









DEPARTMENT OF WATER AFFAIRS

Situational Analysis, GAP Analysis, Action Plan and Stakeholder Engagement for Phase 1 of the Moreleta Spruit Adopt-a-River Project

Submitted to:

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LIST OF ACRONYMS

Acronym	Meaning
BID	Background Information Document
CA	Competent Authority
CoT	City of Tshwane
CSIR	Council for Scientific and Industrial Research
DWA	Department of Water Affairs
FRAI	Fish Response Assessment Index
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	geographic information system
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IHAS	Invertebrate Habitat Assessment System
MPNE	Magaliesberg Protected Natural Environment
NEMBA	National Environmental Biodiversity Management Act (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological Status
RHP	(DWA's) River Health Programme
RQS	(DWA's) Resource Quality Services
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SASS5	South African Scoring System 5
SIBIS	SANBI's Integrated Biodiversity Information System
WSS	(Gauteng DWA Region) Water Sector Support





1.0 INTRODUCTION

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Interest-groups along the Moreleta Spruit have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the Department of Water Affairs (DWA) and the City of Tshwane (CoT) Municipality. To this end a group of concerned citizens approached the DWA and expressed a desire to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River Programme. The Adopt-a-River programme was initiated by DWA in support with various community based initiatives, as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

The Gauteng Region of the DWA has subsequently allocated funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Project, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. This project is being implemented in phases and includes the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam. The project is being linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT. (DWA: 2009)

The regional coordinator for the Adopt-a-River programme in Gauteng, IKAMVA Strategic Insights, then appointed Golder Associates Africa (Golder) for phase 1 of the project, from July-December 2011. Golder was assisted by Eko-Info cc on terrestrial ecology and geographic information systems (GIS) mapping. Ms Yolande Burger, one of the contributors of the inception phase of the Adopt-a-River programme, also provided strategic input on the direction of the project.

1.1 The Adopt-a-River Programme

The Department of Water Affairs (DWA) Adopt a River Programme (DWA 2009) reads as follows:

The DWA has initiated a water resource programme named the "Adopt-a-River" as a means of creating awareness among communities and relevant stakeholders of the need to care for our scarce water resources and to actively participate in the protection and management of our water resources, with emphasis on our natural rivers watercourses. The programme is primarily based on community participation, training, partnerships, and focused action plans. The program primarily seeks to promote the commitment, from various natural rivers stakeholders, to protect the health of the related river watercourse in a sustainable manner. (DWA: 2009)

1.1.1 Institutional/governmental support and guidance

Key principles for a sustainable Adopt-a-River Programme include institutional/governmental support and guidance, starting small, providing training and education opportunities, keep the goals realistic, secure funding, realise that it is a lengthy process, promote stewardship, make connections and create partnerships and co-ordinate with similar initiatives and have incentives. The Gauteng DWA Region, through the Water Sector Support (WSS) Directorate, is committed to ensure that the programme, due to its possible magnitude, gains substantial momentum, attracts appropriate resources and is sustainable. To this end, the WSS has initiated the Moreleta Spruit Adopt-a-River Project. (DWA: 2009)

1.1.2 The Moreleta Spruit Adopt-a-River Project

The purpose of the project is to develop an overall framework and master environmental management plan for an Adopt-a-River volunteer programme for the Moreleta Spruit and its tributaries under the auspices of the DWA Gauteng Region – WSS Directorate, the Pienaars River Catchment Management Forum and the City of Tshwane. Special attention will be given to involving schools and other learning institutions and in particular previous disadvantaged communities situated along the river course in the programme. Patrons and donors will be recruited to provide moral, financial, scientific and technical support to the programme in order to promote long term sustainability of the programme. The project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains in the Roodeplaat Dam. (DWA: 2009)





1.2 Location

The Moreleta Spruit is located within quaternary catchment A23A that forms part of the Limpopo Primary Catchment in Gauteng Province (Figure 1). The Moreleta Spruit and its associated local catchment transect the city of Pretoria within the Tshwane municipal area.

It represents a mainly built up area, with dense urban settlement in the south and semi-urban settlement in the north (Figure 2). Note that the Hartbeesspruit has not been included in the study area, as the section of the watercourse north of the confluence between the Moreletaspruit and Hartbeesspruit is indicated as the Hartbeesspruit on the relevant 1:50 000 topographical map; and the Moreletaspruit is therefore considered a tributary of the Hartbeesspruit. The section of the watercourse north of the confluence has however been included in the study area, as the Roodeplaat Dam forms a logical termination point for the purposes of this study.

Quaternary catchment A23A covers 68 238 ha, of which the Moreleta catchment represents 13 258 ha (19%). According to the National Spatial Biodiversity Assessment River component, quaternary catchment A23A has rehabilitation potential; therefore human activities within the Moreleta Spruit catchment will either increase or decrease this potential.





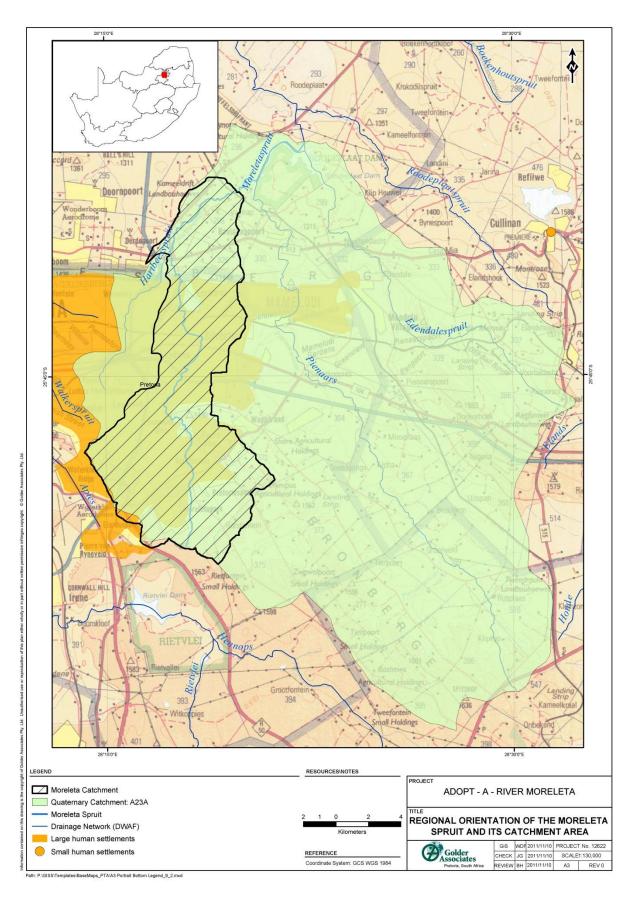


Figure 1: Regional orientation of the Moreleta Spruit and its catchment (see also Map 1: Appendix B)





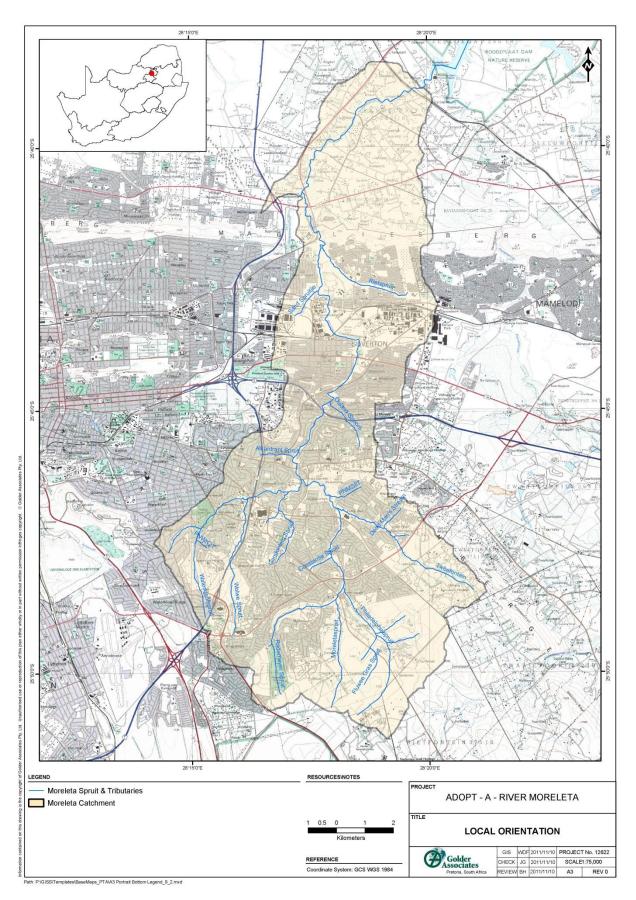


Figure 2: Local context of the Moreleta Spruit and its catchment within the City of Tshwane (see also Map 2: Appendix B)



2.0 TERMS OF REFERENCE

The terms of reference as per IKAMVA Strategic Insights cc (regional coordinator for Adopt-a-River for Gauteng) included the following:

Situation Analysis

Development of a **situation analysis** of the Moreleta Spruit in terms of its past history, environmental/ecological, institutional and legal status, demographic composition, infrastructure development and financial aspects.

Gap Analysis

Conduct and report on a **gap analysis** to identify lacking information that will be required for the development of a State of the Rivers Report and a Master Environmental Management Plan for the Moreleta Spruit in the next phase of the project.

Action Plan

Using the outputs from the previous two activities, provide recommendations and a **high level action plan** for the next phases of the project, viz. the development of a State of the Rivers Report and a Master Environmental Management Plan for the Moreleta Spruit.

Stakeholder Engagement

One of the principles of the Programme is the engagement and active participation of community interest groups, including involving volunteers, volunteer groups and residents in the protection, management and monitoring of water resources, which is not a new concept and is used successfully in many countries globally.

2.1 Report structure

This report covers all the aspects of above mentioned terms of reference. A quick reference guide to chapters reads as follows:

- Chapter 1: Introduction;
- Chapter 2: Terms of reference;
- Chapter 3: Situational Analysis;
- Chapter 4: GAP analysis;
- Chapter 5: High level action plan;
- Chapter 6: Stakeholder Engagement;
- Chapter 7: Conclusions And Recommendation;
- Chapter 8: References;
- **Tables**: Many of the tables referred to in the text are referenced to **Appendix B**, in order to make the report more digestible; and
- Maps: Whereas selected maps have been included in the text to augment the report, most of the maps are referenced to Appendix D.





3.0 SITUATION ANALYSIS

The Moreleta Spruit traverse from its headwaters in the eastern suburbs of Pretoria through the industrial area of Waltloo, through Eersterust, to the small holdings of Kameeldrift up to the point where it flows into the Roodeplaat dam. It is one of the few remaining green water ways in the Tshwane Metropolitan Area as very few sections of the river have been channelized. Therefore it has immense recreational and aesthetic value for residents along the banks of the river as well as for the wider community. The river has been in a process of transformation due to urbanisation since the 1940's. Alien vegetation, gardening/farming along the banks, dumping of rubble and development of infrastructure within the flood zone of the spruit has substantially changed its character in terms of flow, quality and the flora and fauna composition along the spruit.

Information for the study was derived from many different sources. These include:

- Personal interviews;
- National databases such as DWA;
- City of Tshwane;
- Expert knowledge;
- Resource Quality Services (DWA);
- Existing NGO's in the catchment; and
- Published reference data such as GDARD C-Plan 3.

3.1 Historical overview

The name Moreleta derives from the Sotho name 'Moretla' which is the Grewia flava (Brandy Bush).

The Farm 'The Willows', which included the western section of the Bronberg and Faerie Glen, was the property of Hendrick (Hendry) Struben, who together with brother Frederick discovered gold in August 1884. Sons of the former State Secretary of the Z.A.R., Capt. Johan Marinus Struben, they were indirectly responsible for the discovery of the main reef of the Witwatersrand.

Figure 3 provides an aerial overview of what the area associated with the Moreleta Spruit looked like in 1939. It is evident that the spruit's floodplain areas were used for cultivation, with only two suburbs bordering on it, where Silverton and Garsfontein are located today. The broader landscape represents mainly grassland or open savannah, which was most probably maintained by fire and utilisation. Electricity was not widespread and people still depended on wood, which is evident from the woodlots distributed throughout the area. Stands of woody species are visible on the ridges, the more difficult to access areas away from human activities.

Some of the residents interviewed make reference to lucerne growing in along the spruit which dates from the farming era of the 1960's.

In the late 90's some sections the river bed was deepened through scouring by the CoT, for flood management purposes. This had a definite impact on the animal and bird habitat, although a decade on, deposition of soil over time and subsequent plant growth has recently seen some species returning.

In other areas, natural head-cutting erosion and such flood-management scouring has permanently changed the river structure from a flat, slow flowing system to a deep, fast-flowing channel shaped system.

3.1.1 History of nature reserves

Mention is made of Hendrick Struben as, after nearly 100 years, part of his properties have become nature reserves - Kloofendal in Roodepoort and Faerie Glen in Pretoria. Another park close to the Faerie Glen Nature Reserve is Struben Dam, which is used for casual fishing and recreational purposes and offers a small hiking trail. The stream from this dam (the Waterkloof Spruit) also joins the Moreleta Spruit.



The Faerie Glen Nature Reserve (124 ha) was established in 1984 and has now been fully fenced for security reasons. The ridge at Renosterkop (1468 m), up the northern fence of the reserve, has been reinforced with stones probably by British forces during the Anglo Boer war (Kantor, S. and Kantor, D., 2010). Between Renosterkop and Faerie Glen Kop (1442 m) there are also well built walls, but this area is heavily overgrown.

The Moreleta Kloof Nature Reserve (± 100 ha) situated north of Hans Strijdom drive, was once the starting point for the Moreleta hiking trail (Kantor 2010). The Reserve was part of the initial farm that belonged to the Rademeyer Family that farmed cattle in the area. The farm was subdivided after the death of Mr Rademeyer and the current portion was later owned by Mr Marneweck. The farmhouse was constructed in 1903 and although it is utilized today as a restaurant the building is still in the original form. The farm and buildings were transferred to the then Pretoria Town Council from the estate of the last owner who requested that the Kloof must be kept as a Green Zone and that no residential developments must be permitted in the Kloof.

3.2 Current Ecological Status

3.2.1 Terrestrial

This component involves the understanding of the current ecological status of, and pressures on the system from a terrestrial point of view. It involves an assessment of the amount of vegetation present in the area, the ecological status (natural or exotics) of the vegetation, the type of animals occurring in the area (natural or feral), and the function and contribution of these animals in maintaining the vegetation associated with the system.

Geology

The Moreleta Spruit is a perennial stream that has many tributaries feeding it. The source of the water of the Moreleta is from the Malmani Dolomite found on the southern side of Pretoria. The dolomite is fissured and stores considerable quantities of water, which may arise in the form of valuable springs (Kantor 2010).

Regional habitats

Overall the distribution of trees reflects the change in biomes from grassland in the south towards savannah in the north (Map 4), with the main drivers of change at a regional scale being geology, climate, and topography (Map 5). These regional ecological drivers have a local influence in terms of slope and soil conditions (Map 6), and therefore the movement of moisture through the landscape. It is therefore evident that the high lying areas in the south drains towards the low lying areas in the north, with the channel historically poorly defined in the south and becoming more pronounced towards the north, due to the slow and cumulative release of the higher rainfall in the south towards the north. However, current human activities have changed the landscape significantly, with the open grassland and its associated seepage wetlands in the south now being replaced with impervious human infrastructure (Map 2).





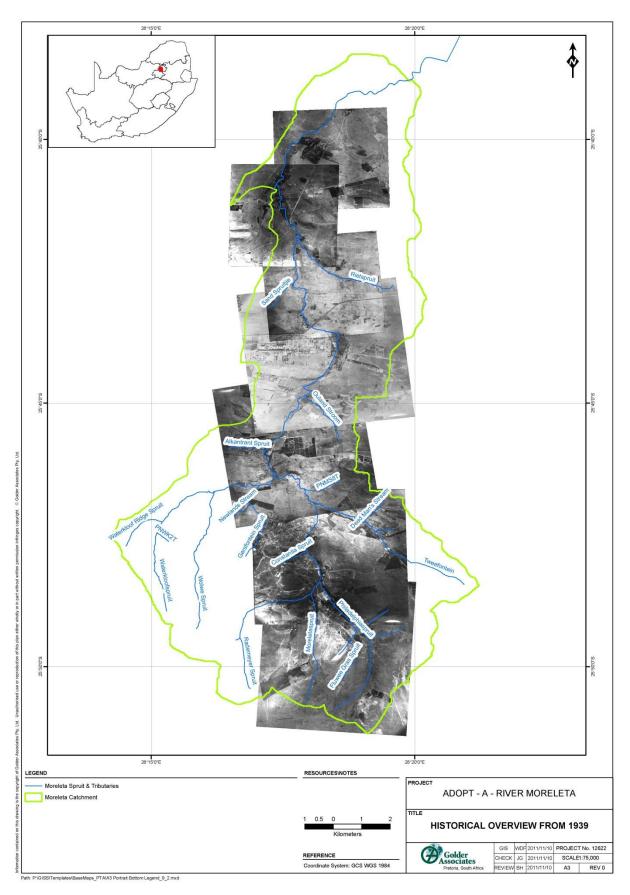


Figure 3: Aerial photos from 1939 (see also Map 3: Appendix B)



Flora

The following significant intact undeveloped or conservation areas are present in the catchment area, and the Moreleta or its tributaries:

- The Magaliesberg Protected Natural Environment (MPNE) includes the eastern spurs of the mountain directly north of Eersterust and Mamelodi);
- The Faerie Glen Nature Reserve (124 ha) The reserve is considered the jewel of the Moreleta system (Kantor 2010) and is the biggest single area of more or less undisturbed natural habitat with diverse geology, soils, micro-climates and vegetation. This nature reserve is also the start of the Bronberg Ridge, which extends toward the south-east, and is whole is regarded as a sensitive environment by Gauteng Department of Agriculture and Rural Development's CPlan version 3, and ten percent of the ridge being made up of mountain wetlands. The contiguous section of Bronberg Ridge directly adjacent on the eastern side of Faerie Glen Nature Reserve represents an area at least equal that size, therefore an area of approximately 250 hectares of habitat in good condition;
- Struben Dam Bird Sanctuary (9 ha) The dam was upgraded in September 1984 to form part of the flood control system of the Waterkloof Spruit. The birdlife is abundant. Fish species include banded tilapia, sharp tooth catfish, canary kurper, and exotic carp and bass. The vegetation at Struben Dam is Bankenveld, which is a transitional vegetation type between grasslands and bushveld. Also to be found are marsh areas and riverine bush below the dam wall. River bush willow, *Acacia karroo*, *Acacia caffra* and *Celtis africana* are the dominant three species. Small groups of indigenous trees and shrubs occur in the higher parts;
- CSIR Grounds (± 60 ha) Although not formally a conservation area, the eastern section of the CSIR grounds is unbuilt and most probably in a moderate state of transformation this area is in close proximity to the Moreleta, and does contribute to some extent to the clean runoff and water quality of that section of the Moreleta; and
- The Moreleta Kloof Nature Reserve (± 100 ha) Hiking trails were developed in the late 90's and small amounts of game were also introduced. This fully fenced nature reserve with controlled entry offers three small hiking trails. The dam and riverside forest offer excellent birding opportunities. The reserve lists 71 often sighted bird species. Small herds of game, blesbok, impala, springbok, zebra and ostrich, were introduced into the area (Kantor, S. And Kantor, D., 2010).

Red data species

According to the various states of the environment reports and strategic environmental assessments relevant to the catchment, red data species occur mainly in the protected areas (i.e. the Nature Reserves, Bird Sanctuaries, on ridges and along rivers and in Conservation areas). Few studies have been done on the open space and riparian habitat of the Moreleta Spruit itself.

The most well-known red data species in the Faerie Glen Nature Reserve and Bronberg is the Juliana's Golden Mole and *Ceropegia decidua subsp. Pretoriensis* (plant).

Alien Invasive Species

- The biggest problem in the Moreleta Spruit is the high amount of alien invasive plants present. There is a desperate need to eradicate these plants. The control of problem plants in South Africa is regulated by the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983). According to this act, there is a legal obligation for the control of invasive alien plants, especially within the 1:50 flood line of a river or water body;
- North-west of the National Intelligence Agency of RSA, where the Moreleta Spruit begins there are not many trees or alien invasive plants, and vegetation cover is predominantly grassland. According to Danie van Eeden of Wild Route Consultants the only original tree species found here were Sweet Thorn (*Acacia karroo*) and river bushwillow (*Combretum erythrophyllum*);



3

MORELETA SPRUIT ADOPT-A-RIVER PHASE 1

- As one move further downstream along the spruit towards Hans Strijdom road, more tree species and more alien invasive plants are found. Species include wattles (*Acacia mearnsi*), *Eucalyptus*, bugweed (*Solanum mauritianum*), and further downstream in the valley there are some large stands of grey poplars (*Populus x canescens*) with bugweed, privets, lantana and willows also present; and
- No clear pattern exists in terms of alien invasive species, and it appears unique on a localised level.

Plants with medicinal value

- Both Lippia javanica (Fever tea/ Lemon Bush) and Lippia rehmanni occur in the Faerie Glen Nature reserve. The latter tends to be a smaller plant and has a lemony aroma while the former is said to be pungent and minty. Lippia javanica grows in open veld, in the bush as well as on forest margins. This plant is one of the most aromatic plants and is well known medicinally to many African tribes and avid herbalists and herb gardeners. A mosquito repellent candle (Ulwazi Botanicals) has been developed from the aromatic oils of the plant (Maharaj et al, 1995). The threatened status of this species is listed least concern by the IUCN and as unknown on NEMBA (SIBIS:SABIF); and
- Lippia rehmanni (Rehmann-Lippia, Beukesbossie) is an aromatic plant also with medicinal value (antifungal properties Linde et al, 2010) such as L. javanica. This species is listed as Least Concern by the IUCN and its status unknown on NEMBA (SIBIS:SABIF).

Ecological connectivity

■ Map 14 indicates the ecological systems (most significantly ridges) as mapped by GDARD's CPlan-3, of which large parts are already transformed. Ridges like the Bronberg and Magaliesberg spans in an east-west direction. The Moreleta Spruit system provides ecological and open space links between these systems in a south to north axis. [One of the registered Master's Degrees at University of Pretoria's Botany department is investigating the species distribution patterns based on these linkages].

Fauna

Mammals in the Faerie Glen Nature reserve are conservatively numbered at 37 and the majority is considered to be nocturnal. Mammals observed are hares, mongoose, hedgehog, dassies and the common duiker. Mammals sighted along the Waterkloof / Wolwespuit include the otter, slender mongoose, bush baby, greater cane rat, porcupine, and hedgehog. This is only two of the relevant areas, and greater species variety is expected as more communities add information to the database.

Further reading

More complete information can be obtained from the following studies conducted in the catchment, and referenced in chapter 8:

- @LAND Landscape Architects and Ecological Planners, 2001. Strategic Environmental Assessment of the Bronberg Ridge;
- City of Tshwane, 2003. City of Tshwane State of the Environmental Report (2003-2005);
- City of Tshwane, 2005. Proposed Tshwane Open Space Framework;
- City of Tshwane, 2001. State of the Environment of the City of Tshwane (2001/2002); and
- Eco Assessments Ecological and Environmental Consultants, 2004. Strategic Environmental Assessment of the Faerie Glen Nature Reserve.

3.2.2 Aquatic

Available aquatic ecological data on the Moreleta spruit has been sourced from DWA's Resource Quality Services (RQS) Directorate, the National Rivers Database and the River Health Programme (RHP). The RHP initiative of DWA is driven by regional champions. The Gauteng Department of Agriculture and Rural Development (GDARD) is the driving organization for this programme in Gauteng.





Fish

Several fish species have been observed in the Moreleta spruit, e.g. Ghieliemientjies, Vleikurper, Dwarf kurper, Blue Kurper and Bass (near Roodeplaat dam). Table 1 indicates the indigenous fish species that have been recorded by the Friends of the Faerie Glen Nature Reserve.

Table 1: Fish species in the Moreleta Spruit at the FGNR (Source: Friends of the Faerie Glen Nature Reserve)

Scientific Name	Common Name
Barbus paludinosus	Straight fin barb
Barbus anoplus	Chubbyhead barb
Tilapia sparrmanii	Banded Tilapia or Vleikurper
Pseudocrenilabrus philander	Southern mouthbrooder
Sarotherodon mossambicus	Mozambique Tilipia (Bloukurper)

Aquatic present ecological status

The aquatic data typically includes fish, macro invertebrates and riparian and in-stream habitat assessments. This data is then linked to the quality of the water and the available flow which are the drivers of the aquatic system. These drivers intern determine the responses of the fish, macro invertebrates and habitat.

Typically these aquatic assessments are used to determine the Present Ecological Status (PES) of a river using as series of standardized assessment tools such as SASS5 (macro invertebrates), FRAI (fish), IHAS (in-stream and riparian vegetation). These tools are used to generate an overall assessment of the current status of the aquatic's at a specific site or reach of a river.

Recently the NFEPA database has been developed (2011) which as classified the status of the aquatic of the Moreleta spruit as follows:

- NFEPA: Present Ecological Status (fish, macro-invertebrates and riparian vegetation) of Class C: Moderately Modified; and
- NFEPA: River Condition (Habitat) Class D: Largely Modified.

This information indicates that the aquatic status of the Moreleta spruit is moderately to largely modified. This ecological status varies from tributary and river reach depending on the current land use practices and pollution sources. This data is limited and currently the RHP for Gauteng does not have a champion and hence the programme is not currently functional.

3.2.3 Water quality

CoT monitoring and results

The CoT water and sanitation department has a monitoring network and data history spanning in some cases 30 years. Whereas the original focus of the monitoring network is around the waste water treatment works of the city, the industrial townships such as Waltloo and Silvertondale are also focus areas. This department monitors 11 points in the Moreleta catchment (**Map 11**), Table 2 on a monthly basis, which provides a useful basis for this project.





Table 2: CoT water quality monitoring points

Point	Description	No. of samples taken	Yddeg	Xddeg
E66	Morelettastream at Pretoria Street Bridge	33	-25.73355556	28.3085
E67	Morelettastream at Boulevard Street	32	-25.72616667	28.3012
E68	Morelettastream at Mamelodi Road-Bridge	1	-25.71683333	28.2983
E69	Morelettastream at Voetpadnek Street	33	-25.70363889	28.2951
E70	Eersterust Stream at Hans Coverdales Street West	33	-25.71075	28.3099
E71	Morelettastream Before Hartebees Junction	33	-25.69377778	28.2944
E72	Hartebeestream at H. F. Odendaal School	33	-25.68622222	28.2858
E72A	Morelettastream Roodeplaatdam	33	-25.641	28.3356
F63	Morelettastream at Fearie Glen Pick 'n Pay Hyper Market	32	-25.76869444	28.2871
F64	Morelettastream at Lynnwood Road	31	-25.78127778	28.3008
F65	Morelettastream at Murrayfield	31	-25.74708333	28.3002

Water quality data for the past three years (2009-2011) were provided to Golder for the purposes of the project. This data set has a list of variables that include the following:

- Nutrients
- pH
- Microbial (E Coli)
- COD
- Electrical conductivity
- Chlorine
- Suspended solids
- Dissolved oxygen
- Temperature

The summaries of the water quality data are available in APPENDIX C.

DWA RQS monitoring and results

In addition, the DWA Regional Quality Services (RQS) monitor 4 points in the catchment (**Map 11**), on a quarterly basis, and non-overlapping points to the 11 points of the CoT.

Table 3 indicates the current DWA monitoring sites in the catchment. As can be seen from this table the number of samples or data available from these sites is limited.



Table 3: DWA water quality monitoring sites in the Moreleta spruit study area

Monitoring Point ID	Number of samples	Monitoring Point Name	Latitude	Longitude
90175	162	A2H028Q01 AT KAMEELDRIFT ON HARTBEESSPRUIT	- 25.6508	28.319444
90198	17	A2H054Q01 AT WOLMARANSPOORT ON HARTBEESSPRUIT	- 25.6789	28.290833
90199	18	A2H055Q01 MORETELE SPRUIT AT DERDEPOORT PRETORIA/MORELETTA	- 25.6906	28.292778
100000884	21	A23 MORELETA SPRUIT @ KAMEELDRIFT	- 25.6569	28.30841611

This data set has an extensive list of variables that include the following:

- Salts;
- Nutrients:
- pH; and
- Microbial (E Coli and Fecal coliforms).

There are no metals analyzed in this database and the number of samples collected for three of the sites is limited. The summaries of the water quality data are available in APPENDIX C.

Centurion Academy monitoring and results

For their ecology subject, the nature management students of the Academy monitor water quality in the Moreleta spruit in Garstfontein. The sampling is overseen by Ms Carina Kurpershoek, a former employee of DWA.

Table 4: Centurion Academy water quality monitoring sites in the Moreleta spruit study area.

Monitoring Point Name	Number of samples	Monitoring Point Description	Latitude	Longitude
Stroom-op	7	Garstfontein road crossing of Rademeyer Spruit	25deg 48min 31.53sec	28deg 18min 4.30sec
Stroom-af	7	Hans Strijdom crossing of Moreleta spruit	25deg 48min 13.71sec	28deg 18min 12.45sec

This data set has a list of variables that include the following:

- pH;
- Suspended solids;
- Dissolved solids:
- Dissolved oxygen;
- Ammonia nitrogen (mg/l N);
- Total phosphorous (mg/ℓ P); and



Faecal coliforms (cfu/100 ml).

The summaries of the water quality data are available in APPENDIX C.

3.3 Institutional and legal status

There are many acts, regulations, and subsequent competent authorities (CA) (and their policies and guidelines) to be taken into account for a riverine system such as the Moreleta Spruit. All the stewardship and other activities of the Adopt-a-River Programme must adhere to and take guidance from these legal instruments. The most important of these include:

- National Water Act (1998) and Section 21 Water Uses (Department Water Affairs as CA);
- National Environmental Management Act (1998), and its amendments including the Biodiversity Act (2004) (GDARD and City of Tshwane as CAs);
- Water Services Act (Act No. 108 of 1997); and
- Legislation pertaining to Local Government (such as the Municipal Systems Act of 2000).

