamination by nitrate/nitrite is inknown.

In Namibia, the ephemeral nature of the rivers complicates any analysis of the nutrient conditions (IWRM JVN, 2010). The stagnant pools in the Fish River, however, indicate nutrient enrichment – most probably derived from intensive livestock watering, sewage overflow (for example at /Ai-/Ais Hot Springs Resort) and agrochemical runoff. Irrigation activities along the Fish River, specifically at Hardap, are considered to be a source of nutrients for invasive river reeds. There are perceptions that water quality on the Orange River is also polluted by mining and irrigation activities. The extent of this is unknown.

3.3 ECOLOGY

Four different biomes are found in Namibia (Irish, 1994 as cited by Irish, 2009) and all are represented in the Namibian part of the basin (Figure 5). The major part of the Orange–Fish River basin falls within the Nama-Karoo biome and is characterised mostly by shrubs and grasses. The south-western parts fall within the Succulent Karoo and Desert biomes. The Nossob–Auob basin is mainly within the (Kalahari) Savannnah biome and therefore has trees in addition to shrubs and grasses. Livestock farming is predominant in this biome.

The biodiversity hotspots of plant endemicity fall within the Succulent Karoo biome, a significant proportion of which falls within the /Ai-/Ais–Richtersveld and Sperrgebiet national parks. The Orange River mouth falls within the Desert biome. It contains a number of endemic plant species, is one of the richest wetlands in southern Africa with respect to bird numbers, and is an important feeding area and stopover point for migrating birds. The environmental water demands at the mouth are met by water flowing from the Fish River and releases from the Vanderkloof Dam (in South Africa).

3.4 LAND COVER AND LAND USE

Most of the land in the basin consists of freehold and communal farmland. There are some areas with intensive crop production under irrigation, particularly on the Orange River and below Hardap Dam. The vast majority of the land is extensive rangeland livestock and wildlife farming within indigenous ecosystems. Cattle farming is predominant in the northern part of the basin, while sheep and goats are farmed in the more arid south. The mean carrying capacity (stocking biomass) in the basin is low, ranging from about 25 kg/ha in the extreme north and east to less than 10 kg/ha in the south and west. Because of the low and highly variable rainfall in the basin, the carrying capacity also varies considerably from year to year. The south-west of the basin is the driest part and is unsuitable for any agricultural activity, but it is highly suitable for eco-tourism, or as conservation or wilderness areas.

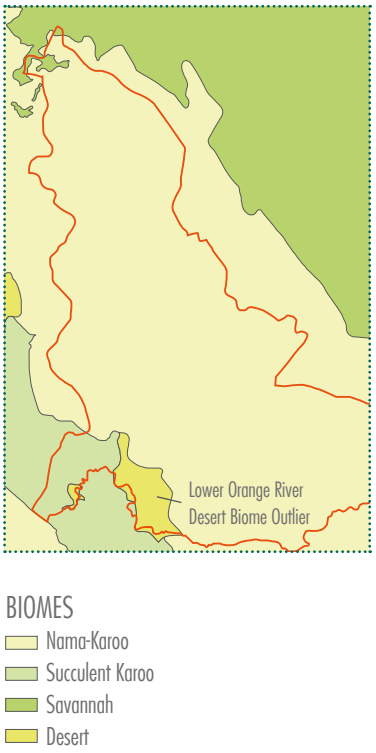

Figure 5: Biomes represented in the Orange–Fish River basin
Source: Irish, 2009

At Aussenkher, water is pumped from the river to irrigate farmlands.

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4. PRIORITY CONCERNS

4.1 NATIONAL CONCERNS

Through the various studies conducted as part of the TDA and regional and national stakeholder consultation processes, four transboundary priority problems were identified as having led to a decline in ecosystem health and functioning of aquatic ecosystems in the basin. These are:

- Increasing water demand;
- Declining water resources quality;
- Changes to the hydrological regime;
- Land degradation.

Increasing water demand

The main water-use sectors in the basin are irrigation, livestock, mining, urban centres, domestic and the environment. Demands are steadily increasing with little surplus resources to allow for increased abstraction. Although surface water is available at the major dams within the basin (Figure 3), the greater basin area has limited access to surface water and relies on groundwater for domestic use, stock watering and even some irrigation. Little is known about this hidden resource, in terms of both quantity and quality. There is a fear that irrigation on the Stampriet aquifer may lead to over-abstraction and pollution of the source. Furthermore, the impacts of land-use and management practices on groundwater quality are unknown.

Although Namibia is an arid to semi-arid country, water supply services are poorly managed, particularly by local authorities, largely because of limited technical and managerial capacity. This results in increasing debt, i.e. of consumers owing local authorities and local authorities in turn owing NamWater. Limited capacity also leads to water wastage due to unmaintained and aging water infrastructure.

The volume of water currently reaching the mouth of the Orange–Senqu is estimated to be approximately 5,500 Mm^3/a on average – approximately half of the annual natural flow estimated at 11,500 Mm^3. The decrease in the number of floods, the change in pattern of flow and the reduction in quantity and quality of water reaching the river mouth is a concern to Namibia because this has resulted in the degradation of the estuary. The estuary is of significant biodiversity importance and is also a potential tourist attraction in Namibia.

Declining water resources quality

The key water quality issues in the Namibian part of the basin are high nitrite/nitrate and fluoride concentrations, groundwater salinity and potential pollution from improper sanitation facilities and irrigation.

In parts of the basin, very high nitrate/nitrite concentrations in groundwater are reported that exceed the 45 mg/ℓ limit for human consumption. Currently, this does not pose a risk to surface waters or the aquatic environment, but might have a negative impact on humans, especially babies, and livestock. The high nitrate/nitrite concentrations are most likely due to irrigation-derived nutrients and cattle-watering stations.

Groundwater quality is influenced by the geology of the basin. Groundwater salinity is a major problem in the area referred to as the 'salt block'. With predominantly shallow groundwater tables in the basin, recharge of groundwater happens very fast after rainfall events. As a result, pollutants can easily be transported into the aquifer system and therefore special precautions are necessary to prevent this.

Improper sanitation facilities (including lack of sanitation facilities and improperly managed sewerage systems in almost all local authorities and some lodges) is believed to contribute to pollution of both surface and groundwater sources, and consequently

Water from Hardap Dam flows along 16 km of concrete-lined canals and pipelines to irrigate 2,000 ha of farmland.

Opposite page: Colourful Barberton daisies (*Gerbera jamesonii*) are commercially grown in greenhouses by the Rehoboth Community Trust and are watered using groundwater from the ephemeral Oanob River in Namibia. Controlling the climate under sheltered greenhouse conditions helps reduce evapotranspiration and water requirements.

poses a threat to human health. Most of the wastewater treatment facilities in Namibia are overloaded and deliver substandard effluent unsuitable for discharge into the environment. The majority of the towns and settlements in the basin rely on oxidation and maturation ponds which were originally designed not to discharge effluent into the environment. Seepage from unlined ponds creates an immediate threat to groundwater resources. Pond systems, such as in Rehoboth, are a good example of such sources of pollution. As a result of both organic and hydraulic overloading, substandard effluent is discharged into the environment (rivers and dams), for example from abattoirs and the tannery at the Brukarros Meat Processor plant.

