Department of Water and Sanitation

NATIONAL WATER RESOURCE INFRASTRUCTURE (NWRI)

Resource Management Plan
STERKFONTEIN DAM

REPORT – Volume 4 of 5 | **August 2017**




WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

2030 NDP

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- Department of Water and Sanitation;
- Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs;
- Maloti Drakensburg Transfonteir;
- Maluti a Phofung Local Municipality;
- North West University;
- Thabo Mufutsanyana District Municipality; and
- The community members of ward 6.

Acknowledgement is also extended to other Stakeholders, not listed above, who attended and participated in the Stakeholder engagements.

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Review:

Review Period	Month	Year				
Annual Review of Business Plan	December	2019[1]	2020	2021	2022	2023
Five (5) Year Review of RMP	December	2023				

[1] The implementation of the RMP and BP requires a year budget planning prior to operationalisation.

AMENDMENTS PAGE

Revision No	Description	Date
1	Draft RMP for DWS Review	27/01/2017
2	Draft RMP for DWS Review	22/02/2017
3	Draft RMP for Public Review	23/02/2017
4	Final Draft RMP for DWS Review	19/06/2017
5	Final Draft RMP for Public Review	05/07/2017
6	Final RMP for DWS Approval	25/07/2017
7	Final RMP for DWS Sign off	16/08/2017

LIST OF ACRONYMS

ADU	Animal Demography Unit
AGIS	Agriculture Geo-Referenced Information System
AToN	Aid(s) to Navigation
BID	Background Information Document
BP	Business Plan
CARA	Conservation of Agricultural Resources Act
CATHSSETA	Culture, Arts, Tourism, Hospitality, Sports Sector, Education and Training Authority
CD: IO MANCO	Chief Director: Infrastructure Operations Management Committee
CIWSP	Cooperative Inland Waterways Safety Programme
CMC	Co-Management Committee
CoGTA	Department of Cooperative Governance and Traditional Affairs
CPA	Communal Property Association
CPSI	Centre for Public Service Innovation
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DESTEA	Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs
DHS	Department of Human Settlement
DLA	Department of Land Affairs
DMC	Dam Management Committee
DoT	Department of Transport
DPW	Department of Public Works
DRDLR	Department of Rural Development and Land Reform
DSR	Department of Sports and Recreation
DT	Department of Tourism
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ECA	Environment Conservation Act
ECC	Effective Carrying Capacity
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
FSDARD	Frees State Department of Agriculture and Rural Development
FSL	Full Supply Level
GIAMA	Government Immovable Asset Management Act
GP	Guideline Programme
GPS	Global Positioning System
GVD	Gross Value Added
GWWs	Government Water Works
I& APs	Interested and Affected Parties
IA	Implementing Agency
IBA	Important Bird Area
IDP	Integrated Development Plan
IEE	Integrated Environmental Engineering

IRMP	Integrated Resource Management Plan
IUCN	International Union for Conservation of Nature
KNP	Kruger National Park
KPAs	Key Performance Area
LED	Local Economic Development
MAPLM	Maluti a Phofung Local Municipality
MDTP	Maloti Drakensburg Transfonteir Programme
MOA	Memorandum of Agreement
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity act
NGOs	Non-Governmental Organizations
NPSC	National Project Steering Committee
NWA	National Water Act
NWRI	National Water Resource Infrastructure
NWU	North-West University
OMC	Operations Management Committee
PCC	Physical Carrying Capacity
PFMA	Public Finance Management Act
PP	Public Participation
PPP	Public Private Partnership
PSP	Professional Services Provider
QDS	Quarter Degree Square
RCC	Real Carrying Capacity
RDP	Reconstruction Development Programme
RMP	Resource Management Plan
RW	Rand Water
SAMSA	South African Maritime Safety Authority
SANBI	South African National Biodiversity Institute
SAPS	South African Police Services
SASCOC	South African Sports Confederation and Olympic Committee
SDF	Spatial Development Framework
SFDNR	Sterkfontein Dam Nature Reserve
SRSA	Sports and Recreation of South Africa
SWOT	Strengths, Weaknesses, Threats, Opportunities
TDA	Tourism Development Area
TMDM	Thabo Mofutsanyana District Municipality
TWQR	Target Water Quality Range
WfF	Working for Fire
WfW	Working for Water
WfW	Working for Wetlands
WRC	Water Research Commission
WUL	Water Use Licence

EXECUTIVE SUMMARY

Mandate: The Department of Water and Sanitation (DWS), through the National Water Act, 1998 (Act No. 36 of 1998), is mandated to protect aquatic and associated ecosystems and their biological diversity. The Minister of Water and Sanitation, as the custodian of the nation's water resources must ensure that the Government Waterworks (GWWs), including Sterkfontein Dam, are protected, used, developed, managed and controlled in a sustainable manner, for the benefit of all. To assist the Minister in attaining the mandate, and to ensure that access to, and use of, the dam is equitable, the DWS initiated and commissioned the development of the Resource Management Plan (RMP) for Sterkfontein Dam.

Purpose of the RMP: The RMP is a plan which aims to regulate access and the recreational utilisation of a water resource and the surrounding state land in ways which promote community participation and beneficiation, environmental conservation and to unlock socio-economic potential of the water resource.

According to DWAF (2006), the use and management of the GWWs for recreation purpose needs to be based on Integrated Resource Management Plan (IRMP) included within the RMP.

Location of the Dam: Sterkfontein Dam is an Earthfill Embankment type of a dam which impounds the Nuwejaarspruit River. It falls under ward Ward 6 of Maluti a Phofung Local Municipality (MPLM), which form part of the Thabo Mofutsanyane District Municipality (TMDM) in the Free State Province, South Africa. Its GPS coordinates are: **28°26'54.24"S; 29° 1'22.08"E.**

Purpose of the dam: The primary purpose of the dam is to provide raw water for industrial and domestic use.

The dam also currently offers a variety of recreational activities such as windsurfing, fly-fishing and birding. The accommodation in the reserve includes self-catering chalets, guest houses (Qwantani and Wild Horses) and camping facilities.

Dam ownership and management: The dam is owned by DWS. The Management Authority responsible for the Sterkfontein Dam Nature Reserve (SFDNR) is the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA). The DESTEA is responsible for the conservation of the aquatic and terrestrial biodiversity as well as the recreational use of the dam. DWS manage the dam levels (inflow and outflow) and water quality.

Stakeholder engagements: The success of the development and implementation of the RMP depends on the role players and their level of participation. It is thus recognized that different roles and responsibilities of the stakeholders [Authorities and Interested and Affected Parties (I&APs)], their relationship towards each other and the steps in the planning procedure are imperative in the successful development of the RMP. As such, proper consultation with the public was done in order to help in producing a credible RMP.

DWAF's Guidelines for Public Participation (2001) outlines three (3) broad phases for public participation namely the **Planning, Participation** and **Exit phase**.

During the **Planning phase** a site inspection was conducted and literature reviewed in order to gather baseline information about the dam. A process was also established to get into contact

with the I&APs and relevant authorities to ensure co-operative interests and support in the RMP project.

The **Participation phase** entailed three (3) important aspects, namely:

- Informing stakeholders about the RMP project;
- Meeting the stakeholders to present the RMP process; and
- Giving Feedback in the form of meeting minutes, follow-up emails, telephonic and direct communication.

During the **Exit phase**, a draft RMP was presented to the stakeholders for comment and inputs. The Exit phase entailed two (2) important aspects, namely:

- Ensuring that all goals, challenges, concerns, objectives and the vision of the dam are identified and documented in the RMP; and
- Officially ending the public participation process.

Identified objectives and vision: During the Authority and Public Meetings issues of concerns were raised from which common objectives were identified and a vision for the dam for a period of 20 years was formulated by the stakeholders.

The identified objectives are:

- To maintain a good water quality at the dam in order to conserve the immaculate resource for recreational use as well as to ensure a healthy environment;
- To eradicate alien invasive plant species and ensure non-infestation in the dam and surrounding environment;
- To eradicate and monitor the alien fish population within the dam;
- To provide the local communities with an easily accessible entrance to the dam;
- To stabilize the security system in order to reduce fish poaching;
- To provide the local communities with an opportunity for subsistence fishing;
- To establish potential developments on the dam's surrounding environment like resort, golf course, function centres & entertainment centres;
- To educate the local communities about the importance of biodiversity, environment and water conservation;
- To equip community members with the necessary skills and expertise for the eco-tourism industry;
- To unlock the socio-economic potential of the dam by creating employment and entrepreneurship opportunities; and
- To improve the dam's tourism marketing strategy as it is not well known amongst local community members.

A vision for the dam for a period of 20 years was formulated by Stakeholders to be as follows:

"Conserving and promoting the biodiversity, aesthetic and cultural heritage while uplifting the socio-economy in a manner that enables sustainable benefit for all generations".

The aforementioned objectives and vision are aimed at supporting the attainment of DWS's vision, mission and objectives.

Tourism Potential: The following were identified as some of the potential recreational developments at the Sterkfontein Dam that could enhance tourist attraction:

- Development of swimming pools and picnic areas at the dam; and
- Development of golf course, sports & entertainment centre.
- Development of animal exhibition centre to expand the knowledge of the learners, particularly those who are not familiar with animals.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF STERKFONTEIN DAM

The Sterkfontein Dam is situated outside Harrismith in the Free State Province (See **Figure 1:** Locality Map). It is situated within Ward 6 of Maluti a Phofung Local Municipality (MPLM), which form part of the Thabo Mofutsanyane District Municipality (TMDM) at coordinates: **28°26'54.24"S; 29° 1'22.08"E**. The Sterkfontein Dam was commissioned in 1977 and subsequently raised in 1980. DWS owns and manages the dam levels (inflow and outflow) and water quality of the dam. DESTEA is responsible for the conservation of the aquatic and terrestrial biodiversity as well as the recreational use of the dam.

The Sterkfontein Dam impounds Nuwejaarspruit River. The primary purpose of the dam is for industrial use, where it provide raw water to Eskom for hydro-electrical production and also supply raw water to Rand Water (RW) for domestic use.

The dam also currently offers a variety of recreational activities such as windsurfing, fly-fishing and birding. The accommodation in the reserve includes self-catering chalets, guest houses (Qwantani and Wild Horses) and camping facilities.

Table 1 shows a summarised profile of the dam.

Table 1: Sterkfontein Dam Profile (DWS, 2015)

Sterkfontein Dam Profile	
Location	South Africa
Province	Free State
District Municipality	Thabo Mofutsanyana District Municipality
Local Municipality	Maluti a Phofung Local Municipality
Nearest Town	Harrismith
Completion Year	1977
Dam Raise Completion Year	1980
Co-ordinates	28°26’54.24"S 29° 1'22.08"E
Purpose	Industrial and domestic
Owners	Department of Water and Sanitation
Water Management Area	Tugela Catchment
Catchment area (km^2)	3 723
River	Nuwejaarspruit River
Capacity (m^3)	2 656
Surface Area (ha)	6 937.0
Wall type	Earthfill Embankment
Wall Height (m)	93
Length (m)	3 060

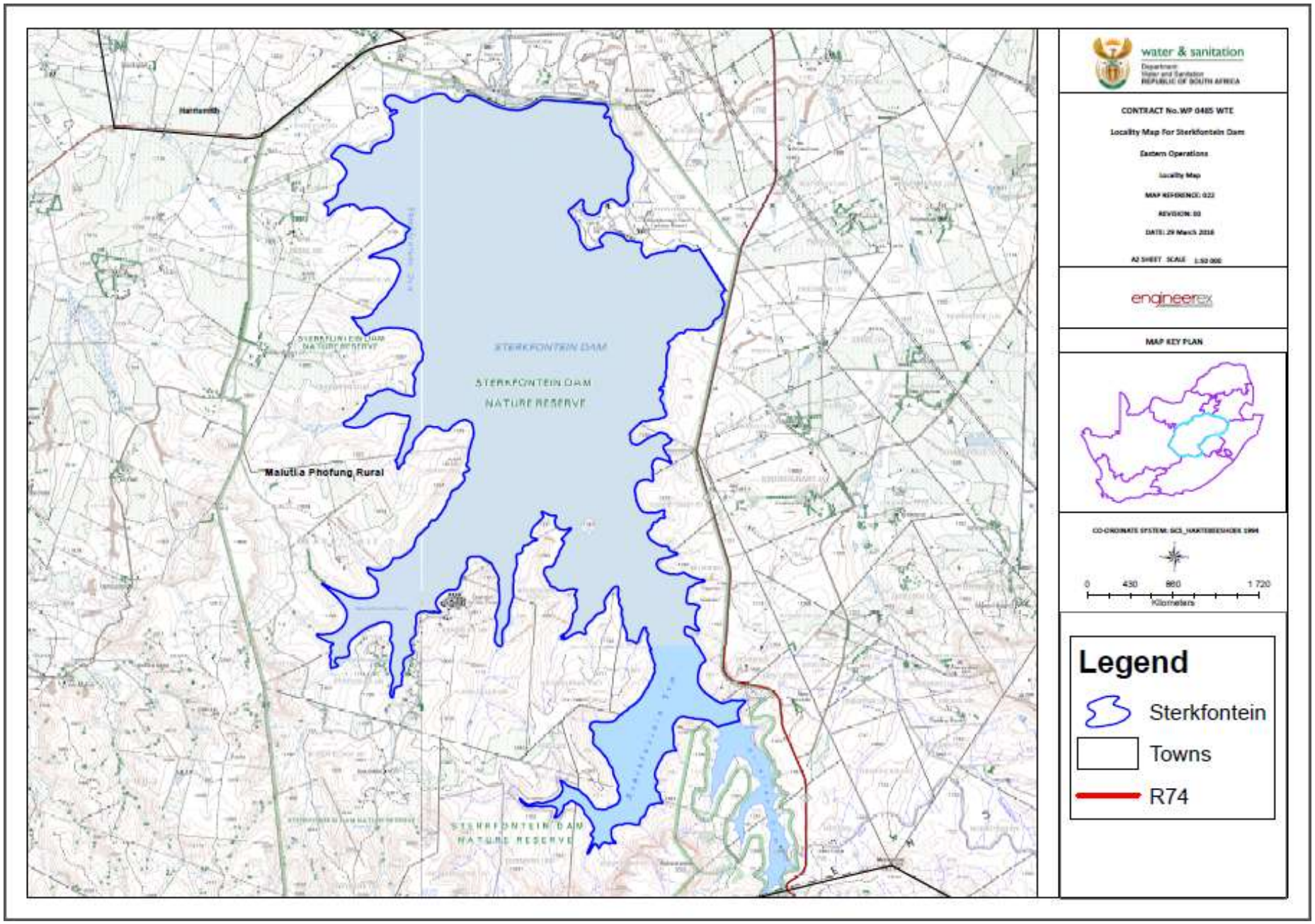

Figure 1: Locality Map for Sterkfontein Dam

1.2 BIO-PHSICAL ENVIRONMENT

1.2.1 Climate

The Sterkfontein Dam is situated in an area which receives lowest in July, with an average of 8 mm, and most rainfall is received in January, with an average of 115 mm. January is the hottest month of the year at an average temperature of 19.2°C. In June, the average temperature is 6.9°C, which is the lowest average temperature of the whole year (Climate Data. ORG, 2016). (Refer to **Figure 2** for the average temperatures and rainfall patterns of the area for the year 2016).

According to Heard (2007), weather in the area change rapidly at times and is mainly influenced by high and low pressure systems with cold fronts moving in from the south. The dominant weather in the area will limit certain recreational activities (i.e. Kayak fishing) from taking place. Therefore care should be taken when using boats as Sterkfontein is notorious for stormy conditions with high winds and surprisingly big waves which often develop within a very short period of time.

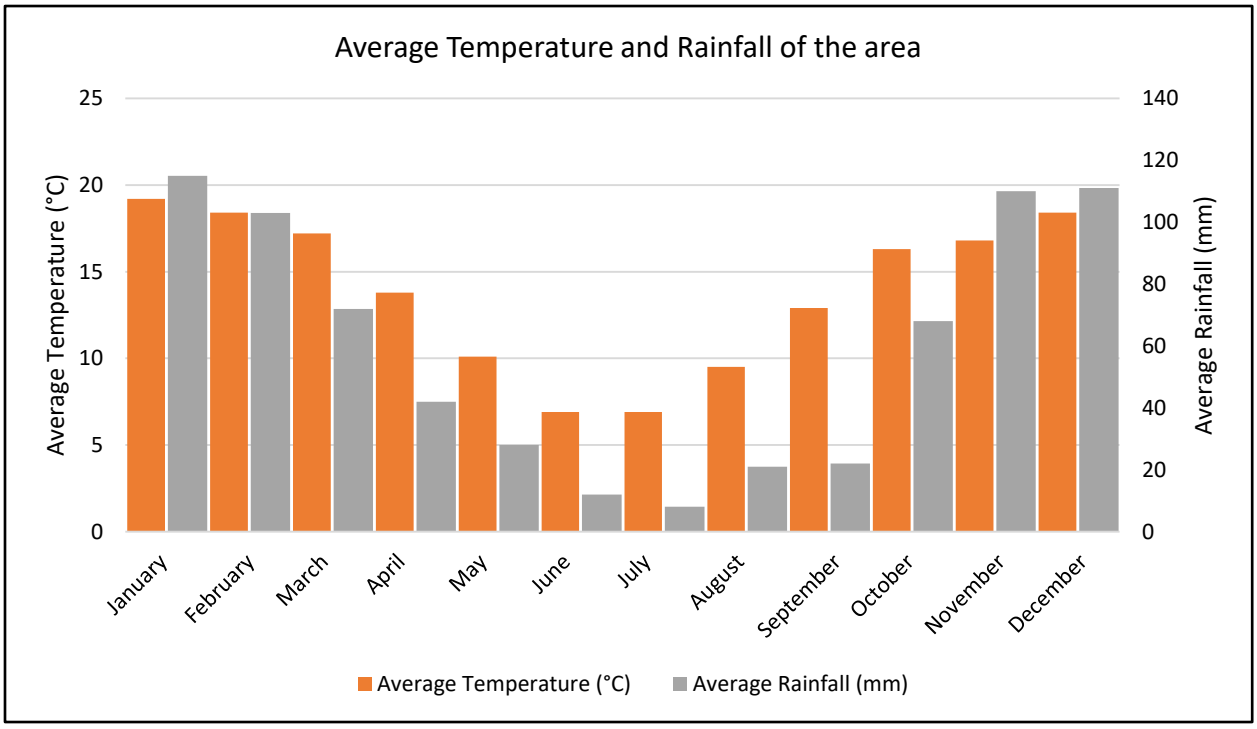

Figure 2: Average Temperature and Rainfall of the area (Climate Data. ORG, 2016).

