EIA FOR THE
PROPOSED BERG RIVER-VOËLVLEI AUGMENTATION SCHEME (also known as the First Phase Augmentation of Voëlvlei Dam),
BOLAND SUB-REGION,
WESTERN CAPE PROVINCE

Agricultural Assessment Study:
Soils and soil suitability and
Agricultural economic assessment

Prepared by:

F Ellis (*Pr. Sci. Nat. (registration Number 400158/08)*
Department of Soil Science
University of Stellenbosch
Private Bag X1
Matieland. 7602

and

Johann Laubscher
Agricultural Economist
102 Aan de Weber
Webersvallei Road
Jamestown
Stellenbosch, 7600

Prepared for:

NEMAI Consulting (Pty) Ltd
info@nemai.co.za

Date: January 2017

EXECUTIVE SUMMARY

The Western Cape Water Supply System serves the City of Cape Town, surrounding urban areas and irrigators. It consists of infrastructure components owned and operated by both the City of Cape Town and the Department of Water and Sanitation. In 2007, the Western Cape Reconciliation Strategy Study was commissioned by the Department of Water and Sanitation to determine future water requirements for a 25 year planning horizon. The Study investigated a number of options and found that whilst 556 million m^3 per annum would be available from 2007, the estimated water requirement in 2011 would be 560 million m^3/a, with the implication that the system supply will then be fully utilized and thus additional interventions will thus be required.

Based on the above, Department of Water and Sanitation identified the need for augmentation of the Western Cape Water Supply System by 2019 and proceeded with pre-feasibility and feasibility studies into potential surface water development options. Initially six options were assessed at a pre-feasibility level of detail. These options were then prioritized to identify the two most viable options. These were:

- Berg River-Voëlvlei Augmentation Scheme (also known as the First Phase Augmentation of Voëlvlei Dam); and
- Breede-Berg Transfer Scheme (also known as the Michell's Pass Diversion Scheme).

Ultimately, the Feasibility Study found that the Berg River-Voëlvlei Augmentation Scheme option was the most favourable surface water intervention and as such the Department of Water and Sanitation proposes to implement this scheme which involves the transfer of approximately 23 million m^3 per annum from the Berg River to the existing Voëlvlei Dam. It is assumed that the proposed abstraction water scheme will not impact negatively on agricultural activities further downstream due to the fact that it will be excess winter water to be stored in Voëlvlei Dam (Personal communication with Dr Mike Shand, Aurecon Consulting Engineers, Cape Town, 29 September 2016).

The project components include the following:

- A low level weir, abstraction works and 4 m^3/s raw water pump station on the Berg River;
- A rising main pipeline from the Berg River to Voëlvlei Dam; and
- A potential new summer release connection at the existing Swartland WTW to facilitate summer releases into the Berg River for environmental requirements thus eliminating the need to utilize the existing canal from which water losses occur.

All the infrastructure and activities that require environmental authorization (agricultural perspective) were assessed as part of the Environmental Impact Assessment. In this regard, the impact of the following associated infrastructure that was identified was analyzed:

- Abstraction works;
- Rising main pipeline and pump station;
- Diversion weir;
- Access roads during construction;
- Access roads during operation;
- Construction camp (footprint).

This report thus deals with the impact of the proposed Berg River-Voëlvlei Augmentation Scheme on existing and potential agricultural activities in the area where project components are to be constructed.

The impact analyses will be based on:

- A soil suitability analyses of the relevant agricultural areas to be impacted by the proposed Berg River-Voëlvlei Augmentation Scheme.
- An agricultural economic assessment (farm level) of the impact of the project, based on the findings of soil suitability study.

Some of the affected sites are currently used for agricultural purposes, including small-grain, sheep farming and vineyards.