All water users and local authorities are required to have effluent discharge permits. However, often the conditions of permits are not complied with and DWAF has limited capacity to follow up and conduct periodic monitoring visits to the sites.

Changes to the hydrological regime

As a consequence of upstream development, the hydrological regime of the river, especially downstream of the Vanderkloof Dam, has changed dramatically. Apart from the mean annual runoff being reduced to half the estimated natural flow, the pattern of flow is very different from that of the natural river. There is less variability in flow from one year to the next and within the year there is a less distinct seasonal pattern. The frequency of smaller floods has also been reduced, with most being absorbed by upstream abstraction and storage. These changes in the hydrological regime of the river impact downstream ecosystems, especially at the estuary, a Ramsar site. In some localised areas, the changes in the hydrological regime have led to an increased risk of flooding due to increased occurrence of reeds and a reduction in turbidity. An increase in the occurrence of blackfly is also attributed to hydrological regime changes.

In 2005, preliminary assessments were done for the ecological water requirements for the Orange River, downstream of Augrabies, and at the river mouth. The releases required from Vanderkloof Dam for ecological water requirements were determined. In terms of water resource planning and yield analysis, the estuarine flow requirements control the allocated yield. According to the Lower Orange River Management Study, the desired category for the mouth is A or B, but the present ecological state of the river mouth is Category D+, largely modified and on a negative trajectory. The current inflow is less than 50 per cent of the natural inflow, and the occurrence of significant floods and even elevated flows is considerably reduced.

Improving the ecological category of the mouth is highly dependent on flow patterns, particularly seasonality, and the removal of non-flow-related impacts. The best attainable ecological state for the mouth is considered to be Category C. In order to reach Category C, a Category D state for the river mouth must first be achieved and maintained, i.e. the necessary variability of inflow should be re-introduced to stop the negative trajectory of the river (Category D requires a flow of about 1,060 Mm^3/; Category C requires an additional 500 Mm^3/a on top of this), and in addition, the non-flow-related issues must be addressed. To achieve these improvements in the ecological state of the mouth and continue to meet existing upstream irrigation demands would require re-regulation of the river flows and a concerted effort to address the impacts of human presence at the mouth.

Land degradation

Unsustainable land management practices in Namibia are particularly evident in the agriculture sector, for example in the form of inefficient irrigation systems, overstocking and overgrazing.

Commercial and subsistence livestock farming is the leading land-use type in both the Nossob–Auob and Orange–Fish river basins. Like the rest of Namibia, livestock are

kept as a source of income, as well as for cultural reasons. Land degradation in the basin is due to overstocking, lack of mobility due to land being divided into farming units, drought subsidies, unsuitable distribution of water and boreholes, and poverty. Loss of vegetation cover is perhaps the most obvious indicator of rangeland degradation, ranging from the loss of grass species diversity and perennial grasses, a loss of grass vigour, to a loss of ground cover and land productivity, increasing vulnerability to drought and facilitating encroachment of undesirable plants.

Increases in distribution and abundance of alien species contribute to loss of biodiversity, changes in the flow of rivers, loss of water yields (surface and ground) and general environmental degradation. Some alien invasives are pioneer species which take advantage of disturbed areas and outcompete indigenous species.

Prosopis was introduced in Namibia for fodder and shade in the 1960s. Since then, *Prosopis* densities have been increasing in many of the ephemeral watercourses in southern and central Namibia. These watercourses include the Fish, but the impact is especially noticable on the Auob and Nossob rivers. *Prosopis* plants are considered to have a more adverse ecological impact than all other alien plants in Namibia. *Prosopis* prevents groundwater infiltration and recharge and in areas of dense growth (for example, the Black Nossob at Leonardville) it also impedes surface flow, which is why the species is believed to use a lot of groundwater. *Prosopis* also displaces native species and reduces the aesthetic value and biodiversity of the areas it invades. As the impact of *Prosopis* is not understood properly, there are limited or no measures to manage it.

4.2 NATIONAL PLANS AND PROJECTS ADDRESSING NATIONAL CONCERNS

International context

Although the Namibia Action Plan aims to address national concerns, it also serves as a vehicle for SAP implementation. As a result, the Action Plan is developed against the background of internationally agreed policies such as the ORASECOM Agreement, the Revised SADC Protocol on Shared Watercourses and the UN Framework Conventions on desertification, biodiversity and climate change. The Action Plan also aims to include strategies to reach the Millennium Development Goals. These examples illustrate the comprehensive nature of the Action Plan/SAP (see Table 3). Through these policies, the country has committed itself to aligning its national policies and strategies with these global agreements.

Table 3: Main international agreements ratified by Namibia

International agreement	Date of ratification/accession
Revised SADC Protocol on Shared Watercourses	2000
ORASECOM Agreement	2000
Permanent Water Commission for the Orange River (between Namibia and South Africa)	1992
UN Convention to Combat Desertification	1995
UN Framework Convention on Climate Change	1996
UN Convention on Biological Diversity	1995
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	2001
Convention on Wetlands of International Importance (Ramsar Convention)	2004

This canyon on Namibia's ephemeral Fish River is claimed to be the second largest in the world.

National context

This section highlights the policies and strategies formulated at national level to address national concerns which are also the priority environmental issues for the Namibia Action Plan.

National development policies

The Namibian Vision 2030 sets out the long-term aspiration of the country: its goal is to improve the quality of life of the people of Namibia by 2030 to the level of their counterparts in the developed world. The quality of life of rural communities could be significantly improved through access to potable water supply. The fundamental importance of water in Namibia has been recognised by the government. The Ministry of Environment and Tourism commissioned a series of State of the Environment reports in the early 2000s, the first of which was on water. This report provides a baseline on the most important information relating to water, its quantity, distribution and uses in the country.

Implementation plans

The national IWRM Plan was adopted by Cabinet in 2012, as the guiding framework for water resources management in Namibia. Many of the basin management committees in Namibia are using this overall framework to develop their own basin plans. The Okavango River Basin Management Committee, for example, adopted its Action Plan as its long-term planning/strategic document.

Water master plans have been developed by DWAF and NamWater. Relevant master plans for the Namibian part of the basin include: Use of Perennial Rivers, Use of the Fish River and Use of Groundwater.

The site of the proposed Neckartal Dam on the ephemeral Fish River. On completion, it will be the largest dam in Namibia and supply irrigation water to 5,000 ha of land.

Projects contributing to managing increasing water demand

DWAF is responsible for national water planning, protection, development and management. Consequently, it has to generate information and knowledge on the status of current and potential water resources in the country. The situation assessment that was conducted as part of the IWRM Plan provides estimates on water demands and water resources potential for the various basins within the country.

DWAF implements monitoring programmes (surface, groundwater, water quality) to improve the understanding of the potential of water resources. However, the monitoring programmes are limited by technical capacity. The monitoring programme is therefore not extensive, does not cover all the necessary parameters and there is limited enforcement. NamWater, as the bulk water supplier, also monitors water availability and quality.

The proposed Neckartal Dam meant for irrigation, is the largest water development project in the basin at the moment. Another dam, the Noordoewer/Vioolsdrift Dam is also proposed jointly by Namibia and South Africa.

