FINAL RESOURCE MANAGEMENT PLAN

VAAL DAM

water & sanitation

Department:
Water and Sanitation
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- Rand Water;
- Metsimaholo Local Municipality;
- Midvaal Local Municipality;
- Sedibeng District Municpality;
- Department of Agriculture, Foresty and Fisheries; and
- South African Maritime Safety Authority.

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Amendments Page

Date	Nature of Amendment	Amendment No.
29 September 2014	First Draft for DWS Review	1
10 October 2014	Draft for PSC Review	2
31 October 2014	Draft for Public Review	3
9 January 2015	Final for PSC Review	4
20 January 2015	Final for Public Review	5
16 March 2015	Final	6

Executive Summary

According to the Guidelines for the Compilation of Resource Management Plans (2006), the main aim of a Resource Management Plan is to "attain the objectives underlying sustainability and to compile workable, functional sustainable access and utilisation plans for water resources and in particular State Dams". A Resource Management Plan is thus a planning tool aimed at working within the requirements of existing policies, while taking into account the needs and interests of stakeholders.

A Resource Management Plan can also be described as a systematic process for the sustainable development and management of a water resource in the context of social, economic and environmental objectives. One of the main functions of the Resource Management Plan process is to implement an **Institutional Plan**. The focus on institutional arrangements is accompanied by a **Zonal Plan** together with a detailed **Strategic Plan**. In addition, a **Financial Plan** provides guidance on funding opportunities and how these should be used for the improved management of the Dam. Together these components provide a comprehensive guide on the "what?"; "why?"; "how?" and "who?" of the management of prioritised Government Waterworks.

The construction of the Vaal Dam commenced during the Great Depression in the 1930s and was completed by 1938. It was constructed as a joint project between the then Department of Irrigation (now Department of Water and Sanitation) and Rand Water and initially had a fully supply capacity of 994 million m^3. However, the capacity of the Dam has been increased through a number of projects in order to meet increasing water demand in the area. The first of these projects took place in the 1950s where the Dam wall was raised by 6.1m which increased the fully supply capacity to 2 188 million m^3. In 1985, the Dam wall was raised by a further 3.05 m which increased the permanent capacity of the Dam to 2 536 million m^3. About 1.95 m of this increase is used for flood storage capacity and did not contribute to permanent capacity (DWAF, 1991).

A number of transfer schemes have also been put in place to ensure water availability in the catchment (and therefore the Dam) including the Tugela-Vaal Water Transfer Scheme, where water is transferred from the Tugela River over the Drakensberg escarpment into the Wilge River which is a tributary of the Vaal. The Usutu-Vaal Government Water Scheme and the Slang River Transfer Scheme also transfer water across into the catchment of the Dam. More recently, the Lesotho Highlands Water Project has been put in place and provides water to the Dam.

The main purpose of the Dam is to provide water for domestic, mining, industrial and irrigation use in the Pretoria-Witwatersrand–Vereeniging Region (DWAF, 1991). The main water user is Rand Water, which abstracts water from the Dam and treats it at the Vereeniging and Zuikerbosch Purification and Primary Pumping Stations. Purified water is then sent to 58 reservoirs around Gauteng and includes supplies to three metropolitan councils (City of Johannesburg, City of Tshwane and Ekurhuleni Metropolitan Municipality), 15 municipalities, the Royal Bafokeng administration, 45 mines and approximately 771 industries and direct consumers. Approximately 92% of the water goes to municipalities for supply to domestic, industrial and commercial end users.

The Dam also supplies water to industrial customers such as Sasol Sasolburg, Eskom and Accelor Mittal Steel as well as downstream users such as irrigators. Midvaal Water and Sedibeng Water are also supplied or supported with water released from Vaal Dam.

The Dam is located approximately 56 km south of Johannesburg and borders three provinces namely, Gauteng, Free State and Mpumalanga. The main towns around the Dam include Deneyville and Oranjeville in the Free State and Vaal Marina in Gauteng. The Dam is the second largest Dam in South Africa in terms of surface

area (32 060 ha or 320.6 km^2) and has 880 km of shoreline (DWAF, 1991). Due to the large shoreline and surface area, the Dam is also used for recreation and a number of Sailing Clubs are located at the Dam including:

- Deneysville Aquatic Club;
- Lake Deneys Yacht Club ;
- Aeolians Yacht Club;
- Pennant Nine Yacht Club;
- Sunset Shores Yacht Club;
- Vaal Cruising Association;
- Stilbaai Yacht Club ; and
- Seal Point Yacht Club.

In addition to the clubs, a number of Marinas occur at the Dam including Manten Marina, Anchor Creek Marina and Bayshore Marina to name a few.

The Dam is also a popular fishing venue and both power boat and fishing activities take place at Deneysville Aquatic Club. The Rand Piscatorial Association offers bank angling, boat angling and fly fishing. The Afrikaanse Hengel Vereeniging also offers fishing but is a member only club restricted to 2 000 members.

The following activities commonly occur at the Dam:

- Sailing;
- Bank Angling;
- Boat Angling;
- Fly Fishing;
- Motor Boating;
- Canoeing;
- Swimming;
- Water Toys;
- Water skiing;
- Parasailing;
- Jet Skiing;
- Commercial Fishing;
- Subsistence Fishing;
- Baptisms;
- Bird Watching;
- Picnicking; and
- Research.

A number of competitive events are held at Vaal Dam including the Vaaldam Bonanza, the Round the Island Race, Keelboat Week and the Bayshore 200m Jet Ski Race.

Unlike most Dams in South Africa, the Dam occurs within a servitude of storage and thus the land adjacent to the Dam is in general, privately owned. A number of privately owned establishments that offer accommodation as well as access for water sports activities occur at the Dam and include the following:

- Vaal Privé Holiday Resort (offers boat cruises etc.);
- Stone Cottage (as part of the price, access to the Dam via the Water Sports Club is included);
- Caroline's Cottage;
- Anchor Marina;
- Vaal Dam Boat Cruises;
- Tasha's on Main (as part of the price, access to the Dam via the Water Sports Club is included);
- Platinum Moon (as part of the price, access to the Dam via the Water Sports Club is included);
- Heron's Haven (private slipway for guests);
- Lakeview on Vaal (waterfront access for fishing, boat-launching facilities available);
- Rus 'n Bietjie Karavaan Park;
- Letsatsi Bay;
- Herberg Hotel;
- Mihanzi;
- Rock Island Lodge;
- Vaaldam Breakaway;
- Leboya Bay;
- Boshkop Oord Resort; and
- Vaal Rawdah.

Further, a number of estates have also recently been built around the Dam including Harbour Town and Peninsula on the Vaal.

A small portion of the Dam (near Deneysville) is adjacent to the Vaal Dam Nature Reserve. The Reserve is not currently formally open to the public although access for day visitors does take place.

There are three main local communities around the Dam including Mamelo community (outside

Vaal Marina), Refengkgotso Community (outside Deneysville) and Metsimaholo Community (outside Oranjeville). Some public access areas occur in both Oranjeville and Deneysville (although no proper facilities are available at these areas). However, no formalised public access is available at Vaal Marina/Mamelo and thus community use in this area is restricted although some subsistence fishing does occur and some access through the Vaal Marina Property Owners Waterfront Association takes place.

In compiling the Resource Management Plan for Vaal Dam the following process was applied.

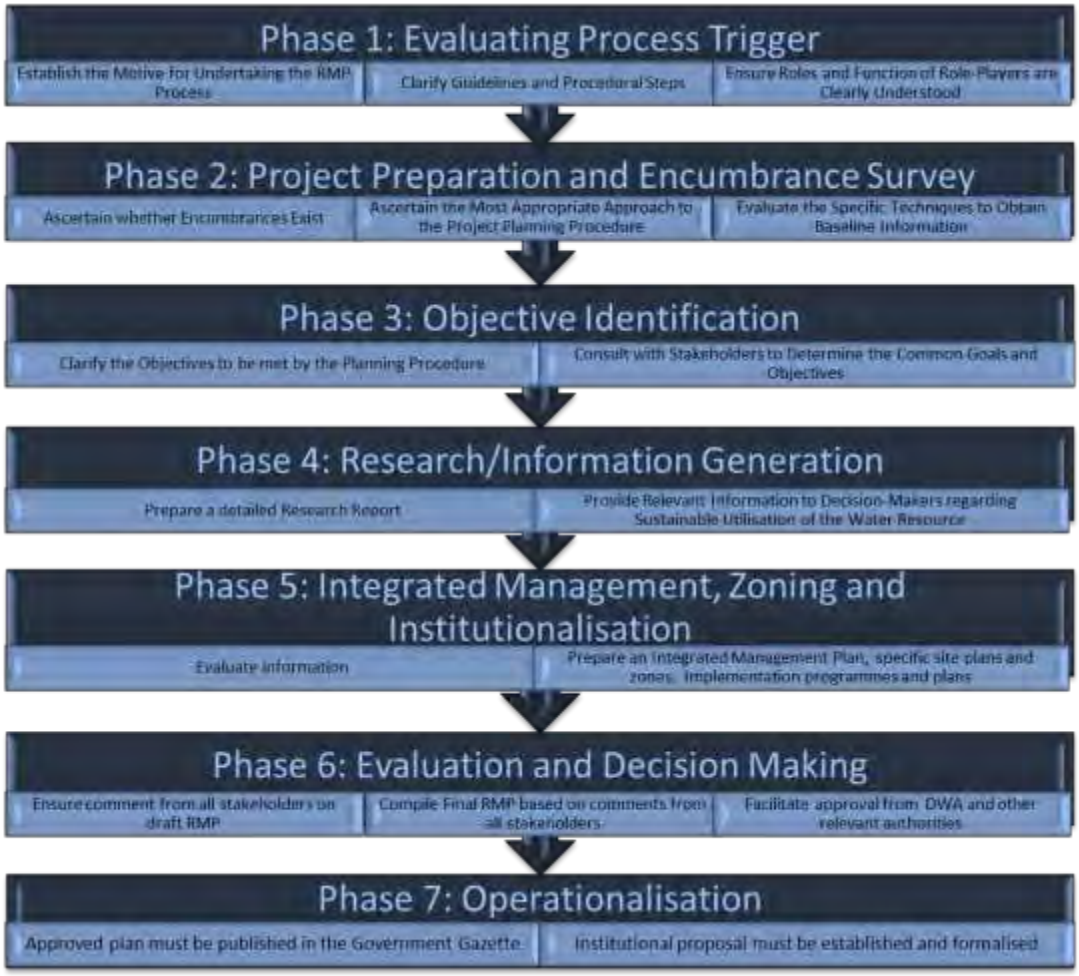

Figure 1: RMP Process (DWA, 2006)

It is important to note that the Resource Management Plan was compiled based on detailed stakeholder input and engagement. This formed the cornerstone of the Resource Management Plan through the establishment of a Vision for the Dam with a number of Key Objectives.

The key recommendations of the Vaal Dam Resource Management Plan are as follows:

- Implementation of the Institutional Plan including the formation of a Dam Management Committee, Operations Management Committee and Resource Management Plan Steering Committee. As part of this Institutional Plan, it is vital that all agreements are updated to take into account the findings of the Resource Management Plan;
- Implementation of standardised and harmonised Aids to Navigation and

Demarcation Markers and Unique Positioning Number System and the Wash Bay System at the Dam;
- Facilities at the Public areas to be created;
- Assessment of servitude, adjacent landowners, recreational clubs and commercial enterprises to be undertaken as well as zonal plan to be updated with the servitude extent;
- Agreements to be put in place with all stakeholders;
- Coordination with local municipalities, National Sea Rescue Institute, Waterwise and SwimSA to create community swimming schools at the Dam to improve swimming skills in the short term at the Dam. Detailed safety assessments must be undertaken and only small class sizes are allowed due to the dark water and potential difficult water conditions at the Dam;
- Discussions between DWS and National Sea Rescue Institute and Waterwise to take place to determine the feasibility of rolling out community swimming safety measures at public areas. Examples of these safety measures include affordable life rings etc.;
- Coordination with SwimSA to create a swimming pools at the Dam;
- Integrated tourism plan to be developed;
- The potential for community agriculture programmes with irrigation to be determined. These community programmes could provide food for tourism ventures in the area;
- Potential for water troughs for watering of cattle;
- The potential for a small-scale fisheries project for the local community to be determined;
- Development of community craft market and farmers market;
- The extent of the Vaal Dam Nature Reserve to be determined;
- Survey of the Dam to identify any Invasive Aquatic Plants;
- Pollution point study to be undertaken to identify main sources of pollution at the Dam;
- Upgrade of the a number of Wastewater Treatment Works around the Dam;
- Shoreline management plan to be compiled and implemented;
- Education programmes regarding the impacts of alien invasive species to be instituted;
- Paleontological and archaeological heritage resources study to be undertaken;
- Lifeguard skills training and first aid training to ensure safe public use of the Dam;
- Awareness campaign to be developed by the DMC. The campaign should focus on potential uses of the Dam, the importance of infrastructure and Dam safety; and
- Discussions between local schools and universities regarding the potential for using the Dam as part of education programmes.

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Acronyms

ADU	Avian Demographic Unit
AGIS	Agriculture Geo-Referenced Information System
AHV	Afrikaanse Hengel Vereeniging
Al	Aluminium
AMD	Acid Mine Drainage
AtoN	Aids to Navigation
AYC	Aeolians Yacht Club
BMAA	β-N-methylamino-L-alanine
BP	Business Plan
Ca	Calcium
CABI	Invasive Species Compendium
CARA	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
Cd	Cadmium
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CIWSP	Cooperative Inland Waterways Safety Programme
Co	Cobalt
COGTA	Department of Cooperative Governance and Traditional Affairs
CPSI	Centre for Public Service Innovation
Cr	Chromium
Cu	Copper
DAC	Deneysville Aquatics Club
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DLM	Dipaleseng Local Municipality
DMC	Dam Management Committee
DoT	Department of Transport
DPW	Department of Public Works
DRDLA	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water Affairs and Sanitation
ECC	Effective Carrying Capacity
EIA	Environmental Impact Assessment
Fe	Iron
FS DETEA	Free State Department of Economic Development, Tourism and Environmental Affairs

GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GIS	Geographic Information System
GN	Government Notice
GTA	Gauteng Tourism Authority
GVA	Gross Value Added
Ha	Hectare
I&APs	Interested and Affected Parties
IA	Implementing Agent
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IDP	Integrated Development Plan
IPCC	Intergovernmental Panel on Climate Change
ISSG	Invasive Species Specialist Group
IUCN	International Union for Conservation of Nature,
IWRM	Integrated Water Resource Management
JPTC	Joint Permanent Technical Commission
LAAP	Local Accountable AtoN Parties
LDYC	Lake Deneys Yacht Club
LHDA	Lesotho Highlands Development Agency
LHWC	Lesotho Highlands Water Commission
LHWP	Lesotho Highlands Water Project
MAP	Mean Annual Precipitation
MLM	Metsimaholo Local Municipality
Mn	Manganese
MP DEDT	Mpumalanga Department of Economic Development and Tourism
MTPA	Mpumalanga Tourism and Parks Agency
MVLM	Midvaal Local Municipality
N	Nitrogen
N03	Nitrate
NEMA	The National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Amendment Act, 2003(Act 57 of 2003)
Ni	Nickel
NSRI	National Sea Rescue Institute
NWRI	National Water Resources Infrastructure
NWRI: IEE	National Water Resources Infrastructure: Integrated Environmental Engineering

OFS	Orange Free State
OMC	Operations Management Committee
P	Phosphorous
Pb	Lead
PCC	Physical Carrying Capacity
PFMA	Public Finance Management Act, 1999 (Act 29 of 1999)
PNYC	Pennant Nine Yacht Club
PO4	Phosphate
PPP	Public Private Partnership
PSDF	Provincial Spatial Development Frameworks
PWV	Pretoria-Witwatersrand-Vereeniging
QDS	Quarter Degree Square
RCC	Real Carrying Capacity
RHIB	Rigid Hulled Inflatable Boat
RMP	Resource Management Plan
RPA	Rand Piscatorial Association
RSC	RMP Steering Committee
RWU	Recreational Water Use
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAMSA	South African Maritime Safety Authority
SANBI	South African National Biodiversity Institute
SAPS	South African Police Service
SARCA	Southern African Reptile Conservation Assessment
SASCOC	South African Sports Confederation and Olympic Committee
SDF	Spatial Development Framework
Sn	Tin
SO4	Sulphate
SPC	Strategic Plan for Commercialisation
SPYC	Seal Point Yacht Club
SRSA	Department of Sports and Recreation
SSYC	Sunset Shores Yacht Club
SYC	Stillbaai Yacht Club
TAL	Total Alkalinity
TCTA	Trans-Caledon Tunnel Authority
TDS	Total Dissolved Salts
THETA	Tourism, Hospitality and Sports Education Training Authority
ToR	Terms of Reference
TP	Total Phosphorus

TSD	Total Dissolved Salts
UPN	Unique Positioning Number
USDA-ARS	United States Department of Agriculture: Agricultural Research Service
VCA	Vaal Cruising Association
VMPOWA	Vaal Marina Property Owners Waterfront Association
VMUS	Virtual Museum
VRESAP	Vaal River Eastern Subsystem Augmentation Project
WHO	World Health Organisation
WIP	Weeds and Invasive Plants
WMA	Water Management Area
WWTW	Wastewater Treatment Works
WULA	Water Use License Application
ZAR	Zuid- Afrikaanse or Transvaal Republic
Zn	Zinc

1 WHAT IS A RMP AND WHY IS IT NECESSARY?

A Resource Management Plan (RMP) is a management tool which provides guidance on how recreational use at Government Waterworks, such as Dams, should be managed. RMPs focus on the current and future uses of the Dam, as well as requirements that must be met, to ensure the optimal, equitable and sustainable management of the Dam.

According to the Guidelines for the Compilation of RMPs (DWAF, 2006), the main aim of the RMP is to "attain the objectives underlying sustainability and to compile workable, functional sustainable access and utilisation plans for water resources and in particular State Dams". A RMP is thus, a planning tool aimed at working within the requirements of existing Government Policy, while taking into account the needs and interests of stakeholders.

A RMP can also be explained as a systematic process for the sustainable development and management of a water resource in the context of social, economic and environmental objectives. In many ways, it shares similarities with Integrated Water Resource Management (IWRM). Hence, one of the main functions of the RMP process is to implement an **Institutional Plan** for the effective management of State Dams. The focus on institutional arrangements is accompanied by a **Zonal Plan** together with a detailed **Strategic Plan**. In addition, a **Financial Plan** provides guidance on funding requirements and funding options. Together these components provide a comprehensive guide on the "what?"; "why?"; "how?" and "who?" of the management of prioritised Government Waterworks.

The RMP lays the foundation required to consolidate objectives for the resource, within the framework of existing policy priorities. The RMP also informs decision-making which may have a direct impact on the resource. Further, the RMP creates a platform to unlock economic potential at the Dam without compromising environmental principles and recreational use of the Dam. Recreational use includes activities which range from leisure, sport to culture and religion. Although recreational use is not consumptive, it is still a major water use and needs to be managed correctly to ensure increased personal, societal and economic benefits with minimal disturbances and environmental impacts.

RMPs are managed by the National Water Resources Infrastructure Branch (NWRI) of the Department of Water and Sanitation (DWS). This Branch is tasked with developing, operating and maintaining strategic water resource infrastructure in an efficient way to ensure that the needs of the Nation are met.

The RMP also provides a platform for coordination between different spheres of government that have official mandates regarding the management of the Dam. These Departments include:

Table 1: Government Departments and Agencies

DEPARTMENT	MANDATE
Department of Transport (DoT)	Responsible for legislation, policy and regulations for all transportation in South Africa, including shipping and other transport by water or sea, including inland waterways.
Department of Environmental Affairs (DEA)	Responsible for biodiversity management within the Dam including Invasive alien species.
Nature Conservation	In the case of Vaal Dam, Vaaldam Nature Reserve occurs in Gauteng and thus the Gauteng Department of Agriculture and Rural Development (GDARD) would be responsible for it management although the Reserve does not currently appear to be open. In addition, the Free State Department of Economic Development, Tourism, and Environmental Affairs (FS DETEA) has a role in terms of management of fish and fisheries on the Free State side of the Dam as does Mpumalanga Parks and Tourism Agency (MPTA) as an agency of the Mpumalanga Department of Economic Development and Tourism (MP DEDT) on the Mpumalanga section of the Dam.
Rand Water	Rand Water is one of 15 Water Boards in South Africa which reports to Department of Water And Sanitation (DWS). Rand Water is the main user of Vaal Dam.
Local Municipalities	Vaal Dam is located in three separate local municipalities including Midvaal Local Municipality (MVLM) in Gauteng, Dipaleseng Local Municipality (DLM) in Mpumalanga and Metsimaholo Local Municipality (MLM) in the Free State.
Department of Water and Sanitation	DWS is the official custodian of all surface water in South Africa. DWS is also responsible for the establishment, operation and maintenance of Government Waterworks (as per the National Water Act, 1998 (Act 36 of 1998). This includes management of Dam Safety and operation and management of Dams.
South African Maritime Safety Authority (SAMSA)	Administers and executes maritime related legislation and regulations.

Each Government Department has its own suite of Legislation to govern the use and management of the Dam. The RMP consolidates these roles and functions into a coherent management platform.

The RMP presents the twenty-year vision of the Dam which is distilled into 5 year goals and annual Business Plans (BPs). Hence, the RMP is a tool aimed at meeting the expectations of users without sacrificing the environment.

2 WHERE ARE WE NOW?

2.1 Overview of the WMA

The Upper Vaal Water Management Area (WMA) is one of five WMAs that occur within the Orange/Vaal River Basin and occurs in the Gauteng, Free State, Mpumalanga and North West Provinces. The WMA covers a catchment area of 55 562 km^2 and is the uppermost WMA in the Vaal River System and includes the Grootdraai Dam and the Vaal Dam, two major Dams in the country.

The general topography of the area is described as flat with occasional gentle slopes. The general surface drainage is to the west.

Temperature and rainfall differ extensively with the seasons although the same patterns are seen throughout the WMA. The winters are typically dry and cold (17 °C average) with occasional frost, while the summers are very hot and wet (28 °C average daily maximum). Rainfall occurs during the summer. The mean annual precipitation (MAP) decreases from 800 mm in the south east to 600 mm in the north west with the potential evaporation increasing from 1300 mm in the south east to 1700 mm in the north west (DWAF, 2004).

Vegetation is mostly savannah grassland with sparse bushveld. The geology is varied and is particularly complex in the west and north-west where mineral deposits are found. Extensive dolomitic formations also occur in these parts.

2.1.1 Surface Water and River Systems

The largest proportion (46%) of the surface flow in the WMA is contributed to by the Vaal River upstream of the Vaal Dam, together with its main tributary the Klip River. In addition, the Wilge River and the Liebenbergsvlei River contribute 36%, with the remaining 18% originating from the tributaries downstream of the Vaal Dam. Other rivers include the Boesmanspruit, the Leeuspruit and the Diepspruit River (DWAF, 2003).

There are no natural lakes in the WMA however a number of important wetlands occur along the Klip River, with several vlei areas occuring elsewhere in the WMA (DWAF, 2003).

The surface water naturally occurring in WMA has been well developed through the construction of several large dams. The main Dams include:

- Grootdraai Dam and the Vaal Dam on the Vaal River;
- Sterkfontein and Fika Patso Dams in the Wilge River Catchment;
- Saulspoort on the Liebenbergvlei River, in the Wilge sub-area; and
- The Vaal Barrage as well as Klerkskraal, Boskop and Klipdrif Dams in the sub-area downstream of the Vaal Dam.

Heyshope Dam does not occur within the WMA, however it is part of the inter-catchment transfers which take place and therefore also impacts on the status of surface water in the WMA.

Naturally the quality of surface water in WMA is good. However,the large quantities of urban and industrial effluent, together with urban wash-off and mine pumpage, have a major impact on the water quality in some tributary rivers in the north-western part of the WMA (e.g. Waterval, Blesbokspruit, Natalspruit and Klip). The Waterval River upstream of Vaal Dam, for example, contributes 2% of the water but 12% of the salinity load that reaches Vaal Dam.

The Upper Vaal WMA does not directly share any rivers with neighbouring countries. Large quantities of water are, however, transferred into the WMA from Lesotho and through inter catchment transfers to and from neighbouring WMAs (DWAF, 2004).

The majority of the rivers in the WMA are classified as Class C: Moderately Modified however some exceptions do occur with a number of rivers classified as Class D: Largely Modified or Class E: Not an Acceptable Level.

2.1.2 Land Use

Land use in the Upper Vaal WMA is characterised by sprawling urban and industrial areas in the northern and western parts. Mining is also located

in these areas although much of this is now inactive. Maize, wheat and other annual crops are grown on large areas under dry land cultivation in the central and south western parts. There are several large towns in the WMA, mainly to serve the mining and agricultural developments (DWAF, 2004).

The main land use impacts are relatively large increases in runoff due to impermeable surfaces in urbanised areas, as well as reductions in runoff due to infestations by alien vegetation. No significant afforestation occurs in the WMA. Numerous farm dams have also been built in the catchment of the Vaal Dam (DWAF, 2003).

Products of the mining industry in the Upper Vaal WMA include coal, precious metals (gold, uranium, etc.), base metals, semi-precious stones and industrial minerals. Major industries in this WMA include Sasol I (Sasolburg), Iscor, Sappi, AECI and Sasol Synthetic Fuels (SSF) (Secunda). In addition, there are three operational coal fired power stations located in the WMA (Lethabo, Tutuka and Majuba Power Stations) (DWAF, 2004).

About 1700 km^2 land in the Upper Vaal WMA is currently used. Of this, urbanisation accounts for 60%, irrigation, 17%, alien vegetation, 20% and afforestation is negligible. The extent of dryland farming is unkwown (DWAF, 2003c).

The main agricultural activities in the WMA are dryland agriculture and livestock farming. Dryland cultivation comprising much of the agricultural activity occurring mainly in the central and southwestern parts where maize, wheat and other annual crops are grown. There is also significant irrigation along the main river reaches.

The large metropolitan areas in the WMA include Germiston, Boksburg, Alberton, Benoni, Brakpan, Springs, and Nigel on the East Rand, Vereeniging, Vanderbijlpark, Sasolburg, Westonaria and Carletonville on the West Rand. These areas represent the most heavily populated areas of the WMA and all the areas are supplied by Rand Water via its bulk water network from the Vaal Dam. The large urban users are heavily dependent on water transferred into this WMA. Other significant areas include Bethlehem, Harrismith and Phuthaditjhaba in the Wilge River subcatchment, Highveld complex, Standerton and Ermelo in the Vaal River sub-catchment upstream of Vaal Dam and Potchefstroom in the Mooi River sub-catchment (DWAF, 2009).

2.1.3 Water Quality

In general, the quality of surface water in the Upper Vaal WMA is good due to the outflow from the dolomitic aquifers in the Region. However, due to the large quantities of urban and industrial effluent, together with urban wash-off and mine pumpage, tributary rivers in the north western part of the WMA such as the Waterval, Blesbokspruit, Natalspruit and Klip etc. have been negatively affected.

Atmospheric pollution is also prevalent over parts of the WMA and contributes to the pollution of surface water resources.

According to the Department of Water Affairs and Forestry (DWAF) Water Quality Monitoring Status Report for the Upper Vaal WMA (Munnick, 2005), the two main concerns in the area are salinity and eutrophication (nutrient enrichment).

Salinity is evaluated by looking at variables such as Total Dissolved Salts (TDS), an indication of dissolved salts, such as Sulphate (SO_4), which is usually related to coal and gold mining activities. Examples of point sources of salinity are industrial and mine water discharges, and the diffuse sources of salinity are seepages from mine dumps and other discard and disposal facilities.

In general, the biggest impact on water quality in terms of salinity and eutrophication is from the Vaal Barrage. Specifically, there is a huge inflow of phosphate and nitrate from the tributaries of the Vaal Barrage, namely the Klip River, the Leeu Taaibos Spruit, the Blesbok Spruit and Suikerbosrand River, and the Riet Spruit.

Eutrophication is evaluated by looking at nutrients such as Phosphate (PO_4) and Nitrate (NO_3). Examples of point sources of nutrients are discharges from sewerage works and the diffuse sources are informal settlements. The worst

impacts in terms of eutrophication is also at the Vaal Barrage (Figure 2).

Nitrogen inputs to catchment areas have dramatically increased as a result of anthropogenic activities. A portion of this nitrogen (N) enters river systems, degrading river water quality.

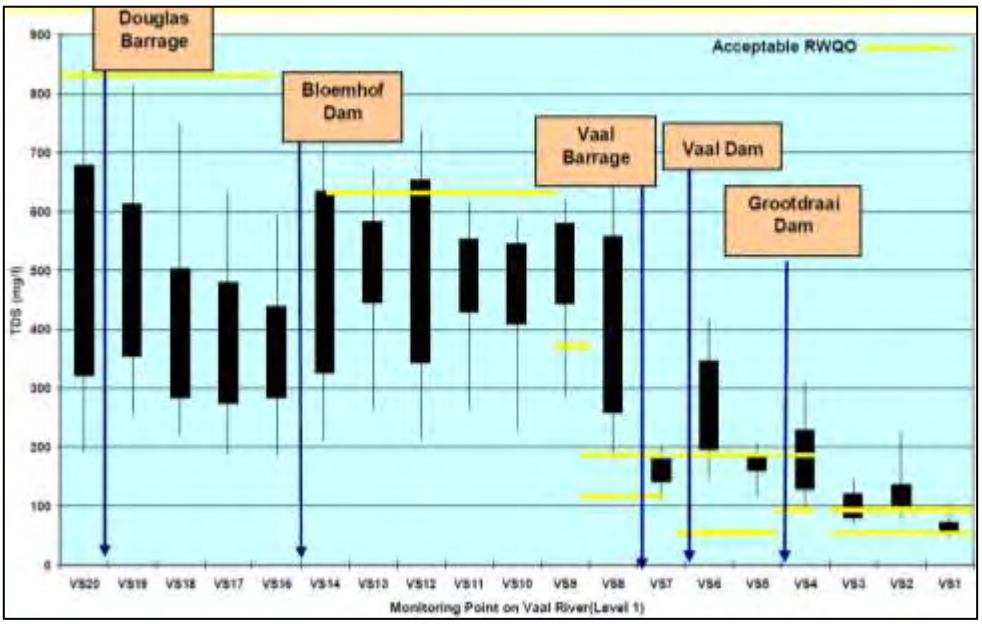
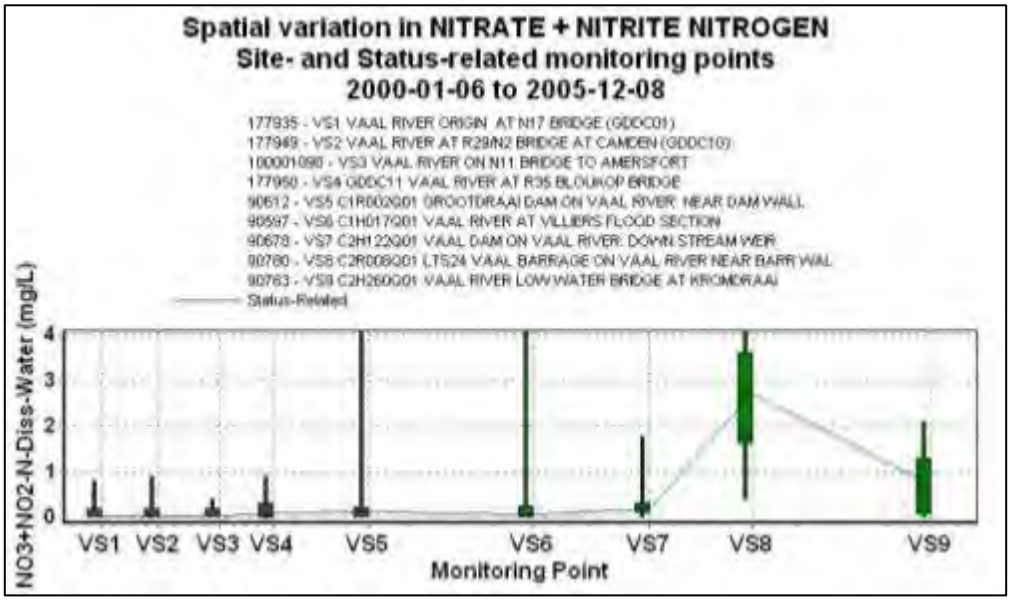
Salinity	
Nitrates	

Figure 2: Water Quality along the Vaal River (DWAF, 2009 and Munnik, 2005).