Further, each of the relevant CAs has developed certain policies and programmes to give effect to their mandates. The most significant of these include:

- DWA River Health Program;
- National DWA chemical, eutrophication and microbiological monitoring programmes;
- City of Tshwane Open Space Framework (2005); and
- GDARD CPlan (version 3 of 2011).

It must be noted that even within these competent authorities, various departments exist, often with different objectives and targets, and it must not be assumed that internal communication is faultless. Specific departments within the CoT that was included into this process include:

- Roads and Stormwater;
- Environmental Management and Open Space;
- Environmental Information and Research Operations; and
- Water and Sanitation.

It is expected that more information will become available upon further communication between the various stakeholders, and such communication will be one of the main objectives of the proposed Moreleta Spruit Adopt-a-River Forum. The start of such communication is the compilation and distribution of a stakeholder database, which is part of the deliverables of the project.

3.4 Demographics and Land Use

3.4.1 Land use

It is evident from the historical overview that the current status of development is far from its original status as observed in 1939. Land cover information from 2009 (Map 7) provides an overview of the level of transformation currently present in the area. This data indicates that in 2009, more than 60% of the area had been transformed with less than 40% presenting natural vegetation, with only 1% of the catchment associated with wetlands conditions specifically. Urbanisation represents 56% of the land cover within the catchment and is associated with 19 wards (Map 8, Table 8) with a total of 39 515 land parcels (Table 9) being present within the area. This implies that a minimum of 39 515 persons contribute to what activities



take place within the catchment. It is evident that the density of human settlement is higher in the south than in the north (Map 2), with land parcels being larger in the north than in the south (Map 8).

The land use of the study area is mostly residential with small pockets of institutional, commercial and business use. The section through Silvertondale / Waltloo is industrial, and then becomes predominantly rural residential (small-holdings) as the Moreleta joins with the Hartbeesspruit before entering the Roodeplaat Dam north of the Magaliesberg range.

3.4.2 Demographics

The Moreleta Spruit and its tributaries flow through the following suburbs, although the list may not be exhaustive:

Table 5: Tshwane suburbs within the Moreleta catchment area

Jan Niemand Park	Murrayfield	Lynnwood Manor
Eersterust	Lydiana	Lynnwood Glen
Silvertondale	■ Brummeria	Lynnwood Park
La Concorde	■ Navors	■ Faerie Glen
Salieshoek	■ Val de Grace	■ Garstfontein
Meyerspark	■ Die Wilgers	■ Wapadrand
La Montagne	■ Lynnwood Ridge	Derdepoort
Koedoespoort	■ Kameeldrift	■ Mamelodi-east

Whereas the greater part of the communities living onto the Moreleta Spruit is represented by privileged, the greatest risks and opportunities for learning are probably in the few disadvantaged communities, such as Eersterust or Mamelodi-east.

3.4.3 Recreational activities

As a result of the advent of security controlled access to many areas the once popular Moreleta Spruit hiking trail closed (Kantor, S and Kantor, D., 2010). It was an easy 9 km stroll which started in Constantia Park and finished at the Pioneer Open Air Museum in Silverton. Lack of maintenance resulted in many high reed beds encroaching onto pathways. Currently an attempt is being made to turn the trail from Faerie Glen into a mountain bike track.

The hiking routes are often used by hikers, mountain bikers and bird watching enthusiasts and outdoor photographers. Difficulty has been noted to follow the route from start to end as the recorded route information is not always clear.

3.5 Urban densification and infrastructure development

The Moreleta Spruit is largely an urban river system (mostly transformed), including several channelized sections with small reaches remaining in an untransformed state. This is due to infrastructure and urban development within the catchments of the system.

3.5.1 Installation of new infrastructure

A new sewerage pipeline is currently being constructed along the Moreleta Spruit by appointed contractor on behalf of CoT and large scale rehabilitation will be needed after completion of the project. Concerns were raised during the stakeholder sessions regarding the installation and related environmental control.



3.5.2 Runoff risk

Associated with the presence of human settlement, is runoff risk (**Map 9**) and pollution risk (**Map 10**). Due to the nature of the land use within the catchment, 56% of the catchment is associated with very high runoff risk due to impervious surfaces (roads, roofs, pavements) in the urban areas (Table 13). Very low and low runoff risk (high infiltration) represents 38%, and is associated with the small holdings, the remaining grasslands and cultivated lands, therefore more than 60% of the surface within the catchment present moderate to very high runoff risk. These high runoff risk areas are mainly located in the higher lying south, which implies that the runoff drains towards the north via the Moreleta Spruit and its tributaries.

3.5.3 Pollution risk associated with runoff

The increased runoff has the potential to transport pollutants (direct and indirect/ source and diffuse) from the high pollutant's risk areas, which also mainly occurs in the high-lying southern area of the Moreleta Spruit catchment (Map 10). As would be expected the high-density areas in the south are associated with high to very high pollution risk (60%), shown in Table 14 due to the presence of households, shopping centres, filling stations and industrial areas. The rural/ small holding areas in the north are associated with lower pollution risk, although agricultural activities such as the concentration of animals and the cultivation of lands can introduce hormones, antibiotics, pesticides, herbicides and fertilisers into the area.

3.5.4 Specific point source pollution risks

Industries / sewerage distribution system

There are no waste water treatment works in the Moreleta Catchment itself, but there are a number of industries. The water quality monitoring done by CoT Water and Sanitation Department at 11 points in the catchment focus on ensuring the sewerage system of the municipality does not have any leaks or faults, thereby causing reduction in water quality. Further, it monitors water quality in the industrial areas of Waltloo and Silvertondale. Good relationships have been built up with the industries, where controlled releases are done during off-peak hours into the waste water stream of the CoT, and thus treated by the relevant waste water treatment plant, and such industry then being levied for the additional service.

Landfill Sites

Garstkloof Landfill was a general landfill site, originally receiving domestic waste, which was stopped due to complaints by residents – currently it still receives building rubble and garden refuse or "greens". The site does not have many years (perhaps less than 5 years) until closure.

Derdepoort Landfill was a designated site for building rubble and garden refuse, and is now decommissioned – it also has leachate potential, and indications are that a liner system was not installed during the design phase.

Designated surface and groundwater monitoring points should be in place upstream and downstream of these sites given the close proximity to the spruit. The status of water quality in close proximity of these sites was not investigated in this study, and should be in the next phase of the study, or via the Moreleta Adopt-a-River Forum.

In case of the Derdepoort site, DWA surface monitoring points are located up- and downstream, which should be investigated to ascertain the potential impact of leachate on water quality of the spruit.

"Plastic View" informal township

Whereas this informal township located in the easternmost part of Moreletapark opposite Mooikloof, is a multi-faceted challenge for the CoT, the lack of sanitation and services pose a risk to the water quality of the Moreleta.

Waste compactors of shopping centres

A typical shopping centre such as Menlyn or Pick n Pay Faerie Glen has waste compactors for wet and dry waste. The wet waste compactors generate waste liquid, which should, according to CoT bylaws, be disposed of via grease / fat traps into the waste water system of Tshwane.



Upon investigation, it was found that Faerie Glen PnP waste water did not drain into a grease trap and was discharged into the storm water system, in that case negatively influencing the water quality of the Moreleta Spruit. PnP have with the advice and consultation with CoT department of Water and Sanitation, since upgraded their system to include the require grease trap and discharge into the waste water system.

As the CoT investigates these cases, it is expected that the water quality in the catchment will further improve.

Golf courses and residential estates

There are a number of golf courses / estates in the catchment (see list below), most of which are directly adjacent to the Moreleta, or the Spruit flowing through these properties. The typical practices for pest control and fertilisation of the golf courses cause high nitrate and phosphate concentrations in water, thus negatively influencing water quality of the Moreleta Catchment. Investigation into the management of golf courses in the catchment was not done as part of this study, and the possibility of such pollution should be further investigated in the next phase of the project:

- Kimiad Golf Course;
- Wingate Golf Course;
- Pretoria County Club;
- Woodhill Estate and Golf course; and
- Boardwalk Manor Estate and development.

3.5.5 Urban densification and impacts on ecological functionality

These two risk sources have a negative impact on the Moreleta Spruit and its tributaries, with especially the wetland functioning being affected with the increase of runoff, which bring along sediment, and results in erosion of the streambed, and the subsequent lowering of the channel. Flash floods deposit the sediment in dams and aquatic organisms' habitat to the detriment of the aquatic organisms. Therefore the overall wetland integrity (Map 11) is jeopardised through high volume, fast flowing runoff after storm events that brings along litter and chemicals. It should be noted that the majority of wetlands mapped occurs along the drainage system, but it is evident from the wetland index created from 5 m contours, that many slope related wetlands had been lost over time, especially in the south (Map 12).

3.5.6 Rehabilitation potential

Based on this information, it is evident that the remaining open areas from south to north and the small holdings in the north are critical for the rehabilitation and restoration of the Moreleta Spruit and its tributaries (Map 13). Only 30% (Table 15) of the land cover categories present within the catchment has moderate to high rehabilitation potential, therefore it will take significant time and resources to rehabilitate and restore the Moreleta Spruit and its tributaries. Rehabilitation and restoration will only succeed through a structure and well-organised approach with the assistance of the communities located within the Moreleta Spruit and its catchment.

3.6 Financial aspects

Currently the financial challenges for the Moreleta Adopt-a-River project relate to the following:

- Lack of available funds of CoT, or prioritization of such funds in terms of the IDP these funds are required for aspects such as physical improvement projects for flood control or rehabilitation, including stormwater retention dams, gabions etc;
- Future funding mechanisms to forward the objectives of the programme; largely this project is being driven by a combination of volunteerism and limited funds from DWA. The challenge for going forward



will be to leverage either national funds from DWA, funds from CoT, or private stakeholders from within the catchment such as industry, business etc;

- Land values of properties along the system typically the aesthetics of a well-functioning riverine ecosystem would increase the land value of adjacent properties – this can however be negated by incidents of crime; and
- Flood damage has effectively been mitigated by the stormwater master planning of the CoT, however if these structures are not maintained on a regular basis, floods could again cause substantial damage to infrastructure and buildings.

Without the blend of stakeholder passion, government support (all spheres) and finances from local business, the Moreleta Adopt-a-River Project vision will be limited and success not guaranteed.

3.7 Situation conclusions

A summary of issues gathered during the situational analysis phase of the project includes the following:

3.7.1 Ecology

Based on this information, it is evident that the remaining open areas from south to north and the small holdings in the north are critical for the rehabilitation and restoration of the Moreleta Spruit and its tributaries (Map 13). Only 30% (Table 15) of the land cover categories present within the catchment has moderate to high rehabilitation potential, therefore it will take significant time and resources to rehabilitate and restore the Moreleta Spruit and its tributaries. Rehabilitation and restoration will only succeed through a structure and well-organised approach with the assistance of the communities located within the Moreleta Spruit and its catchment.

3.7.2 Land use and demographics

The catchment area has distinct land use groupings and issues:

South residential

This area represents the predominantly residential 1 and 2 (thus between 10 and 20 units per hectare) neighbourhoods; with some commercial and retail land use in the south of the catchment, i.e. south of Pretoria Street (R104) in the Silverton and Meyerspark suburbs, including all the tributaries. The characteristics of this area include:

- The greatest percentage of property is privately owned;
- Low pollution risk based on land use;
- Crime prevention (fencing of system) and legal enforcement need;
- Well-developed people networks and volunteer numbers;
- Many river initiatives;
- High percentage of hard surfaces; and
- Limited open space abutting the spruit (typically 50 m or less) and opportunity for rehabilitation due to historic development.

Central industrial

The Waltloo, Silvertondale and Koedoespoort industrial area (and associated industrially zoned areas) in the central part of the catchment has to following broad characteristics:

High pollution risk due to industrial activities and effluents;





- Low level of involvement on the spruit by businesses in the area; and
- High percentage of paved areas.

Central residential

Silverton, Eersterust, Mamelodi East, Jan Niemand Park and Ekklesia residential areas:

- Moderate pollution risk based on mixed and changing land use (many industrial home businesses); and
- Almost no people network or involvement in the river.





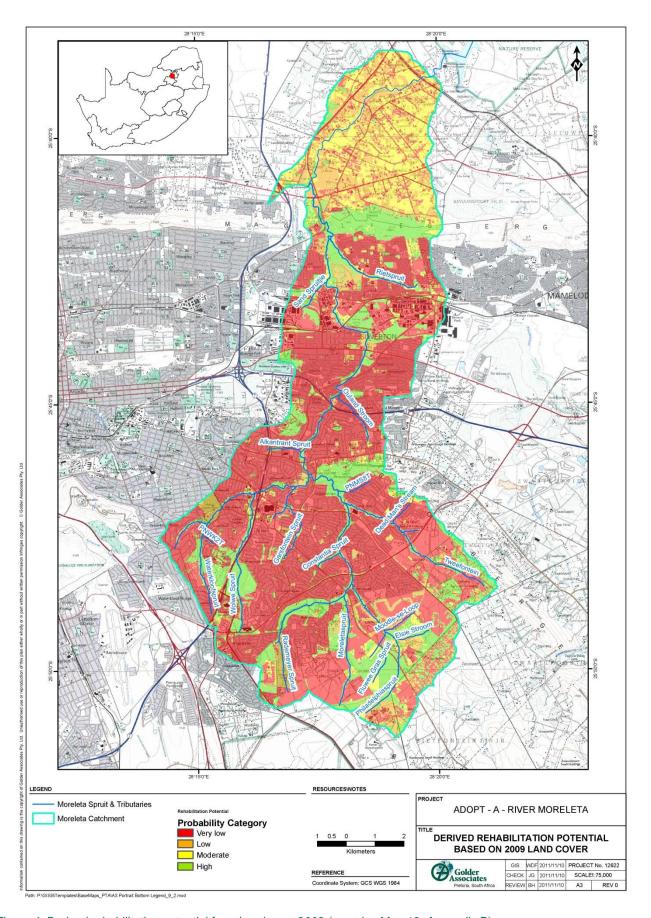


Figure 4: Derived rehabilitation potential from Landcover 2009 (see also Map 13: Appendix B)





- High percentage of paved areas;
- Specific open space litter problem due to challenges with waste collection (Eersterust and Mamelodi);
 and
- Fair amount of open space around the spruit (typically 100m or more) and therefore ample opportunity for rehabilitation or improvement (It appears some larger properties on the spruit here are owned by government institutions).

North smallholdings

Derdepoort, Kameeldrift and Roodeplaat smallholding areas (north of R513 / Zambesi Road):

- Almost no people network or involvement in the river;
- Low percentage of paved areas;
- Fair to good amount of open space around the spruit (typically 100m or more) and therefore ample opportunity for rehabilitation or improvement; and
- Low pollution risk, although smallholding activities such as small scale agriculture or concentration of animals may change this on local scale.





4.0 GAP ANALYSIS

Table 6 below show a summary of the GAPS identified from the situation analysis and with a view towards phase 2 of the project.

Table 6: GAP Analysis of information from the situation analysis phase

Aspect of project	Identified GAPS				
	 Qualitative information available, mainly species lists – quantitative data required for effective monitoring; 				
Terrestrial Ecology	 Current information available mainly on a regional scale (1: 50 000 or smaller) – for effective management local scale data (1: 10 000 at least) is required; 				
	No information is available on the size / extent / condition of the "natural" areas left; and				
	No information is available on the effect of feral animals on remaining fauna in the catchment.				
	No aquatic monitoring network in place in the catchment, and very few ad-hoc aquatic studies have been done;				
Water and Aquatic Ecology	 Aquatic information available date from 2003, and on national regional scale, although it is currently in process of being updated; and 				
	 Point source pollution from golf courses, landfills and commercial waste compactors undetermined. 				
Land use / zoning	 Cross-border areas (after Tshwane taking over Kungwini and Metsweding) are in process of being included into planning such as storm water, infrastructure and zoning of land; 				
Infrastructure development (including storm water)	 Outdated flood line information (mid 1990's), although this is in process of being updated by CoT; and 				
	Perceived lack of environmental control / rehabilitation on implementation of infrastructure (e.g. outfall sewer project in the Moreleta open space).				
	 No representation from large and small industries in the Koedoespoort, Waltloo and Silvertondale in industrial area; 				
Stakeholder engagement	Mamelodi / Eersterust / Kameeldrift areas' involvement is lacking, they should nevertheless be pursued actively in order to strengthen the stakeholder base in the central and northern part of the catchment;				
	 Despite invitations to all headmasters in the catchment, no schools are yet on board; and 				
	Little information on activities and locations has been received to date from "friends" groups for database.				





5.0 STAKEHOLDER ENGAGEMENT

This section provides an overview of the stakeholder engagement process that was undertaken as part of phase one of the project according to the specified terms of reference.

5.1 Approach and methodology

The purpose of the "Adopt-a-river" programme is to create awareness among communities and stakeholders of the need to care for our scarce water resources and to actively participate in the protection and management of our water resources. In order to fulfill in this purpose, large emphasis has been placed on communication and public participation.

The following approaches and methodologies have been implemented during phase one of the project and will be used to support the future phases of the State of the Rivers Report and Master Environmental Management Plan development:

- Upfront planning session with the Department of Water Affairs;
- Identification and engagement of all relevant stakeholders and communities;
- Establishment of a Forum that will implement the Master Environmental Management Plan and ensure project sustainability;
- Creating awareness of the Forum establishment and the Moreleta Adopt-a-River Project; and
- Development of a communication strategy for further implementation by the Forum.

5.2 Identification of stakeholders

Golder developed a comprehensive stakeholder database to include stakeholder groups and key interested and affected parties identified during a strategic planning session in August 2011, and updated during a stakeholder mapping exercise at the first Stakeholder Work Session held in October 2011. This database was used to announce the project and invite interested affected parties to become involved in the project. The stakeholder database has been updated throughout phase one of the project and is attached as **Appendix A1**. Stakeholder groups originally identified is shown in Figure 5:

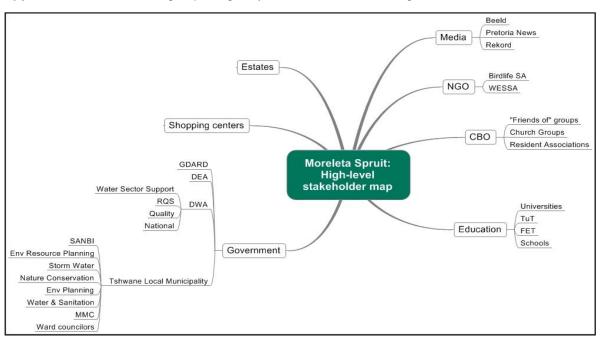


Figure 5: High-level stakeholder map of the Moreleta Spruit catchment





5.3 Announcement of the project and invitation to become involved

The opportunity to participate in the project and to register for the project was announced in September 2011 in English as follows:

- Distribution of a letter of invitation to become involved, personally addressed to an initial 127 I&APs, accompanied by a Background Information Document (BID) and registration and comment sheet. The BID contained details of the proposed project, maps of the project area, and a registration and reply sheet for I&APs to register for the EIA process. In addition, the BID was e-mailed to everyone on the database with e-mail addresses. Copies of the letter of invitation, BID, registration and reply sheet are included in **Appendix A2**; and
- Several posters were placed in the project area to create awareness of the project and provided interested parties with information of how to become involved. A copy of the poster is included in Appendix A3.

5.4 Establishment of the Stakeholder Liaison Forum

The process to establish the Moreleta Spruit Stakeholder Liaison Forum ensured significant engagement with key interest groups and all stakeholders being kept informed of progress. The process to establish the Forum took place as follows:

5.4.1 Work Session One – 4 October 2011

The first work session took place on 4 October 2011 from 17h30 to 20h00 at the Silverton Recreation Hall in Pretoria.

The purpose of the first work session was for stakeholders to undertake:

- Stakeholder mapping to identify the relevant parties to be involved in this process;
- The identification of issues of concern and suggestions for enhanced benefits; and
- Development of the project purpose, potential institutional process to establish a forum.

The proceedings of Work Session One are attached as Appendix A4.

5.4.2 Work Session Two – 3 November 2011

The second work session took place on 3 November 2011 from 17h30 to 20h00 at the Silverton Recreation Hall in Pretoria.

The purpose of the second work session was for stakeholders to:

- Discuss the proposed model of the stakeholder liaison forum and selection of forum;
- Agree on process to establish the forum; and
- Receive progress feedback on the technical studies undertaken in the project.

The proceedings of Work Session Two are attached as **Appendix A5**.

5.4.3 Work Session Three – 29 November 2011

The third work session took place on 29 November 2011 from 15h00 to 17h00 at the Golder Associates Offices in Hatfield, Pretoria.

The purpose of the third work session was for stakeholders to:

- Discuss the institutional setup of the Forum;
- Present and discuss the Gap Analysis; and



Present and discuss the High Level Action Plan.

The proceedings of Work Session Three are attached as Appendix A6.

5.4.4 Progress feedback to stakeholders

Stakeholders have been kept informed of progress throughout phase one of the project as follows:

- Announcement and invitation letter was sent out on 15 September 2011;
- Progress feedback letter of first work session and invitation to attend second work session was sent out on 28 October 2011;
- Progress feedback letter for second work session and invitation to attend the third work session was sent out on 9 November 2011; and
- Final progress feedback letter was sent on 9 December 2011.

5.5 The Contextual Framework of the Stakeholder Liaison Forum

Understanding the various issues facing the Moreleta Spruit catchment, participants contributed towards the development of a structure/forum purpose statement. The following thoughts and key words were captured and as overall characteristics and purpose of the forum:

- Needs to upholds law enforcement;
- Must implement practical actions plans to ensure long term sustainability;
- Must ensure water resource sustainability;
- Must be a civil society initiative;
- Must be inclusive to establish and promote networks / partnerships;
- Must promote integrated water management of the overall eco system;
- Must improve the Moreleta Spruit's value as a community asset; and
- Must ensure conservation of the Moreleta Spruit catchment to a healthy state and environment.

There are currently various community based initiatives active within the Moreleta Spruit catchment, each with their own objectives and methodologies. One of the key characteristics as identified by the work session is for the various groups to maintain their independence. It was agreed to establish a network-based model for the Moreleta Spruit catchment which will include, integrate and leverage current initiatives within the catchment The Government, through DWA, has developed and implemented a number of programmes that is aimed to ensure that South Africa's water resources remain healthy.

The objectives of national programmes and community initiatives need to collaborate and integrate as far as possible in order to achieve the commune of healthy sustainable river and ecological systems. An overall contextual framework is provided below (Figure 6) and provides the background and context for the Moreleta Spruit Network-based Forum (Figure 7).





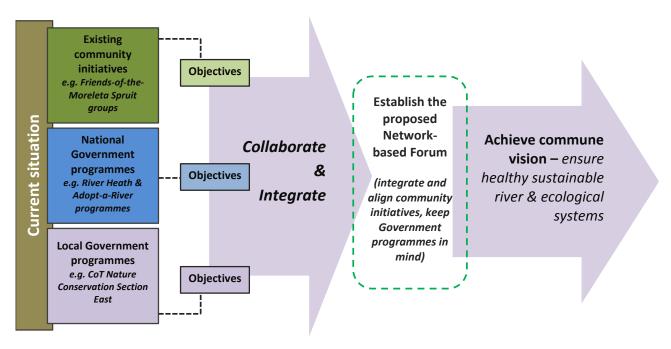


Figure 6: Contextual framework of the Moreleta Spruit Stakeholder Liaison Forum

The main aim of the Adopt-a-River project is to create an understanding among all water users and in particular the previously marginalized communities of the concepts of integrated water resource management, to encourage them to become actively involved in the protection and management of these resources.

- Empowering all users of water to protect their water resources and participate in water resources management as captured;
- Facilitating the involvement of patrons and sponsors (influential individuals) in stakeholder empowerment and resource management strategies;
- Developing and making available the necessary tools for training and empowering local implementing agents and other role-players;
- Ensuring optimum effectiveness, through involvement and linkages with other existing programmes and initiatives aimed at water resource protection and management;
- Create public capacity and environmental awareness; and
- Promoting a volunteerism ethic in South Africa to benefit all levels of society.

The adopted network-based forum is illustrated below (Figure 7). A network-based approach ensures that initiatives and entities are included that have the Moreleta Spruit's health and development at heart. It is envisaged that participants will subscribe to a forum charter that will underpin the philosophy, objectives and principles of the network to guide current and future initiatives, ensuring an open process for all stakeholders. Because of the open process, existing community entities will not be prescribed to which initiatives and projects to be done and will still be able to act independently.

A facilitation team has been established to coordinate and integrate the various network initiatives to ensure that the collective efforts are aligned to benefit the various areas of the Moreleta Spruit catchment. The envisaged network could have various focus areas that participants belonging to the network can contribute their efforts towards. This will ensure, although the community entities are still driving initiatives independently, that they are collectively supporting the same focus areas.





The core group of stakeholder representatives in the process has accepted ownership and responsibility to continue with the project and Dr Anneli Kühn was chosen as chairperson of the Moreleta Spruit Forum and would set up the next meeting to give effect to the tasks agreed during phase one of the project.

The high level action plan as proposed by Golder Associates was accepted by the meeting of 29 November 2011 and the following aspects were included:

- All activities, and proposed community-based projects should be in alignment with the DWA priorities;
- Creating awareness in communities should result in projects with tangible and quick results (so-called 'quick wins') to start off with;
- The bio-monitoring project (mini SASS) should be the first project of the Moreleta Spruit Forum and serve as a catalyst project leading to community awareness and more projects in the catchment; and
- It was agreed that Water Week in March 2012 would be an ideal opportunity for the bio-monitoring project.

The stakeholder engagement process throughout Phase One has been constructive and is well positioned for Phase Two of the project.





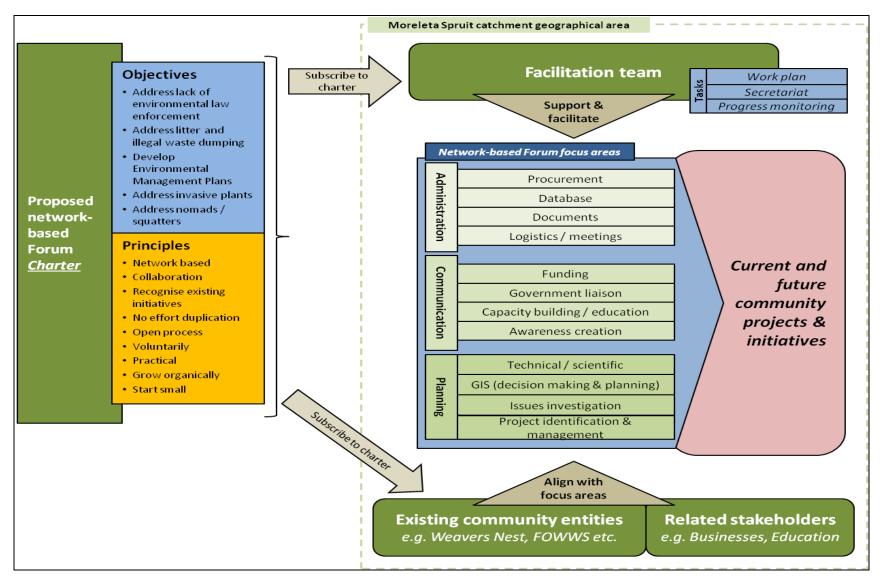


Figure 7: Diagram of the network-based Moreleta Spruit Stakeholder Liaison Forum





6.0 HIGH LEVEL ACTION PLAN

The high level action plan as derived from the situation analysis and GAP analysis phases of the project was presented as follows to the work session of 29 November 2011, which included representatives from the community work group, City of Tshwane and DWA. The action plan is presented in Table 7. It must be notes that this plan will develop in finer detail as the Forum becomes more established. It was left on high level to allow flexibility and direction to develop from the forum itself.

Table 7: High level action plan for the Moreleta Spruit Adopt-a-River project

Aspect	Description of action	Tim	ning	Res	sponsible person / institution
	Compile quantitative base data (scale 1:10 000) for flora, fauna and ecological. function and services as follows formally, as well as informally per volunteer group with lead and input of ecology experts from the community: Flora:	•	Immediately and on-going; and	•	Volunteer groups from the catchment community (as per already existing species lists provided in phase 1); and
Terrestrial Ecology	 Describe and map the vegetation – 1: 10 000 scale; Collect population dynamics per plant community – species density & age structure, both indigenous and exotics; and Veld condition & carrying capacity – small & medium sized mammals. Fauna: Document fauna species present – tracks, trap camera, actual observations; Assess the presence of key stone and generalist species; and Assess the potential to introduce key stone species to enhance species richness and diversity. Ecological function: Assess and highlight the ecological function and services provided by these system – pollination, wildlife refugia, carbon fixation, flood management, recreation, education; and 	•	Phase 2 of the formal project through DWA when funds available in 2012.	•	Appointed consultants.