1.2.2 Flora

The Sterkfontein Dam area is dominated by five (5) grassland vegetation types: Eastern Free State Sandy Grassland (listed as an Endangered ecosystem, it is poorly protected with only 55.3% of its total extent intact); Northern Drakensberg Highland Grassland (classified as Least Threatened, with more than 90% of its total extent remaining); Lesotho Highland Basalt Grassland (classified as Least Threatened, with more than 90% of its total extent remaining); Low Escarpment Moist Grassland (with 94.2% of its total extent remaining); and the recently added Northern KwaZulu-Natal Moist Grassland (with wooded kloofs), which is listed as Vulnerable and has 73.7% of its total extent remaining. The wetlands in the area are classified as Mesic Highveld Grassland Group 1_Channelled valley-bottom wetland, Mesic Highveld Grassland Group 1_Seep and the Nuwejaarspruit (Barnes, 2014).

These grasslands are mainly characterized by the tropical (C4) grasses, Red Grass (Themeda triandra) and Hairy Trident Grass (Tristachya leucothrix), with Toothbrush Grass (Rendlia altera), and the temperate (C3) grass, Tussock Grass (Festuca costata) limited to the higher elevations (> 1800 m above sea level). Within this grassland matrix, wetland communities (dominated by sedges and grasses) occur in depressions and along hill slopes and valley bottoms, mostly in the south of the reserve (Barnes, 2014).

Heard (2007) further emphasized that the distribution of woody communities appears to be determined primarily by fire, and secondarily by available moisture and geology. The Lip-flower Protea (*Protea subvestita*) populations are closely associated with *Erica*-dominated fynbos communities, which are limited to fire refugia on the Clarens sandstone outcrops in the west. Similarly, broad leaf woodlands [characterized by *Calpurnia* spp. (African Laburnum Trees) and Wild Currant Trees (*Rhus dentata)]* are restricted to cliff faces that form natural fire refugia. Oldwood/ Ouhout *(Leucosidea sericea*) scrub occurs along the drainage lines in the south, with localized patches also occurring within the grassland matrix. Although not extensive, Afromontane forest patches [characterized by Real Yellowwood Trees {*Podocarpus latifolius*}] are found in kloofs and gorges in the south.

1.2.2.1 **Alien Invasive Plant Species**

Alien invasive plant species are non-indigenous plants introduced from other countries. Once they were introduced, they tend to spread beyond the area where they are desired. Alien plants declared weeds and invader plants under section 29 of Conservation of Agricultural Resources Act, 1983(Act No. 43 1983) are a serious threat to the ecological functioning of natural systems as well as water production and must be controlled in terms of the relevant CARA regulations.

Alien invasive species have been categorized in the following categories: National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), Alien and Invasive Species Regulations, 2014:

- **Category 1a:** Invader plants species which must be combatted or eradicated.
- **Category 1b:** Invader plants species which must be controlled.
- **Category 2:** Invader plants species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be.
- **Category 3:** Invader plants species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act.

Terrestrial Alien Invasive Vegetation

Terrestrial alien plant species were either intentionally or unintentionally introduced to South Africa. Some plants have been introduced with the intent of aesthetically improving public recreation areas or private properties, whilst others are introduced for ornamental or timber uses.

According to SDNR IMP, alien plant species have been planted or have established themselves within SFDNR over time. The following methods have been proposed in order to control the existence and spread of non-invasive alien plants:

- Prevention of alien plants introduction to SFDNR except for non–invasive garden plants, vegetables, fruit trees or herbs (for domestic consumption) planted within staff accommodation plots or non-invasive pot plants used indoors for decoration purposes, provided these plants in no way impact negatively on the ecological processes or disrupt normal animal behaviour patterns (e.g. Fruit trees and baboons).
- Only plants indigenous to the SFDNR and surrounds will be used in landscaping projects.

- Nature Reserve residents are to be encouraged to plant indigenous plants in demarcated gardens.

Aquatic Alien Invasive Vegetation

Invasive Aquatic Plants are introduced plants that have adapted to living in, on, or next to water, and that can grow either submerged or partially submerged in water.

Their presence may harm native ecosystems or commercial, agricultural, or recreational activities dependent on these ecosystems. They may even harm human health.

On the western side of the dam, there is infestation of Water Grass alien invasive species (*Echinochloa crus-galli*). The species grows as a weed of waterways, swamps, wetlands and other damp habitats and disturbed sites altering successional processes and outcompeting native vegetation (Rojas-Sandoval and Acevedo-Rodríguez, 2014).

These species can be spread in many ways including ships, boats, aquaculture, aquatic recreation, water gardening, connected waterways and many other pathways. Through these and other means, Aquatic Invasive Species have been introduced into South Africa (Invasive Species South Africa, 11/04/2016).

1.2.3 Fauna

1.2.3.1 ***Mammals***

According to Heard (2007), approximately 61 mammal species should occur on SFDNR. On average 1 300 antelope occur on the nature reserve, some of the larger antelope that occurred historically in the region have been introduced since 1986.

The smaller game species *e.g.* Mountain Reedbuck (*Redunca fulvorufula)*, Grey Duiker *(Sylvicapra grimmia),* Steenbok *(Raphicerus campestris),* Grey Rhebuck *(Pelea capreolus) and* smaller carnivores *e.g.* Black-backed Jackal *(Canis mesomelas),* Cape Fox *(Vulpes chama)* and various others were present in small numbers when the nature reserve was proclaimed. Leopards *(Panthera pardus)* have been seen occasionally on the southern side of the nature reserve (Heard, 2007).

1.2.3.2 ***Amphibians***

According to the Frog map Atlas, twenty nine (29) species were found in the 2828 QDS (ADU, 2015), and the conservation status of all the species is tabulated in **Table 2**.

Table 2: Amphibians Species occurring in 2828

Scientific Name	Common Name	Conservation Status
Breviceps adspersus	Bushveld Rain Frog	Least Concern
Breviceps mossambicus	Mozambique Rain Frog	Least Concern
Breviceps verrucosus	Plaintive Rain Frog	Least Concern
Sclerophrys capensis	Raucous Toad	Least Concern
Sclerophrys gutturalis	Guttural Toad	Least Concern
Vandijkophrynus gariepensis	Karoo Toad (subsp. gariepensis)	Not listed
Hadromophryne natalensis	Natal Ghost Frog	Least Concern
Hyperolius marmoratus	Painted Reed Frog	Least Concern
Kassina senegalensis	Bubbling Kassina	Least Concern
Semnodactylus wealii	Rattling Frog	Least Concern
Phrynobatrachus natalensis	Snoring Puddle Frog	Least Concern
Xenopus laevis	Common Platanna	Least Concern
Amietia fuscigula	Cape River Frog	Least Concern
Amietia hymenopus	Phofung River Frog	Least Concern
Amietia poyntoni	Poynton's River Frog	Not evaluated
Amietia quecketti	Queckett's River Frog	Least Concern

Scientific Name	Common Name	Conservation Status
Amietia vertebralis	Maluti River Frog	Least Concern
Anhydrophryne hewitti	Hewitt's Moss Frog	Least Concern
Cacosternum boettgeri	Common Caco	Least Concern
Cacosternum nanum	Bronze Caco	Least Concern
Pyxicephalus adspersus	Giant Bull Frog	Near Threatened
Strongylopus fasciatus	Striped Stream Frog	Least Concern
Strongylopus grayii	Clicking Stream Frog	Least Concern
Strongylopus wageri	Plain Stream Frog	Near Threatened
Tomopterna cryptotis	Tremelo Sand Frog	Least Concern
Tomopterna natalensis	Natal Sand Frog	Least Concern
Breviceps adspersus	Bushveld Rain Frog	Least Concern
Breviceps mossambicus	Mozambique Rain Frog	Least Concern
Breviceps verrucosus	Plaintive Rain Frog	Least Concern

*1.2.3.3 **Fish Species***

A total of nine (9) fish species have been recorded in the dam of which two (2), the Large-mouth and Smallmouth Yellowish (*Barbus kimberleyensis* and *Barbus aeneus)* are red data species indigenous to the Orange River system. A matter of concern is the possible crossbreeding (and genetic contamination) of these species with the Natal Scaly (*Barbus natalensis*) introduced from the Tugela River system, through the Tugela-Vaal water transfer scheme. A Natal Scaly was first recorded in the dam during a survey in 1994 (Heard, 2007).

It was further emphasized by Weaver *n.d.* that there is a high fishing demand for yellow fish particularly resulting from the clear water which lends to excellent sight fishing. There are also large numbers of sharp tooth catfish, some very big, as well as common carp. Both these species are also targeted by fly fishers as well as the odd rainbow trout and the Orange River mudfish. The small banded tilapia is sometimes taken on tiny flies and there are disturbing reports that largemouth bass have entered the lake and if these are caught they should be killed immediately.

It is also known that Alien Fish Species, namely Trout (*Salmonidae* spp.) and Bass (*Micropterus* spp.) were introduced for recreational purposes. At present, although it is unclear how successfully the trout have established themselves, it is known that bass are caught by anglers on a regular basis. The rapid increase in the number of largemouth black bass in Sterkfontein Dam is a matter of great concern and this aggressive predatory alien and invasive species might have a further detrimental effect on the recruitment of all indigenous fish species. Due to this, a research project will be initiated in the near future to investigate this further and to determine what can be done to address this problem (Leon, 2013).

*1.2.3.4 **Reptiles***

According to ADU (2016), forty nine (49) reptile species were recorded within 2828 QDS, the conservation status of the species least concern is also indicated in **Table 3**.

Table 3: Reptile Species occurring in 2828

Scientific Name	Common Name	Conservation Status
Agamanaculeata	Distant's Ground Agama	Least Concern
Agama atra	Southern Rock Agama	Least Concern
Bradypodion dracomontanum	Drakensberg Dwarf Chameleon	Near Threatened
Chamaeleo dilepis	Common Flap-neck Chameleon	Least Concern
Crotaphopeltis hotamboeia	Red-lipped Snake	Least Concern

Scientific Name	Common Name	Conservation Status
Dasypeltis scabra	Rhombic Egg-eater	Least Concern
Philothamnus natalensis	Western Natal Green Snake	Least Concern
Chamaesaura aenea	Coppery Grass Lizard	Near Threatened
Chamaesaura anguina	Cape Grass Lizard	Least Concern
Pseudocordylus		Not listed
Pseudocordylus langi	Lang's Crag Lizard	Near Threatened
Pseudocordylus melanotus	Common Crag Lizard	Least Concern
Pseudocordylus melanotus	Drakensberg Crag Lizard	Least Concern
Pseudocordylus spinosus	Spiny Crag Lizard	Near Threatened
Smaug giganteus	Giant Girdled Lizard	Vulnerable
Hemachatus haemachatus	Rinkhals	Least Concern
Afroedura nivaria	Drakensberg Flat Gecko	Least Concern
Pachydactylus capensis	Cape Gecko	Least Concern
Pachydactylus vansoni	Van Son's Gecko	Least Concern
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Least Concern
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable
Nucras lalandii	Delalande's Sandveld Lizard	Least Concern
Pedioplanis burchelli	Burchell's Sand Lizard	Least Concern
Tropidosaura cottrelli	Cottrell's Mountain Lizard	Near Threatened
Tropidosaura essexi	Essex's Mountain Lizard	Least Concern
Duberria lutrix	South African Slug-eater	Least Concern
Homoroselaps lacteus	Spotted Harlequin Snake	Least Concern
Lamprophis aurora	Aurora House Snake	Least Concern
Lamprophis guttatus	Spotted House Snake	Least Concern
Lycodonomorphus inornatus	Olive House Snake	Least Concern
Lycodonomorphus rufulus	Brown Water Snake	Least Concern
Lycophidion capense	Cape Wolf Snake	Least Concern
Psammophis crucifer	Cross-marked Grass Snake	Least Concern
Psammophylax rhombeatus	Spotted Grass Snake	Least Concern
Pseudaspis cana	Mole Snake	Least Concern
Leptotyphlops scutifrons	Peters' Thread Snake	Not listed
Trachylepis capensis	Cape Skink	Least Concern
Trachylepis punctatissima	Speckled Rock Skink	Least Concern
Trachylepis varia	Variable Skink	Least Concern
Afrotyphlops bibronii	Bibron's Blind Snake	Least Concern
Bitis arietans	Puff Adder	Least Concern
Agama aculeata	Distant's Ground Agama	Least Concern
Agama atra	Southern Rock Agama	Least Concern
Bradypodion dracomontanum	Drakensberg Dwarf Chameleon	Near Threatened
Chamaeleo dilepis	Common Flap-neck Chameleon	Least Concern
Crotaphopeltis hotamboeia	Red-lipped Snake	Least Concern
Dasypeltis scabra	Rhombic Egg-eater	Least Concern
Philothamnus natalensis	Western Natal Green Snake	Least Concern
Chamaesaura aenea	Coppery Grass Lizard	Near Threatened

1.2.3.5 Avifauna

SFDNR is designated internationally as an Important Bird Area **(IBA ZA 035**) (Barnes, 2014) with 213 species being recorded thus far (Barnes, 2014). Birds associated with grassland are common and the larger bird species include Cape Vulture (*Gyps coprotheres*), Bearded Vulture (*Gypaetus barbatus*), Verreauxii's Eagle (*Aquila verreauxii*), African Fish Eagle (*Haliaeetus vocifer*), Martial Eagle (*Polemaetus bellicosus*) and some species of bustards and cranes. Furthermore the following species were recorded within 2828 QDS; Cape Weaver (Ploceus capensis), Southern Masked Weaver (Ploceus velatus) and Red-billed Quelea (Quelea quelea) (ADU, 2016).

1.2.4 Topography

The topography of SFDNR area is described by Heard (2007) as undulating giving rise to foot and middle range mountains with deep gorges, vertical cliffs and grass covered plateaus.

The relative complex topography of the area, together with associated differences in geology and microclimate, results in complex soil patterns. Duplex soils, that are often dispersive in nature, are common. Dispersive soils are high in sodium content and are chemically highly erodible. These soils, due to their chemical properties, contribute towards the present geomorphological processes through processes such as dispersive piping and natural erosion.

1.2.5 Geology and Soils

The geology of the area is described by Heard (2007) as six (6) formations i.e. Burgersdorp, Molteno, Elliot, Clarens, Drakensberg and Masotcheni. These formations are all part of the Karoo Sequence of which the first four (4) formations are sedimentary and the Drakensberg a lava layer. The height above sea level is between 1 702m and 2 327m. See **Figure 3** for the geology of Sterkfontein Dam.

Figure 3: Sterkfontein Dam Geology

1.2.6 Hydrology

1.2.6.1 Surface Water

Sterkfontein Dam is situated in the very upper reaches of the Vaal Dam catchment on the Nuwejaarspruit, a few kilometres from the edge of the Drakensberg Escarpment. It has a very small catchment area with negligible natural inflow with the result that it requires no spillway. The Sterkfontein Dam acts as a reservoir for water pumped from the Tugela River in KwaZulu-Natal Province to augment the Vaal Dam for the Gauteng Province when required. The water from KwaZulu-Natal is stored in Sterkfontein Dam and released to Vaal Dam via the Wilge River when needed (DWS, 2016).

The topography and geology of the area results in a relatively high water table. The Basalt and Clarens formations are water retaining structures in SFDNR and these formations release water on a continuous basis from seeps into streams, wetlands and pans (Heard, 2007). **Figure 4** show the fluctuations of water level over a year.

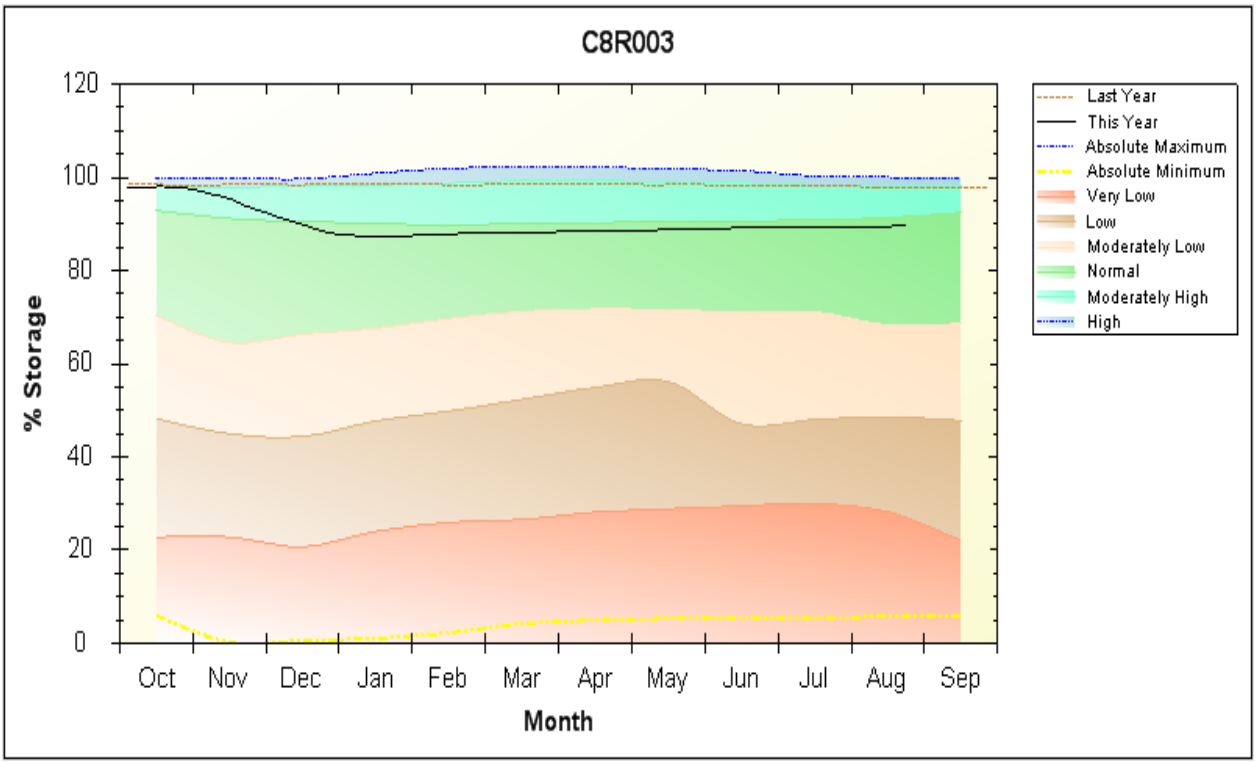

Figure 4: Sterkfontein Dam Full Supply Level

*1.2.6.2 **Water Quality***

The term water quality refers to the physical, chemical and microbiological properties of water that determines its fitness for use (WRC, 1998).

According to (WRC, 1998), "In nature, water rarely occurs in its pure form and normally contains a variety of substances. People generally have their own feeling for what "good" or "bad" quality water is, without giving it much thought. If water does not look clean, people think it is bad. On the other hand, clear water is not always safe. This means that good quality water sources are sometimes rejected while bad quality sources are accepted".

DWS is responsible for managing the dam levels (inflow and outflow) and water quality at the dam. The quality of the water stored at the Sterkfontein Dam is high with a low turbidity and neutral pH. In order to ensure a sustained flow of good quality water from the dam's natural catchment and to maintain good quality water stored in the dam, it is essential that there is regular water monitoring throughout the catchment.

The water quality data for the dam was obtained from DWS (Resource Quality Services). The water quality samples were analysed in November 2015, refer to **Table 4**.