2.1.4 The Social Environment

The Upper Vaal WMA is economically important, contributing nearly 20% of the Gross Domestic Product (GDP) of South Africa, which is the second largest contribution to the National wealth amongst all nineteen of the WMAs in the country (DWAF 2003). The manufacturing sector contributes over 30% to the Gross Geographic Product (GGP) generated in the WMA, followed by trade at just over 15% and both finance and mining slightly higher that 10%.

Although there are large areas under cultivation, agriculture only contributes about 2% of the GGP. It nevertheless has important linkages to other sectors and provides livelihood to a large proportion of the rural population.

2.1.5 Tourism Potential

The tourism potential of the Upper Vaal WMA varies based on the province. According to the Annual Mpumalanga Tourism Statistics Report (MTPA, 2011), Gauteng, Western Cape and Mpumalanga were the most visited provinces in South Africa.

Gauteng continued to enjoy the largest share of foreign arrivals in 2012 as well as the most bednights increase (3.35% growth rate). It also captured the highest tourism revenue in South Africa, contributing R30 billion (According to the Gauteng Tourism Authority (GTA) Annual Report (GTA, 2012)). Johannesburg in particular has had a substantial growth in international visitors from 2009 to 2013 which has propelled it into one of the top 20 fastest growing cities globally. Johannesburg also comes out tops in Africa in terms of international visitor spending, with $2,7 billion estimated to be injected into the city during 2013. In terms of the District, Sedibeng District has a number of areas with intrinsic potential for tourism, including areas such as the Suikerbosrand Nature Reserve, the Vaal Dam area and along the Vaal River and numerous historical and other sites. Yet Tourism does not make an appreciable contribution to the economy. The Midvaal IDP also recognises the area around the Vaal Dam (Sedibeng SDF, 2013).

Mpumalanga also has high tourism potential and it retained 3rd position with an increase of 15.9% in 2011 in terms of international arrivals. Foreign Direct Spend, Bed nights and Direct Employment in Tourism increased for Mpumalanga in 2011 and leisure remained the primary purpose for travel. Overall, Mpumalanga had an increase in Tourism related annual spend of R0.3 million (from R4.4 million to R4.7 million) and had approximately 1,316,869 visitors in 2011.

The Tourism Enterprise Partnership found that the Free State, although third largest in terms of area, is one of South Africa's smaller tourism provinces. Further, it is estimated that the tourism sector contributes approximately 3% to the province's economy representing approximately 5% of South Africa's tourism market (Tourism Talk, 2009). However, the Free State Province aims to grow its tourism sector to turn what has been called a 'hidden treasure of South Africa' into a popular and repeat destination for thousands of domestic and international tourists.

2.1.6 Catchment Management Agency

There is no catchment management agency in place for the Upper Vaal WMA. However, there are a number of forums in the Upper Vaal WMA. These include:

- Barrage Reservoir Forum;
- Blesbokspruit Forum;
- Klip River Forum;
- Leeu-Taaiboschspruit Forum;
- Rietspruit Forum;
- Grootdraai Dam Forum;
- Vaal Dam Reservoir Forum;
- Waterval Forum; and
- Wilge River Forum.

2.1.7 Safety of Navigation

In addition to its common law responsibility, DWS is, in terms of the requirements described in the National Water Act (Act 36 of 1998), amongst others, responsible for the safety of Government's Waterways and watercourses, including its Dams. DWS, its delegated public sector partner, or a delegated water management institution, has therefore the responsibility to provide the required

fixed and/or floating Aids to Navigation[1] (AtoN) for general navigation.

In addition to the DWS, Local Accountable AtoN Parties (LAAP) and other Bodies providing access to Government Waterways and watercourses have a responsibility to ensure that the required fixed and/or floating AtoN are provided after obtaining the necessary support from DWS and thereafter the permission by SAMSA.

2.2 Purpose of Vaal Dam

The construction of the Vaal Dam commenced during the Great Depression in the 1930s and was completed by 1938. It was constructed as a joint project between the then Department of Irrigation (now DWS) and Rand Water and initially had a fully supply capacity of 994 million m^3. However, the capacity of the Dam has been increased through a number of projects in order to meet increasing water demand in the area. The first of these projects took place in the 1950s where the Dam wall was raised by 6.1m which increased the fully supply capacity to 2 188 million m^3. In 1985, the Dam wall was raised by a further 3.05 m which increased the permanent capacity of the Dam to 2 536 million m^3. About 1.95 m of this increase is used for flood storage capacity and did not contribute to permanent capacity (DWAF, 1991).

The main purpose of the Dam is to provide water for domestic, mining, industrial and irrigation use in the Pretoria-Witwatersrand–Vereeniging (PWV) Region (DWAF, 1991). The main water user is Rand Water, which abstracts water from the Dam and treats it at the Vereeniging and Zuikerbosch Purification and Primary Pumping Stations. Purified water is then sent to 58 reservoirs around Gauteng and includes supplies to three metropolitan councils (City of Johannesburg, City of Tshwane and Ekurhuleni Metropolitan Municipality), 15 municipalities, the Royal Bafokeng administration, 45 mines and approximately 771 industries and direct consumers. Approximately 92% of the water goes to municipalities for supply to domestic, industrial and commercial end users.

The Dam also supplies water to industrial customers such as Sasol Sasolburg, Eskom and Accelor Mittal Steel as well as downstream users such as irrigators. Midvaal Water and Sedibeng Water are also supplied or supported with water released from Vaal Dam.

2.3 Overview of the Dam

The Vaal Dam falls within three separate local municipalities (MVLM, DLM and MLM) in the Gauteng, Mpumalanga and Free State Provinces. As discussed in the previous sections, it also falls within the Upper-Vaal WMA.

Below is an overview of the Dam.

Table 2: Overview of Vaal Dam

Dam Characteristics	
Year of completion	1938
Purpose	Domestic and Industrial Use
River	Vaal and Wilge Rivers
Nearest Town and Province	Deneysville, Free State
Type	Gravity Dam
Net Storage capacity	256 million m^3
Wall height	63 m
Crest length	714 m
Material content of Dam wall	Concrete
Type and length of spillway	Controlled
Capacity of spillway	12 500 m^3/s
Surface area of Dam at full supply	32060 ha (320.6 km^2)
Owner, designer and construction	Department of Water Affairs

[1] A marine Aid to Navigation (AtoN) is defined by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) as "*A device or system external to vessels that is designed and operated to enhance the safe and efficient navigation of vessels and/or vessel traffic*".

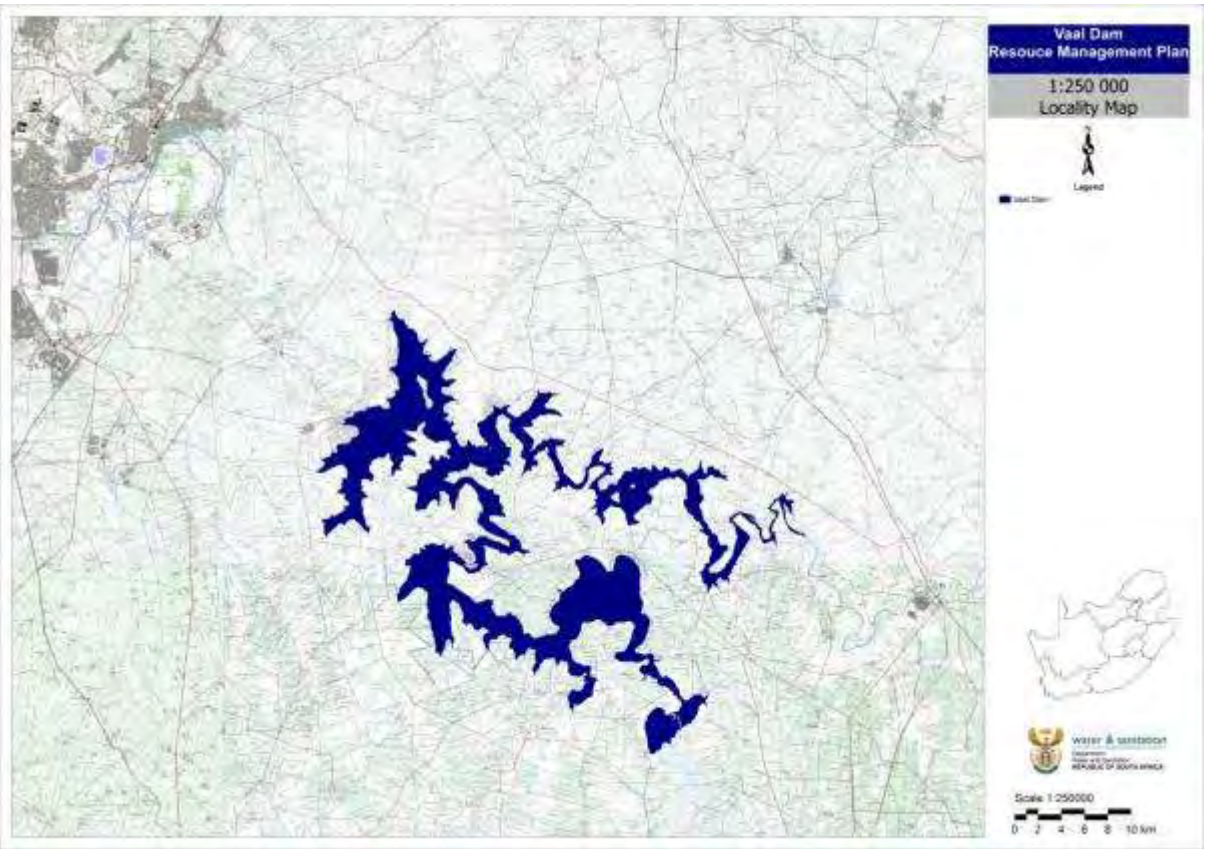


Figure 3: Location of Vaal Dam

2.4 Legislative Framework

The RMP forms the overarching framework for the management of Vaal Dam. It is informed by relevant policy, legislation and planning documents administered by other Government Departments. Similarly, these Government Departments are required to use the RMP to inform the development of future policy, legislation and planning documents.

The Vaal Dam RMP was informed by the following policies, legislation, frameworks and strategies:

- Constitution of the Republic of South Africa, (Act 108 of 1996);
- National Water Act (Act 36 of 1998);
- Municipal Systems Act, 2000 (Act 32 of 2000);
- The Development Facilitation Act, 1995 (Act 67 of 1995);
- Communal Land Right Act, 2004 (Act 11 of 2004);
- Restitution of Land Rights Act, 1994 (Act 22 of 1994);
- Intergovernmental Relations Framework Act, (Act 13 of 2005);
- Disaster Management Act, 2002 (Act 57 of 2002);
- Water Services Act, 1997 (Act 108 of 1997);
- State Land Disposal Act, 1961 (Act 48 of 1961);
- Land Administration Act, 1995 (Act 2 of 1995);
- Environment Conservation Act (Act 73 of 1989);
- National Environmental Management Act (Act 107 of 1998);
- National Environmental Management Air Quality Act (Act 39 of 2004);

- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004);
- National Environmental Management: Protected Areas Act (Act 57 of 2003);
- National Environmental Management: Waste Act (Act 59 of 2008);
- National Veld and Forest Fire Act, (Act 101 of 1998);
- Minerals and Petroleum Resources Development Act (Act 28 of 2002);
- National Heritage Resources Act (Act 25 of 1999);
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Tourism Act (Act 72 of 1993);
- South African Maritime Safety Authority Act (Act 5 of 1998);
- National Sport and Recreation Act (Act 110 of 1998 as amended);
- Safety at Sports and Recreational Events Act (Act 2 of 2010);
- Game Theft Act (Act 105 of 1991);
- Merchant Shipping (National Small Vessel Safety) Regulations, 2007
- National Environmental Management Act EIA Regulations (2010);
- South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System information;
- (Free State) Nature Conservation Ordinance, (Act 8 of 1969);
- The Free State Tourism Authority Act, 2011 (Act 4 of 2011);
- The Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998)
- The Mpumalanga Tourism and Parks Agency Act, 2005 (Act 5 of 2005);
- The Transvaal Nature Conservation Ordinance, 1983 (Act 12 of 1983); and
- Sport and Recreation SA Strategic Plan - 2011-2015.

The Section below provides an overview of how the RMP has considered some of key policies, legislation and strategies.

2.4.1 National Water Act (Act 36 of 1998)

The Act aims to ensure that the Nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account (amongst other factors):

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Redressing the results of past racial and gender discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Providing for growing demand for water use; protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations;
- Promoting Dam safety; and
- Managing floods and droughts.

Further, Section 113 of the Act makes provision for the recreational use of Dams. It further allows that the Minister may control or prohibit access to Dams and make reasonable charges for the a.) use of; b.) entrance into; and c.) use of any water surface or land associated with any Government Waterworks for recreational purposes.

The definition of water use in the Act includes the use of water for recreational use (Section 21k). Based on this requirement, the Department has published guidelines for recreational use of water and requires the following:

- DWS structures or infrastructure in and around water resources need to be constantly protected and maintained;

- Enforcement through mechanisms such as a Zonal Map, which is developed as part of the RMP process, is essential to resolve conflict amongst users both within the recreational water use; e.g. skiing vs. angling, or with other uses; e.g. agriculture;
- An appropriate degree of policing of irresponsible use should be maintained;
- Establishing water management institutions for the water resource users allows the institutions to charge for their activities therefore improving management and policing which instils a sense of ownership and responsibility among users; and
- Involving Public Private Partnerships (PPPs) could address commercial use but also assist with safety management at the Dam.

Once the RMP has been gazetted, the RMP will regulate access and use of the Dam. It is important to note that users will need to comply with other relevant legislation including the Merchant Shipping (National Small Vessel Safety) Regulations, 2007, The National Water Act, 1998 (Act No 36 of 1998), SAMSA Marine Notices and its Directive on the Standardisation of fixed and floating AtoN and Demarcation Markers on all navigable Inland Waterways in the Republic of South Africa and the relevant provincial ordinances.

According to DWAF (2007) Internal Guideline: Generic Water Use Authorisation Application Process, the term Recreational Water Use (RWU) encompasses the uses of water, including the surface, for:

- The exclusive purpose of sport, tourism or leisure;
- Personal or commercial recreational water use; and
- Activities which contribute to the general health, well-being and skills development of individuals and society.

In addition, the only water use entitlement that currently applies to RWU is Schedule 1 of the Act. Currently the Act is silent on Commercial RWU (although the Strategic Plan for Commercialisation (2009) does deal with Commercial RWU) and thus it is necessary for the RMP to provide guidance this regard.

2.4.2 GN 654 of May 1964

The only Departmental Regulations limiting RWU at Government Waterworks is Government Notice (GN) R654, dated 1 May 1964.

These Regulations are read together with section 113 of the National Water Act (Act 36 of 1998) and only apply to the water surface and surrounding State Land of a State Dam, and not to other water resources.

The Regulations provide guidance on access control, use of firearms and other weapons, speed limits, parking areas, trading, reserved areas, fire management, hygiene, camping and accommodation, access to works, photography, safety rules, reckless and unseemly conduct, damage to property, prohibited areas, protection of fauna and flora, swimming, angling, boat Regulations, water skiing and hydroplaning; and general rules.

2.4.3 Water Services Act (Act 108 of 1997)

The Act outlines the roles and responsibilities for the supply of water and sanitation to citizens. It also recognises the rights of all humans to basic water supply and sanitation services. The management of the Dam cannot compromise the purpose of the Dam especially if it is for domestic water supply.

2.4.4 National Environmental Management Act (Act 107 of 1998) as Amended

The National Environmental Management Act (Act 107 of 1998), or NEMA, as it is simply known, is the foundation piece of legislation for environmental management in South Africa.

Section 2 of the Act has the largest impact on the RMP in that future development and management of the Dam must ensure the following:

- The disturbance of ecosystems and loss of biological diversity both in and around the Dam must be avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- Pollution and degradation of the Dam is avoided, or, where it cannot be altogether avoided, is minimised and remedied;
- The disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
- Development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

Coupled with these considerations, the following is stipulated with regards to integrating social and economic aspects into the purely biophysical aspects of the environment:

> *"Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option."* ***(National Environmental Management Act, 1998 (Act 107 of 1998)***

2.4.5 National Environmental Management: Protected Areas Amendment Act (Act 15 of 2009)

The National Environmental Management: Protected Areas Amendment Act (NEMPA) (Act 15 of 2009) ensures the protection and conservation of ecologically viable areas in the country. It further seeks to achieve co-operative environmental governance and to promote sustainable and equitable utilisation and community participation.

2.4.6 The National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities.

Chapter 4, Part 2 of the Biodiversity Act provides a listing of species as threatened or protected. If a species is listed as threatened, it must be further classified as critically endangered, endangered or vulnerable. The Act defines these classes as follows:

- **Critically endangered species**: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered species**: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable species**: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in

this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain restricted activities are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the Act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species. Many Dams around South Africa are likely to have threatened or protected species. The management of these species in line with NEMBA must be taken into account in the RMP and by managers at the Dam.

2.4.7 National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Lists, 2014 (GN 599 of 2014)

The Alien and Invasive Species Lists were promulgated on 1 August 2014. They provide certain prohibitions of use of Invasive alien species. This includes Catch and release of a specimen of a listed invasive fresh-water fish or listed invasive fresh-water invertebrate species. However certain exemptions apply depending on the area and species in question. The details are provided in Notice 3 of the Species List and include:

Species	Category/Area
Large-mouth bass	a. a. 2 in National Parks, Provincial Reserves, Mountain Catchment Areas and Forestry Reserves declared in terms of the Protected Areas Act. b. 3 in all rivers, wetlands, natural lakes and estuaries in which it occurs. c. 2 for conveying, moving or otherwise translocating a live specimen. d. d. Large-mouth bass is not listed for dams within discrete catchment systems in which it occurs (excluding (a) above).
Grass carp	a. 1b in National Parks, Provincial Reserves, Mountain Catchment Areas and Forestry Reserves declared in terms of the Protected Areas Act. b. 2 for breeding of triploid grass carp. c. 3 in all other discrete catchment systems in which it occurs.
Common carp	e. 1b in National Parks, Provincial Reserves, Mountain Catchment Areas and Forestry Reserves declared in terms of the Protected Areas Act. f. 2 for release into a Dam within a discrete catchment system in which it occurs. g. 3 in all rivers, wetlands, natural lakes and estuaries in which it occurs. h. Subject to b, common carp is not listed for dams within discrete catchment systems in which it occurs.

Largemouth Bass, Grass Carp and Common Carp occur at the Dam. However certain exemptions apply for these species.

2.4.8 The National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations (GN 33683 of 19 July 2013)

The Alien and Invasive Species Regulations require the development and coordination of Species Management Programmes for all Invasive Species listed in Category 1B.

These species management programmes must stipulate the following:

- The listed invasive species to which it relates;
- The measures to eradicate or control the listed invasive species;
- The areas in which the measures are to be applied; and
- The schemes to fund the measures, if applicable.

Species monitoring, control and eradication plans are also required and the Department will publish guidelines on the compilation of these documents within a year of the publication of the regulations.

The Regulations provide for a register of alien and listed invasive species to be compiled. In addition, all research on invasive species needs

to be lodged. This has implications for the RMP as any small-scale fishery proposals or alien invasive management plans will need to be approved in line with these regulations.

2.4.9 The Municipal Systems Act (Act 32 of 2000)

The Municipal Systems Act (Act 32 of 2000) serves to provide the framework to enable municipalities to ensure access to essential services to their citizens. The Act gives priority to the basic needs of the community, but also gives local government the freedom to set tariffs, and charge for services independently of other municipalities, providing that decisions made are in the best interest of the community.

The Act is of particular relevance to the RMP process, as it requires integrated planning from all spheres of government to ensure equitable and accessible municipal services. This means that any planning or policy-making must be in line with local government policies, planning and initiatives.

2.4.10 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) seeks to provide for the conservation of natural agricultural resources by maintaining the production potential of land, combating and preventing erosion and weakening or destruction of water resources, protecting vegetation and combating weeds and invader plant species.

Given that much of the land surrounding the Dam is State Owned Land it needs to be managed in such a way that it reduces the threat and spreading of invasive alien species.

In addition, Invasive Alien Plants are known to use significant volumes of water in correlation to the plants biomass and thus affect the volume of water available for use.

2.4.11 Public Finance Management Act (Act 29 of 1999)

Section 76 of the Public Finance Management Act (PFMA) (Act 29 of 1999) provides for the making of Regulations for governing the efficient use and financial management of State Resources.

The object of the Act is to secure transparency, accountability and sound management of the revenue, expenditure, assets and liabilities of Government Departments.

The Act promotes the objective of good financial management in order to maximise service delivery. The Act allows DWS to enter into Public Private Partnership (PPP) agreements with the private sector for the commercial use of state assets.

2.4.12 Treasury Regulations of 15 March 2005

Section 16 of the Treasury Regulation provides guidance on PPP including the process that needs to be followed, procurement and management of PPPs.

2.4.13 Safety at Sports and Recreational Events Act (Act 2 of 2010)

The purpose of the Safety at Sports and Recreational Events Act (Act 2 of 2010) is to provide measures to safeguard the physical wellbeing and safety of people at at sports, recreational, religious, cultural or similar events held at stadiums, venues or along a route. It also provides for the accountability of event role-players. The Act also provides for Access Control Officers which can be appointed by the Event Organisers. These officers control access of both people and motor vehicles to an event and prevent a person from entering or requesting that a person leaves should the need arise. The Act also allows for Peace Officers to be in charge of search and seizures at an event.

The Act also specifies that an Event Planning and Safety Committee must be set up for all events categorized as medium or high risk. This

committee should include the following stakeholders:

- The National Commissioner or an authorised member;
- A local authority disaster management department or centre;
- A controlling body, in respect of high-risk events only;
- A stadium or venue owner;
- The event organiser; and
- An emergency service provider.

2.4.14 *Merchant Shipping (National Small Vessel Safety) Regulations (GN.R 705 of 8 August 2007)*

The National Small Vessel Safety Regulations, 2007 were promulgated under Section 356 of the Merchant Shipping Act (Act 57 of 1951) and provides a number of requirements including:

- Vessel Safety Requirements; and
- Crewing.

It also provides the provision of an Enforcement Officer who can board and inspect a small vessel and its appliances and equipment, ask any pertinent questions of, and demand all reasonable assistance from the owner or skipper or any person who is in charge or appears to be in charge of the vessel. The Enforcement Officer may request documents or certificate required by these regulations etc. to be produced. An Enforcement Officer may, in order to ensure compliance with these regulations and in the interests of public safety direct the movement of a vessel or prohibit the operation of the vessel.

2.4.15 *South African Maritime Safety Authority Act (Act 5 of 1998)*

One of SAMSA's three legislative mandates is "to ensure safety of life and property at sea". The Act enables SAMSA to administer and execute the relevant maritime legislation.

2.4.16 *The Free State Tourism Authority Act, 2011 (Act 4 of 2011)*

The Free State Tourism Authority Act (Act 4 of 2011) mandates the Free State Tourism Authority to achieve four important goals, namely:

- Marketing of tourism,
- Promotion of tourism;
- Development of sustainable tourism within the province; and
- Promotion of major sports events to promote tourism.

2.4.17 *(Free State) Nature Conservation Ordinance, (Act 8 of 1969)*

The Act provides for the conservation of fauna and flora and the hunting of animals. The Act also deals with fishing, the requirement for fishing licenses and management of Nature Reserves.

2.4.18 *The Mpumalanga Nature Conservation Act (Act 10 of 1998)*

The Act sets out how wild species are to be managed in terms of human use, such as collecting, fishing, hunting, capture, transport and trade. It deals with rare and endangered species and the powers needed to protect them, and the protection of sensitive natural sites from damage and exploitation.

2.4.19 *The Mpumalanga Tourism and Parks Agency Act (Act 5 of 2005)*

The Act was responsible for creating the MTPA in 2006, with a specific mandate:

- To promote and sustainably manage tourism and nature conservation; and
- To provide for the sustainable use of natural resources.

In pursuing its objectives, the MTPA is required to:

- Conserve and manage biodiversity and ecosystems;
- Develop and manage protected areas;

- Promote, develop and market tourism; and
- Create growth and transformation within the industry, and thereby economic and employment opportunities for disadvantaged people.

2.4.20 Transvaal Nature Conservation Ordinance (12 of 1983)

The purpose of this ordinance is to consolidate and amend laws relating to nature conservation including the declaration of nature reserves and the management of protected games, hunting and fisheries.

2.4.21 Lesotho Highlands Water Project Treaty, 1986

The foreign ministers of Lesotho (Colonel Thaabe Letsie) and South Africa (Mr Pik Botha) signed the Lesotho Highlands Water Project (LHWP) Treaty on 24 October 1986, in Maseru, Lesotho. The treaty aimed at governing the design, construction, operation, and maintenance of the Project, as well as the export of water to South Africa and included information on the volume of water to be delivered to South Africa, as well as a basis for sharing the benefits and a formula for calculating the royalties to be paid to Lesotho.

Importantly, the Treaty also defined the responsibilities of each county as concerns payment for the Project. South Africa was to pay for everything relating to the transfer of the water, including the implementation, operation and maintenance costs of all facilities involved, as well as compensation for the displacement of individuals and communities. Lesotho would finance the hydroelectric power component of the Project.

The Treaty also set out the structures for management of the project including the following:

- The Joint Permanent Technical Commission (JPTC) which has a monitoring, advisory and approval function with regard to the project implementation in Lesotho. Protocol VI resulted in a revision of the governance on the Project, as well as a re-naming of the JPTC, to reflect its true nature: the Lesotho Highlands Water Commission (LHWC). The LHWC has the responsibility for a bi-national body consisting of three delegates per country, that advices the Lesotho Highlands Development Agency (LHDA) on design, technical acceptability, tender procedures and documents, cash flow forecasts, allocation of costs and financing arrangements;
- The Lesotho Highlands Development Authority (LHDA) was set up to manage that part of the Project that falls within Lesotho's borders-the construction, operations and maintenance of all dams, tunnels power stations and infrastructure- as well as secondary developments such as relocation, resettlement, compensation, supply of water to resettled villages, irrigation, fish hatcheries and tourism;
- The Trans-Caledon Tunnel Authority (TCTA) takes care of the delivery tunnel transporting the water over(or rather, under) the border (the Caledon River) to the Ash River, as well as all structures required to integrate and control the flow of Lesotho water in the river.

The LHDA reports to the Commission on all matters concerning the Project, but the TCTA, with its structures now complete, is only responsible to the LHWC with regard to operations and maintenance issues (Meissnera and Turton, 2003).

2.5 Existing Plans

An RMP cannot function in isolation and so all associated planning initiatives must be considered and used to inform the development of the RMP.

The following planning initiatives were taken into account in developing the RMP:

- The Integrated Development Plan (IDP) of MMLM, DLM and MLM;
- The Free State and Gauteng Provincial Spatial Development Frameworks (PSDF);
- The Mpumalanga Biodiversity Conservation Plan;
- The Water Services Development Plan of MVLM, MLM and DLM;
- The Strategic Framework of Water Services, 2003;
- The Provincial Spatial Economic Development Strategy, 2003;
- National Spatial Development Perspective, 2006;
- The New Growth Path, 2012; and
- The Cooperative Inland Waterways Safety Programme.

Figure 4 below provides an overview of how the RMP is informed by existing plans at different spheres of government.

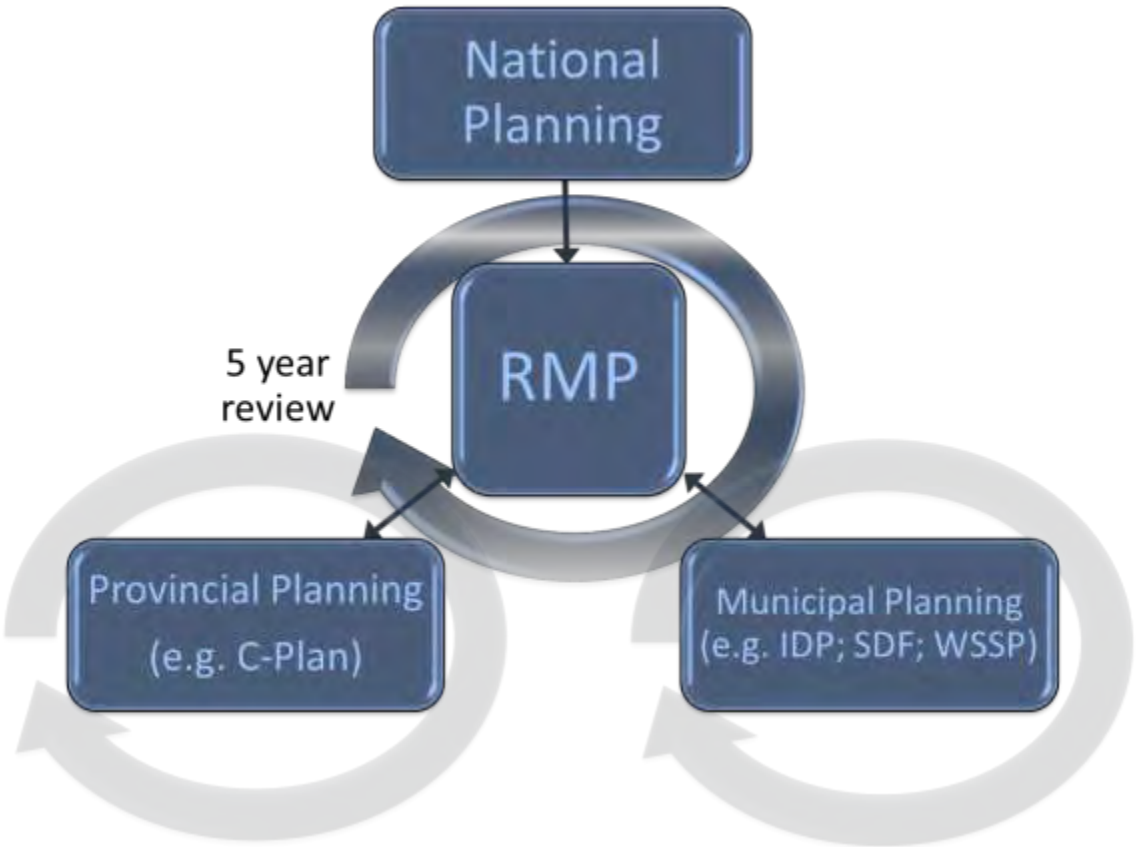


Figure 4: Relationship between RMP and Planning Initiatives

2.5.1. The Cooperative Inland Waterways Safety Programme

The Cooperative Inland Waterways Safety Programme (CIWSP) project is a partnership between multiple government entities and between the government and the community. The aim is to enhance the development of a best practice model to ensure a safe and structured inland maritime environment and culture, whilst protecting the country's precious water resources. Although Vaal Dam is not one of the Pilot Dams for this project, this RMP integrates information from the CIWSP into the management objectives for this Dam.

2.5.2. The Vaal Dam Zoning Plan, 2001

DWS (then Department of Water Affairs and Forestry – DWAF), developed the Vaal Dam Zoning Plan in 2001 as an addition to the Vaal River Complex Regional Structure Plan. The main aims of the zoning plan were to allow for:

- The promotion of safe, optimal, equitable, sustainable and compatible recreational development and related water use of government water works;
- The facilitation of consideration of requests for access and development in a procedurally fair manner; and
- The effective and fair management and control of recreational use within the study area.