Aspect	Description of action	Timing	Responsible person / institution
	Prioritise those ecological function and service which needs to be restored or enhanced.		
	Compile the following management plans:		
	 Environmental/ Biodiversity Management Plan – emphasis on improvement of human and wildlife environment, legislation driven – national, provincial, local municipality; 		
	■ Wildlife Management Plan – to ensure the effective management of fauna species, currently present or introduced; and		
	 Restoration/ rehabilitation management plan – focus on critical or priority areas to restore or rehabilitate with regards to erosion (storm water control), alien invasive plants (category 1 & 2 species), feral animals. 		
Water and Aquatic Ecology	 Compile quantitative base data on catchment scale for macro- and micro- invertebrates, fish and present ecological status; 	Immediately and on-going; and	 Volunteer groups from the catchment community (as per already existing species lists provided in phase 1); and
	 Compile quantitative monitoring datasets of other relevant water quality parameters including chemical and microbiological characteristics; 		
	■ Use the expertise and tools from DWA RQS and volunteer experts in the catchment to undertake a "current status update of the aquatic ecology of the rivers. This assessment can also be used as a training and information session for the stakeholders in the Moreleta Spruit. The current aquatic	Appointed consultants.	
	ecological status assessment can be used as a quick win for the Adopt of River committee and can then be used to prioritise further management interventions; and	 Phase 2 of the formal project through DWA when funds 	
	Compile management plan for aquatic habitat.	available in 2012.	
Stakeholder engagement	■ Finalise institutional setup of network based forum;	■ Immediately and	Forum work group under lead of Dr Anneli Kuhn.
	 Operationalize the forum's focus areas as per agreed organogram 	on-going.	





Aspect	Description of action	Timing	Responsible person / institution			
	presented and agreed at Work Sessions 2 and 3; Specifically build the forum and friends groups in areas not we represented in the central and northern part of the catchment (such a Silvertondale, Waltloo, Mamelodi, Eersterust and Kameeldrift Roodeplaat);					
	 Link the Adopt-a-River programme with the existing CoT Environmenta Forum, to facilitate stakeholder engagement; and 	ı				
	 Target schools in the catchment for awareness programmes through quick win projects. 					
Land use / zoning / new	 Community monitoring of new developments and compliance to relevant approvals (as is currently taking place); and 	■ Immediately and on-going; and	 Volunteer groups from the catchment community; and 			
developments	 Add land use / zoning of cross-border areas once classified and incorporated by CoT. 	Phase 2 of the formal project through DWA when funds available in 2012.	Appointed consultants.			
Infrastructure development (including storm water)	 Strengthen relationships between key stakeholders (such as DWA, Coand communities) by inviting specific persons of relevant departments to Adopt-a-River meetings from time to time; and It is critical that the stormwater management plan for the next 5 years b appointed consultant is dovetailed with phase 2 of this project. 	Dhaga 2 of the	■ Forum work group under lead of Dr Anneli Kuhn.			





Aspect	Description of action	Timing	Responsible person / institution				
		available in 2012.					
	Additional to the actions proposed by the professional team, the meeting of 29 November 2011 agreed to the following principles:	Immediately and on-going; and	 Volunteer groups from the catchment community; 				
	 All activities, and proposed community-based projects should be in alignment with the DWA and CoT: Nature Conservation priorities; 		Forum work group under lead of Dr Anneli Kuhn;				
Agreed principles from work session 3 (29	 Creating awareness in communities should result in projects with tangible and quick results (so-called 'quick wins') to start off with; and 						
November 2011)	■ The bio-monitoring project (mini SASS) should be the first project of the		DWA RQS under lead of Elija Mogakabe;				
	Moreleta Spruit Forum and serve as a catalyst project leading to community awareness and more projects in the catchment - It was agreed that Water Week in March 2012 would be an ideal opportunity for the bio-	■ First quarter	 Forum work group under lead of Dr Anneli Kuhn; and 				
	monitoring project.	2012.	■ City of Tshwane.				



7.0 CONCLUSIONS AND RECOMMENDATION

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Interest-groups along the Moreleta Spruit are mobilised to do valuable work on a voluntary basis in support of the management responsibility of the Department of Water Affairs (DWA) and the City of Tshwane (CoT) Municipality. To this end a group of concerned citizens have worked with the DWA to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River Programme.

The conclusions and recommendations of this study are as follows:

- Moreleta Spruit Stakeholder Liaison Forum needs to finalise the institutional setup of network based forum;
- Strengthen relationships between key stakeholders (such as DWA, CoT and communities) by inviting specific persons of relevant departments to Adopt-a-River meetings from time to time;
- Work with DWA on the Phase 2 Adopt-a-River Programme when funds available become available in 2012;
- Build the forum and friends groups in areas not well represented in the central and northern part of the catchment (such as Silvertondale, Waltloo, Mamelodi, Eersterust and Kameeldrift / Roodeplaat);
- Target schools in the catchment for awareness programmes through quick-win projects;
- Strengthen relationships between key stakeholders (such as DWA, CoT and communities) by inviting specific persons of relevant departments to Adopt-a-River meetings from time to time;
- All activities, and proposed community-based projects should be in alignment with the DWA priorities;
- Creating awareness in communities should result in projects with tangible and quick results (so-called 'quick wins') to start off with;
- The bio-monitoring project (mini SASS) should be the first project of the Moreleta Spruit Forum and serve as a catalyst project leading to community awareness and more projects in the catchment It is recommended that Water Week in March 2012 would be an ideal opportunity for the bio-monitoring project;
- Compile the following management plans:
 - Environmental/ Biodiversity Management Plan emphasis on improvement of human and wildlife environment, legislation driven – national, provincial, local municipality;
 - Wildlife Management Plan to ensure the effective management of fauna species, currently present or introduced; and
 - Restoration/ rehabilitation management plan focus on critical or priority areas to restore or rehabilitate with regards to erosion (storm water control), alien invasive plants (category 1 & 2 species), feral animals and water quality.





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Moreleta Kloof Nature Reserve: http://moreletakloof.co.za/about/

Rietvlei Reserve. http://wikitravel.org/en/Rietvlei

SIBIS: SABIF: http://sibis.sanbi.org/faces/SearchSpecies/SearchDetails.jsp?1=1

Wapadrand: http://www.sa-venues.com/attractionsga/wapadrand.php

GOLDER ASSOCIATES AFRICA (PTY) LTD.

Johan Bothma Landscape Architect Ralph Heath

Business Unit Leader: Environmental Technology

JG/RH/pb

Reg. No. 2002/007104/07

Directors: FR Sutherland, AM van Niekerk, SAP Brown, L Greyling

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APPENDIX A

Stakeholder Engagement

Appendix A1 - Stakeholder Database

Appendix A2 - Letter of invitation and BID

Appendix A3 - Posters

Appendix A4 - Proceedings WS1 - 4 October 2011

Appendix A5 - Proceedings WS2 - 3 November 2011

Appendix A6 - Proceedings WS3 - 29 November 2011

(Some personal information deleted for the Internet version)





Project no: 11616140 15 September 2011

Dear Sir / Madam

ADOPT-A-RIVER PROGRAMME FOR THE MORELETA SPRUIT

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA) as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

Interest-groups along the Moreleta Spruit have been actively involved with rehabilitation and caring of the Spruit on a voluntary basis. This group of concerned citizens approached the DWA and expressed a desire at a public meeting held on 8 December 2010 to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative. Subsequently, the Gauteng Region of the DWA has allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are coordinated.

The project will be implemented in phases and Phase I of the proposed project will include the following:

- Establishment of a Moreleta Spruit Adopt-a-River Forum;
- A situational analysis of the Moreleta Spruit; and
- Compilation of a high level action plan.

Special attention will be given to involving schools and other learning institutions and in particular previously disadvantaged communities situated along the river course, in the programme. One of the principles of the programme is the engagement and active participation of community interest groups, including volunteers, volunteer groups and residents in the protection, management and monitoring of water resources.

Important milestones for Phase I of the project

- Work Session I, 4 October 2011: at this work session, the project will be discussed in general and a broader stakeholder base identified. The Moreleta Adopt-a-River Forum structure and election process will be defined. Technical information will also be requested form available sources.
- **Public inputs, 18 October 2011:** technical information that is readily available concerning the Moreleta Spruit, will be gathered from the public and relevant stakeholders.
- Work Session II, 27 October 2011: the election, structure and strategy of the Forum will be finalised during this work session. The established Forum will also provide inputs towards a communications strategy that will be developed.
- Present gaps and action plan, 29 November 2011: the gaps identified, draft action plan and communication strategy will be presented to the established Forum for inputs.

How to become involved in the project

You are invited to become involved with the project and can do so by:

- Completing the enclosed registration and reply sheet and submitting it to the Public Participation Office by Friday, 30 September 2010;
- Joining an existing Friends of the Moreleta group in your area; and
- Attending the first Work Session on 4 October 2011.



Please feel free to forward this letter with the registration and reply sheet to individuals who would like to become part of the project.

Invitation to attend the first Work Session

You are cordially invited to attend a Work Session that will be held:

Date: Tuesday, 4 October, 2011

Time: 17h30 to 20h00

Venue: Silverton Recreation Centre

Venue details: 513 Pretoria Road (between Fakkel & Fontein Streets), Silverton, next to the SAPS

Should you have any questions, need more information, or wish to raise issues of concern or suggestions, please contact Nestus Bredenhann at tel: (011) 254 4978 / e-mail: nbredenhann@golder.co.za / fax: (011) 315 0317.

Yours sincerely

NESTUS BREDENHANN

Nextus Bredenhann

Public Participation Office: Moreleta Spruit Adopt-a-River Programme

Enclosed:

Registration and reply sheet



ADOPT-A-RIVER PROGRAMME FOR THE **MORELETA SPRUIT REGISTRATION & REPLY SHEET**

• To register for the project To attend the first Work Session

Please complete and return by Friday, 30 September 2011 to the

Golder Associates Africa PUBLIC PARTICIPATION OFFICE

Nestus Bredenhann

P O Box 6001, Halfway House, 1685 Tel: (011) 254 4978 Fax: (011) 315 0317 F-mail: nbredenhann@golder.co.za

Public	Participation office (see alongside)	E-mail. <u>III</u>	<u>Jieuerillaliili 🧠 Ç</u>	Joide1.	<u>a</u>
TITLE	FIRST NAME				
INITIALS	SURNAME				
ORGANISATION					
ADDRESS &					
POSTAL CODE		CELL NO			
TEL NO		FAX NO			
EMAIL					
	d the first Work Session on Tuesday, 4 Octol	per 2011 at the Silve	erton	YES	NO
	please circle the appropriate block)				
COMMENTS (please t	use separate sheets if you wish)				
	THANK YOU FOR YOUR	RESPONSE			
NAME:	SIGNATURE:		DATE:		







BACKGROUND INFORMATION DOCUMENT

ADOPT-A-RIVER PROGRAMME: MORELETA SPRUIT

BACKGROUND INFORMATION DOCUMENT



Project No: 11616140

September 2011

INTRODUCTION



The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA) as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources. The purpose of this Background Information Document (BID) is to invite interested citizens of the City of Tshwane (CoT) and all other stakeholders to become involved in

ABBREVIATIONS								
BID	Background Information Document							
CoT	City of Tshwane							
DWA	Department of Water Affairs							
IWRM	Integrated Water Resource Management							
MEMP	Master Environmental Management Plan							
WSS	Water Sector Support							

the Adopt-a-River programme for the Moreleta Spruit that runs through the city.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Unfortunately the Moreleta Spruit has been used, and in some cases abused, over many years and can no longer be described as a natural river system. To rehabilitate and restore the Moreleta Spruit to the best possible state, will require energy and resources from various contributors of society. Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the CoT Municipality, To this end a group of concerned citizens approached the DWA and expressed a desire at a public meeting held on 8 December 2010 to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative.

The Gauteng Region of the DWA has subsequently allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. The project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam (**Figure 1**). The project will be linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT.

Special attention will be given to involving schools and other learning institutions and in particular previously disadvantaged communities situated along the river course, in the programme. Patrons and donors will be recruited to provide moral, financial, scientific and technical support to the programme, in order to promote long term sustainability of the programme.

One of the principles of the programme is the engagement and active participation of community interest groups, including volunteers, volunteer groups and residents in the protection, management and monitoring of water resources. Therefore, a key component of this project is the establishment of a Moreleta Spruit Adopt-a-River Forum, consisting of various stakeholder groups, which will take ownership for the Moreleta Spruit, to ensure future sustainability and continuous engagement with relevant governmental institutions.

2

This document provides a brief description of Phase I of the Moreleta Spruit Adopt-a-River project and an overview of the subsequent project phases. Please complete the enclosed comment and registration sheet, or contact the public participation office by mailing or faxing a letter, by telephone or e-mail. You will then receive further information about the proposed project.

We invite you to become part of the Moreleta Spruit Adopt-a-River Programme

Return address for comments and to become involved in the project:

Public Participation Office
Nestus Bredenhann

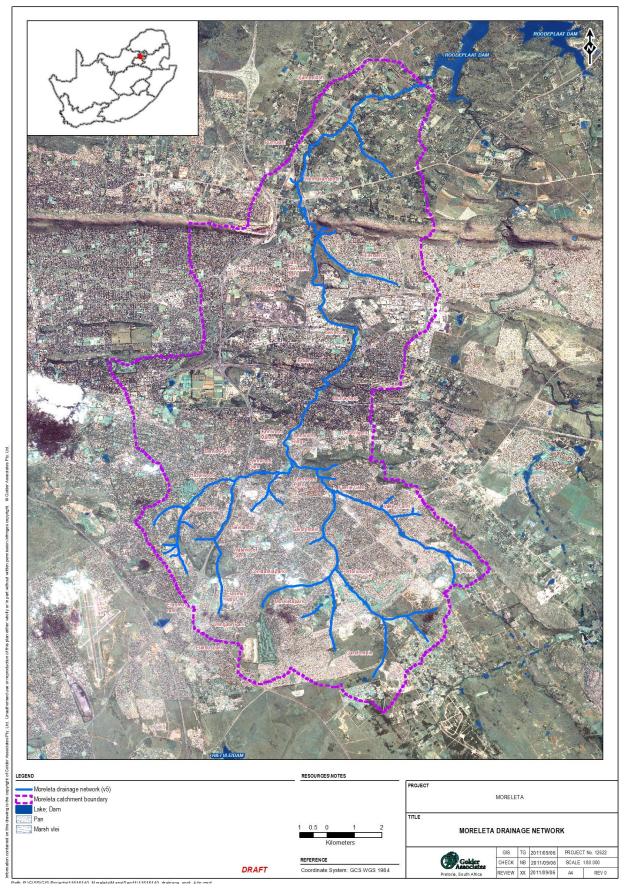
Golder Associates Africa (Pty) Ltd P O Box 6001, Halfway House 1685 Tel: (011) 254 4978 Fax: (011) 315 0317

Email: nbredenhann@golder.co.za









3

Figure 1: Moreleta Spruit Catchment area and locality map



PROJECT DESCRIPTION



Key components of Phase I of the project

The following key components of this project will be undertaken:

- Establishment of a Moreleta Spruit Adopt-a-River Forum;
- A situational analysis of the Moreleta Spruit; and
- Compilation of a high level action plan.

Moreleta Spruit Adopt-a-River Forum

The Forum will play a vital role to ensure sustainability, protection and development of the Moreleta Spruit. It will comprise stakeholders from

various disciplines and segments of society that will act in favour of the Moreleta Spruit as well as communities along the spruit. Establishment of the Forum will follow an open and transparent process to ensure inclusive representation of all stakeholder groups.

Situational analysis

A situational analysis of the Moreleta Spruit will be done in terms of its past history, environmental/ecological, institutional and legal status, demographic composition, infrastructure development and financial aspects. A gap analysis to identify lacking information that will be required for the development of a State of the Rivers Report and a Master Environmental Management Plan (MEMP) for the Moreleta Spruit, will also be done.

High level action plan

Using the outputs from the previous two activities, recommendations and a high level action plan for Phase II of the project will be developed. This will be in support of the development of a State of the Rivers Report and a MEMP for the Moreleta Spruit.

14 Sept '11

- Announce project
- Letter, BID, street Posters, through existing Friends of the Moreleta Spruit groups

4 Oct '11

- Work Session I (all stakeholders)
- Define Forum structure & election process
- Identify broader stakeholder base
- Request available technical information

18 Oct '11

27 Oct '11

29 Nov '11

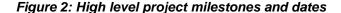
- Gather available technical information from
- public / stakeholders

Public inputs

- Work Session II (all stakeholders)
- Oversee Forum election process
- Finalise Forum structure & strategy
- Inputs for communication strategy
- Present Gaps and Action Plan
- Present to established Forum for inputs
- Present draft communication strategy















Friends of the Moreleta

ADOPT-A-RIVER PROGRAMME FOR THE MORELETA SPRUIT

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA) as a means of creating awareness among communities and relevant stakeholders, of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Unfortunately the Moreleta Spruit has been used, and in some cases abused, over many years and can no longer be described as a natural river system.

Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the City of Tshwane (CoT) Municipality. To this end the Gauteng Region of the DWA has allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated.





- Establishment of a Moreleta Spruit Adopt-a-River Forum
- A situational analysis of the Moreleta Spruit
- Compilation of a high level action plan

Special attention will be given to involving schools, learning institutions and previously disadvantaged communities. Patrons and donors will be recruited to provide moral, financial, scientific and technical support to the programme.

You are invited

to attend the first Working Session to establish the

Moreleta Spruit
Adopt-a-River Programme Forum

Date: Tuesday, 4 October 2011

Time: 17h30 to 20h00

Venue: Silverton Recreation Centre

Details: 513 Pretoria Road

(between Fakkel & Fontein Streets),

Silverton, next to the SAPS

To register and become part of the project, please contact Golder Associates:

Nestus Bredenhann

Public Participation Office Golder Associates Africa (Pty) Ltd P O Box 6001, Halfway House 1685 Tel: (011) 254 4978

Fax: (011) 315 0317

Email: nbredenhann@golder.co.za

become part

of the change



FEEDBACK REPORT: FIRST WORK SESSION

Adopt-a-River Programme: Moreleta Spruit

Submitted to:Department of Water Affairs Project Stakeholder Database



Report Number: 11616140 **Distribution:**

Thabisile Rakgotho Billy Twala







FIRST WORK SESSION FEEDBACK REPORT

List of Acronyms

BID Background Information Document

CBO Community-Based Organisation

CID Community Initiatives Database

CoT City of Tshwane

DMR Department of Mineral Resources

DEA Department of Environmental Affairs

DWA Department of Water Affairs

EMP Environmental Management Plan

GMBA Gauteng Master Builders Association

GDARD Gauteng Department of Agriculture and Rural Development

MBA Master Builders South Africa

MMC Member of Mayoral Committee

MSCN Moreleta Spruit Catchment Network

NGO Non-Governmental Organisation

PBO Public Benefit Organisation

SAGDA South African Graduates Development Association

SANBI South African National Biodiversity Institute

SANRAL South African National Roads Agency

SAPS South African Police Service

RQS Regional Quality Services

WS Work Session

WSS Water Sector Support

PUBLIC PARTICIPATION OFFICE AND RETURN ADDRESS FOR COMMENTS

Elna de Beer/Meshack Mokonotela

Golder Associates

P O Box 6001, Halfway House, 1685, South Africa Tel: +27 11 254 4800, Fax: +27 11 315 0317

Email:edebeer@golder.co.za, mmokonotela@golder.co.za





FIRST WORK SESSION FEEDBACK REPORT

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Stakeholder database

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Rolling stakeholder matrix and Community Initiatives Database

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Work Session presentation and agenda

APPENDIX D

Announcement letter and Background Information Document

User Note: This Table of Contents section acts as a reference point for the Record of Issue, Executive Summary and Study Limitations sections as and when they might be required. Therefore, the structure of this section must not be altered in any way.



No.

FIRST WORK SESSION FEEDBACK REPORT

1.0 INTRODUCTION AND BACKGROUND

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA), in support with various community based initiatives, as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the City of Tshwane (CoT) Municipality. To this end a group of concerned citizens approached the DWA and expressed a desire to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative.

The Gauteng Region of the DWA has subsequently allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. This project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam. The project will be linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT.

As part of phase one of the project, which is focused on information gathering and gap analysis, a structure/forum will be established that will ultimately integrate and support community initiatives along the Moreleta Spruit. The first Work Session (WS) in order to establish this structure/forum was held on Tuesday, 4 October 2011 from 17:30 – 20:00 at the Silverton Recreation Hall in Pretoria.

This report serves the purpose to provide feedback on the progress of the structure/forum and related information that will serve to the benefit of all interest groups.

2.0 PROCEEDINGS

2.1 Summary

The first WS officially started at 18:00 and all participants were welcomed and thanked for attending the first WS of the project. Helen Moremong from DWA, Integrated Water Management Support, provided background and detailed information on the overall Adopt-a-River Programme. Helen also answered some questions from participants, mainly around future DWA involvement and possible budget allocation from DWA for community-based initiatives.

Anneli Kühn from Friends of the Moreleta Spruit provided brief background on the community's history and involvement in the Adopt-a River Programme and Moreleta Spruit. Anneli also thanked the DWA for making the needed funds available to make Adopt-a-River Programme a reality for the Moreleta Spruit. Johan Goosen and Nestus Bredenhann from Golder Associates provided a brief overview of project's technical component, information gathered and the community engagement done thus far.

Nestus Bredenhann facilitated a session where all attendees participated in:

- Stakeholder mapping to identify the relevant parties to be involved in this process;
- The identification of issues of concern and suggestions for enhanced benefits; and
- Development of the project purpose, potential institutional process to establish a forum.

Open discussion took place throughout the evening and various suggestions, ideas and issues of concern were raised. Participants had the opportunity to break for refreshments and the WS officially adjourned at 20:00.

Thirty five individuals attended the first WS individuals and their contact details are included in the stakeholder database (**Appendix A**). The PowerPoint presentation and full agenda is included as **Appendix C**. The Background Information Document (BID) was also available to participants (**Appendix D**).





FIRST WORK SESSION FEEDBACK REPORT

2.2 Stakeholder mapping

A high level stakeholder map that was developed during a strategic session held at Golder Associates in Pretoria on Friday, 12 August 2011 with key stakeholders was presented at the WS. The stakeholder map was updated with inputs from the participants and is listed below:

Table 1: Stakeholder map

Main stakeholder groups	Sub stakeholder groups	Specific stakeholders/entities				
	National	■ Department of Water Affairs (DWA)				
	INational	 Department of Environmental Affairs (DEA) 				
	Provincial	Gauteng Department of Agriculture and Rural Development (GDARD)				
	Regional	■ Water Sector Support (WSS)				
	(DWA)	Regional Quality Services (RQS)				
		■ South African Police Service (SAPS)				
		■ Metro Police				
Government		South African National Biodiversity Institute (SANBI)				
	Local	Nature conservation				
	(Tshwane Local	Member of Mayoral Committee (MMC)				
	Municipality)	■ Ward councillors				
		■ Water & sanitation				
		Environmental planning				
		Environmental resource planning				
		■ Storm water				
		■ Transnet pipeline				
Parastatal		 South African National Roads Agency (SANRAL) 				
	Schools	As per stakeholder database				
Education	FET colleges	Various to be identified				
Laddation	Universities	■ University of Pretoria				
	Offiversities	Technical University of Tshwane				
		■ WESSA				
Nan payaganantal	Environmental	■ Birdlife SA				
Non-governmental organisations (NGOs)		 Dendrological Society of SA 				
o.gao ()	Education	South African Graduates Development Association (SAGDA)				
		■ Friends of the Weavers Nest				
		■ Friend of the Wolwe & Waterkloof Spruits				
		Friends of the Serene Valley				
Community-based	Environmental	Friends of the Moreleta Spruit				
organisations (CBOs)	Environmental	■ Friends of the Faerie Glen Nature Reserve				
		■ Sakabula Sanctuary				
		■ Hadeda Sanctuary				
		Zita Park				





FIRST WORK SESSION FEEDBACK REPORT

Main stakeholder groups	Sub stakeholder groups	Specific stakeholders/entities				
	Safety/security/safety	Meyerspark Community Watch				
Public benefit organisations (PBOs)	Environmental	Ecoglen Association				
Media	National	 Sunday Times Beeld Rapport City Press Daily Sun 				
	Regional	Pretoria NewsBusiness Day				
	Local	■ Record				
Industrial	Oil & GasManufacturingUtilitiesTransport	Various to be identified				
Farmoro	Small / informal	Various to be identified				
Farmers	Commercial	Various to be identified				
Developers		Master Builders South Africa (MBA)Gauteng Master Builders Association (GMBA)				
Residents	Per suburb	As per stakeholder database				
Taxi associations	Per suburb	Various to be identified				
Informal settlements / Townships	Per suburb	Mamelodi				
Churches	Per suburb	NG Lynnwood				
Libraries	Per suburb	Alkantrant				
Estates	Per suburb	Garsfontein Secura Park				
Shopping centres	Per suburb	Menlyn				
Other	Museums	Pioneer Museum				

The stakeholder database needs to be kept updated and a draft rolling stakeholder matrix is included in **Appendix B** to be used by the proposed forum to continuously monitor stakeholder involvement.

2.3 Identification of issues

Issues of concern relating to the Moreleta Spruit catchment were identified and were converted to objectives for the structure/forum to deliver on. The first five issues were collectively accepted to be used as the main objectives for immediate focus by the proposed forum. Issues are listed below with a priority rating assigned to each (1 = highest and 10 = lowest).



No.

FIRST WORK SESSION FEEDBACK REPORT

Table 2: Issues of concern

Issues of concern	Priority rating
Lack of environmental law enforcement and negative impact of illegal activities	1
Litter, illegal waste dumping and the lack of recycling	2
Lack of plans and/or Environmental Management Plans (EMP)	3
Invasive plants	4
Homeless nomads and/or squatters	5
Need for security and the presence of crime	6
Lack of funding for community initiatives	7
Negative impact of developers and/or builders	8
Lack of awareness creation and capacity building	9
Continuous state of the Moreleta Spruit monitoring	10

2.4 Development of the structure/forum's purpose

Understanding the various issues facing the Moreleta Spruit catchment, participants could more clearly contribute towards the development of a structure/forum purpose statement. The following thoughts and key words were captured and will be refined into a statement by the formalised structure/forum:

- Needs to upholds law enforcement;
- Must implement practical actions plans to ensure long term sustainability;
- Must ensure water resource sustainability;
- Must be a civil society initiative;
- Must be inclusive to establish and promote networks / partnerships;
- Must promote integrated water management of the overall eco system;
- Must improve the Moreleta Spruit's value as a community asset; and
- Must ensure **conservation** of the Moreleta Spruit catchment to a **healthy** state and environment.

2.5 Establishment of the structure/forum

Establishing the structure/forum that will deliver on the overall purpose and objectives will be critical to ensure sustainability and success of the Adopt-a-River initiative. Suggestions were provided by the participants and are listed below.

2.5.1 Required characteristics

Suggestion on the proposed structure/forum should have the following characteristics:

- Must have geographical representation from the Moreleta Spruit catchment;
- Must have representation from all CBOs and relevant interest groups;
- Must be inclusive and have broad buy-in;
- The various interest groups must be able to function independently and have autonomy; and
- Must be focussed on the various sectors of society.



Yes .

FIRST WORK SESSION FEEDBACK REPORT

2.5.2 Structure/forum components

The following components were identified and suggested to form part of the proposed structure/forum:

- Fund raising / funding;
- Administrative function;
- Communication and marketing function;
- Technical and scientific function;
- Education and capacity building function;
- Procurement function;
- Project identification and project management
- Law enforcement; and
- Investigating issues / concerns / complaints function.

2.5.3 Proposed framework of forum establishment

There are currently various community based initiatives active within the Moreleta Spruit catchment, each with their own objectives and methodologies. One of the key characteristics as identified by the WS is for the various groups to maintain their independence. It is therefore proposed to establish a network-based model for the Moreleta Spruit catchment which will include, integrate and leverage current initiatives within the catchment The Government, through DWA, has developed and implemented a number of programmes that is aimed to ensure that South Africa's water resources remain healthy. The objectives of national programmes and community initiatives need to collaborate and integrate as far as possible in order to achieve the commune of healthy sustainable river and ecological systems. A proposed overall framework is provided below (**Figure 1**) in order to provide the background and context for the proposed forum (**Figure 2**).

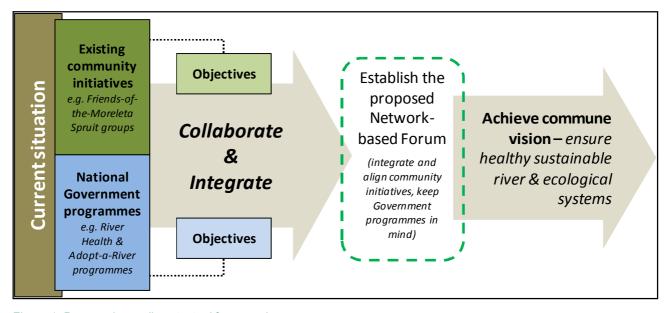


Figure 1: Proposed overall contextual framework



FIRST WORK SESSION FEEDBACK REPORT

The contextual framework for the proposed forum needs to recognise the DWA River Health Programme objectives and are listed below:

- Measure, assess and report the ecological state of aquatic ecosystems;
- Detect and report spatial and temporal trends in the ecological state of aquatic ecosystems;
- Identify and report emerging problems regarding aquatic ecosystems; Communication and marketing function;
- Ensure that all aquatic ecosystem health reports provide scientifically relevant information for the management of aquatic ecosystems; and
- Create public capacity and environmental awareness.

In addition to the River Health Programme the DWA Adopt-a-River Programme objectives also need to be aligned with that of the proposed forum and are listed below:

The main aim of the Adopt-a-River programme is to create an understanding among all water users and in particular the previously marginalised communities of the concepts of integrated water resource management, to encourage them to become actively involved in the protection and management of these resources.

- Empowering all users of water to protect their water resources and participate in water resources management as captured;
- Facilitating the involvement of patrons and sponsors (influential individuals) in stakeholder empowerment and resource management strategies;
- Developing and making available the necessary tools for training and empowering local implementing agents and other role-players;
- Ensuring optimum effectiveness, through involvement and linkages with other existing programmes and initiatives aimed at water resource protection and management;
- Create public capacity and environmental awareness; and
- Promoting a volunteerism ethic in South Africa to benefit all levels of society.