The purpose of this report is to provide information with regard to the expected impact of the envisaged water scheme on agricultural activities on the sites that are earmarked therefor. The investigation thus focused on the potential of the natural resource base as far as production possibilities are concerned, influence that the placement of the pipelines and roads will have on the land use, as well as on the economics of current and potential agricultural production practices on the affected areas. The soils and soil suitability assessment (refer to Section A) will serve as a base for the agricultural economic perspective (refer to Section B). The analysis of the impact (agricultural perspective) of the proposed water scheme is presented in Section C of this report.

The Terms of Reference are as follows:

- Determine agricultural potential in project footprint.
- Determine impacts of project from an agricultural perspective.
- Provide recommendations regarding the alternatives provided from an agricultural perspective.
- Compile a report that reflects the above and includes appropriate mapping. Ensure that the report complies with Appendix 6 of GN No. R982 (2014), as part of the EIA Report.
- Prepare a sensitivity map (GIS-based), based on the findings of the study.
- Reporting of the findings of the investigation.

The farms are currently used for agricultural purposes and production possibilities are winter grain and winter grazing crops for animal feedstuff. Both cattle and sheep are possible livestock enterprises to be practised in combination with winter grain production systems in rotation with grazing crops, mainly medic types. Irrigated vineyards exist on certain soils near the Berg river. An ‘average’ suitability is assumed for the soils that are utilized for both winter cropping and the vineyards (refer to Table 6.1).

The financial calculations were done with a typical farming model as a point of departure. This is a normal procedure when agricultural potential is studied as the managerial productivity differs between farmers. The typical farming model was developed with the aid of industry experts. Valuable inputs in this regard were obtained from the Agricultural economic Section of Overberg Agri (Edms) Bpk., Moorreesburg, October, 2016.

It is assumed that the results of the financial evaluation of the typical farming situations will serve as a plausible source of information for the evaluation of the agricultural potential of the land that is earmarked for the proposed water scheme. It is further assumed that the managerial inputs on the farming areas will be optimal.

A typical farm of 600ha is assumed for calculation purposes. The following farming strategy is assumed as far as the winter grain/grazing cropping system is concerned:

- 300ha of wheat per year
- 300ha of medics grazing per year
- 450 ewes (Meat-type Merino’s) on the farm of 600ha

This farming strategy is typical for the region. A Scenario is developed for the expected financial outcome from farming, namely a medium suitability situation for winter grain as well as for the vineyards that may exist on certain farms.

Expected farm profitability is illustrated with a gross margin analyses of the production system that is generally implemented. The yearly gross margin/ha served as an indicator for the negative impact of the proposed alternative layouts on agricultural land. The higher the expected yearly gross margin to be lost, the more negative the impact of that alternative layout. Farming overheads such as labour costs, regional taxes, depreciation of equipment and fixed improvements and the remuneration to capital and management are not considered as it is expected to stay the same due to the relative small part of individual farms to be impacted.

The estimated yearly loss (i.e. the negative impact, should the pipeline/access road impede with small grain production practices) is **R1619 per hectare** (refer to Table 6.5).

The estimated yearly loss (i.e. the negative impact, should the pipeline/access road impede with vineyard production practices of this kind) is **R130 256 per hectare** (refer to Table 6.9).

The impact of the project is thus expected to be as follows:

- It can be seen as a permanent substitution of some of the agricultural resources for the construction of the water scheme developments.
- The magnitude of the impact of the water scheme developments at a national level is expected to be more positive than negative (i.e. the positive contribution towards the

availability of limited water sources for the Cape Metropole is expected to be considerably more than the negative impact of the loss in agricultural output value).

- The magnitude of the impact of the water scheme developments at a local (i.e. farm) level is expected to be more negative than positive (i.e. the negative impact of the project on agricultural output value will be permanent for the farms that are impacted).
- The magnitude of the impact of the water scheme developments at a regional (i.e. sectoral, downstream) level is not expected to be negative due to the fact that it will be excess winter water to be stored in Voëlvlei Dam.
- The duration of the project can be seen as long term (i.e. permanent).