Other relevant projects are:

- two new gauging stations on the Orange River;
- a real-time model for the Lower Orange River under development (for surface water monitoring);
- water demand management and conservation demonstration project at Namdeb mine on the Orange River;
- Stampriet groundwater mapping project;
- capacity-building project for local authorities in water management;
- UNDP–GEF irrigation demonstration project in Noordoewer and Vioolsdrift looking to improve irrigation techniques.

Crossing the Fish River on a donkey-cart near Gibeon village; there is no bridge at Gibeon, necessitating a 15-km detour to the nearest bridge when the river is in flood.

Projects aimed at addressing changes to water resources quality

DWAF has a water quality monitoring programme for the Orange River, including the Stampriet area.

The Orange–Fish River Basin Management Committee also identified water quality monitoring as a priority in the basin. The committee at one stage sought funding to develop and implement a participatory monitoring programme to assist DWAF because of its limited human resource capacity.

DWSSC through the National Sanitation Strategy is committed to enhancing access to improved sanitation and building capacity at different levels for appropriate sanitation management. The directorate is supported by various development partners.

The Desert Research Foundation of Namibia (DRFN), with funding from the Embassy of Finland, supported four local authorities in the basin to enhance sanitation and waste management. The DRFN also piloted dry-sanitation facilities in the basin, to determine which ones are best suited to the environmental and socio-economic conditions in the basin.

Projects contributing to addressing changes in hydrological regime

The most significant impact from changes in the hydrological regime is the degradation of the river mouth. The Lower Orange River Management study recommended the implementation of an extensive monitoring programme to improve the understanding of the ecology and flow regimes of the Orange River and mouth. Namibia and South Africa are jointly constructing low-flow gauging weirs on the Lower Orange, the last one being at Sendelingsdrift. The UNDP–GEF Benguela Current Large Marine Ecosystem Project is aimed at developing a management plan for the river mouth and a draft management plan has recently been produced. A study was conducted to estimate environmental flow requirements of the Fish River, the Lower Orange and the river mouth.

This gauging station at /Ai–/Ais is one of the few on the Fish River with a long-term record of flow.

Projects aimed at addressing land degradation

- MAWF/DEES has a programme to provide extension services to farmers in communal rural areas. Its main aim is to build capacity of farmers for better rangeland management practices.
- UNDP–GEF implemented the five-year Country Pilot Partnership for Sustainable Land Management project, until 2012. A number of communities in the basin benefited from this project.
- Rehabilitation of small mines on the Orange River.

4.3 KNOWLEDGE GAPS AND OTHER CONSTRAINTS

Namibia has a water policy and legal framework to support integrated resource management approaches such as IWRM, community-based natural resources management and integrated sustainable management. Despite the integrated approach to its policies, limited institutional coordination and integration within and across line ministries continue to be significant constraints in IWRM implementation. This is mainly due to fragmentation of management responsibilities across the line ministries, as well as unharmonised policies and limited institutional capacities.

Basin management committees are established to coordinate the implementation of IWRM at basin level. Although the existing committees are gradually building capacity to execute their functions, they still require strengthening in terms of management capacity, integrated planning, technical skills and financial resources. Some basin management committees have been established to provide platforms for information exchange, coordinated planning and capacity development of stakeholders, mainly by improving understanding of water resources. A basin management committee has been established for the Orange–Fish River basin. At present there is no committee for the Nossob–Auob, however a water management body focuses on groundwater management for irrigation in Stampriet.

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5. THE ACTION PLAN

5.1 ACTION PLAN DEVELOPMENT PROCESS

The Action Plan in each country is structured around the four environmental priority areas of concern identified in the TDA: increasing water demand, declining water resources quality, changes to the hydrological regime and land degradation. Through the Action Plan consultation process, each country prioritised four areas of concern from its national perspective. In response to each priority area of concern, national targets were set to address these concerns over a ten-year time period. Interventions were then identified to meet the targets. In line with national policies, strategies and plans, project concepts were developed that package the proposed interventions into structured, implementable projects. These project concept notes (PCNs) form the backbone of each Action Plan.

The Action Plan development process involved intersectoral dialogue to achieve integration of water resources management and, most importantly, national endorsement of the Action Plan. Action Plans feed into the SAP but are independent planning products and their success depends on receiving full support of both state and non-state stakeholders. In practice this means that the political and technical guidance for the Action Plans comes from the countries, through an Action Plan Working Group as well as a broader National Stakeholder Platform, each structure specifically set up for the purpose of Action Plan (and SAP) development.

While it is part of the national stakeholder forum, the Action Plan Working Group is smaller in size (between five and eight members), comprised mostly of individuals holding positions in government related to water, planning and finance. Each country's delegate to the ORASECOM Technical Task Team was appointed as the national coordinator of the Action Plan/SAP process for their country. With support from the consultant team, the Action Plan Working Group was primarily responsible for the development of the Action Plan (and the SAP, together with the Action Plan/SAP Working Groups from the respective other countries) and provided the technical and political guidance for the formulation of the Action Plan.

The National Stakeholder Platforms consist of stakeholders representing a wide range of role-players, including both state and non-state participants. While established initially for the purposes of Action Plan/SAP development, the aim is that the National Stakeholder Platforms and the Action Plan Working Groups are maintained in the long term and become permanent national partners with ORASECOM.

Two workshops of the National Stakeholder Platform were held at national level in each country, in addition to regular meetings of the (smaller) Action Plan Working Groups. Furthermore, the Action Plan Working Groups from the four basin states met collectively three times throughout the process, forming the regional Action Plan/SAP Working Group. This served to ensure synergy between the four Action Plans, as well as joint development of the SAP as the basin-wide planning document.

In addition to the National Stakeholder Platforms and Action Plan/SAP Working Groups, there were other key role-players in the Action Plan/SAP development process. The ORASECOM Secretariat and the United Nations Office for Project Services (UNOPS) provided important political and technical guidance to the process. Likewise, regular information exchange and coordination with other ongoing initiatives (notably the Orange–Senqu Basin IWRM Plan development process) took place in order to ensure technical coherence and harmonisation of the Action Plans (and SAP) with the Orange–Senqu Basin IWRM Plan.

Opposite page: The grapes grown at Aussenkehr provide a market in Europe at a time when other vineyards are not able to.

5.2 ACTION PLAN RATIONALE

In response to the problems identified at transboundary level and the priority areas of concern identified at national level, four priority areas were identified for the Namibia part of the Orange–Senqu River basin. The priority areas are closely inter-linked because of the integrated nature of the natural resources being managed and the common goal for management of the Orange–Senqu River basin as a whole. The Action Plan for Namibia identifies objectives, targets and interventions with a view to resolving the problems and threats to the integrity of the river basin, at national level, to promote sustainable management and development of the Orange–Senqu River basin.

5.3 ACTION PLAN PRIORITY AREAS AND TARGETS

The Namibian Action Plan has the following priority areas:
- Increasing water demand;
- Declining water resources quality;
- Changes to the hydrological regime;
- Land degradation.

Table 4 details the defined country targets for the four priority areas of concern as well as the proposed interventions required to address the priority areas and achieve the agreed targets. Based on the identified, required interventions, project concept notes have been developed aimed at addressing the priority problems and achieving the Action Plan targets. Priority concerns that can be addressed at national level are included in the Action Plan project concept notes, while those issues that require basin-wide intervention are integrated into SAP project concept notes.