The proposed network-based forum is illustrated below in **Figure 2**. A network-based approach is proposed to ensure that initiatives and entities are included that have the Moreleta Spruit's health and development at heart. It is proposed that participants will subscribe to a forum charter that will underpin the philosophy, objectives and principles of the network to guide current and future initiatives, ensuring an open process for all stakeholders. Because of the open process, existing community entities will not be prescribed to which initiatives and projects to be done and will still be able to act independently.

A facilitation team could therefore be established to coordinate and integrate the various proposed network initiatives to ensure that the collective efforts are aligned to benefit the the various areas of the Moreleta Spruit catchment. The proposed network could have various focus areas that participants belonging to the network can contribute their efforts towards. This will ensure, although the community entities are still driving initiatives independently, that they are collectively supporting the same focus areas.



14

FIRST WORK SESSION FEEDBACK REPORT

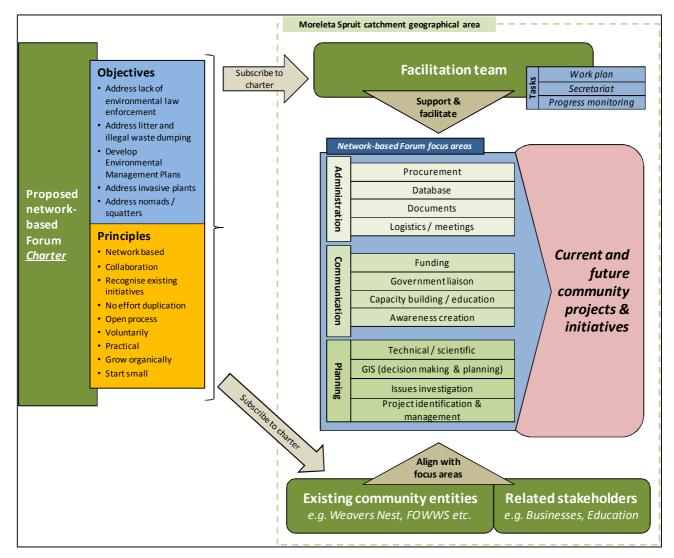


Figure 2: Proposed network-based Forum

3.0 WAY FORWARD

It is envisaged that a third WS will be needed towards the end of November to finalise the institutional framework and process of the network-based forum and the establishment of a facilitation team. A database of community initiatives (e.g. clean ups, tree planting, security, walks, awareness etc.) for the catchment will also be developed and information presented on a map. The aim of this tool will be to understand which initiatives were conducted in the past by the various entities and to plan for future initiatives. This will ensure that individual geographically dispersed initiatives:

- are continuously recorded and plotted on a single map;
- integrated in order to capitalise on the collective efforts; and
- can be planned more thoroughly to meet MSCN objectives and address key issues/risks.





FIRST WORK SESSION FEEDBACK REPORT

Lessons can be learnt and ideas shared which will minimize efforts and duplication that can be spatially communicated and managed. The Excel-based Community Initiatives Database (CID) is included in **Appendix B** to be populated as far as possible by the various entities and sent back to Golder by 10 November 2011. A map with the various initiatives plotted will be presented at the third WS for inputs.

GOLDER ASSOCIATES AFRICA (PTY) LTD.

Nestus Bredenhann

Nestus Bredenhann

Public Participation Practitioner

Johan Goosen Project Manager

NΒ

Reg. No. 2002/007104/07

Directors: FR Sutherland, AM van Niekerk, SAP Brown, L Greyling

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FIRST WORK SESSION FEEDBACK REPORT

APPENDIX A

Stakeholder database







APPENDIX B

Rolling stakeholder matrix and Community Initiatives Database



Main groups	Sub groups	Specific groups	Constantiapark	East Lynne	Eersterus	Erasmuskloof	Erasmusrand Faerie Gle	n Garsfontein	Hazelwood	Jan Niemand Park	Koedoespoort	Lydiana	Lynnwood Glen	Lynnwood Lynnwood Manor Park	Lynnwood Ridge	Mamelodi	Menlo Park Moreletapark Murrayfield	Newlands	Olympus	Pretoriuspark	Silverton	Valley Farm	Waterkloof	Waterkloof Wilgers	Wingate Park	Wolmaranspoort
Government	National	DWA, DEA											Glen	IVIATIOT PATK	Ridge									Gieri	PdIK	
	Provincial	GDARD																								
	Regional	WSS, RQS																								
	Local	SAPS																								
		Metro Police SANRI																								
		Nature conservation MMC																								
		Ward councillors																								
		Water & sanitation																								
		Environmental planning																								
		Environmental resource planning																								
		Storm water																								
Parastatal		Transnet pipeline SANRAL																								
Education	Schools	Afrikaanse Hoër	Glenstantia	Harvey Junior	Eersterust	Hoërskool	Tomorrow's			Laerskool			Doxa Deo		Lynnwood		Hoërskool &				CBC,		Waterkloof		Carpe Diem	
		Meisieskool, Afrikaanse	Primary,	Education,	Sekondêr, Nantes		People	Laerskool	Alphen Park	Derdepoort			Christian		Ridge	1	Laerskool				Hoërskool &				Academy,	
		Hoër Seunskool, Brooklyn Primary,	Laerskool Constantiapark	Mervyn Harvey Education	Primary, PS Fourie Primary,	·	Independent Primary Scho						School, St Alban's		Primary, Tyndale		Menlopark				Laerskool Silverton			School, The Hoërskool Die Glen High Wilgers,	Pretoria Chinese	
		Laerskole Elarduspark,	Constantiapark	Centre,	Prosperitus		Filliary Scho	101					College		Christian						Silverton				School	
		Lynnwood, Meyerspark,		Hoërskool FH	Sekondêr										School									High School		
		Pretoria-Oos, Boys High		Odendaal,																						
				Hoërskool CR												1										
				Swart, Meridian College												1										
				& Private Primary																						
	FET Colleges					1											 									
	Universities	University of Pretoria																								
		Technical University of																								
		Tshwane																								
NGO	Environmental	WESSA, Birdlife SA, Dendrological Society SA																								
	Education	SAGDA																								
СВО	Environmental	Weavers Nest				 	Friends of the	e	+														l			
		Friends of the Serene Valley					Faerie Glen	·																		
		& Moreleta Spruit					Nature Reser	rve															FOV	/WE		
		Sakabula & Hadeda																								
		Sanctuaries, Zita Park																								
	Community policing forums	Meyerspark Community Watch																								
РВО		Ecoglen Association				1																				
Media	National	Sunday Times, Beeld,																								
		Rapport, City Press, Daily																								
		Sun																								
	Regional	Pretoria News, Business Day	'																							
	Land	Danard	-	1	-					-																
Industrial	Local Oil & gas	Record	1	 	1	1			+	1						-	 		1						+	
Muustral	Manufacturing			1	†	†	+		1								 								+	
	Utilities					1																				
	Transport																									
Farmers	Small / informal				ļ	ļI																				
D. H.	Commercial		1	 	1	1				-						ļ			ļ						-	
Developers Residents				 	+	 	-		1																-	
Taxi				 	†	 		-	+										1						+	
Associations				1												1										
Townships /																										
informal																х										
settlements Churches		NG Lynnwood		 	+	 	-		1																-	
Libraries	+	NO Lylliwood		+	 	 	Alkantrant	+																		
Estates				1	Ì			Garsfontein																		
								Secura Park																		
Shopping																	Menlyn									
Centres Other				1	-	 			1																	
other		1	1	1	1	1	<u> </u>		1	l		l		I	1		1 1	l	1							

		Communty	Initiatives Database (all information provided b	elow are examples)		
Date	Location	Participants	Activities	Approach	Challenges	Outcomes
01-Mar-08	Attach .kmz (google point) file or insert GPS location or describe with street names, or draw a polygon in google earth and attach.	Friends of Weavers nest (contact person Ronel van Heerden cell: 082 345 2354)	Educational walk through spruit with litter pickup.	Focussed on school children / SPAR moreleta sponsored caps.	Lack of interest / collaboration.	Greater awareness / contact made with schools.
	Serene Valley: Incorporating the nature area along the Moreletaspruit from Hans Strydom to Serene Streets, as well as the nature area along the Constantiaspruit joining the Moreletaspruit from Veldrift Street.	Glover (Vice Chairman), Stan Williams (Finance), Elizabeth	The committee identified fencing and restriction of access to the nature area as an initial project. Other projects are to clean up litter, to remove alien vegetation, to identify and tag trees, to plant new trees, to identify bird species and to monitor the wetland.	Annual membership to the Friends of Serene Valley is R200 per household. Funds collected will be used to complete projects identified by the Friends Committee.		
2005 - 2006	N4 to Lynnwood	Friends of Moreletta Spruit (N4 to Lynnwood road).	Mission: To encourage public participation in caring for the Moreletaspruit and in particular the section between Lynnwood Road and the N4 Freeway in order to promote the conservation and sustainable utilisation of the area by the public and the landowners of the area.	Planning: An ecological survey which has lead to a Management Plan. Moreleta Wetland rehabilitation project. Birding days to identify what birds inhabit our area. Establish a proper hiking trail. To involve the schools and Boy Scouts, Girl Guides and Voortrekkers in our vicinity.		
29-Oct-10	The project is located in the Eastern Suburbs of Pretoria, South Africa inside the Moreleta Kloof Nature Reserve at 60 Helios Street (GPS – 25º 48' 49. 94" S and 28º 17' 15. 89" E) that is one of the reserves that is owned by the City of Tshwane and managed and operated by the department of Nature Conservation of the Tshwane City Council.	Friends of Moreletta Kloof: contact us on info@moreletakloof.co.za	Discovery and Sensory trail: The aim with the Moreleta Kloof Discovery and Sensory trail development project is to develop a 2 Kilometre long discovery and sensory walking trail inside the Moreleta Kloof Nature Reserve in the Eastern Suburbs of Pretoria, South Africa. The Directors of "The Friends of Moreleta Kloof" decided to develop an easily accessible route inside the Kloof that will allow disabled people the opportunity to experience nature closer in an area situated almost in the centre of Tshwane. Two people in wheelchairs were asked to get involved in the planning and support of the wheelchair trail. Mr Chris Patton is the Project Manager: Business Development Unit of SANPARKS and also a wheelchair user and Mr Mathys Roets are a South African musician and celebrity that became a wheelchair user two years ago after a motorcycle accident. Mathys Roets are currently acting as the custodian of the project and both Chris and Mathys are closely involved with the project team in the planning of the project.			





APPENDIX C

Work Session presentation and agenda







1st Work Session

Tuesday, 4 October 2011
Silverton Recreation Centre

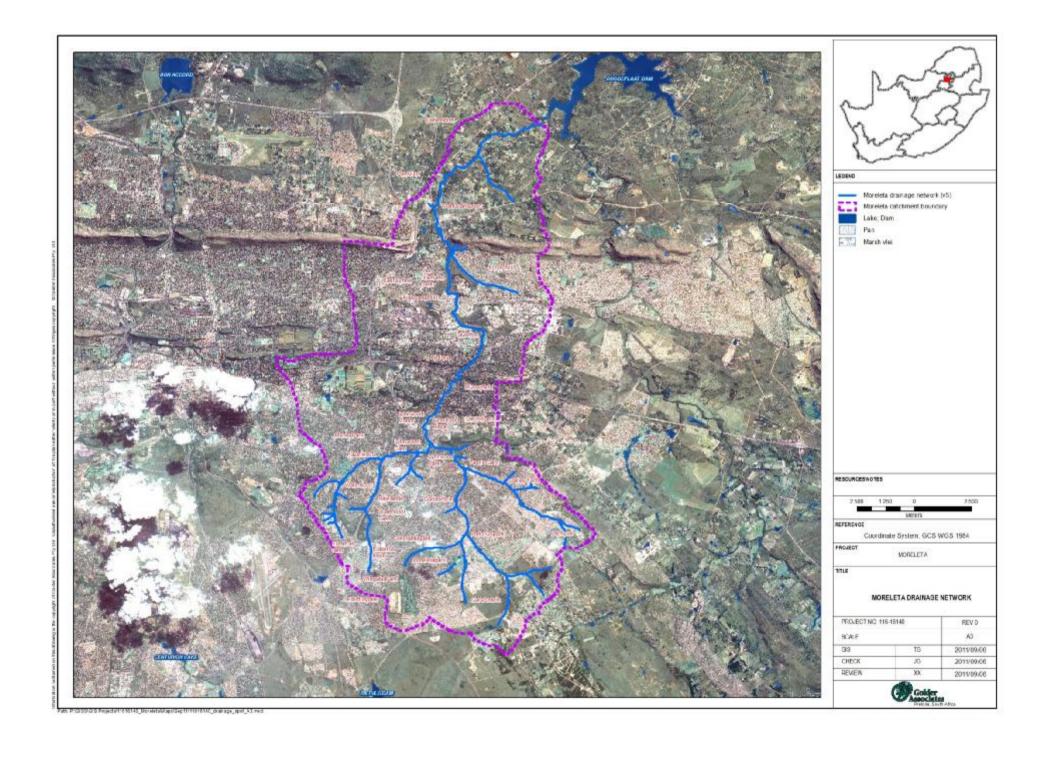




Agenda

- Welcome
- Project background
- Establishment of ground rules
- Progress feedback
- Establish 'Interim' Forum
 - Stakeholder mapping
 - Identify key issues
 - Determine purpose
 - Determine objectives
 - Determine structure
- Approach to election process
- 2nd Work Session
- Closure

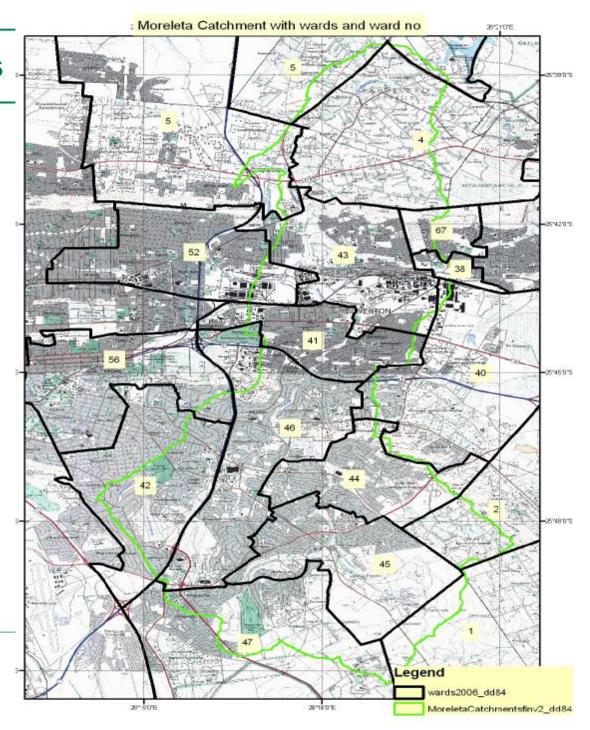






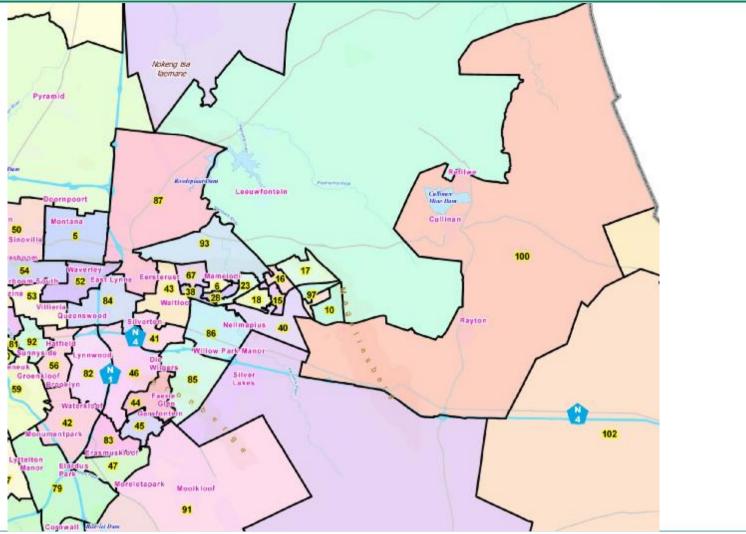
Old Wards

- Ward 4
- Ward 38
- Ward 41
- Ward 42
- Ward 43
- Ward 44
- Ward 45
- Ward 46
- Ward 47
- Ward 67





New wards



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Progress feedback

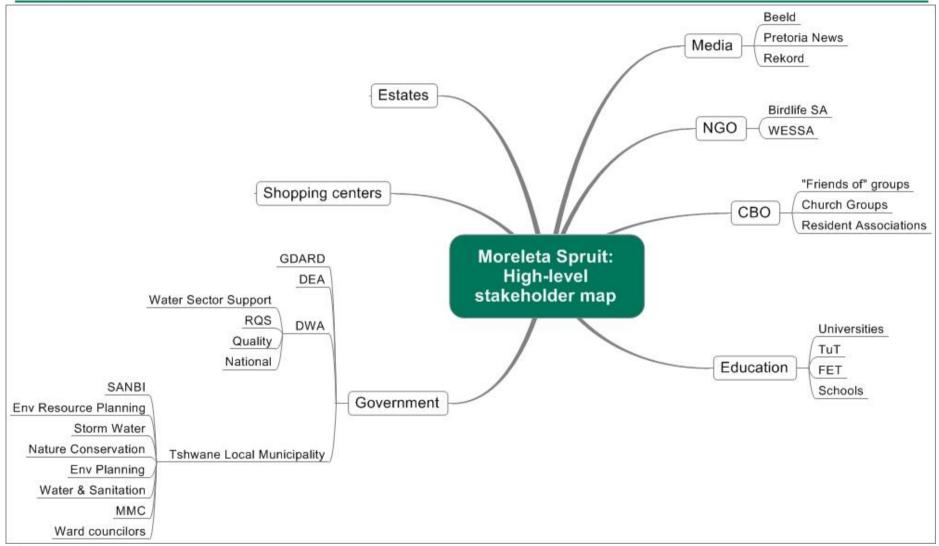
- Project inception meeting held at DWA on Tuesday, 12 July 2011
- Strategic Session held at Golder on Friday, 12 August 2011
- Formal project announcement on Thursday, 15 September 2011
- Findings from information gathering phase thus far:
 - CoT monitors H2O quality in Moreleta catchment at 11 points
 - DWA monitors water quality in Moreleta catchment at 4 points
 - CoT SW Management has 3 areas (a) old city (b) new south-east (c) new Nokeng smallholdings – active flood attenuation plan in south-east / new areas still a challenge to integrate
 - CoT has mapped wetlands in the Moreleta catchment
 - Shopping Centres point source pollution from wet waste compactors is receiving attention
 - CoT actively manage effluent release from industries and H2O pollution
 - Catchment area has distinct land use groupings



October 27, 2011 6



High level stakeholder map



Golder





APPENDIX D

Announcement letter and Background Information Document





Project no: 11616140 15 September 2011

Dear Sir / Madam

ADOPT-A-RIVER PROGRAMME FOR THE MORELETA SPRUIT

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA) as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

Interest-groups along the Moreleta Spruit have been actively involved with rehabilitation and caring of the Spruit on a voluntary basis. This group of concerned citizens approached the DWA and expressed a desire at a public meeting held on 8 December 2010 to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative. Subsequently, the Gauteng Region of the DWA has allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are coordinated.

The project will be implemented in phases and Phase I of the proposed project will include the following:

- Establishment of a Moreleta Spruit Adopt-a-River Forum;
- A situational analysis of the Moreleta Spruit; and
- Compilation of a high level action plan.

Special attention will be given to involving schools and other learning institutions and in particular previously disadvantaged communities situated along the river course, in the programme. One of the principles of the programme is the engagement and active participation of community interest groups, including volunteers, volunteer groups and residents in the protection, management and monitoring of water resources.

Important milestones for Phase I of the project

- Work Session I, 4 October 2011: at this work session, the project will be discussed in general and a broader stakeholder base identified. The Moreleta Adopt-a-River Forum structure and election process will be defined. Technical information will also be requested form available sources.
- **Public inputs, 18 October 2011:** technical information that is readily available concerning the Moreleta Spruit, will be gathered from the public and relevant stakeholders.
- Work Session II, 27 October 2011: the election, structure and strategy of the Forum will be finalised during this work session. The established Forum will also provide inputs towards a communications strategy that will be developed.
- Present gaps and action plan, 29 November 2011: the gaps identified, draft action plan and communication strategy will be presented to the established Forum for inputs.

How to become involved in the project

You are invited to become involved with the project and can do so by:

- Completing the enclosed registration and reply sheet and submitting it to the Public Participation Office by Friday, 30 September 2010;
- Joining an existing Friends of the Moreleta group in your area; and
- Attending the first Work Session on 4 October 2011.



Please feel free to forward this letter with the registration and reply sheet to individuals who would like to become part of the project.

Invitation to attend the first Work Session

You are cordially invited to attend a Work Session that will be held:

Date: Tuesday, 4 October, 2011

■ Time: 17h30 to 20h00

Venue: Silverton Recreation Centre

Venue details: 513 Pretoria Road (between Fakkel & Fontein Streets), Silverton, next to the SAPS

Should you have any questions, need more information, or wish to raise issues of concern or suggestions, please contact Nestus Bredenhann at tel: (011) 254 4978 / e-mail: nbredenhann@golder.co.za / fax: (011) 315 0317.

Yours sincerely

NESTUS BREDENHANN

Nextus Bredenhann

Public Participation Office: Moreleta Spruit Adopt-a-River Programme

Enclosed:

Registration and reply sheet



ADOPT-A-RIVER PROGRAMME FOR THE **MORELETA SPRUIT REGISTRATION & REPLY SHEET**

• To register for the project To attend the first Work Session

Please complete and return by Friday, 30 September 2011 to the

Golder Associates Africa PUBLIC PARTICIPATION OFFICE

Nestus Bredenhann

P O Box 6001, Halfway House, 1685 Tel: (011) 254 4978 Fax: (011) 315 0317

Public	Participation office (see alongside)		E-mail. <u>m</u>	<u>Jieueilliailii e</u>	901001.00	<u>a</u>
TITLE	FIRST NAME					
INITIALS	SURNAME					
ORGANISATION						
ADDRESS &						
POSTAL CODE			CELL NO			
TEL NO			FAX NO			
EMAIL						
WORK SESSION I, 17:30 – 20:00 I would like to attend the first Work Session on Tuesday, 4 October 2011 at the Silverton Recreation Centre (please circle the appropriate block)						
COMMENTS (please ι	use separate sheets if you wish)					
THANK YOU FOR YOUR RESPONSE						
NAME:	CICA			DATE		









Friends of the Moreleta Spruit

ADOPT-A-RIVER PROGRAMME: MORELETA SPRUIT

BACKGROUND INFORMATION DOCUMENT



Project No: 11616140

September 2011

BACKGROUND INFORMATION DOCUMENT

INTRODUCTION



The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA) as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources. The purpose of this Background Information Document (BID) is to invite interested citizens of the City of Tshwane (CoT) and all other stakeholders to become involved in

ABBREVIATIONS			
BID	Background Information Document		
CoT	City of Tshwane		
DWA	Department of Water Affairs		
IWRM	Integrated Water Resource Management		
MEMP	Master Environmental Management Plan		
WSS	Water Sector Support		

the Adopt-a-River programme for the Moreleta Spruit that runs through the city.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Unfortunately the Moreleta Spruit has been used, and in some cases abused, over many years and can no longer be described as a natural river system. To rehabilitate and restore the Moreleta Spruit to the best possible state, will require energy and resources from various contributors of society. Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the CoT Municipality, To this end a group of concerned citizens approached the DWA and expressed a desire at a public meeting held on 8 December 2010 to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative.

The Gauteng Region of the DWA has subsequently allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. The project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam (**Figure 1**). The project will be linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT.

Special attention will be given to involving schools and other learning institutions and in particular previously disadvantaged communities situated along the river course, in the programme. Patrons and donors will be recruited to provide moral, financial, scientific and technical support to the programme, in order to promote long term sustainability of the programme.

One of the principles of the programme is the engagement and active participation of community interest groups, including volunteers, volunteer groups and residents in the protection, management and monitoring of water resources. Therefore, a key component of this project is the establishment of a Moreleta Spruit Adopt-a-River Forum, consisting of various stakeholder groups, which will take ownership for the Moreleta Spruit, to ensure future sustainability and continuous engagement with relevant governmental institutions.

2

This document provides a brief description of Phase I of the Moreleta Spruit Adopt-a-River project and an overview of the subsequent project phases. Please complete the enclosed comment and registration sheet, or contact the public participation office by mailing or faxing a letter, by telephone or e-mail. You will then receive further information about the proposed project.

We invite you to become part of the Moreleta Spruit Adopt-a-River Programme

Return address for comments and to become involved in the project:

Public Participation Office
Nestus Bredenhann

Golder Associates Africa (Pty) Ltd P O Box 6001, Halfway House 1685 Tel: (011) 254 4978 Fax: (011) 315 0317

Email: nbredenhann@golder.co.za









3

Figure 1: Moreleta Spruit Catchment area and locality map



PROJECT DESCRIPTION



Key components of Phase I of the project

The following key components of this project will be undertaken:

- Establishment of a Moreleta Spruit Adopt-a-River Forum;
- A situational analysis of the Moreleta Spruit; and
- Compilation of a high level action plan.

Moreleta Spruit Adopt-a-River Forum

The Forum will play a vital role to ensure sustainability, protection and development of the Moreleta Spruit. It will comprise stakeholders from

various disciplines and segments of society that will act in favour of the Moreleta Spruit as well as communities along the spruit. Establishment of the Forum will follow an open and transparent process to ensure inclusive representation of all stakeholder groups.

Situational analysis

A situational analysis of the Moreleta Spruit will be done in terms of its past history, environmental/ecological, institutional and legal status, demographic composition, infrastructure development and financial aspects. A gap analysis to identify lacking information that will be required for the development of a State of the Rivers Report and a Master Environmental Management Plan (MEMP) for the Moreleta Spruit, will also be done.

High level action plan

Using the outputs from the previous two activities, recommendations and a high level action plan for Phase II of the project will be developed. This will be in support of the development of a State of the Rivers Report and a MEMP for the Moreleta Spruit.

14 Sept '11

Announce project

Public inputs

public / stakeholders

 Letter, BID, street Posters, through existing Friends of the Moreleta Spruit groups

• Work Session I (all stakeholders)

- Define Forum structure & election process
- Identify broader stakeholder base
- Request available technical information

18 Oct '11

27 Oct '11

29 Nov '11

4 Oct '11

Work Session II (all stakeholders)

• Gather available technical information from

- Oversee Forum election process
- Finalise Forum structure & strategy
- Inputs for communication strategy
- Present Gaps and Action Plan
- Present to established Forum for inputs
- Present draft communication strategy









Project No: 11616140

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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REPORT

PROCEEDINGS: SECOND WORK SESSION

Adopt-a-River Programme: Moreleta Spruit

Submitted to:

Department of Water Affairs Project Stakeholder Database

Report Number.

11616140

Thabisile Rakgotho Billy Twala

Distribution:





SECOND WORK SESSION PROCEEDINGS

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APPENDICES

APPENDIX A

Attendance List

APPENDIX B

Presentation: Technical Studies

Yes.

SECOND WORK SESSION PROCEEDINGS

1.0 INTRODUCTION AND BACKGROUND

Elna de Beer (Golder Associates) facilitated the proceedings and welcomed everybody to the meeting. Nestus Bredenhann has resigned from Golder Associates and Elna de Beer is now the Stakeholder Engagement Specialist on the Project.

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA), in support with various community based initiatives, as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the City of Tshwane (CoT) Municipality. To this end a group of concerned citizens approached the DWA and expressed a desire to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative.

The Gauteng Region of the DWA has subsequently allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. This project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam. The project will be linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT.

As part of phase one of the project, which is focused on information gathering and gap analysis, a structure/forum will be established that will ultimately integrate and support community initiatives along the Moreleta Spruit. The second WS took place on 3 November 2011 from 17:30 – 20:00 at the Silverton Recreation Hall in Pretoria.

The purpose of the meeting was to:

- Discuss the proposed model of the stakeholder liaison forum;
- Agree on process to establish the forum; and
- Receive progress feedback on the technical studies undertaken in the project.

The feedback report of the first WS sent out to all stakeholders on the database served as discussion document for the second WS. (Please note that this report is not appended to these proceedings in order to save paper. However it is available upon request). This report summarises the proceedings of the meeting.

2.0 ATTENDANCE AND APOLOGIES

See attendance list attached as Appendix A.

Twelve people attended the meeting and concern was expressed by all about the low attendance. The change of the date of the meeting from 1 November 2011 to 3 November 2011 was discussed as a possible reason;

The meeting agreed that any agreements reached during this work session will have to recognise the low attendance in the context of the agreement.

3.0 MATTERS FOR DISCUSSION

3.1 Proposed model of the stakeholder liaison forum

The following contextual framework was discussed as the proposed model of the forum:

SECOND WORK SESSION PROCEEDINGS

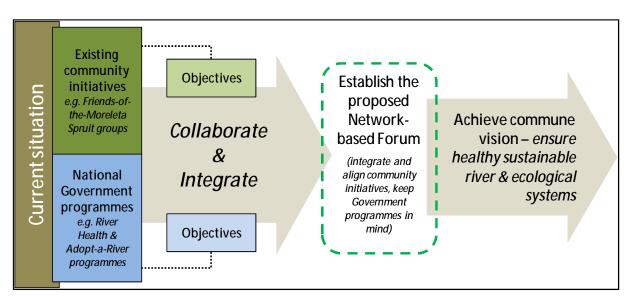


Figure 1: Proposed overall contextual framework

The meeting agreed on the establishment of a network-based forum as explained in the Feedback Report of Work Session 1 and based upon the discussions during the meeting the following principles will be adhered to in the forum:

- Integrated Catchment Management as the fundamental approach should ensure the integration of Environmental, Socio-Economic, and Political aspects into processes and projects undertaken by the forum:
- The issues of concern, purpose of the forum and its required characteristics as discussed during the first WS will be critical to ensure sustainability and success of the Adopt-a-River initiative.