The **negative impacts** on farming will thus mainly be the loss of agricultural land due to the construction of:

- The pipeline;
- The access roads; and
- Construction laydown area.

The relevant areas in this regard were calculated as between 20 and 50 hectares, depending on the alternative route chosen for the pipeline and access road. The income in excess of the running costs to be incurred to generate that income thus present the expected net loss of agricultural production value due to the envisaged water scheme development. Farm overhead costs will not be influenced by the relative small loss of agricultural production practices. The financial analyses were thus performed to the profit-level of **gross margin per ha** (i.e. the income in excess of the running costs to be incurred to generate that income). The *yearly loss* in net agricultural production value ranges between **R1 253 000** and **R1 135 000**, depending on the alternative chosen for the pipe line and access road.

As far as the pipeline alternatives are concerned, the harm to agricultural production is more severe, especially when it crosses land with perennial crops (i.e. vineyards). It seems that Alternatives B or C of the pipeline alternatives will be marginally less harm full than Alternative A.

The yearly net loss in agricultural production value must, however, be weighed against, *inter alia*, the contribution of the project to the national water supply network and should obviously decrease the pressure of the increasing water demand from the rising population numbers of the Cape Metropolitan area.

The expected loss in farmland (20 to 50ha) comprises a relative small percentage of the farm land of the area.

The **''no-go''** option will obviously be advantageous for the farms that are to be impacted by the water scheme development (local farming perspective), but it will at the same time be disadvantageous for the community of the Cape Metropolitan area (i.e. provincial level) as far as the provision of scarce household water sources is concerned.

The development will have minor negative impacts on the current farming activities as well as on possible future farming developments. However, appropriate mitigation measures with regard to the conservation of the natural resource base should form an important part of the planning process, *inter alia* regarding the following aspects:

1. Avoiding of sensitive areas, if applicable (i.e. wetlands, slopes and existing soil conservation works such as contours), in order to prevent the degradation thereof.

2. Proper planning of road layout so that roads follow the contours as far as possible or where contours are crossed, proper structures be developed and implemented that will ensure proper functioning of the existing contours

3. Conservation of the topsoil during construction and the proper rehabilitation of the construction sites after construction.

4. Protection of the vegetation and veld by means of the construction of proper service roads and the proper maintenance thereof over time.

5. The construction of the project infrastructure should be synchronised, as far as possible with the seasonal pattern of farming activities in order to minimize the possible disturbance of the latter.

DECLARATION OF INDEPENDENCE

I, Johann Laubscher, declare that I am an independent consultant, and that I am financially independent of the client and their consultants, and that all opinions expressed in this report are substantially my own.

Johann Laubscher

Abridged CV

Surname: Laubscher
First names: Johann
Date of Birth: 29 July 1945
University of Stellenbosch, South Africa. Ph D (Agric) 1987

Key Experience

I retired in 2006 as professor in Agricultural Economics at the University of Stellenbosch with 32 years' experience. My expertise covers various fields, *inter alia*, strategic planning and -management, financial viability analyses, agricultural enterprise budgeting and advice, business plans and environmental impact analyses (Agricultural economic perspective). I was involved, since 1990, in 18 projects in water resource planning, *inter alia* the Western Cape Systems Analysis (Estimation of the irrigation water demand) and the financial viability analysis of various envisaged irrigation schemes in the Olifants-, Doring- and Breede river basins.

I was involved, since 2011, in 15 projects that focussed on the impact of the development of alternative energy installations on farms on their agricultural production potential.

I trade under the name **Johann Laubscher**.

DECLARATION OF INDEPENDENCE

I, Freddie Ellis, declare that I am an independent consultant, and that I am financially independent of the client and their consultants, and that all opinions expressed in this report are substantially my own.