2.6. Socio-Economic Environment

MVLM is an administrative area in the Sedibeng district of Gauteng and lies between Johannesburg and the East Rand and the Vaal River and Vereeniging. MLM is one of the local municipalities that fall under the Fezile Dabi District in the Free State province. While, DLM is situated in the southern part of the Gert Sibande District Municipality. Unless otherwise indicated, all information in the section was obtained from the Census 2011 (Statistics South Africa, 2011) data.

2.6.1. Population

According to Census 2011, MVLM has a total population of 95 305, of which 58.4% are black African, 38.7% are white, 1.6% are coloured, and 0.6% are Indian/Asian. In contrast, MLM has a far larger proportion of people who are black African (82.3%). In addition, 0.7% are coloured, 16.4% are white and 03% are Indian/Asian. DLM has similar demographics with almost 90% of the population being black African, with the white population making up 8.6%. The other population groups make up the remaining 1.4% (Table 3).

Table 3: Population Groups

Municipality	MMLM	MLM	DLM
Black African	58.40%	82.30%	89.80%
Coloured	1.60%	0.70%	0.50%
Indian/Asian	0.80%	0.30%	0.90%
White	38.70%	16.40%	8.60%
Other	0.50%	0.30%	0.20%

2.6.2. Education

According to Census 2011 data, in MVLM, 14.9% of the population have completed matric. Both MLM and DLM have similar statistics although to a lesser extent with only 13.9% of MLM have completed matric and only 12.2% of DLM have (Table 4).

Table 4: Highest Education

Municipality	MMLM	MLM	DLM
No Schooling	3.20%	3.20%	2.80%
Some Primary	36.90%	38.80%	43.40%
Completed Primary	5.70%	5.80%	6.70%
Some Secondary	32.20%	33.80%	33.50%
Completed Secondary	14.90%	13.90%	12.20%
Higher Education	3.10%	2.20%	1%
Not Applicable	4%	2.30%	0.40%

2.6.3. Employment

In terms of employment for those aged between 15 to 65 years, in MVLM, more than half the population are employed (55.57%) with on 12.83% unemployed. In MLM, the

unemployment rate is higher (20.27%) although 42.82% do have work. In DLM, the unemployment rate is highest (22.33%) with only 37.72% of those between 15 and 65 being employed (Table 5).

Table 5: Employment for those between 15 and 65

Employment Status	MMLM	MLM	DLM
Employed	55.57%	42.82%	37.72%
Unemployed	12.83%	20.27%	22.33%
Discouraged Work Seeker	2.89%	2.91%	4.63%
Not Economically Active	28.71%	34.00%	35.32%

2.6.4. Average Household Monthly Income

Average income is grouped into the following brackets:

- No income;
- R1 - R4,800;
- R4,801 - R9,600;
- R9,601 - R19,600;
- R19,601 - R38,200;
- R38,201 - R76,4000;
- R76,401 - R153,800;
- R153,801 - R307,600;
- R307,601 - R614,400;
- R614,001 - R1,228,800;
- R1,228,801 - R2,457,600; and
- R2,457,601+.

Table 6 below shows average household income per month for 2011. The majority of households in MLM and DLM are earning between R9 601 and R19 600 per month. In MVLM, the majority (16.40%) are earning between R19.601 - R38.200.

Table 6: Average Household Monthly Income

Municipality	MMLM	MLM	DLM
None income	14.50%	13.20%	12.90%
R1 - R4.800	3.20%	4.80%	4.40%
R4.801 - R9.600	4.90%	7.10%	6.90%
R9.601 - R19.600	14.80%	14.90%	19.90%
R19.601 - R38.200	16.40%	19%	22.90%
R38.201 - R76.4000	12.40%	14.10%	15.40%
R76.401 - R153.800	10.30%	10.20%	9.40%
R153.801 - R307.600	10.90%	8.80%	5.30%
R307.601 - R614.400	8.30%	5.40%	2.20%
R614.001 - R1.228.800	3.10%	1.80%	0.40%
R1.228.801 - R2.457.600	0.70%	0.40%	0.10%
R2.457.601+	0.50%	0.30%	0.10%

2.6.5. Gross Value Added

Gross Value Added (GVA) is defined as the total value of all the goods produced in a specific area during a specific period.

Quantec Research defines the major sectors into Primary Sector, which is extractive, Secondary Sector, made up of manufacturing and the Tertiary Sector, which comprises of services. The Table below shows the GVA per sector for 2011. This data is taken from Quantec Research and the variables are explained below.

Primary Sector:

- Agriculture, forestry and fishing; and
- Mining and Quarrying.

Secondary Sector:

- Manufacturing. This includes food, beverages and tobacco; textiles, clothing and leather goods; wood, paper, publishing and printing; petroleum products, chemicals, rubber and plastic; other non-metal mineral products; metals, metal products, machinery and equipment; electrical machinery and apparatus; radio, TV, instruments, watches and clocks; transport equipment; and furniture and other manufacturing.
- Electricity, gas and water; and
- Construction.

Tertiary Sector:

- Wholesale and retail trade, catering and accommodation. This sector represents the tourism sector through catering and accommodation and the sale of goods through trade.

- Transport, storage and communication;
- Finance, insurance, real estate and business services;
- Community, social and personal services; and
- General Government.

Table 7 below shows that the greatest contribution is from Manufacturing for MVLM, MLM and DLM (R1 279 million, R2 450 million and R210 million respectively). DLM makes relatively low contributions to GVA while MLM makes the highest.

Table 7: Regional output and GVA by industry at basic prices by 2006 local municipality 2011 in R millions

Regional output and GVA by industry at basic prices by 2006 local municipality 2011 in R millions			
Municipality	**MMLM**	**MLM**	**DLM**
Total	**4276**	**6171**	**924**
Agriculture, forestry and fishing	29	65	104
Mining and quarrying	147	559	11
Manufacturing	1279	2450	210
Electricity, gas and water	288	175	184
Construction	311	90	31
Wholesale and retail trade, catering and accommodation	618	492	133
Transport, storage and communication	271	264	21
Finance, insurance, real estate and business services	798	1086	178
Community, social and personal services	126	472	24
General government	407	517	29

2.6 Development Potential

Despite the fact that the Vaal Dam is well known and already attracts numerous visitors for a number of recreational activities, there is still potential for further development. Currently, development has been constrained by a lack of public resorts and access for day visitors as well as the fact that much of the shoreline is privately owned and therefore not open to recreational use by visitors. The Sedibeng SDP (2013) highlighted the impact of subdivision of land adjacent to River or Dam which often serves to sterilise the plot as well as the land behind them from further agricultural or tourism as approximately 100m of frontage is used by one dwelling and no further development is possible.

The development potential of the Vaal Dam is high for a number of reasons, firstly, the Dam is located only 56km from Johannesburg and is therefore ideally located for weekend and holiday visits from the major urban area of Gauteng. Secondly, with 850km of shoreline, the Dam is one of the largest in South Africa and therefore can provide for a number of different activities. In addition, a number of routes, recreational activities, estates and tourism guides have been created to capitalise on this including the following:

- The Vaal Meander: The meander was developed approximately 16 years ago by local artists and crafters pooled their ideas to bring the public out of the hustle and bustle of Johannesburg city life into the tranquil surroundings of greater Southern Gauteng. International and local tourists were invited to see these artists at work. Over the years the Vaal Meander has grown to include many fascinating attractions. Its central location provides an ideal site for a meander route that can be tailored to suit individual interests. From daytrips to longer country breaks in little hideaways or quaint accommodations, the area is well-known for its craft factories, outdoor adventure centres, entertainment, animal attractions, sporting facilities, boating and world class conference venues. There are also a host of delightful bed & breakfast, self catering establishments and romantic wedding venues on the banks of the Vaal River or Vaal Dam;
- The Vaal Birding Route was also recently launched (GTA, 2013) and aims to harness the launch of the lucrative Avi-tourism market;
- The Vaal Wine Route has also been developed as part of promoting domestic tourism and includes six

weeks of wine tasting (usually between July and August) at a number of venues showcasing 44 different Wine Estates with over 300 wines; and

- There is also a push to develop the Vaal Region as a Wedding and Function destination by the Vaal Wedding Association (Vaalwed);
- Due to the large shoreline and surface area, the Dam is also used for recreation and a number of Sailing Clubs are located at the Dam; and
- Further, a number of estates have also recently been built around the Dam including Harbour Town and Peninsula on the Vaal.

2.7 Access and Infrastructure

Public access is available at the Dam in Deneysville and Oranjeville at public fishing/picnic spots. These are not well maintained and do not have many facilities in place. In Vaal Marina, there is no formalised public access point for community members from Mamelo although subsistence fishing does occur and some individual access through the Vaal Marina Property Owners Waterfront Association (VMPOWA) takes place. Currently there is no subsidy programme or community access card in place.

A number of marina's, jetties and slipways occur around the Dam. These are privately owned and in some cases include significant infrastructure.

The main infrastructure at the Dam includes:

- The Vaal Dam Wall;
- Vaal River Eastern Subsystem Augmentation Project (VRESAP);
- Rand Water Abstraction Infrastructure;
- A number of weirs which are now underwater; and
- Recreational infrastructure (slipways, marinas etc.).

During consultation it was also noted that powerlines cross the Dam at one point and that this has resulted in an accident where someone was electrocuted whist sailing beneath the lines.

2.8 Biophysical Environment

2.8.1 Water Quality

The water quality at Vaal Dam has been monitored by DWA since 1968. The average values during the period between 1968 and 2014 are provided below for Monitoring Point C83_90604 (Table 8). For the most part, the values are good and the time series analysis does not show any worrying trends at this point. However, levels of phosphorous in the Dam over the monitoring period is a concern.

Table 8: Water Quality at Vaal Dam

Variable	Average (1976-2013)
Calcium (Ca)	14.46
Chloride (Cl)	8.63
Dimethyl sulphide (DMS)	148.31
Electrical Conductivity (EC)	20.41
Fluoride (F)	0.24
Potassium (K)	3.34
KJEL_N_Tot_Water	0.79
Magnesium (Mg)	7.42
Sodium (Na)	11.49
Amonia (NH4_N)	0.06
Nitrates (NO3_NO2)	0.23
Phosphorous (P)	0.11
pH	7.87
Phosphates (PO4_P)	0.04
Silicon (Si)	4.81
Sulphates (SO4)	16.14
Total Alkalinity (TAL)	68.86

The Maucha Diagram below shows that the Total Alkalinity (TAL) of the Vaal Dam is relatively high (Figure 5).

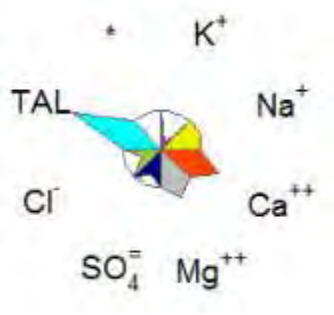


Figure 5: Maucha Diagram for Vaal Dam

However, according to DWS (DWAF, 2009), Total Dissolved Salts (TDS) are within acceptable limits at Vaal Dam (average TDS concentration of water in Vaal Dam is 154 mg/l). This is an improvement to the rest of the Vaal River Catchment and is attributed to the inflow of water from Katse Dam (part of the LHWP) which acts to dilute the water from the catchment. However, should the inflow from Katse Dam not occur, water quality issues related to TDS would most likely occur.

Further, one of the main concerns noted during consultation was that of water quality especially in relation to the following WWTWs which were noted to be operating above their design capacity:

- Deneysville;
- Oranjeville;
- Vaal Marina;
- Frankfort; and
- Villiers.

The DWS Green Drop Status Reports for these WWTWs were assessed (DWS, 2014) and show that all five do not meet the required operational compliance (Figure 6)

In general, DWS has found that uncontrolled sewage and poorly managed wastewater treatment works in the Upper Vaal Water Management Area (WMA) is due to a lack of skilled contractors who render services and poor construction supervision, which diminishes the life expectancy of infrastructure; lack of municipal staff (especially engineers, scientists and technicians) to operate and maintain water services infrastructure; and absent or weak municipal systems for infrastructure management (DWAF, 2009).

Further, the persistent discharge of treated sewage is one of the most obvious sources of degradation of urban freshwater ecosystems (Luger & Brown, 2004). However, these relatively constant impacts are exacerbated by emergency events like intermittent spillages of raw sewage due to power failures, pump or pipe failures or blockages, and inadequate hydraulic capacity during high rainfall events. The impact of these non-compliant wastewater discharges from the WWTWs is considered to be a major contributor to salinity, eutrophication and microbiological problems. The sewage works in many of the smaller towns are inadequate and are in a poor state. The total effluent return flow from wastewater treatment plants to the river system in the Upper Vaal WMA is 295,5 x 106m3/a (DWAF, 2002a) and thus is quite significant.

This situation is largely to poor management, poor planning, lack of resources and capacity, inadequate skilled personnel and the lack of prioritising wastewater treatment as an issue within local government planning.

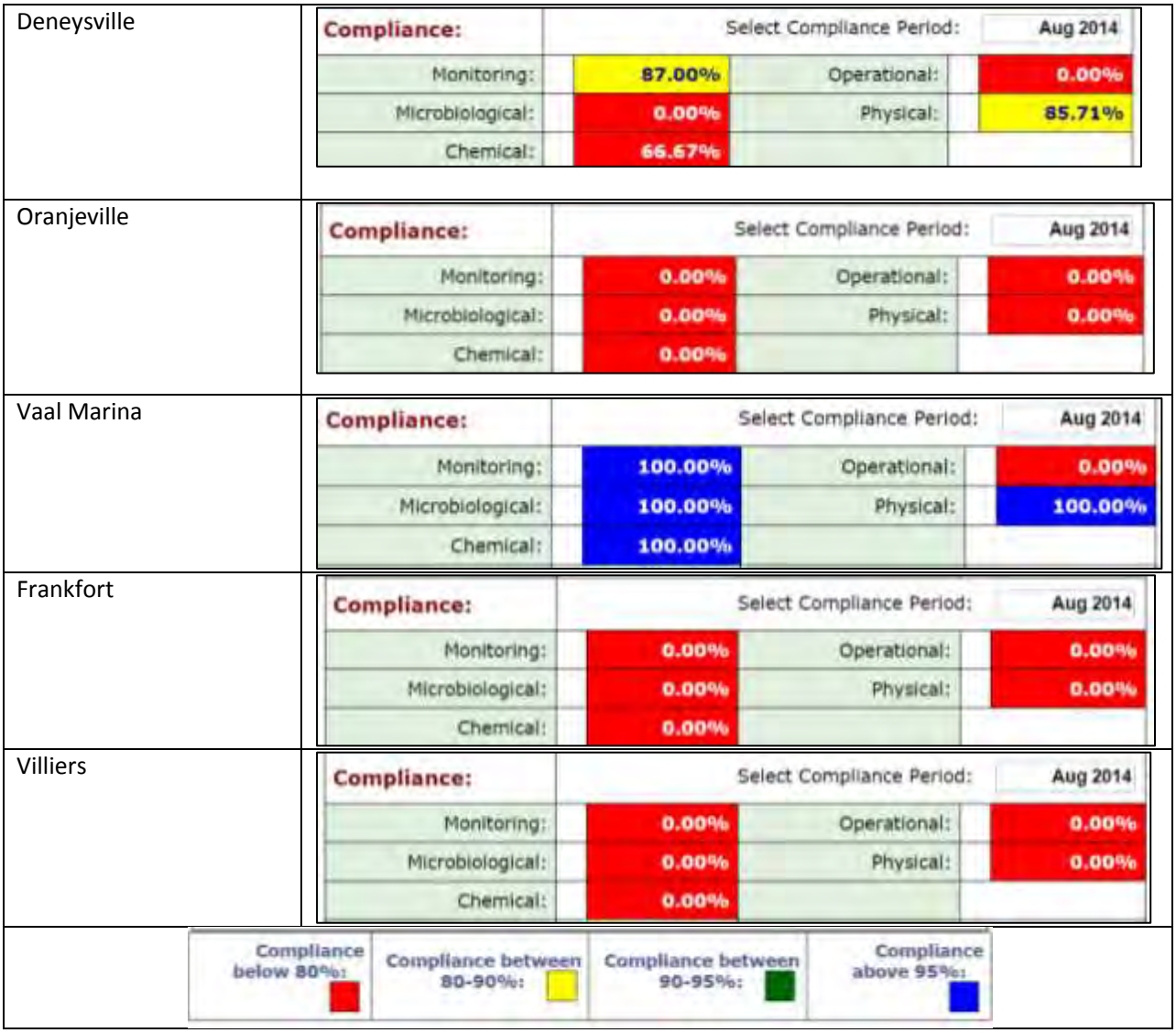


Figure 6: Green Drop Compliance (DWS, 2014)

According to DWAF 2009, deterioration of the water quality of the water resources in the Vaal River System, is mainly attributable to the following land use impacts:

- Wastewater treatment works discharges (from the numerous small towns and urbanised areas within the catchment area, many of which are non-compliant to the wastewater discharge standards and licence conditions);
- Mining pollution (point decants from dewatering and diffuse pollution originating from mining areas and tailings dams);
- Urban run-off (arising from the highly urbanised areas within the catchment with formalised and informal settlements);
- Irrigation return flow (originating from large irrigated areas within the system which carry fertilisers and high salt loads through leaching); and
- Industrial pollution (originating from direct discharges to the water resource and from diffuse pollution at the numerous industrial complexes within the catchment area).

Water quality monitoring undertaken by DWS and Rand Water show that for the most part the variables fall within the in-stream quality guidelines for the Vaal Dam Catchment for the period 2013 to 2014. However Nitrates were in the unacceptable levels in some cases as was, chemical oxygen demand, ammonia and *E.Coli* (Table 9).

Table 9: Quarterly water quality monitoring (www.reservoir.co.za)

	Vaal Dam 1 - Rand Water Intake				Vaal Dam 2 - Confluence of Vaal and Wilge				Vaal Dam 3 - Wilge River downstream of Oranjeville				Vaal Dam 4 - Upstream of Vaal Marina			
Ammonia	0.15	0.15	0.25	0.2	0.15	0.15	0.25	0.2	0.15	0.15	0.25	4.5	0.1	0.2	0.2	0.2
Chloride	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fluoride	0.24	0.24	0.29	0.22	0.23	0.25	0.27	0.24	0.19	0.25	0.23	0.21	0.29	0.3	0.34	0.25
M-Alkalinity	70	69	67	62	65	67	63	61	57	62	59	58	87	91	65	61
Nitrate	1.1	0.34	0.51	0.83	1.1	0.28	0.64	0.92	1.1	0.26	0.23	0.46	0.61	0.16	0.59	0.74
Phosphate	0.13	0.07	0.1	0.11	0.07	0.16	0.08	0.13	0.7	0.1	0.4	0.7	0.7	0.13	0.13	0.13
Sulphate	21	19	27	34	14	18	19	18	8	15	18	14	25	24	28	22
Chemical Oxygen Demand	<10	<10	16	18	23	12	31	19	<10	<10	<10	16	18	23	28	27
Conductivity	20	22	21	22	18	18	22	20	15	20	16	18	25	30	21	22
pH	7.7	7.3	7.6	7.4	7.7	7.1	7.6	7.3	7.4	7.5	7	7.6	7.4	6.39	7.3	7.4
E. coli	4	13	50	7	1	9	7	3	7	10	3500	3	1	15	13	2

DWS (DWAF, 2009) has also found that the Vaal Dam can be classified as eutrophic due to relatively high levels of Total Phosphorus (TP). Further, there appears to be an increasing trend in P concentrations in the Dam with the average phosphate increases from about 40 to 60 µg/ℓ, i.e. a 50 % increase, during the past 10 years (Figure 7).

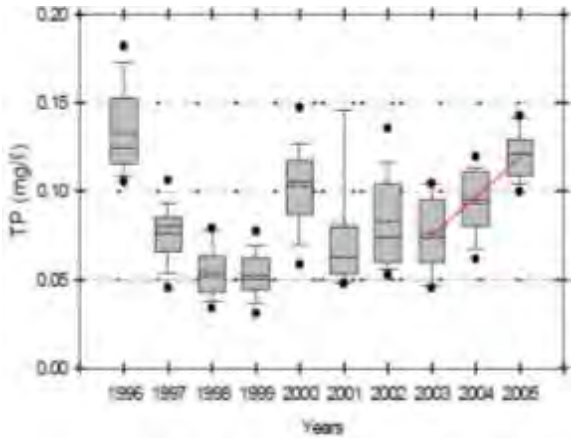


Figure 7: Increasing TP (DWAF, 2009)

One of the major consequences of eutrophication is the potential for Cyanobacterial blooms, which often including species such as *Microcystis* species that can be toxic to man, biota, livestock and wildlife. The production of the toxins by the algae also pose a threat and could involve additional water treatment ranging from granular activated carbon filtration, followed by reverse osmosis, to more elaborate treatment including membrane filtration (WHO, 1999). *Microcystis aeruginosa*, *Oscillatoria* spp., and Anabaena floss-aqua have regularly been recorded in the Vaal River and the probability for toxic algal blooms are high. Taste and odour problems are also a common symptom of eutrophic waters worldwide.

The phytoplankton concentration (expressed as chlorophyll-a) in the Vaal Dam shows an increasing trend with an overall average of 20 µg/ℓ. The increasing trend in chlorophyll-a concentration could be ascribed to the increasing trend in P concentrations discussed above. The peak chlorophyll concentrations also seems to increase with a recorded maximum of 250 µg/ℓ. Generally it is the peaks of algal development (the blooms) that cause the management problems in most reservoirs. Even though 57 % of the observed data was the

chlorophyll-a concentration ≤10 µg/ℓ, the percentage of time with chlorophyll-a concentrations >30 µg/ℓ was 11 %, which indicate a significant nuisance value of algal bloom productivity.

In addition, cyanobacteria (especially *Microcystis* and *Anabaena*) dominate (55%) the algal composition in Vaal Dam (DWAF, 2009) (Figure 8).

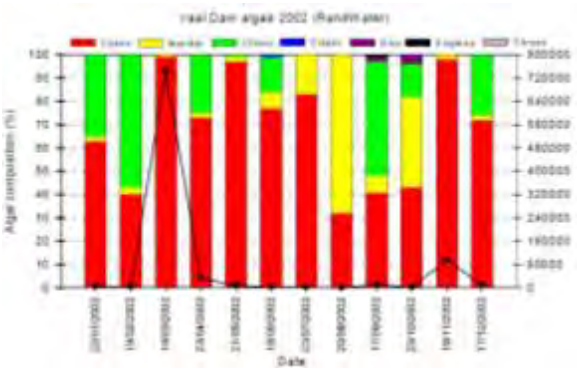


Figure 8: : Algal Composition (DWAF, 2009)

Another issue is the impact of algal blooms on the supply of water for irrigation. The distribution of nutrient rich water can impact on the efficient abstraction, transfer, pumping, calibration of weirs and distribution of irrigation water, which could result in losses from canals. These impacts could have economic implications on agricultural users. A further problem of algae present in irrigation waters is that it could affect the efficiency of the irrigation system used, for example drip irrigation systems can become blocked. While the exact impact of the algae present in the Vaal River on irrigation systems has not been determined, it is believed that it could present a problem in the future.

In addition, these bacteria are capable of producing a number of toxins including β-N-methylamino-L-alanine (BMAA).

Studies by Esterhuzien-Londt (2010) evaluated BMAA which is produced in most cyanobacterial blooms. This has potential negative impacts on human health as very low BMAA concentrations are required to yield neurological damage and even motor neuron death. However, the extent of the risk to humans from direct exposure of free BMAA in these waters remains unknown (Esterhuizen-Londt, 2010). BMAA was first detected in 2005 and thus the necessary tolerable daily intake and guideline values for BMAA have not been established. In addition there is limited information on prevalence, incidence, and toxicology. The efficiency of standard water treatment processes to remove other cyanotoxins such as microcystin has been extensively studied but no studies on the removal of BMAA have been undertaken. As Vaal Dam is used for domestic use, this lack of information can have extremely negative implications.

Fortunately, Esterhuzien-Londt (2010) found that in the absence of dissolved organic carbon in the water, BMAA is efficiently removed by sand filtration, chlorination by calcium hypoclorite, and powdered activated carbon during water treatment. However, flocculation was not effective in BMAA removal and the ozone concentrations achieved were not sufficient to result in BMAA removal.

In addition, BMAA was detected as both free and protein-associated fractions in Clarias gariepinus (Catfish), and Crocodylus niloticus (Crocodile) liver samples. BMAA content increased from the fish to the crocodile. BMAA content in the crocodile samples increased with age and thus bioaccumulation does appear to occur. Catfish is consumed occasionally by humans.

In terms of metals, it should be noted that metals entering the Dam cannot disappear from a system, but can only be transferred from one place to another (Crafford and Avenant-Oldewage, 2010). It is the build-up of these metals over many decades in sediment ‘sinks’ that is of major concern today (Lloyd, 1992) as sediment can affect water quality in many ways. Under certain circumstances pollutants can be remobilised into the water column (Coetzee, 1993; Grobler et al., 1987). A number of mechanisms regarding metal binding to, and release from, sediments have been identified. These include acid-volatile sulphides in anaerobic sediments, particulate organic carbons in aerobic sediments, iron and manganese oxyhydroxides in aerobic sediments (all metal-binding phases), complexation by

ligands and oxidation caused by physical, biological and human activities (Chapman et al., 1998), such as re-suspension of sediment during flood conditions (Literathy and Laszlo, 1977). Water bodies in the Vaal River system are generally shallow and seldom develop anaerobic hypolimnia (Grobler et al., 1987). As a result re-suspension (i.e. oxidation caused by physical and biological activities) rather than chemical release could be the dominant mechanism for returning pollutants to the water column (Grobler et al., 1987).

Gouws and Coetzee (1997) found the extractable metal content (Ni, Mn, Co, Cr, Zn, Fe, Ca, Sn, Cd, Pb, Al and Cu) of Vaal Dam sediment to be low. Furthermore major proportions of most metals seemed to be associated with the inert phase and could therefore be classified as being of geochemical origin (Gouws and Coetzee, 1997). In comparison, the Vaal River Barrage receives domestic and industrial runoff and effluent from the PWV area, through streams like the Rietspruit and the Klip and Suikerbosrand Rivers. Water quality at the Vaal River Barrage is poorer when compared to the Vaal Dam (Crafford and Avenant-Oldewage, 2009). However, contrary to expectations, metal concentrations in sediment and water recorded at both localities were similar although water quality at the barrage is worse. There is therefore a risk that these metals can become bio-available and once again enter the water column, thus impacting water quality at the Dam.

Another indirect issue is the water quality at the Vaal Barrage (downstream of the Vaal Dam) which is far worse than that of the Vaal Dam. This results in a number of potential issues. Firstly, major industrial users are experiencing an increase in treatment costs especially with regard to the high TDS concentrations and in some cases the nuisance algal blooms, and water hyacinths. Some additional problems experienced include corrosion and scaling which are of major importance to industrial users, especially those employing elevated temperatures for processes such as steam generation; increased waste generation and deterioration in effluent quality. The poor water quality of the Vaal Barrage therefore limits its use by potential users. Industrial users such as Sasol, Mittal Steel and Eskom (Lethabo Power Station) now rely on Vaal Dam water and this has added additional demand on the Vaal Dam.

Another issue is potential AMD releases into the Vaal Barrage. If AMD, which has not been desalinated, is discharged into the Vaal River System, the high salt load will require large dilution releases to be made from the Vaal Dam to achieve the fitness-for-use objectives set for the Vaal Barrage and further downstream. This would result in unusable surpluses developing in the Lower Vaal River. Moreover, if dilution releases are still required after 2015, the acceptable levels of assurance of water supply from the Vaal Dam would be threatened. This will mean that there would be an increasing risk of water restrictions in the Vaal River water supply area, which will have negative economic and social implications. These negative impacts will be much greater if the catchment of the Vaal River System enters a period of lower-than-average rainfall with drought conditions (DWA, 2013).

It can be seen from Figure 9 that the amount of water that is required from the Vaal Dam to dilute the saline mine water will reduce the long term yield by about 400 million m³ per annum. This means that the yield of the future Phase 2 of the LHWP is effectively lost from the system (Van Wyk et al., 2010). This is a major concern.

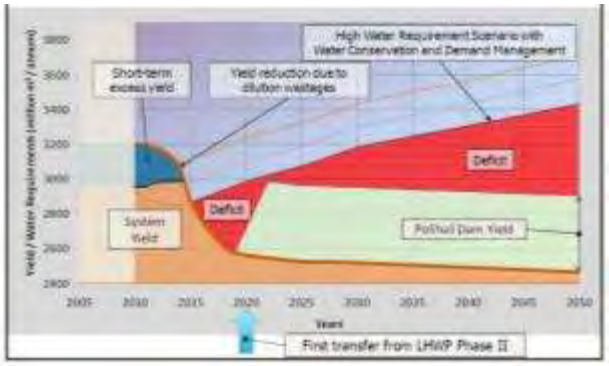


Figure 9: Impact of Water Requirements for Dilution of the Vaal Barrage of Water Availability (Van Wyk et al., 2010)

There is also potential for AMD to affect the Vaal Dam itself due to mining in the headwaters of the Vaal River. According to the Integrated

Water Quality Management Plan for the Vaal River System (DWAF, 2009), the most significant pollution sources in the incremental catchment between Vaal Dam and Grootdraai Dam are located in the Waterval River catchment. These include gold and coal mines as well as the Sasol Secunda oil-from-coal petrochemical plant. There are significant waste facilities in the form of ash dumps and tailings storage facilities associated with the mines and Sasol Secunda industrial complex. There are also point source discharges in the form of permitted cooling water blow down from Sasol Secunda plant and the major wastewater treatment works discharges from Embalenhle and Secunda.

2.8.2 Flora

2.8.2.1 Aquatic Invasive Plant Species

Currently 14 alien aquatic and wetland plant species are declared weeds or invader plants in South Africa and their control is subject CARA, Act 43 of 1983, and amended in 2001. Another 13 species have been proposed for listing under CARA and NEMBA, Act 10 of 2004. There are also a number of indigenous or cosmopolitan (world-wide) species that can flourish and become troublesome in disturbed aquatic habitats.

Macrophytes such as *Eichhornia crassipes* (water hyacinth) which are free floating plants are also a common problem in the Vaal River System and have been a nuisance in the Vaal River since 1985 (DWAF, 2009). However, according to the Agricultural Geo-Referenced Information System (AGIS) Weeds and Invasive Plants (WIP) Database, water hyacinth does not occur in the Quarter Degree Square (QDS) around the Dam. The presence of the weed upstream however is a concern as infestations are likely to occur as a symptom of eutrophication.

Water hyacinth is indigenous to the New World tropics, with its centre of origin in Amazonia, Brazil (Barrett & Forno 1982). To date the distribution of water hyacinth is mostly pan-tropical, but it also occurs in warm temperate regions of the world, extending to latitudes 40° N and S (Gopal 1987).

Figure 10: Water Hyacinth (SAPIA, 2010)

Reproduction of water hyacinth is both sexual and asexual, with asexual reproduction being the most predominant (Center & Spencer 1981). However, sexual reproduction does occur and each flower can produce a large number of seeds that can remain viable up to 20 years (Gopal 1987). There are several sites in South Africa where seeds have been found in the substrate and several of these seeds are viable, with germination between 25 and 80 % (Albano Pérez et al. 2011).

Due to vegetative growth under suitable conditions water hyacinth populations can grow very quickly and in some cases double their biomass in as little as 11 to 18 days (Edwards & Musil 1975). As the nutrient concentrations (nitrogen and phosphorous) increase it has been shown that water hyacinth biomass also increases.

The species is known to cause major ecological and socio-economic impacts. According to Villamagna and Murphy (2010), these impacts include:

- Altering of water clarity and decrease in phytoplankton production, dissolved oxygen, nitrogen, phosphorous, heavy metals and concentrations of other contaminants;
- Decreasing abundance and diversity of aquatic invertebrates through decreased phytoplankton (food) availability;
- Decreased dissolved oxygen concentrations and decreased

phytoplankton negatively impact fish species;
- Increasing of sedimentation rates within the plant's complex root structure; and
- Increased evapotranspiration rates from water hyacinth leaves when compared to evaporation rates from open water.