3.2 Process to establish the forum

The proposed network-based forum is illustrated below in **Figure 2**. A network-based approach is proposed to ensure that initiatives and entities are included that have the Moreleta Spruit's health and development at heart. It is proposed that participants will subscribe to a forum charter that will underpin the philosophy, objectives and principles of the network to guide current and future initiatives, ensuring an open process for all stakeholders. Because of the open process, existing community entities will not be prescribed to which initiatives and projects to be done and will still be able to act independently.

The meeting agreed on the following:

- To establish the facilitation team as explained in the Feedback Report of Work Session 1;
- The purpose of the facilitation team will be for a small group of stakeholders (as volunteers) to serve as a steering group to initiate the process to establish the Network-based forum;
- The meeting agreed that although the facilitation team will remain a small group of people, additional people will be approached to become part of the facilitation team and attend the next work session. Stakeholders who are interested to become part of the facilitation team, should please indicate their interest in the enclosed reply sheet and return to the Public Participation Office by Wednesday, 23 November 2011.

The following people volunteered to be involved in the facilitation team: Anneli Kühn, Carol Martin, Ferdi Everts, and Bill Gunnell.

SECOND WORK SESSION PROCEEDINGS

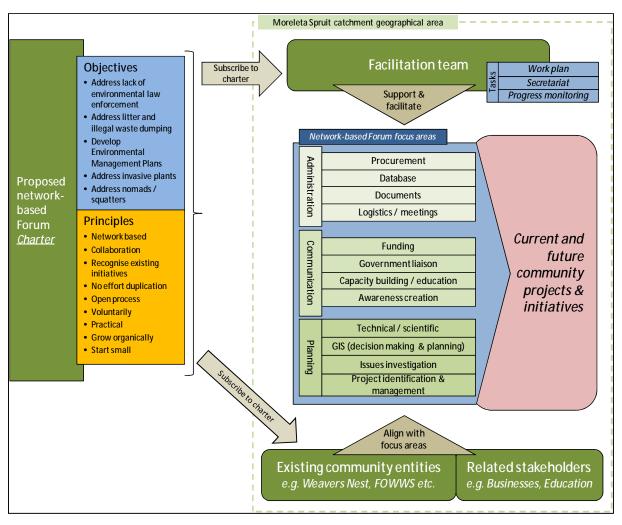


Figure 2: Proposed network-based Forum

3.3 Progress on the Technical Studies

Johan Goosen (Golder Associates: Project Manager) presented progress on the technical studies undertaken. The presentation is attached as Appendix B.

4.0 WAY FORWARD

The meeting agreed that the way forward would be to:

- Approach additional people to become part of the facilitation team and invite them to attend the next work session. Stakeholders who are interested to become part of the facilitation team, should please indicate their interest in the enclosed reply sheet and return to the Public Participation Office by Wednesday, 23 November 2011.
- A third work session will be held to finalise the institutional set up of the network-based forum and to initiate the establishment of the network. The meeting will be attended by the facilitation team (Steering group) only and the outcome of this meeting will be communicated to all the stakeholders on the overall database shortly after the meeting.

VA.

SECOND WORK SESSION PROCEEDINGS

5.0 DATE OF NEXT MEETING

The third work session will be held as follows:

Date: Tuesday, 29 November 2011

Time: 15h00-18h00

venue: Golder Associates Offices in Hatfield, Pretoria (Directions will be send to the facilitation team)

6.0 CLOSURE OF MEETING

Elna de Beer thanked everybody for their contributions and closed the meeting at 20:00

Elna de Beer

Elva de Zeer.

Stakeholder Engagement Specialist

Johan Goosen Project Manager

EdB/EdP/JG

Reg. No. 2002/007104/07

Directors: FR Sutherland, AM van Niekerk, SAP Brown, L Greyling

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APPENDIX A

Attendance List





APPENDIX B

Presentation: Technical Studies

3 November 2011 Report No. 11616140

1



CITY OF TSHWANE

Adopt-a-River Programme: Moreleta Spruit

Situational Analysis feedback / Second Stakeholder Workshop

3 November 2011





Overview

- n Historic overview
- n Institutional and legal framework
- n Ecological status
 - n Terrestrial
 - n Aquatic (including H20 quality)
- n Demographics / land use / zoning
- n Infrastructure development (including storm water)
- n Financial
- n Stakeholder mapping
- n Information database





Historic overview

- Perennial stream that has many tributaries feeding it.
- Moreleta Spruit's headwaters eastern suburbs of Pretoria, has its source in Bapsfontein - from Malmani Dolomite - south side of Pretoria
- n Increased scale of development in upper catchment area contributed to increased run off of storm water - longer periods of water in the channel.
- n Tributary of the Pienaars River.
- n Faerie Glen Nature reserve (124 ha) established 1984, considered the jewel of the Moreleta system. Moreleta spruit is reserves only source of water.
- Moreleta Kloof Nature Reserve (100 ha).
- n Sources of pollution (1978) Silverton industrial area, Baviaanspoort sewage works.
- n It is apparent from assessing old aerial photography that the upper reaches/ headwaters of the Moreleta consisted of unchannelled valley bottoms





Historic Overview



Current

1939

1968/69





Institutional and legal framework

- n NWA DWA
- n NEMA GDARD
- n CoT Openspace Framework
- n Ownership and zoning
- n Ward structure
- n CoT has to catch up the backlog of all info on "cross-border areas" inherited from Metsweding (Nokeng and Kungwini)

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Ecological status - terrestrial

n Terrestrial Ecology Statistics (Surface area – ha)

Ecological Status	Grand Total	% Cover
Aquatic	139	1%
Natural	4196	32%
Transformed	8933	67%
Grand Total	13268	100%

Land Cover 2009	Aquatic	Natural	Transformed	Grand Total	% Cover	Cum % Cover
urban			7482	7482	56%	56%
grassland		1325		1325	10%	66%

n CoT has mapped wetlands in the Moreleta catchment

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29/11/2011



Ecological status - terrestrial

- n Tree species lists available from hiking clubs/ friends of/ Nature groups.
- n List of birds observed available from photographic and bird clubs.
- n Fauna and Flora information available for Nature Reserves large mammals mainly in reserves.
- n Wapadrand, nestled on the slopes of the Bronberg is home to the endangered Juliana's Golden Mole.
- n State of the Environment report 2001 red data species occur mainly in protected areas
 - n Sensitive plant communities Undisturbed Bankenveld, Clay Thorn Bushveld and Vlei areas.
 - n Riverbanks and floodplain soils are sensitive when cleared of vegetation and have low agricultural potential. Soils are important as wetland system and habitat to a variety of invertebrates and breeding place to bird species.





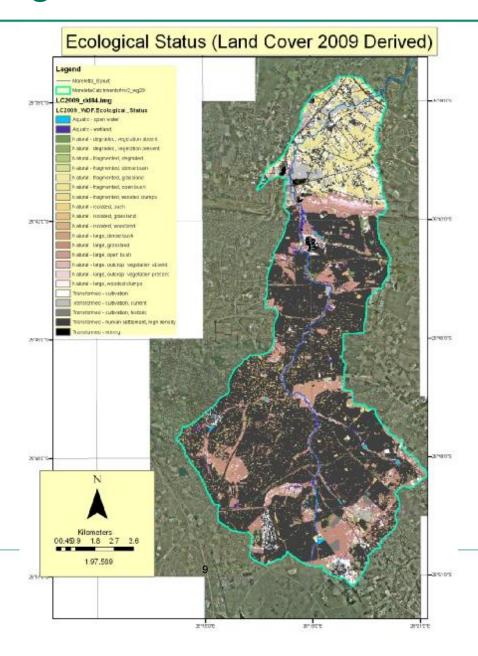
Ecological status - terrestrial

- n Faerie Glen Nature Reserve home to red data reptile species, invertebrate species, two flora species and several protected flora species.
- n Several fish species have been observed in the Moreleta spruit, e.g. Ghieliemientjies, Vleikurper, Dwarf kurper, Blue Kurper and Bass (near Roodeplaat dam).
- n Rehabilitation initiatives
 - n Friends of the Moreleta: Lynnwood Brookside: Management plan 2004 2008
 - n Tree planting and tagging along hiking trails
 - n Moreleta Kloof Discovery and sensory trail
- n Study 1978 showed that Silverton industrial area contributes large amounts of dissolved minerals to Hartbeesspruit-Moreletaspruit system





Ecological Status – Land Cover 2009 derived







Ecological status – water quality

- n CoT monitors H2O quality in Moreleta catchment at 11 points (list of constituents, dates available, according to internal standards)
- n DWA monitors water quality in Moreleta catchment at 4 points
- n GAP in data for aquatic water quality, dates to 2000/1
- n NFEPA: Present Ecological Status (fish, macro-invertebrates and riparian vegetation) of Class C: Moderately Modified (A to F)
- n NFEPA: River Condition (Habitat) Class D: Largely Modified (A to F)
- n UCT Database aquatic data received 31Oct (will still analyse)
- n Wetlands (error in data from CoT awaiting resend)
- n Shopping Centres point source pollution from wet waste compactors is receiving attention
- n CoT actively manage effluent release from industries and H2O pollution





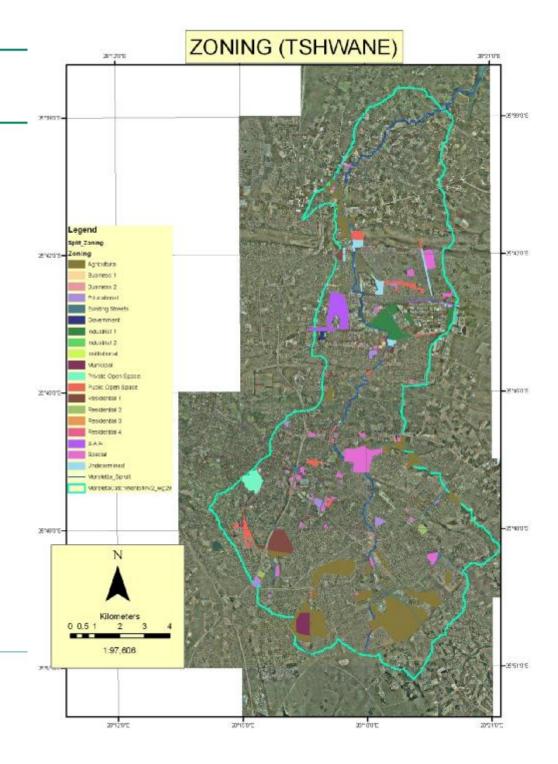
Demographics / land use / zoning

- n Catchment area has distinct land use groupings and issues:
 - n South residential (green)
 - ø crime prevention need (fencing of system) and legal enforcement need
 - ø good people networks
 - ø many river initiatives
 - ø Limited space due to development
 - n Central industrial (yellow)
 - Ø No network or involvement in river
 - ø Highest pollution risk
 - n Central Eersterust / Mamelodi (red)
 - Ø No network or involvement in river
 - Ø Open space litter problem
 - Space available for rehabilitation (govt land)
 - n North smallholdings (orange)
 - Ø No network or involvement in river
 - Space available for rehabilitation (private

29/11/2011

land)







Infrastructure development (incl storm water)

- n CoT SW Management has 3 areas
 - n (a) old city
 - n (b) new south-east
 - n (c) new Nokeng smallholdings
- n Active flood attenuation plan in south-east / new areas still a challenge to integrate (e.g Hans Strijdom bridge is max 100Qm/s (managed) as opposed to more than 250Qm/s (expected).





Stakeholder mapping

Currentsituation

Existing community initiatives

e.g. Friends-ofthe-Moreleta Spruit groups

National
Government
programmes
e.g. River
Health &
Adopt-a-River
programmes

Objectives

Collaborate & Integrate

Objectives

Establish the proposed Network-based Forum

(integrate and align community initiatives, keep Government programmes in mind)

14

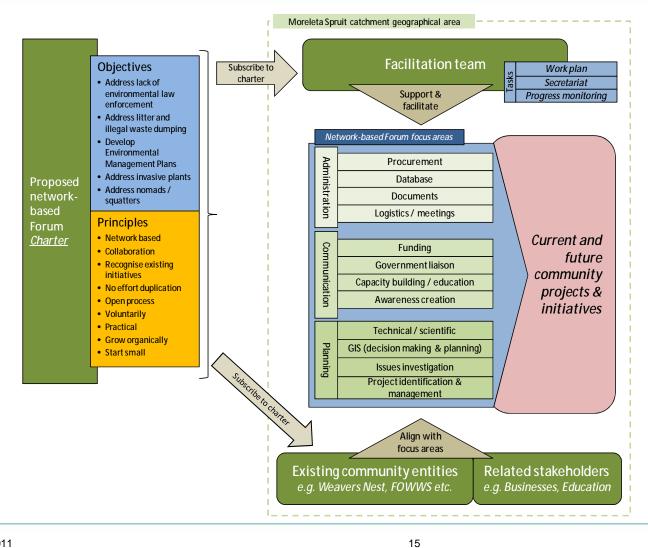
Achieve commune vision – ensure healthy sustainable river & ecological systems

29/11/2011





Stakeholder mapping



29/11/2011





Proposed database of activities / initiatives

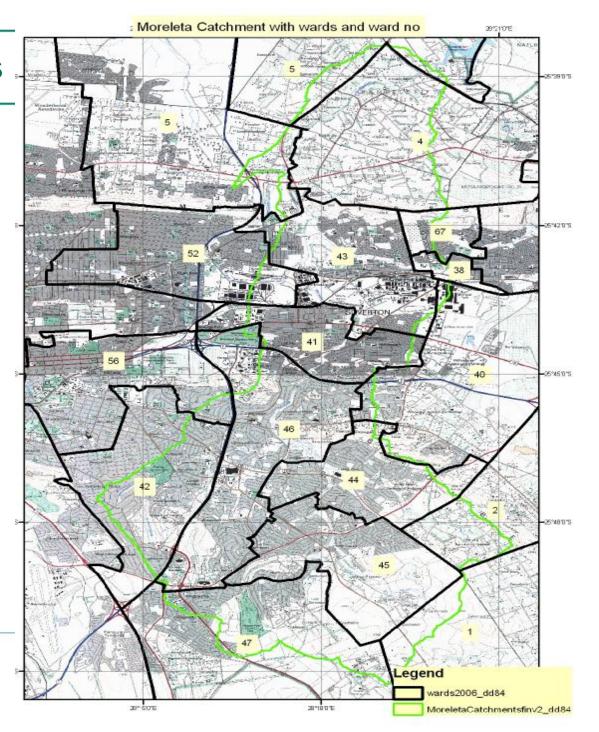
- n GIS based database to track all positive activity in the catchment, learn lessons, share information and draw analysis per fields as follows:
- n GPS point
- n Date
- n Where
- n Who
- n Webpage
- n What (describe activity)
- n Approach
- n Challenges
- n Outcomes
- n Resources required

Golder



Old Wards

- n Ward 4
- n Ward 38
- n Ward 41
- n Ward 42
- n Ward 43
- n Ward 44
- n Ward 45
- n Ward 46
- n Ward 47
- n Ward 67





New wards

- n Ward 38
- n Ward 41
- n Ward 42
- n Ward 43
- n Ward 44
- n Ward 45
- n Ward 46
- n Ward 47
- n Ward 64
- n Ward 79
- n Ward 82
- n Ward 83
- n Ward 84
- n Ward 86
- n Ward 87
- n Ward 91
- n Ward 101

2015000 MareletaCatchmentsfin/2_wg29 1.97,606

MUNICIPALITY WARDS (TSHWANE)



Progress feedback / way forward

- n Project inception meeting held at DWA on Tuesday, 12 July 2011
- n Strategic Session held at Golder on Friday, 12 August 2011
- n Formal project announcement on Thursday, 15 September 2011
- n CoT S/W and Water Sanitation meet on 26 Sept 2011
- n Round 1 Stakeholder on 4 October 2011
- n 3 Nov Second round stakeholder engagement
- n 14 Nov Completion and submission of Situational Analysis
- n 21 Nov Present outline of GAPS and Action Plan to client for inputs
- n 25 Nov Stakeholder Work Session 3
- n 1 Dec Draft to client
- n 7 Dec Review back from client
- n 13 Dec Delivery of final report

Golder Associates



Conclusions (so what)

- n Cross-border areas info is lacking (smallholding areas not yet involved)
- n Mamelodi / Eersterust
- n No representation from industries
- n Aquatic monitoring data lacking
- n Good water quality monitoring networks are in place
- n History shows increase in size due to hardening of surfaces
- n Bottom-up network approach proposed for forum, per focus area and geographic representation
- n Issues and drivers differ greatly in each of 4 main areas



29/11/2011 20

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PROCEEDINGS: THIRD WORK SESSION

Adopt-a-River Programme: Moreleta Spruit

Submitted to:

Department of Water Affairs Project Stakeholder Database

Report Number.
Distribution:

11616140

Thabisile Rakgotho Billy Twala







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APPENDICES

APPENDIX A

Attendance list - 29 November 2011

APPENDIX B

Situational analysis, Gap analysis and Action Plan presentation



TAX.

THIRD WORK SESSION PROCEEDINGS

1.0 INTRODUCTION AND BACKGROUND

Elna de Beer (Golder Associates) facilitated the proceedings and welcomed everybody to the meeting.

As part of phase one of the project, which is focused on information gathering and gap analysis, a structure/forum will be established that will ultimately integrate and support community initiatives along the Moreleta Spruit. The third WS in this process took place on 29 November 2011 from 15h00 – 17h00 at the Golder Offices in Hatfield, Pretoria.

The purpose of the meeting was to:

- Discuss the institutional setup of the Forum
- Present/discuss Gap Analysis
- Present / discuss High Level Action Plan

The proceedings of the second WS was presented to the meeting and will be sent out to all stakeholders on the database as a record of proceedings. (Please note that this report is not appended to these proceedings in order to save paper. However it is available upon request). This report summarises the proceedings of the third WS.

2.0 ATTENDANCE AND APOLOGIES

See attendance list attached as Appendix A.

The following apologies were received:

- Rudolf Booyens
- Billy Twala
- Piet van Wyk de Vries
- Danie van Eeden

3.0 PROCEEDINGS OF WORK SESSION 2

Elna de Beer presented the proceedings to the meeting and it was accepted as a fair reflection of the meeting held on 3 November 2011. (Please note that WS 2 report is not appended to these proceedings in order to save paper. However it was handed out to those attending WS3 and it will be appended to the final Project Report).

The meeting concurred that their expectation of this process and the outcome of WS3 were to see a positive decision leading to action that would address the protection and management of the Moreleta Spruit.

4.0 MATTERS FOR DISCUSSION

4.1 Background information

Elna de Beer provided the following background to the process thus far:

The Adopt-a-River programme was initiated by the Department of Water Affairs (DWA), in support with various community based initiatives, as a means of creating awareness among communities and relevant stakeholders of the need to care for South Africa's scarce water resources and to actively become involved in the protection and management of our water resources.

The Moreleta Spruit is one of the few remaining green areas in the Tshwane Metropolitan Area and is thus of immense recreational and aesthetical value. Interest-groups along the Moreleta have been, and are still, doing valuable work on a voluntary basis in support of the management responsibility of the DWA and the



City of Tshwane (CoT) Municipality. To this end a group of concerned citizens approached the DWA and expressed a desire to adopt the Moreleta Spruit as part of the DWA's Adopt-a-River initiative.

The Gauteng Region of the DWA has subsequently allocated some funds to initiate the development of a Master Environmental Management Plan for the Moreleta Spruit as part of its Adopt-a-River Program, to ensure that efforts from various stakeholders and Government institutions are co-ordinated. This project will be implemented in phases and will include the Moreleta Spruit from its headwaters up to the point where it drains into the Roodeplaat Dam. The project will be linked to all existing volunteer initiatives along the river as well as with the Ecological Management Plan of the CoT.

This WS was the third and last meeting in Phase 1 with the objective to agree on a high level action plan to be submitted to the Department of Water Affairs.

4.2 Working Group and way forward

The overall contextual framework of the Moreleta Spruit Forum was presented to the meeting and there was agreement that a network-based forum would be the most appropriate process to ensure that existing initiatives can be expanded in the project.

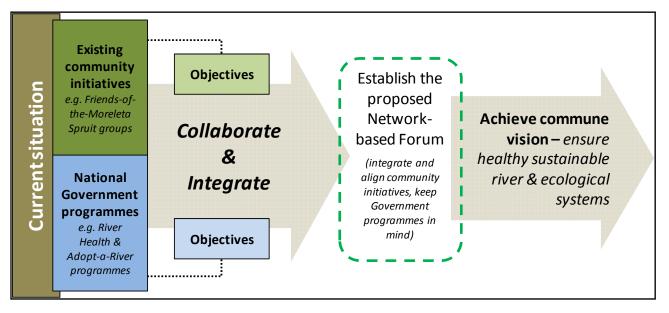


Figure 1: Contextual Framework of Moreleta Spruit Forum

Adelene Marais (CoT) indicated that a network similar to the proposed network already existed for all the "Friends of Moreleta Spruit" groups in the catchments. Golder presented a map showing the extent of the "Friends of Moreleta Spruit" groups spatially represented along the catchment. It was agreed that this will be the foundation for networking with other areas currently not indicated as 'active' in the Adopt-a-River project.

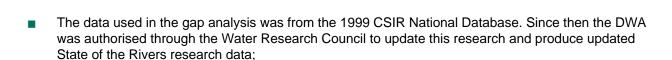
Yolande Burger emphasised that the essential drive of the Adopt-a-River was for people next to the river to take responsibility for their immediate area and that we should guard against this process becoming a catchment wide management plan. The meeting concurred that while taking the overall state of the Moreleta Spruit Catchment into consideration, action should be community based and focused on areas immediately next to where people live.

4.3 Presentation of GAP Analysis

Johan Goosen (Golder) presented the findings of the Gap Analysis and map series to the meeting. (See Appendix B)

The meeting congratulated Golder for the manner in which the information was collated and presented and the following aspects were highlighted:





- Dr Mike Silberbauer emphasised the importance of freshwater priority area projects focusing on smaller areas and the development of own classification of these areas;
- Community-based projects e.g. bio-monitoring (Mini SASS) of parts of the catchments could be a valuable source of information. This could be considered as the first collaborative project for the Forum. CoT and the Department of Water Affairs would be essential partners in such a project; and
- Considering all the data that was presented, it was important to understand that although the bigger perspective was vital to ensure integrated catchment management, it would be costly to manage the whole catchment with the existing resources and interest; and
- It was agreed that the understanding should be there that the catchment functions as a system (Up and down stream linkages) and that the framework for community-based activities should be aligned to the overall management of the catchment. The data provided by the gap-analysis that Golder presented should serve as strategic planning and decision-making tools that can be used and updated as the project progresses.

4.4 High level Action Plan

Johan Goosen explained that a high level action plan was developed based upon the gap analysis as one of the key deliverables of phase one of this process and will be submitted to the DWA. He presented the proposed high level action plan and requested the meeting to comment and make recommendations. The proposed high level action plans is included in the presentation attached as Appendix B.

Adelene Marais challenged the meeting to focus its response on what to do by contemplating the following question: "If the DWA gives the Forum R300 000,00 in the next phase, what will our action plan look like?"

The high level action plan as proposed by Golder Associates was accepted by the meeting and the following aspects were included:

- All activities, and proposed community-based projects should be in alignment with the DWA priorities;
- Creating awareness in communities should result in projects with tangible and quick results;
- The bio-monitoring project (mini SASS) should be the first project of the Moreleta Spruit Forum and serve as a catalyst project leading to community awareness and more projects in the catchment; and
- It was agreed that Water Week in March 2012 would be an ideal opportunity for the bio-monitoring project.

4.5 GIS data reader – database

Johan Goosen presented the meeting with the application GIS data reader and demonstrated how it can be used as a presentation, planning and decision-making tool by the Forum to identify priority areas and actions based upon scientific data. He explained that all the data presented at the meeting will be made available through GIS data reader on a CD to the Forum.

In addition to the data, the stakeholder database and all the reports developed throughout Phase 1 will be made available to the Forum as record of Phase 1. This can be used during the operationalisation of the Forum during Phase 2. The meeting congratulated Golder on the process and the work done during Phase 1.

4.6 Final steps to completion of Phase 1

The meeting agreed upon the following actions to complete Phase 1:





- Dr Anneli Kühn was chosen as leader of the Moreleta Spruit Forum and would set up the next meeting to give effect to the tasks agreed upon in the process;
- Golder (Johan Goosen) will complete and submit the final Project Report to DWA by mid December 2011;
- Once the final Project Report has been accepted by DWA, Golder will make all project related documentation as discussed in this meeting available to the Forum;
- Golder will sent a progress feedback letter to all stakeholders on the database by mid December 2011. This letter will inform stakeholders of the outcome of Phase 1 and provide contact information of the leader of the Moreleta Spruit Forum; and
- Should the Forum request it, a session to train members in the use of GIS data reader will be arranged at the Golder office in Pretoria.

5.0 CLOSURE OF MEETING

Elna de Beer expressed Golder's appreciation for the attendees' positive and constructive contributions to Phase 1 of the Adopt-a-River Project and wished the Forum well in its endeavours. The meeting was closed at 17h00.

Elna de Beer

Elva de Zeer.

Stakeholder Engagement Specialist

Johan Goosen

Project Manager

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Directors: FR Sutherland, AM van Niekerk, SAP Brown, L Greyling

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APPENDIX A

Attendance list - 29 November 2011







APPENDIX B

Situational analysis, Gap analysis and Action Plan presentation



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APPENDIX B

Terrestrial Ecology Background Data / Analysis





Table 8: Municipal wards (number and sizes) which intersects the Moreleta Spruit catchment

Count – no of wards:	19	Wards
Minimum size:	165	ha
Maximum size:	55 069	ha
Sum – Total coverage:	98 846	ha
Mean – Average ward size:	5 202	ha
Standard Deviation:	12 332	ha

Table 9 Land parcels (number and sizes) which intersects the Moreleta Spruit catchment

Count - no of wards:	39 515	Parcels	ha
Minimum size:	1	m2	0.0
Maximum:	6 143 175	m2	614.3
Sum – Total coverage:	148 709 823	m2	14 871.0
Mean- Average parcel size:	3 763	m2	0.4
Standard Deviation:	52 131		5.2

Table 10: Non-exhaustive list of trees in Serene Valley (along the Moreleta Spruit)

S.A. No	English Name	Afrikaans name	Botanical name	Conservation Status IUCN
39	White- stinkwood	Witstinkhout	Celtis africana	Least Concern
162	Common Hook Thorn	Gewone Haakdoring	Acacia caffra	Least Concern
166	Monkey Acacia	Apiesdoring	Acacia galpinii	LC
172	Sweet Thorn	Soetdoring	Acacia karroo	LC
187	Paperbark Thorn	Papierbasdoring	Acacia sieberiana	LC (SA Red Data List)
386	Karee	Karee	Searsia lancea (rhus lancea)	LC
392	Common Currant	Gewone Taaibos	Searsia pyroides (rhus pyroides)	LC
399	Common Spikethorn	Gewone Pendoring	Gymnosporia buxifolia	LC
447	Buffalo-thorn	Blinkblaar-wag-'n- bietjie	Ziziphus mucronata	LC
463	Cross-berry	Kruisbessie	Grewia occidentalis	LC





S.A. No	English Name	Afrikaans name	Botanical name	Conservation Status IUCN
471	Wild-pear	Drolpeer Dombeya rotundifolia		LC
536	River Bushwillow	Riviervaderlandswilg	Combretum erythrophyllum	LC
594	Blue Guarri	Bloughwarrie	Eucla crispa	LC
617	African Olive	Olienhout	Olea europaea	LC

Table 11: Non-exhaustive list of birds spotted or heard in Serene Valley (along the Moreleta Spruit)

New Name (Rob 7)	Old name	Afrikaans name	Scientific name	
African Darter	Darter	Slanghalsvoël	anhinga rufa	
Black-headed Heron	Blackheaded Heron common name: Heron	Swartkop reier	ardea melanocephala	
Cattle Egret	Cattle Egret common name: Egret	Veereier	bubulcus ibis	
Hamerkop	Hamerkop	Hamerkop	scopus umbretta	
African Sacred Ibis	Sacred Ibis common name: Ibis	Skoorsteenveër	threskiornis aethipoicus	
Hadeda Ibis	Hadedah Ibis common name: Hadeda	Hadeda	bostrychia hagedash	
Egyptian Goose	Egyptian Goose common name: Goose	Kolgans	alopochen aegyptiacus	
Yellow-billed Duck	Yellowbilled Duck common name: Duck	Geelbekeend	anas undulata	
African Black Duck	African Black Duck common name: Duck	Swarteend	anas sparsa	
Helmeted Guinea Fowl	common name: Guinea Fowl	Gewone Tarental	numiea meliagris	
Crowned Lapwing	Crowned Plover common name: Plover	Kroonkiewiet	vanellus coronatus	
Blacksmith Lapwing	Blacksmith Plover common name: Plover	Bontkiewiet	vanellus armatus	
African Wattled Lapwing	common name: Plover	Lelkiewiet	vanellus senegallus	
Spotted Thick-knee	Spotted Dikkop common name: Dikkop	Gewone Dikkop	birhinus capensis	
Speckled Pigeon	common name: Pigeon	Kransduif	columba guinea	
Red Eyed Dove	common name: Dove	Grootringduif	streptopelia semitorquata	
Ring-necked Dove	Cape Turtle Dove	Gewone Tortelduif	streptopelia capicola	