Freddie Ellis
Pr. Sci. Nat. (registration Number 400158/08)

Abridged CV

Surname: Ellis
First names: Freddie
Date of Birth: 21 April 1947
University of Stellenbosch, South Africa. PhD Agric (Soil Science) 1988

I have been working as a soils consultant for more than 30 years and consult under my own name**.**

Some of the activities are briefly listed below:

1990	**South Africa:** An agricultural evaluation of the Atlantis Corridor (approx. 75 000 ha) area
2001	**Namibia** Soil survey and land interpretation for irrigation development along the Lower Orange River near Koeskop and Daberas
2001-2003	**South Africa:** Western Cape Olifants/Doring River Irrigation Study. Responsible for field soil survey and classification and mapping of the soils. Soil suitability evaluations for irrigated crop production; recommendations for physical and chemical ameliorations measure.
2001-2003+	**South Africa:** Water quality information systems for integrated water resource management: The Riviersonderend-Berg River systems (funded by WRC) involved as a *Soil Science Team Member:*
2008	**Uganda:** Potential for afforestation of an area of approximately 24 000 ha at Sango Bay, Uganda.
2009	**South Africa:** Reconnaissance soil survey and land use plan for the Heidelberg farms (approx. 5 000 ha), University of Stellenbosch

CONTENTS

TABLES

ANNEXURE 1

1 INTRODUCTION

The Western Cape Water Supply System serves the City of Cape Town, surrounding urban areas and irrigators. It consists of infrastructure components owned and operated by both the City of Cape Town and the Department of Water and Sanitation. In 2007, the Western Cape Reconciliation Strategy Study was commissioned by the Department of Water and Sanitation to determine future water requirements for a 25 year planning horizon. The Study investigated a number of options and found that whilst 556 million m^3 per annum would be available from 2007, the estimated water requirement in 2011 would be 560 million m^3/a, with the implication that the system supply will then be fully utilized and thus additional interventions will thus be required.

Based on the above, Department of Water and Sanitation identified the need for augmentation of the Western Cape Water Supply System by 2019 and proceeded with pre-feasibility and feasibility studies into potential surface water development options. Initially six options were assessed at a pre-feasibility level of detail. These options were then prioritized to identify the two most viable options. These were:

- Berg River-Voëlvlei Augmentation Scheme (also known as the First Phase Augmentation of Voëlvlei Dam); and
- Breede-Berg Transfer Scheme (also known as the Michell's Pass Diversion Scheme).

Ultimately, the Feasibility Study found that the Berg River-Voëlvlei Augmentation Scheme option was the most favourable surface water intervention and as such the Department of Water and Sanitation proposes to implement this scheme which involves the transfer of approximately 23 million m^3 per annum from the Berg River to the existing Voëlvlei Dam.

The project components include the following:

- A low level weir, abstraction works and 4 m^3/s raw water pump station on the Berg River;
- A rising main pipeline from the Berg River to Voëlvlei Dam; and
- A potential new summer release connection at the existing Swartland WTW to facilitate summer releases into the Berg River for environmental requirements thus eliminating the need to utilize the existing canal from which water losses occur.

All the infrastructure and activities that require environmental authorization need to be assessed as part of the EIA. In this regard, the following associated infrastructure was identified:

- Abstraction works;
- Rising main pipeline and pump station;
- Diversion weir;
- Access roads during construction;
- Access roads during operation; and
- Construction camp (footprint).

It is assumed that the proposed abstraction water scheme will not impact negatively on agricultural activities further downstream due to the fact that it will be excess winter water to be stored in Voëlvlei dam (Personal communication with Dr Mike Shand, Aurecon Consulting Engineers, Cape Town, 29 September 2016).

This report thus deals with the impact of the proposed Berg River-Voëlvlei Augmentation Scheme on existing and potential agricultural activities in the area where project components are to be constructed.

The impact analyses will be based on:

- A soil suitability analyses of the relevant agricultural areas to be impacted by the proposed Berg River-Voëlvlei Augmentation Scheme.
- An agricultural economic assessment (farm level) of the impact of the project, based on the findings of soil suitability study.