According to AGIS WIP database, *Azolla filiculoides* (red water fern) and *Arundo donax* (Giant Spanish Reed) occur in the QDS around the Dam.

Figure 11: Azolla filiculoides (www.invasives.org)

A. filiculoides is a small, free floating freshwater fern, green to reddish-brown or purplish orange or red at the edges, branching freely, and breaking into smaller sections as it grows. It forms dense mats and outcompetes native plant species. These infestations can reduce light levels below the mats and cause die off of water plants and algae and reduce water oxygenation levels with serious impacts on fish and other fauna (Lusweti et al., 2011).

The species also causes a decrease in drinking water quality due to bad odours, colour and turbidity. The economic impact of *A. filiculoides* in South Africa was calculated by McConnachie et al. (2003). Among those water-uses most seriously affected were farming (71%), recreational (24%), and municipal (5%). On average, *A. filiculoides* was found to cause on-site damages of US$589 per hectare per year.

A. donax is an aggressive species with an ability to reproduce quickly, allowing it to out-compete native plant species, and has established itself as one of the primary threats to native riparian habitats in its introduced range, dramatically altering ecological and successional processes and altering habitats towards dense, monotypic stands up to 8 m tall. It is listed as one of the 100 world's worst invasive alien species (ISSG, 2011). This species represent a serious concern in arid and semiarid habitats because it outcompete native vegetation in the access to soil-water. It uses more water than native plants, lowering groundwater tables. *A. donax* is highly flammable and can change fire regimes in invaded areas (USDA-ARS, 2014).

Control is an expensive process involving cutting plants to the ground and manual application of herbicides to avoid harming native species. Biological control efforts are being developed as one of the primary tools for the long-term management of this pest (CABI, 2014).

Further, in general, invasive aquatic plants are known to disrupt navigation, fishing and other recreational activities, adversely affect waterflow, increase the loss of water from storage dams and pose a threat to hydro-electric installations. High densities of the plants degrade aquatic ecosystems and are a threat to biodiversity. They can also result in the deaths of cattle and livestock (due to walking on 'beds' of aquatic weeds which can result in drowning).

2.8.2.2 Terrestrial Invasive Plant Species

Invasive alien plants are widely regarded as the single greatest threat to South Africa's biological diversity. The water taken up by alien plants affects not only the water supply, but can also have negative impacts on water quality.

A large number of alien species occur in the 3025DA, 3025DB, 3026CA and 3026AC QDS surrounding the Dam. These include the following.

- *Achyranthes aspera;*
- *Agave americana;*
- *Argemone ochroleuca;*
- *Atriplex inflate;*

- *Cirsium vulgare;*
- *Convolvulus arvensis;*
- *Cupressus arizonica;*
- *Cuscuta campestris/suaveolens;*
- *Datura ferox;*
- *Datura stramonium;*
- *Echium plantagineum;*
- *Eucalyptus camaldulensis;*
- *Eucalyptus* sp;.
- *Gleditsia triacanthos;*
- *Melia azedarach;*
- *Nicotiana glauca;*
- *Opuntia engelmannii ;*
- *Opuntia ficus-indica;*
- *Opuntia imbricate;*
- *Opuntia robusta;*
- *Pinus* sp.;
- *Populus deltoides;*
- *Populus nigra;*
- *Populus X canescens;*
- *Prosopis glandulosa;*
- *Prosopis velutina;*
- *Prunus armeniaca;*
- *Prunus persica;*
- *Pyracantha angustifolia;*
- *Robinia pseudoacacia;*
- *Rosa rubiginosa;*
- *Salix babylonica;*
- *Salix babylonica;*
- *Salsola kali/tragus;*
- *Schinus molle;*
- *Tamarix* sp.;
- *Xanthium spinosum;* and
- *Xanthium strumarium.*

This is an encumbrance for the management of the Dam as terrestrial invasive plant species are known to result:

- Loss of indigenous species as a result of competition for space and resources with alien species;
- Disruption of aquatic and riparian ecosystems;
- Erosion of river banks and riparian areas;
- Alterations in environmental flows as a result of water use by invasive alien plants; and
- An increased fire risk, which destroys indigenous habitats.

A further issue related to thus is the apparent community perception that removal of invasive species has a negative impact in terms of habitat provision for birds, increased erosion and increased water level of the Dam (and related impacts on infrastructure). This may make implementation of projects such as Working for Water difficult.

2.8.2.3 Vegetation

The following vegetation types occur in the vicinity of the Dam:

- Soweto Highveld Grassland;
- Tsakane Clay Grassland;
- Frankfort Highveld Grassland;
- Andesite Mountain Bushveld; and
- Eastern Temperate Freshwater Wetlands.

The Soweto Highveld Grassland occurs in Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North-West) Provinces. It lies in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast. It is found on the Highveld plateau and is characterised by short to medium high, dense, tufted grassland dominated almost entirely by *Themeda triandra* (Rooi grass) and accompanied by a variety of other grasses such as *Elionurus muticus* (Wire grass), *Eragrostis racemosa* (Small heart grass), *Heteropogon contortus* (Spear grass) and *Tristachya leucothrix* (Trident grass). Only small scattered wetlands, narrow streams and occasional ridges or rocky outcrops interrupt the continuous grassland cover. It is currently considered *Endangered* as at present only a handful of patches of Soweto Highveld Grassland are statutorily (within the Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves) or privately conserved (in the Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site). Almost half of the area originally containing Soweto Highveld Grassland has already been transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been inundated by dams

(Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer dams) (Mucina and Rutherford, 2006).

Tsakane Clay Grassland occurs in Gauteng and Mpumalanga Provinces in patches extending in a narrow band from Soweto to Springs, broadening southwards to Nigel and from there towards to Vereeniging. It also occurs north of the Vaal Dam and between Balfour and Standerton (including Willemsdal). The vegetation is short dense grassland which is dominated by common Highveld grasses such as *Themeda triandra* (Red grass), *Heteropogon contortus* (Spear grass), and *Elionuris muticus* (Wire grass) and a number of *Eragrostis* species. The most common forbs belong to the families Asteraceae, Rubiaceae, Malvaceae, Lamiaceae and Fabaceae. Disturbance leads to an increase in abundance of particularly *Hyparrheniahirta* (Common thatching grass) and *Eragrostis chloromelas* (Curly leaf love grass). The most significant rock is basaltic rock from the Klipriviersberg group (Ventersdorp supergroup) (Mucina & Rutherford 2006). The vegetation type is also considered Endangered as only 1.5% conserved in statutory reserves (Suikerbosrand, Olifantsvlei, Klipriviersberg, and Marievale) and a small portion also in private nature reserves (Avalon, Ian P. Coetser, and Andros). More than 60% transformed by cultivation, urbanisation, mining, Dam-building and roads.

Franfort Highveld Grassland occurs in Free State and marginally in Mpumalanga province, especially on the northeastern Free State, south and southeast of Vaal Dam in the vicinity of Heilbron, Frankfort and Vrede. The vegetation and landscape is flat to undulating and undulating terrain, with grassland dominated by *Eragrostis curvula* and *Themeda triandra,* and accompanied by *E. Capensis, E.plana, E.racemosa, Cymbopogon pospischilii, Elionurus muticus* and *Aristida junciformis* (Mucina & Rutherford, 2006). It is formally classified as Vulnerable with a target of 24%. None of this vegetation type is conserved in statutory conservation areas and more than a third is already transformed due to cultivation of maize and flooded by dams (Vaal Dam) (Mucina & Rutherford, 2006).

The Andesite Mountain Bushveld occurs in four provinces: Gauteng, North-West, Mpumalanga and Free State. It is a dense, medium-tall thorny bushveld with a well-developed grass layer on slopes and some valleys in an undulating landscape. The vegetation type is considered to be Least threatened with a conservation target of 24%. About 7% is statutorily conserved mainly in the Suikerbosrand Nature Reserve. An additional 1–2% is conserved in other reserves mainly in the Hartbeesthoek Radio Astronomy Observatory. Some 15% is already transformed, mainly due to cultivation and some urban development (Mucina & Rutherford 2006).

There is also a small portion Eastern Temperate Freshwater Wetlands to the north of the Dam. This vegetation unit occurs in the Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces as well as in neighbouring Lesotho and Swaziland: It occurs around water bodies with stagnant water (lakes, pans, periodically flooded vleis, edges of calmly flowing rivers) and is entrenched within the Grassland Biome (Mucina and Rutherford, 2006). Currently, Eastern Temperate Freshwater Wetlands vegetation unit is listed as Least Threatened with a national conservation target of 24% (Mucina and Rutherford, 2006)..

2.8.3 Fauna

2.8.3.1 Fresh Water Fish

South Africa has a long history of non-native fish introductions from the first introduction of goldfish *Carassius auratus* in 1726 to the introduction of the giant pangasius *Pangasius sanitwongsei* in 2012 (Mäkinen et al. 2013). In total, 55 fishes (27 alien, 28 extralimital) have been introduced into or translocated within South African freshwater ecosystems (Jordaan and Bezuidenhout, 2013).

According to the Fish Species Specialist Study undertaken as part of the Vaal Dam Zoning Plan (Malan et al., 1997), the following invasive fish species occur in the Vaal River in the reach between Grootdraai Dam and Vaal Dam and between Vaal Dam and the Vaal Barrage:

- *Micropterus salmoides* – Largemouth Bass*; and*
- *Cyprinus carpio* – Common Carp.

In addition, Grass Carp, *Ctenopharyngodon idella* is known to occur at the Dam.

There are a number of problems linked to this. Firstly, invasive fish species are often the primary vector for parasite/disease introductions. In general, *C. carpio*, is a primary vector and is suspected to have introduced seven species (*Ichthyobodo necator, Chilodonella cyprini*, *C. hexasticha, Apiosoma piscicola, Trichodina acuta, T. nigra* and *Trichodinella epizootica*). *Ctenopharyngodon idella* were also implicated in the introduction of *Bothriocephalus acheilognathi* (Bruton and Van As, 1986).

Ellender and Weyl (2014) note that the impacts of introduced parasites/diseases in South Africa may be serious and mass mortalities of native and non-native fishes have also been recorded and attributed to five introduced parasite species (*C. hexasticha*, *I. multifiliis, Argulus japonicus*, *B. acheilognathi, T. acuta*) (Bruton and Van As 1986). A high prevalence and abundance of *B. acheilognathi* was recorded from two native species *Labeobarbus. aeneus* and *L. kimberleyensis* in the Vaal Dam (Bertasso and Avenant-Oldewage 2005).

Recreational fishing for these species also generates large revenue and thus control of reduction of these species may have socio-economic impacts. However without control, these species may impact indigenous fish stocks.

Carp is also known to increase turbidity at Dams as it is a bottom feeder.

Exotic fish species threaten the existence of the indigenous fish species by altering the habitat competing for food, aggressively preying on indigenous fish and out-competing indigenous predators. The following indigenous species are found at the Dam (Malan et al., 1997):

- *Austroglanis sclateri* – Rock Catfish*;*
- *Pseudocrenilabrus philander*- Southern mouthbrooder;
- *Tilapia sparrmanii* - Banded tilapia;
- *Clarias gariepinus* - African sharptooth catfish;
- *Labeobarbus aeneus* – Vaal –Orange Smallmouth yellowfish;
- *Labeobarbus kimberleyensis* – Vaal-Orange Largemouth yellowfish;
- *Barbus paludinosus* - Straightfin Barb;
- *Barbus trimaculatus* - Threespot barb;
- *Labeo capensis* - Orange River Mudfish; and
- *Labeo umbratus* – Moggel.

The only Red Data species is the Vaal-Orange Largemouth yellowfish (*Labeobarbus kimberleyensis*).

Figure 12: Largemouth yellowfish (www.theguidecompany.co.za)

According to Impson and Swart (2007), the main threat to the Largemouth Yellowfish is poor water quality in the Vaal River below Vaal Dam and from tributaries which receive treated effluent water. Instream dams and weirs are not a problem if suitable spawning habitat is present above the Dam. River regulation and destruction of different habitat types may be causing hybridisation between this species and *Labeobarbus aeneus*, but this possibility has to be investigated further.

2.8.3.2 Amphibians

Gauteng province has 30 described frog species, Mpumalanga has 58 and the Free-State Province has 36. Twelve species were found using the South African Frog Atlas Project (www.sarca.adu.org.za) in the quarter degree squares: 3025DA, 3025DB, 3026CA and 3026AC which surround the Dam (Table 10).

Table 10:: Amphibians species occurring around Vaal Dam

Genus	Species	Common Name
Amietophrynus	*gutturalis*	Guttural Toad
Amietophrynus	*rangeri*	Raucous Toad
Kassina	*senegalensis*	Bubbling Kassina
Semnodactylus	*wealii*	Rattling Frog
Xenopus	*laevis*	Common Platanna
Amietia	*angolensis*	Common or Angola River Frog
Amietia	*fuscigula*	Cape River Frog
Cacosternum	*boettgeri*	Common Caco
Pyxicephalus	*adspersus*	Giant Bull Frog
Tomopterna	*cryptotis*	Tremelo Sand Frog
Tomopterna	*natalensis*	Natal Sand Frog
Strongylopus	*fasciatus*	Striped Stream Frog

The Giant Bull Frog occurs in the area around the Dam and is the only Red Listed Species in the Province (Near Threatened) (Figure 13).

Figure 13: African Bullfrog ©Martin Grimm, www.inaturalist.org)

The species is common in many of the southern parts of its range which includes South Africa, Swaziland, Namibia, Botswana, and Zimbabwe, extending north to southern Angola, Zambia, Malawi, Mozambique, Tanzania, and Kenya (IUCN SSC Amphibian Specialist Group, 2013). However it has declined in South Africa, especially in Gauteng Province, but it is still locally common in some places. The major threat to the species is harvesting of frogs for local consumption, which is believed to be responsible for some population declines. In South Africa, breeding habitat has been lost due to urbanization.

2.8.3.3 Reptiles

Gauteng Province has 97 described reptile species, Mpumalanga has 178 and the Free-State Province has 112. Of these, 32 are found around Vaal Dam (South African Reptile Assessment www.vmus.adu.org.za) (Table 11). All of these species are listed as least concern.

Table 11: Reptile species occurring around Vaal Dam

Genus	**Species**	**Common name**
Agama	*aculeata*	Common Ground Agama
Agama	*atra*	Southern Rock Agama
Monopeltis	*capensis*	Cape Worm Lizard
Boaedon	*capensis*	Brown House Snake
Crotaphopeltis	*hotamboeia*	Red-lipped Snake
Dasypeltis	*scabra*	Rhombic Egg-eater
Duberria	*lutrix*	South African Slug-eater
Prosymna	*sundevallii*	Sundevall's Shovel-snout
Psammophis	*notostictus*	Karoo Sand Snake
Psammophis	*trinasalis*	Fork-marked Sand Snake
Psammophylax	*rhombeatus*	Spotted Grass Snake
Pseudaspis	*cana*	Mole Snake
Karusasaurus	*polyzonus*	Karoo Girdled Lizard
Aspidelaps	*lubricus*	Coral Shield Cobra
Naja	*nivea*	Cape Cobra
Chondrodactylus	*bibronii*	Bibron's Gecko
Pachydactylus	*capensis*	Cape Gecko
Pachydactylus	*mariquensis*	Marico Gecko
Pachydactylus	*oculatus*	Golden Spotted Gecko
Nucras	*holubi*	Holub's Sandveld Lizard
Pedioplanis	*lineoocellata*	Spotted Sand Lizard
Pedioplanis	*namaquensis*	Namaqua Sand Lizard
Pelomedusa	*subrufa*	Marsh Terrapin
Acontias	*gracilicauda*	Thin-tailed Legless Skink
Trachylepis	*capensis*	Cape Skink
Trachylepis	*punctatissima*	Speckled Rock Skink
Trachylepis	*sulcata*	Western Rock Skink
Trachylepis	*variegata*	Variegated Skink
Homopus	*femoralis*	Greater Padloper
Rhinotyphlops	*lalandei*	Delalande's Beaked Blind Snake
Varanus	*albigularis*	Rock Monitor
Varanus	*niloticus*	Water Monitor

2.8.3.4 Mammals

Both The Free-State and Gauteng Province have a total of 59 recorded mammal species each and Mpumalanga has 86 mammal species (FS DETEA, 2008). Twenty-seven species have been found in the QDS surrounding the Dam (www.vmus.adu.org) (Table 12).

Table 12:: Reptile species occurring around Vaal Dam

Genus	**Species**	**Common name**
Alcelaphus	*caama*	Red Hartebeest

Genus	Species	Common name
Antidorcas	*marsupialis*	Springbok
Connochaetes	*gnou*	Black Wildebeest
Connochaetes	*taurinus*	
Oryx	*gazella*	Gemsbok
Raphicerus	*campestris*	Steenbok
Redunca	*arundinum*	Southern Reedbuck
Redunca	*fulvorufula*	Mountain Reedbuck
Sylvicapra	*grimmia*	Bush Duiker
Syncerus	*caffer*	African Buffalo
Taurotragus	*oryx*	Common Eland
Tragelaphus	*strepsiceros*	Greater Kudu
Canis	*mesomelas*	Black-backed Jackal
Otocyon	*megalotis*	Bat-eared Fox
Cercopithecus	*aethiops*	Vervet Monkey
Papio	*ursinus*	Chacma Baboon
Equus	*quagga*	Quagga
Caracal	*caracal*	Caracal
Proteles	*cristata*	Aardwolf
Hystrix	*africaeaustralis*	Cape Porcupine
Lepus	*saxatilis*	Scrub Hare
Tadarida	*aegyptiaca*	Egyptian Free-tailed Bat
Nycteris	*thebaica*	Egyptian Slit-faced Bat
Pedetes	*capensis*	South African Spring Hare
Procavia	*capensis*	Rock Hyrax
Phacochoerus	*africanus*	Common Wart-hog
Neoromicia	*capensis*	Cape Serotine

According to the Vaal Dam Zoning Plan (2001), the following Red Data List Species have occurred historically around the Dam and in some cases may still occur:

- White- tailed mouse (vulnerable);
- African Wild Cat (vulnerable);
- Antbear (vulnerable);
- Oribi (vulnerable);
- South African Hedgehog (rare);
- African Striped Weasel (rare);
- Aardvolf (rare);
- Brown Hyena (rare);
- Serval (rare); and
- Small Spotted Cat (rare).

During public consultation it was also noted that a hippopotamus was spotted in the Dam in the area between Deneysville and Oranjeville. It was unfortunately killed by a landowner and no hippos have been spotted in the area since. .

2.8.3.5 Avifauna

A list of recorded bird species was obtained using the Avian Demography Unit MyBirdPatch database (www.mybirdpatch.adu.org.za) which includes data from the South African Bird Atlas Project 1 and 2 (ADU, 2013). An area around Vaal Dam was selected and a list of bird species occurring in this area was then generated. The list contains 344 bird species which shows the astonishing amount of bird diversity. Despite the diversity of the area, the Dam does not occur within an Important Bird Area although it is located 30km from one.

The Dam also is part of the Vaal Birding Route and is the focus of an annual bird count by Birdlife Vaal Dam. In 2010, 72, 000 Black-winged Pratincoles where counted – a number which has led to a re-assessment of this species global population estimate. The species is classified as Near Threatened currently (Birdlife International, 2013).

Figure 14:: Black-winged Pratincoles (@Paul F Donald, RSPB; www.arkive.org)

Threatened species such as Martial Eagles, Blue Crane and the Lesser Flamingo also occur in the area. Martial Eagle has recently been uplisted to Vulnerable in the IUCN Red List as it is suspected to have undergone rapid declines during the past three generations (56 years) owing to deliberate and incidental poisoning, habitat loss, reduction in available prey, pollution and collisions with power lines (Birdlife International, 2013) (Figure 15).

Figure 15 :Martial Eagle (@Kenneth W Fink/www.ardea.com, www.arkive.org)

The Lesser Flamingo is classified as Near Threatened because populations appear to be undergoing a moderately rapid decline. Proposed large-scale soda ash extraction at Lake Natron, the most important breeding colony, although currently on hold, would be disastrous for this species and, were this to happen, the species may qualify for uplisting to a higher threat category. Only three main breeding sites exist in Africa, all facing threats and requiring protection (IUCN, 2014) (Figure 16).

Figure 16: Lesser Flamingo (@Ferrero-Labat/Auscape International; www.arkive.org)

2.9 Climatic Conditions

The mean annual temperature in the Upper Vaal Water Management Area is in the range of 14 – 18.5°C. Maximum and minimum temperatures are usually experienced in January and July respectively and mean maximum temperatures for the basin range from 22.1 to 24.6°C whereas mean annual minimum temperatures range from 6.3 – 9.8°C. (Haji, 2011). The Vaal Dam Zoning Plan (2001) noted that temperatures in Vereeniging were between 9.3°C and 24.1°C, whereas in Franfort, there were lower (between 6.8°C and 23.7°C).

In terms of precipitation, the Upper Vaal is characterised by a mean annual precipitation (MAP) ranging between 600 mm to 900 mm (Haji, 2011). The Vaal Dam Zoning Plan (2001) found that Vereeniging and Frankfort fell at the lower end of that range (671mm and 665mm respectively).

According to Windfiner.com, strong westerly winds are common (Figure 17) in Vaal Marina (www.windinder.com).

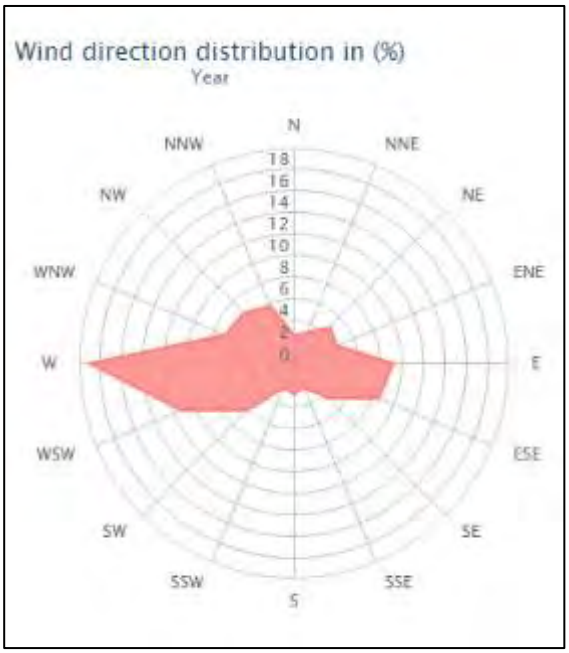


Figure 17: Wind Distribution (Yearly Average) (http://www.windfinder.com/windstatistics/vaal-marina)

The Vaal Plan Zoning Plan (2001) found that the dominating wind in Vereeniging and Frankfort was a north-easterly. Speeds varied between 1.6 and 3.5 m/s in Vereeniging and 3.9m/s in

Frankfort. However the wind speed over the open water was expected to be stronger.

Temperature, precipitation and wind all influence recreational use. Wind is particularly important for the numerous sailing clubs at the Dam. In addition, during consultation, climate change was raised as a concern. The Vaal River Basin is highly developed and regulated with numerous inter basin transfers from adjacent catchments to supplement the natural supply and there is only marginal potential for further development. However, increase in population coupled with increased human activities in this basin in the future (DWAF, 2006) will require additional supply, resulting in greater pressure on the already strained existing resources. The pressure can be further exacerbated by Climate Change.

According to the latest report released by the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2007), the mean global temperature has risen by more than 0.76°C over the last century. Furthermore, an increase of 0.2°C per decade has been projected even if the future emissions were mitigated. In fact, if the concentration of greenhouse gases were to be capped at year 2000 levels, an increase of 0.1°C per decade would still be inevitable and thus the impacts of climate change on water availability is an encumbrance.

The IPCC (2007) describes a future where snow cover and sea ice will drastically reduce and more frequent occurrences of extreme temperatures and precipitation events. It has been predicted with high confidence (scale of confidence of 8 out of 10) that climate change will exacerbate the water stress situation in some countries, while introducing water stress to countries that currently do not experience it (Boko *et al.*, 2007).

Huji (2011) modelled the impacts of climate change in the Upper Vaal WMA based on three scenarios and found the following changes were likely:

- The mean monthly stream flow indicates a one month shift in peak flow from February to January. The magnitude of peak maximum monthly stream (year 2005 -2030) flow increases between 91% and 77% (based on the scenario) relative to observed maximum monthly stream flow (year 1960 – 2000);
- The existing storage infrastructure will not be able to buffer the deficits in meeting water demand in the basin if the LHWP transfer is constrained in any way. Both climate models indicate the reservoirs having critical drawdowns between years 2019 – 2024, with an instance of drying up under one of the models. A Water Conservation/Water Demand Management of between 2 – 14% implemented over a 10 year period improves storage and prevents drying of the reservoirs. In the case of unconstrained LHWP transfer, the reservoirs are maintained at an average of 80% of storage capacity under both climate models. However, the period between years 2016 – 2024 shows significant drawdowns under the one of the model indicating a potential dry period;
- The major urban water demand from Rand Water is satisfied together with industrial requirements up to the year 2030. However, demands for some smaller towns namely Harrismith, Qwa Qwa, Vrede and Warden are not met during the dry seasons; and
- The Instream Flow Requirement is met at all key points across all scenarios except Klip River which undergoes a deficit during the dry season for 15 out of the 30 years of simulation. If continued augmentation of the Upper Vaal WMA water resources is constrained, then instream flow requirements across the basin will be difficult to meet in the future.

2.10 Heritage

The South African Heritage Resources Agency (SAHRA) has recently developed the South African Heritage Resources Information System (SAHRIS). As part of this, they have compiled a

fossil sensitivity map for South Africa. The map provides an overview of estimated paleontological sensitivity of an area. The map shows that the sensitivity of the area north of Deneysville as well as part of Oranjeville is rated as very high (red). A significant portion has insignificant or no paleontological resources (grey) or low sensitivity (blue). No specific records of fossils were found at the Vaal Dam however approximately 35km away in Vereeniging, since the late 19th century, quarrying operations have revealed some fossiliferous sandstone outcrops in the area. The most common genera present are *Noeggarathiopsis*, *Gangamopteris* and *Glassopteris* (Pistorius, 2010).

Pistorius (2010) also provided an overview of the archaeology of the region. According to archaeological research, the earliest ancestors of modern humans emerged some two to three million years ago. The remains of Australopithecine and *Homo habilis* have been found in dolomite caves and underground dwellings in the Bankeveld at places such as Sterkfontein and Swartkrans near Krugersdorp. *Homo habilis*, one of the Early Stone Age hominids, is associated with Oldowan artefacts, which include crude implements manufactured \from large pebbles.

The Acheulian industrial complex replaced the Oldowan industrial complex during the Early Stone Age. This phase of human existence was widely distributed across South Africa and is associated with *Homo Erectus*, who manufactured hand axes and cleavers from as early as one and a half million years ago. Oldowan and Acheulian artefacts were also found four to five decades ago in some of the older gravels (ancient river beds and terraces) of the Vaal River and the Klip River in Vereeniging. The earliest ancestors of modern man may therefore have roamed the Vaal valley at the same time that their contemporaries occupied some of the dolomite caves near Krugersdorp.

Middle Stone Age sites dating from as early as two hundred thousand years ago have been found all over South Africa. Middle Stone Age hunter-gatherer bands also lived and hunted in the Orange and Vaal River valleys. These people, who probably looked like modern humans, occupied campsites near water but also used caves as dwellings. They manufactured a wide range of stone tools, including blades and points that may have had long wooden sticks as hafts and were used as spears.

The Late Stone Age commenced twenty thousand years ago or somewhat earlier. The various types of Stone Age industries scattered across the country are associated with the historical San and Khoi-Khoi people. The San were renowned as formidable hunter-gatherers, while the Khoi-Khoi herded cattle and small stock during the last two thousand years. Late Stone Age people manufactured tools that were small but highly effective, such as arrow heads and knives.

The Late Iron Age people were also known for their rock art skills. At least one rock engraving site exists near Vereeniging, at Redan.

During the Late Iron Age, farming was practised in the northern, central and eastern parts of the country. These farming communities built numerous stone walled settlements throughout the southern Highveld of the Orange Free State, on the Witwatersrand, in the Bankeveld and numerous other places in South Africa from the 17th century onwards.

Specific periods are provided below (PGS Heritage & Grave Relocation Consultants, 2012):

- 1450 – 1650: This period is associated with a Late Iron group referred to as the Ntsuanatsatsi facies of the Urewe Tradition (Huffman, 2007);
- 1700 – 1820: During the early Historic Period the Ntsuanatsatsi south of the Vaal River developed into the Makgwareng facies (Huffman, 2007). c. 1800s At the time a Tswana group known as the Khudu settled near the confluence of the Vaal and Suikerboschrand Rivers (Bergh, 1999);
- 1823 – 1827: The Matabele of Mzilikazi settled in the central reaches of the Vaal River after leaving present-day KwaZulu-Natal (www.mk.org.za).

- October 1834: A group of Griqua hunters under the leadership of Pieter David were hunting near the confluence of the Vaal and Wilge Rivers when they were attacked here by Mzilikazi's Khumalo Ndebele (Bergh, 1999);
- February 1836: Voortrekker leader Louis Trichardt moved with his party to the confluence of the Wilge and Vaal Rivers and stayed on the western bank of the Wilge for a while before crossing over the Vaal (d'Assonville, 2002). They subsequently met up with Lang Hans van Rensburg at Elandspruit, near present-day Heidelberg (Bergh, 1999);
- 29 December 1880 Prisoners-of-war Captains Elliott and Lambert were fired on by their Boer escort while crossing the Lies Drift and Elliot was killed. This event made headlines worldwide and a case of murder was opened in the Transvaal high court (d'Assonville, 2002; Green, 1966);
- 21 May 1892: The first railway line over the Vaal River linking the Orange Free State (OFS) Republic and the Zuid-Afrikaanse or Transvaal Republic (ZAR) was officially opened on by President Reitz of the OFS and President Kruger of the ZAR. Pillars of the bridge carrying the old railway line can still be seen in the Vaal River (Pistorius, 2010);
- 1899-1902 – An Anglo-Boer War British blockhouse is located at Witkop, ten kilometres to the north of Meyerton on the main road to Johannesburg. The Vereeniging concentration camp cemetery is located in the old municipal cemetery, off Beaconsfield Avenue near the abbatoir; and
- 1938: The small Voortrekker Monument celebrating the 100 year anniversary of the Ossewatrek was erected in 1938 in the middle of Voortrekker road in Vereeniging, between Marklaan and Merrimanlaan.

Further, during consultation it was noted that a small Stone Age site occurs at the Koppie outside Deneysville. The History of Deneysville brochure noted that Iron Age Tools where found while digging foundations in town and where likely early Tswana inhabitants. A Khoi skull was also found at a site on High street in Deneysville.

In addition, the heritage of the built environment is also important and was noted during consultation. Vaal Dam was built during the Great Depression in the 1930's and was used to provide employment for the so-called poor whites of the area. By 1938 the work on the Dam wall was completed and in December 1938, the Dam overflowed for the first time. After World War II, because of the rapid expansion in industrial activity and development of the Free State goldfields, it was decided that the Vaal Dam be raised by 6.1 m to make additional supplies of water available. This comprised raising the concrete overspill crest by 3.05 m and installing 60 crest gates 2.05 m high on top of the concrete. The earth embankment was also raised. Work started in 1952 and was completed in 1956. In 1979, the DWS proposed to raise the Dam wall to 3.05 m. This second raising took place in 1985. The Dam is therefore a central part of the history of management of water resources and also highlights impressive engineering designs (The Water Wheel, 2008).

2.11 Current Institutional Arrangement

2.11.1 Official Institutional Structure

DWS is the official custodian of all surface water in South Africa in terms of the National Water Act, 1998. In terms of the shoreline, unlike many of the Dams in South Africa, the State did not purchase a specific shoreline buffer around the Dam and instead the Dam occurs within a servitude of storage which corresponds to the 1487 contour line (126% level of the Dam). Most of the land in the Dam basin is therefore privately owned.