New Name (Rob 7)	Old name	Afrikaans name	Scientific name
	common name: Dove		
Laughing Dove	Laughing Dove common name: Dove	Rooiborsduifie	streptopelia senegalensis
Grey Go-away Bird	Grey Lourie common name: Lourie	Kwêvoël	corythaixoides concolor
Diederik Cuckoo	Diederik Cuckoo common name: Cuckoo	Diederikkie	chrysococcyx caprius
Burchell's Coucal	Burchell's Coucal common name: Coucal	Gewone Vleiloerie	centropus burchellii
White-rumped Swift	common name: Swift	Witkruiswindswael	apuscaffer
African Palm Swift	common name: swift	Palmwindswael	cypriurus parvus
Speckled Mousebird	Speckled Mousebird common name: Mousebird	Gevlekte Muisvoël	colius striatus
Redfaced Mousebird	common name: Mousebird	Rooiwangmuisvoël	urocolius indicus
Woodland Kingfisher	Woodland Kingfisher common name: Kingfisher	Bosveldvisvanger	halcyon senegalensis
Brown-hooded Kingfisher	Brownhooded Kingfisher common name: Kingfisher	Bruinkopvisvanger	halcyon albiventris
Golden-backed Bee-eater	common name: Bea-eater	Europese byvreter	merops apiaster
Whitefronted Bee-eater	Whitefronted Bee-eater	Rooikeelbyvreter	merops bullockoides
African Hoopoe	African Hoopoe common name: Hoopoe	Hoephoep	upupa africana
Green Woodhoopoe	Redbilled Woodhoopoe common name: Woodhoopoe	Rooibekkakelaar	phoeniculus purpureus
African Grey Hornbill	Grey Hornbill common name: Hornbill	Grysneushoringvoël	tockus nastutus
Blackcollared Barbet	Blackcollared Barbet common name: Barbet	Rooikophoutkapper	lybius torquatus
Crested Barbet	Crested Barbet common name: Barbet	Kuifkophoutkapper	trachyphonus vaillantii
White-throated Swallow	common name: Swallow	Witkeelswael	hirundo albigularis
Greater Striped Swallow	common name: Swallow	Grootstreepswael	hirundo cucullata
Lesser Striped Swallow	common name: Swallow	Kleinstreepswael	hirundo abyssinica
Pied Crow	Pied Crow common name: Crow	Wirborskraai	corvus albus





New Name (Rob 7)	Old name	Afrikaans name	Scientific name
Dark-capped Bulbul	Blackeyed Bulbul common name: Bulbul	Swartoogtiptol	pycnonotus tricolor
Olive Thrush	Olive Thrush common name: Thrush	Olyflyster	turdus olivaceus
Groundscraper Thrush	Groundscraper Thrush common name: Thrush	Gevlekte Lyster	psophocichla litsipsirupa
Robin-chat	common name: Robin	Lawaaimakerjanfrederik	cossypha dichroa
Cape Robin-chat	Cape Robin common name: Robin	Gewone Janfrederik	cossypha caffra
Cape Grass Bird	common name: Grass Bird	Grasvoël	sphenoeacus afer
Neddicky	common name: Neddicky	Neddickie	cisticola fulvicappilus
Tawny-flanked Prinia	common name: Prinia	Bruinsylangstertjie	prinia subflava
Spotted Flycatcher	common name: Flycatcher	Europese Vlieevanger	muscicapa striata
African Paradise-Flycatcher	Paradise Flycatcher common name: Flycatcher	Paradysvlieëvanger	terpsiphone viridis
Cape Wagtail	Cape Wagtail common name: Wagtail	Gewone Kwikkie	motacilla capensis
Common Fiscal	Fiscal Shrike common name: Shrike	Fiskaallaksman	lanius collaris
Southern Boubou	Southern Boubou common name: Bou-bou	Suiderlike Waterfiskaal	laniarius ferrugineus
Black-backed Puffback	Puffback	Sneeubal	dryoscopus cubla
Common Myna	Indian Myna Myna	Indiese Spreeu	acridotheres tristis
Cape Glossy Starling	Glossy Starling common name: Starling	Kleinglansspreeu	lamprotornis nitens
White-bellied Sunbird	Whitebellied sunbird common name: Sunbird	Witpenssuikerbekkie	cinnyris talatala
Amethyst Sunbird	Black Sunbird	Swartsuikerbekkie	chalcomitra amethystina
Cape White-eye	common name: White-eye	Kaapse Glasogia	zosterops pallidus
Cape Sparrow	Cape Sparrow common name: Sparrow	Gewone Mossie	passer melanurus
Thick-billed Weaver	Thickbilled Weaver common name: Weaver	Dikbekwewer	amblyospiza albifrons
Cape Weaver	common name: Weaver	Kaapse Wewer	ploceus capensis





New Name (Rob 7)	Old name	Afrikaans name	Scientific name	
Southern Masked-Weaver	Masked Weaver common name: Weaver	Swartkeelgeelvink	plocues velatus	
Southern Red Bishop	Red Bishop common name: Bishop	Rooivink	euplectes orix	
Long-tailed Widow	common name: Widow	Langstertflap	euplectes progne	
Bronze Mannikin	common name: Mannikin	Gewone Fret	Ionchura cucullata	
Pin-tailed Whydah common name: whydah		Koningrooibekkie	vidua macroura	
Yellow-billed Kite	Yellow-billed Kite Yellowbilled Kite common name: Kite		milvus aegyptius	

Table 12: Overview of the ecological status of the Moreleta catchment based on 2009 land cover categories

	Derived Broa		_			
Land cover 2009 categories	Aquatic	Natural	Transformed	Grand Total	l% Cover	
urban			7482	7482	56%	
grassland		1325		1325	10%	
dense trees / bush		593		593	4%	
smallholdings: woodland / open bush		458		458	3%	
sports & recreation grassland			450	450	3%	
plantation / woodlots			436	436	3%	
smallholdings: grassland		265		265	2%	
urban trees		251		251	2%	
wooded grassland		251		251	2%	
woodland / open bush		238		238	2%	
urban grassland		193		193	1%	
smallholdings: wooded grassland		158		158	1%	
degraded		152		152	1%	
cultivated crops			144	144	1%	
non-vegetated / bare		143		143	1%	
cultivated other			141	141	1%	
wetland (non-pan)	103			103	1%	
smallholdings: dense trees / bush		85		85	1%	
cultivated pasture			80	80	1%	
smallholdings: cultivated			77	77	1%	
old lands (topo): grassland			48	48	0%	
mines			45	45	0%	
man-made water	36			36	0%	





	Derived Bro	ad Ecological			
Land cover 2009 categories	Aquatic	Natural	Transformed	Grand Total	% Cover
natural bare rock		34		34	0%
rocky grass matrix		28		28	0%
urban woodland		19		19	0%
old lands (topo): wooded grassland			13	13	0%
old lands (topo): non-vegetated / bare			9	9	0%
old lands (topo): dense trees / bush			4	4	0%
old lands (topo): woodland / open bush			3	3	0%
old lands (topo): degraded			2	2	0%
smallholdings: degraded		0		0	0%
Grand Total	139	4196	8933	13268	100%
	1%	32%	67%		

Table 13: Overview of the runoff risk due to impervious surfaces based on land cover categories from 2009

	Total extent (ha)	Derived Runoff Risk/ Impervious surfaces					
Land Cover 2009 Categories		None	Very low	Low	Moderate	High	Very high
cultivated crops	144			144			
cultivated other	141			141			
cultivated pasture	80			80			
degraded	152				152		
dense trees / bush	593		593				
grassland	1325			1325			
man-made water	36	36					
mines	45					45	
natural bare rock	34					34	
non-vegetated / bare	143					143	
old lands (topo): degraded	2					2	
old lands (topo): dense trees / bush	4				4		
old lands (topo): grassland	48				48		
old lands (topo): non-vegetated / bare	9						9
old lands (topo): wooded grassland	13				13		
old lands (topo): woodland / open bush	3				3		
plantation / woodlots	436		436				
rocky grass matrix	28				28		
smallholdings: cultivated	77				77		
smallholdings: degraded	0				0		
smallholdings: dense trees / bush	85			85			
smallholdings: grassland	265			265			
smallholdings: wooded grassland	158			158			





	Total extent (ha)	Derived Runoff Risk/ Impervious surfaces					
Land Cover 2009 Categories		None	Very low	Low	Moderate	High	Very high
smallholdings: woodland / open bush	458			458			
sports & recreation grassland	450			450			
urban	7482						7482
urban grassland	193		193				
urban trees	251		251				
urban woodland	19		19				
wetland (non-pan)	103	103					
wooded grassland	251		251				
woodland / open bush	238		238				
TOTALS	13268	139	1982	3106	326	225	7491
		1%	15%	23%	2%	2%	56%

Table 14: Overview of the pollution risk of the catchment due to human activities based on land cover categories from 2009

		Derived I	Pollu	tion Risk		
Land Cover 2009 categories	Total Extent (ha)	Very low	Low	Moderate	High	Very high
cultivated crops	144				144	
cultivated other	141				141	
cultivated pasture	80				80	
degraded	152	152				
dense trees / bush	593	593				
grassland	1325	1325				
man-made water	36	36				
mines	45					45
natural bare rock	34	34				
non-vegetated / bare	143	143				
old lands (topo): degraded	2				2	
old lands (topo): dense trees / bush	4				4	
old lands (topo): grassland	48				48	
old lands (topo): non-vegetated / bare	9				9	
old lands (topo): wooded grassland	13				13	
old lands (topo): woodland / open bush	3				3	
plantation / woodlots	436		436			
rocky grass matrix	28	28				
smallholdings: cultivated	77			77		
smallholdings: degraded	0			0		
smallholdings: dense trees / bush	85			85		
smallholdings: grassland	265			265		
smallholdings: wooded grassland	158			158		
smallholdings: woodland / open bush	458			458		
sports & recreation grassland	450			450		
urban	7482					7482





Land Carren 2000 actamatica	Total Futant (ha)	Derived Pollution Risk				
Land Cover 2009 categories	Total Extent (ha)	Very low	Low	Moderate	High	Very high
urban grassland	193			193		
urban trees	251			251		
urban woodland	19			19		
wetland (non-pan)	103	103				
wooded grassland	251	251				
woodland / open bush	238	238				
TOTALS	13268	2904	436	1957	443	7527
		22%	3%	15%	3%	57%

Table 15: Overview of the rehabilitation potential remaining with the Moreleta Spruit catchment based on land cover categories of 2009

		Derived R	Derived Rehabilitation Potential			
CLASS_NAME	Total Extent (ha)	Very low	Low	Moderate	High	
cultivated crops	144		144			
cultivated other	141		141			
cultivated pasture	80		80			
degraded	152			152		
dense trees / bush	593				593	
grassland	1325				1325	
man-made water	36				36	
mines	45		45			
natural bare rock	34				34	
non-vegetated / bare	143			143		
old lands (topo): degraded	2		2			
old lands (topo): dense trees / bush	4			4		
old lands (topo): grassland	48			48		
old lands (topo): non-vegetated / bare	9		9			
old lands (topo): wooded grassland	13			13		
old lands (topo): woodland / open bush	3			3		
plantation / woodlots	436		436			
rocky grass matrix	28				28	
smallholdings: cultivated	77		77			
smallholdings: degraded	0		0			
smallholdings: dense trees / bush	85			85		
smallholdings: grassland	265			265		
smallholdings: wooded grassland	158			158		
smallholdings: woodland / open bush	458			458		
sports & recreation grassland	450		450			
urban	7482	7482				
urban grassland	193	193				
urban trees	251	251				
urban woodland	19	19				
wetland (non-pan)	103				103	
wooded grassland	251				251	





CLACC NAME	Total Fritant (ba)	Derived Rehabilitation Potential				
CLASS_NAME	l otal Extent (na)	Total Extent (ha) Very low		Moderate	High	
woodland / open bush	238				238	
TOTALS	13268	7946	1383	1330	2609	
		60%	10%	10%	20%	





APPENDIX C

Aquatic Ecology / Water Quality Background Data
Appendix C1 – Summary of CoT Water Quality Data
Appendix C2 – Summary of DWA RQS Water Quality Data
Appendix C3 – Summary of Centurion Academy Water Quality
Data 2010



Site	CountOfSite	AvgOfSS	StDevOfSS	MinOfSS	MaxOfSS
E66	33	30.1124999	28.4793048	0.40000001	112.599998
E67	32	31.0612903	32.8217475	3.79999995	153.199997
E68	1				
E69	33	26.0437503	39.0882462	0.60000002	201.800003
E70	33	14.9687501	14.5728084	1.60000002	69.8000031
E71	33	18.3562501	22.6059507	1.20000005	95.8000031
E72	33	28.7437498	56.0795554	1.39999998	305.799988
E72A	33	248.55	707.488235	1.20000005	3472
F63	32	20.1870968	21.2126968	2.79999995	93.4000015
F64	31	30.7499997	37.9233769	3.4000001	149.399994
F65	31	32.2733332	39.9147182	0.40000001	179
Site	CountOfSite	AvgOfCl	StDevOfCl	MinOfCl	MaxOfCl
E66	33	26.8445454	5.13741832	11.5	34.5999985
E67	32	35.576875	48.7440491	13.1000004	301
E68	1				
E69	33	31.9184849	5.99735875	15.6999998	
E70	33	39.6118183	13.6399289	14.1000004	88.9100037
E71	33	33.7981819	12.9102781	14.8100004	96.5
E72	33	31.8881819	8.46074075	5.19999981	47.0999985
E72A	33	36.0233332	5.60941119	25.2999992	
F63	32	23.1009374	8.4945867	13.8999996	64
F64	31	25.5041935	10.2089199	13.9700003	70
F65	31	26.5335486	7.61017914	1	43.4900017
01:	2		N.D. 051110 1		
Site	CountOfSite	AVGOTNH3_N	stDevOtNH3_N	MINOTINH3_N	MaxOfNH3_N
, ,	2.2	0 22121212	0.20400072	•	1 / 5000007
E66	33	0.23121212	0.28489863	0	1.65999997
E67	32	0.23121212 0.176875	0.28489863 0.12081544	0	1.65999997 0.44
E67 E68	32 1	0.176875	0.12081544	0	0.44
E67 E68 E69	32 1 33	0.176875	0.12081544 0.17837705	0	0.44
E67 E68 E69 E70	32 1 33 33	0.176875 0.21393939 2.37545459	0.12081544 0.17837705 4.14148618	0 0	0.44 0.7900002 18.9400005
E67 E68 E69 E70	32 1 33 33 33	0.176875 0.21393939 2.37545459 0.37333333	0.12081544 0.17837705 4.14148618 0.47843278	0 0 0	0.44 0.79000002 18.9400005 2.41000009
E67 E68 E69 E70 E71 E72	32 1 33 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774	0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999
E67 E68 E69 E70 E71 E72 E72A	32 1 33 33 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507	0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991
E67 E68 E69 E70 E71 E72 E72A F63	32 1 33 33 33 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188	0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996
E67 E68 E69 E70 E71 E72 E72A F63	32 1 33 33 33 33 33 32 31	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284	0 0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999
E67 E68 E69 E70 E71 E72 E72A F63	32 1 33 33 33 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188	0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999
E67 E68 E69 E70 E71 E72 E72A F63 F64	32 1 33 33 33 33 32 31 31	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518	0 0 0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.7599999 2.33999991 4.28999996 3.0999999 0.54000002
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	32 1 33 33 33 33 32 31 31 CountOfSite	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC	0 0 0 0 0 0 0 0 0 MinOfTOC	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002
E67 E68 E69 E70 E71 E72 E72A F63 F64	32 1 33 33 33 33 32 31 31	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518	0 0 0 0 0 0 0	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	32 1 33 33 33 33 32 31 31 CountOfSite	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732	0 0 0 0 0 0 0 0 0 0 MinOfTOC 1.26999998	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	32 1 33 33 33 33 32 31 31 CountOfSite 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732	0 0 0 0 0 0 0 0 0 0 MinOfTOC 1.26999998	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67	32 1 33 33 33 33 32 31 31 CountOfSite 33 32	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741	0 0 0 0 0 0 0 0 0 0 MinOfTOC 1.2699998	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69	32 1 33 33 33 33 32 31 31 CountOfSite 33 32 1	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292 4.00357145	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741 1.6146602	0 0 0 0 0 0 0 0 0 0 MinOfTOC 1.26999998 0.94	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992 7.98000002
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69	32 1 33 33 33 33 32 31 31 CountOfSite 33 32 1 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292 4.00357145 21.5364288	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741 1.6146602 23.7545931	0 0 0 0 0 0 0 0 0 0 MinOfTOC 1.26999998 0.94 1.58000004 2.6500001	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992 7.98000002 89.6200027 9.06000042
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71	32 1 33 33 33 33 32 31 31 CountOfSite 33 32 1 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292 4.00357145 21.5364288 4.66629631	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741 1.6146602 23.7545931 1.88464478	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2699998 0.94 1.58000004 2.6500001	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992 7.98000002 89.6200027 9.06000042
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71 E72	32 1 33 33 33 33 32 31 31 CountOfSite 33 32 1 1 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292 4.00357145 21.5364288 4.66629631 6.5140741	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741 1.6146602 23.7545931 1.88464478 6.28122651	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2699998 0.94 1.58000004 2.6500001 1.99000001	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992 7.98000002 89.6200027 9.06000042 34.5999985 6680
E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71 E72 E72A	32 1 33 33 33 33 32 31 31 CountOfSite 33 32 1 33 33 33 33	0.176875 0.21393939 2.37545459 0.37333333 0.21242424 0.52242424 0.6128125 0.36741935 0.25129032 AvgOfTOC 3.78821425 3.67296292 4.00357145 21.5364288 4.66629631 6.5140741 277.843704	0.12081544 0.17837705 4.14148618 0.47843278 0.17122774 0.6207507 0.83860188 0.55465284 0.13343518 StDevOfTOC 1.19877732 1.5170741 1.6146602 23.7545931 1.88464478 6.28122651 1281.90421	0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.26999998 0.94 1.58000004 2.6500001 1.99000001 1.88 2.38000011	0.44 0.79000002 18.9400005 2.41000009 0.75999999 2.33999991 4.28999996 3.0999999 0.54000002 MaxOfTOC 6.59000015 7.57999992 7.98000002 89.6200027 9.06000042 34.5999985

Site	CountOfSite	AvgOfFColi	StDevOfFColi	MinOfFColi	MaxOfFColi
E66	33	32535.9375	86897.3116	20	430000
E67	32	29729.0323	92744.3379	100	500000
E68	1				
E69	33	13055	25298.5074	100	96000
E70	33	131803.125	227048.161	200	1000000
E71	33	19065.625	45572.3573	300	250000
E72	33	23676.875	87886.1203	160	500000
E72A	33	881.875	1126.3227	20	4600
F63	32	46845.8065	127000.557	60	500000
F64	31	27460	63406.4263	300	224000
F65	31	40880.6452	69863.1921	900	330000

Site	CountOfSite	AvgOfTDS	StDevOfTDS	MinOfTDS	MaxOfTDS
E66	33				
E67	32				
E68	1				
E69	33				
E70	33				
E71	33				
E72	33				
E72A	33				
F63	32	473		473	473
F64	31	469		469	469
F65	31				

Site	CountOfSite	AvgOfpH	StDevOfpH	MinOfpH	MaxOfpH
E66	33	7.53787882	0.52983929	6.59000015	9.06999969
E67	32	7.510625	0.48509351	6.59000015	8.39999962
E68	1				
E69	33	7.57878789	0.44754718	6.86000013	8.86999989
E70	33	7.39636363	0.44713549	6.28999996	8.30000019
E71	33	7.44545453	0.54971641	6.15999985	8.47000027
E72	33	7.5475757	0.4500835	6.6500001	8.55000019
E72A	33	7.81757571	0.90355903	6.3499999	10.7399998
F63	32	7.41718747	0.53973249	6.11000013	8.17000008
F64	31	7.54451618	0.44831426	6.65999985	8.27000046
F65	31	7.5048387	0.50973759	6.32000017	8.18999958
Site	CountOfSite	AvgOfOA	StDevOfOA	MinOfOA	MaxOfOA
E66	33	2.23030302	1.21975529	0.30000001	5.19999981
E67	32	2.403125	1.52240987	0.2	7.19999981
E68	1				
E69	33	2.15151516	1.5012747	0.40000001	6.5999999
E70	33	11.0272727	19.1945186	0.2	100
E71	33	2.19696971	1.35749882	0.40000001	6.5999999
E72	33	2.64424243	2.25440542	0.2	13.1999998
E72A	33	20.2272727	54.9658944	0.60000002	312
F63	32	2.32187499	1.78519615	0.40000001	8.19999981
F64	31	2.4483871	1.90102974	0.40000001	8.60000038
F65	31	2.33548387	1.43632595	0.60000002	6
Site	CountOfSite	ΔvαΩfP	StDevOfP	Min∩fP	Max∩fP
Site F66	CountOfSite 33	AvgOfP 0.2559375	StDevOfP 0.52853332	MinOfP	MaxOfP 3 0599994
E66	33	0.2559375	0.52853332	0	3.05999994
E66 E67	33 32	-			
E66 E67 E68	33 32 1	0.2559375 0.1775	0.52853332 0.20210186	0	3.05999994 0.81999999
E66 E67 E68 E69	33 32 1 33	0.2559375 0.1775 0.14878788	0.52853332 0.20210186 0.16721538	0	3.05999994 0.81999999 0.70999998
E66 E67 E68 E69	33 32 1 33 33	0.2559375 0.1775 0.14878788 0.35454546	0.52853332 0.20210186 0.16721538 0.51081486	0 0 0 0	3.05999994 0.81999999 0.70999998 2.70000005
E66 E67 E68 E69 E70	33 32 1 33 33 33	0.2559375 0.1775 0.14878788 0.35454546 0.15757576	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831	0 0 0 0 0	3.05999994 0.81999999 0.70999998
E66 E67 E68 E69 E70 E71	33 32 1 33 33 33 33	0.2559375 0.1775 0.14878788 0.35454546	0.52853332 0.20210186 0.16721538 0.51081486	0 0 0 0 0	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1
E66 E67 E68 E69 E70 E71 E72 E72A	33 32 1 33 33 33 33 33	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187	0 0 0 0 0 0	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997
E66 E67 E68 E69 E70 E71	33 32 1 33 33 33 33	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169	0 0 0 0 0	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 33	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439	0 0 0 0 0 0 0 0	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 33 32	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491	0 0 0 0 0 0 0 0 0.01	3.05999994 0.81999999 0.70999998 2.70000005 0.7099998 1 0.83999997 1.41999996
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 33 32	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491	0 0 0 0 0 0 0 0 0.01	3.05999994 0.81999999 0.70999998 2.70000005 0.7099998 1 0.83999997 1.41999996
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64	33 32 1 33 33 33 33 32 31 31	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005	0 0 0 0 0 0 0 0.01 0.01	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 33 32 31 31 CountOfSite	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO	0 0 0 0 0 0 0 0.01 0.01 0.01	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 33 32 31 31 CountOfSite	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042	0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 33 31 31 31 CountOfSite 33 32	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042	0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 33 33 31 31 CountOfSite 33 32 1	0.2559375 0.1775 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769 7.24720003	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442	0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994 2.13000011	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046 11.8599997
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69	33 32 1 33 33 33 33 33 31 31 31 CountOfSite 33 32 31 33 33	0.2559375 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769 7.24720003 7.34115381	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442	0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994 2.13000011	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046 11.8599997 11.3999996
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69	33 32 1 33 33 33 33 33 33 31 31 CountOfSite 33 32 1 33 33 33	0.2559375 0.1775 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769 7.24720003 7.34115381 6.0419231	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442 1.89418753 3.01685667	0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994 2.13000011 2.24000001 1.38999999	3.05999994 0.81999999 0.70999998 2.70000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046 11.8599997 11.3999996 13.1499996
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70	33 32 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 31 33 33 33 33 33	0.2559375 0.1775 0.1775 0.14878788 0.35454546 0.15757576 0.19545455 0.1869697 0.24709677 0.45933334 0.16333334 AvgOfDO 7.0480769 7.24720003 7.34115381 6.0419231 7.41076925	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442 1.89418753 3.01685667 1.96440108	0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.8099994 2.13000011 2.24000001 1.38999999 2.45000005	3.05999994 0.81999999 0.70999998 2.7000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.7700046 11.8599997 11.3999996 13.1499996 13.5100002
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71	33 32 1 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 1 31 31 33 33 33 33 33	0.2559375	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442 1.89418753 3.01685667 1.96440108 1.57622728	0 0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994 2.13000011 2.24000001 1.38999999 2.45000005 1.84000003	3.05999994 0.81999999 0.70999998 2.7000005 0.7099998 1 0.83999997 1.4199996 8 0.72000003 MaxOfDO 9.7700046 11.8599997 11.399996 13.149996 13.5100002 9.65999985
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71 E72 E72A	33 32 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 33 33 33 33 33 33 33 33	0.2559375	0.52853332 0.20210186 0.16721538 0.51081486 0.1671831 0.23309187 0.18348169 0.28083439 1.43408491 0.14972005 StDevOfDO 1.62951042 1.84417442 1.89418753 3.01685667 1.96440108 1.57622728 2.89326315	0 0 0 0 0 0 0 0 0.01 0.01 0 MinOfDO 1.80999994 2.13000011 2.24000001 1.38999999 2.45000005 1.84000003 4.88000011	3.05999994 0.81999999 0.70999998 2.7000005 0.70999998 1 0.83999997 1.41999996 8 0.72000003 MaxOfDO 9.77000046 11.8599997 11.3999996 13.1499996 13.5100002 9.65999985 16.1299992

Site	CountOfSite	AvgOfEC	StDevOfEC	MinOfEC	MaxOfEC
E66	33	35.1757577	6.04674651	21.2000008	50.70000076
E67	32	36.2	6.36745766	23.7999992	58.29999924
E68	1				
E69	33	39.6666667	6.60287189	21.8999996	49.90000153
E70	33	51.5515153	11.4200791	31.2999992	83.09999847
E71	33	40.2818179	6.45965627	26.2999992	52.5
E72	33	43.0051514	8.85569031	18.5699997	56.70000076
E72A	33	42.4242424	6.42320134	32.5	59.59999847
F63	32	36.2077421	11.4193402	19.5	74.90000153
F64	31	35.5486667	9.87580184	16.2999992	69.19999695
F65	31	38.2851612	10.7584707	19.7999992	81.59999847
Site	CountOfSite	AvgOfCOD	StDevOfCOD	MinOfCOD	MaxOfCOD
E66	33	20.2333334	12.6121139	2	47
E67	32	24.66875	30.2025681	1	168
E68	1				
E69	33	19.7454545	13.1053683	3	63
E70	33	155.527273	346.26305	4	1970
E71	33	20.9272727	15.0494865	2	70
E72	33	26.7151515	44.0407774	2	262
E72A	33	243.7625	839.184519	12	4800
F63	32	26.571875	18.9273864	2	72
F64	31	25.3806451	19.7294605	3	80
F65	31	23.1774194	15.1220305	4	59
Cito	CountOfCita	AUTUS NIOS	OVOENIOS NIOS	POTNICS NICS	MayOfNO2 NO2 N
Site					MaxOfNO3_NO2_N
E66	33	1.06878787	0.33139626	0.01	1.899999976
E66 E67	33 32				
E66 E67 E68	33 32 1	1.06878787 1.13343749	0.33139626 0.24071947	0.01	1.899999976 1.75999999
E66 E67 E68 E69	33 32 1 33	1.06878787 1.13343749 1.22878788	0.33139626 0.24071947 0.33868087	0.01 0.61000001 0.69	1.899999976 1.75999999 2.109999895
E66 E67 E68 E69	33 32 1 33 33	1.06878787 1.13343749 1.22878788 1.24757576	0.33139626 0.24071947 0.33868087 1.09539101	0.01 0.61000001 0.69 0.02	1.899999976 1.75999999 2.109999895 4.320000172
E66 E67 E68 E69 E70	33 32 1 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608	0.01 0.61000001 0.69 0.02 0.63	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933
E66 E67 E68 E69 E70 E71	33 32 1 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143	0.01 0.61000001 0.69 0.02 0.63 0.13	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019
E66 E67 E68 E69 E70 E71 E72	33 32 1 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 32 31	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0	1.89999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924
E66 E67 E68 E69 E70 E71 E72 E72A F63	33 32 1 33 33 33 33 32 31 31	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64	33 32 1 33 33 33 33 33 32 31	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924 4.670000076
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 33 32 31 31 CountOfSite	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0 MinOfT	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924 4.670000076
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65	33 32 1 33 33 33 33 32 31 31 CountOfSite 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0 0.2 MinOfT 10.3699999	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924 4.670000076 MaxOfT 25.01000023
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66	33 32 1 33 33 33 33 33 31 31 31 CountOfSite 33 32	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0 0.2 MinOfT 10.3699999	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924 4.670000076 MaxOfT 25.01000023
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67	33 32 1 33 33 33 33 32 31 CountOfSite 33 32	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0.2 MinOfT 10.3699999 10.3599997	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68	33 32 1 33 33 33 33 33 32 31 31 CountOfSite 33 32 31 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125 18.8939392	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0 0.2 MinOfT 10.3699999 10.3599997	1.89999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69	33 32 1 33 33 33 33 33 33 31 31 CountOfSite 32 1 31 31 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125 18.8939392 19.9418181	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674 4.52573799 4.57787446	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0.02 MinOfT 10.3699999 10.3599997 8.82999992 9.36999989	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023 25.29999924 26.57999992
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71	33 32 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 31 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125 18.8939392 19.9418181 18.2963637	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674 4.52573799 4.57787446 4.34259196	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0.2 MinOfT 10.3699999 10.3599997 8.82999992 9.36999989 9.15999985	1.899999976 1.75999999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023 25.29999924 26.57999992 24.37999916
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71	33 32 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 31 31 31 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125 18.8939392 19.9418181 18.2963637 18.0678788	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674 4.52573799 4.57787446 4.34259196 4.3684491	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0 0.2 MinOfT 10.3699999 10.3599997 8.82999992 9.3699989 9.1599985 10.0299997	1.89999976 1.7599999 2.109999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023 28.51000023 25.29999924 26.57999992 24.37999916 25.39999962
E66 E67 E68 E69 E70 E71 E72 E72A F63 F64 F65 Site E66 E67 E68 E69 E70 E71 E72 E72A	33 32 1 33 33 33 33 33 31 31 CountOfSite 33 32 1 33 33 33 33 33 33 33	1.06878787 1.13343749 1.22878788 1.24757576 1.27090909 1.30969697 1.00121212 0.9053125 0.90225806 1.17870968 AvgOfT 19.4006061 19.3528125 18.8939392 19.9418181 18.2963637 18.0678788 20.3215153	0.33139626 0.24071947 0.33868087 1.09539101 0.38635608 0.55327143 0.81436616 0.87527316 0.89905397 0.82948073 StDevOfT 4.1909024 4.76657674 4.52573799 4.57787446 4.34259196 4.3684491 4.66233052	0.01 0.61000001 0.69 0.02 0.63 0.13 0.05 0 0.2 MinOfT 10.3699999 10.3599997 8.82999992 9.3699989 9.1599985 10.0299997 11.6599998	1.89999976 1.7599999 2.10999895 4.320000172 2.319999933 2.230000019 4.150000095 5.579999924 4.670000076 MaxOfT 25.01000023 28.51000023 28.51000023 25.29999924 26.57999992 24.37999916 25.39999962 27.56999969