Some of the sites are currently used for agricultural purposes, including small-grain, sheep farming and vineyards.

The purpose of this report is to provide information with regard to the expected impact of the envisaged water Scheme on agricultural activities on the sites that are earmarked therefor. The investigation thus focused on the potential of the natural resource base as far as production possibilities are concerned, influence that the placement of the pipelines and roads will have on water and wind erosion, as well as on the economics of current and potential agricultural production practices on the affected areas. The soils and soil suitability assessment (refer to Section A) will serve as a base for the agricultural economic perspective (refer to Section B). The analysis of the impact (agricultural perspective) of the proposed water Scheme is presented in Section C of this report.

The Terms of Reference are as follows:

- Determine agricultural potential in project footprint.
- Determine impacts of project from an agricultural perspective.
- Provide recommendations regarding the alternatives provided from an agricultural perspective.
- Compile a report that reflects the above and includes appropriate mapping. Ensure that the report complies with Appendix 6 of GN No. R982 (2014), as part of the EIA Report.
- Prepare a sensitivity map (GIS-based), based on the findings of the study.
- Reporting of the findings of the investigation.

The **negative impacts** on farming will mainly be the loss of agricultural land and thus by implication the loss of net output value due to the construction of:

- The pipeline alternatives
- Access road alternatives
- Construction camp (footprint).

Appropriate background information was supplied by Nemai Consulting, while a site visit on 20 October 2016 contributed to the development of a sound perspective as far as possible impacts (agricultural perspective) is concerned.

SECTION A

SOIL AND SOIL SUITABILITY ASSESSMENT

2 GENERAL DECRIPTION AND LAND USE OF THE SURVEY AREA

The survey area is situated to the west and north-west of Voëlvlei Dam mainly on the western side of the Wellington – Gouda road. The terrain is fairly flat with a maximum elevation of about 110m above mean sea level and a minimum of about 60m along the Berg River. The highest elevation occurs on the western side of the Berg River.

The area is underlain by Malmesbury Formation slates and phyllites. Generally the degree of weathering is low and soft to hard weathered base rock occurs at a shallow depth (less than 1m from the soil surface). Due to the high salt content of the Malmesbury Formation, rocks free salts are common in many low-lying depression soils. A narrow strip of deeper alluvial soils occur along the Berg River and they are generally intensively used for irrigated agriculture

The surface horizon of most soils has developed in a colluvial overburden. The texture is sandy to sandy loam with less than 10 % clay. The sand grade ranges from fine to coarse. This might be an indication that the colluvial material is a mixture of fine sandy Malmesbury Formation weathering products combined with Table Mountain Sandstone weathering products. The Voëlvlei Mountains to the east as well as the Riebeek Mountain to the west of the survey area consist of Table Mountain Sandstones.

In Table 2.1 below, an indication of the main climate statistics of the area is given by using data representing a farm lying in the survey area

Table 2.1: Climate statistics for farm 648(Schulze, 1997)

Frost (days)	0		
Mean annual rainfall (mm)	589	**Median annual Temp. (C)**	17.3
Median Jan. rainfall (mm)	9	**Median Jan. Temp. (C)**	21.5
Median Feb. rainfall (mm)	7	**Median Feb. Temp. (C)**	21.6
Median Mar. rainfall (mm)	16	**Median Mar. Temp. (C)**	20.1
Median Apr. rainfall (mm)	41	**Median Apr. Temp. (C)**	17.6
Median May rainfall (mm)	79	**Median May Temp. (C)**	15.7
Median Jun. rainfall (mm)	101	**Median Jun. Temp. (C)**	13.5
Median Jul. rainfall (mm)	89	**Median Jul. Temp. (C)**	12.4
Median Aug. rainfall (mm)	82	**Median Aug. Temp. (C)**	13.1
Median Sept. rainfall (mm)	46	**Median Sept. Temp. (C)**	14.8
Median Oct. rainfall (mm)	32	**Median Oct. Temp. (C)**	16.9
Median Nov. rainfall (mm)	18	**Median Nov. Temp. (C)**	18.9
Median Dec. rainfall (mm)	10	**Median Dec. Temp. (C)**	20.6
Total Annual Pot. Evap. (mm)	2302		