Although no title deeds were available, based on various documents provided by DWS, it is believed that some properties around the Dam will have title deed restrictions due to the servitude. The exact conditions are however not known.

In addition, some agreements were available between DWS and adjacent landowners and are provided below:

- Lease agreement for Erven 288, 289 and 291;
- Cancellation of the servitude of storage for Portion 376 of Knoppiesfontein 478;
- Pipeline agreement between Department of Public Works (DPW) and Rand Water for Portion 4 and Portion 7 of Vaalbank 476;
- Lease agreement between DWS and Allemanshome Pty Ltd for Portion 1 of Farm Allemanshome 46 (allowing for subdivision); and
- Lease agreement between DPW and Vaal Dam Shearwater Estate (allowing for subdivision).

2.11.2 Informal Institutional Structure

In addition to the agreements discussed above, a number of commercial enterprises are located around the Dam for which no agreements are in place/available. There are also a number of private developments, marinas, recreational clubs and municipal managed public access areas (at Deneysville and Oranjeville). No agreements are in place or available for these stakeholders either. Thus most of the access and use of the Dam is informal.

Correspondence between DAC and DWS and the then Deneysville Local Municipality was provided which showed that DAC made a request to DWS to purchase Erf 785, 786 and 787. The correspondence also showed that DAC owned Erf 750, leased Erf 785 and 786 from the State, leased Erf 787 from the Municipality (which had in turn leased it from the State) and used Erf 971 and Erf 751 and a closed off portion of Pier Avenue from the Municipality based on an informal agreement with the municipality. The status of the request and whether the property was purchased was not known.

Further, the Vaal River Complex Guide Plan was developed by DWA and was updated in 1987. This was replaced by the Vaal River Complex Regional Structure Plan in 1996. The local municipalities and/or provinces (in the case of Free State), are responsible for approving building plans and development in line with the Structure Plan and submit plans to DWS for comment.

The National Sea Rescue Institute (NSRI) is based at Manten Marina and are responsible for much of the rescue activities at the Dam. There does not appear to be any agreement in place.

2.11.3 Management of the Water Surface

DWS is responsible for the management of the surface water. In terms of AtoN and demarcation markers, initial payment for the AtoN and demarcation markers (for general navigation) will be undertaken by DWS. However, the provision and maintenance of the demarcation markers at the various clubs, marinas, estates, resorts etc. will be for the cost of the latter.

2.11.4 Access

Public access is available at the Dam in Deneysville and Oranjeville at public fishing/picnic spots. These are not well maintained and do not have many facilities in place. In Vaal Marina, there is no formalized public access point for day visitors or community members from Mamelo although subsistence fishing does occur and some individual access through the Vaal Marina Property Owners Waterfront Association (VMPOWA) takes place. Currently there is no subsidy programme or community access card in place.

2.11.5 Permits

In Deneysville and Oranjeville, a Freshwater Angling License is required from FS DETEA for freshwater angling in the Free State. A Gauteng Freshwater Angling License is required for fishing on the Gauteng side (Vaal Marina) or at the Government Farm area. No specific angling licenses are required for fishing at the Dam.

2.11.6 Safety

There is no overall safety system in place at the Dam. The NSRI is based at Manten Marina. They have volunteer crew with one 6m semi rigid

craft and a vehicle to Act as a backup mobile unit. There is no formal system to ensure that clubs, estates, marinas etc. undertake safety checks before people access the surface water. Although these may occur at some of the clubs, there is no formalized procedure.

2.11.7 Overnight facilities

As the Dam occurs in a servitude of storage, private overnight facilities occur in many locations around the Dam. Some of these are at the various clubs and are for members only (and in some cases are limited to camping facilities), in some cases, the adjacent land has been subdivided and various holiday/weekend homes have been built. There are also some resorts/bed and breakfasts especially in Deneysville and Oranjeville.

2.11.8 Event Management

A number of competitive events are held at Vaal Dam including the Vaaldam Bonanza, the Round the Island Race, Keelboat Week and the Bayshore 200m Jet Ski Race. There does not appear to be any formal event management system in place and events are primarily arranged by the various clubs.

2.12 Users and Uses of Vaal Dam

2.12.1 Current and Future Domestic Use

The main purpose of the Dam is to provide water for domestic, mining, industrial and irrigation use in the Pretoria-Witwatersrand–Vereeniging (PWV) Region (DWAF, 1991). The main water user is Rand Water, which abstracts water from the Dam and treats it at the Vereeniging and Zuikerbosch Purification and Primary Pumping Stations. Purified water is then sent to 58 reservoirs around Gauteng and includes supplies to three metropolitan councils (City of Johannesburg, City of Tshwane and Ekurhuleni Metropolitan Municipality), 15 municipalities, the Royal Bafokeng administration, 45 mines and approximately 771 industries and direct consumers. Approximately 92% of the water goes to municipalities for supply to domestic, industrial and commercial end users.

The Dam also supplies water to industrial customers such as Sasol Sasolburg, Eskom and Accelor Mittal Steel as well as downstream users such as irrigators. Midvaal Water and Sedibeng Water are also supplied or supported with water released from Vaal Dam.

During consultation it was also noted that adjacent landowners around the Dam abstracted small amounts of water for domestic purposes (to water their gardens).

2.12.2 Irrigation

Irrigation is not one of the main uses of the Dam however according to DWAF (2007), large volumes of unlawful abstractions are taking place in the Upper Vaal WMA and in particular upstream of Vaal Dam in the Frankfort and Vaal Dam incremental catchments. Large volumes of transferred water from the Lesotho Highlands and Thukela transfer schemes is flowing through these sub-catchments and is seemingly used illegally for irrigation purposes. In the order of 235 million m^3/a, is currently used illegally upstream of Vaal Dam.

During consultation, it was also noted that some adjacent landowners use water from the Dam to irrigate their farms.

2.12.3 Recreational and Commercial Use

Due to the large shoreline and surface area, the Dam is also used for recreation and a number of Sailing Clubs are located at the Dam including:

- Deneysville Aquatic Club (DAC);
- Lake Deneys Yacht Club (LDYC);
- Aeolians Yacht Club (AYC);
- Pennant Nine Yacht Club (PNYC);
- Sunset Shores Yacht Club (SSYC);
- Vaal Cruising Association (VCA);
- Stilbaai Yacht Club (SYC); and
- Seal Point Yacht Club (SPYC).

In addition to the clubs, a number of Marinas occur at the Dam including Manten Marina, Anchor Creek Marina and Bayshore Marina to name a few.

The Dam is also a popular fishing venue and both power boat and fishing activities take place at

DAC. The Rand Piscatorial Association (RPA) offers bank angling, boat angling and fly fishing. The Afrikaanse Hengel Vereeniging (AHV) also offers fishing but is a member only club restricted to 2 000 members.

The following activities commonly occur at the Dam:

- Sailing;
- Bank Angling;
- Boat Angling;
- Fly Fishing;
- Motor Boating;
- Canoeing;
- Swimming;
- Water Toys;
- Water skiing;
- Parasailing;
- Jet Skiing;
- Commercial Fishing;
- Subsistence Fishing;
- Baptisms;
- Bird Watching;
- Picnicking; ; and
- Research.

A number of competitive events are held at Vaal Dam including the Vaaldam Bonanza, the Round the Island Race, Keelboat Week and the Bayshore 200m Jet Ski Race.

Unlike most Dams in South Africa, the Dam occurs within a servitude of storage and thus the land adjacent to the Dam is in general, privately owned. A number of privately owned establishments that offer accommodation as well as access for water sports activities occur at the Dam and include the following:

- Vaal Privé Holiday Resort (offers boat cruises etc.);
- Stone Cottage (as part of the price, access to the Dam via the Water Sports Club is included);
- Caroline's Cottage;
- Anchor Marina;
- Vaal Dam Boat Cruises;
- Tasha's on Main (as part of the price, access to the Dam via the Water Sports Club is included);
- Platinum Moon (as part of the price, access to the Dam via the Water Sports Club is included);
- Heron's Haven (private slipway for guests);
- Lakeview on Vaal (waterfront access for fishing, boat-launching facilities available);
- Rus 'n Bietjie Karavaan Park;
- Letsatsi Bay;
- Herberg Hotel;
- Mihanzi;
- Rock Island Lodge;
- Vaaldam Breakaway;
- Leboya Bay;
- Boshkop Oord Resort; and
- Vaal Rawdah.

Further, a number of estates have also recently been built around the Dam including Harbour Town and Peninsula on the Vaal.

2.12.4 Conservation

The Dam occurs next to the Vaaldam Nature Reserve which was legally declared in 1954 however the extent of the reserve is different according to different sources (DEA, 2010 and SANBI Protected Areas GIS).

Deneysville may also occur within an Urban Conservancy. A number of amphibian, reptile, mammal and bird species do occur in the area and as the shoreline of the Dam is not highly developed, it likely provides habitat for those species.

2.13 Catchment Interactions

Based on the status quo of Vaal Dam, it is clear that there are a number of factors that influence the ecological status, the use and management of the Dam.

- Land use in the catchment, especially WWTWs which are operating outside of their designed capacity;
- AMD releases downstream which may negatively impact water availability;
- The location of the Dam between three separate provinces and local

municipalities which makes management difficult;
- The fact that the Dam is within a servitude of storage and therefore there is a lack of State Land available for public access;
- Due to the servitude of storage, control of access to the surface water as well as the control of commercial activities in line with National Treasury requirements is difficult;
- Poor roads and a lack of road signs negatively impact tourism at the Dam;
- The extent of the Vaaldam Nature Reserve is unknown which makes management of the area difficult;
- The avifaunal diversity provide an opportunity for conservation and education;
- Potential for Algal blooms and the eutrophic state are potential threats to recreational use; and
- The potential for Important paleontological, archaeological and historical heritage resources in the area around the Dam provide an opportunity for heritage conservation as well as heritage based tourism and education.

It is important to understand how the Dam is influenced by these factors so that management of the Dam through the RMP are taken into account.

3 WHERE DO WE WANT TO BE?

3.1 Vision

A visioning exercise was carried out with a combination of stakeholder input from public meetings, authorities meetings and one on one stakeholder meetings.

This Vision for Vaal Dam is highlighted through the unpacking of the needs, interests, requirements and uses of the Dam.

Stakeholders showed a strong focus on improved management and institutional arrangements which would facilitate increased but well managed development and tourism in the area. Improved and equitable access for the communities around the Dam and for visitors as well as improved control and compliance was also seen as important. The need for improved water quality, management of invasive species and protection of biodiversity was highlighted as was the need for improved services, community development and skills training.

The Vision statement that encompasses this is:

"Increased and sustainable development of a safe and well managed Dam to create lasting opportunities for the surrounding community without compromising the primary purpose of the resource or the cultural and natural environment around the Dam."

3.2 Objectives

Based on the SWOT analysis as well as the Uses, Needs, Interests and Requirements, a number of objectives were identified. These are listed below together with some of the requirements needed to meet these objectives.

Improved institutional arrangements, safety, control and communication

- Formalised institutional structure;
- Land matters to be resolved including identification of all adjacent landowners and implementation of access agreements;
- Unauthorised commercial activities to be resolved in line with National Treasury requirements;
- Survey of illegal abstraction points around the Dam and all unauthorised use to be rectified;
- Survey of illegal structures (including jetties, slipways, ablution facilities, houses, marinas etc.) and all unauthorised structures to be undergo rectification process or be removed;
- Discussions between Provinces to be facilitated to determine the potential for a tripartite provincial partnership between surrounding provinces to coordinate economic development and urban renewal around the Dam;
- Discussions between DWS and MVLM and MLM to be undertaken to determine feasibility of municipal management of the public access area;
- Agreements with IAs, adjacent landowners, commercial enterprises and recreational clubs to be put in place. These agreements should include management of disposal of general waste and effluent so to ensure water quality is not impacted by recreational use;
- Update of the Vaal River Complex Regional Structure Plan to be undertaken;
- Implementation of standardised Aids to Navigation and demarcation markers at the Dam; and

- Implementation of Wash Bays and Unique Positioning Number (UPN System) at the Dam.

Community beneficiation and equitable access and use of Vaal Dam

- Potential for water troughs for watering of cattle;
- The potential for community agriculture programmes with irrigation to be determined. These community programmes could provide food for tourism ventures and 'community farmers markets' in the area;
- The potential for a small-scale fisheries or subsistence fishing project for the local community to be determined. This would include training, provision of boats and nets etc. and would be implemented at all three towns around the Dam;
- A formalised public access picnic area (including facilities) should be put in place in Vaal Marina. This should be undertaken through discussions with the MVLM and the VMPOWA so that land can be sourced from current municipal land and/or public access servitudes which are in place but are not currently utilised;
- The potential for a community access card to be assessed for access at public areas;
- Facilities at the public access areas in Deneysville and Oranjeville to be put in place; and
- Information brochures to be developed to inform communities about the potential uses of the Dam to encourage community use.

Sustainable economic development and urban renewal

- Urban renewal plan for Deneysville and Oranjeville to be developed and implemented;
- The potential for waterfront restaurants to be used by Sailing Community, visiting tourists and the local community to be assessed. This could be undertaken as part of a PPP;
- Integrated Tourism Plan including marketing, website creation and road signage to compiled and implemented;
- The status of the current commercial fishery license to be determined and if necessary, a feasibility study to be undertaken to determine the potential for commercial fisheries at the Dam. This should include lessons learnt from the original commercial fisheries project at the Dam;
- The potential feasibility for a Public Private Partnership (PPP) for the management of the Jim Fouche Resort to be determined;
- Discussions with MVLM and GDARD to be undertaken and the potential for a PPP for the management of the Government Farm land (next to the Dam wall) to be determined. A section of this area should be retained as a public access area and facilities should be upgraded;
- The potential for a number of small PPPs for the management of tourism activities such as house boats and floating restaurants to be determined;
- The potential for a large scale PPP for the creation and management of an upmarket hotel and restaurant on the island to be determined;
- The development of a Vaal Meander route around the Dam linked to a number of community craft markets, farmers markets etc.; and
- Development SMMEs around the Dam linked to tourism.

Coordinated and improved management and protection of cultural heritage, biodiversity and water resources

- The upgrade of the Deneysville, Vaal Marina, Oranjeville, Frankfort, Villiers and Standerton WWTWs to be undertaken;
- A long terms trend analysis of water quality in the Vaal Dam to be undertaken. This analysis should be used as part of a risk assessment for all potential recreational uses and should

be included the various feasibility assessments suggested;
- A study to understand/determine the cultural significance of the area around the Dam to be undertaken;
- Working for Water to remove all alien plant species and replace with adequate indigenous plants. The wood from the removal trees should be provided to the community for firewood and not left in place;
- Paleontological and archaeological heritage resources study to be undertaken;
- The status and extent of the Vaaldam Nature Reserve to be determined;
- The potential feasibility of creating an urban conservancy around the Deneysville area of the Dam including the koppie and the islands to be determined. As part of this, small day hikes could be put in place (including labelling plant and tree species in the area etc);
- Avifauna Management Plan to be compiled and implemented. This should include current Birdlife count data and should determine best mechanisms for protection of bird biodiversity at the Dam;
- The feasibility of creating a biodiversity and cultural centre in Deneysville to be determined
- Implementation of a wash bay to prevent Invasive Aquatic Plants;
- Survey of the Dam to identify any Invasive Aquatic Plants and if necessary control and management of Invasive Aquatic Plants;
- Pollution point study to be undertaken to identify main sources of pollution at the Dam;
- Water quality monitoring to be linked to the UPN System to allow quick response;
- Shoreline management plan to be compiled and implemented in conjunction with adjacent landowners;
- Education programmes regarding the impacts of alien invasive species to be instituted; and
- Sustainable fishing plan for invasive species to be compiled in line with the National Environmental Management: Biodiversity Act (NEMBA).

Improved access and services

- The feasibility for the completion of the Oranjeville bridge to be undertaken; and
- Upgrades of roads and road signs to improve access to be undertaken.

Community skills development, education and training

- Lifeguard skills training and first aid training to ensure safe public use of the Dam;
- Coordination with local municipalities, National Sea Rescue Institute (NSRI), Waterwise and SwimSA to create community swimming schools at the Dam to improve swimming skills in the short term at the Dam. Detailed safety assessments must be undertaken and only small class sizes are allowed due to the dark water and potential difficult water conditions at the Dam;
- Discussions between DWS and NSRI and Waterwise to take place to determine the feasibility of rolling out community swimming safety measures at public areas. Examples of these safety measures include affordable life rings etc.;
- In the medium term, coordination with local municipalities, and SwimSA to create public swimming pools at the three towns around the Dam and to introduce swimming development schools; and
- Access agreements with clubs to include development requirements.

4 HOW DO WE GET THERE?

4.1 How does the RMP Work?

The overarching framework for the Vaal Dam RMP is presented in Figure 18 below. It highlights the consultative nature of the RMP process where stakeholder meetings, public meetings and authority meetings were used to identify the Vision and Objectives for the Dam. The Vision and Objective forms the central tenet around which the RMP is based. The RMP is further broken down into 4 main Plans namely, the Institutional Plan, Financial Plan, Strategic Plan and Zonal Plan.

Each of the major areas of the RMP will be presented in detail further in this chapter. Briefly: The **Institutional Plan** provides a framework for the institutional arrangements at the Dam. In this case a three-tiered management system is proposed. This three-tiered approach includes a RMP Steering Committee (RSC), Operations Management Committee (OMC) and Dam Management Committee (DMC). Further, it should be noted that DWS reserves the right to appoint an Implementing Agent (IA) at the Dam. This IA would then form part of the institutional structure.

The RSC includes representatives of National Government Departments and fulfils a monitoring and high level guidance function to ensure that all functions of the DMC and OMC are being undertaken.

The OMC will be formed at an Operations or Cluster Level and is a current reporting line within DWS. The DMC will include authorised access point representatives and those who have an official mandate at the Dam. All three committees are chaired by a DWS official or IA should one be appointed.

The Institutional Plan discusses requirements for agreements, development targets (in relation to community development of water sports) and information on the affiliations required. The detailed Institutional Plan is provided in the **Chapter 4.2.**

The **Financial Plan** provides information on how money generated through recreational use should be used, by whom and for what. It also provides guidelines on the financial reporting required. Further, the information from the Financial Plan is used to inform the Business Plan. The detailed Financial Plan is provided in **Chapter 4.3.**

The **Zonal Plan** has three main components:

- Shoreline Management Zones;
- Water Surface Management Zones; and
- Activities allowed in each zone.

The activities are presented in Table 14 and provide information on activities that currently allowed as well as potential activities. The detailed Zonal Plan is provided in **Chapter 4.4.**

In terms of the **Strategic Plan**, the vision for the Dam was distilled into a number of objectives. These objectives are further distilled into actions required in order to achieve the Vision. This information was used to inform the BP for each objective. The detailed Strategic Plan is provided in **Chapter 4.5.**

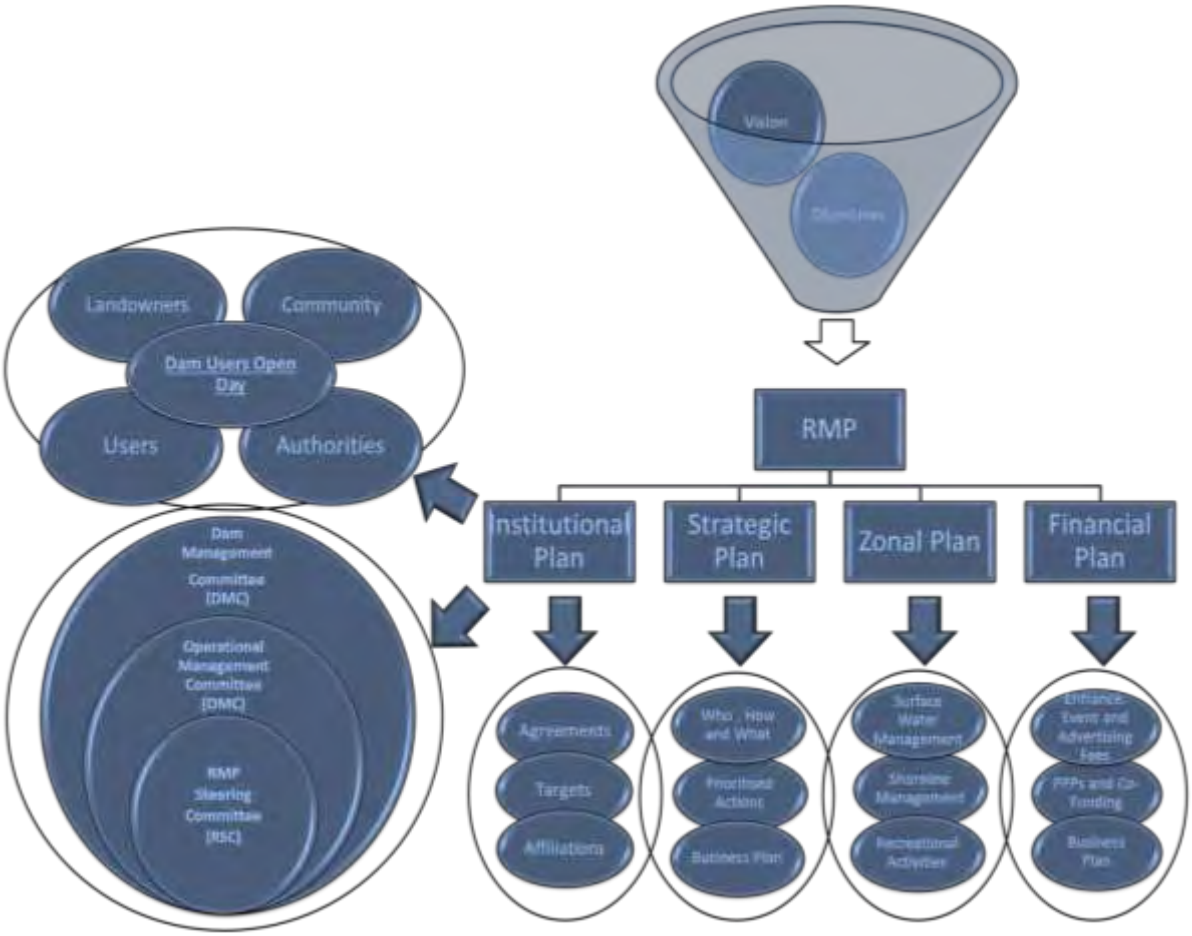


Figure 18: RMP Framework

4.2 Institutional Plan

The Institutional Plan is the backbone of the RMP as it identifies the management system which is required to ensure the objectives of the RMP are met. The Institutional Plan consists of three sets of tools which will be used to manage the Dam so that the Vision can be met.

The first toolset involves three separate but interlined committees all chaired by the DWS because DWS is the custodian of all surface water in South Africa.

The membership of each committee and their roles and responsibilities is provided in Section 4.2.1., 4.2.2. and 4.2.3. below.

The second toolset involves an open communication forum which allows all stakeholders to be involved in the management of the Dam. The purpose of this forum is to share information and allow stakeholders to raise concerns and ideas regarding the management of the Dam. It also provides a platform for dealing with issues and challenges faced by users.

The third toolset includes a number of management tools including agreements, affiliations and targets. Figure 19 below provides a visual representation of how these toolsets function together.

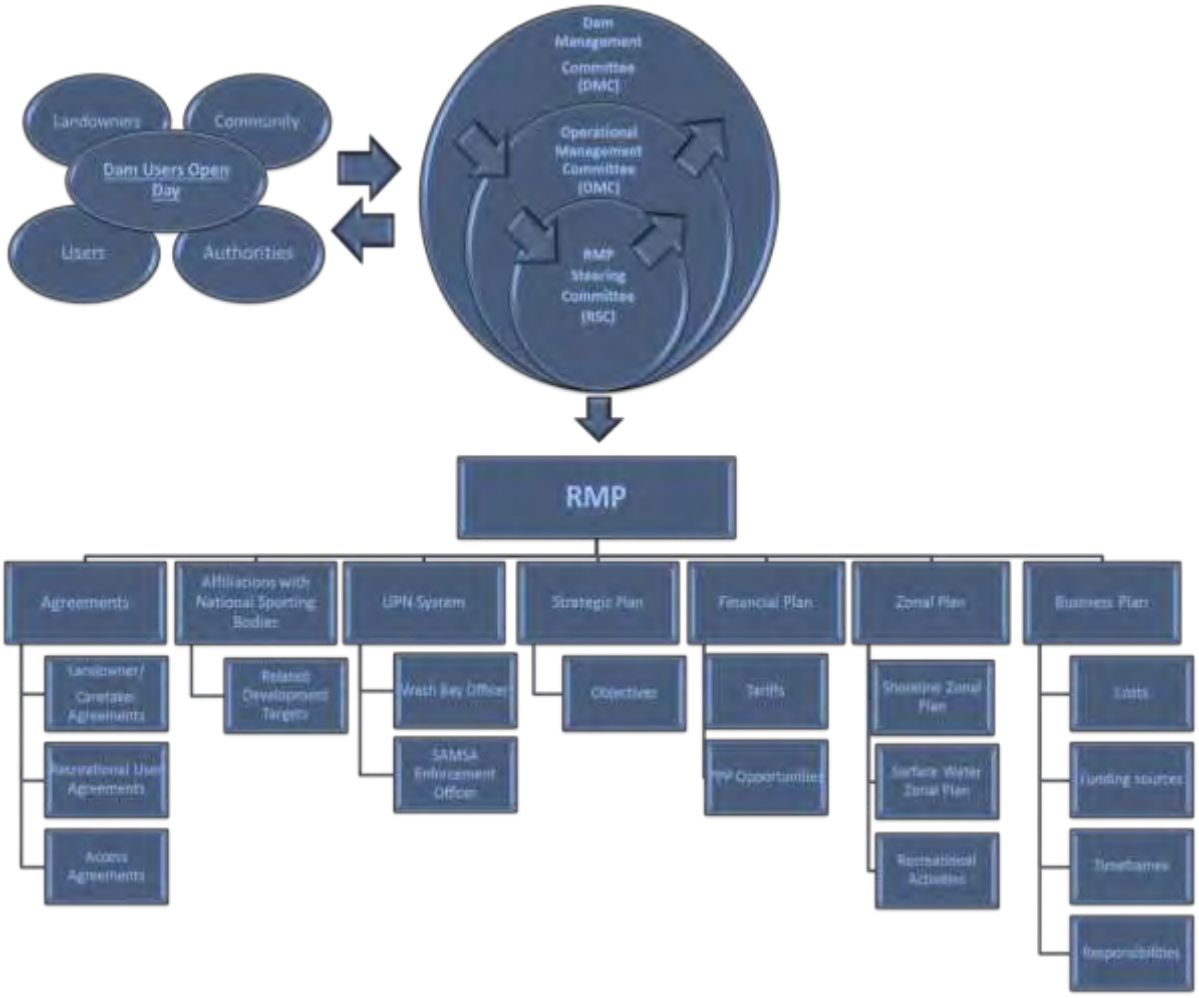


Figure 19: Institutional Framework

4.2.1 RMP Steering Committee (RSC)

The RSC is made up of representatives from National Government/Agencies. The main focus of this meeting is to ensure both the DMC and OMC are performing all necessary functions. The committee will also provide high level guidance. The RSC allows for a formal reporting structure between the Chief Director: Operations and the National Water Resources Infrastructure Branch: Integrated Environmental Engineering (NWRI:IEE). Relevant departments from DWS including Operations, Water Quality Management and Catchment Management will be included in the RSC. The committee will meet every six months. Figure 20 below provides details of the membership of the RSC.

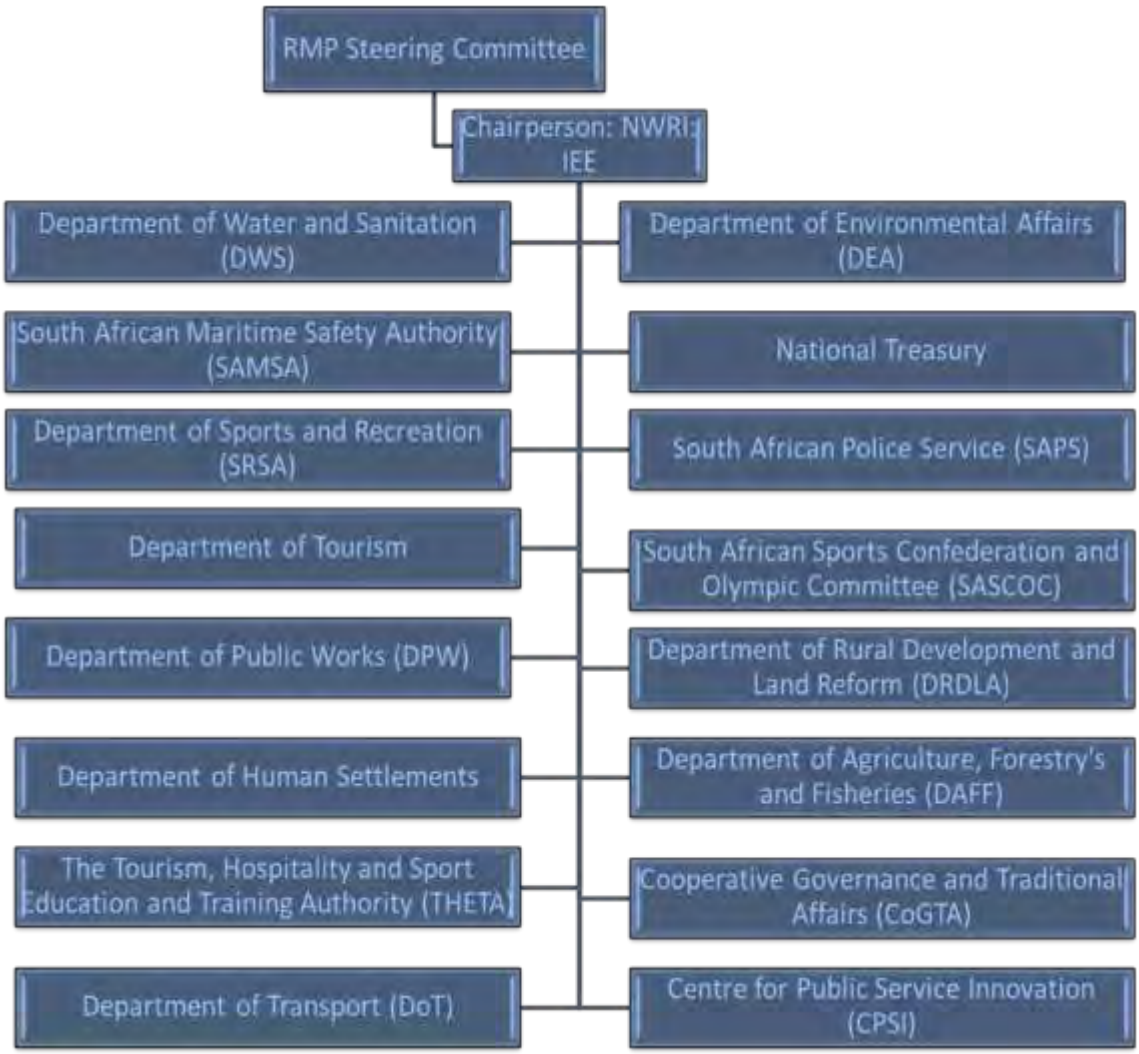


Figure 20: RSC Membership

4.2.2 *Operations Management Committee (OMC)*

The OMC will function at a catchment level and will provide high level guidance for all Dams occurring within one catchment. This is an existing reporting line between Area Managers for various schemes, the Regional Manager and the Director: Operations. The implementation of the RMP will be added as an agenda item, hence providing an opportunity to discuss the RMP. The Regional Manager will be fully aware of all commercial and/or recreational activities/opportunities at all Dams within the cluster.

Figure 21: OMC Membership

4.2.3 Dam Management Committee (DMC)

The DMC is responsible for the operationalising of the RMP and includes a larger pool of representatives. This committee is chaired by the delegated DWS Official or IA.

Should DWS appoint an IA, the IA as part of their functions may also be asked to chair the DMC.