	AvgOfASAR-Diss-		AvgOfCa-Diss-		
	Water Detection	AvgOfASAR-Diss-	Water Greater	AvgOfCI-Diss-Water	
Monitoring Point ID	Limit	Water Greater Than	Than	Greater Than	AvgOfCOD Result
90175					
90198					
90199					
100000884					15.9

			AvgOfCORR-Diss-		
	AvgOfCOD Detection	AvgOfCOD Greater	Water Detection	AvgOfCORR-Diss-	AvgOfDMS-Tot-
Monitoring Point ID	Limit	Than	Limit	Water Greater Than	Water Result
90175					352.3754865
90198					369.132625
90199					337.3178
100000884	10				

	AvgOfDMS-Tot-Water	AvgOfDMS-Tot-Water	AvgOfDS-Tot-	AvgOfDS-Tot-Water	AvgOfDS-Tot-Water
Monitoring Point ID	Detection Limit	Greater Than	Water Result	Detection Limit	Greater Than
90175					
90198					
90199					
100000884			293.5	10	

	AvgOfE#COLI-Susp-	AvgOfEC-Phys-Water	AvgOfF-Diss-Water	AvgOfF-Diss-Water	AvgOfF-Diss-Water
Monitoring Point ID	Water Greater Than	Greater Than	Result	Detection Limit	Greater Than
90175			0.2593125	0.0625	
90198			0.223	0.06875	
90199			0.2202	0.05	
100000884					

			AvgOfFC-Susp-		AvgOfHARD-Mg-
	AvgOfFC-Susp-Water	AvgOfFC-Susp-Water	Water Greater	AvgOfFS-Susp-Water	Calc-Water
Monitoring Point ID	Result	Detection Limit	Than	Greater Than	Detection Limit
90175	5683.867925	0			
90198					
90199					
100000884	14900.72727	0			

			AvgOfHARD-Tot-		AvgOfKJEL N-Tot-
	AvgOfHARD-Mg-Calc-	AvgOfHARD-Tot-Water	Water Greater	AvgOfK-Diss-Water	Water Detection
Monitoring Point ID	Water Greater Than	Detection Limit	Than	Greater Than	Limit
90175					0.099298246
90198					
90199					
100000884					

			AvgOfLANGL-Index-		
	AvgOfKJEL N-Tot-	AvgOfLANGL-Index-	Water Detection	AvgOfLANGL-Index-	AvgOfMg-Diss-
Monitoring Point ID	Water Greater Than	Water Result	Limit	Water Greater Than	Water Result
90175		0.541108108			23.77015238
90198		0.398375			26.28488235
90199		0.3946			19.90158824
100000884					

				AvgOfN-Tot-Calc-	AvgOfN-Tot-Calc-
	AvgOfMg-Diss-Water	AvgOfMg-Diss-Water	AvgOfN-Tot-Calc-	Water Detection	Water Greater
Monitoring Point ID	Detection Limit	Greater Than	Water Result	Limit	Than
90175	1.5		2.108181818		
90198	1.5				
90199	1.5				
100000884					

			AvgOfNH3(25)-		AvgOfNH4-N-Diss-
	AvgOfNH3(25)-Union-	AvgOfNH3(25)-Union-	Union-Diss-W	AvgOfNH4-N-Diss-	Water Detection
Monitoring Point ID	Diss-W Result	Diss-W Detection Limit	Greater Than	Water Result	Limit
90175	0.004009174			0.049807339	0.05
90198	0.002176471			0.039294118	0.05
90199	0.004647059			0.088764706	0.05
100000884	0.0158			0.27	0.1

			AvgOfNO3+NO2-N-	AvgOfNO3+NO2-N-	
	AvgOfNH4-N-Diss-	AvgOfNO3+NO2-N-	Diss-Water	Diss-Water Greater	AvgOfNa-Diss-
Monitoring Point ID	Water Greater Than	Diss-Water Result	Detection Limit	Than	Water Result
90175		1.41440404	0.047979798		17.0206699
90198		1.258142857	0.012857143		17.7623125
90199		1.2615	0.036666667		15.01366667
100000884		1.11	0.1		

					AvgOfpH-Diss-
	AvgOfNa-Diss-Water	AvgOfNa-Diss-Water	AvgOfpH-Diss-	AvgOfpH-Diss-Water	Water Greater
Monitoring Point ID	Detection Limit	Greater Than	Water Result	Detection Limit	Than
90175	0.888466019		8.122330275	2	
90198	0.656125		7.918823529	2	
90199	0.464266667		7.967611111	2	
100000884			7.71	0.1	

			AvgOfpHs-Calc-		
	AvgOfpHs-Calc-Water	AvgOfpHs-Calc-Water	Water Greater	AvgOfP-Tot-Water	AvgOfP-Tot-Water
Monitoring Point ID	Result	Detection Limit	Than	Result	Detection Limit
90175	7.664702703			0.080818182	0.011563636
90198	7.602125				
90199	7.6908				
100000884					

			AvgOfPO4-P-Diss-		
	AvgOfP-Tot-Water	AvgOfPO4-P-Diss-	Water Detection	AvgOfPO4-P-Diss-	AvgOfRYZNAR-
Monitoring Point ID	Greater Than	Water Result	Limit	Water Greater Than	Index-Water Result
90175		0.014807339	0.010091743		7.211351351
90198		0.019117647	0.011882353		7.21775
90199		0.035647059	0.011529412		7.3138
100000884		0.1	0.1		

	AvgOfRYZNAR-Index-				AvgOfSAR-Diss-
	Water Detection	AvgOfRYZNAR-Index-	AvgOfSAR-Diss-	AvgOfSAR-Diss-Water	Water Greater
Monitoring Point ID	Limit	Water Greater Than	Water Result	Detection Limit	Than
90175			0.533153061		
90198			0.53825		
90199			0.494428571		
100000884					

			AvgOfSO4-Diss-		AvgOfSOLIDS-Susp-
	AvgOfSO4-Diss-Water	AvgOfSO4-Diss-Water	Water Greater	AvgOfSOLIDS-Susp-	Water Detection
Monitoring Point ID	Result	Detection Limit	Than	Water Result	Limit
90175	28.44369811	2.893867925			
90198	27.17582353	0.882352941			
90199	27.03435294	1.279411765			
100000884	29.4	10		21.9	3.07

	'	AvgOfSi-Diss-Water		_	AvgOfTAL-Diss-
Monitoring Point ID	Water Greater Than	Result	Limit	Greater Than	Water Result
90175		6.661321101	0.125		142.3914762
90198		7.956294118	0.125		165.5787059
90199		6.866823529	0.125		129.0411176
100000884					

					Avg Of Ca-Diss-
	AvgOfTAL-Diss-Water	AvgOfTAL-Diss-Water	Avg Of ASAR-Diss-	Avg Of Ca-Diss-Water	Water Detection
Monitoring Point ID	Detection Limit	Greater Than	Water Result	Result	Limit
90175	5.142857143		1.015670213	36.30714815	1
90198	7.823529412		1.079125	38.60670588	1
90199	7.294117647		0.906214286	33.99611765	1
100000884					

					Avg Of E#COLI-Susp-
	Avg Of CI-Diss-Water	Avg Of CI-Diss-Water	Avg Of CORR-Diss-	Avg Of E#COLI-Susp-	Water Detection
Monitoring Point ID	Result	Detection Limit	Water Result	Water Result	Limit
90175	33.0726055	0.149449541	0.536529412	5675.753846	0
90198	31.2465	0.849375	0.4411875		
90199	30.23970588	0.709411765	0.568235294		
100000884				12211.8	0

				Avg Of FS-Susp-	
	Avg Of EC-Phys-Water	Avg Of EC-Phys-Water	Avg Of FS-Susp-	Water Detection	Avg Of HARD-Mg-
Monitoring Point ID	Result	Detection Limit	Water Result	Limit	Calc-Water Result
90175	43.50844037	0.88440367	5381.490566	0	82.45879048
90198	45.68823529	0.205882353			91.18235294
90199	40.38222222	0.3			69.03864706
100000884	44	1			

	_	Avg Of K-Diss-Water		Avg Of KJEL N-Tot-
Monitoring Point ID	Water Result	Result	Limit	Water Result
90175	188.6122885	2.75606422	0.142018349	0.665614035
90198	204.6552941	3.028470588	0.116	
90199	166.8540588	2.681111111	0.116	
100000884				

Monitoring point name:	Stroom-op						
Description:	Hans Strijdom Road cros	Hans Strijdom Road crossing of the Moreleta Spruit					
Latitude:	25deg 48min 31.53sec						
Longitude:	28deg 18min 4.30sec						
				Stroom-op	Klerksdorp stroom-		
Sample name	Stroom-op 1.2	Stroom-op 2.1	Stroom-op 2.2	3.2	ор	Stroom-op	Stroom-op
Dissolved oxygen (mg/l)	5.9		4.9	6.7	4.7	6.7	4.7
Suspended solids (mg/l)	<10		15	<10	175	<10	175
Dissolved solids (mg/ℓ)	260		222	208	226	208	226
Ammonia nitrogen (mg/ℓ N)	0.2		0.1	0.4	0.2	0.4	0.2
Total phosphorous (mg/ℓ P)	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
рН	7.5		7.4	7.9		7.9	
Faecal coliforms (cfu/100 mℓ)		63	67		38	63	38

Monitoring point name:	Stroom-op						
Description:	Garstfontein Road cross	ing of the Rademe	yer spruit				
Latitude:	25deg 48min 13.71sec						
Longitude:	28deg 18min 12.45sec						
				Stroom-af	Klerksdorp stroom-		
Sample name	Stroom-af 1.2	Stroom-af 2.2	Stroom-af 4.1	4.2	af	Stroom-af	Stroom-af
Dissolved oxygen (mg/l)		4.2	5.8		5	5.8	5
Suspended solids (mg/l)		<10	13		18	13	18
Dissolved solids (mg/ℓ)		248	192		248	192	248
Ammonia nitrogen (mg/ℓ N)		0.2	0.2		0.2	0.2	0.2
Total phosphorous (mg/ℓ P)		<1.0	<1.0		<1.0	<1.0	<1.0
рН		7.5	8		7.7	8	7.7
Faecal coliforms (cfu/100 m²)	140	140	30	330	970	330	970





APPENDIX D

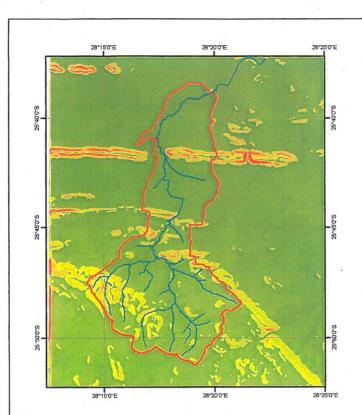
Complete Map Set





Map Number	Description
1	Regional Location
2	Local Orientation
3	Historical overview from 1939
4	Biophysical overview: biome and regional vegetation
5	Biophysical overview: geology, rainfall and topography
6	Biophysical overview: Slope and soils
7	Land cover from 2009
8	Wards and Land Parcels present within the catchment
9	Runoff risk / impervious surfaces based on 2009 land cover
10	Pollution risk based on 2009 land cover
11	Wetlands and aquatic monitoring
12	Current and past wetland potential
13	Derived rehabilitation potential based on 2009 land cover
14	Ecological connectivity: GDARD CPlan V3
15	Geographic representation of active stakeholder groups in the catchment
16	National freshwater priority areas: present ecological state: 1999
17	National freshwater priority areas: river condition 1999





Legend

A. SLOPE ATTRIBUTES

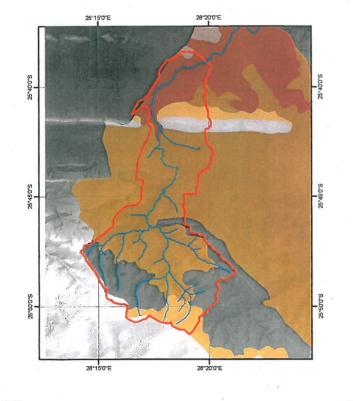
Slope classes

Plains: 0 - 5° (Low runoff, high infiltration)

Ridge: 5 - 10°

Ridge: 10 - 15° Ridge: 15 -20°

Ridge: 20°+ (High runoff, low infiltration)



Moreleta Spruit & Tributaries

Moreleta Catchment

Legend

B. SOIL ATTRIBUTES

RED APEDAL SOILS, WELL DRAINED

Ae21 Ae22

YELLOW-BROWN APEDAL, SHALLOW WATER TABLE

Ba2

Ba23

Ba3

Ba5

Ba7

Ba9

ROCKY, SHALLOW SOILS

lb3

lb7

RESOURCES/NOTES

ENPAT 2000, DEAT

5 2.5 0
Kilometers

REFERENCE
Coordinate System: GCS WGS 1984

PROJECT

ADOPT - A - RIVER MORELETA

TITLE

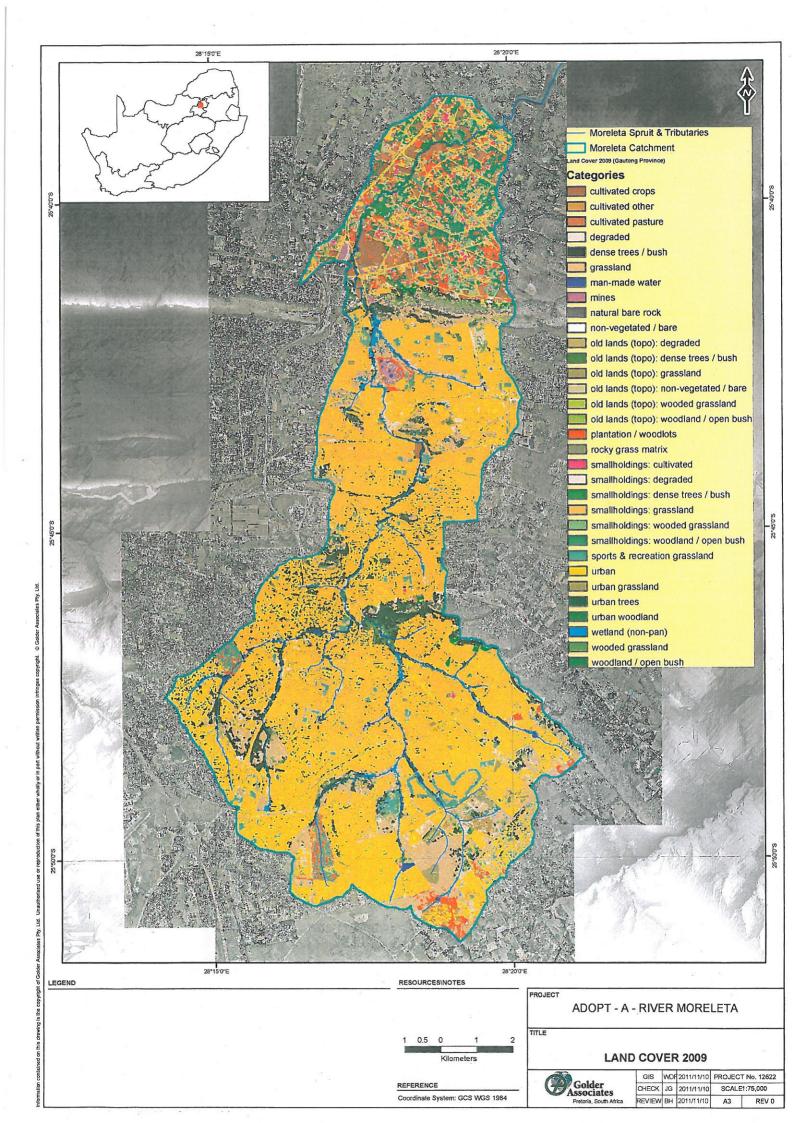
BIOPHYSICAL OVERVIEW -SLOPE & SOILS

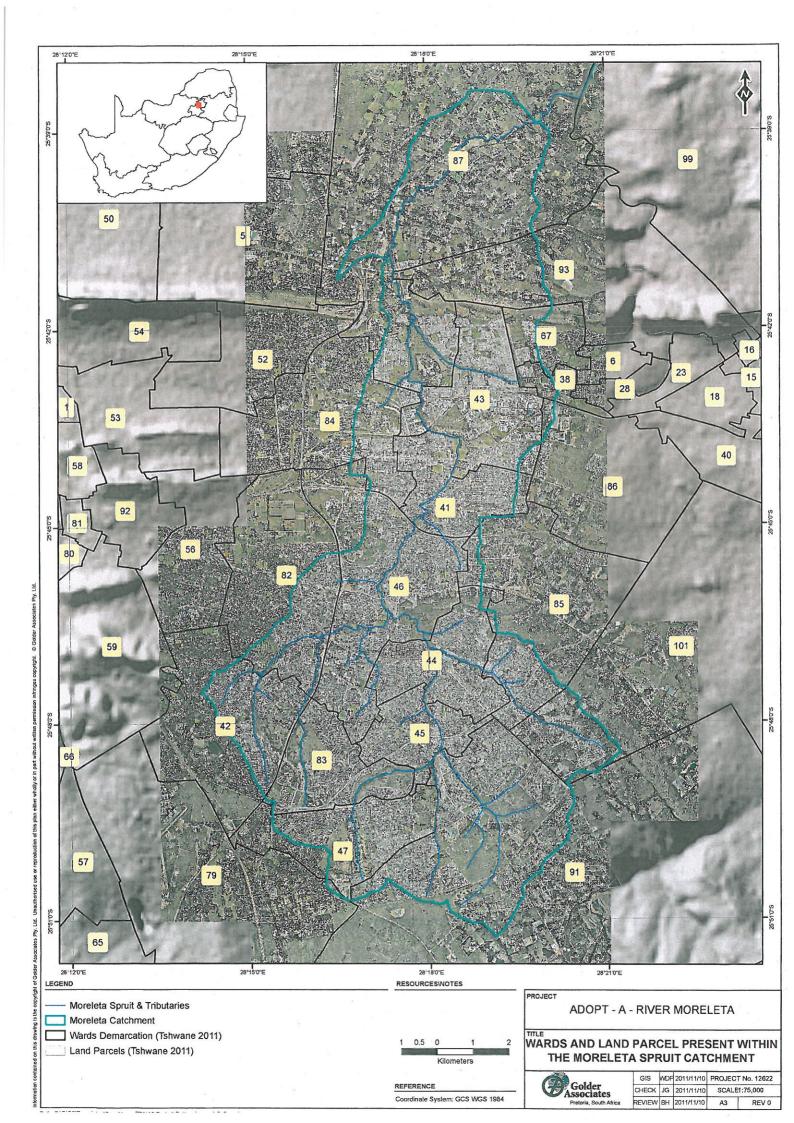


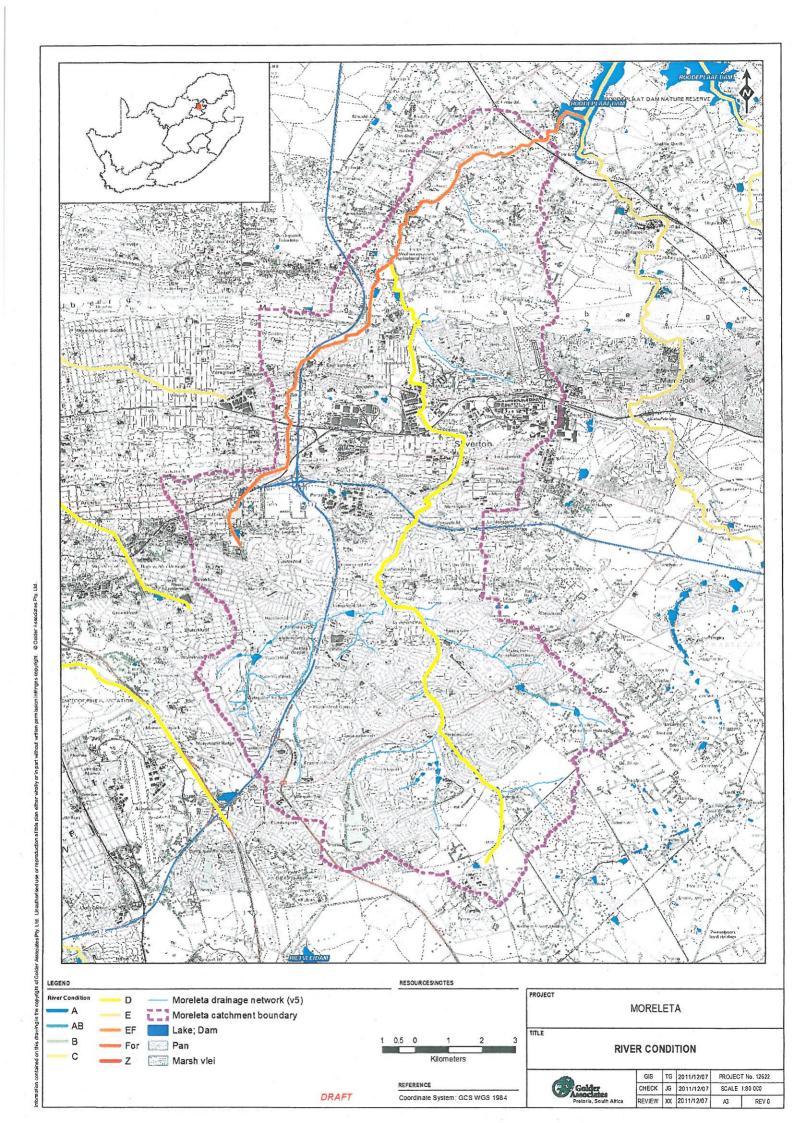
GIS WDF 2011/11/10 PROJECT No. 12622

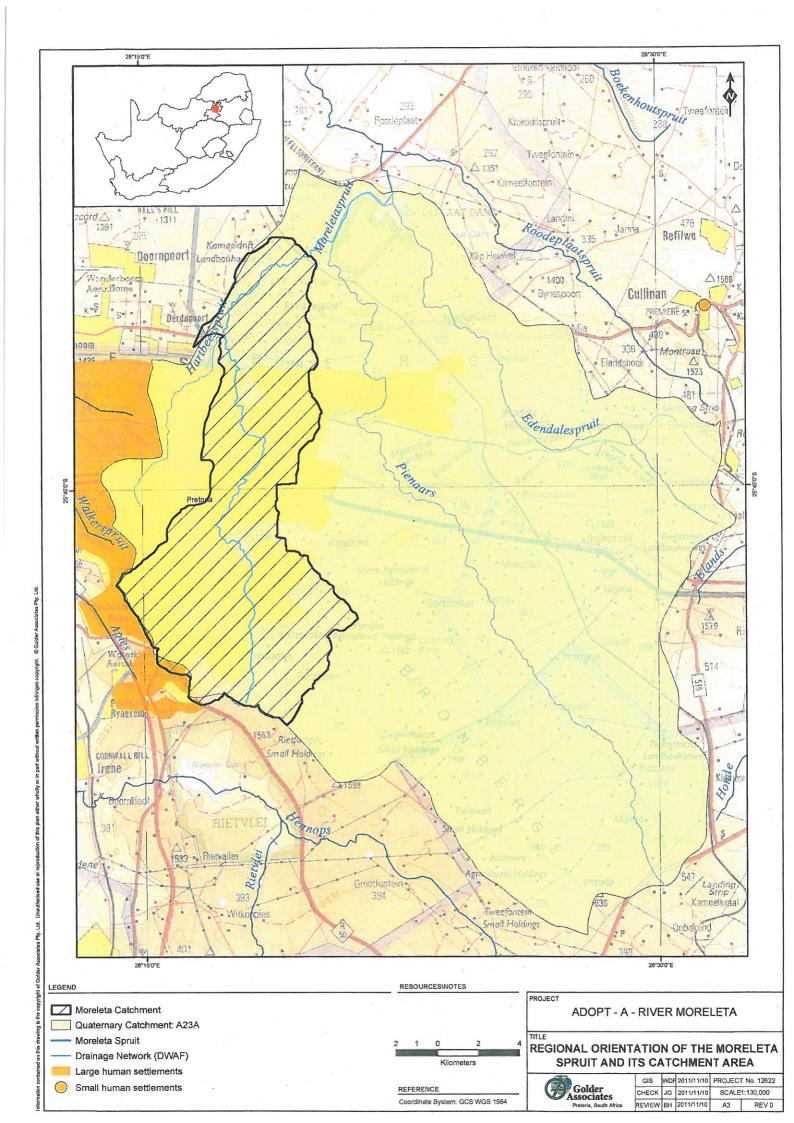
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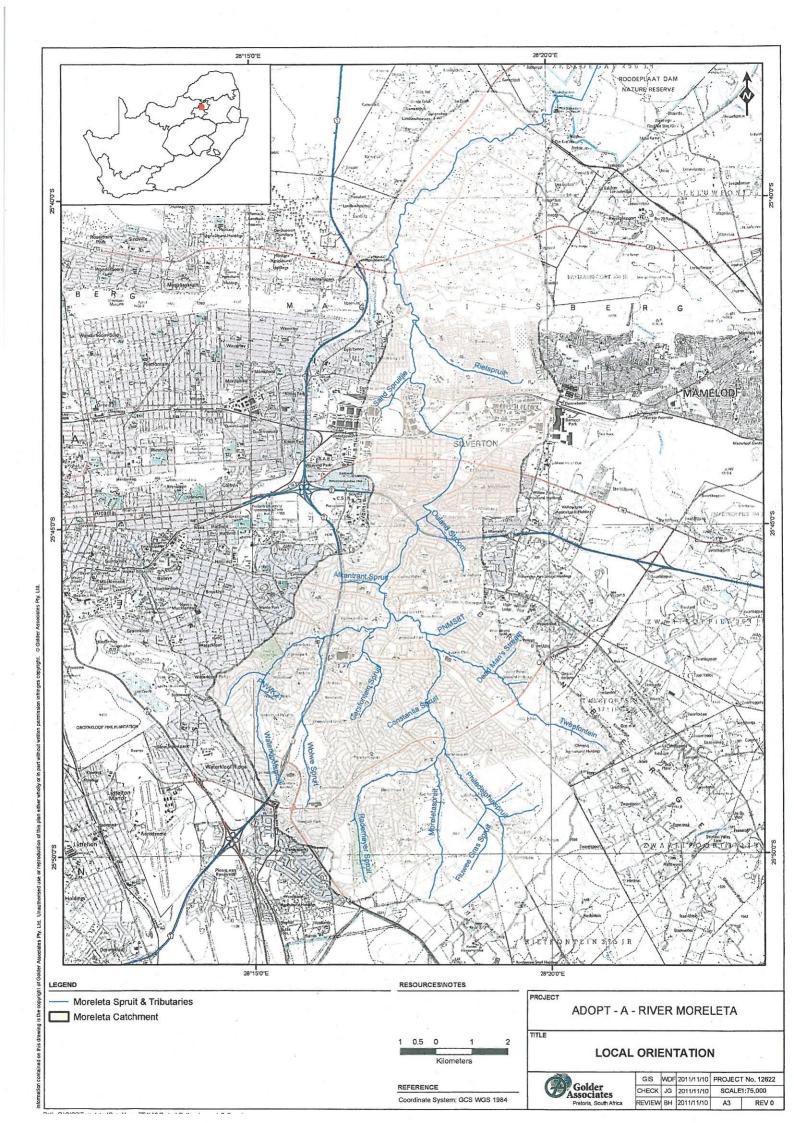
REVIEW BH 2011/11/10 A3 REV 0