From Table 2.1, it is clear that although annual rainfall is medium high, annual crops can be grown during the winter months (May to August and even September) when rainfall is reasonable. Although lower than the mentioned months above, some rain also occurs in other months but it is then too low for growing of annual crops. Due to the overall medium rainfall, crop failures may occur in some years when the rainfall is too low. Without irrigation, water farming with perennial crops such as table grapes, wine grapes or deciduous fruit crops would not be possible in the area.

3 SOIL SURVEY

No detail soil survey was done specifically for this investigation. Use was made of three different sources of soil data namely:

1. A soil survey of the farm Halfgewaagd (lying immediately north of the Voëlvlei dam and therefore in the survey area) done during 2009 by Ellis, Lambrechts and Schloms (2009)
2. A soil map prepared as part of a Water Research Commission report on the Berg River by De Clercq, W.P., Ellis, F, Fey, M.V., Van Meirvenne, M., Engelbrecht, H. & De Smet, G (2006).
3. A field visit to the area on 20 October 2016.

4 SOIL LIMITATIONS

All the soils investigated during the different surveys mentioned above may have one or more soil physical, morphological and/or chemical properties that could negatively affect root development, plant growth and production potential. Further influences may be on water and wind erosion. The properties that have been used for to try to quantify the impacts they might have on agriculture are briefly listed below:

- Low clay content in top- and upper subsoil
- Subsoil hardpans
- Dense, structured subsoil clay layer
- Wetness
- Free carbonates and alkalinity
- Salt affected soils (salinity)
- Other limitations

These properties were then used to derive at a suitability rating for area along the proposed alternative pipelines suggested as well as the access roads and construction sites.

5 SOIL SUITABILITY FOR DRY-LAND AND IRRIGATED CROP PRODUCTION

Soils described during the soil surveys were evaluated by the surveyors in terms of its suitability for the commercial production of annual (e.g. grain crops) and perennial irrigated crops (e.g. table grapes). The suitability rating ranges from 1 to 10, with 1 the lowest and 10 equal to the highest or best suitability. The suitability rating refers to vigour and potential production potential without considering product quality. Although fairly subjective, suitability ratings by experienced soil scientists with many years of field experience are a handy tool to group soil types into production potential classes and for land use recommendations. The ratings can be interpreted according to the guidelines in **Table 5.1.** Climate was not included in the evaluation of soil suitability.

Table 5.1: Interpretation of suitability ratings

Rating	General suitability	
≤2	Very low	Not recommended (NR)
>2 - ≤3	Low	
>3 - ≤4	Low-medium	Marginally recommended (MR)
>4 - ≤5	Medium	Conditionally recommended (CR)
>5 - ≤6	Medium-high	Recommended (RE)
>6 - ≤8	High	Highly recommended (HR)
>8	Very high	

The majority of soils in the study area are (<10 % clay) sandy in the topsoil and upper subsoil. The inherent nutrient status and potential to retain nutrients will therefore be low.

Due to the small areas involved along pipelines, access roads or construction sites, evaluation was not typically that what is done in "normal" soil evaluation surveys. Along each route the areas were rated for the growing of annual or perennial crops using the subjective system described above and interpreted according to the guidelines given in Table 5.1 above.

From this information, the soil suitability tables (Table 5.2a and 5.2b) and soil suitability map (Annexure 1, Figure 1) were prepared.