Dates require a lot of water, but is labour intensive, virtually pest free and once dried are relatively easy to market. The dates grown here at Naute Irrigation Scheme are marketed in Europe at the time of Ramadan.

Table 4: The Namibia Action Plan

Targets	Proposed interventions	Project concept note	Ongoing initiatives	Policies/strategies/plans/programmes
PRIORITY AREA 1: INCREASING WATER DEMAND				
Objective: Sustainable water resources management and development				

1 Understanding of surface water and groundwater, including climate variability and change improved	• Determine the size and sustainable yield for the Stampriet aquifer (and other aquifers)
	  • Further groundwater assessment required through exploration, drilling and testing; assessment of the groundwater flows
	  • New aquifer potential maps showing sustainable yields and water quality
	• Establish surface/groundwater models
	• Evaluate historic data for rainfall and runoff modelling
	• Maintain the existing surface and groundwater databases
	• Publish water availability data on the website
		PCN 1: Improving groundwater resources management to enhance water supply in the Nossob–Auob sub-basin
		SAP PCN 2: Groundwater management and use
			• Stampriet transboundary groundwater investigation; DWAF Geohydrology – UNESCO
			• Construction of gauging weirs at Gras, Sendelingsdrift and Blouputs
			• Ongoing hydrology data collection (DWAF hydrology)
			• Growas and Hydstra databases (DWAF)
			• Daily flood bulletin (DWAF)
				• IWRM Plan
				• ORASECOM IWRM Plan phases 2 and 3 (planned)

2 Water demand management strategy implemented	• Assess, verify and update current and future water demand data per sector • Assess existing sectoral water-use practices, enforce efficient water use and public reward best practices • Promote/implement best water demand management practices as per strategy	PCN 2: Improving water-use efficiency and demand management in local authorities PCN 3: Water conservation and demand management in the irrigation sector	• Water-use efficiency in the irrigation sector – pilot project by UNDP–GEF • Ongoing assessment by DWAF, e.g. through national IWRM Plan; DWAF planning and water environment has started assessments in some municipalities and mines • Local authority capacity-building initiatives by the DRFN (Gobabis, Gibeon, Kalkrand, Stampriet)	• Water Demand Management and Water Use Efficiency Strategy, 2012
PRIORITY AREA 2: DECLINING WATER RESOURCES QUALITY				
Objective: Water resources quality is managed and maintained within national and international standards/guidelines				
1 Understanding of water resources quality improved	• Water quality monitoring • Integration of monitoring networks/systems • Awareness raising on pollution	PCN 4: Improvement of water quality management and pollution control SAP PCN 1: ORASECOM information and knowledge management	• Agrochemicals study by DWAF Water Environment • Transboundary water quality monitoring (European Union, GEF, DWAF) • Environmental flow (Fish and Orange rivers) by ORASECOM • Pollution control and compliance monitoring by DWAF Water Environment • Water quality monitoring by NamWater (dams and boreholes) • Plans to develop a water quality laboratory by DWAF • Water quality monitoring by DWAF Water Environment and DWAF	
2 Mechanisms for pollution control developed, enforced and implemented	• Finalise and enforce pollution control regulations • Enhance coordination in the sector	PCN 4: Improvement of water quality management and pollution control	• Drafting of pollution control regulations • Ongoing compliance monitoring to permit conditions	• Draft water quality regulations and standards (for Water Act)

Targets	Proposed interventions	Project concept note	Ongoing initiatives	Policies/strategies/plans/programmes
3 Awareness of the impact of agrochemicals/POPs on water resources quality created	• Study of agrochemicals • Create awareness of impact, use and management of agrochemicals		• Study of agrochemicals by DWAF Water Environment	
4 Innovative methods for water quality improvements identified and implemented in pilot sites	• Investigate options for wastewater re-use in local authorities • Implement wastewater re-use technologies • Investigate and implement small-scale desalination where appropriate • Research on appropriate use of non-potable water for uses such as mining, construction, agriculture	PCN 4: Improvement of water quality management and pollution control	• Wastewater re-use in Tses • Planned wastewater treatment for /Ai-/Ais Hot Springs Resort • SADC IWRM pilot project in Keetmanshoop on water re-use • Local authority capacity-building on wastewater treatment by DRFN (Stampriet)	
PRIORITY AREA 3: CHANGES TO THE HYDROLOGICAL REGIME				
Objective: Adverse effects of changed hydrological regime mitigated				
1 Environmental flow requirement for the river mouth determined and adhered to	• Finalise environmental flow requirements study and implement recommendations thereof in collaboration with Lesotho and South Africa	SAP PCN 3: Basin-wide environmental flows regime	• Study on environmental flows requirements for Orange and Fish Rivers	• National Water Policy, 2000
2 Integrated management plan for the river mouth (Ramsar site) developed and implementation ongoing	• Establish and implement joint dam operation protocols (basin wide) • Finalise and approve the Orange River Mouth Management Plan by interim Orange River Mouth Management Committee	SAP PCN 4: Orange–Senqu River mouth management	• Lower Orange River Operational System – South Africa • Feasibility study of Noordoewer/Vioolsdrift re-regulation dam (planned) – DWAF	• Draft Orange River Mouth Management Plan
3 Siltation and reed growth below Hardap Dam controlled	• Dredging silt out of Hardap Dam • Raising of Hardap Dam wall • Widening and deepening of the Fish River • Eradication of reeds and alien invasive species • Manage fertilisers use/return flow from flood irrigation (reed re-growth control) • Develop and widely disseminate awareness materials on invasive species for different audiences (communities, farmers, environmentalist, decision-makers)		• Mariental Flood Task Force • Feasibility study for dredging • Plans on raising the dam wall (terms of reference developed) • Pilot activities on reed clearing ongoing through dredging as well as biannual reed spraying • Clearing of *Prosopis* near Ausenkher ongoing	

Targets	Proposed interventions	Project concept note	Ongoing initiatives	Policies/strategies/plans/programmes
PRIORITY AREA 4: LAND DEGRADATION				
Objective: The adverse effects of land degradation are reduced and the sustainability of land use is improved				
1 Sustainable land management practices implemented	• Best rangeland management practices (in the policy and strategy) implemented • Foster community-based natural resources management initiatives • Identification of new income-generation initiatives	PCN 6: Alternative land-use options for improved rangeland conditions and sustainable livelihoods	• Game translocation scheme by MET • Land-use plan Karas and Hardap (Ministry of Lands and Resettlement) • Transfontier Conservation areas initiative (MET) • Greater Fish River Landscape Initiative (MET–NAMPLACE) • Local level monitoring (MAWF–DEES) • Bio-mass determination project (MAWF) • Kalahari–Namib Project (International Union for the Conservation of Nature)	
2 Environmental impact of alien species understood and the spread is controlled	• Map alien species • Implement eradication and rehabilitation programmes • Create awareness • Investigate and develop products for income generation of alien species	PCN 5: Control of invasive species through integrated management in a pilot area in the Orange–Fish River Basin SAP PCN 5: Control of alien invasive species	• Dredging of reeds (Fish River) • Invasive alien eradication programme (MET) – Naute, /Ai-/Ais–Richtersveld Transfrontier Park, Hardap, Sperrgebiet National Park	

5.4 ACTION PLAN IMPLEMENTATION, COORDINATION AND MONITORING

The Action Plan has been designed as a portfolio of project concepts. Funding is sought for each project, either individually or for a combination of projects. Potential funding sources are primarily national governments, international cooperation partners and, to some degree, the private sector.