Table 4: Water Quality Variables at Sterkfontein Dam (DWS RQS, 2016)

Characteristics	Analytical Results	Target Water Quality Range (Recreational Purposes)	Effects
Clarity (Secchi disc, m)	N/A	3.0	If a water body is used exclusively for non-contact recreation, then water clarity and turbidity should be such that there are minimal adverse impacts on the aesthetic appreciation of the water body.
pH (pH units)	8	6.5-8.5	Minimal eye irritation occurs. The pH of water is well within the buffering capacity of the lachrymal fluid of the human eye. Skin, ear and mucous membrane irritation absent
Algae (Chlorophyll-a method, µg/chl-a)	N/A	0-15	Nuisance conditions negligible for lower end of range, but at a mean concentration of 15 Fg/R, severe nuisance conditions encountered for < 12 % of a year. No health effects
Phosphate (measured as Inorganic Phosphorus mg/l)	0.023	<5	Oligotrophic conditions; usually moderate levels of species diversity; usually low productivity systems with rapid nutrient cycling; no nuisance growth of aquatic plants or blue-green algae.

1.3 BUILT ENVIRONMENT

1.3.1 Infrastructure

The main infrastructures at the dam includes:

- Administrative buildings;
- The boat house;
- Chalets;
- Guest Houses (Qwantani and Wild Horses);
- Sewage oxidation pond;
- Lapas;
- Boundary and internal fences;
- Recreational hall; and
- Ablution Facilities.

1.3.2 Transport Network

The Sterkfontein Dam is accessed from the R74 on the Oliviershoek Pass from KwaZulu-Natal and Harrismith. The roads provide visitors with access to the office, accommodation and recreational angling shoreline. The access road to the dam (camping, caravan site and chalets) is tarred and paved.

1.4 LAND OWNERSHIP

The Sterkfontein Dam Nature Reserve (SFDNR) was proclaimed under the Free State Nature Conservation Ordinance: Ordinance 8 of 1969 (Provincial Gazette no. 392 dated 25 September 1987).

Not all the land currently managed by SFDNR has, however, been proclaimed as a protected area or nature reserve and assigned or reserved by the National Department of Land Affairs for “nature conservation purposes” (Heard, 2007).

It was stipulated in the Authorities meetings (dated **04 July 2016)**, that there are currently two land owners around the dam. The Department of Rural Development and Land Reform (DRDLR) and DWS. It is essential that there is cooperative governance in the management of the respective land or the land can be centralized under one department of avoid conflict in the future use of land.

1.4.1 Agreements

The DESTEA is responsible for managing the conservation of the aquatic and terrestrial biodiversity as well as the recreational use of the land and water surface area. DWS manage the dam levels (inflow and outflow) and water quality.

There is no Memorandum of Agreement (MoA) that exists between these Departments at present. In order to clarify management relationships and to harmonise management responsibilities, it is essential that an MOA be developed with regard to the integrated management plan of the Sterkfontein Dam and SFDNR.

All the private land owners adjacent to the dam do not have any agreements with DESTEA and DWS to utilize the dam for recreational purposes. This will be addressed as part of the RMP.

1.5 USES AND USERS OF THE DAM

1.5.1 Primary Functions

1.5.1.1 Domestic Use

The dam supply water for domestic use to Rand Water (RW) for the Gauteng Province via the Vaal Dam.

1.5.1.2 Industrial Use

The dam also provides raw water primary purpose of the dam is mainly for industrial use such as providing Eskom with water for hydro-electrical production.

1.5.2 Secondary Functions

1.5.2.1 Recreational Use

The dam also currently offers a variety of recreational activities such as windsurfing, fly-fishing and birding. The accommodation in the reserve includes self-catering chalets, guest houses (Qwantani and Wild Horses) and camping facilities.

Some of the activities currently taking place around the dam which were evident during site inspection are depicted in **Figures 5, 6 & 7**.

Figure 5: SFDNR Boat Houses

Figure 6: SFDNR Lapa Area

Figure 7: SFDNR Caravan Park

1.6 RECREATIONAL INSTITUTIONAL STRUCTURE

The current Management Authority responsible and accountable for the Sterkfontein Dam Nature Reserve (SFDNR) is the DESTEA. The DESTEA is responsible for the conservation of the aquatic and terrestrial biodiversity as well as the recreational use of the dam.

As part of the RMP, the recreational Institutional Structure consisting of all revelevant stakeholders will be established and formalised as per the DWAF's considerations on the Institutional Arrangements for Managing Use of Water for Recreational Purposes guideline (2003).

1.4.1 Management of Water Surface

The management of the surface water in terms of operation of the Dam is done by DWS.

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.

1.4.2 Access

According to SFDNR IMP (2008-2012), the main gate of SFDNR on the eastern boundary of the reserve has an entry control point, which is located at a distance from the public resort gate entrance. The IMP further stipulates that, the entrance gate on the western boundary, the servitude (S20) road to Qwantani, has no control point at all, which has the potential to increase the illegal activity within the Nature Reserve.

1.7 SAFETY

1.7.1 Safety of Navigation

The only AtoN and Demarcation Markers at the dam are at the dam wall (safety and security zone) on the water surface, to restrict users from coming close to the dam wall. These AtoN and Demarcation Markers are inadequate and not standardised for the regulation of activities that needs to take place on the water surface.

1.7.2 Incident Management

There is no specific incident management system in place to ensure that incidents are responded to in a co-ordinated manner.

1.8 EXISTING ZONING PLAN

A Zoning Plan was developed as part of the SFDNR Integrated Management Plan (2007), refer to **Appendix A** for the existing zoning map. The Zoning of SFDNR is based on the Free State Provincial Nature Reserve Zoning System. Two main environments are identified for zoning, namely terrestrial and aquatic Zonation.

1.8.1 Terrestrial Zoning

Visitor use zones

The visitor use zones reflect a gradient of wilderness-type experiences and levels of sophistication. These are defined as follows:

Wilderness

An area retaining an intrinsically wild appearance and character or capable of being restored to such a condition, which is undeveloped and roadless, without permanent improvements or human habitation.

Remote

An area with an essentially pristine and natural character, providing opportunities for solitude and with the long term potential to upgrade Wilderness. Some signs of human impacts outside the zone may occasionally be visible or audible.

Primitive
An area with an essentially natural character, providing the facilities and access to serve Wilderness and Remote zones. The primitive zone also serves as a buffer to the fringe of the reserve and other zones.

Low intensity Leisure
A general access area with higher numbers of visitors using self-driven vehicles.

High intensity Leisure
An area where more concentrated human activities are allowed - usually placed on the periphery of the reserve.

Special terrestrial management zones
Special terrestrial management zones are overlay zones applied to specific areas of the Reserve requiring special management intervention. Special management zones are applied to areas of national, regional or reserve-based significance. These may be inter alia specific landscapes, RAMSAR sites or sensitive cultural sites. At this stage, only two Special terrestrial management: conservation zones have been applied to the reserve to meet the biodiversity objectives of that area. The area indicated will be closed to all leisure activities as a result of its environmental / biodiversity sensitivity to disturbance.

1.8.2 Aquatic Environment Zoning

Visitor use zones:
Two aquatic visitor use zones can be described as follows:

Low intensity leisure:
This area will allow limited access to visitors and is aimed at given a more wilderness like experience to the user. No motorised craft will be allowed in this zone and could be closed to visitors during certain times of the year. Audible disturbances will be controlled and beaching and extractive resource utilisation will be strictly limited.

High intensity leisure:
Terrestrial infrastructure will service this zone and controlled activities at a more concentrated level could be allowed. Motorised craft will be allowed under conditions set by relevant legislation. Extractive utilisation under controlled conditions will be allowed in this area.

Special aquatic management zones:
Special aquatic management zones are overlay zones applied to specific areas of the Sterkfontein Dam in the Reserve that require special management intervention. Special management zones are applied to areas of national, regional or reserve-based significance. These may be *inter alia* specific landscapes, RAMSAR sites or sensitive cultural sites.

The special aquatic management zones are then further defined as:

- Conservation
- Heritage
- Rehabilitation

At this stage, only two Special aquatic management: conservation zones have been applied to the reserve to meet the biodiversity objectives of these areas.

The areas indicated zones will be closed to all leisure activities and will be characterised by environmental or biodiversity sensitivity. A Special Management zone will be applied to areas requiring specific management intervention or areas of scientific or educational importance.

1.9 SOCIO-ECONOMIC ENVIRONMENT

1.9.1 Social Audit

The main purpose of socio-economic analysis is to examine the general situation of the study area and to determine issues that need to be addressed when developing the RMP in order to overcome potential difficulties in an area. The study area falls within Ward 6 of the MAPLM as illustrated in **Figure 8**. An understanding of socio-economic conditions of Ward 6 can be used at a later stage to determine the impact of a RMP in the area in terms of changed socio-economic conditions.

A social Audit which focused on the population composition of the ward, Education level and employment status was undertaken and is 3 presented in section 1.9.1.1 to 1.9.1.3, respectively.

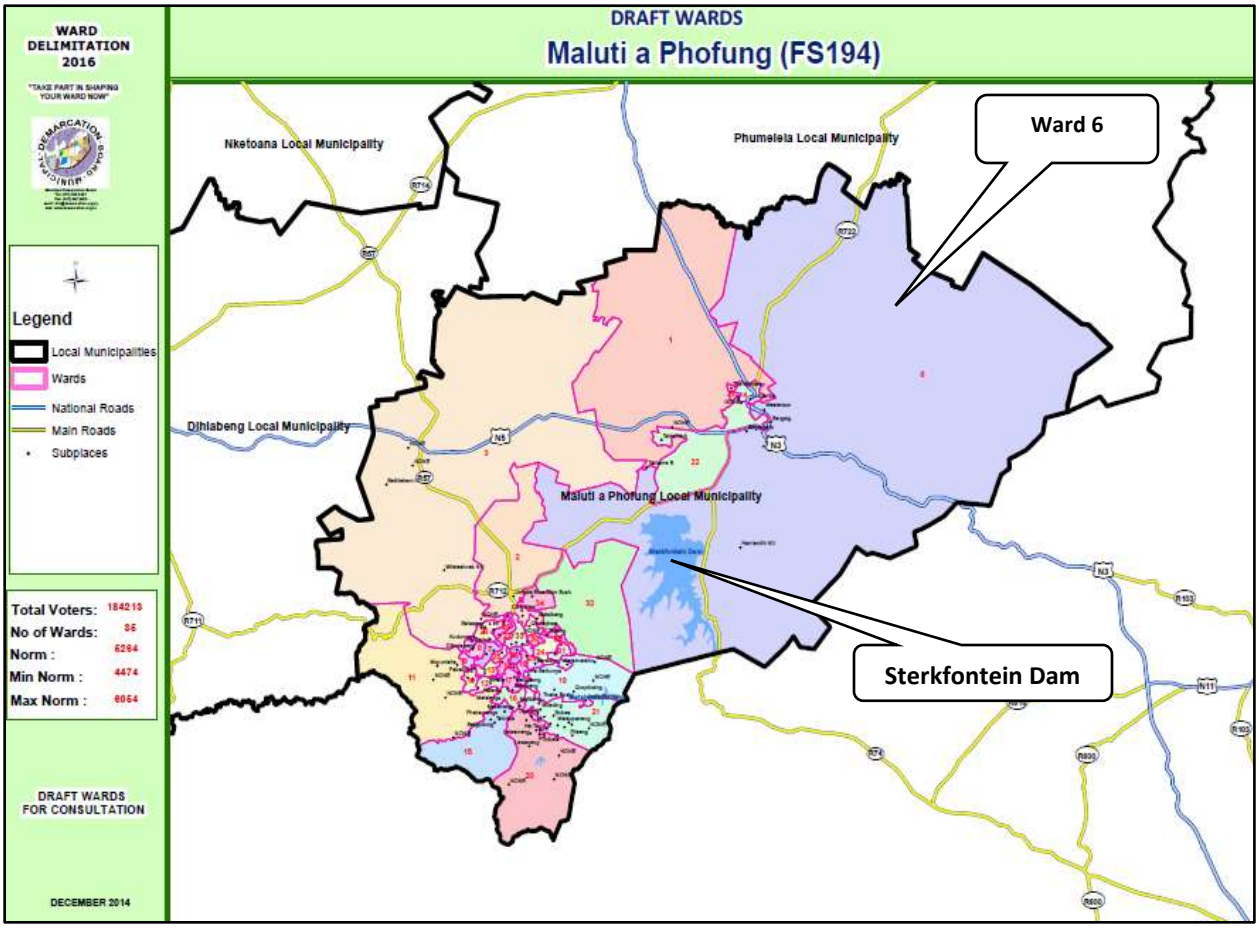

Figure 8: MAPLM Ward Demarcation Map

1.9.1.1 Population Dynamics

The MAPLM has a total population of 335,784, ward 6 has a total population of 6 582 which forms 2% of the MAPLM (Census, 2011), refer to **Figure 9**:

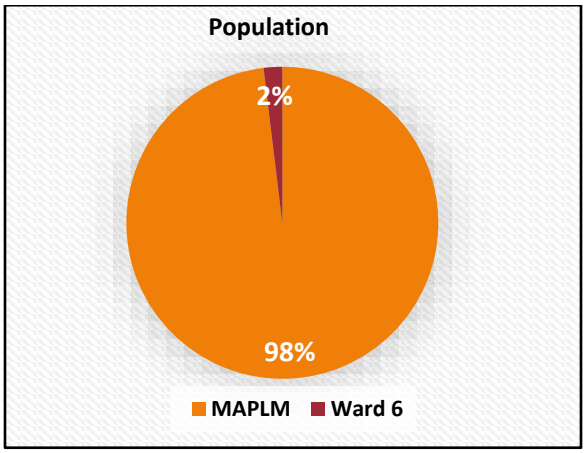

Figure 9: Population of Ward 6

1.9.1.2 Education Level

The Census (2011) breaks down educational levels into each year of study. For the purpose of this report, the educational levels are grouped into key schooling and higher educational categories. Majority of residents in ward 6 have completed matric (See **Table 5** & **Figure 10**).

Table 5: Education Levels of Ward 6

Description	Ward 6
No Schooling	17, 797
Some Primary	49, 696
Completed Primary	13, 431
Some Secondary	104, 093
Matric	104, 765
Higher Education	4,3 652

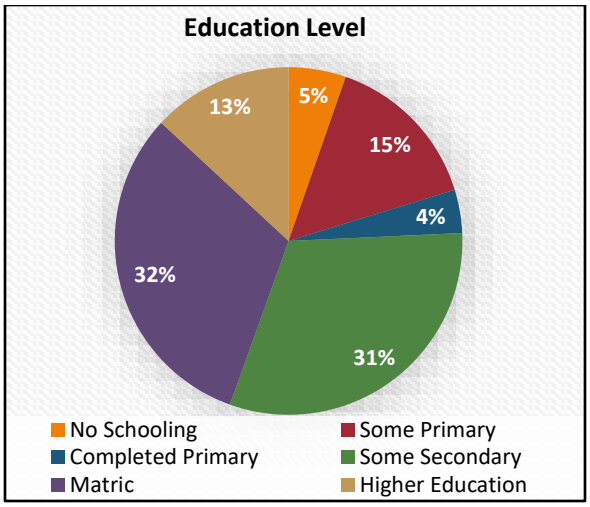

Figure 10: Education Levels of Ward 6

1.9.1.3 Employment Status

In terms of employment levels within ward 6, **Table 6** and **Figure 11** are indicative (Census, 2011). About 34% of the residents of working age of ward 6 are employed.

The greater majority of the population depends on subsistence farming and backyard gardens for a living. It is essential to expand support and service sectors, i.e. arts and crafts, beadwork, sculpting, pottery, entertainment, cultural heritage projects, B&Bs, Eco-tourism, etc. in the area to be able to curb the unemployed rate.

Table 6: Employment Status of Ward 6

Employment Status	Population
Employed	2, 242
Unemployed	202
Discouraged work-seeker	457
Other not economically active	1, 474
Not applicable	2, 206

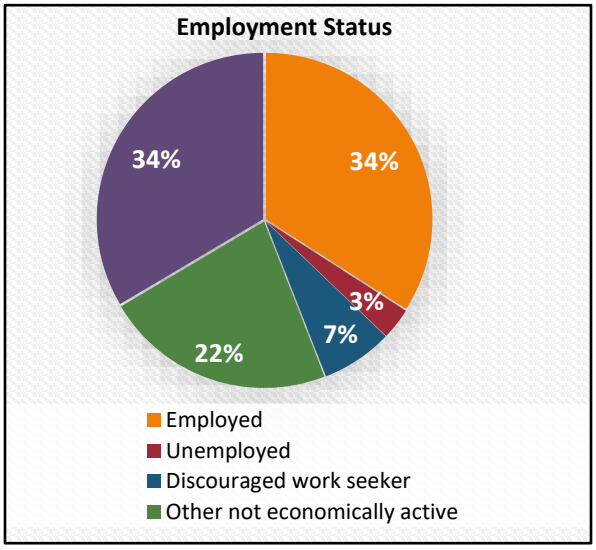

Figure 11: Employment Status of Ward 6

1.9.2 Community Beneficiation

It is DWS's belief that Local Communities should equally share the benefits emanating from the utilisation of the dam for recreational purposes, by ensuring that they have both physical access to the resource, as well as access to the water-based recreation economy.

According to DWAF (2006), by ensuring that the Local Communities move beyond merely being affected by or living close to a water resource, but rather undertaking the transition to become participants will ensure that water resources can and will be protected by the people closest to and most affected by the dam.

The community will benefit in amongst others the following ways:

- By having equitable access to the dam;
- The community needs will be addressed in an appropriate and equitable manner;
- By being safe while accessing and using the dam;
- By being given first preference when there are employment opportunities and skills development;
- Through the PPP; and
- By participating in decision-making with respect to major developments planned or proposed for the dam (through the Dam Management Committee).

CHAPTER 2: LEGISLATIVE FRAMEWORK

The RMP forms the overarching framework for the management of Sterkfontein Dam. It is informed by relevant policy, legislation and planning documents administered by other government departments, most of which are herein under discussed. Similarly, these government departments are required to use the RMP to inform the development of future policy, legislation and planning documents.

I. **The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996), Section 24:** Provides that, everyone has a right to an environment that is not harmful to their health or well-being.

II. **Conservation of Agricultural Resource Act, 1983 (Act No. 43 of 1983):** Provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith. Regulation 7 and 8 within the same Act deals with the protection of wetlands and water courses, while regulations 15 and 16 deals with Alien Invasive Plant Species and bush encroachment**.**

III. **Consideration on Institutional Arrangement for Managing Use of Water for Recreational Purposes (DWAF, 2003):** It outlines some of the institutional issues at a local level and makes recommendations about the conditions under which different Institution Management arrangements may be considered.

IV. **General Public Participation Guidelines (DWAF, 2001):** Public Participation refers to the ongoing interaction between Role Players and all stakeholders that is aimed at improving decision making during planning, design, implementation and evaluation of all projects within the state, this includes the proposed development of the RMP.