Table 5.2a: Soil suitability along total length (m) of pipeline or access roads and length and width for construction site

Soil suitability *	Pipe alter-native 1	Pipe alter-native 2	Pipe alter-native 3 (preferred)	Access road west	Access road (near river)	Construc-tion laydown area reserve	Construc-tion laydown area reserve	Construc-tion laydown area near river	Weir
N/A	1681	1003	1905			87 * 49	86 * 49		
L	4615	2144	2990						
M-L				6789				106 * 81	
M	1009	1009	1009		2336				675

N/A = Not applicable; L = Low; M-L = Medium-Low; M = Medium

Table 5.2b: Percentage soil suitability along total length of pipeline, access roads, and construction sites

Soil suitability*	Pipe alternative 1	Pipe alternative 2	Pipe alternative 3 (preferred)	Access road west	Access road near river	Construction laydown area 1	Construction laydown area 2	Construction laydown area 3	Weir
N/A	21	20	32			100	100		
L	67	60	51						
M-L				100				100	
M	12	20	17		100				100

N/A = Not applicable; L = Low; M-L = Medium-Low; M = Medium

This information was then used in the Agricultural Economic Assessment given below in Section B.

SECTION B

AGRICULTURAL ECONOMIC ASSESSMENT

The proposed Berg River-Voëlvlei Augmentation Scheme is in the Gouda area of the Boland Region of the Western Cape Province. The main infrastructure (i.e. pipelines and access roads) is planned to cross over agricultural land as well as parts of the Berg River bed.
The magnitude of the impact of the water scheme developments at a regional (i.e. sectoral, downstream) level is not expected to be negative due to the fact that it will be excess winter water to be stored in Voëlvlei Dam (Personal communication with Dr Mike Shand, Aurecon Consulting Engineers, Cape Town, 29 September 2016).

The focus of this component of the study is thus to investigate the impact for *agricultural production* along the footprint of the scheme structures on agricultural land (refer to Annexure 1, Figure 1).
This region is characterised by a fairly unreliable winter rainfall. This factor, when seen together with the relatively medium-low suitable soils (refer to Section A above), limits crop production. The site is situated in the winter-grain production region, but the production thereof is risky due to:

- medium-low potential soils and thus, lower output
- relatively variable (unreliable) winter-rain volumes

The agricultural economic assessment that follows is based on the findings of the soil suitability study (refer to Section A above).

6 PRODUCTION POSSIBILITIES AND LIMITING FACTORS

Production possibilities are winter grain and winter grazing crops for animal feedstuff and irrigated vineyards near the river. Both cattle and sheep are possible livestock enterprises to be practised in combination with winter grain production systems in rotation with grazing crops, mainly medic types.

The profitability of winter grain production is mainly determined by the following aspects:

- The producer price level. This can be seen as a ‘given’, due to the fact that individual producers have little/no influence as far as price determination of produce are concerned.
- The output level of the different grain kinds. Output levels are influenced by controllable factors (mainly of a managerial kind, *inter alia* effective and efficient

production practices) as well as un-controllable factors (mainly fluctuating climatic conditions and soil potential). The medium-low suitability of the area (i.e. low to medium-low suitable soils and relative variable winter rain volumes) that is earmarked for the proposed development (refer to Table 2.1) will thus have a negative impact on the expected output levels of the winter grain kinds that can be considered for production.

The level of success as far as risk management is concerned. The production of wheat (monoculture) is relatively cost intensive and thus risky, given fluctuating climatic conditions. Risk levels can, however, be lowered via the implementation of crop rotation systems, a general practice in the grain producing regions of the Western Cape Province. The inclusion of grazing crops like medic types in a grain crop rotation system thus enlarge the animal factor and usually leads to more stable income levels for the farm in the long run. This strategy is a normal practice in the region and the calculations with regard to the farming potential of the affected areas (i.e. Map portions, refer to Table 6.1) will thus be based thereon.

The suitability of the soils for winter grain cropping is based on the soil investigation as presented in Section A above. An 'average' suitability is assumed for the soils that are utilized for both winter cropping and the vineyards. (refer to Table 6.1).