In line with the project approach to the Action Plan, implementation is not through a central implementation agency responsible for the entire Action Plan. Instead, implementation is project-specific and the implementation mechanism is dependent on the requirements of the lead implementing agent for each respective project. A proposed implementation mechanism at project level is described in each project concept note.

Overall coordination and monitoring of the Action Plan is through the relevant government line ministry(ies) using their established structures and systems. Therefore, close collaboration with ORASECOM is necessary to ensure synergy in coordination and monitoring of the implementation of Action Plan (and SAP) activities in the four basin states.

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Opposite page: Hardap Dam consists of a rockfill embankment with an upstream bituminous concrete blanket. The wall is 35.5 m high and 865 m long.

Hardap Dam

ANNEXURE 1: PROJECT CONCEPT NOTES

PROJECT CONCEPT NOTE 1

CORE DATA	
Project number	Namibia PCN 1
Project title	Improve groundwater resources management to enhance water supply in the Nossob–Auob sub-basin
Action Plan priority area	Increasing water demands
Short description	The project will give an indication of existing and potential groundwater resources through targeted research. The information will be used to derive sustainable groundwater-use options. The proposed actions will be tested during the project implementation phase.
PROJECT RATIONALE	
Background	Groundwater is widely used in the Nossob–Auob sub-basin in Namibia. Surface water does not contribute greatly to the water demand of the basin, although water supply to the urban areas of Rehoboth and Gobabis is from existing dams (Oanob, Otjivero, Daan and Tilda Viljoen). The Nossob–Auob sub-basin is part of the transboundary Molopo–Nossob basin, which is in turn part of the larger Orange–Senqu River basin. The Molopo–Nossob basin is shared by Namibia, Botswana and South Africa. Groundwater recharge across the basin depends on ephemeral rivers. Rural communities and livestock farmers rely mainly on boreholes which are often low yielding and difficult to site. Irrigation is taking place on the Stampriet aquifer. This artesian aquifer is considered to be fragile and is classified as one of the eight national protected groundwater bodies (water control areas). Groundwater investigations and monitoring is critical in this sub-basin because: • water supply is predominantly from groundwater and there is potential risk for over-exploitation; • the sub-basin has not received enough attention (e.g. it has limited data and information); and • it is part of a transboundary basin.
Project objectives	1 Groundwater resource potential in the basin is determined. 2 Sustainable groundwater management options are determined and applied.
Integration with relevant ongoing projects/ initiatives	In 2009, ORASECOM commissioned a study: Groundwater Review of the Molopo–Nossob Basin for Rural Communities including Assessment of National Databases at the Sub-basin Level for Possible Future Integration. The German Federal Institute for Geosciences (BGR) has done similar work in the Cuvelai–Etosha basin as well as in the neighbouring Epukiro–Eiseb basin. Recommendations and experiences from the projects will be taken up further in this project.
Project outcomes	1 Detailed information on resource potential (potential, use, sustainable yields) is available. 2 Groundwater monitoring network updated and strengthened. 3 Groundwater use and management is improved.

The /Ai-/Ais–Richtersveld Transfrontier Park straddles southern Namibia and north-western South Africa and features magnificent barren landscapes, spectacular river valleys and the richest succulent flora in the world.

Technical approach	**OUTCOME 1: DETAILED INFORMATION ON RESOURCE POTENTIAL (POTENTIAL, USE, SUSTAINABLE YIELDS) IS AVAILABLE** Groundwater is widely used in the Nossob–Auob sub-basin, but the water resource potential is not fully understood. The project seeks to make detailed information available, i.e. on potential of groundwater availability, define sustainable yields and map current uses. **Output 1.1 Water use and demands determined** • Determine current usage (abstraction) of groundwater. • Determine (estimate) future demands. • Document results. **Output 1.2 Status of current boreholes determined** • Sensitise communities on the hydrocensus survey. • Collect information on existing boreholes through a mini-hydroncensus (survey of borehole locations and their status, include water quality). **Output 1.3 Behaviour of aquifers and sustainable yields determined** • Determine priorities for geohydrological investigations (geophysical, recharge studies). • Conduct investigations. • Determine safe yields of selected aquifers. **OUTCOME 2: GROUNDWATER MONITORING NETWORK UPDATED AND STRENGTHENED** This outcome is about strengthening the existing monitoring network of DWAF. This will be achieved through updating parameters and monitoring procedures as well as building the technical capacity for monitoring. **Output 2.1 Institutional capacity for groundwater resource management (including monitoring) developed** • Determine skills requirement to maintain the monitoring network. • Build DWAF capacity through formal staff training and short courses. **Output 2.2 Existing monitoring network updated** • Update monitoring parameters and update where relevant. • Update data collection procedures. • Update database with new information (from Outcome 1). **OUTCOME 3: GROUNDWATER USE AND MANAGEMENT IS IMPROVED** Data and information collected in this project will be used for improving groundwater use and management. **Output 3.1 Participatory groundwater management approach implemented** • Develop decision support tools (e.g. groundwater harvest potential map which is used in the South African part of the basin). • Sensitise groundwater users on the importance of groundwater protection and the role they can play. • Determine a model for stakeholder participation in groundwater management. • Pilot the model for stakeholder participation.
Assumptions and risks	The DWAF has enough staff with capacity to drive the project.
IMPLEMENTATION	
Project duration	Five years
Project cost	USD1,500,000
Proposed funding sources	To be secured
Implementation mechanism	To be determined

PROJECT CONCEPT NOTE 2

CORE DATA	
Project number	Namibia PCN 2
Project title	Improving water-use efficiency and demand management in local authorities
Action Plan priority area	Increasing water demand
Short description	The project seeks to improve water-use efficiency in local authorities. It aims to reduce annual water growth in selected local authorities, reduce non-revenue water and improve cost recovery. Lessons learnt will be documented for future application in other local authorities.
PROJECT RATIONALE	
Background	Although Namibia is an arid to semi-arid country, water is poorly managed, particularly in local authorities due to limited technical and managerial capacity. This results in high non-revenue water, unnecessary increase in water demand, and increasing debt – of consumers owing local authorities (largely due to improper water metering, inequitable tariffs and billing) and local authorities in turn owing NamWater (water utility). The non-revenue water in local authorities in Namibia ranges between 6 per cent and 50 per cent. In 2013, the Ministry of Regional Local Government, Housing and Rural Development identified 12 local authorities within the basin for poor performance in terms of service delivery (including water). The target of the Water Demand Management Strategy (which is part of the national IWRM Plan) is to maintain annual water growth in urban areas at a rate of lower than three per cent per annum, even with economic and population growth. Windhoek municipality has demonstrated that this is achievable through its water demand management policy and practices.