V. **Government Immovable Asset Management Act, 2007 (Act No. 19 of 2007):** To provide for a uniform framework for the management of an immovable asset that is held or used by a national or provincial department; to ensure the coordination of the use of an immovable asset with the service delivery objectives of a national or provincial department; to provide for issuing of guidelines and minimum standards in respect of immovable asset management by a national or provincial department; and to provide for matters incidental thereto.

VI. **Government Notice R654 dated 1 May 1964, in terms of the Water Act, 1956 (Act No. 54 of 1956):** Regulates access and use of government waterworks for recreational purposes.

VII. **Guidelines for Compilation of Resource Management Plans (DWAF, 2006):** Directs and guides the development of RMPs by providing insight into the purpose and objectives of these plans, the procedure for its compilation and structure of such documents.

VIII. **Merchant Shipping (National Small Vessel Safety) Regulations (2007):** These Regulations provide *inter alia* for:

- Requirements for vessel safety;
- Crewing requirements and responsibilities;
- Controlled events such as competitions and regattas; and
- Responsibilities of authorised agencies (governing boards/clubs/organisations and regulating authorities).

These Regulations apply to the Department of Water and Sanitation as they are applicable to all inland and sheltered waters and as the Department and its agencies are allowing access to government waterworks for recreational boating vessels.

IX. **Methodology for Carrying Capacity Assessment for the Use of Water for Recreational Purposes (DWAF, 2003):** The carrying capacity of a water resource represents the maximum level of visitor/recreational use and related infrastructure that the water resource and surrounding area can accommodate, without diminishing user satisfaction or adverse impacts upon the local or host community, the economy and culture of the area.

X. **National Environmental Management Act, 1998 (Act No. 107 of 1998):** NEMA serves as South Africa's Environmental Framework Legislation. It was designed to provide for co-operative and Integrated Environmental Governance by establishing a general framework for decision-making on matters affecting the environment.

XI. **National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and Related Regulations:** This Act aims to provide the framework, norms and standards for the conservation, sustainable use and equitable benefit-sharing of South Africa's biological resources.

The Alien and Invasive Species Regulations for this Act came into effect 01 October 2014. NEMBA together with these Regulations aim to prevent the introduction and spread of alien and invasive species across South Africa.

XII. **National Environmental Management: Protected Area Act, 2003 (Act No. 57 of 2003):** The aim of this Act is to provide for the protection and conservation of ecologically viable areas, which are representative of South Africa's Biodiversity, as well as natural landscapes and seascapes.

XIII. **National Treasury Public Private Partnership (PPP) Toolkit for Tourism, 2005:** This toolkit assist the process of development of tourism-based businesses on State-owned Land. The Toolkit make it easier for Institutions and the Private Sector to enter into tourism related partnerships on State Property managed by National and Provincial Government Institutions.

XIV. **National Water Act, 1998 (Act No. 36 of 1998):** The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in a sustainable and appropriate manner, for the benefit of all. Furthermore Section 113 of the Act states that the water of a government waterworks and surrounding state owned land may be made available for recreational purposes, subject to controls determined by the Minister and regulations made by the Minister.

Using water for recreational purposes is a water use under Section 21K and can be exercised as permissible use of water under Schedule 1 of the Act. However, this provision does not cater for commercial use hence the RMP should be implemented in line with General Strategic Plan for commercialisation of Tourism Public Private Partnerships at Government Waterworks, 2009 and PFMA Treasury Regulation 16.

Once the RMP has been approved, 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.

XV. **Operational Policy: Using Water for Recreational Purposes (DWAF, 2004):** This policy is the main guideline in support of the RMP process with regards to the basic principles, policies, strategies and actions for regulating the use of water for recreational purposes.

XVI. **Public Finance Management Act (PFMA) (Act No. 29 of 1999**): Section 76 of the Act secures 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 PPP agreements with the private sector for the commercial use of state assets.

XVII. **Safety at Sport and Recreational Events Act, 2010 (Act No. 2 of 2010):** Events management is addressed by Safety at Sport and Recreational Events Act (Act No. 2 of 2010). This act deals with ensuring responsibility for safety and security at events. The act deals with among other things,

- Responsibility for safety and security at the events;
- Risk categorization of events; and
- Safety certificates.

XVIII. **South African Maritime Safety Authority Act, 1998 (Act No. 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.

XIX. **Water Services Act (Act No. 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 RMP process also takes cognizance of the following Legislations, Policies, Programmes and Reports:

- Broad-based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003).
- Communal Land Rights Act, 2004 (Act No.11 of 2004).
- Development Facilitation Act, 1995 (Act No. 67 of 1995).
- Disaster Management Act, 2002 (Act No. 57 of 2002).
- Environmental Conservation Act, 1989 (Act No. 73 of 1989).
- Fire Brigade Services Act (Act No. 99 of 1987).
- Integrated Development Plan of TMDM (2012-2016).
- Intergovernmental Relations Framework Act, 2005 (Act No.13 of 2005).
- Land Administration Act, 1995 (Act No. 2 of 1995).
- Local Government: Municipal Systems Act [No. 32 of 2000]
- National Heritage Resources Act, 1999 (No. 25 of 1999)
- Occupation Health and Safety Act, 1993 (Act No. 85 of 1993).
- Policy for the small scale fisheries sector in South Africa (Department of Agriculture, Forestry and Fisheries, 2012).
- Restitution of Land Rights Act, 1994 (Act No. 22 of 1994).
- State Land Disposal Act, 1961 (Act No. 48 of 1961).
- South African Water Quality Guidelines for Recreational Use (DWA, 1996).
- Sustainable Development Goals (2015)

- **Safety of Navigation:** In addition to its common-law responsibility, DWS is, in terms of the requirements described in the National Water Act, Act No 36 of 1998, amongst others, responsible for the safety of GWWs. DWS, its delegated public sector partner, or a delegated water management institution, has therefore the responsibility to provide the required fixed and/or floating 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. In order to demarcate specific zones/areas, standardised demarcation markers are to be used in conjunction with the relevant AtoN.
- 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.

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.Not only do these Acts, Regulations and Frameworks guide specific decisions and actions, they also provide the framework for monitoring performance and compliance, and provide guidelines regarding contravention, offences and penalties. This list is not extensive, other legislation could be applicable.

CHAPTER 3: WHAT IS RESOURCE MANAGEMENT PLAN

3.1. DEFINITION OF RMP

A Resource Management Plan (RMP) is a plan which aims to regulate access, and the recreational utilisation, of a water resource and the surrounding state land, in ways which promote community participation and beneficiation, environmental conservation and unlock socio-economic potential of the water resource.

Recreational use includes activities ranging from leisure, sport to culture and religion. Although recreational use does not involve consumption of water, it is still a major water use and needs to be managed effectively with minimal negative environmental impacts and to ensure communities have access to water based economy.

3.2. PURPOSE OF THE RMP

The main aim of RMPs is to attain the objectives underlying sustainability and to compile functional, workable sustainable access and utilization plans for water resources.

Without approved management plans relating to water resources utilized for recreational purposes, it is difficult for informed decisions to be made, necessitating a precautionary approach to access, utilization and development proposals.

One of the components of the RMP process is to implement an Institutional Plan for effective management of GWWs. The focus on the Institutional Plan is accompanied by a Zoning Plan which is influenced by current and potential recreational uses. The RMP also outlines the Strategic Plan for all the identified objectives for the dam. In addition, a Financial Plan is incorporated into the Business Plan (BP) and provides guidance on funding requirements and funding options to implement the potential recreational activities at the dam.

3.3. PROCESS TRIGGERS

Triggers are factors that have encouraged DWS to initiate and commission the development of RMPs.

A number of generic factors have been identified by DWS for the development of RMPs, however, the Process Facilitator identified site specific trigger factors, as illustrated by **Table 7.**

Table 7: Trigger factors for the development of Sterkfontein Dam RMP

Trigger Factors	Description
Resource Management	**Protected Area** • The dam is part of the Sterkfontein Dam Nature Reserve and the area is prone to veld fires, often caused by strong winds. • There is illegal fishing at the dam. • There is overgrazing by cattle from surrounding farms/ communities. **Invasive alien species** • The dam is partially infested by alien invasive species such as large and smallmouth black bass, carp and water grass.
Recreational Industry Involvement	**Public safety with regards to use of inland vessels** • There are a number of drowning incidents at the dam, mostly resulting from high consumption of alcohol by some dam users.

Trigger Factors	Description
	Conflict between users • Other users of the dam often camp in areas outside the recognized recreational zones.
Community Participation and Beneficiation	**Community Participation** • There was a system which was implemented by DESTEA to provide community members with an opportunity for subsistence fishing, however, the Reconstruction and Development Programme (RDP) system was underutilized by the community. Surrounding communities allege that they were not aware of this programme. Outreach programmes to inform local communities is required.
Public Policy	**Local Planning Initiatives** • The dam needs to be identified as a local development objective by the Maluti a Phofung Local Municipality (MAPLM). The dam should be integrated in other planning initiatives and decision support tools such as the MAPLM IDP, Strategic Development Framework (SDF) and Local Economic Development (LED) plan as well as the TMDM Environmental Management Framework (EMF).

3.4. RMP DEVELOPMENT PROCESS

The RMP is being compiled in accordance with the RMP Guideline (DWAF, 2006) as illustrated in **Figure 12**.

Figure 12: RMP Procedure

3.5. RMP PLANNING STAGES

3.5.1 Desktop Study

The desktop study was conducted with the aim of acquiring background information about the Sterkfontein Dam. This was done through literature review. This study provided information such as the location of the dam, user groups, current activities, previous studies conducted for the dam.

3.5.2 Site Inspection

A site inspection was conducted at Sterkfontein Dam on **17 November 2015** to gather baseline information using a checklist questionnaire. The site inspection was undertaken with the DWS delegates (DWS IEE), dam control officer and the Sterkfontein Dam Nature Reserve manager. Furthermore, a follow up site inspection was conducted with the Blue Gum Bosch Community on **17 November 2016**.

Photos of the study area were also taken during site inspection as illustrated in **Figure 13, 14 & 15.**

Figure 13: SFDNR Resort Park

Figure 14: Sterkfontein Dam Resort Chalets

Figure 15: Sterkfontein Dam Recreational Signage

3.5.3 Public Participation

Public Participation process (PP) is a process in which potential Interested and Affected Parties (I&APs) are given an opportunity to comment on or raise issues relevant to specific matters. The three (3) fundamental and theoretical objectives of PP process as stipulated in the DWAF's Guideline for Public Participation (2001) are:

- To improve decision-making;
- To bring about sustainable development; and
- To normalise the attitudes of stakeholders (Authorities and I&APs).

A Public Participation was conducted in order to obtain information for **Phase 2 (Encumbrance Survey), Phase 3 (Objective Identification)** and **Phase 4 (Research/ Information Gathering)** from stakeholders, which was used to complete **Phase 5 (Integrated Management, Zoning and Institutional Planning)**. In order to successfully complete the RMP, it is essential that the information obtained in the previous phases is utilised as planning input.

The public participation process for this project was formulated to include the following objectives:

- The identification of role players;
- The introduction of the RMP project to role players and inform them about their roles and responsibilities;
- The engaging of the Stakeholders (Authorities and I&APs) in the planning process;
- The answering of questions and noting of concerns;
- The identification of important issues, problems, conflicts and alternatives;
- Identification of the overall vision of the dam;
- The elimination of false expectations and preconceptions; and
- The creation of awareness amongst users.

DWAF's Guidelines for Public Participation (2001) outlines three (3) broad phases for public participation namely the **Planning, Participation** and **Exit phase**. Summarized below are the aspects of each phase and the approach for this project.

3.5.3.1 **The Planning Phase**

The **Planning phase** entails three (3) important aspects namely;

- Decision analysis;
- Participation planning; and
- Implementation planning.

During the **Planning phase** a Site inspection and literature review was conducted to gather baseline information about the dam. A process was also established to get into contact with the I&APs and relevant Authorities to ensure co-operative interests and support in the RMP project.

3.5.1.1.1. The Role Players

It is recognized that different roles and responsibilities of the Stakeholders (Authorities and I&APs), and their relationship towards each other and the steps in the planning procedure are imperative in the successful development of the RMP. It is also important that proper consultation with the public is done in order to produce a credible RMP. As such the success of this RMP is dependent on the level of involvement of the various Stakeholders. Numerous Stakeholders were identified and invited to participate in an open and consultative process. (See attached registered stakeholder list in **Appendix B)**. The Stakeholder list is updated on a continuous basis throughout the RMP process.

3.5.3.2 **The Participation Phase**

The **Participation Phase** entails three (3) important aspects:

- Informing and identifying stakeholders – explained briefly under **3.5.3.4 (Advertising Process).**
- Meeting the stakeholders – explained briefly under **3.5.3.5 (Direct Communication)**.
- Feedback – it is of utmost importance that feedback is directed to and from stakeholders. In this project feedback thus far has been given in a form of minutes of the meetings and follow up emails.

3.5.3.3 **The Exit Phase**

The **Exit Phase** entails two (2) important aspects namely:

- Ensuring that challenges, objectives and the vision for the dam have been identified and documented.

- Officially ending the public participation process for the RMP development.

During this phase, a draft RMP will be presented to the Stakeholders so that they comment and give inputs.

3.5.3.4 **Advertising Process**

3.5.3.4.1 Compilation and Distribution of Background Information Document (Bid)

The purpose of this document was to provide stakeholders with the background information about the proposed RMP project and to introduce the processes to be followed in developing the plan. It also aimed to inform stakeholders on how to fully participate in the process and encouraged active attendance to stakeholder's engagement meetings. The BID was compiled from the information collated through the desktop study and site inspection (See attached **Appendix C**).

3.5.3.4.2 Newspaper Advert

A Newspaper advert regarding the RMP project was placed in the **Harrismith Chronicle** and **Issues Newspaper**. The advert invited the public to attend the Public Participation Meeting. The advert was published in English on **17 & 23 June 2016**. Furthermore, an advert for the draft RMP was advertised on **02 March 2017**. (See attached **Appendix D**).

3.5.3.4.3 Flyers Compilation and Distribution

Flyers were also used as a form of notification, they aimed at informing the I&APs about the public consultative meetings. The flyer detailed a brief description of the RMP, meeting date, time, venue and relevant contact details. The flyers were compiled in English and Sotho and were distributed on **17 July 2016.** Furthermore, the flyers for the draft RMP were distributed on **23 February 2017** (See attached **Appendix E**).

3.5.3.5 **Direct Communication**

3.5.3.5.1 E-mails

Meeting invitations were sent out to authorities and I&APs notifying them about the scheduled consultative meetings. The invitation entailed the BID, meeting venue and time. The email notification was sent out on **17 June 2016**. Moreover, the meeting invites for the draft RMP were sent out on **28 February 2017** (See attached **Appendix F**).

3.5.3.5.2 Authority Meeting

The initial authorities meeting was conducted on **04 July 2016** at **MAPLM, Harrismith Offices**.

The purpose of the meeting was:

- To present the RMP, its goal and the objectives of the project to the authorities; and
- To allow the authorities an opportunity to participate in the project by sharing information on their respective mandates.

The draft RMP was presented to the authorities on **09 March 2017.**

3.5.3.5.3 Public Meeting

The initial public meetings were held on **03 & 04 July 2016** at Blue Gum Bosch, **Beaulah**, **Many Waters**, **Mabate** and **Harrismith Town Hall**. A platform was also given to I&APs to identify encumbrances/challenges that might hinder theprogress of the RMP as well as to identify objectives and vision for the Sterkfontein Dam.

The draft RMP was presented to the public on **09, 10 & 11 March 2017.**

3.5.3.5.4 Special Meeting

A special meeting requested by the Maluti a Phofung Local Municipality was held on **11 November 2016** with DWS, Engineerex, North-West University and Rainbow Lake. The purpose of the meeting was to discuss the proposed aquaculture project at Sterkfontein Dam.

3.5.3.5.5 Comments and Responses Register

A copy of the draft report was circulated on **23 February 2017** for commenting purposes. The commenting period was to elapse on **09 March 2017.** (See attached **AppendixG**).

3.5.4 Planning Partners

RMPs are developed through a process of cooperative governance and Stakeholder participation. The distinctly different roles and responsibilities of the stakeholders, and their relationship towards each other and the steps in the planning procedure are imperative in the success compilation of the RMP.

The RMP provides for coordination between different governments and agencies to ensure that not only the objectives of DWS are attained, but also the objectives of other relevant Government Departments are attained. Such Departments includes among others as illustrated by **Table 8**:

Table 8: RMP Planning Partners and their Respective Mandates

Department/ Agency	Mandate
Thabo Mufutsanyana District Municipality/Maluti a Phofung Local Municipality (TMDM/MAPLM).	The dam is within the jurisdiction of the municipality and is mandated to provide bulk water services.
Free State Department of Economic, Small business development, Tourism and Environmental Affairs (DESTEA)	Responsible for the conservation of the aquatic and terrestrial biodiversity and ecosystems as well as the recreational use of the land and water surface area.
Department of Agriculture, Forestry and Fisheries (DAFF)	The purpose of DAFF includes sustainable development and management of resources to maximizing the economic potential of the fisheries sector while protecting the integrity and quality of the country's aquatic ecosystems. Operation Phakisa expansion to inland dams is one of DAFF initiative aimed at unlocking economic potential of fisheries sector within the inland water. The latter programme will be used as benchmark for implementation of conservation policies while implementing job creation within fishery and fish processing market.
Department of Rural Development and Land Reform (DRDLR)	The department will assist in terms of Land Claims/Ownership issues.
Department of Environmental Affairs (DEA)	Responsible for Biodiversity Management within the dam including Invasive Alien Species.
Department of Public Works (DPW)	Has the power to regulate and control the use of state land outside the GWWs. In this regard, lease agreements or permits will be required from the department as some of the recreational activities will overlap into the state land.
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 also inland waterways.
National Treasury (NT)	The use of State assets is governed by National Treasury Regulations, requiring DWS to plan concessions in compliance or association with National Treasury, guided by the Tourism Public Private Partnership (PPP) Toolkit of 2005.
South African Maritime Safety Authority (SAMSA)	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.

3.6. RMP DATA ANALYSIS

3.6.1 Encumbrance Survey (Phase 2)

The purpose of the Encumbrance Survey is to investigate/ ascertain whether any encumbrances exist around the dam and other factors that may influence the development and implementation of the RMP. The survey also identifies the information that is required for effective decision-making regarding the RMP (DWAF, 2006).

The identified encumbrances will assist DWS to identify hindrances and other factors that may influence the development and implementation of the RMP. The identified encumbrances are broken down into **Biophysical, Legal and Social.**

Table 9 to Table 11 outlines the summary of limitations that might affect the development or implementation of the RMP for the dam.