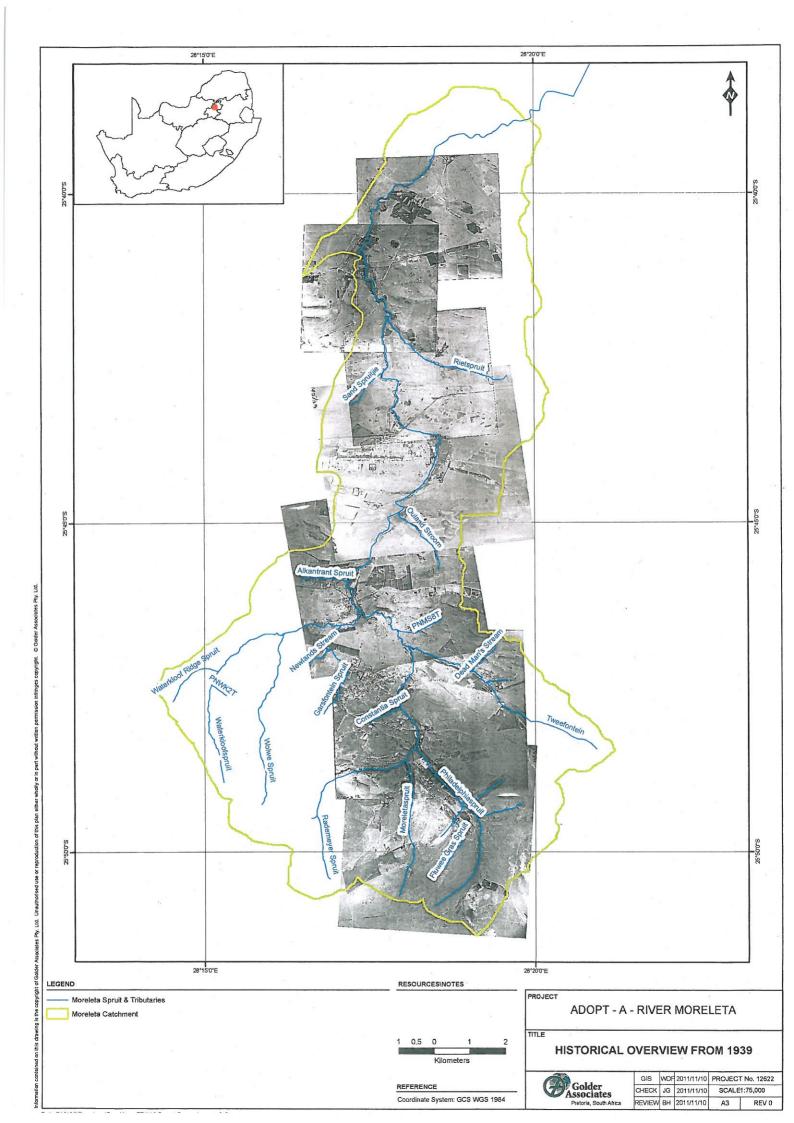




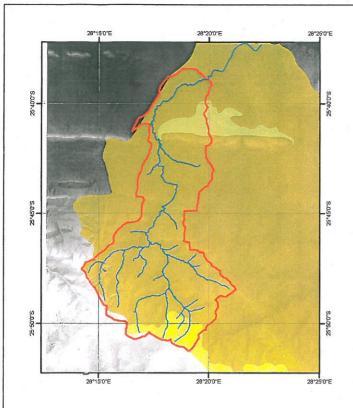










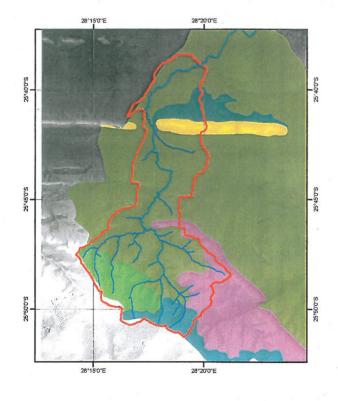


Legend

A. Biome Attributes BIOME

Grassland Biome





Legend

B. Regional Vegetation Attributes Vegetation Unit, Conservation Status

Andesite Mountain Bushveld, Least threatened

Eastern Highveld Grassland, Endangered

Gauteng Shale Mountain Bushveld, Vulnerable

Gold Reef Mountain Bushveld, Least threatened

Marikana Thornveld, Endangered

Rand Highveld Grassland, Endangered

LEGEND

Moreleta Spruit & Tributaries

Moreleta Catchment

ENPAT 2000 & VEGMAP 2006, DEAT

REFERENCE

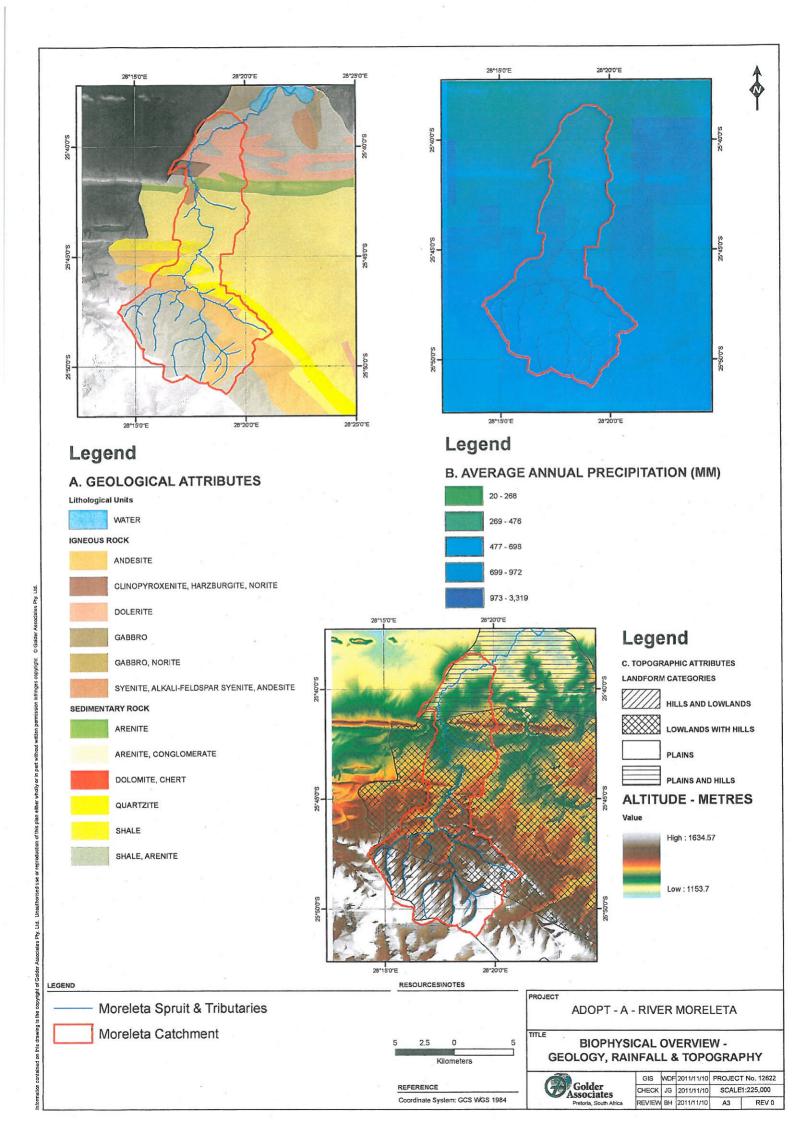
Coordinate System: GCS WGS 1984

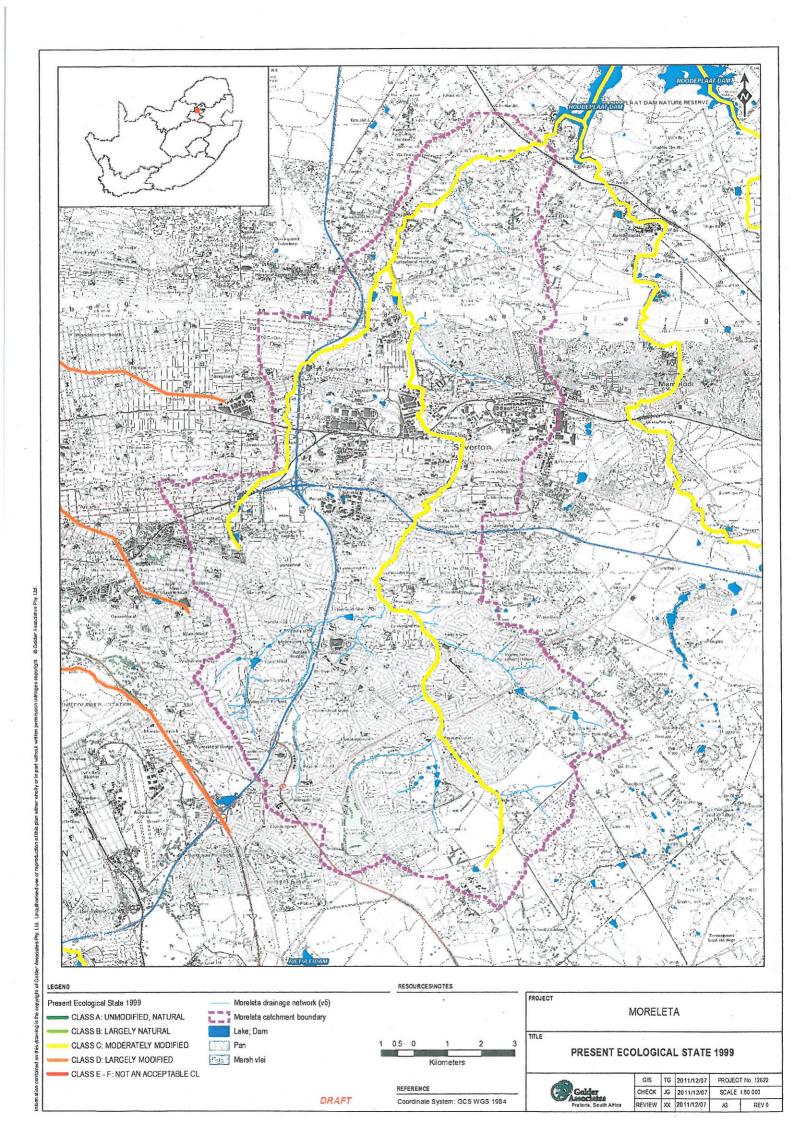
PROJECT

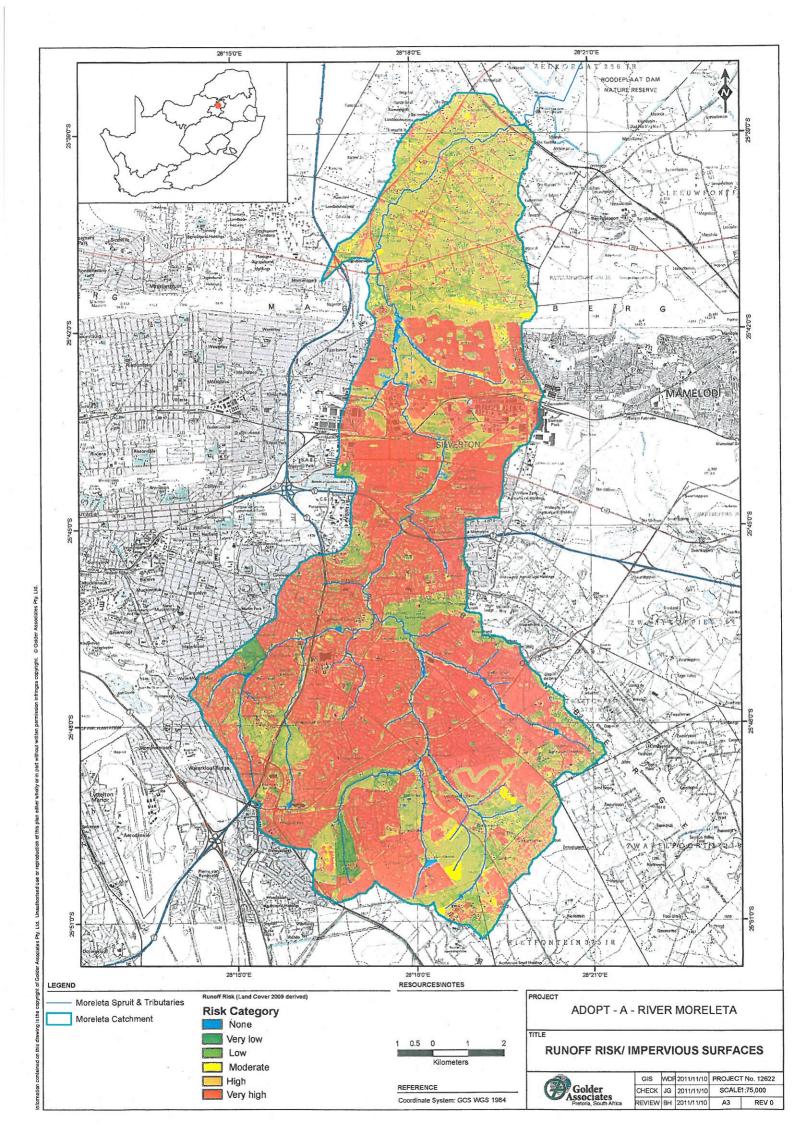
ADOPT - A - RIVER MORELETA

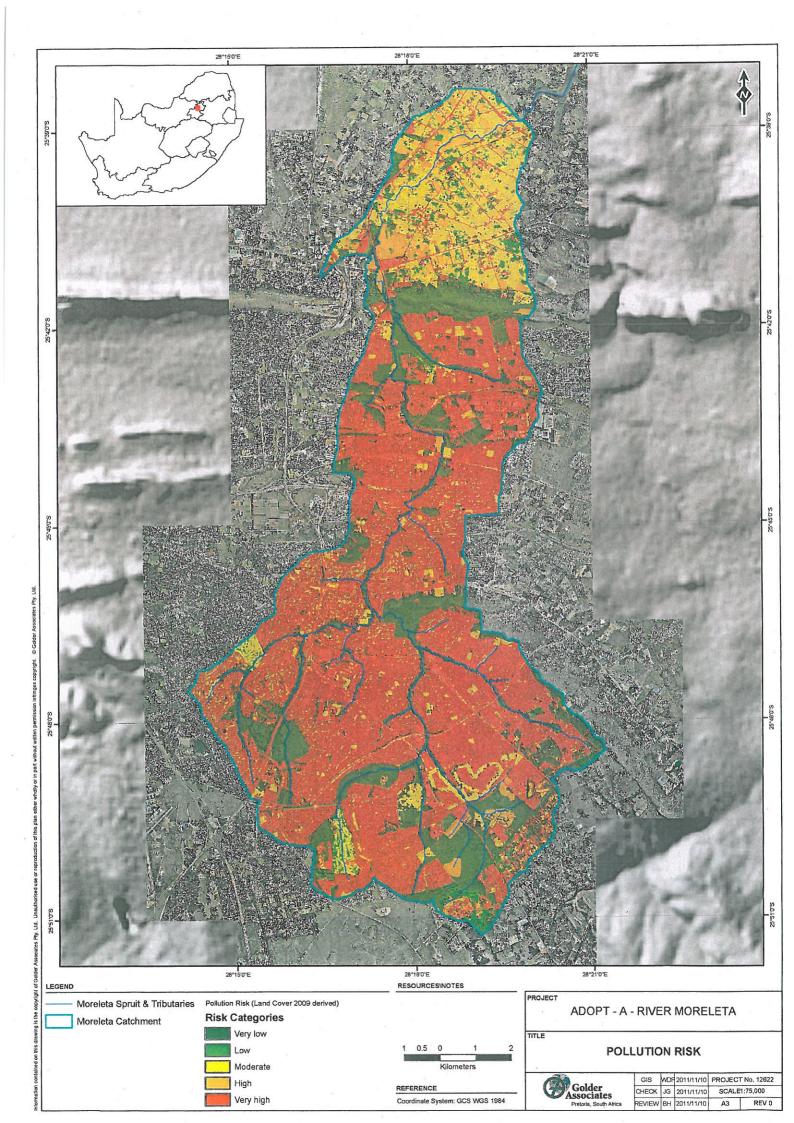
BIOPHYSICAL	OVERVIEW -	
BIOME & REGION	IAL VEGETATION	

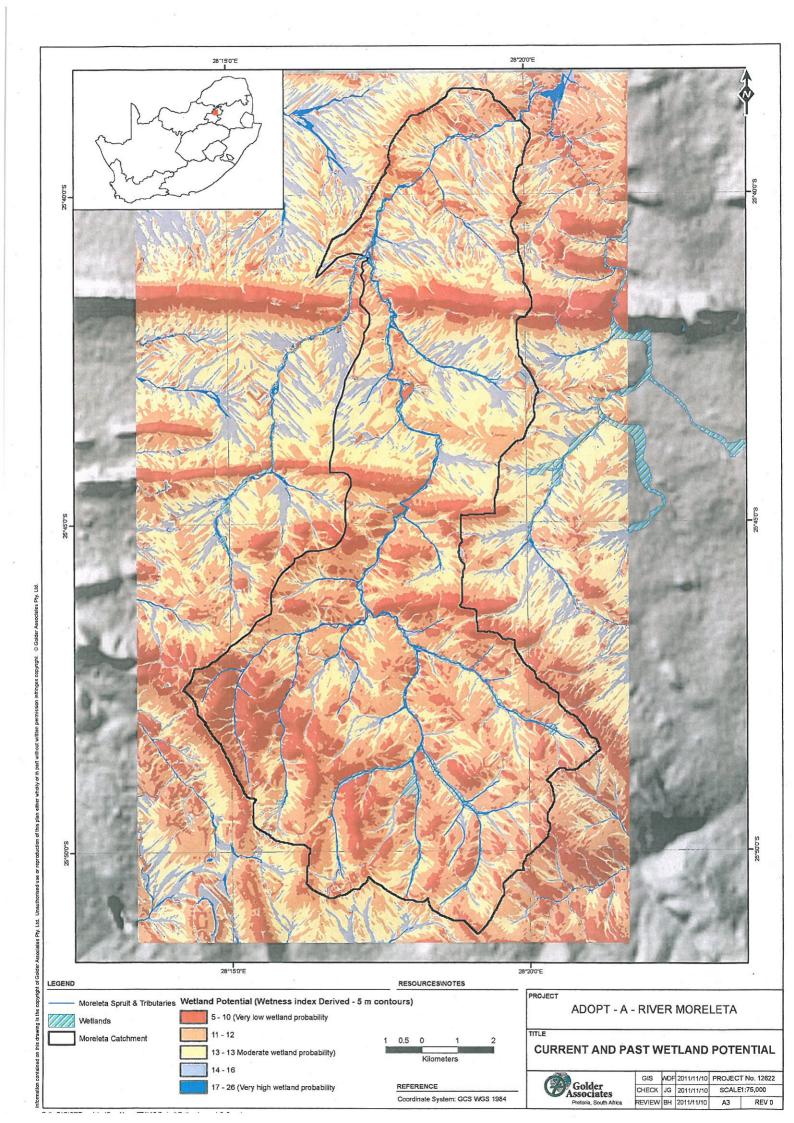
DIOINE OF ICE	CICIAR	~	VLOL	AIIO	
Golder Associates	GIS	WDF	2011/11/10	PROJECT No. 12	
	CHECK	JG	2011/11/10	SCALE1:225,00	
Pretoria, South Africa	REVIEW	вн	2011/11/10	Δ3	RE\

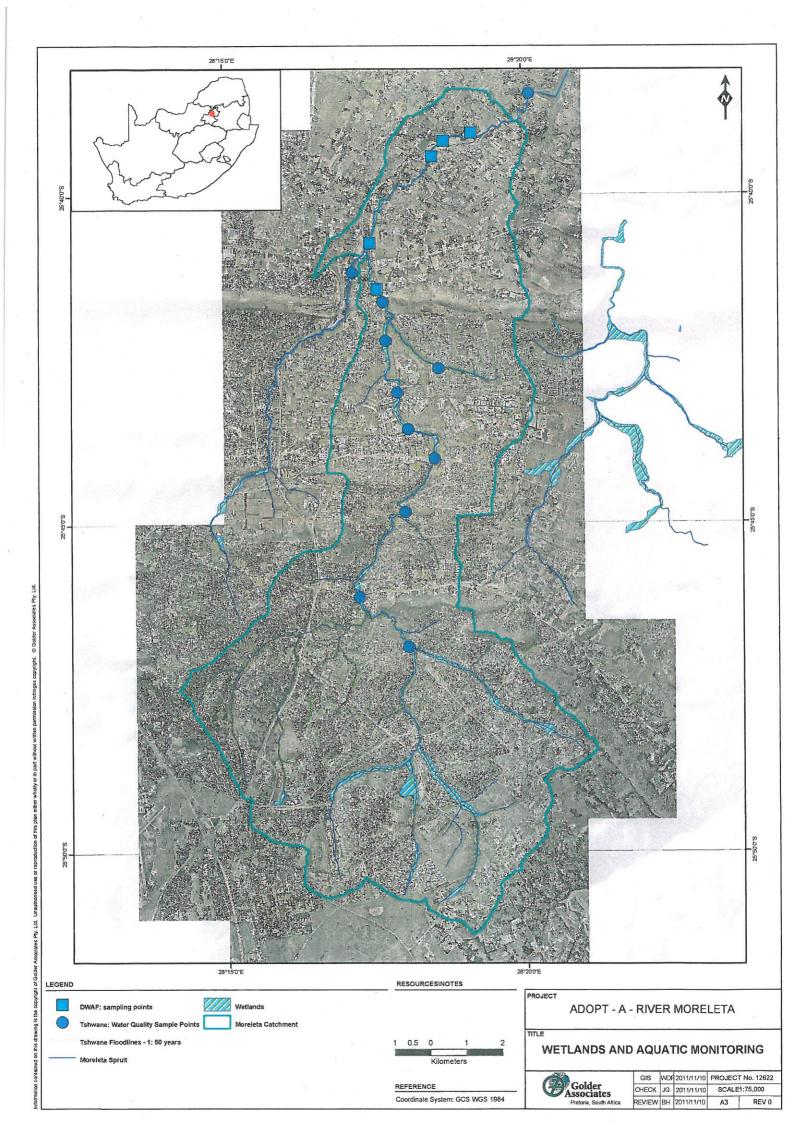


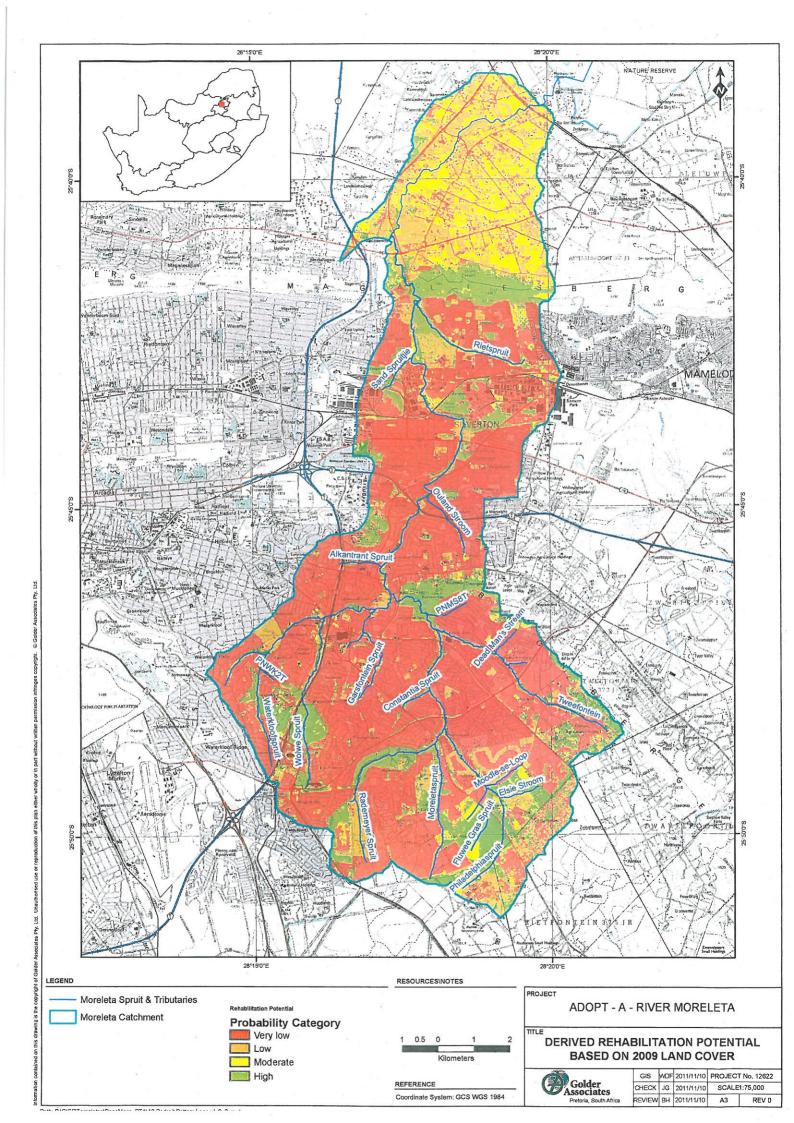


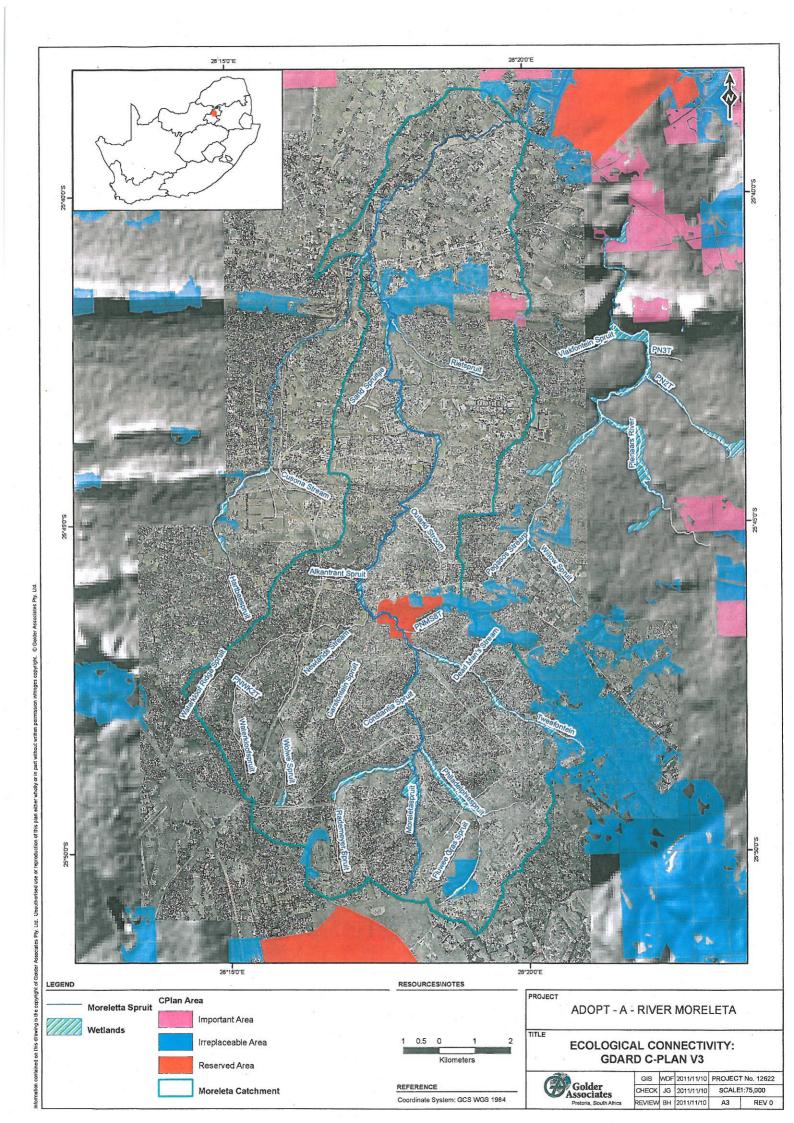


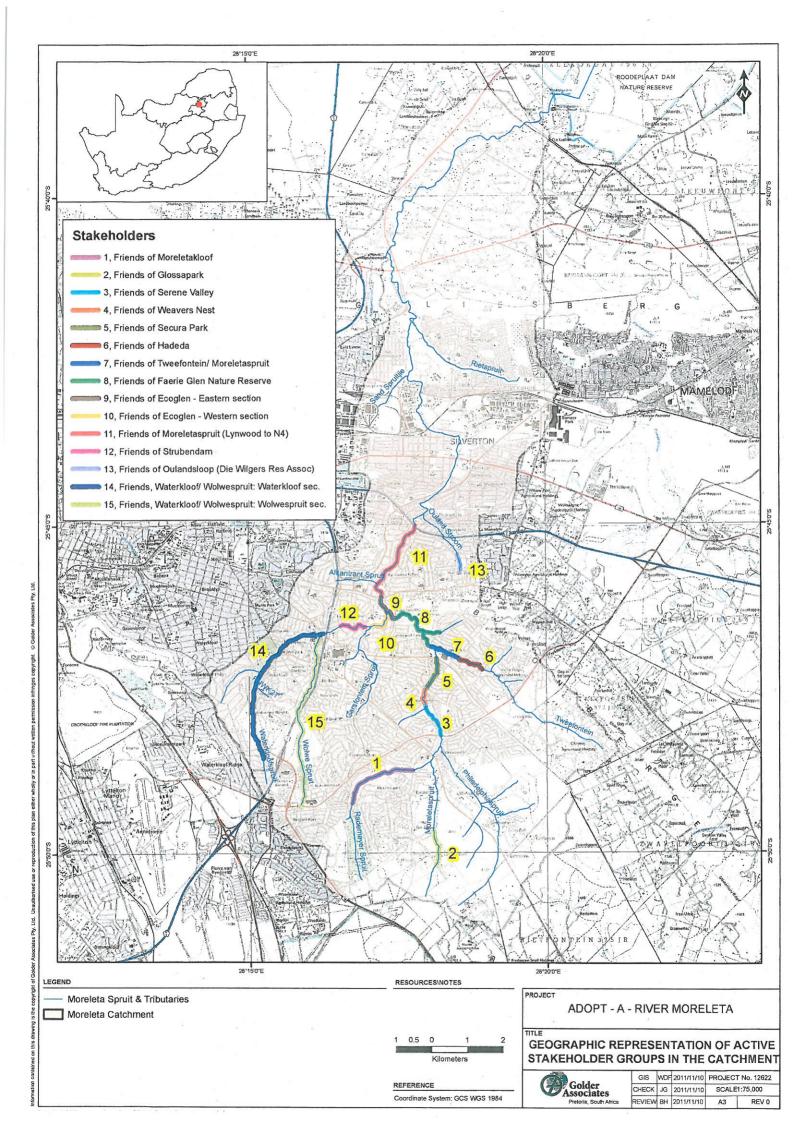
















APPENDIX E

Document Limitations





DOCUMENT LIMITATIONS

DOCUMENT LIMITATIONS

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May 2010 1/1



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