Project objectives	1 Water-use efficiency in selected local authorities improved. 2 A model for wider application of water-use efficiency in local authorities developed.
Integration with relevant ongoing projects/ initiatives	In 2010, a national review on water demand management and water-use efficiency for all the water-use sectors was conducted as part of the IWRM Plan. The process had a strong element of stakeholder consultations and involvement in the formulation of the Water Demand Management Strategy and Action Plan. The Action Plan offers practical measures as well as targets for all water-use sectors to improve water-use efficiency and demand management. It draws on experiences from the country as well as best practices from elsewhere. This project will implement some of these good strategies, while learning from local authorities that are implementing water demand management, e.g. Windhoek, Walvis Bay, Arandis and Karibib.
Project outcomes	1 Baseline indicators for water-use efficiency set. 2 Non-revenue water reduced and cost recovery improved. 3 A model for replication adopted.
Technical approach	**OUTCOME 1: BASELINE INDICATORS FOR WATER-USE EFFICIENCY SET** The first step for the project it to do a proper situation assessment to determine annual water growth rates, quantify non-revenue water and current cost recovery levels. This will be followed by reaching agreements on performance indicators that the local authorities will be working towards. Experience from other local authorities in Namibia has shown that technical solutions alone cannot fix the problems. As a result, the project will look into barriers that hinder water-use efficiency and demand management. Such factors could include limited management and technical capacities, funding and political interferences. The project will offer solutions to enhancing management and technical capacities; it expects to reduce dependency on external funding sources due to improved financial systems within the local authority. **Output 1.1 Pilot local authorities for the project selected** • Desktop review of water use and management in local authorities in the basin. • Develop criteria for site selection. • Select pilot sites and sign agreements with the selected local authorities. **Output 1.2 Current water use and management situation in the selected local authorities determined** • Conduct meetings and workshops with staff of local authorities as well as consumers to map the current situation. • Map current situation. **Output 1.3 Performance indicators agreed upon (on annual water growth, non-revenue water and cost recovery)** • Determine current performance levels (meetings, field research and data analysis). • Determine current performance challenges. • Set performance targets in accordance with the national Water Department Management Strategy. **OUTCOME 2: NON-REVENUE WATER REDUCED AND COST RECOVERY IMPROVED** This outcome will focus on improving non-revenue water through technical and management interventions. The project will work to build the capacity of local authorities to reduce non-revenue water and improve cost recovery. This will be done through hands-on actions in the local authority, i.e. enhancing administrative, institutional and infrastructural systems while building the capacity of local authority. **Output 2.1 Capacity for implementation built** • Determine capacity requirements to achieve the set targets. • Develop capacity for implementation (formal training and mentoring). • Develop implementation plan (include support requirements and mechanisms). • Continuous implementation of the plan as well as monitoring and evaluation (include technical and management solutions). **OUTCOME 3: A MODEL FOR REPLICATION ADOPTED** For most local authorities, there are external factors (e.g. political interference through the councils and interactions with ministries, i.e. Ministry of Regional Local Government Housing and Rural Development) that influence performance of the local authorities. Results from the project will be communicated to decision-makers to further support (e.g. financially) the local authority and for replication of lessons learnt. **Output 3.1 A model for replication developed and adopted** • Hold workshops to consolidate lessons learnt in all local authorities. • Develop a model for replication based on lessons learnt. • Share the model with decision makers and seek adoption.
Assumptions and risks	• Political interference and constant changes in staff in the local authority. • Ministry of Regional Local Government, Housing and Rural Development support for the project.
IMPLEMENTATION	
Project duration	Four years
Project cost	USD4,400,000
Proposed funding sources	To be secured
Implementation mechanism	To be determined

PROJECT CONCEPT NOTE 3

CORE DATA	
Project number	Namibia PCN 3
Project title	Water conservation and demand management in the irrigation sector
Action Plan priority area	Increasing water demands
Short description	The use of recent research findings to increase the efficiency of irrigation water use.
PROJECT RATIONALE	
Background	In the Orange–Senqu River basin in Namibia the irrigation sector accounts for roughly 76 per cent of all water abstractions. Approximately the same percentage applies for actual abstraction from the Orange–Senqu River. The water is used mainly for the production of high value crops, i.e. table grapes and dates, and to a lesser extent to irrigate fodder crops and vegetables. The sector is a major employer, contributes significantly to earning foreign currency and contributes to rural livelihoods, as well as supporting agri-processing industries through high economic multiplier effects. Expansion of this economic activity is constrained by the availability of water for irrigation and the high costs to develop and farm new land cost-effectively further away from the river and at considerably higher elevations. The system of water allocation to agriculture has in the past not incentivised the efficient use of water and, in common with most of Orange–Senqu River basin irrigation, it is believed that water-use efficiency can be improved. The Water Research Commission in South Africa has recently published three major research reports on irrigation efficiency (Reinders et al., 2010; Reinders et al., 2012; and Stevens, 2012). This project seeks to operationalise the research findings, as well as the findings from the UNDP–GEF supported irrigation efficiency demonstration project implanted in Noordoewer/Vioolsdrift in priority areas of the Orange–Senqu basin in both Namibia and South Africa.
Project objectives	1 Water-use efficiency protocol for the irrigation sector established. 2 Improved water-use efficiency in the irrigation sector.
Integration with relevant ongoing projects/ initiatives	The project seeks to improve water-use efficiency in the irrigation sector. The project will draw on research findings and experiences from similar interventions. These include findings from the research project: 'Standards and guidelines for improved efficiency of irrigation water use from dam wall release to root zone application'; findings from stakeholders' consultation on water demand management and water-use efficiency for the irrigation sector (part of IWRM Plan) and findings for the ORASECOM demonstration project on irrigation water efficiency in Noordoewer/Vioolsdrift, as well as performance indicators for the sector.
Project outcomes	1 Irrigation farmers and relevant authorities buy into the concept of water-use efficiency. 2 Water-use efficiency and consequently on-farm productivity increased. 3 The technology of increased efficiency is transferred to users, water-user associations and basin management committees.
Technical approach	**OUTCOME 1: IRRIGATION FARMERS AND RELEVANT AUTHORITIES BUY INTO THE CONCEPT OF WATER-USE EFFICIENCY** The project will seek to get buy-in from farmers into the concept of water-use efficiency. The farmers are already irrigating using methods they are familiar with. Changing practices is not expected to be easy. The project will therefore investigate and promote incentives for the shift and build capacity for adoption of sustainable practices. **Output 1.1 Standards and guidelines are accepted locally and adopted to local conditions** • Sensitise and raise awareness of irrigators on water-use efficiency. • Standardise and define terminology for water-use efficiency (definitions and formulae for distribution, surface storage, application, soil storage and return flow efficiencies). • Develop locally relevant tools and criteria to measure efficiency and practically achieve benchmarks. • Determine policy implications through consultations with key stakeholders. • Compile guidelines for improving water-use efficiency. **Output 1.2 Incentives to motivate the irrigators to improve water-use efficiencies agreed upon** • Carry out an assessment to understand irrigation water-use patterns and methods (including motivation for current methods). • Carry out a cost–benefit analyses for changing irrigation methods. • Determine potential incentives for shift in irrigation methods (towards water-use efficiency) in a participatory manner involving irrigators and government. **OUTCOME 2: WATER-USE EFFICIENCY AND CONSEQUENTLY ON-FARM PRODUCTIVITY INCREASED** This outcome is aimed at testing water-use efficiency instruments on selected farms. The project expects that the instruments will not only improve efficiency in water use, but will also increase productivity. **Output 2.1 The efficiency of proposed tools tested for adoption** • Apply the tools at selected locations to determine current efficiency levels, propose best management practices for improvement, and develop site-specific scenarios for water management. **Output 2.2 Implement best management practices at selected sites** • Implement practices that have shown to be sustainable. • Conduct ongoing monitoring and evaluation for both water use and farm productivity. **OUTCOME 3: THE TECHNOLOGY OF INCREASED EFFICIENCY IS TRANSFERRED TO USERS, WATER-USER ASSOCIATIONS AND BASIN MANAGEMENT COMMITTEES** Capacity of institutions at basin level will be built for sustainability of the intervention. This will include water-user associations as well as basin management committees. • Raise awareness on best practices and lessons learnt (include exposure trips to pilot sites). • Provide training to irrigators and support staff. • Develop options for transfer of technology in consultation with water users, government and basin management committees (including continuous support to the irrigators, e.g. through extension services). • Document lessons learnt and guidelines for replication/expansion.