Table 9: Summary of Biophysical Encumbrances

Item	Description
Climate	• The dominant weather in the area will limit certain recreational activities (i.e. Kayak fishing) from taking place. Therefore care should be taken when using boats as Sterkfontein is notorious for stormy conditions with high winds and surprisingly big waves which often develop within a very short period of time. • The strong winds in the area are likely to cause veld fires which are often difficult to control and manage. Annual fires can be a problem if not adequately controlled. Late season fires, if too hot, destroy protea trees.
Flora	• There is infestation of Water Grass Alien Invasive Species (Echinochloa crus-galli) on the western side of the dam. The species grows as a weed of waterways, swamps, wetlands and other damp habitats and disturbed sites altering successional processes and outcompeting native vegetation (Rojas-Sandoval and Acevedo-Rodríguez, 2014).
Fauna	• There are alien fish such as Large and Smallmouth Black Bass and Carps in the dam. The occurrence of alien fish species will threaten indigenous fish population, resulting mainly from predation by largemouth bass and carp. • There is poaching of fish mainly by rods taking place at the dam.
Surface Water	• Surrounding communities require water for domestic use. If the primary functions of the dam have not been achieved, it will be challenging for the communities to explore the secondary use of the dam. • There is spillage of water from the Maluti a Phofung Water Treatment Works at the dam and as a result a lot of water is lost in the process.

Table 10: Summary of Legal Encumbrance

Item	Description
Land Ownership	• It is essential that the DRDLR and DWS manages the respective lands collectively and communicate effectively regarding their plans to avoid conflict in land use for future purposes. Failure to cooperatively manage and communicate before plans are implemented might have a negative impact on the implementation of the RMP.

Table 11: Summary of Social Encumbrances

Item	Description
Tourism Information	• The SFDNR is not well marketed in the area, particularly amongst local communities. Locals specified that they are unaware of the recreational facilities and activities that are currently taking place at the dam.
Social Audit	• Only 13% of the population has moved beyond schooling to receive some kind of higher education. The implication of the project is that the majority of residents in ward 6 will not have received any kind of training to equip themselves to become active participants in the eco-tourism sector. • This speaks to the fact that there is a large proportion of people within ward 6 who have limited income sources and few hopes that this situation will change in the future. This is because 22% of the residents are not economically active suggesting they no longer seek to become employed. There is high expectations of employment creation from the community when developing the RMP, this can be a challenge as the RMP is not aimed at creating employment for community. • About 34% of the population's employment status is unknown however, it is unlikely that the unemployed in this region have the necessary skills to enter the tourism market. The direct impact that this has for this study is that there is a large pool of potential labour should tourism development projects be implemented that are labour intensive.

Upon identifying the encumbrances, objectives needed to be identified in order to facilitate a planning procedure aimed at the compilation of a RMP. It is essential to clarify objectives to be met by the planning procedure (DWAF, 2006).

3.6.2 SWOT Analysis and Objective Identification

The SWOT Analysis was conducted to gather **Strengths** and **Opportunities** that define the potential of the dam whereas the challenges regarding the dam where identified through **Weaknesses** and **Threats**. The common key objectives were formulated and identified from the **Strengths** and **Opportunities** of the dam. Moreover, the vision for the dam for a period of 20 years was formulated by stakeholders from the identified objectives.

3.6.2.1 **Swot Analysis Approach**

There were issues of concerns that were raised in the stakeholder engagement meetings prior to conducting the SWOT Analysis. Other challenges or encumbrances that may hinder the progress of the dam's RMP process were identified by the stakeholders following the SWOT analysis approach as illustrated in **Table 12.**

Table 12: SWOT Analysis for Sterkfontein Dam

Strengths	Weaknesses
• The dam is currently fairly well controlled/ managed. • The dam has a large capacity accommodate a variety of facilities and activities. It can also supplement other dams i.e. Fika Patso Dam for water supply. • The water quality of the dam is very good. • The dam has several facilities such as boat houses, lapa area, jetty etc.	• There is a shortage of trained staff at the Sterkfontein Dam Nature Reserve. • The dam is partially infested by alien invasive species. • Marketing from DESTEA is poor. The dam requires a good marketing strategy that will also target local communities as it is not too popular and well known to the local communities. • Community involvement is a major problem as there are several projects that were initiated by the Nature Reserve, however during the

• The dam has a lot of fish to feed the local communities, particularly the yellow fish. • The dam is well developed and there are a variety of economic potential opportunities that can arise from the dam. • The dam has a capability to accommodate economic aquaculture projects that will supplement the livelihoods of the surrounding communities through employment opportunities and community upliftment.	implementation stage only a few community members attended meetings. • The expansion of the recreational activities will be curbed by the limited space available for recreational use, as the current use of the dam should not compromise the ability of the future generations to meet their needs. • There are no agreements between Private Land Owners and DESTEA, however, they are all on a private owned land. • Most local communities are not familiar with the dam. • Water supply to the local communities is very poor, they use water from Jojo tanks. • Access to the dam is only through payment and the local communities cannot afford the levies charged to access the dam. • It is alleged that certain racial group are allowed to access some parts of the dam and conduct recreational activities such as boating. • There is a high poverty rate in the area as a result people rely on the dam for fishing. • When employment opportunities arise people from townships are employed and the people residing in the farms are neglected. • The local communities walk a long distance to access the dam for subsistence fishing. • There is a concern regarding the pollution of the dam, which is caused by lack of education regarding the use of natural resources to local communities. • Local communities are not informed about the activities and facilities available at the dam for recreational purposes. • There is littering around the dam which causes a big problem at the dam and might also interfere with recreational activities. • Vandalising of surrounding facilities that can attract more tourists at the dam and uplift the livelihoods of the local communities is a problem e.g. Beahula Guesthouse.
Opportunities	**Threats**
• Expanding recreation/ tourism at the dam, mainly water recreation such as pressure craft. • Aquaculture opportunities should be created in order to capacitate local communities with skills and jobs. • Environmental Education should be offered at the dam and surrounding communities to ensure that local schools are educated about the conservation of nature and importance of taking care of the environment. Furthermore environmental	• The spillage from the reservoir near the road causes high loss of water. • There are two land owners at the dam currently, DWS and Land Affairs. This may lead to conflict of interest in the use of land going forth. The whole land should be centralized under one department to avoid conflict. • Currently local communities go to the dam to fish illegally.

education can be offered in a form of animal exhibitions like at the zoo to expand the knowledge of the learners, particularly those who are not familiar with animals. • The parks forum should be involved to create a relationship between the Nature Reserve and local communities. • Employment opportunities should target local communities. • Locals should be informed about the activities taking place at the dams. • Communities require access to the dam for fishing purposes and should get free membership to fish at the dam. The free membership can be controlled in a form of cards that will be given to the community members. • There should be skills development opportunities for local communities. • Life guard training should be provided to local communities. • There should be a guesthouse build to employ local communities. • There is potential for golf courses, function centres and sports & entertainment centres. • Subsistence fishing will be beneficial to local communities as the unemployment rate is high in the area. • Business opportunities such as enabling local people to make crafts and other artistic materials for commercial purposes. • A good marketing strategy will enable the communities to use the dam more often as they will be well informed about the kind of activities taking place at the dam.	• The field rangers from the Nature Reserve confiscate fish from local fishermen when they are caught fishing at the dam. • There are often dangerous wild animals (leopard) observed wondering around the area not in any protected area. The animals are believed to be coming from KZN Province as there are no carnivorous animals within the Sterkfontein Dam Nature Reserve.

3.6.2.2 **Objective Identification (Phase 3)**

Objectives were identified by all the stakeholders in order to ascertain common goals. These objectives address the following questions:

- What do we want?
- How are we going to achieve this?
- Who will be involved?
- By when would we like to achieve our goals?
- Why would we want to achieve our goals?

The set common key objectives were derived from the SWOT Analysis for the Sterkfontein Dam and have been categorized into three (3) Key Performance Areas (KPAs) as illustrated below:

KPA 1: Resource Management

- To maintain a good water quality at the dam in order to conserve the immaculate resource for recreational use as well as to ensure a healthy environment;
- To eradicate alien invasive plant species and ensure non-infestation in the dam and surrounding environment; and
- To eradicate and monitor the alien fish population within the dam.

KPA 2: Resource Utilisation

- To provide the local communities with an easily accessible entrance to the dam;
- To provide the local communities with an opportunity for subsistence fishing;
- To establish an aquaculture/ fish farming project at the dam; and
- To establish potential developments on the dam's surrounding environment like resort, function and entertainment centres.

KPA 3: Benefit Flow Management

- To educate the local communities about the importance of biodiversity, environment and water conservation;
- To equip community members with the necessary skills and expertise for the eco-tourism industry;
- To unlock the socio-economic potential of the dam by creating employment and entrepreneurship opportunities; and
- To improve the dam's tourism marketing strategy as it is not well known amongst local community members.

Action projects required to achieve these objectives are provided in detail in **Section 4.3.** (**The Strategic Plan**).

A vision for the dam for a period of 20 years was formulated from the key common objectives identified by the stakeholders and stands as follows:

"Conserving and promoting the biodiversity, aesthetic and cultural heritage while uplifting the socio-economy in a manner that enables sustainable benefit for all generations".

After setting both the dam's specific objectives, a research was conducted in order to provide relevant information to decision makers regarding the sustainable utilisation of the water resource and where applicable the State Land.

3.6.3 Research / Information Generation (Phase 4)

The aim of undertaking the research process was to collect the relevant data about the dam to serve as decision-making guideline tool. The report will serve as a decision-making guideline tool, guided by the objectives set for the dam and any limitations due to encumbrances. The report documents the following data as illustrated in **Figure 16**.

Figure 16: Research Data

The main aim of the research data have been described briefly in the background of the dam. The main component of the research was to identify the dam tourism development potential and also to evaluate the practicability/feasibility of the potential objectives identified.

3.6.3.1 Tourism Development Potential

SFDNR was proclaimed a nature reserve. It is therefore essential to consider the purpose and objectives of a protected area prior to allowing provision for major developments around the dam. It was established to conserve the most significant areas of habitat, cultural heritage and of geological formations. However, tourism opportunities should be created which will result in socio-economic benefits.

The SFDNR is not well marketed in the area, particularly amongst local communities. The dam has a tranquil environment that can enable a variety of recreational activities. The historical and archaeological beauty of the area can also be an attraction factor for tourists to visit the dam. This dam is surrounded by mountains of the Drakensberg Range. The climate is extremely variable with daily weather patterns also fluctuating considerably.

3.6.3.2 Feasibility of Identified Potential Objectives

According to DWAF (2006), the feasibility of the proposed objectives needs to be determined in light of the local environmental conditions.**Table 13** shows the practicability of all proposed recreational objectives.

Table 13: Feasibility of Potential Recreational Objectives

KPA 1:Resource Management		
Objective	**Status Quo**	**Practicability**
• To maintain a good water quality at the dam in order to conserve the immaculate resource for recreational use as well as to ensure a healthy environment.	• The water quality of the dam is generally good and it should be maintained in order to meet the needs of the current users, while not compromising the ability of the future generation to meet their needs.	• Enforcement of all relevant environmental legislations (e.g. NWA and NEMA) at the dam can assist to improve the dam's water quality. • The components of CIWSP such as incidents management plan, should be implemented at the dam to achieve this objectives. • A management plan should be developed to address the management of wastes within the dam basin. • DWS must develop a programme for monitoring and reporting of the water quality. • Determine water monitoring sites and add these to the national grid. • Research the status of the aquatic resource and associated ecosystem, with a view of developing a comprehensive set of baseline data for future monitoring purposes.
• To eradicate alien invasive plant species and ensure non-infestation in the dam and surrounding environment.	• On the western side of the dam, there is infestation of Water Grass alien invasive plant species (*Echinochloa crus-galli*). The plant grows as a weed of waterways, swamps, wetlands and other damp habitats and disturbed sites altering successional processes and outcompeting native vegetation (Rojas-Sandoval and Acevedo-Rodríguez, 2014). • The further spreading of these species can have a detrimental effect on the ecology of the dam and the natural aesthetic of the area in general.	• Alien invasive control resides within the Working for Water (WfW) Programme of DEA as well as Land Use Management Department with Department of Agriculture, Forestry and Fisheries (DAFF). • Monitoring of wet areas should take place to ensure that the *Echinochloa crus-galli* species does not re-infest after eradication.

• To eradicate and monitor the alien fish population within the dam.	• There are alien fish such as Large and Smallmouth Black Bass and Carp in the dam. The occurrence of alien fish species will threaten indigenous fish population, resulting mainly from predation by largemouth bass and carp.	• A management strategy is needed to monitor and manage the impact of alien fish species in the dam. • Methods that can assist to eliminate alien fish species can be provincial competition where fishermen are only required to catch such alien fish species. • The competition should be an ongoing routine of controlling alien fish as it is a fun activity and attracts visitors to the dam. • The caught alien fish could be donated to the nearby communties.
KPA 2: Resource Utilisation		
Objective	**Status Quo**	**Practicability**
• To provide the local communities with an easily accessible entrance to the dam.	• The local communities walk a long distance to access the dam for subsistence fishing and other recreational activities. • Community involvement is a major problem as there are several projects that were initiated by the nature reserve, however, during the implementation stage only a few attended the project meetings.	• Public access and use should be equitable, compatible and safe. • The existing gate on the North western side of the dam can be opened temporarily to provide the local communities with an easy access to the dam for subsistence fishing. • Entry fees can be levied for public access and use; however, these need to be reasonable to ensure the dam remains an affordable destination.
• To provide the local communities with an opportunity for subsistence fishing.	• Currently local communities go to the dam to fish illegally. • There was a system which was implemented by SFDNR to provide community members with an opportunity to fish at the dam and the RDP system was underutilized by the community.	• Area for subsistence fishing must be identified and formalized. • Allocate suitable fishing area on the zoning map in order to preserve the core habitats for nesting, resting, feeding and breeding of fish within the inlets. • Management authority must develop a communication signage in order to effectively inform different angling groups about the dam fishing rules.
• To establish an aquaculture/ fish farming project at the dam.	• Sterkfontein Dam is rich in fish diversity and it can accommodate the aquaculture project. • The unemployment rate in the area is very high at the moment and commercial fishing projects can assist to develop the skills of the local communities. • Aquaculture will make an important contribution to nutrition, food security, sustainable livelihoods and poverty alleviation to the local communities.	• A feasibility study must be conducted to determine the viability of aquaculture project, as well as to demarcate suitable area for such project at the dam. • Job opportunities arising should benefit all the community members and should be allocated fairly.

• To establish potential recreational developments on the dam's surrounding environment like resort, function and entertainment centres.	• The location of the dam is an ideal environment that provides an excellent opportunity to develop the recreational facilities within the area.	• Feasibility study should be undertaken to determine whether of the development of recreational facilities will be feasible in the area. • Should the design, development and operation of the public facility be outsourced, then contracts need to be obtained from local business.
KPA 3: Benefit Flow Management		
Objective	**Status Quo**	**Practicability**
• To educate the local communities about the importance of biodiversity, environment and water conservation.	• Environmental Education should be offered at the dam and surrounding communities to ensure that local schools are educated about the conservation of nature and importance of taking care of the environment.	• The management authority should develop an awareness programme based on its vision and objectives. Wherever possible this awareness programme should be implemented to ensure that all interested parties know what the dam is all about. • The awareness programme should be dynamic and adaptable for variety of audiences, and should clearly highlight the benefits of sustainable utilisation. • Awareness should also focus strongly on the dam as an open and inclusive public recreation facility. • A good relationship should be developed with existing programmes. Business in the region may already have developed corporate social responsibility programmes. • Upliftment programmes that deal with sport should ideally receive support from relevant sporting federations.
• To equip community members with the necessary skills and expertise for the eco-tourism industry.	• Some of the local community members do not have the necessary skills and expertise for recreational activities taking place at the dam. As a result the interest and use from community members is low.	• Develop a strategy on capacity building and training programmes at the dam and implement them accordingly. • Initiate, assist and participate in capacity building and training programmes targeting local communities. Programmes that can be associated with the dam (for example sport training) should be prioritised. • Operators and sporting federations should be encouraged to participate in such capacity building and training initiatives with a view of partnering with specific projects or institutions (such as schools). • Research at the dam should be encouraged and wherever possible, be supported.
• To unlock the socio-economic potential of the dam by creating employment and	• There is a high unemployment rate within the communities staying around the dam.	• Strengthen community participation and beneficiation by ensuring that the communities are involved in the planning of every projects relating to the dam.

entrepreneurship opportunities.	• Business opportunities such as enabling local people to make crafts and other artistic materials for commercial purposes can provide employment opportunities.	• Job opportunities arising should benefit all the community members and should be allocated fairly. • Contracts need to be awarded against pre-set criteria, which include environmental principles, skills transfer, commitment, intent, fees, expectations, existing entitlements, equity, employment, cost and impact. • All commercial access, use and development activities within the dam basin should be tourism and recreation related.
• To improve the dam's tourism marketing strategy as it is not well known amongst local community members.	• The dam is not well marketed in the area, particularly amongst local communities. Locals specified that they are unaware of the recreational facilities and activities that are currently taking place at the dam.	• Utilize photos of the dam, its attractive surrounding and recreational activities taking place as marketing material in local newspapers and other media. • Involve media by inviting them to the dam and afford them the opportunity to view the site, take pictures of the beautiful site of the dam and publish articles about exciting experiences they had whilst visiting the dam.

CHAPTER 4: INTEGRATED MANAGEMENT, ZONING AND INSTITUTIONAL PLANNING (PHASE 5)

The purpose of this phase is to evaluate the information obtained from previous stages to ascertain what could be achieved based on specific constraints and parameters of the various input factors such as biophysical, cultural and socio-economic, current institutional and needs of the dam users. The Integrated Resource Management Plan (IRMP) will take into account the following:

- Biophysical, Cultural and Socio-economic and User needs constraints;
- Development potential and requirements;
- Site planning and Zonation;
- Programmes and Plans that will unlock the potential of the water resource; and
- Institution options and legal aspects required to create these programmes and plans.