The DMC also includes authorised access point representatives. In this case, this includes all commercial operations and recreational clubs (should agreements be put in place to authorise access).

Due to the exceptionally large number of landowners around the Dam, it is suggested that in addition to authorised access point representatives, landowners around the Dam should appoint one representative to sit on their behalf. This Authorised Landowner representative will represent landowners who do not allow access to the general public.

The DMC is involved in the management of the UPN System as part of the CIWSP and includes the following representatives:

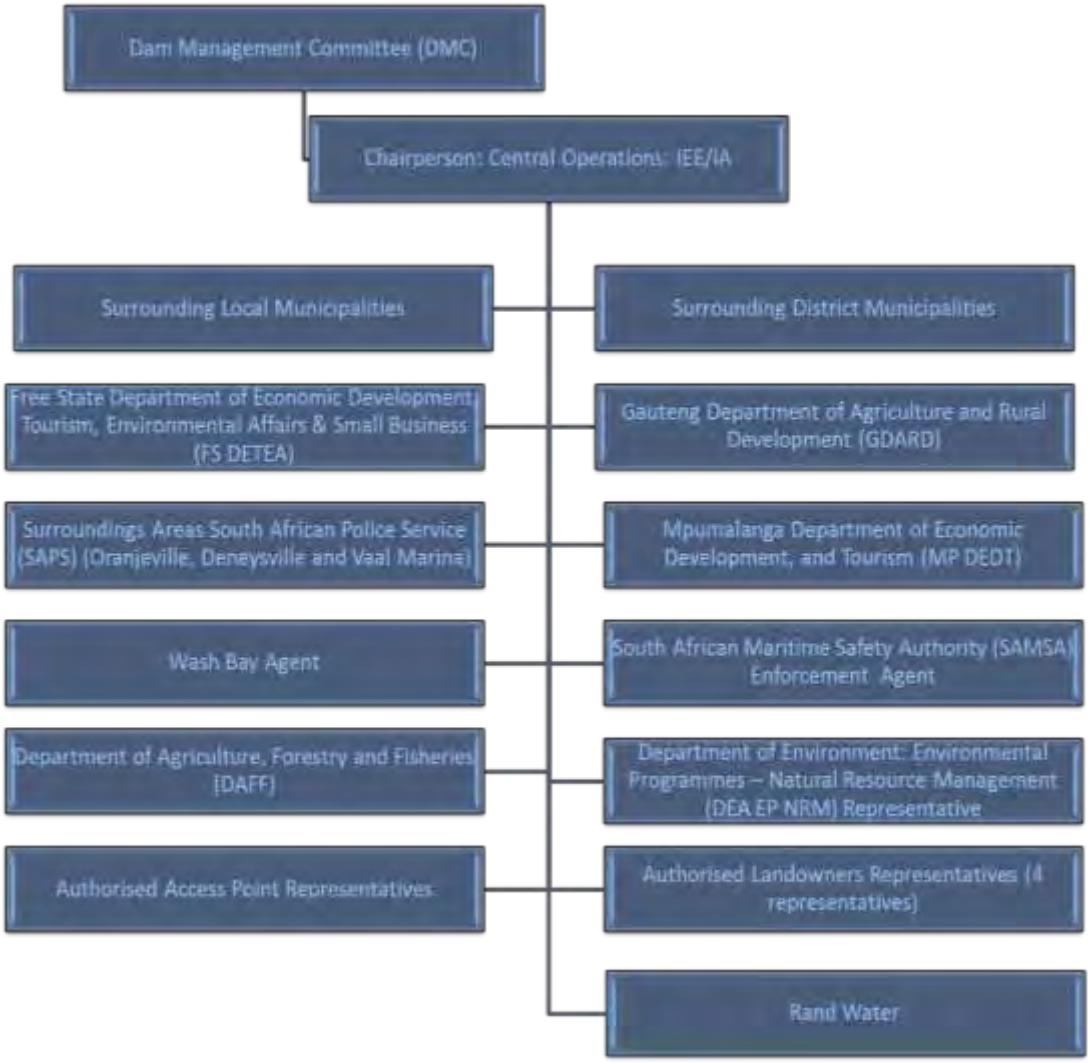


Figure 22: DMC Membership

One of the main functions of the DMC is to assess commercial opportunities at the Dam. As such, an agenda item related to the Strategic Plan for Commercialisation (SPC) is required. In addition, changes in water quality, developments in the area, status of Aquatic Invasive Species and education and information programmes should be discussed. The DMC should meet every three months (i.e. quarterly).

Another important function of the DMC is to organise and facilitate the quarterly Dam User Open Day. All stakeholders should be invited to this meeting so that issues regarding use of the Dam can be discussed. If necessary, serious issues can be escalated from the Public Open Day to the OMC and then RSC so to ensure swift conflict resolution. The Open Day also provides an opportunity for the DMC to inform users of the Dam of all rules and regulations governing the access and use of the Dam.

Due to the size of the Dam, it is suggested that three Public Open Days are held quarterly (prior to the DMC). These should be held in the following locations:

- Deneysville;
- Oranjeville; and
- Vaal Marina.

At least three members of the DMC (including a representative from DWS) should attend all three Public Open Days to ensure that all comments raised are noted and raised at the DMC meeting. The location of the DMC meeting should rotate between the three locations.

Operational management of recreational activities such as ensuring the AtoN and demarcation markers system is in place and setting times for use of the Dam (within the current framework of GN 654 of 1964) will also be managed by the DMC.

Due to the large number of adjacent landowners around the Dam, it is suggested that both authorised access point representatives (i.e. recreational clubs and commercial enterprises – once agreements are put in place) and authorised adjacent landowner representatives form part of the DMC. As the Dam is so large, representatives should be elected by the landowners of a specific section. Four sections have been suggested and are provided in the map below:

- Deneysville, Free State;
- Oranjeville, Free State;
- Gauteng; and
- Mpumalanga.

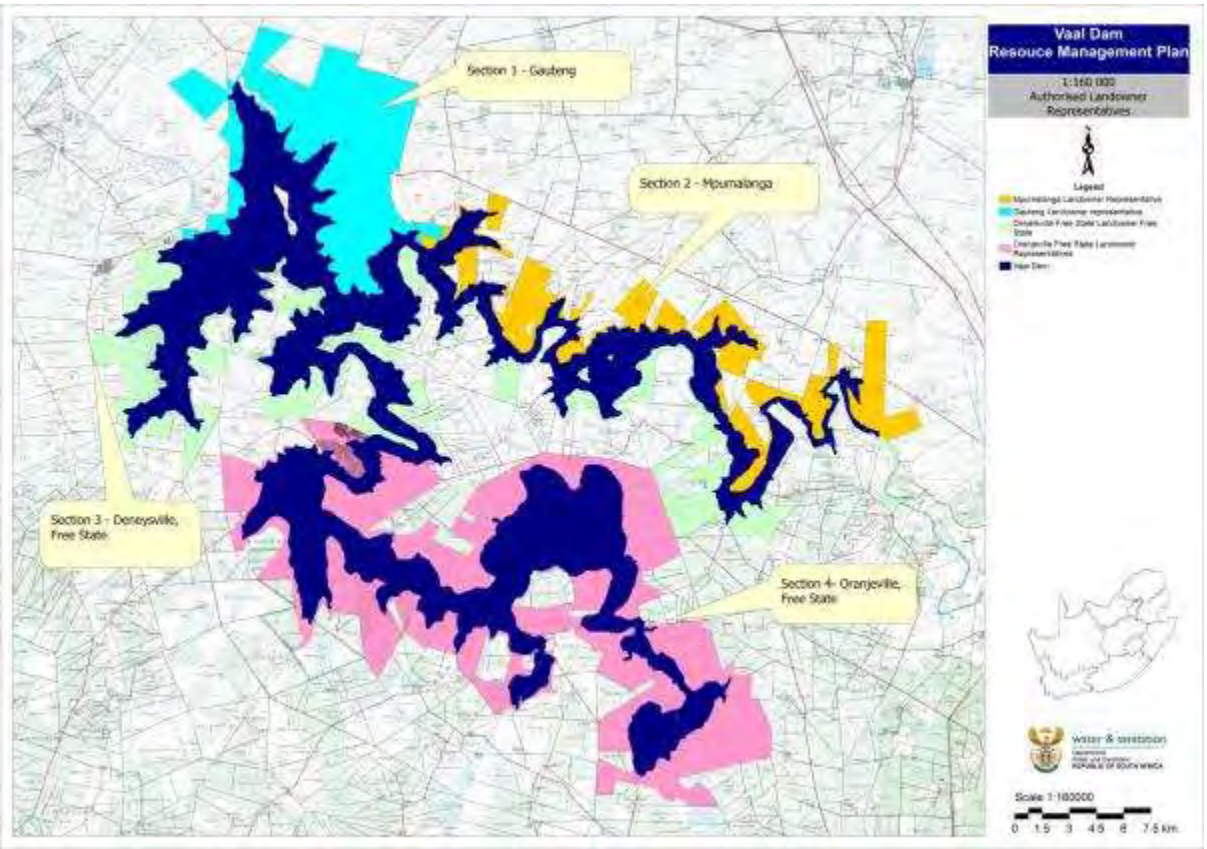


Figure 23: Authorised Landowner Representatives

The final structure of the DMC may change once agreements with Authorised Access Points Representatives and landowners are concluded. The updated DMC membership list will be added as an addendum of the Gazetted RMP.

Lastly, the DMC is also responsible for ensuring the BP is implemented.

4.2.4 Management tools

The RSC, OMC and DMC will have a number of management tools which will enable proper management of the Dam in line with Legislative requirements.

4.2.4.1 Terms of Reference

The RSC, and DMC will be guided by Terms of Reference (ToR) regarding roles and responsibilities. The ToR will provide guidance on the following management aspects:

- Meeting frequency;
- Roles and Responsibility of Chairperson;
- Roles and Responsibilities of Members;
- Minutes and attendance requirements;
- Reporting requirements;
- Management of agreements;
- Management of access objectives;
- Management of development targets;
- SPC;
- Management of Water quality monitoring;
- Management of the Control of Aquatic Invasive Species;
- Management of Development Pressure; and
- Management of UPN system and wash bays.

Terms of Reference are not required for the OMC as this is an existing reporting structure.

4.2.4.2 Agreements

1.) Agreements between DWS and Implementing Agents

One of the main management tools available is the use of agreements to ensure proper use of the Dam in line with the RMP vision and objectives.

However, the Vaal Dam is slightly different due to its extremely large size and the fact that the Dam occurs on a servitude of storage and thus does not have much State Land available. The Dam also occurs across three separate provinces which also makes management challenging. Despite this, appointing an IA to manage specific commercial opportunities and/or public access areas is seen as the most viable management option. It is suggested that this approached in the following way:

- DWS undertake discussions with MVLM and MLM and GDARD;
- Based on these discussions (should it be accepted), it is suggested that both MVLM and MLM be appointed as IAs with separate functions and jurisdictions;
- MLM would be responsible for operating and managing the Jim Fouche Report as well as public access areas in Oranjeville and Deneysville (which could be undertaken as a PPP or through agreement with the Local Municipalities). They would also be responsible for managing the Wash Bays in those areas; and
- As part of MVLM's management role, they would have an opportunity to manage/generate income through PPPs for the management of the Government Farm (based on discussions with GDARD) and Groot Eiland. They would also be responsible for management of the Public Access area in Vaal Marina (which would need to be created) as well as the Wash Bay in Vaal Marina.

Despite the appointment of two IAs at the Dam, it is further suggested that DWS remain responsible for managing agreements with all adjacent landowners, recreational clubs and commercial operators. The IAs will have an opportunity to comment on agreements but will not enter directly into agreements with other stakeholders other than through the PPP process for the Jim Fouche Resort (MLM) or Government Farm and Groot Eiland (MVLM).

All agreements should be in line with the RMP requirements which as a minimum must achieve the following:

- Conditions on IA's mandate to enter into agreements with other parties on the use of the surface water for recreational use;
- Terms and conditions regarding equitable access must be included in ALL agreements;
- Guidance on the use of the State Resource for PPP in line with Treasury's requirements;
- Safety management to be in line with SAMSA requirements;
- Targets and objectives for the management of the Dam;
- Roles and responsibilities regarding the following:
    - Maintenance of AtoN and Demarcation Markers;
    - Maintenance of Wash Bays;
    - Maintenance of Recreational Infrastructure;
    - Maintenance of Fencing;
    - Maintenance of the UPN System including signage;
    - Conditions on the use of the Dam for small scale fisheries or for commercial fisheries projects; and
    - Conditions for the negotiations of agreements between DWS and recreational clubs. As a minimum, it is suggested that all agreements between the DWS and any recreational clubs, should be reviewed and accepted in writing by the IAs. They should also be presented to the DMC prior to signature to ensure the vision and objectives of the RMP are met.

Irrespective of the nature of the agreement the following must be incorporated:

- Clear start and end dates and terms of renewal/extension;
- Rights and obligations of both parties;
- Access points to be used must be stipulated. Due to the fact that the IAs will only be managing the State Land, the access points for the IAs will be at Government Farm (MVLM) and Jim Fouche Resort (MLM) as well as at the public access areas in Vaal Marina (MVLM) and Deneysville and Oranjeville (MLM). Access for recreational clubs and adjacent landowners will be managed through agreements with DWS and be discussed below;
- IA's (and therefore DWS's) exclusion of liability;
- Terms and conditions of improvements made to the property should be stipulated. All improvements require consent from DWS and the DMC. Furthermore, the financial consequences should this requirement not be met should also be stipulated in the agreement. No permanent structures shall be built within the 1:100 year floodline without additional approval as required by Section 21 (c) and (i) of the National Water Act, 1998 (Act no 36 of 1998);
- The extent of the rights to use the resource should be stipulated;
- Clear instructions on the financial requirements of both parties, and where and when money must be paid should also be stipulated. All recreational clubs and societies on State Land must be managed in line with National Treasury requirements. Lease agreements for use of State Land should include fair remuneration at the current market value;
- All agreements should include a cancellation clause if requirements cannot be met;
- Limitations of the number of people allowed to access the water surface of the Dam based on carrying capacity of Dam as well as the carrying capacity of the CIWSP wash-bays must be adhered to;
- A list of current and potential recreational activities allowed at the Dam;
- Requirements for safety, disaster management and emergency response plans;
- Duties and responsibilities of either party regarding maintenance, management and infrastructure;
- A list of prohibited activities;
- Requirements for subletting portions of the leased area (if allowed);
- Conditions on the use of the Dam for small-scale fisheries projects;
- A mandate for programmes to assist in equitable access and redressing past imbalances at the Dam, such as sponsored gate-fees for members of previously disadvantaged communities. This should be in line with the RMP. The DMC will then be required to report against all targets at the OMC;
- All agreements must include a cancellation clause should community access targets not be met; and
- All recreational activities must be in line with the RMP, which once gazetted, becomes the mechanism to control and manage recreational use. Although no Section 21k Water Use License Application (WULA) is required, all activities must comply with all other relevant legislation requirements including the following:
    - The Merchant Shipping (National Small Vessel Safety) Regulations, 2007, - Control of Boating;
    - Section 21 (a) of the National Water Act, 1998 – abstraction;
    - Section 21 (c) and (i) of the National Water Act, 1998 – construction of slipways/infrastructure;
    - Safety at Sports and Recreational Events Act, 2010 – Events; and
    - Provincial Ordinances – Fishing.

These agreements should be updated within one year of the RMP being gazetted.

2.) Recreational Use Agreements

Any new recreational Clubs must enter into an agreement with DWS and be approved by the IAs and DMC. All recreational use at the Dam must be through an appropriate legal framework.

Recreational Use Agreements must be developed in line with the conditions stipulated in the agreement between DWS and the IA. They should at a minimum include the following:

- All clubs or associations must be affiliated to a national sporting body recognised by the South African Sports Confederation and Olympic Committee (SASCOC);
- All agreements must include a cancellation clause if clubs or associations fail to obtain affiliation within one year from date of signature of the agreement;
- Limitations of the number of people allowed to access the water surface of the Dam based on carrying capacity of Dam as well as the carrying capacity of the CIWSP wash-bays must be adhered to;
- A mandate for programmes to assist in equitable access and redressing past imbalances at the Dam, such as sponsored gate-fees for members of previously disadvantaged communities. This should be in line with the RMP. The DMC will then be required to report against all targets at the OMC; and
- All agreements must include a cancellation clause should community access targets not be met.

Access agreements will also be required as discussed below.

All agreements must be finalised within one year of the RMP being gazetted.

3.) Land Management Agreements

The DMC should actively consider land management strategies that improve the efficiency of current practices. This could include co-management agreements with surrounding or adjacent landowners which may result in environmentally sustainable and more efficient land management.

Agreements must be developed with appropriate legal advice and consultation.

In the case of Vaal Dam, the Dam occurs in a servitude of storage and thus there is no DWS owned purchase boundary. However as part of the RMP, it is suggested that a shoreline management plan be developed so to ensure management of the land within the servitude is in line with best practices, agreements with all adjacent landowners should take into account the shoreline management plan.

All agreements should be should be put in place within one year of the RMP being gazetted.

4.) Access Agreements

All surface water access must be formalised. The conditions for such access must be written into the agreement. All illegal practices must be addressed. Appropriate action must be taken to ensure that all parties comply with the requirements of the RMP.

All community members, adjacent landowners and clubs must be made aware that access to the surface water should only be through authorised access points. Accessing the surface water through unauthorised access points is an illegal activity unless they enter into a formal agreement with DWS.

Further, a formal agreement with DWS will be required by all community members, adjacent landowners and new recreational clubs that have direct access to the water surface of the Dam through 1.) constructed slipways; 2.) natural slipways; or 3.) jetties for angling and/or launching of boats. Additional agreements with the IA may also be necessary.

The wash bay must be built on State Property as part of the CIWSP. A formal agreement is necessary between the IA and DEA on the management and maintenance of the facility. The agreement will be overseen by the DMC.

All agreements should be put in place within one year of the RMP being gazetted.

5.) Safety of Navigation Agreements

Agreements between SAMSA and DWS/other relevant Parties/Bodies are to be concluded to allow them to:

- Exhibit the relevant AtoN; and
- Establish or deploy the relevant fixed and/or floating AtoN.

6.) Event Applications

Vaal Dam is used for a number of events and all events must be managed through an event application process. While the application may be made to the IA, DWS and the DMC must approve the application. These applications must follow a specific template and will include the following:

- Number of participants;
- Emergency Response Plan;
- Advertising and branding (will need to be in line with DWS communication requirements);
- Access points to be used;
- Costs; and
- Films/photographs that will be generated to be in line with DWS communication requirements.

Further, all Events must meet the requirements of the Safety at Sports and Recreation Act, 2010 (Act No 2 of 2010).

4.2.4.3 National Affiliations and Development Targets

All recreational clubs should be affiliated to a SASCOC affiliated organisation. The development targets set by the National Organisations must be met. The Clubs must be affiliated within two years of the RMP coming into effect.

4.2.4.4 Community Participation and Beneficiation

The RMP has suggested a number of different objectives, actions, interventions, agreements and institutional arrangements to ensure that community participation and beneficiation of the resource takes place. These are captured throughout the different plans and in the vision and objectives. However, in order to ensure a strong focus on this aspect by the DMC, OMC and RSC going forward, the different elements of community participation and beneficiation are consolidated below.

1.) Socio-Economic Development

Socio-economic development is a key aspect of the RMP and is captured in the Vision for the Dam. The Vaal Dam has the potential to be one of the premier destinations in Gauteng and Free State. This would create employment and economic opportunities in these provinces. This socio-economic aspect has been captured in the Vision for the Dam: "*Increased and sustainable development of a safe and well managed Dam to create lasting opportunities for the surrounding community without compromising the primary purpose of the resource or the cultural and natural environment around the Dam.*" Therefore socio-economic development is a key factor of the vision for the Dam.

There is also a specific objective and a number of related actions regarding sustainable development:

Sustainable economic development and urban renewal

- Urban renewal plan for Deneysville and Oranjeville to be developed and implemented;
- Integrated Tourism Plan including marketing, website creation and road signage to compiled and implemented;
- The status of the current commercial fishery license to be determined and if necessary, a feasibility study to be undertaken to determine the potential for commercial fisheries at the Dam. This should include lessons learnt from

the original commercial fisheries project at the Dam;
- The potential feasibility for a Public Private Partnership (PPP) for the management of the Jim Fouche Resort to be determined;
- Discussions with MVLM and Gauteng Province to be undertaken and the potential for a PPP for the management of the Government Farm land (next to the Dam wall) to be determined. A section of this area should be retained as a public access area and facilities should be upgraded;
- The potential for a number of small PPPs for the management of tourism activities such as house boats and floating restaurants to be determined;
- The potential for a large scale PPP for the creation and management of an upmarket hotel and restaurant on the island to be determined;
- The development of a Vaal Meander route around the Dam linked to a number of community craft markets, farmers markets etc.; and
- Development SMMEs around the Dam linked to tourism.

In addition, as discussed in the Financial Plan below, Vaal Dam can become a key economic lever for the region, thereby creating job opportunities for the local community.

One of the key mechanisms for this is the use PPPs. However in regards to potential PPPs, the following should be noted:

- A balance between high and small cap opportunities is required to ensure that revenue generation occurs together with the promotion of equitable access and job creation at the Dam; and
- While the tariff structure can be used for revenue generation, it should not be used to deny people access to the Dam.

The BP has a number of specific interventions regarding this objective including the compilation of an Integrated Tourism Plan, potential for Commercial or Small-Scale Fisheries at the Dam, and potential PPPs.

2.) Equitable Use

In general, one of the main triggers for most RMPs is the issue of equitable access. At Vaal Dam, there are three main towns around the Dam, namely, Deneysville and Oranjeville in the Free State and Vaal Marina in Gauteng. Both Free State towns have public access (however the facilities require maintenance and upgrade). However in Vaal Marina, public access is an issue. In order to rectify unequitable access in Vaal Marina and unequitable use at the other towns (due to the lack of facilities, a specific objective related to this has been identified:

Community beneficiation and equitable access and use of Vaal Dam

- Potential for water troughs for watering of cattle;
- The potential for community agriculture programmes with irrigation to be determined. These community programmes could provide food for tourism ventures and 'community farmers markets' in the area;
- The potential for a small-scale fisheries or subsistence fishing project for the local community to be determined. This would include training, provision of boats and nets etc. and would be implemented at all three towns around the Dam;
- A formalised public access picnic area (including facilities) should be put in place in Vaal Marina. This should be undertaken through discussions with the MVLM and the VMPOWA so that land can be sourced from current municipal land and/or public access servitudes which are in place but are not currently utilised;
- The potential for a community access card to be assessed for access at public areas;
- Facilities at the public access areas in Deneysville and Oranjeville to be put in place; and
- Information brochures to be developed to inform communities about the potential uses of the Dam to encourage community use.

In addition, a specific intervention in the BP is focused entirely on the creation of facilities at the two public areas (Deneysville and Oranjeville) as well as sourcing of land for a public access facility in Vaal Marina. It is suggested that DWS undertake the initial planning and construction while the management and maintenance of the area be included in the agreement with the IA.

Section 4.2.4.1. provides guidance on the aspects which should be included in the ToR for the DMC and RSC. Specific mention is made of Management of access objectives and Management of development targets. Section 4.2.4.2. provides the guidance on the aspects which should be included in all agreements. This includes the following:

- A mandate for programmes to assist in equitable access and redressing past imbalances at the Dam, such as sponsored gate-fees for members of previously disadvantaged communities. This should be in line with the RMP. The DMC will then be required to report against all targets at the OMC.; and
- All agreements must include a cancellation clause should community access targets not be met.

3.) Skills Development and Training

The RMP also focuses on skills development and training through one of the objectives (and related actions items – listed below).

Community skills development, education and training

- Lifeguard skills training and first aid training to ensure safe public use of the Dam;
- Coordination with local municipalities, National Sea Rescue Institute (NSRI), Waterwise and SwimSA to create community swimming schools at the Dam to improve swimming skills in the short term at the Dam. Detailed safety assessments must be undertaken and only small class sizes are allowed due to the dark water and potential difficult water conditions at the Dam;
- Discussions between DWS and NSRI and Waterwise to take place to determine the feasibility of rolling out community swimming safety measures at public areas. Examples of these safety measures include affordable life rings etc.;
- In the medium term, coordination with local municipalities, and SwimSA to create public swimming pools at the three towns around the Dam and to introduce swimming development schools; and
- Access agreements with clubs to include development requirements.

The BP has a specific intervention relating to development and implementation of a skills training programme as there is an opportunity for local community members to obtain skills (such as first aid) to be employed at the public access area as 'lifeguards'. This would have the added benefit of improving community safety at the Dam.

4.3 Financial Plan

Vaal Dam is an economic lever and can become central to development in the Region. The RMP provides guidance on cost recovery mechanisms to ensure the sustained and improved management of the Dam.

Currently income is generated by a number of private parties for accommodation and access to the Dam. Recreational clubs also generate an income through membership fees and events. DWS does not generate an income from the Dam at this time.

There are opportunities for PPPs which could further unlock the economic potential of the Dam.

With PPPs, the private party assumes the financial, technical and operational risks but receives a benefit for this. PPPs allow for DWS to make State Assets such as Dams available to

private parties who wish to engage in tourism related commercial operations (DWAF, 2009). This risk sharing mechanism aims to unlock socio-economic potential of State Dams. In addition, development of PPPs in remote areas often require related infrastructure upgrades and thus there is the opportunity for new infrastructure investment and development and related services which would benefit local communities.

Although high cap PPPs result mostly in revenue generation, small cap opportunities (less than R10 million (2007 figures) are more likely to fulfil socio-economic objectives such as job creation, promotion of Broad-Based Black Economic Empowerment, Local Economic Development and Small, Medium and Micro Enterprises. A balance between high and small cap opportunities is required to ensure that revenue generation occurs together with the promotion of equitable access and job creation at the Dam.

Further, Vaal Dam is a State Resource and as such all profits made from the recreational use of the Dam should be used for further development of the Dam.

While the fees for use of the Dam can be used for revenue generation, it should not be used to deny people access to the Dam. Thus it should take into account the socio-economic status of recreational users. For example, a sliding scale, cross subsidy fee structure and/or contractual obligations which ensure equitable access must be considered when setting a fee.

The BP provides a financial framework to undertake certain interventions.

4.4 Zonal Plan

The Zonal Plan for Vaal Dam has three main sections. The first involves the current recreational activities together with an identification of potential recreational and/or commercial opportunities. This section also includes the determination of carrying capacity. The second involves the shoreline management zones (together with preferred activities within each zone) and the third involves surface management zones (together with preferred activities within each zone).

4.4.1 Current Recreational Uses

Due to the large shoreline and surface area, the Dam is also used for recreation and a number of Sailing Clubs are located at the Dam including:

- DAC;
- LDYC;
- AYC;
- PNYC;
- SSYC;
- VCA;
- SYC; and
- SPYC.

In addition to the clubs, a number of Marinas occur at the Dam including Manten Marina, Anchor Creek Marina and Bayshore Marina to name a few.

The Dam is also a popular fishing venue and both power boat and fishing activities take place at DAC. The RPA offers bank angling, boat angling and fly fishing. The AHV also offers fishing but is a member only club restricted to 2 000 members.

The following activities commonly occur at the Dam:

- Sailing, Windsurfing and kite surfing;
- Bank Angling/Shore Fishing;
- Boat Angling;
- Fly Fishing;
- Motor Boating;
- Canoeing;
- Swimming;
- Water Toys;
- Water skiing/Slalom Skiing;
- Pedal Boat;
- Parasailing;
- Jet Skiing;
- Commercial Fishing (current status unknown);
- Subsistence Fishing;
- Baptisms and Traditional Ceremonies;
- Bird Watching;
- Picnicking;
- Swimming; and

- Research.

A number of competitive events are held at Vaal Dam including the Vaaldam Bonanza, the Round the Island Race, Keelboat Week and the Bayshore 200m Jet Ski Race.

4.4.2 Potential Recreational and/or Commercial Opportunities and Uses

A matrix model was used to determine the feasibility of possible recreational and eco-tourism activities in line with the operational requirements of the Dam, the biophysical environmental conditions and safety requirements. The scores utilised to determine viability are as follows:

Table 13: Scores for Recreational Use

Score	Meaning	Comment
0	Not feasible	High Negative Impact to Dam Environment + High Negative Impact to Recreational Users Text provided in red highlights the specific factors which make the activity not feasible at the Dam.
1	Likely to be feasible however feasibility study is required.	**Feasibility Study is required**
2	Likely to be feasible	Benefits appear to outweigh impacts. Allowed should there be an interest. Adequate agreements and safety measures would be required as per RMP. **No feasibility study is required.**
3	Current use	Benefits outweigh impacts. **No feasibility study is required.**

The main potential activities include:

- High End Hotel on Groot Eiland;
- PPP for the Resort on Government Farm (including conference facilities etc.);
- Floating Restaurant;
- House Boats;
- Pleasure Boats;
- Swimming School for Local community (at community swimming pools);
- Public Access Area;
- Day cycling trails;
- Farmers and Craft Markets;
- Wedding Venue;
- Birding Boat Tours;
- Junior Angling School;
- Junior Sailing School; and
- Potential commercial fishery.