Assumptions and risks	• The national department is able to coordinate its functions effectively. • Irrigation efficiency is low and can be improved without adverse effects on other dimensions of irrigation farming, such as salination of soil and deterioration in water quality. • Farmers and water-user associations are willing to participate. • Organised agriculture supports the initiative.
IMPLEMENTATION	
Project duration	Five years
Project cost	USD1,500,00 million
Proposed funding sources	To be secured
Implementation mechanism	To be determined

PROJECT CONCEPT NOTE 4

CORE DATA	
Project number	Namibia PCN 4
Project title	Improvement of water quality management and pollution control
Action Plan priority area	Changes to water resources quality
Short description	The project aims to improve and maintain water quality levels within national (and basin-wide) standards and guidelines. This is to be achieved through enhanced coordination and participation of stakeholders in water quality management and pollution control, strengthening legal instruments and piloting appropriate wastewater treatment options.
PROJECT RATIONALE	
Background	Pollution control, water quality and compliance monitoring in Namibia is currently not taking place as intended. There are limitations with respect to human resources capacity to collect and analyse data as well as to monitor quality and compliance. The situation is worsened by the absence of clear regulations (finalisation of these is delayed by the delay in the commencement of the Water Act). One of the most pressing concerns for pollution is inappropriate wastewater treatment plants in local authorities. Most of the wastewater treatment facilities in Namibia are overloaded and deliver substandard effluent which is not suitable for discharge into the environment. Most of the towns and settlements in the basin rely on oxidation and maturation ponds which were originally designed not to discharge effluent into the environment. Seepage from unlined ponds creates an immediate threat to groundwater resources.
Project objectives	Water quality is maintained within national (and basin-wide) standards and guidelines.

The date farm at Naute Irrigation Scheme

Integration with relevant ongoing projects/ initiatives	Within the basin, a project was recently initiated in Tses to treat wastewater through oxidation ponds and to re-use the water to grow crops. Similar projects are proposed for Keetmanshoop and Luderitz (which is outside of the basin). An assessment of sanitation and its contribution to water quality deterioration is envisaged for Sossuvlei in the latter part of 2013. Wastewater treatment and re-use is supported by the Water Supply and Sanitation Policy. This project is expected to generate lessons for implementation of the policy.
Project outcomes	1 Improved water quality and pollution control monitoring network. 2 Reduce pollution from wastewater treatment plants.
Technical approach	**OUTCOME 1: IMPROVED WATER QUALITY AND POLLUTION CONTROL MONITORING NETWORK** **Output 1.1 A sector-wide task force established to coordinate the monitoring network** • Identify and nominate key stakeholders at national level to the task force. • Raise awareness of water resources quality and pollution prevention. **Output 1.2: Water resources quality monitoring regime developed** • Identify water quality monitoring parameters in consultation with other basin countries. • Train staff on water quality monitoring (data collection, analysis and reporting). • Recruit additional staff. • Strengthen current monitoring system (identify opportunities for stakeholder participation in the monitoring regime). **Output 1.3 Strengthened pollution control and compliance monitoring** • Investigate application of pollution control instruments (e.g. polluter pays principle, green dot). • Formulate water quality regulations for the country. • Raise awareness of the regulations, standards and procedures. • Enforce the regulations. **OUTCOME 2: REDUCE POLLUTION FROM WASTEWATER TREATMENT PLANTS** The project aims to pilot innovative sustainable technology for water treatment which can possibly allow for re-use of the water. Many of the unsustainable alternative technologies are a result of poor integration between people and technology. This project will introduce/pilot an appropriate grey water treatment technology in local authorities with the aim of eliminating direct raw sewage disposal into river systems (e.g. Fish River). **Output 2.1 Awareness-raising and capacity-building on water quality, pollution and treatment built at local authority level** • Establish management principles, tasks and tools. • Develop training material. • Conduct training (theoretical and hands-on training). • Communicate results to relevant stakeholders (including development of information packages for clients). **Output 2.2 Feasibility study on water treatment (including re-use) conducted** • Undertake a feasibility study to improve the understanding of requirements as well as to ensure that the best treatment option is selected. • Assess the suitability of water re-use. • Conduct an environmental impact assessment as part of the feasibility study. **Output 2.3 Water treatment technology installed** • Install the appropriate water treatment technology.
Assumptions and risks	• NWR will be interested to update and invest in treatment of water quality.
IMPLEMENTATION	
Project duration	Three years
Project cost	USD500,000
Proposed funding sources	To be secured
Implementation mechanism	To be determined

PROJECT CONCEPT NOTE 5

CORE DATA	
Project number	Namibia PCN 5
Project title	Control of invasive species through integrated management in pilot areas in the Orange–Fish River basin, Namibia
Action Plan priority area	Land degradation
Short description	The project aims to eradicate invasive species in the basin in order to restore groundwater resources and biodiversity, while providing a fuel resource.