The IRMP is broken down into four (4) main plans namely the **Institutional Plan, Zoning Plan, Strategic Plan** and **Financial Plan** as illustrated in **Figure 17.**

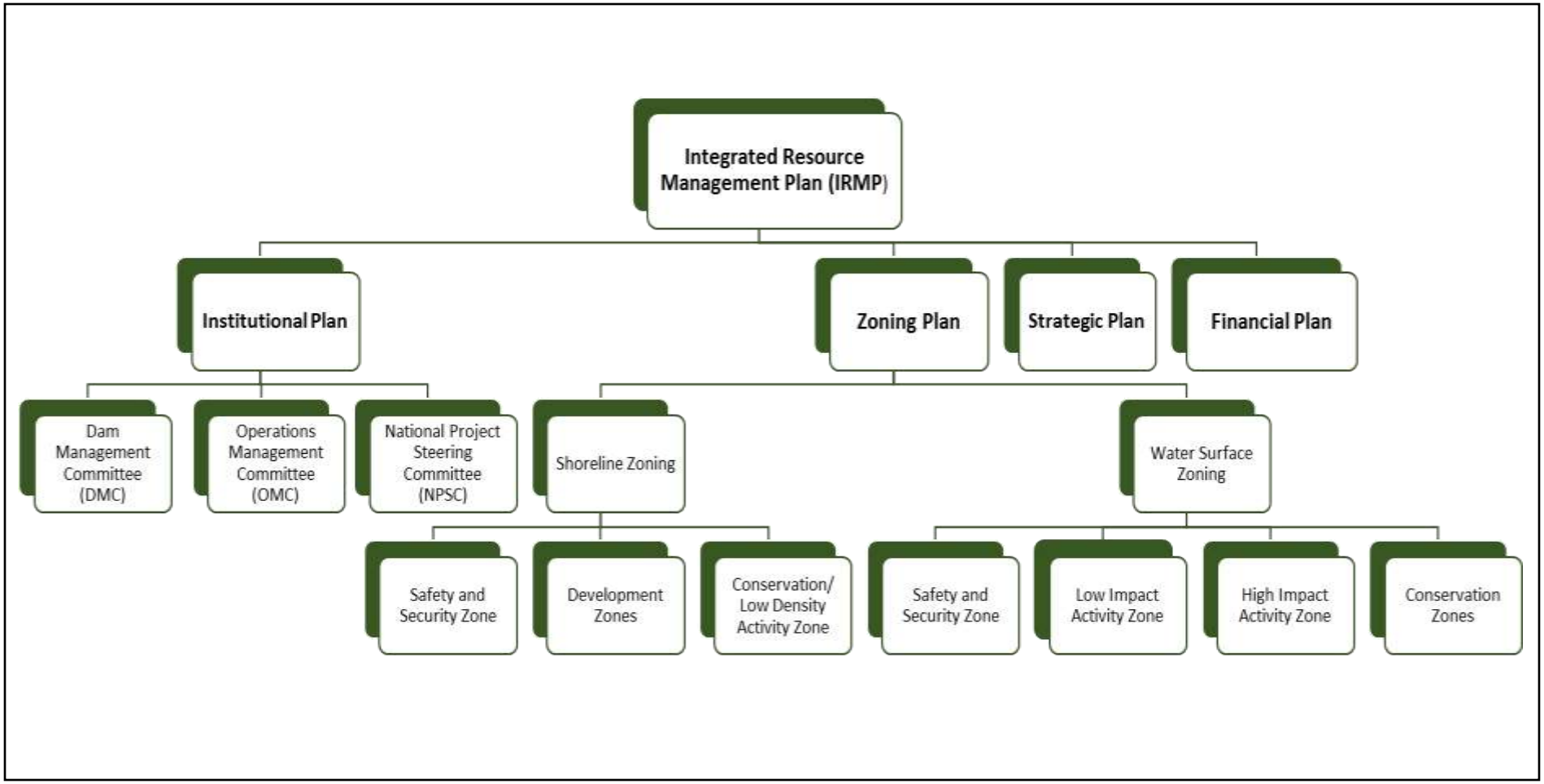

Figure 17: Integrated Resource Management Plan

4.1. INSTITUTIONAL PLAN

The Institutional Plan provides a framework for the institutional arrangements at the dam. The proposed management systems includes three (3) committees namely; Dam Management Committee (DMC), Operations Management Committee (OMC), and National Project Steering Committee (NPSC). The appointed management authorities by DWS at the dams, should also form part of the institutional structure.

4.1.1 Dam Management Committee (DMC)

DMC refers to any party that is interested or affected by the dam and will assist in raising and addressing issues relating to the dam.

One of the main functions of the DMC is to give support to Implementing Agency (IA) in the management of the dam for recreational purposes. Moreover, to assess commercial opportunities at the dam. As such, an agenda item related to the Strategic Plan for commercialization 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 must meet quarterly.

The functions of the DMC include the following (amongst others):

- Seeking resolution for general management issues;
- Monitoring the practical implementation of the RMP and BP;
- Reviewing the feedback received from I&APs;
- Operational management of recreational activities such as ensuring the floating AtoN and demarcation markers are in place and setting times for use of the dam (no recreational activities can take place between sunset and sunrise);
- Conveying the Management Objectives and decisions pertaining to the dam to the relevant stakeholders; and
- Management of the incident management system and wash bays.

Figure 18 illustrates the proposed user groups that will form part of the DMC.

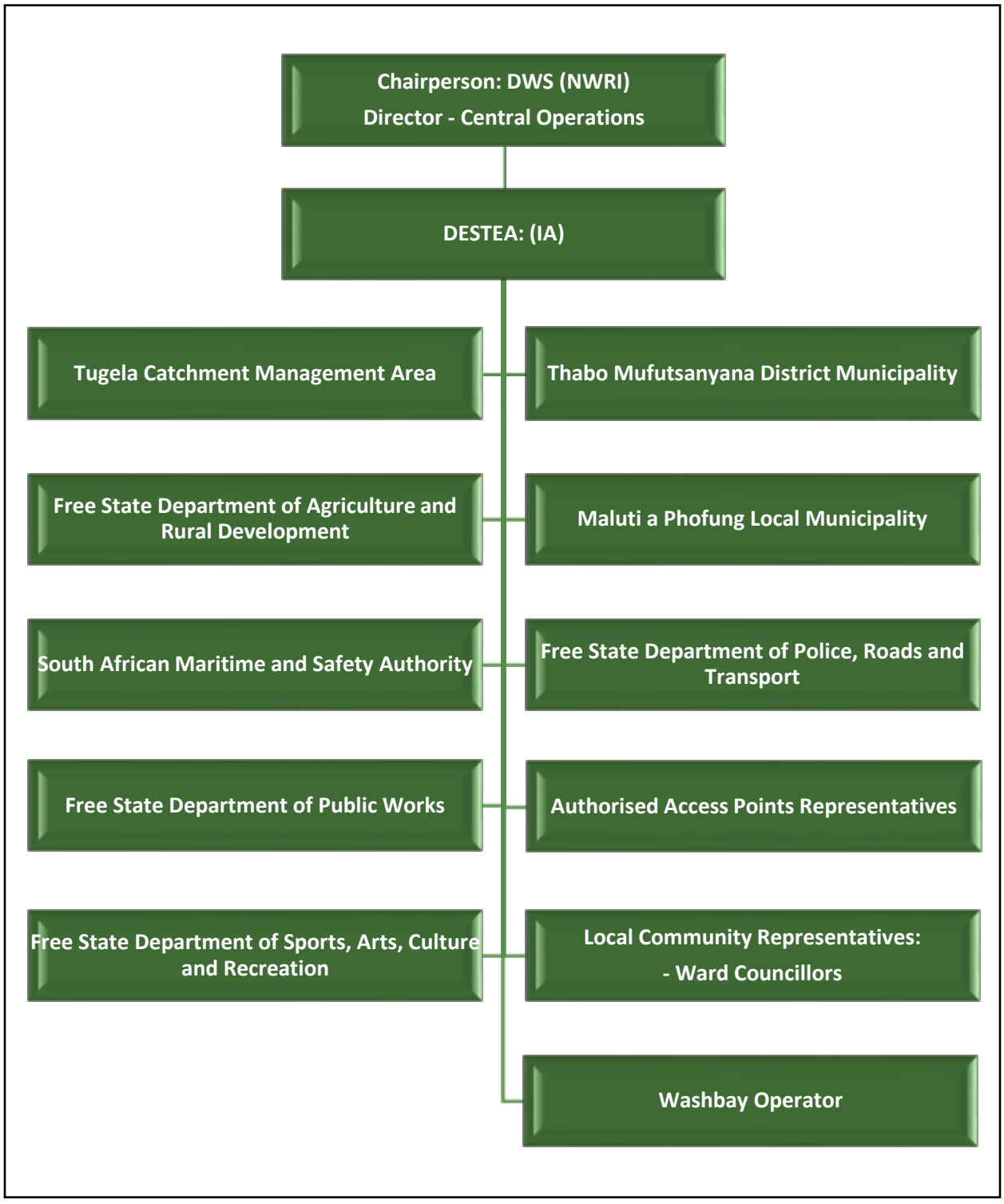

Figure 18: Proposed DMC

The DMC will have a number of management tools which will enable proper management of the dam in line with existing Legislations and Regulations requirements.

4.1.1.1 **Management Tools**

Terms of Reference

The DMC and NPSC will be guided by Terms of Reference (ToR) regarding roles and responsibilities. ToR is not required for the **OMC** as this is an existing reporting structure. The ToR provide guidance on the following management aspects:

- Roles and Responsibility of chairperson;
- Roles and Responsibilities of IA;
- Roles and Responsibilities of members;
- Minutes and attendance requirements;
- Reporting requirements;
- Management of agreements;
- Management of access objectives;
- Management of development targets;
- Management of water quality monitoring;
- Management of the control of aquatic invasive species;
- Management of development pressure;
- Management of incident management system and wash bays; and
- Management of AtoN and demarcation markers.

Agreements

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

All the existing agreements should be reviewed within the twelve (12) months of the RMP being approved. This is to ensure that the agreements are aligned with the objectives of the RMP.

Agreements between DWS and Implementing Agency (IA)

The DESTEA will be appointed as an Implementing Agency (IA) for the RMP of Sterkfontein Dam. DESTEA and DWS will sign a Memorandum of Agreement (MOA), which is a legal binding document which will outline the roles and responsibilities and conditions to be followed by both parties in terms of managing the water resource for recreational use.

The minimum requirements of an IA includes the following:

- An IA can be a government entity or public sector body identified by DWS;
- Must have the best interest of a water resource and the community at large; and
- Must be willing to work with DWS and other users of the water resource.

The IA is appointed to manage commercial and recreational use of the dam. This would include the following:

- Management of public access area;
- Management of incident management system;
- Management of community skills and training programmes;
- Management of commercial activities (in line with Treasury Requirements); and
- Management of AtoN and demarcation markers.

Regardless, all agreements should be in line with the RMP requirements and relevant Legislations and Regulations.

Recreational Use Agreements

Recreational Clubs must enter into an agreement with the IA who will be responsible for the surface water and shoreline management of the dam. All recreational use at the dam must be through an appropriate Legal Framework. However all agreements must be approved in writing by DWS and the IA. Recreational Use Agreements must be developed in line with the conditions stipulated in the agreement between

DWS and the IA. All agreements must be finalised within twelve (12) months of the RMP being gazetted.

Safety of Navigation Agreements

In addition to its common law responsibility, DWS is, in terms of the requirements described in the National Water Act, 1998 (Act No. 36 of 1998), amongst others, responsible for the safety of GWWs 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 (AtoN) for general navigation.

Agreements between SAMSA, DWS and other relevant parties or bodies are to be concluded to allow them to:

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

Access Agreements

All surface water and shoreline 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 adjacent landowners must be made aware that access to the surface water as well as shoreline 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 IA.

Event Applications

The dam is used for a number of competitive angling events as well as swimming. All events must be managed through an event application process. Permit must be applied to the IA for approval and to DWS for commenting. 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); and
- Access points to be used.

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

National Affiliations

All recreational clubs should be affiliated to a SASCOC affiliated organisation. The development targets set by the National Organisations must be met.

4.1.2 Operational Management Committee (OMC)

There is an existing Chief Director: Infrastructure Operations Management Committee (CD: IO MANCO) which comprises of all directors of four (4) operations (Northern, Southern, Eastern and Central) and is chaired by the Chief Director: Infrastructure Operations within NWRI as illustrated by **Figure 19**.

The committee should meet quarterly discussing matters relating to operations and maintenance of all GWWs. RMP must be a standard item on the agenda. Any matters relating to the RMP that are outside the scope of DWS will be escalated to the NPSC.

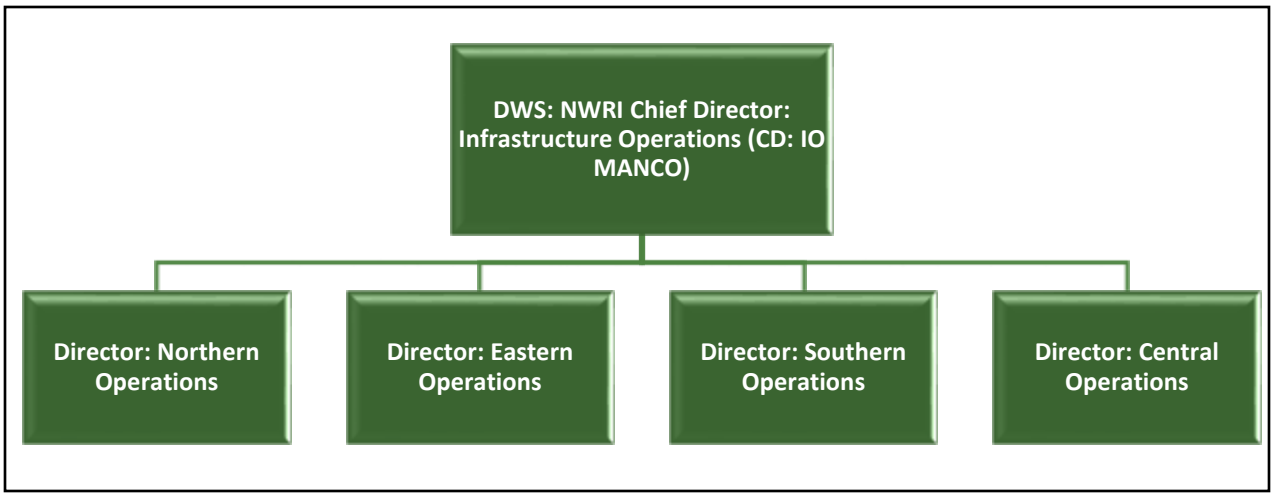

Figure 19: Existing CD: IO MANCO

4.1.3 National Project Steering Committee (NPSC)

NPSC is formed by DWS and is made up of representatives from National Government Departments and Implementing Agencies that are relevant in terms of managing the water resource.

The primary function of the NPSC is to provide guidance on recreational water use in terms of their respective mandates as well as to ensure that continuous support by different Government Sectors is provided to the dam with the aim of achieving sustainable utilisation of the dam for recreational purposes. The NPSC should meet twice a year. **Figure 20** illustrates a typical example of Governmental Departments that will form part of the NPSC:

Figure 20: Proposed NPSC

The role of the relevant departments forming part of the NPSC is listed below:

Centre for Public Service Innovation (CPSI):
The CPSI is supporting a multi-departmental working group that is developing an innovative approach to inland water and safety integrity. The project, was initiated out of the need to find an innovative, practical and cost-effective way to implement SAMSA' vessel safety regulations on inland waterways and to implement responsible water use within the broader socio-economic context of the country.

The CIWSP is a project piloted by CPSI that is a partnership between multiple Government entities and between the Government and communities. The main aim of the project is to enhance the development of a best practice model to ensure safe and structured inland maritime environment and culture, whilst protecting the country's precious water resource.

Culture, Arts, Tourism, Hospitality, Sport Sector, Education and Training Authority (CATHSSETA):
CATHSSETA deals with the approval and financing of training relating to culture, hospitality, tourism and sport sectors.

Department of Agriculture, Forestry and Fisheries (DAFF):
The purpose of DAFF includes sustainable development and management of resources to maximizing the economic potential of the fisheries sector while protecting the integrity and quality of the country's aquatic ecosystems.

Operation Phakisa expansion to inland dams is one of DAFF initiative aimed at unlocking economic potential of fisheries sector within the inland water. The latter programme will be used as benchmark for implementation of conservation policies while implementing job creation within fishery and fish processing market.

Department of Corporative Governance and Traditional Affairs (CoGTA):
Its function is to develop national policies and legislation with regard to Provinces and Local government, and to monitor their implementation. Other function of the Department is to support Provinces and Local Government in fulfilling their constitutional and legal obligations.

Department of Environmental Affairs (DEA):
DEA is mandated to give effect to the right of citizens to an environment that is not harmful to their health or wellbeing, and to have the environment protected for the benefit of present and future generations. In relation to the RMP, the Department should ensure that Environmental Impact Assessments is undertaken for all activities that triggers EIA Regulations at the dam. Furthermore, DEA through WfW programme can assist to eradicate alien invasive plants species (Blue Gums and Parrot Furthers) and alien invasive fish species at the dam.

Department of Public Works (DPW):
DPW has the power to regulate and control the use of state land outside the GWWs. In this regard, lease agreements or permits will be required from the Department as some of the recreational activities will overlap into the State Land, e.g trail running, biking and running.

Department of Rural Development and Land Reform (DRDLR):
The Department is tasked with the facilitation of land claims within the country. They are also involved in rural development by improving both economic infrastructure (such as roads, etc.) and social infrastructure (e.g. communal sanitation and non-farming activities).

Department of Sports and Recreation (DSR):
The Department is mandated to promote and develop sport and recreation activities and also in co-ordination of the relationships between the Sports Commission, national and recreation federations and other agencies.

Department of Tourism (NDT):
The Department is mandated to create conditions for the sustainable growth and development of tourism in South Africa. The Tourism Act makes provision for the promotion of tourism to and in the Republic and for regulation and rationalisation of the tourism sector, including measures aimed at the enhancement and maintenance of the standards of facilities and services utilised by tourists; and the co-ordination and rationalisation of the activities of those who are active in the tourism sector.

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 small vessels and inland waterways.

Department of Water and Sanitation (DWS):
DWS through the National Water Act, 1998 (Act No. 36 of 1998) is mandated to protect aquatic and associated ecosystems and their biological diversity as well as to reduce degradation of the water resources. As part of its mandate, DWS initiated the development of RMPs together with the supporting BPs with the aim of ensuring sustainable and equitable development, utilisation and management of GWWs.

National Treasury (NT):
The Department is mandated to support the optimal allocation and utilisation of financial resources in all spheres of government. As part of the RMP, The National Treasury Public Private Partnership (PPP) Toolkit for Tourism (2005), will assist the process of tourism-based businesses development on State-owned Land. The Toolkit make it easier for Institutions and the Private Sector to enter into tourism related partnerships on State Property managed by National, Provincial and Local Government Institutions.

South African Maritime Safety Authority (SAMSA):
Administers and executes maritime related legislation and regulations, including the National Small Vessel Safety Regulations and ensures standardisation, harmonisation and compliance of all AtoN in South African waters.

South African Police Service (SAPS):
The South African Police Service have been entrusted with the responsibility of creating a safe and secure environment for all people in South Africa as well as to prevent anything that may threaten the safety or security of any community.

South African Sports Confederation and Olympic Committee (SASCOC):
SASCOC is mandated to promote and develop high performance of sports as well as to act as a controlling body for sports in South Africa. It can also assist to coordinate organise events at the dam.

4.2. ZONING PLAN

According to DWAF RMP Guideline RWU GP2 (2006), a site specific master planning and zoning which describes a framework for the allocation of zones needs to be undertaken based on the results of the Encumbrance Survey and basic Research regarding the Bio-physical, Social and Cultural environment as well as the objectives set by the Stakeholders (refer to **3.6**).

The proposed Zoning Plan will integrate conservation, recreation and development whilst not retarding the primary functions of the dam.

4.2.1 Water Surface Zoning

The water surface zoning provides guidance on permissible and non-permissible recreational activities on the water surface taking into account the biophysical factors of the dam. The Water Surface is zoned as follows:

Safety and Security Zone:

It covers a minimum of 100m area from the wall and outlet works indicated by demarcation markers and AtoN. This area is reserved for DWS management purposes.