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Table 14: Potential and Current Recreational Activities

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
No Contact	Guided Bird Viewing Hiking/ Walking Trail	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances but can be mitigated through well-chosen routes that do not impact bird nesting	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response would be required	N/A	N/A	Not required for Day hikes	Ablution facilities would be required	Not required	No formal purchase boundary	Guided trails are generally popular especially in light of the sensitive bird species in the area	N/A	0
	Day Cycling Trails between towns	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances but can be mitigated through well-chosen routes that do not impact bird nesting	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Not required	Ablution facilities would be required at Public areas	Not required	No formal purchase boundary however there may be potential to market cycling between towns. This would require upgraded roads and cycling lanes	Cycling is very popular in Gauteng	Local municipality	1
	Public Picnic Areas	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Effluent disposal required – potential negative impacts	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Picnic spots and braai facilities would be required	Ablution facilities would be required	Access agreement with DWS would be required	There are public access areas in Denesyville and Oranjeville that require facilities but land is available however in Vaal Marina, land would need to be sourced.	Community is interested	DWS	3
	Conference Facility at Government Farm	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Effluent disposal required – potential negative impacts	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Facilities in place	Facilities in place	Access agreement with DWS would be required	Land at Government Farm Is available	The proximity to Johannesburg makes it a potential activity	IA/PPP	1
	Floating Restaurant	Water levels should not impact no contact activities	Feasibility study would need to assess potential impacts	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Effluent disposal required – potential negative impacts	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Facilities in place	Facilities in place	Access agreement with DWS would be required	Land at Government Farm Is available – would provide access to water	The proximity to Johannesburg makes it a potential activity	IA/PPP	1
	Craft/ Farmers Markets	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Market facilities would be required	Ablution facilities would be required	Access agreement with DWS would be required	As there is no available State Land, markets would need to be developed by different Local municipalities and IAs	Community is interested	Local Municipality/IA/ Tourism Authority	1
	Wedding venue	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Effluent disposal required – potential negative impacts	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Facilities would be required	Ablution facilities would be required	Access agreement with DWS would be required	Land at Government Farm Is available	There is a drive to make the Vaal Dam area a wedding area	IA/PPP	1

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
	Traditional Ceremonies/ Baptisms	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	Potential disturbances can be mitigated through site selection	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	No facilities are required	N/A	Not required	Currently land access through Government Farm, however should the area be developed then specific area would be required	Current activity	N/A	3
	Accommodation	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	N/A	Effluent disposal required – potential negative impacts	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	Facilities required	Facilities required	Formal access point and agreements with DWS required	Upgraded and additional facilities required at Jim Fouche Resort as well as Government Farm. High End Accommodation could also be put in place at the Groot Eiland	There are a number of accommodation facilities in the area	IA/PPP	1
	Birding	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	If not well managed then could impact bird nesting	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	N/A	Facilities required at public access areas. Bird Hides would also be required in some areas	Formal access point and agreements with DWS required	Public Access areas area available	Birding is very popular in the area	IA	3
	Research	Water levels should not impact no contact activities	No impact	N/A	N/A	N/A	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	N/A	N/A	N/A	Cell-phone reception available	Emergency response as part of IA's mandate	N/A	N/A	N/A	N/A	Formal access point and agreements with DWS required	Would depend on specific research requirements. UJ has research area on Groot Eiland to facilitate research	Current activity	Universities	3
Primary Contact	Open Water Swimming - Recreational	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Would be required	Acceptable for swimming	The water is very dark and this makes swimming dangerous however recreational swimming within 50m of the shore is allowed in specific areas	Cell-phone reception available	None. Would require UPN System	Zoning would need to be adjusted to accommodate swimmers	N/A	Not required	Required	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	DWS funding for picnic area/IA/PPP	3
	Open Water Swimming – Development Programme	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Would be required	Acceptable for swimming	The water is very dark and this makes swimming dangerous. Therefore, a number of safety requirements need to be put in place	Cell-phone reception available	None. Would require UPN System	Zoning would need to be adjusted to accommodate swimmers	Not required.	Community swimming pools required	Required	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Community is interested	SwimSA, Telkom Splash or similar foundations. Coordination with schools may also be possible.	3
	Snorkelling	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	N/A	N/A	N/A	Would be required	Acceptable for swimming	Water is too turbid for	Cell-phone reception available	None. Would require UPN System	Zoning would need to be adjusted to	N/A	Not required	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	None at present	N/A	0

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue						snorkelling or diving			accommodate snorkelers				agreements with DWS required	required – available at other towns			
	Diving	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	N/A	Would be required	Acceptable for swimming	Water is too turbid for snorkelling or diving	Cell-phone reception available	None. Would require UPN System	Zoning would need to be adjusted to accommodate divers	N/A	Not required	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	None at present	N/A	0
Secondary Contact	Small scale/Commercial Fisheries	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	May negatively impact indigenous species	May disturb bird nesting	Potential Water quality impacts need to be assessed in feasibility	Would be required	N/A	N/A	Cell-phone reception available	None. Would require UPN System	N/A	N/A	Facilities and infrastructure required.	Facilities and infrastructure required.	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	There is currently 1 permit out but the status is not known	PPPs/DAFF/FS DETEA	1
	Birding Boat Tours	Water level does not fluctuate greatly	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Possible pollution from litter	Zoning AtoN and Demarcation Markers required	Unknown – would need to be determined	N/A	Cell-phone reception available	None. Would require UPN System	N/A	N/A	N/A	N/A	Formal access point and agreements with DWS required	Access at Jim Fouche Resort as well as Government Farm	Potential activity as part of PPP	PPP/IA	1
	Shore Fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	The Zonal map should prevent impacts	None	Indirect: Increased visitor numbers may impact water quality	Required	N/A	N/A	Cell-phone reception available	None. Would require UPN System	Shore fishing takes place currently	No required	Not required	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	DWS funding for picnic area	3
	Fly Fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	The Zonal map should prevent impacts	None	Indirect: Increased visitor numbers may impact water quality	Required	N/A	N/A	Cell-phone reception available	None. Would require UPN System	Shore fishing takes place currently	No required	Not required	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	DWS funding for picnic area	3
	Subsistence fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	The Zonal map should prevent impacts	None	Indirect: Increased visitor numbers may impact water quality	Required	N/A	N/A	Cell-phone reception available	None. Would require UPN System	Shore fishing takes place currently	No required	Not required	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	DWS funding for picnic area	3
	Tube Fishing	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	None	None	Indirect: Increased visitor	Zoning AtoN and Demarcation	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	N/A	No winds would be required	N/A	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	Potential interest	N/A	2

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue			numbers may impact water quality	Markers required						however safety is a concern as strong winds can occur at the Dam.			agreements with DWS required	required – available at other towns				
	Pontoon Fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	N/A	No winds would be required however safety is a concern as strong winds can occur at the Dam.	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Potential interest	N/A	2
	Bass Fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No current conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Motorised Boats	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No current conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Jet Powered Boats	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No current conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Similar to motorised boats	N/A	2
	RHIB (Rigid Hulled Inflatable Boat)	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No current conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Water-skiing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No current conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Jet Ski	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	None	None	Indirect: Increased visitor	Zoning AtoN and Demarcation	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to	No	N/A	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	Current activity	N/A	3

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue			numbers may impact water quality	Markers required					prevent major conflict				agreements with DWS required	required – available at other towns			
	Dragon Boats	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No winds would be required however safety is a concern as strong winds can occur at the Dam	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	No interest at this point	N/A	2
	Slalom Canoe	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No winds would be required however safety is a concern as strong winds can occur at the Dam	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Fishing Canoe	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	Canoeing occurs at the Dam	No winds would be required however safety is a concern as strong winds can occur at the Dam	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Jet Ski Fishing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Both jet skiing and fishing are popular so likely to be popular	N/A	2
	Wind Surfing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	Yes, winds available	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	3
	Kite Surfing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	Yes, winds available	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	3
	Ski Jumping	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	None	None	Indirect: Increased visitor	Zoning AtoN and Demarcation	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to	No	N/A	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	Generally popular activity	N/A	2

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue			numbers may impact water quality	Markers required					prevent major conflict				agreements with DWS required	required – available at other towns			
	Slalom Skiing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	3
	Ski and Wakeboard Boat	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	None	None	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	3
	Kayaking Sprints	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular	N/A	2
	Kayaking Marathons	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	The Dam is very large and could thus provide a venue for training	N/A	2
	Kayaking Water Polo	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users zoning to prevent major conflict	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Unknown	N/A	2
	Kayaking Touring	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No conflict – restricted to shoreline	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	The Dam is very large and could thus provide a venue for training	N/A	2
	Kayaking Fishing	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	No impact	No impact	Indirect: Increased visitor	Zoning AtoN and Demarcation	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No conflict – restricted to shoreline	No	N/A	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	Fishing and canoeing	N/A	2

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue			numbers may impact water quality	Markers required									agreements with DWS required	required – available at other towns	are both popular		
	Paddle Ski	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No conflict – restricted to shoreline	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	2
	Surf Ski	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Unknown	N/A	2
	Pedal Boat	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers require	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No conflict – restricted to shoreline	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Hovercraft	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	Disturbance to local fauna	Disturbance to local fauna	Indirect: Increased visitor numbers may impact water quality	N/A	Depth is suitable	Not required	Cell-phone reception available	None. Would require UPN System	Conflicts with sense of place and current use	N/A	Not required	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	None at present	N/A	0
	Stand Up Paddling	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers require	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	None foreseen at present	Not required.	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	2
	Parasailing	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	No impact	No impact	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users, zoning to prevent major conflict	The Dam is known for strong winds	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Generally popular activity	N/A	3
	Sailing	N/A	N/A	Water quality is adequate	Algal blooms can	Aquatic Invasive species	No impact	No impact	Indirect: Increased visitor	Zoning AtoN and Demarcation	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with other users, zoning to	The Dam is known for strong	N/A	Ablution facilities required at Public Access Area	Formal access point and	Public Access area at Vaal Marina is	Current activity	N/A	3

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
					occur	are known to occur in the area and may be a potential issue			numbers may impact water quality Disposal of effluent incorrectly may impact water quality	Markers required					prevent major conflict	winds			agreements with DWS required	required – available at other towns			
	Water Toys	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	N/A	Safety concern as not visible to bigger craft,flags and other safety measures required	Cell-phone reception available	None. Would require UPN System	None foreseen at present	No	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Current activity	N/A	3
	Flying Boats/Water Planes	N/A	Potential impact on Dam wall	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	Disturbance to local fauna	Disturbance to local fauna	Disturbance to local environment	Specific aviation requirement would need to be met	Some sections of the Dam are shallow	N/A	Cell-phone reception available	None. Would require UPN System	May conflict with recreational use and impact on sense of place	N/A	Not required	Not required	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Potential linkage to Vaal Airport	N/A	0
	House Boats	Water level does not fluctuate greatly	Potential impact on Dam wall	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Possible pollution from litter Feasibility study to assess disposal of effluent	Zoning AtoN and Demarcation Markers required	Unknown – would need to be determined	N/A	Cell-phone reception available	None. Would require UPN System	Conflicts with current recreational operating hours	N/A	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Potential activity as part of PPP	PPP/IA	1
	Pleasure Boats	Water level does not fluctuate greatly	Potential impact on Dam wall	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Possible pollution from litter Feasibility study to assess disposal of effluent	Zoning AtoN and Demarcation Markers required	Unknown – would need to be determined	N/A	Cell-phone reception available	None. Would require UPN System	Conflicts with current recreational operating hours	N/A	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Potential activity as part of PPP	PPP/IA	1
	Junior Angling School	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No	Not required	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Community showed interest in recreational fishing involvement	Angling Clubs	1

Contact Type	Activity	Operational Management Issues		Environmental Impacts on Recreational Use			Recreational Use Impacts on the Environment			Safety Requirements					Recreational Requirements				Legal Requirements		Economic Viability		Score
		Change in Water Level	Impacts on Dam Wall	Water Quality	Health Impacts	Aquatic Invasive Species	Fish Spawning	Bird Nesting	Water Quality	AtoN and Demarcation Markers	Water Depth	Visibility	Radio Signal	Emergency Response	Conflicts with current activities	Winds required	Accommodation	Ablution facilities	Access to water	Access to Land	Interest in the activity	Funding Opportunities	
	Junior Sailing School	N/A	N/A	Water quality is adequate	Algal blooms can occur	Aquatic Invasive species are known to occur in the area and may be a potential issue	N/A	N/A	Indirect: Increased visitor numbers may impact water quality	Zoning AtoN and Demarcation Markers required	Depth is suitable	N/A	Cell-phone reception available	None. Would require UPN System	No	Not required	N/A	Ablution facilities required at Public Access Area	Formal access point and agreements with DWS required	Public Access area at Vaal Marina is required – available at other towns	Community showed interest in recreational involvement. DAC runs junior sailing programme already, There is an opportunity to extend this.	Sailing clubs	3

4.4.3 Carrying Capacity

In order to determine the degree of recreational use possible on the water surface, the Methodology for Carrying Capacity Assessment: Recreational Water Use was used as a guideline to determine the level of activity that would be sustainable at Vaal Dam.

Calculating carrying capacity for recreation is a vital step to ensure that recreation at the Dam is safe and that users do not feel crowded and enjoy their use of the Dam as a venue for recreation. There are three kinds of carrying capacity:

1. Physical Carrying Capacity (PCC). This is the maximum number of users that can physically fit onto the water surface at any given time.

2. Real Carrying Capacity (RCC). This is the maximum number of users that can use the resource once corrective factors (such as wildlife or weather conditions) that are unique to the Dam are taken into account.

3. Effective (permissible) Carrying capacity (ECC). This is the number of visitors that can use the resource, given the management capacity available at the Dam.

4.4.3.1. Physical Carrying Capacity (PCC)

PCC is calculated as PCC = A ÷ U/a x Rf

- Where A = area available for public use;
- U/a = area required for each user; and
- Rf = Rotation Factor (the number of visits per day)

A is calculated as the area of the water surface: 277.796 km ^{2}, or 27 769 hectares (ha)

U/A = There is a range of literature regarding the area required for different recreational users. The U/A used for that assessment are as follows:

Craft	Water Depth (m)	U/A (ha/ craft)
Canoes	>0.6	0.5
Windsurfers	>0.6	0.5
Rowing	>1.0	0.5
Dinghies	>1.0	1.0
Yachts	>1.8	2.0
Fishing	>1.0	4.0
Power boats	>1.4	4.0

Based on the fact that most activities do not require much space, and the largest area per user required is 4.0 ha, the U/a is assumed to 4 ha/user or 0.04 km^2/user.

As Vaal is quite remote it is unlikely that people would use the Dam more than once per visit. It is far more likely that visitors to the Dam would spend the majority of the day on the water surface. In this case RF = 1.

The PCC for Vaal Dam can therefore be calculated as:

PCC = 27 779.6÷ 4x 1

PCC = 6 945 boats on the Dam.

However, this is based on the full length of the Dam at 100% capacity. It also doesn't take into account the zoning of the Dam.

4.4.3.2. Real Carrying Capacity (RCC)

Real capacity is the PCC, taking into account factors that limit recreation. In this case limiting factors include:

- Dam Wall Buffers;
- Safety No Go Zones;
- Mooring Zones; and
- Swimming Areas.

The above factors result in a 2.2 % decrease in water area available for recreation at the Dam (Area available for use decreases from 27 779.6 ha (277.79 km^2) to 27 172 ha (271.72 km^2). Therefore, 97.8% of the surface area of the Dam is still available for recreation.

The RCC for Vaal Dam is therefore:

- RCC = PCC x (100 – Cf1) % x (100 – Cf2) % x … (100 – Cfn)%

- Where Cf = a corrective factor expressed as a percentage.
- RCC = 6 945 x (100 –2.2)%

RCC = 6 793 boats on the Dam at any given time, ***Based on water surface.***

4.4.3.3. Effective (permissible) Carrying Capacity (ECC)

Effective Carrying Capacity is the maximum number of visitors that a site can sustain, given the management capacity available. Given that the exact number of slipways, commercial enterprises and clubs need to be surveyed as a specific business plan, and that there is no overall system in place, the management capacity of the Dam is currently relatively low. In addition, the Infrastructure capacity at the Dam is not known.

- ECC = [Infrastructure Capacity x MC]/ RCC
- Where: ECC = Effective Carrying Capacity;
- MC = Management capacity based on staff and budget;
- RCC = Real Carrying Capacity

Once agreements are in place, the ECC will need to be recalculated based on management capacity.

4.4.4 Water Surface Zonal Plan

The Zonal plan for the water surface at Vaal Dam is divided into nine distinct areas or zones. These zones are based on a number of factors including:

- Operational requirements of the Dam;
- Safety requirements of each activity;
- Types of activities (in terms of contact); and
- Environmental requirements.

The overall zonal map is provided in the figure below and the zones are as follows:

- Zone A: Secondary Contact – Motorised Boats and Sailing. This zone is designated for the use of motor boats and sailboats at high speed;
- Zone B: Secondary Contact: Combination Zone. Both Sailing. Motorized activities and Fishing Activities are allowed in this zone however due to shallow nature along the shoreline and to prevent conflict between users, all activities to be kept at a no wake speed. This zone is generally restricted to a 150m buffer around the shoreline. However, inlet areas and narrow channels are also zoned as such for safety reasons;
- Zone C: No Go Zone – Dam Wall. This is the safety buffer around the Dam Wall and is denoted in orange. Due to the size of the Dam and its strategic importance, the buffer has been increased to 300m. No access to the public is allowed;
- Zone D: No Go Zone – Safety Buffer. This is the area around the islands and danger point areas. No access for safety reasons is allowed. The extent of this buffer is 250m.
- Zone E: Secondary Contact – Mooring;
- Zone F: Primary Contact – Swimming and Water Toys. This blue zone is a zone available for swimming and the use of water toys; and
- Zone G: Secondary Contact – Rowing Overlay Zone.

Detailed information of the current and potential activities in each zone is provided in Table 15 below. Information on requirements for each zone is also provided.

In addition, the RMP makes provision for potential commercial fishing and/or small-scale fisheries. At this point, the current status of the commercial fisheries at the Dam (if any) are unknown. As part of Section 4.5., an objective to determine the status of any current fisheries and if necessary the feasibility of new fisheries has been put in place. Should commercial fisheries be viable, the Zonal Plan below should be amended to include Zone H (Table 16).

Table 15: Surface Water Management Zones

Zone Name	Contact Type	Permissible Activities - Current	Permissible Activities - Potential	Access Point	Safety Requirements for Users	Safety Requirements for DMC
Zone A	Secondary Contact – Sailboats and Motorised Boats and	Bass Fishing Motorised Boats RHIB (Rigid Hulled Inflatable Boat) Water-skiing Jet Ski Wind Surfing Kite Surfing Slalom Skiing Ski and Wakeboard Boat Sailing Junior Sailing School Parasailing	Jet Powered Boats Ski Jumping Paddle Ski Surf Ski House Boats Jet Ski Fishing	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Registered Safe for Water Vessel Valid Skipper's License First Aid Kit UPN date stamp UPN tag	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs
Zone B	Secondary Contact – Combination Zone	Shore Fishing Bass Fishing – no wake Slalom Canoe Fishing Canoe Wind Surfing – no wake Kite Surfing – no wake Ski and Wakeboard Boat – no wake Pedal Boat Sailing – no wake Fly Fishing Subsistence fishing	Birding Boat Tours Tube Fishing Pontoon Fishing Dragon Boats Jet Ski Fishing – no wake Kayaking Sprints Kayaking Marathons Kayaking Water Polo Kayaking Touring Kayaking Fishing Stand Up Paddling House Boats Smallscale fisheries Junior Angling School Pleasure boats	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Registered Safe for Water Vessel Valid Skipper's License First Aid Kit UPN date stamp UPN tag	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs

Zone Name	Contact Type	Permissible Activities - Current	Permissible Activities - Potential	Access Point	Safety Requirements for Users	Safety Requirements for DMC
Zone C	No Go Zone – Dam Wall infrastructure	DWA maintenance and management activities	None	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	N/A	AtoN and Demarcation Markers
Zone D	No Go Zone – Safety Buffer	None	None	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	N/A	AtoN and Demarcation Markers
Zone E	Secondary Contact - Mooring	Mooring of sailboats	Mooring of house boats	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Registered Safe for Water Vessel Valid Skipper's License First Aid Kit UPN date stamp UPN tag	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs

Zone Name	Contact Type	Permissible Activities - Current	Permissible Activities - Potential	Access Point	Safety Requirements for Users	Safety Requirements for DMC
Zone F	Primary Contact – Swimming and Water Toys	Swimming – recreational Water Toys	Swimming development school	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Swimming schools will require Safety assessment to ensure there are adequate teacher: student ratios, life jackets, safe conditions, shallow water etc.	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs
Zone G	Rowing Zone	Rowing - competitive and recreational		Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Registered Safe for Water Vessel Valid Skipper's License First Aid Kit UPN date stamp UPN tag Events will require approval from the DMC	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs

Table 16: Potential Surface Water Management Zones should the activity be deemed feasible

Zone Name	Contact Type	Permissible Activities - Current	Permissible Activities - Potential	Access Point	Safety Requirements for Users	Safety Requirements for DMC
Zone H	Secondary Contact – Commercial Fishing		Small-scale fisheries Commercial fisheries	Authorised access points (once agreements have been signed) Authorised landowners (once agreements have been signed) Jim Fouche Resort Government Farm	Agreements with DWS and provincial authority Registered Safe for Water Vessel Valid Skipper's License First Aid Kit UPN date stamp UPN tag	Servitude boundary to be determined Survey of all adjacent landowners and commercial enterprises Wash Bay to be put in place at all three towns Public access area at Vaal Marina Facilities at public access areas in Oranjeville and Deneysville AtoN and Demarcation Markers UPN System OPS Point Wash Bay Rescue Boat available at all times Wash Bay Officer Enforcement Officer System for checking UPN Tags for commercial enterprises and recreational clubs **Should commercial fisheries and/or small-scale fisheries be deemed feasible, the Zonal Map must be amended with the appropriate sized zone. The position of this zone must be discussed with other Dam users and approved by the DMC and DWS.**