PROJECT RATIONALE	
Background	The project is aimed at clearing invasive species in the basin, with special emphasis on *Prosopis*. *Prosopis* species were introduced to South Africa and Namibia in the 1880s as shade, fodder and fuel trees. Invasive species are mostly found along watercourses (wet or dry) and drainage lines, forming dense, impenetrable, mono-specific thickets, doubling its distribution area every five years. Invaded areas have less plant diversity than areas that are not invaded because most alien invasive species out-compete indigenous plants for water and because it over-shades many of the smaller forbs. The dense growth form of *Prosopis* is understood to impact directly on agricultural land productivity and draws heavily on scarce groundwater resources which are vitally important in these arid areas. One densely invaded hectare transpires an estimated 997 m^3 of water per annum. Currently, inhabitants of large informal settlements such as those found in Aussenkehr, Noordoewer and Rosh Pinah burn rare, indigenous and ecologically important species, such as *Aloe dichotoma* (quiver tree), due to a lack of available wood locally. *Prosopis* wood is very hard and workable, and it makes excellent firewood or charcoal. The proposed pilot site falls within the /Ai-/Ais–Richtersveld Transfrontier Park. This site has been selected for these reasons: • Stakeholders (Orange–Fish River Basin Management Committee, /Ai-/Ais–Richtersveld Transfrontier Park Joint Management Board, Working for Water based in South Africa) are interested in the project. However, there is limited political buy-in and funding. • It falls within a national and transboundary conservation area, and just upstream of an internationally recognised biodiversity hotspot and Ramsar site. • It is close to the large informal settlements of Rosh Pinah and Aussenkehr where fuel wood is known to be limited.
Project objectives	Groundwater supplies and biodiversity in the basin is restored through eradication of invasive species.
Integration with relevant ongoing projects/ initiatives	Several studies have been conducted on invasive plant species in the basin, particularly on *Prosopis*. There is a small pilot project on *Prosopis* in the basin. Another eradication project was piloted in the Omaruru basin. Even though there is interest in *Prosopis*, actions to date have been small and uncoordinated. Namibia has no explicit regulation that deals with *Prosopis*.
Project outcomes	1 Distribution and abundance of invasive species in the basin determined. 2 *Prosopis* cleared from the pilot area. 3 Jobs are created.
Technical approach	**OUTCOME 1: DISTRIBUTION AND ABUNDANCE OF INVASIVE SPECIES IN THE BASIN DETERMINED** A key task to be undertaken is the mapping of the probable location of invasive species within the study area. Mapping is essential to determine the distribution, abundance and biomass of invasive species within the basin, to help determine and prioritise potential areas to target for eradication beyond the pilot project. **Output 1.1 Distribution map of invasive species** • Conduct field research on distribution of invasive species. • Conduct interviews and workshops/meetings with stakeholders in the basin to understand distribution of invasive species. **OUTCOME 2: *PROSOPIS* CLEARED FROM THE PILOT AREA** **Output 2.1 *Prosopis* in pilot areas cleared** • Determine effective methods for clearing through trials. • Clear *Prosopis* through the most effective method(s). • Rehabilitate cleared areas, e.g. through planting of indigenous plant species. • Monitor effectiveness of rehabilitation. • Document the process of eradication. **OUTCOME 3: JOBS ARE CREATED** **Output 3.1 Market opportunities for *Prosopis* determined** • Determine viable uses of *Prosopis* and other invasive species in consultation with communities. • Determine viability of sustainable job creation from *Prosopis* and other invasive species. • Secure marketing options for *Prosopis* and other invasive species. **Output 3.2 Capacity for production and marketing created** • Determine capacity requirements for effective production. • Train communities in production and marketing (hands-on training). • Develop training modules. • Conduct periodic monitoring, evaluation and adjustment. • Develop framework for replication and expansion.
Assumptions and risks	• It is assumed that the project will be supported by relevant ministries/organisations and agencies at national level in the same way it is welcomed at regional level. • While some of the attraction of the project is due to the potential problems it will solve regarding fuel wood shortages in the arid, informal settlements of southern Namibia, it is important that communities do not become so dependent on *Prosopis* (or wood in general) that demand for it overshadows the objective of removing this alien invasive species. To help prevent this from happening, training should prepare trainees for the post-project situation.
IMPLEMENTATION	
Project duration	Five years
Project cost	USD2,000,000
Proposed funding sources	To be secured
Implementation mechanism	To be determined

PROJECT CONCEPT NOTE 6

CORE DATA	
Project number	Namibia PCN 6
Project title	Alternative land-use options for improved rangeland conditions and sustainable livelihoods
Action Plan priority area	Land degradation
Short description	This project aims to demonstrate the contribution of alternative land-use options to improve rangeland conditions and support sustainable livelihoods. It will determine and demonstrate the most suitable alternative land-use types in communal areas within the basin.
PROJECT RATIONALE	
Background	Land degradation in the Namibian part of the basin manifests itself in the form of loss of rangeland and economic productivity (CPP ISLM, 2008). Commercial and subsistence livestock farming (small stock in most parts of the basin and large stock in the eastern part) is the leading land-use type. Like the rest of Namibia, livestock are kept as a source of income as well as for cultural motives. Land degradation in the basin is due to overstocking, land tenure systems, drought subsidies, unsuitable distribution of water and boreholes, and poverty. Loss of vegetation cover is perhaps the most obvious indicator of rangeland degradation, ranging from the loss of grass species diversity and perennial grasses, loss of grass vigour to a loss of ground cover, reduced water infiltration, increased surface-runoff, increased vulnerability to drought and encroachment of undesirable plants. The project will pilot alternative income-generating options in selected communities within the basin so as to contribute to enhanced catchment conditions and maintain/improve livelihoods. Although the project targets rural communities, it will strengthen the interaction between communal and commercial farmers because some commercial farmers have experience in farming with the proposed plants.
Project objectives	Improved rangeland conditions for sustainable livelihoods.
Integration with relevant ongoing projects/ initiatives	Several projects aimed at addressing land degradation and desertification have been implemented in Namibia. Most of these projects focused on building capacities of communities and service providers as well as local level institutions to address the challenges of land degradation. The challenge for most of the past and existing projects has been to demonstrate tangible benefits for diversification from livestock farming. The conservancy approach has however demonstrated the benefits of game farming and tourism to improving ecosystem functioning while also providing economic benefits. The Ministry of Lands and Resettlement recently completed the land-use plans for Karas and Hardap regions. These land-use plans identified potential land-use options within the regions. Such options will have to be tested for viability and wider application.
Project outcomes	1 Improved rangeland conditions (soil condition/fertility, increase in annual grass species, reduction in invasive species). 2 Improved livelihoods (through increased productivity and income diversification).
Technical approach	**OUTCOME 1: IMPROVED RANGELAND CONDITIONS (SOIL CONDITION/FERTILITY, INCREASE IN ANNUAL GRASS SPECIES, REDUCTION IN INVASIVE SPECIES)** **Output 1.1 Current livestock carrying capacities re-determined** • Conduct research to determine livestock carrying capacities in the basin. • Raise awareness on adherence to carrying capacity as a farm management tool. • Develop the necessary tools and monitoring methods for compliance to carrying capacities. • Enforce adherence to carrying capacity. **Output 1.2 Farm management plans developed and implemented** • Develop criteria for selecting pilot farms/communities for interventions. • Determine land-use options to complement livestock farming. • Develop integrated farm management plans. • Train farmers on land management (including resource monitoring). • Develop on-farm monitoring systems (e.g. local level monitoring, events calendar). • Develop the capacity of extension services for continuous support. • Implement the plans and conduct implementation monitoring and evaluation. **OUTCOME 2: IMPROVED LIVELIHOODS (THROUGH INCREASED PRODUCTIVITY AND INCOME DIVERSIFICATION)** **Output 2.1 Feasibility of land-use options determined** • List potential land-use options. • Assess key requirements for successful enterprise development (to include water, environment, socio-economic, technology). • Conduct market research (products and markets). **Output 2.2 Viable options across ecological zones in the basin determined** • Test the selected options, e.g. horticulture (saffron, rosemary, olives), game farming and tourism. **Output 2.3 Institutional and individual capacity built for sustainability and replication of lessons learnt** • Provide ongoing hands-on support during the pilot phase. • Determine institutional support beyond project phase and build the necessary capacity. • Document and share lessons learnt.
Assumptions and risks	• It is assumed that the government will remain interested and committed to the promotion of alternative land-use option. • Resistance to adhere to carrying capacities and to reduce livestock numbers.
IMPLEMENTATION	
Project duration	Four years
Project cost	USD2,500,000
Proposed funding sources	To be secured
Implementation mechanism	To be determined