Management of this zone is aimed at protecting the dam wall and outlet works, as well as to ensure the safety of the public. This is a no-go zone to the public unless authorised.

Conservation Zones:

The aim of this zone is to conserve and protect sensitive aquatic habitation at the inlet(s) of the dam. According to Section 12 and 26 of NWA, the existence of these zones is thus not negotiable as it is imperative to protect the water resource for the purposes relating to basic human needs, environmental sustainability and water quality requirements. Access to these areas is generally not allowed due to the following:

- The areas intercept sediments and nutrients/pollutants which pose safety risks to the public due to muddy clay, and
- They are used by aquatic birds and fish species as habitat, refuge and breeding areas.

Low Impact Activity Zone:

This zone act as a buffer between High Impact Activity Zones and Conservation Zones. Low Impact Activity Zone allows for low intensity activities, i.e. activities associated with little or no wake such as wind surfing, kayaking, swimming, rowing, sailing, paddle boating, float tubes, canoeing, angling, yachting, aquaculture and small scale fisheries.

High Impact Activity Zone:

This zone has the largest water surface area and is located where the reservoir is at its deepest. It caters for high impact activities associated with high speed, wake and noise activities such as motorised boating, house boating, water skiing, and para-sailing.

The water surface zoning colour coding means the following:

Colour	Zone Description
Red	Safety and Security Zone
Green	Conservation Zone
Sky Blue	Low Impact Activity Zone
Dark Blue	High Impact Activity Zone

Table 14: Proposed Water Surface Zoning Description

Zone Name	Permissible Activities	Non-Permissible Activities	Recommendation
• Conservation Zone	• Access is limited to conservation and research team.	• Public activities (to prevent aquatic habitats disturbance)	• Area should be demarcated by AtoN/ Demarcation Markers. • Strict management and control of these areas, especially with regards to illegal fishing and dumping. • No vessels may be launched anywhere in this area.
• Low Impact Activity Zone	• Angling • Sailing • Canoeing	• Motorised boating • House boats • Swimming • Beaching	• Area should be demarcated by AtoN/ Demarcation Markers. • The area will allow limited access to visitors and is aimed at given a more wilderness like experience to the user. • Launching and parking bay of vessels should take place at identified waterfront zones. • The area may be closed to visitors during certain times of the year.
• High Impact Activity Zone	• Power boats • House boats • Wind surfing • Swimming	• Jet skiis	• Area should be demarcated by AtoN/ Demarcation Markers. • No speeding of vessels within 70m from the shoreline will be permitted. • Cage culture require deep water therefore it can elongate to this zone. • Terrestrial infrastructure will service this zone.

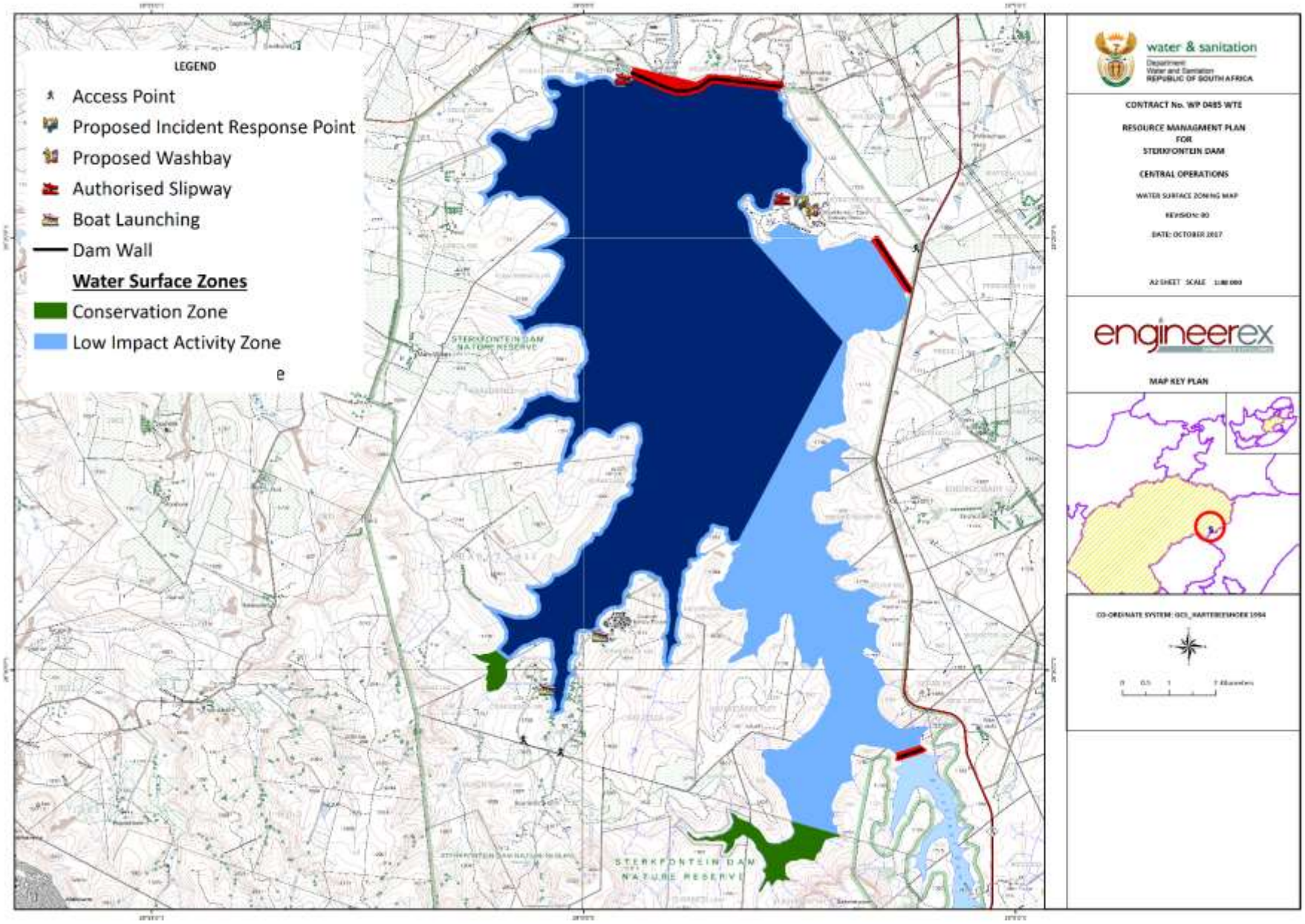

Figure 21: Proposed Water Surface Zoning Map

4.2.2 Shoreline Zoning[2]

In addition to the water surface zoning, an integral part of the RMP is also shoreline zoning, which provides guidance on what recreational activities (if any) are permissible and not permissible on the land adjacent to the dam (DWS purchased boundary). The management zones includes:

Safety and Security Zone (dam wall and associated DWS infrastructure):

It is applicable to the area surrounding the dam wall and the outlet works. The extent of this zone is determined by DWS and shall not be less than 100m from the dam wall and downstream. This area is reserved for DWS management purposes.

Management of this zone is aimed at protecting the dam wall and outlet works, as well as to ensure the safety of the public and surrounding areas. This is a no-go zone to the public unless authorised.

Conservation / Low Density Activity Zone:

This zone consists of ecologically sensitive areas and areas with high biodiversity. It also includes the area around the inlets of the dam. Access to this area is limited to low impact activities such as hiking, bird watching, etc. This area is reserved to prevent ecological damage due to development activities hence high impact development not permitted.

Medium Density Activity Zone:

This area is reserved for small scale activities such as day visitors, picnic areas, shoreline fishing, camping (tent and caravan), braai facilities, swimming pools, ablution facilities and infrastructure for services.

High Density Activity Zone:

This area is reserved for large scale activities including chalets, recreational club houses, infrastructure for services, and Land Based Aquaculture.

Community Resource Zone:

This zone is for the sole beneficiation of the local communities in ensuring that their livelihood is maintained and improved. Activities include subsistence fishing, livestock watering points, small scale community gardens, etc.

The shoreline zoning colour coding means the following:

Colour	Zone Description
Red	Safety and Security Zone
Green	Conservation/ Low Density Activity Zone
Yellow	Medium Density Activity Zone
Orange	High Density Activity Zone
Brown	Community Resource Zone

[2] Permanent structures within the purchase line are not allowed. All developments should be outside 1:100 year floodline.

Table 15: Proposed Shoreline Zoning Description

Zone Name	Permissible Activities	Non-Permissible Activities	Recommendation
• Safety and Security Zone	• Fire management • Alien invasive species clearing • Management of dam infrastructure • Management and maintenance activities by DWS and authorised personnel	• Public access	• A minimum area of 100m wide downstream the dam wall should be demarcated preventing public access and use.
• Conservation Zone/ Low Density Activity Zone	• Conservation • Environmental Education • Research • Hiking • Game	• Developments • Motorised access	• These zone should control access to ecological sensitive areas. • No mechanised access except for management purposes. • Game viewing is done only under controlled conditions
• Medium Density and Activity Zone	• Camping • Picnicking • Bank angling • Launching jetties for boats • Infrastructure for Services • Ablution facilities • Guided / unguided hiking tours • 4x4 routes (sensitively planned and dictated by topography) • vehicular access routes to facilities serving Remote and Wilderness zones • Horse trails. • Parking areas	• Permanent structures • Wash bays • Mixed use land developments	• The management of this area should follow PPP process in terms of the National Treasury. • All developments must be approved by DESTEA (IA). • Requirements of NWA and NEMA must be taken into account in all developments. • Camping and picnicking is allowed only in designated areas. • Noise levels to be kept at a minimum. • No littering at Camping and Picnic spots.
• High Density Activity Zone	• Infrastructure for services • Boat launching • Bank angling • Picnicking • Chalets • Camping • Ablutions, Lapas and Braai facilities • Wash bay	• Permanent structures • Motor bikes	• The management of this area should follow PPP process in terms of the National Treasury • All developments must be approved by IA. • Requirements of NWA and NEMA must be taken into account in all developments. • Noise levels to be kept at a minimum. • No private slipways to be built without approval from DWS.

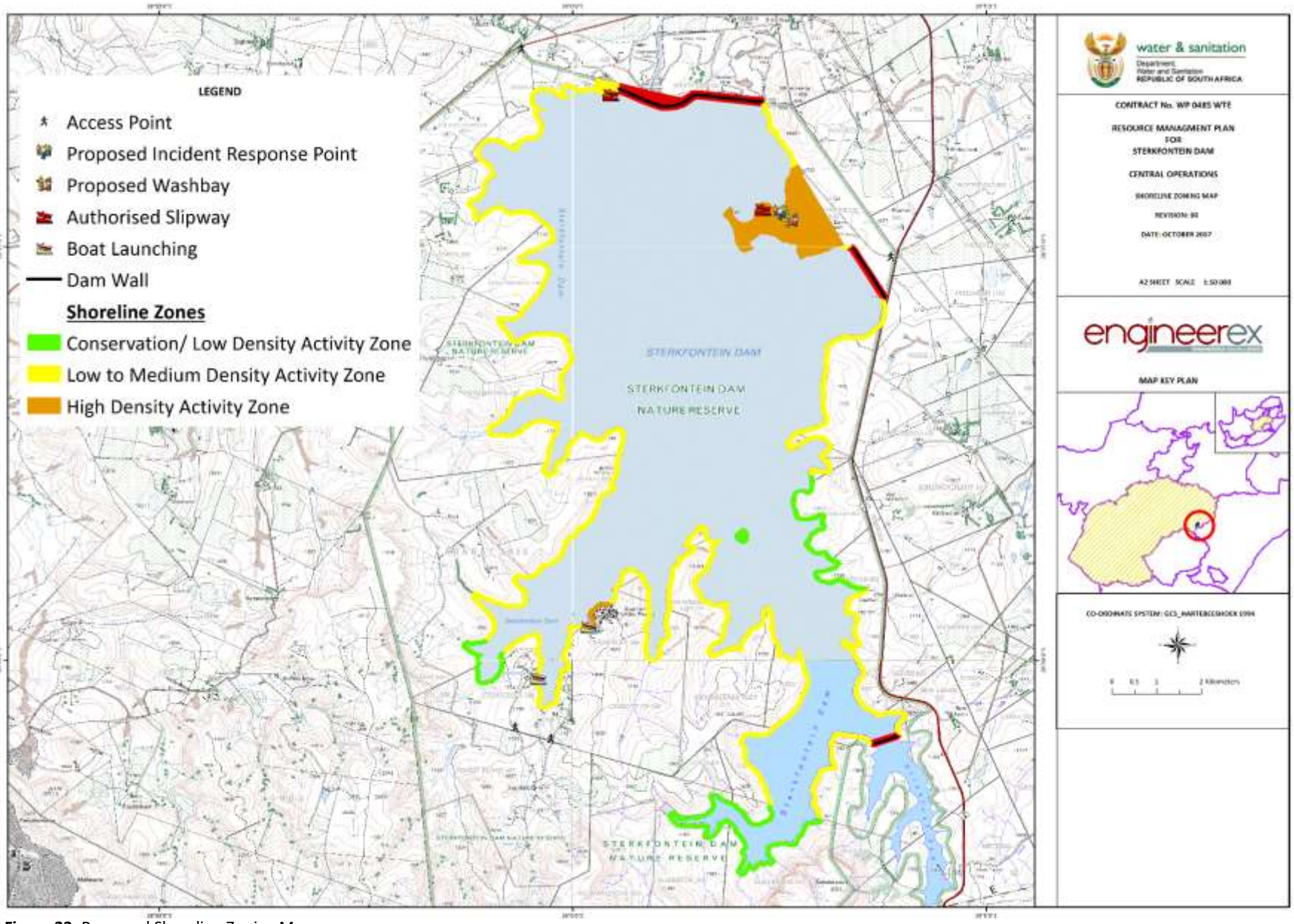

Figure 22: Proposed Shoreline Zoning Map

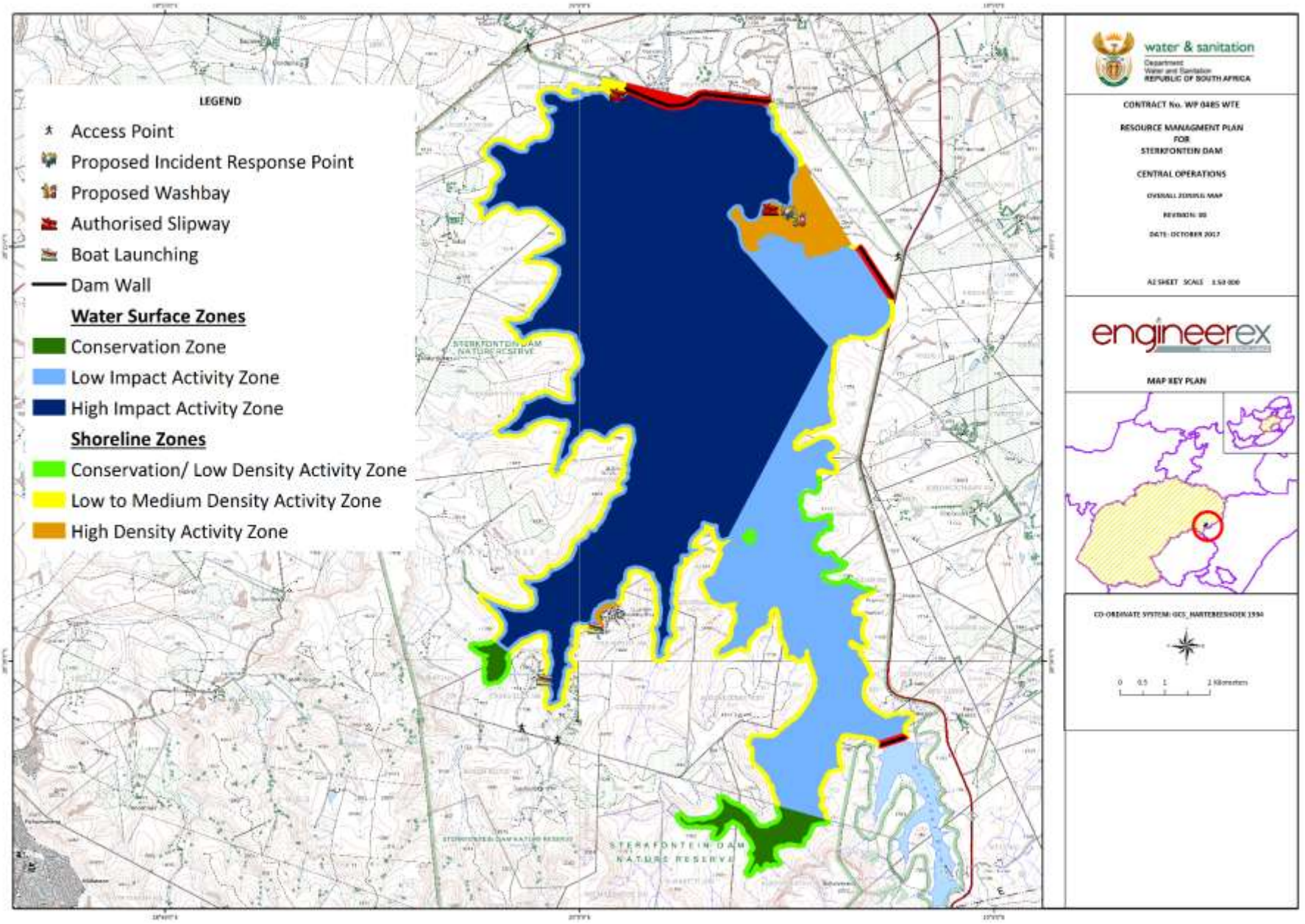

Figure 23: Proposed Overall Zoning Map

4.2.3 Carrying Capacity

In order to determine the degree or possible recreational use on the water surface, the Methodology for Carrying Capacity Assessment: (DWS, RWU. 2003) was used as guideline to determine the level of activities that would be sustainable at Sterkfontein Dam.

Carrying capacity for recreation provides a guideline to ensure that recreation at the dam is safe, that users do not feel crowded and that they enjoy the use of the dam for leisure activities.

There are three kinds of carrying capacity:

- **Physical Carrying Capacity** (PCC) – this is the maximum number of users that can physically fit onto the water surface at any given time;
- **Real Carrying Capacity** (RCC) – this is the maximum number of users that can use the resource once corrective factors that are unique to the dam are taken into account; and
- **Effective** (or permissible) **Carrying Capacity** (ECC) – this is the number of visitors that can use the resource, given the management capacity.

Each level constitutes a corrected capacity level of the preceding level. The PCC is always greater than the RCC, and the RCC is greater than the ECC, thus: **PCC > RCC and RCC ≥ ECC.**

The process of establishing the carrying capacity is normally determined through the following tasks:

- Analysis of recreation and water resource management policies;
- Analysis of objectives of the water resource;
- Analysis of current recreational water use;
- Definition, strengthening or modification of policies regarding recreational water use management;
- Identification of factors influencing recreational water use; and
- Determination of the recreational water use carrying capacity.