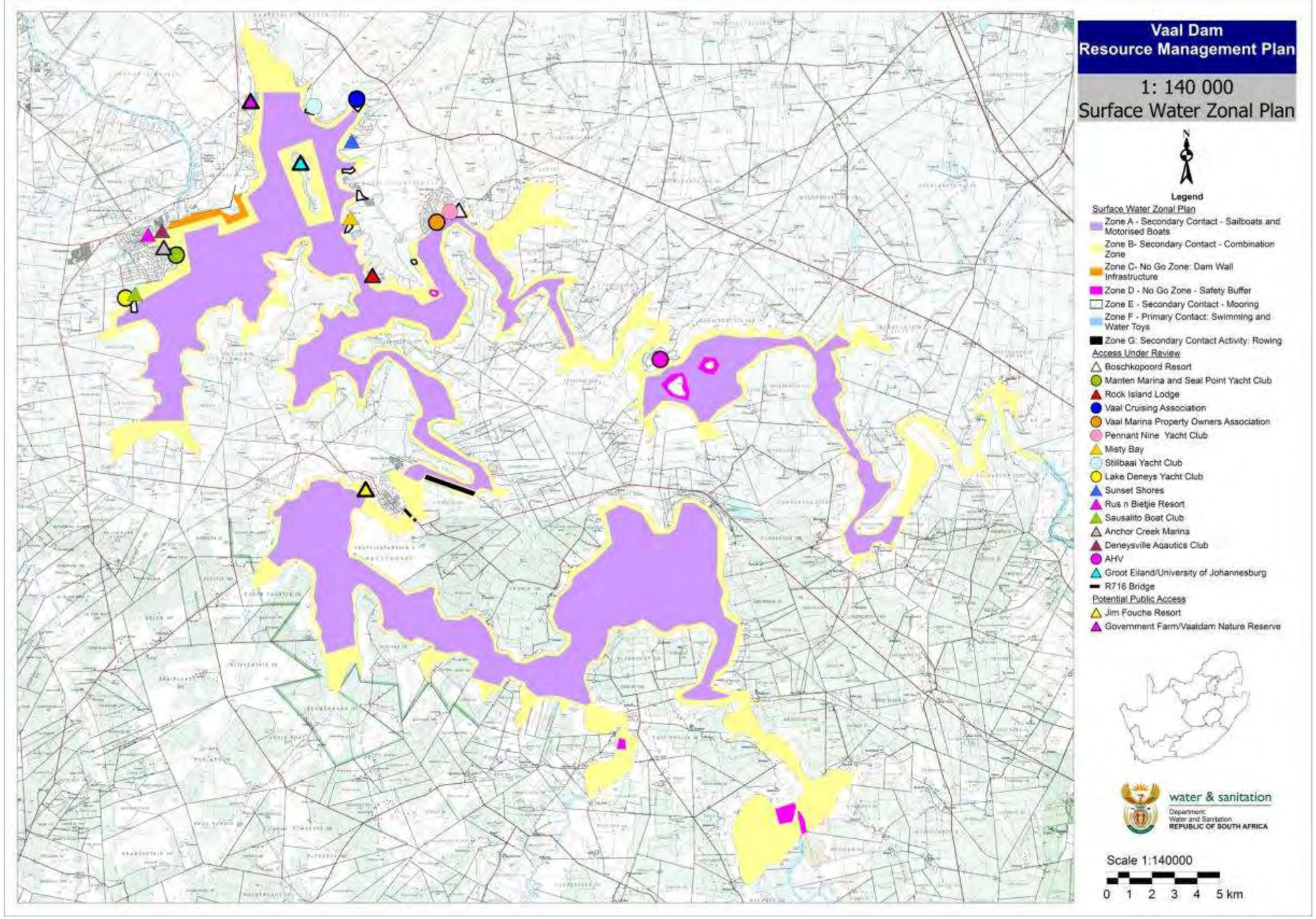

Figure 24: Map of the Water Surface Zonal Plan

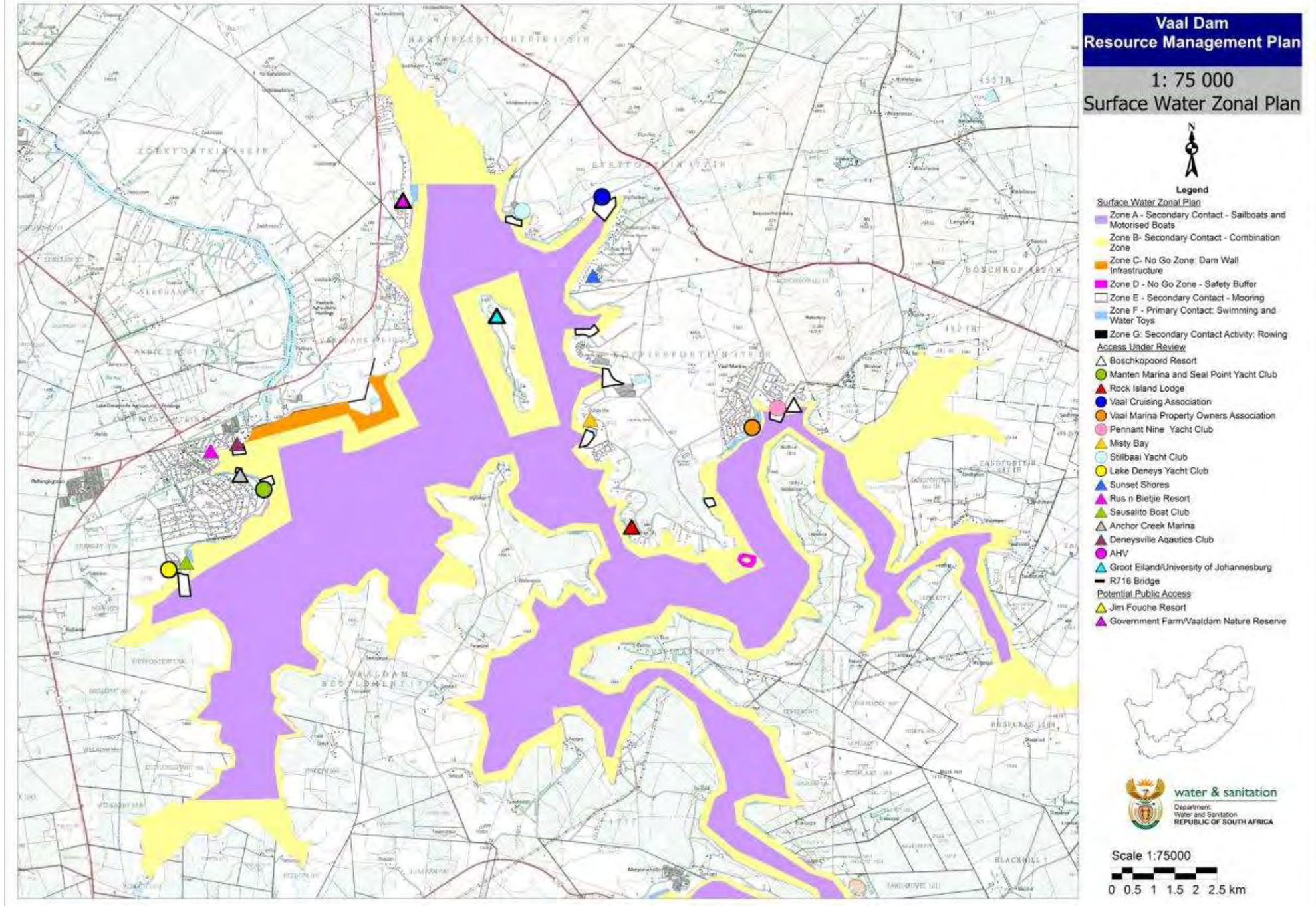

Figure 25: Map of the Water Surface Zonal Plan – Section 1

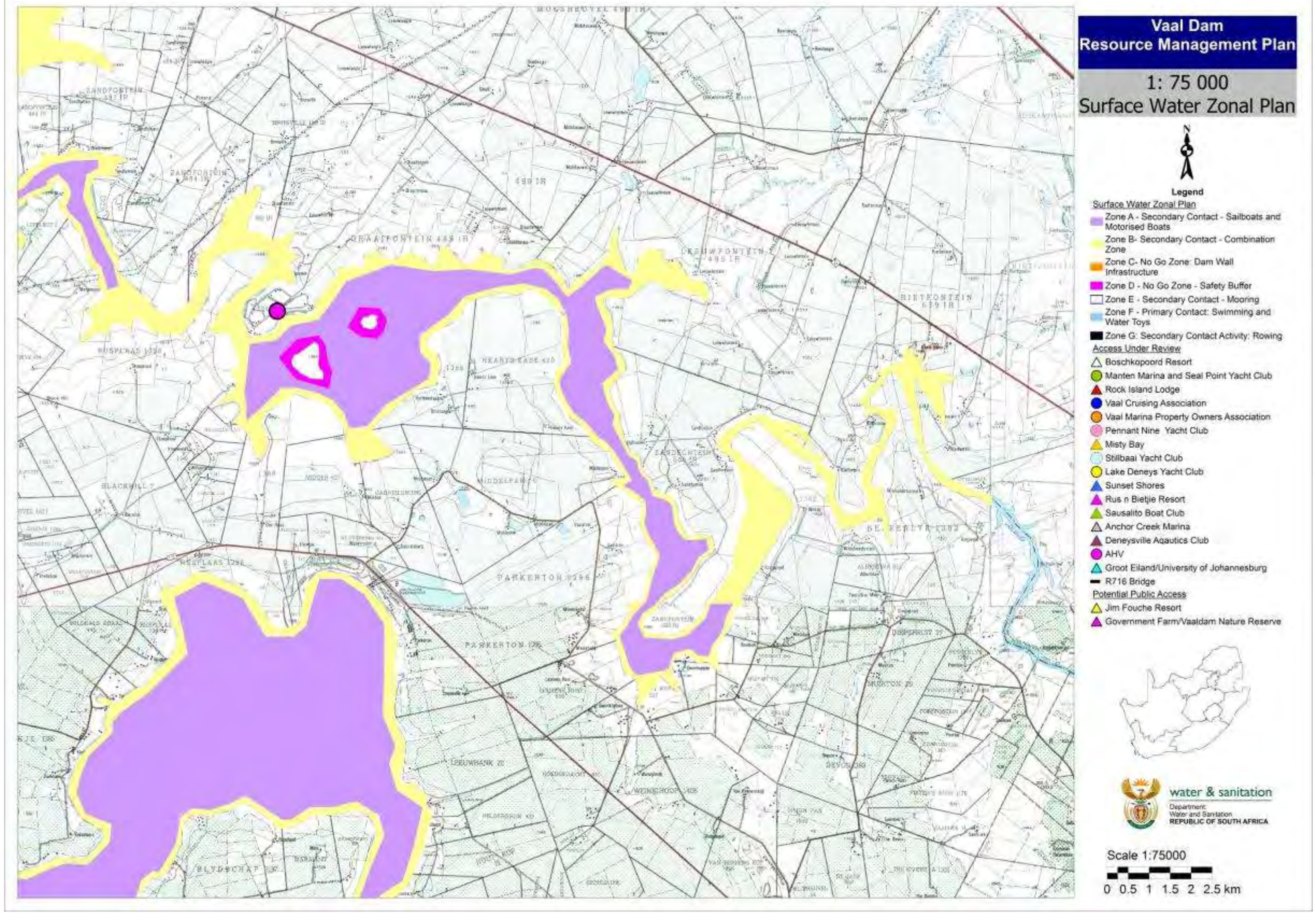

Figure 26: Map of the Water Surface Zonal Plan – Section 2

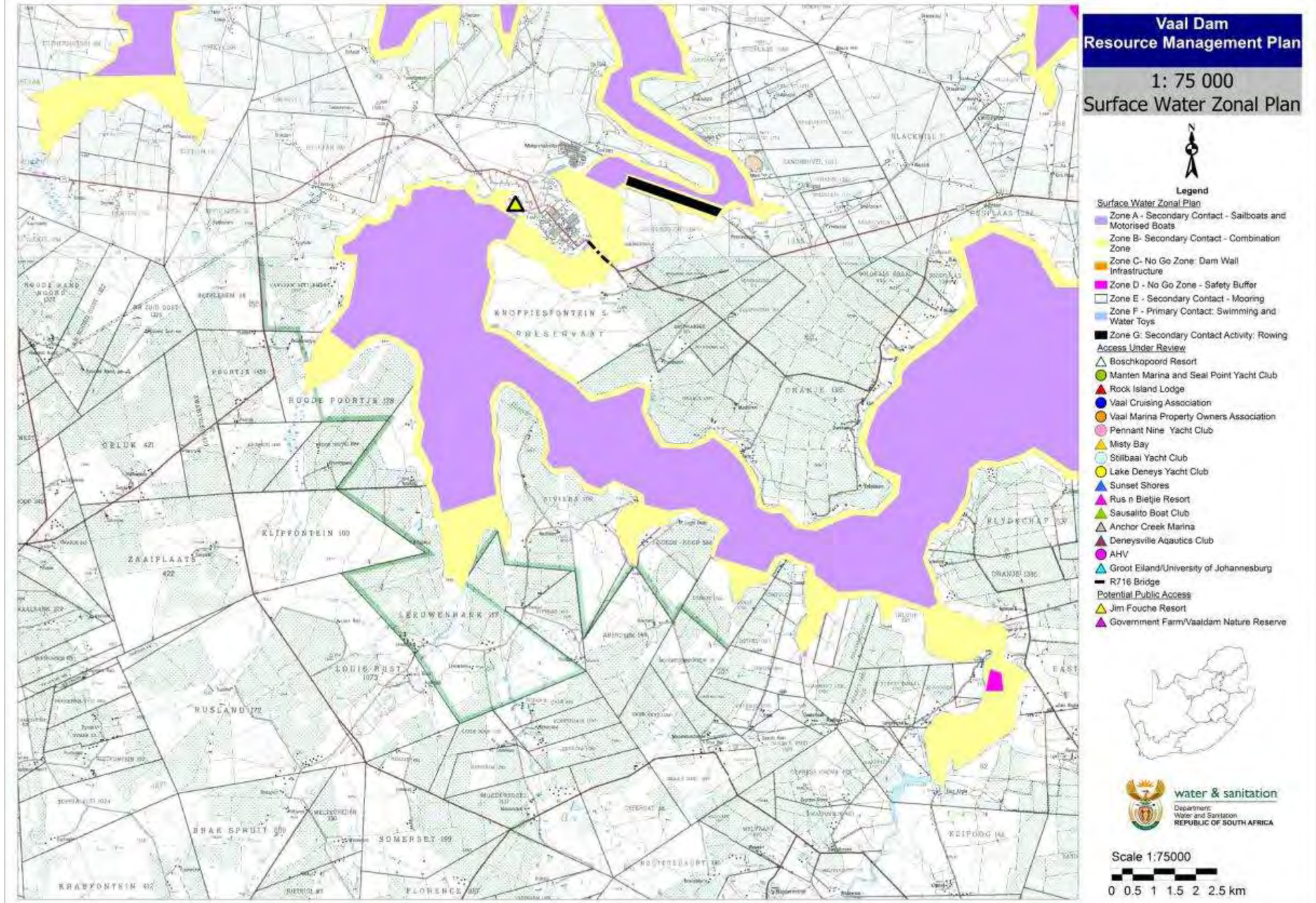

Figure 27: Map of the Water Surface Zonal Plan – Section 3

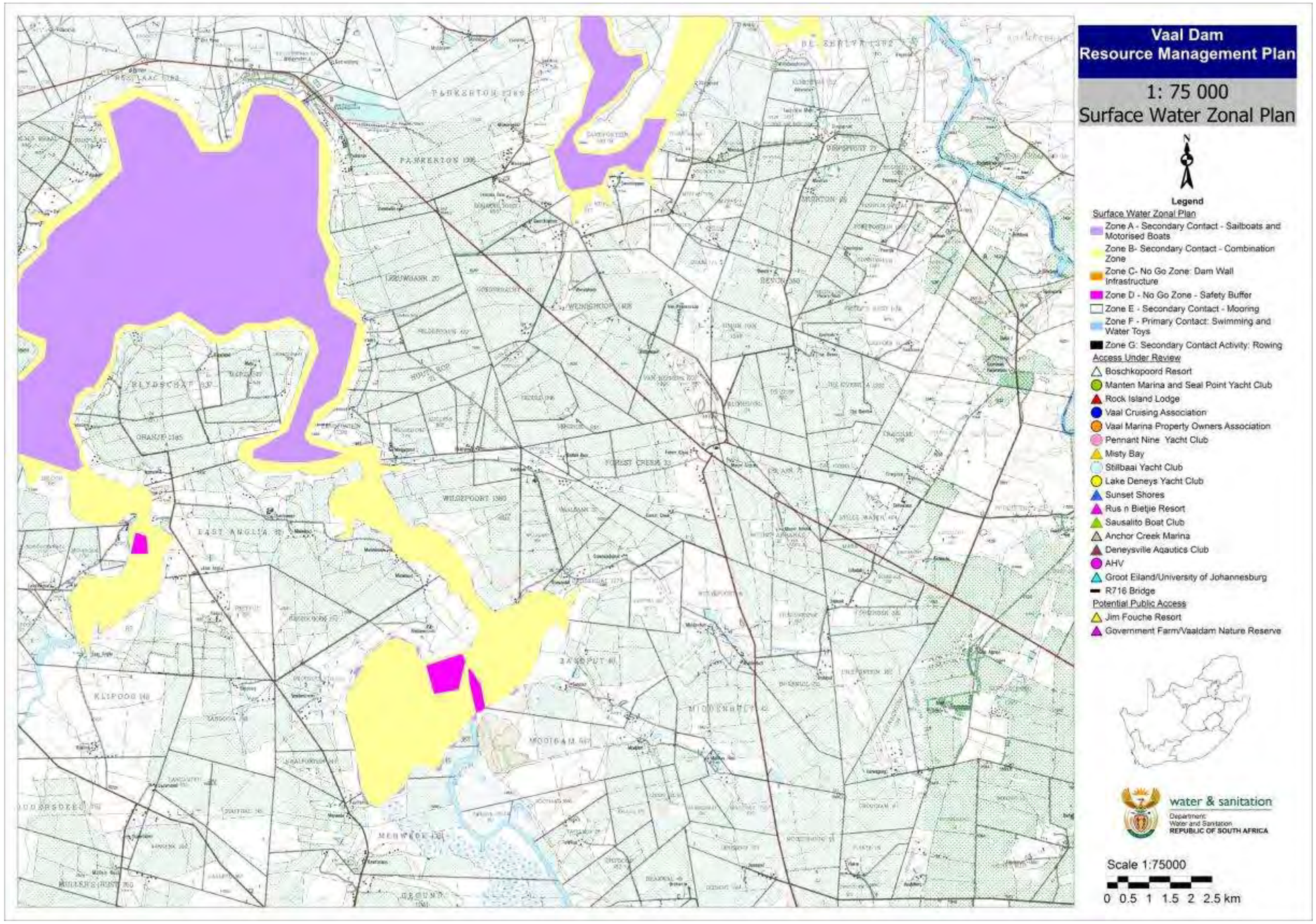

Figure 28: Map of the Water Surface Zonal Plan – Section 4

4.4.5 Shoreline Zonal Plan

In addition to the surface water Zonal Plan above, an integral part of the RMP is shoreline zoning. This provides guidance on what activities (if any) are allowed in the land adjacent to the Dam. In the case of Vaal Dam, DWS does not have a purchase boundary in place as the Dam occurs in a servitude of storage. However the exact extent of the servitude is not known and thus no shoreline zonal map could be produced. One of the critical actions included in the Strategic Plan and Business Plan is to determine the extent of the servitude and State owned land (as well as identification of adjacent landowners, commercial enterprises, recreational clubs and unauthorised activities such as abstraction points, slipways etc.). Once the servitude has been determined, a shoreline zonal plan should be produced and should consider the 2001 Zoning Plan as a baseline.

The following zones are suggested:

- Zone A – Management through Agreements - Conservation and Recreation/Tourism
- Zone B – Management through Agreements - Development and Recreation
- Zone C- Management only – No Access to the Public

Zone A:

It is suggested that the majority of the shoreline be zoned as Zone A. This would allow for DWS to enter into agreements with adjacent landowners to allow conservation and recreation/tourism activities in the servitude. This activities would be low impact in nature but would include allowances for access to the surface water should access agreements be put in place. This zone would also ensure that habitat around the Dam for birds and animals would be protected to a certain extent. Further, it is suggested that a Shoreline Management Plan should be compiled as part of the BP should be included as part of the agreements with landowners to ensure management of the servitude is holistic in nature. The areas around the inlets of the Wilge River, Klip River and other small inlets should also be zoned this way. In addition, the majority of Groot Eiland, the two smaller unnamed islands in the Vaal River Inlet, and Island in the Klip River and all koppie areas should be zoned as Conservation and Recreation.

Zone B:

It is suggested that 'hub' areas such as the three towns, current recreational clubs, marinas, estates etc. be zoned as Development and recreation. This zone allows for high intensity recreation and development for tourism purposes allowing for the potential development of the following:

- Public picnic areas;
- Accommodation;
- House Boats;
- Wash Bays;
- Recreational club areas; and
- Fishing and Sailing Development Schools.

A section of Groot Eiland should be zoned as Zone B to allow for potential PPPs for a high end hotel. The Jim Fouche Resort and Government Farm area should also be zoned in this way.

Zone C:

The area around the Dam wall which is owned and managed by DWS should be zoned as management only and provides for land management of state land but does not allow public use or access. Areas such as VRESAP etc. should also be zoned as such.

Permissible activities are detailed in the table below.

Table 17: Shoreline Management Zones

Zone Name	Zone Type	Permissible Activities	Requirements for Users	Requirements for DMC
Zone A	Zone A: Management through agreements - Conservation and low impact recreation	Conservation initiatives Management of firebreaks Management of litter Management of Invasive Plant Species Hiking Cycling Bird watching Shoreline fishing Shoreline fishing competitions Picnicking Access to the water for recreational use – should agreements be put in place	Birding, hiking, picnicking, shoreline fishing and access to the water must be done in accordance to access agreements Noise levels to be kept at a minimum. No littering at Picnic spots All users bringing boats to go through Wash Bay All activities to be formalised and agreements drafted before the expansion of existing facilities No private slipways to be built without approval from DWA. In addition Section 21 (c). and (i) Water Use License Application (WULAs) would be required	Survey of the servitude, adjacent landowners, commercial enterprises, unauthorised activities etc. to take place Zonal Map to be updated Agreements to be put in place with all adjacent landowners Proclamation status and extent of Vaaldam Nature Reserve to be determined Shoreline Management Plan to be compiled and included in all agreements Enforcement Officer to check all designated picnic spots Feasibility of employing local community members as part of "Working For Dams" programme to be assessed. Potential jobs include management of picnic sites/picking up of any litter DMC must ensure that all developments have been approved by DWS and DMC. Requirements of National Water Act and National Environmental Management Act must be taken into account All developments should have an approved Environmental Management Plan (EMP) to ensure construction does not impact on Dam UPN system to be put in place
Zone B	Management through Agreements - Recreation and Development	Development and Expansion of facilities/infrastructure for recreation Development of facilities/infrastructure for development/training Development of facilities/infrastructure for tourism Fishing Camping/Accommodation Birding Picnicking Access to surface water for recreational purposes	Camping, birding, hiking, picnicking, shoreline fishing and access to the water must be done in accordance to access agreements Camping allowed only in designated areas Noise levels to be kept at a minimum. No littering at Picnic spots All users bringing boats to go through Wash Bay All activities to be formalised and agreements drafted before the expansion of existing facilities No private slipways to be built without approval from DWA. In addition Section 21 (c). and (i) Water Use License Application (WULAs) would be required	Survey of the servitude, adjacent landowners, commercial enterprises, unauthorised activities etc. to take place Zonal Map to be updated Agreements to be put in place with all adjacent landowners Shoreline Management Plan to be compiled and included in all agreements Enforcement Officer to check all designated picnic spots Feasibility of employing local community members as part of "Working For Dams" programme to be assessed. Potential jobs include management of picnic sites/picking up of any litter DMC must ensure that all developments have been approved by DWS and DMC. Requirements of National Water Act and National Environmental Management Act must be taken into account All developments should have an approved Environmental Management Plan (EMP) to ensure construction does not impact on Dam UPN system to be put in place
Zone C	Management – No Public Access	Fire management Invasive alien species clearing Management of Dam Infrastructure Access to surface water for management purposes	N/A	N/A

4.5 Strategic Plan

The Strategic Plan is informed by the objectives determined during the Visioning exercise and through research on feasible opportunities for the Dam.

Objective category/major objective	What	Why	How	Who
Improved institutional arrangements, safety, control and communication	Formalised institutional structure	There is currently no formal institutional structure at the Dam which ensures proper communication between the various stakeholders	DWS to appoint members of the DMC, OMC and RSC as per the RMP	DWS
	Land matters to be resolved including survey of servitude, identification of all adjacent landowners and implementation of access agreements	The exact extent of the servitude, details of landowners and commercial enterprises are not know at this point. Without this information it is impossible to implement the necessary agreements	DWS to undertake survey of servitude, landowners and commercial enterprises DWS to compile Shoreline zonal plan in line with findings and the suggestions of the RMP Agreements with landowners to be put in place	DWS
	Unauthorised commercial activities to be resolved in line with National Treasury requirements	A number of commercial enterprises take place around the Dam. These need to be resolved in line with National Treasury Regulations	DWS to survey the Dam to identify all commercial enterprises around the Dam DWS to put in place agreements/PPPs in line with Treasury regulations to regulate commercial use	DWS
	Survey of illegal abstraction points around the Dam and all unauthorised use to be rectified	Illegal abstraction may take place around the Dam. This use must be identified and resolved	DWS to undertake a survey of the Dam and identify all abstraction points	DWS
	Survey of illegal structures (including jetties, slipways, ablution facilities, houses, marinas etc.) and all unauthorised structures to be undergo rectification process or be removed	There are a number of structures around the Dam including jetties, slipways, marinas, harbours, facilities etc. This needs to be formalised or removed	DWS to undertake a survey of the Dam and identify all structures	DWS
	DWS to facilitate discussions between the three provinces around the Dam regarding the potential for a partnership between surrounding provinces to coordinate economic development and urban renewal around the Dam	A number of tourism initiatives around the Dam are currently isolated as they occur in separate provinces. Coordination between the provinces is required to take advantage of the tourism potential of the area	DWS to facilitate discussions between GTA, MPTA and FSTA as well as FS DETEA, GDARD and MP DEDET so that the tourism initiatives around the Dam be looked at holistically	DWS FS DETEA GDARD MP DEDET MPTA GTA FSTA

Objective category/major objective	What	Why	How	Who
	Agreements with IAs, adjacent landowners, commercial enterprises and recreational clubs to be put in place. These agreements should include management of disposal of general waste and effluent so to ensure water quality is not impacted by recreational use.	Access , recreational use and commercial use needs to be regulated through agreements There is some concern that current recreational users dispose of sewerage directly into the Dam which negatively impacts water quality	DWS to meet with various stakeholders and put agreements In place Agreements to include management of general waste and effluent disposal	DWS Various stakeholders
	Update of the Vaal River Complex Regional Structure Plan to be undertaken	The Vaal River Complex Regional Structure Plan is responsible for ensuring development occurs in line with requirements. This needs to be updated to take into account the RMP	DWS and local municipalities to update the Plan	DWS MVLM MLM DLM
	Implementation of standardised Aids to Navigation and demarcation markers at the Dam	There is no standardised AtoN and demarcation markers system in place at the Dam	Implement AtoN and Demarcation markers as required. Agreements between SAMSA, DWS, and other relevant parties to be concluded	SAMSA DWS Relevant Parties
	Implementation of Wash Bays and Unique Positioning Number (UPN System) at the Dam. Information boards regarding the Wash Bays, safety information, education information etc. should be put in place at the wash bays	There is no overall safety system in place at the Dam. In addition a number of communities are located near the Dam and there is an opportunity to extend the emergency response of the UPN system to these communities	UPN system to be implemented	DWS CIWSP
Community beneficiation and equitable access and use of Vaal Dam	Potential for water troughs for watering of cattle	At Mamelo, a number of people have livestock but do not have access to the surface water for stock watering	DWS and DAFF to assess the feasibility of putting in place a stock watering trough	DWS DAFF
	The potential for community agriculture programmes with irrigation to be determined. These community programmes could provide food for tourism ventures and 'community farmers markets' in the area	During the focus group meeting at Mamelo, interest in community farming programmes was raised	DWS and DAFF to assess the feasibility of community agriculture projects	DWS DAFF
	The potential for a small-scale fisheries or subsistence fishing project for the local community to be determined. This would include training, provision of boats and nets etc. and would be implemented at all three towns around the Dam	The communities around the Dam would be interested in potential small-scale fisheries which would provide an income and also provide a source of protein	DWS and DAFF to assess the feasibility of a small-scale fishery. Should they be feasible, the zonal map should be updated.	DWS FS DETEA GDARD MPTA DAFF

Objective category/major objective	What	Why	How	Who
	A formalised public access picnic area (including facilities) should be put in place in Vaal Marina. This should be undertaken through discussions with the MVLM and the VMPOWA so that land can be sourced from current municipal land and/or public access servitudes which are in place but are not currently utilised	There is no formalised public access facility in Vaal Marina although some municipal land and/or access servitudes may be available for this purpose. Access to individuals is allowed at the VMPOWA however there is no community access card or subsidy programme in place and thus access to the community is relatively restricted.	DWS to meet with the VMPOWA and MVLM to discuss available land for public access and the potential for management of public access through the VMPOWA. Agreements to be put in place with VMPOWA or MVLM for the management of the formalised public access area. These agreements must take into account equitable access and the community access card (below) if feasible	DWS VMPOWA MVLM
	The feasibility of a community access card to be assessed	Access to individuals is allowed at the VMPOWA however there is no community access card or subsidy programme in place. In addition, community access cards will ensure that public access is ensured even if PPPS are put in place.	Feasibility of community access card to be assessed. Other mechanisms such as cross subsidies should also be assessed.	DWS
	Facilities at the public access areas in Deneysville and Oranjeville as well as new Vaal Marina access facility to be put in place	There are no facilities in place at the public access areas in Deneysille and Oranjeville and there is no public access area in Vaal Marina. Facilities are required in all these areas in order for equitable access to be improved	DWS to appoint landscape architect to design public areas DWS to appoint contractors to construct areas DWS to sign agreements with MLM and MVLM regarding management of the public area	DWS MVLM MLM
	Information brochures to be developed to inform communities about the potential uses of the Dam to encourage community use	The community is not always aware of the recreational opportunities at the Dam	The DMC to compile a brochure to inform people of potential use and encourage safe use	DWS DMC
Sustainable economic development and urban renewal	Urban renewal plan for Deneysville and Oranjeville to be developed and implemented	Vaal Dam has enormous tourism potential that is not being harnessed. The towns around the Dam could be improved to create the impression of a holiday towns	DWS to meet with Local Municipalities and provincial authorities to discuss potential renewal programmes	DWS MVLM MLM DLM FS DETEA GDARD Dept of Tourism

Objective category/major objective	What	Why	How	Who
	Integrated Tourism Plan including marketing, website creation and road signage to compiled and implemented.	Vaal Dam has enormous tourism potential that is not being harnessed. By developing a tourism plan which includes marketing strategies, improvement of roads and signage, development of a website for the Dam etc. it will be possible to improve tourism at the Dam.	DWS to appoint tourism specialist compile integrated tourism management plan	DWS MVLM MLM GTA FSTA GDARD FS DETEA Dept of Tourism
	The status of the current commercial fishery license to be determined and if necessary, a feasibility study to be undertaken to determine the potential for commercial fisheries at the Dam. This should include lessons learnt from the original commercial fisheries project at the Dam	During consultation it was noted that there was a commercial fisheries license was in place however the details were not available. There is also potential to put in place a commercial fishery should one not already be in place	DWS, DAFF and FS DETEA to determine status of current project If necessary, agreements to be put in place regarding current fishery. If not in place potential for fishery to be assessed	DWS DAFF FS DETEA
	The potential feasibility for a Public Private Partnership (PPP) for the management of the Jim Fouche Resort to be determined	The Jim Fouche is currently closed. It offers potential for accommodation at the Dam	DWS to meet with MLM regarding potential for appointing MLM as IA for the resort. MLM would be able to manage the resort through a PPP should they wish	DWS FS DETEA MLM FSTA
	Discussions with Gauteng province and MVLM to be undertaken and the potential for a PPP for the management of the Government Farm land (next to the Dam wall) to be determined. A section of this area should be retained as a public access area and facilities should be upgraded.	Government Farm has much potential and already has some tourism infrastructure in place. There has also been much interest in the Groot Eiland.	DWS to meet with GDARD and MVLM regarding potential for appointing MVLM as IA for the Government farm/Groot Eiland. MVLM would be able to manage these areas through a PPP should they wish	DWS GDARD MVLM GTA
	The potential for waterfront restaurants to be used by Sailing Community, visiting tourists and the local community to be assessed. This could be undertaken as part of a PPP (above).	Currently there are few waterfront restaurants around the Dam.	DWS to meet with GDARD and MVLM regarding potential for appointing MVLM as IA for the Government farm/Groot Eiland. MVLM would be able to manage these areas through a PPP should they wish. The PPP feasibility study should assess the potential for waterfront restaurants around the Dam.	DWS GDARD MVLM GTA

Objective category/major objective	What	Why	How	Who
	The potential for a number of small PPPs for the management of tourism activities such as house boats and floating restaurants to be determined	There are a number of potential smallscale PPPs which would improve the economic development of the area	DWS or IAs (depending on agreements) should determine the feasibility of additional activities to be run through PPP	DWS MVLM MLM GTA FSTA GDARD FS DETEA Dept of Tourism
	The potential for a large scale PPP for the creation and management of an upmarket hotel and restaurant on the island to be determined	Government Farm has much potential and already has some tourism infrastructure in place. There has also been much interest in the Groot Eiland.	DWS to meet with GDARD and MVLM regarding potential for appointing MVLM as IA for the Government farm/Groot Eiland. MVLM would be able to manage these areas through a PPP should they wish	DWS GDARD MVLM GTA
	The development of a Vaal Meander route around the Dam linked to a number of community craft markets, farmers markets etc.	Although there is already a Vaal Meander route in place, there is an opportunity for this to be updated and linked to additional activities at the Dam	DWS FSTA, GTA and local municipalities to meet with Vaal Meander organisers to discuss the route can be updated to include additional activities at the Dam	DWS MVLM MLM GTA FSTA GDARD FS DETEA Dept of Tourism
	Development SMMEs around the Dam linked to tourism	The economic potential of the Dam has not been fully realised. By developing SMMEs it creates opportunities for the communities around the Dam to create an income based on the Dam	DWS to meet with MVLM, MLM, FS DETEA, GDARD, FSTA and GTA to discuss potential for SMME development	DWS MVLM MLM GTA FSTA GDARD FS DETEA
Coordinated and improved management and protection of	The upgrade of the Deneysville, Vaal Marina, Oranjeville, Frankfort, Villiers and Standerton WWTWs to be undertaken	During consultation it was noted that the all the WWTWs around the Dam are currently operating above their design capacity. This has the potential to negatively impact water quality	The WWTWs should be upgraded	DWS MVLM MLM

Objective category/major objective	What	Why	How	Who
cultural heritage, biodiversity and water resources	A long terms trend analysis of water quality in the Vaal Dam to be undertaken. This analysis should be used as part of a risk assessment for all potential recreational uses and should be included the various feasibility assessments suggested;	There is potential for mining activities to result in poor water quality at the Dam. Further, recreational activities at the Dam itself may also negatively impact water quality. Therefore, a long terms trend analysis of water quality in the Vaal Dam is required to identify risks and ensure recreational use does not negatively impact water quality	Long terms trend analysis of water quality in the Vaal Dam to be undertaken. This information should be taken into account by feasibility assessments for recreational activities.	DWS Rand Water
	Avifauna Management Plan to be compiled and implemented. This should include current Birdlife count data and should determine best mechanisms for protection of bird biodiversity at the Dam;	According to ADU (2013) approximately 344 bird species have been noted at the Dam which shows the astonishing amount of bird diversity in the area. The Dam also is part of the Vaal Birding Route and is the focus of an annual bird count by Birdlife Vaal Dam. During consultation it was noted that bird hunting (especially of ducks) occurs on the Dam and from hotels etc. along the shoreline. This has safety implications for other uses of the Dam and may also decrease the bird diversity of the area.	DWS to meet with Birdlife Vaal Dam and provincial authorities to discuss the need for an Avifauna Management Plan. The plan should compiled and must include requirements for hunting of birds in line with provincial legislation. In addition, DWS must provide additional permission for hunting from the surface water or the servitude around the Dam to ensure safe use.	DWS FSTA MPTA GDARD Birdlife Vaal
	A study to understand/determine the cultural significance of the area around the Dam to be undertaken	During consultation it was noted that the area around the Dam has important cultural significance however no studies have been undertaken to understand this	A study to determine the cultural significance to be undertaken	DWS
	Working for Water to remove all alien plant species and replace with adequate indigenous plants. The wood from the removal trees should be provided to the community for firewood and should not be left in place.	A number of invasive species occur around the Dam and should be removed. In order to ensure there is enough habitat for bird species, it is suggested that these species are replaced by indigenous species. There is also not adequate removal of cut material which facilitates regrowth of alien plants.	DWS to meet with Working for Water to facilitate the programme around the Dam	DWS Working for Water
	Paleontological and archaeological heritage resources study to be undertaken	A number of archaeological and paleontological resources are known to occur in the area	Paleontological and archaeological heritage resources study to be undertaken	DWS SAHRA

Objective category/major objective	What	Why	How	Who
	The status and extent of the Vaaldam Nature Reserve to be determined	The extent of Vaaldam Nature Reserve and the status of the reserve appear unclear	GDARD and DEA to determine extent of Reserve boundary	GDARD DEA DWS
	The potential feasibility of creating an urban conservancy around the Deneysville area of the Dam including the koppie and the islands to be determined. As part of this, small day hikes could be put in place (including labelling plant and tree species in the area etc).	According to some records an urban conservancy is in place at Deneysville however the exact status is not known. If not in place, the potential for creating an urban conservancy to be determined	MVLM and FS DETEA to determine the status of the urban conservancy and if not in place, determine the potential for creating one	FS DETEA MVLM
	The feasibility of creating a biodiversity and cultural centre in Deneysville to be determined	There is natural and cultural resources on the koppie outside Deneysville and this offers an opportunity to create a centre which could be linked to the urban conservancy	FS DETEA, MVLM, DEA and SAHRA to determine the feasibility of creating a centre for education which could be linked to the urban conservancy	FS DETEA MVLM DEA SAHRA DWS
	Implementation of a wash bay to prevent Invasive Aquatic Plants	A number of aquatic invasive species occur around the Dam and a Wash Bay is required to prevent future infestation	DWS to identify 3 locations for wash bays in the 3 main towns Wash bay to be constructed DEA to provide herbicide, training and staff	DWS DEA CIWSP DMC
	Survey of the Dam to identify any Invasive Aquatic Plants and if necessary control and management of Invasive Aquatic Plants	A number of aquatic invasive species occur around the Dam and may already have infested the Dam. A survey to determine the extent is required	DEA to survey the Dam to determine the extent of any infestation DEA to control infestation through mechanical or chemical control as required	DWS DEA
	Pollution point study to be undertaken to identify main sources of pollution at the Dam	Water quality is a potential threat as although currently the LHWP dilutes pollution, it is necessary to identify pollution sources and mitigate negative impacts	A water quality specialist should be appointed to undertake pollution study Based on the results, the DMC should meet with polluters and discuss measures to improve water quality	DWS DMC CISWP
	Water quality monitoring to be linked to the UPN System to allow quick response	There is an opportunity for water quality monitoring to be linked to the UPN system to ensure quick response to incidents	DWS to meet with CIWSP to determine the potential for linking to the UPN system	DWS

Objective category/major objective	What	Why	How	Who
	Shoreline management plan to be compiled and implemented in conjunction with adjacent landowners	There is no formal management of the shoreline of Vaal Dam taking into account all stakeholders. Issues such as erosion, invasive species, fire management etc. need to be addressed.	Shoreline management plan to be compiled	DWS DAFF FS DETEA GDARD MP DEDEAT DEA
	Education programmes regarding the impacts of alien invasive species to be instituted	There are a number of alien invasive terrestrial and aquatic plant species in the QDS around the Dam. There are also a number of alien fish species at the Dam. An education programme regarding the impacts of these species should be compiled so to ensure better containment and management	Working for Water should compile information brochures regarding the invasive species at the Dam These should be made available at the Wash Bay Information boards with the information should be put in place at the Wash bay	DEA GDARD FS DETEA DMC
Improved access and services	The feasibility for the completion of the Oranjeville bridge to be undertaken	During consultation it was noted that the upgrade of the Oranjeville bridge had previously started but was never finished. It was also noted that the old bridge may also strain the storage capacity of the Dam as the water level has to be kept below a certain level	The need and desirability of upgrading the old bridge should be assessed in terms of water storage capacity and need for the bridge	DWS Dept of Transport MLM
	Upgrades of roads and road signs to improve access to be undertaken	The roads linking the towns around the Dam are not well maintained	DWS to meet with Local municipalities to determine potential for upgrading roads and improving road signs	DWS MVLM MLM DLM
Community skills development, education and training	Lifeguard skills training and first aid training to ensure safe public use of the Dam	There is high level of unemployment in the area. Skills training will provide community members with skills and will improve safety at the Dam.	Feasibility of a "Working for Dams' Project including funding for skills training and job creation to be determined Local community members to be trained	DWS DMC
	Coordination with local municipalities, National Sea Rescue Institute (NSRI), Waterwise and SwimSA to create community swimming schools at the Dam to improve swimming skills in the short term at the Dam. Detailed safety assessments must be undertaken and only small class sizes are allowed due to the dark water and potential difficult water conditions at the Dam	Community swimming schools are needed to ensure that children in the community are able to swim. Due to the dark water at the Dam, detailed safety assessments must be undertaken as part of this	DWS to meet with NSRI, Waterwise and SwimSA to discuss potential community swimming schools at the Dam Based on these discussions, detailed safety requirements for swimming schools must be determined so to ensure safety of children in the swimming school	DMC Waterwise NSRI SwimSA

Objective category/major objective	What	Why	How	Who
	Discussions between DWS and NSRI and Waterwise to take place to determine the feasibility of rolling out community swimming safety measures at public areas. Examples of these safety measures include affordable life rings etc.	Waterwise has been developing low cost life rings. Making these available at public access areas may improve safety in the area.	DWS to meet with NSRI and Waterwise to discuss roll out of community swimming safety measures as the Dam does have dangerous swimming conditions and drownings periodically take place.	DMC Waterwise NSRI
	In the medium term, coordination with local municipalities, and SwimSA to create public swimming pools at the three towns around the Dam and to introduce swimming development schools	The Dam is very dark which makes swimming schools dangerous although they are possible with the correct safety measures in place It is suggested that community swimming pools be created for swimming schools in the future	DWS to meet with MVLM and MLM to discuss potential community swimming pools DWS to meet with SwimSA to discuss potential swimming schools	DMC MVLM MLM SwimSA
	Access agreements with clubs to include development requirements	There do not appear to be any formal development programmes run by the recreational clubs around the Dam	DWS to meet with all recreational clubs and ensure all new agreements have development requirements	DWS Recreational clubs

5 WAY FORWARD

5.1 Compilation of Business Plans

Based on the strategic objectives identified for Vaal Dam, a suite of BPs were developed. The BP describes the financial management and operational requirements to implement the Objectives of the RMP. The Financial Plan will facilitate the implementation of listed and recommended activities in the RMP.

The Business Plans are approached in the following manner:

- Identify Strategic Objective – informed by RMP;
- Determine Interventions – Each objective was divided into practical interventions;
- List Detailed Activities – Interventions were further divided into activities, in order to establish timeframes and provide guidance to the entity who implements the business plan;
- Establish Key Performance Indicators per intervention – Key Performance Indicators allow for monitoring and evaluation;
- Establish timeframes per activity;
- Establish a budget per activity; and
- Determine Funding sources – Innovative mechanisms to obtain funding were identified.

5.2 Review of RMPs and Business Plans

The RMP presents a twenty-year vision for the Dam. This vision will be implemented through the RMP which will be revised and updated every five years, according to changing priorities, constraints and achievements. Within a five-year cycle of the RMP, the BPs will identify key objectives in line with a changing status quo and potential change in circumstances. After five years the RMP will be reviewed and updated so to identify new objectives in line with the vision for the Dam.

The BPs are updated annually.

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