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 available for public use: **6 937ha.**

The **U/A =** There is a range of literature regarding the area required for different recreational users.

The **U/A** used for the assessment is as follows:

Craft	U/A (ha/craft)
Sailing	5.0
Angling boat	3.0
Canoe	1.0
Power Boat	4.0
Wind surfing	2.0
House Boat	5.0
Average	**3.3**

Based on the fact that most activities do not require much space, the average hectare per user is 3.30 ha (33 000 m^2), the value of 5.0 ha (50 000 m^2) can be acceptable area per user. This has been chosen in order to ensure that the dam is not overcrowded, as such impacting on the sense of the area.

The PCC for Sterkfontein Dam can further be calculated as:

PCC = A ÷ U/a x Rf
=6937 x 1/5 x 1
= 1387 crafts

Real Carrying Capacity (RCC)

The RCC takes factors into account that limits recreation. The limiting factors include:

Conservation areas (0.5 ha) and safety and security zones (32 ha).

The above factors results in 32.5 % decrease in water surface available for recreation at the dam,

therefore 67.5% of the surface area of the dam is still available for recreation.

RCC for Sterkfontein Dam is therefore:

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

Where **Cf** = a corrective factor expressed as a percentage.

RCC = 1387 x (100 – 32.5)%/100
=936 crafts

Effective Carrying Capacity

The maximum number of visitors that a site can sustain, given the management capacity (MC) available. Currently there is no formal recreational management structure in place, as such the ECC is 0. The ECC will be calculated after the proposed Institutional structure (as part of the RMP) have been established in order to manage the sustainable utilization of the dam for recreational purposes.

4.3. STRATEGIC PLAN

The Strategic Plan is informed by the objectives identified by stakeholders and through research on potential opportunities at the dam. The objectives are broken down into management fields which are listed below in a format offering ease of reference:

- Objective (What do we want?);
- Motivation (Why do we want to achieve this?);
- Action Projects (How do we achieve this?); and
- Management Support (Who will be involved?).

In **Table 16 - 18**, the Strategic Plan on how to achieve the identified objectives identified regarding the dam is outlined.

Table 16: Strategic Plan for KPA 1: Resource Management

KPA 1: Resource Management			
Objective (What do we want)	**Motivation (Why do we want to achieve this)**	**Action Projects (How do we achieve this)**	**Management Support (Who will be involved)**
Water Quality: • To maintain a good water quality at the dam in order to conserve the immaculate resource for recreational use as well as to ensure a healthy environment.	• The water quality of the dam is generally good and it should be maintained in order to meet the needs of the current users, while not compromising the ability of the future generation to meet their needs.	• Enforcement of all relevant environmental legislations [e.g. National Water Act (NWA) and National Environmental Management Act (NEMA)] at the dam can assist to improve the dam's water quality. • The components of Co-operative Inland Waterways Safety Programme (CIWSP) should be implemented at the dam to achieve this objective. • DWS must develop a programme for monitoring and reporting of the water quality.	• DESTEA (IA) • DWS • TMDM • MAPLM
Alien Invasive Species: • To eradicate alien invasive plant species and ensure non-infestation in the dam and surrounding environment.	• On the western side of the dam, there is infestation of Water Grass alien invasive plant species (*Echinochloa crus-galli*). The plant grows as a weed of waterways, swamps, wetlands and other damp habitats and disturbed sites altering successional processes and outcompeting native vegetation (Rojas-Sandoval and Acevedo-Rodríguez, 2014). • According to SDNR IMP, alien plant species have been planted or have established themselves within SFDNR over time.	• Remove all aquatic alien invasive vegetation within the purchased boundary and the surrounding adjacent area. Manual removal is more environmental friendly and can also create jobs for people. Some of the resort owners are taking out hyacinth on a continuous basis. • A cable to catch the hyacinths at the inflow can help to prevent the spreading of the plant into the dam. • Nature Reserve residents are to be encouraged to plant indigenous plants in demarcated gardens • Rehabilitate areas infested with invasive alien vegetation with suitable plants species indigenous to the SFDNR and surrounds. • Monitoring of wet areas should take place to ensure that the Echinochloa crus-galli species does not re-infest after eradication.	• DEA • DESTEA • DMC

KPA 1: Resource Management			
Objective (What do we want)	**Motivation (Why do we want to achieve this)**	**Action Projects (How do we achieve this)**	**Management Support (Who will be involved)**
		• State poverty relief programs such as 'Landcare', 'Working for Water', ''Working on Fire' and 'Working for Wetlands" should be used to full effect to complement the Nature Reserve budget for this management task. • Develop an inspection and cleaning mechanism (Wash bay) to ensure that vessels entering the dam do not contaminate it with alien vegetation.	
Alien Fish Species: • To eradicate and monitor the alien fish population within the dam.	• There are alien fish such as Large and Smallmouth Black Bass and Carp in the dam. The occurrence of alien fish species will threaten Indigenous fish population, resulting mainly from predation by largemouth bass and carp.	• A management strategy is needed to monitor and manage the impact of alien fish species in the dam. • Methods that can assist to eliminate alien fish species can be provincial competition where fishermen are only required to catch alien fish species. • The competition should be an ongoing routine of controlling alien fish as it is a fun activity and attracts visitors to the dam. • The caught alien fish must be donated to the nearby communties.	• DEA • DESTEA (IA) • DMC

Table 17: Strategic Plan for KPA 2: Resource Utilisation

KPA 2 : Resource Utilisation			
Objective (What do we want)	**Motivation (Why do we want to achieve this)**	**Action Projects (How do we achieve this)**	**Management Support (Who will be involved)**
Access Control: • To provide the local communities with an easily accessible entrance to the dam.	• The local communities walk a long distance to access the dam for subsistence fishing and other recreational activities. • Community involvement is a major problem as there are several projects that were initiated by the nature reserve, however, during the implementation stage only a few attended the project meetings.	• Public access and use should be equitable, compatible and safe. • The existing gate on the North western side of the dam can be opened temporarily to provide the local communities with an easy access to the dam for subsistence fishing. • Entry fees can be levied for public access and use; however, these need to be reasonable to ensure the dam remains an affordable destination.	• DESTEA • DWS • DMC
Subsistence Fishing: • To provide the local communities with an opportunity for subsistence fishing.	• Currently, local communities go to the dam to fish illegally. • There was a system which was implemented by SFDNR to provide community members with an opportunity to fish at the dam and that RDP system was underutilized by the community.	• Permits (fishing licence) must be acquired and the use of gill nets must be prevented, as it has significant negative impact on fish population within the dam. • Educate people on fishing methods that are safe and sustainable. • Preserve the core habitats for nesting, resting, feeding and breeding of fish within the inlets, by demarcating areas for subsistence fishing and by installing demarcation markers. • Management authority or DWS must develop a communication signage in order to effectively inform different angling groups about the dam fishing rules. • Appoint safety officers that will monitor compliance of the dam fishing rules.	• DESTEA • DMC • Frees State Department of Agriculture and Rural Development (FSDARD) • Other relevant conservation Non-Governmental Organisations (NGOs) within the Harrismith area.

KPA 2 : Resource Utilisation			
Objective (What do we want)	**Motivation (Why do we want to achieve this)**	**Action Projects (How do we achieve this)**	**Management Support (Who will be involved)**
Aquaculture: • To establish an aquaculture/ fish farming project at the dam.	• Sterkfontein Dam has a large capacity and it can accommodate the aquaculture project. • The unemployment rate in the area is very high at the moment and commercial fishing projects can assist to develop the skills of the local communities. • Aquaculture will make an important contribution to nutrition, food security, sustainable livelihoods and poverty alleviation to the local communities.	• A feasibility study must be conducted to determine the viability of aquaculture project, as well as to demarcate suitable area for such project at the dam. • Job opportunities arising should benefit all the community members and should be allocated fairly.	• North-West University (NWU) • FSDARD • DESTEA • DWS • MAPLM • Other relevant authorities
Tourism Development: • To establish potential recreational developments on the dam's surrounding environment like resort, function and entertainment centres.	• The location of the dam is an ideal environment that provides an excellent opportunity to develop the recreational facilities within the area.	• Feasibility study should be undertaken to determine whether of the development of recreational facilities will be feasible in the area. • Should the design, development and operation of the public facility be outsourced, then contracts need to be obtained from local business.	• DESTEA (IA) • DMC • MAPLM
Marketing: • To improve the dam's tourism marketing strategy as it is not well known amongst local community members and other tourists.	• The dam is not well marketed in the area, particularly amongst local communities. Locals specified that they are unaware of the recreational facilities and activities that are currently taking place at the dam.	• Utilize photos of the dam, its attractive surrounding and recreational activities taking place as marketing material in local newspapers and other media. • Involve media by inviting them to the dam and afford them the opportunity to view the site, take pictures of the beautiful site of the dam and publish articles about exciting experiences they had whilst visiting the dam.	• DESTEA (IA) • DMC.

Table 18: Strategic Plan for KPA 3: Benefit Flow Management

KPA 3: Benefit Flow Management			
Objective (What do we want)	**Motivation (Why do we want to achieve this)**	**Action Projects (How do we achieve this)**	**Management Support (Who will be involved)**
Environmental Awareness: • To educate the local communities about the importance of biodiversity, environment and water conservation.	• Environmental Education should be offered at the dam and surrounding communities to ensure that local schools are educated about the conservation of nature and importance of taking care of the environment.	• The management authority should develop an awareness programme, which clearly highlight the benefits of sustainable utilisation. Wherever possible, the awareness programme should focus strongly on the dam as an open and inclusive public recreation facility • Academic research at the dam should be encouraged and wherever possible, supported.	• SFDNR parks forum • Maloti Drakensburg Transfonteir Programme • MAPLM
Community Participation and Beneficiation • Uplift the local economy and increase benefit flows to the surrounding communities through community empowerment.	• Tourism sector have been identified as a vehicle for skills development, job creation, Broad-based Black Economic Empowerment (BBBEE), etc. it is imperative that the Local Communities derive benefits from recreational activities conducted at the dam. • Some of the local community members are not aware of what the dam can offer, as a result the interest and use from community members is low.	• Implement Skills Development Programmes where opportunities exist. • Upliftment programmes that deal with sport should ideally receive support from relevant sporting federations. • Priority should be given to the local community if any job opportunities arises. • Contracts need to be awarded against pre-set criteria, which include environmental principles, skills transfer, commitment, intent, fees, expectations, existing entitlements, equity, employment, cost and impact. • All commercial access, use and development activities within the dam basin should be tourism and recreation related.	• DESTEA • DMC • MAPLM • TMDM • NGOs • South African Sports Confederation and Olympic Committee (SASCOC)

4.4 FINANCIAL PLAN

The RMP provides guidance on cost recovery mechanisms to ensure the sustained and improved management of the dam. There are opportunities for PPPs which could further unlock the economic potential of the dam. PPPs allows for DWS to make State Assets such as GWWs available to private parties who wish to engage in tourism related commercial operations (DWAF, 2009). PPPs should be established as per Regulation 16 of the National Treasury.

The dam is a State asset and as such all profits generated from the recreational use, should also be used to further develop the dam. The public should not be denied access to the dam. All fees associated with the usage of the dam for recreation should take into account the socio-economic status of the users. The access fees should make a provision for equitable access.

A more detailed Financial Plan (FP) is contained in the Business Plan (BP) (volume 5 of 5), which will facilitate the implementation of the RMP by providing implementation program cost estimate for all possible economic recreational activities.

The information acquired from the RMP will be used to produce the BP based on the action projects for each objective as stipulated under the Strategic Plan. However, many of the identified objectives are not of commercial nature and as such these non-economic objectives will not feature in the BP.

The BP provides a good description of possible economic recreational activities and the methods that can be used or enhanced to achieve the ultimate vision and the key objectives of Sterkfontein Dam RMP. It also describes the financial management and operational requirements to implement the Objectives of the RMP

WAY FORWARD

Once the RMP and its BP are approved by the Minister of Water and Sanitation, it will be published in the Government Gazette as a regulation in terms of Section 26 of the NWA.

Review of RMP

According to DWAF (2006), the RMP is reviewed and updated every five (5) years to ensure that the management objectives remains relevant and management actions are continually improved. The BP is updated annually. **Figure 24** illustrates the RMP & BP review framework.

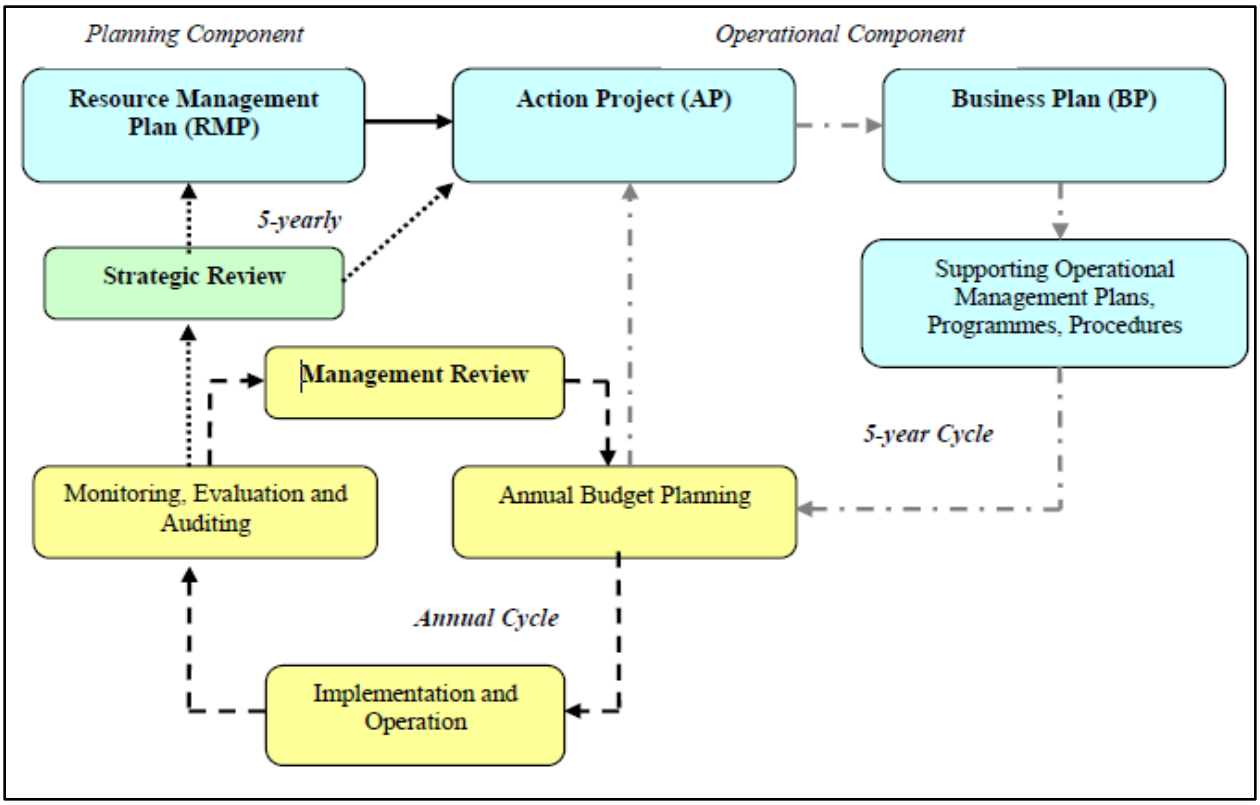

Figure 24: RMP and BP Review Framework

CONCLUSION

The RMP documents the challenges that exists within the Sterkfontein Dam that can significantly impact on the utilisation and management of the dam and it's surrounding for recreational purposes. Such factors include legal, biophysical, socio-economic, hydrological as well as access to the resource. These factors will assist DWS with the most appropriate approach to ascertain that the issues are addressed before the implementation of the RMP.

The RMP will assist in effectively managing the dam and its surrounding environment. Furthermore its function is to implement an **Institutional Plan** for the effective management of dam. The focus on Institutional Plan is accompanied by a **Zonal Plan** which provides guidance on potential activities that are allowed on the dam, together with a **Strategic Plan**. In addition, a **Financial Plan** will provide guidance on funding requirements and funding options to implement the objectives of the RMP.

Furthermore the RMP promotes community participation and beneficiation, through Stakeholders engagement which were conducted to obtain common key objectives to be met by the RMP. The vision for the dam was formulated from the key common objectives identified by Stakeholders. Based on the strategic objectives identified for Sterkfontein Dam, a BP has been developed to describe a manner in which the potential recreational activities are to be financially resourced. Furthermore, by including the RMP in the Local Initiatives such as IDPs, LED, etc, can ensure effective co-operative governance as well as to provide necessary support with regards to the use of the dam for recreational purposes. Undertaken in this manner, it is believed that the potential of the water resource can be optimally unlocked in a sustainable and equitable manner.

REFERENCES

Animal Demography Unit., PHOWN Virtual Museum, viewed 12 September 2016, from http://vmus.adu.org.za/vm=PHOWN

Animal Demography Unit., Reptile MAP Virtual Museum, viewed 12 September 2016, from http://vmus.adu.org.za/vm=ReptileMAP

Barnes K. (ed.)., 2014, Important Bird Areas. BirdlifeSA, South Africa.

David Weaver., 2016, The Complete Fly Fisherman, Maluti Flyfishing, viewed 29 September 2016, from http://www.fosaf.org.za/documents/Guide_to_Sterkfontein.pdf

Department of Environmental Affairs., 1996, Volume 2: South African Water Quality Guidelines, Recreational Use, South Africa.

Department of Water Affairs and Forestry., 2001, Generic Public Participation Guideline.

Department of Water Affairs and Forestry., 2006, Guidelines for the Compilation of Resource Management Plans, Guideline Program 2 - Recreational Water Use.

Department of Water Affairs., 2013, Water Resource Information Management Status Monitoring & Surface Water Level Trends, South Africa.

Department of Water Affairs., 2015, List of registered dams. South Africa

Duncan Heard., 2007. Sterkfontein Dam Nature Reserve: Integrated Management Plan (2008-2012): Free State Provincial Government, Department of Tourism, Environmental and Economic Affairs (DTEEA), Bloemfontein, South Africa.

Leon., 2013 Orange Vaal River Yellowfish Conservation and Management Association Newsletter No. 3

Michael F. Bates, William R. Branch, Aaron M. Bauer, Marius Burger, Johan Marais, Graham J. Alexander & Marienne S. de Villiers., 2014, Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. 2014, SANBI, Pretoria.

ORG, C. D. (2016, 11 12). https://en.climate-data.org/. Retrieved from Climate- Rustenburg: https://en.climate-data.org/location/646/.

Rojas Julissa –Sandoval., 2014, Department of Botany-Smithsonian NMNH, Washington DC, USA.

South African National Biodiversity Institute., BGIS, viewed 30 July 2014, from – http:bgis.sanbi.org/vegmap/map2006.asp

Statistics South Africa, 2011. Census. Statistical Release.

Water Research Commission., 1998, Volume 1: Assessment Guide, Quality of Domestic Water Supplies, WRC Report No. TT101/98 Second Edition, South Africa.

APPENDICES