Table 6.1: Perspective of the agricultural land to be affected by the alternative lay-outs for the pipeline and access roads

Name*	Pipe or road	Distance (m)	Soil suitability	Present Use	Area (ha)**
A	Pipeline	845.3	Medium-low	Table grapes	4.4
B1	Pipeline	306.0	*Not applicable*	River	1.6
B2	Pipeline	1008.8	Medium	Winter grain	5.2
C	Pipeline	2144.4	Low	Grazing crops	11.1
D	Pipeline	2471.3	Low	Grazing crops	12.8
E	Pipeline	1374.7	*Not applicable*	Reserve	7.1
F	Pipeline	1599.1	*Not applicable*	Reserve	8.3
G	Pipeline	697.5	*Not applicable*	Reserve	3.6
	Summer release pipeline	80.0		Table grapes	0.4
I	Proposed Road near river	336.8	Medium	Citrus	0.9
J	Proposed Road near river	1999.0	Medium	Grazing crops	5.2
L	Proposed Road West	6789.0	Medium-low	Grazing crops	17.7
K	Weir	675.0	Medium	Table grapes	3.5
	Construction camp (footprint)		Medium	Winter grain	1.0
* Refer to soil suitability map (Annexure 1)					
** Pipeline area: 51.7m wide and access road area: 26m wide					
Affected areas: Agricultural perspective					
Pipeline					
A	4.8ha table grapes plus 5.2ha, 11.1ha, and 12.8 ha winter grain/grazing crops (rotation)				
B	4.8 ha table grapes plus 5.2ha and 11.1 ha winter grain/grazing crops (rotation)				
C	4.8 ha table grapes plus 5.2ha and 11.1ha winter grain/grazing crops (rotation)				
Road					
1	17.7ha winter grain/grazing crop rotation **(i.e. proposed road west)**				
2	0.9 ha citrus + 5.2 ha winter grain/grazing crops rotation **(i.e. proposed road near river)**				
Construction camp (footprint): 1ha winter grain/grazing crops (rotation)					

The financial calculations were done with a typical farming model as a point of departure. This is a normal procedure when agricultural potential is studied as the managerial productivity differs between farmers. The typical farming model was developed with the aid of industry experts. Valuable inputs in this regard were obtained from the Agricultural economic Section of Overberg Agri (Edms) Bpk., Moorreesburg, October, 2016.

It is assumed that the results of the financial evaluation of the typical farming situations will serve as a plausible source of information for the evaluation of the agricultural potential of the land that is earmarked for the proposed water scheme. It is further assumed that the managerial inputs on the farming areas will be optimal.

The farms are currently used for agricultural purposes, including small-grain, cattle and sheep farming and small portions of vineyards alongside the Berg River. A typical farm of 600ha is assumed for calculation purposes. The following farming strategy is assumed as far as the winter grain/grazing cropping system is concerned:

- 300ha of cash crop, say wheat per year
- 300ha of medics grazing per year
- 450 ewes (Meat-type Merino's) on the farm of 600ha

This farming strategy is typical for the region. A Scenario is developed for the expected financial outcome from farming, namely a medium suitability situation for winter grain/grazing crops as well as for the vineyards that may exist on certain farms.

6.1 Winter grain /grazing crops (rotation)

Expected farm profitability is illustrated with a gross margin analyses of the production system that is generally implemented. The yearly gross margin/ha will serve as an indicator for the negative impact of the proposed alternative layouts on agricultural land. The higher the expected yearly gross margin to be lost, the more negative the impact of that alternative layout. Farming overheads such as labour costs, regional taxes, depreciation of equipment and fixed improvements and the remuneration to capital and management are not considered as it is expected to stay the same due to the relative small part of individual farms to be impacted. The expected gross margin for the winter grain/grazing crop rotation system is illustrated in Tables 6.2 to 6.5.

Table 6.2: Expected profitability of wheat production, Gouda, 2015/16*

	Wheat rotation
	Rand/ha
Gross Production value from crop	
Producers price (R/ton)	3330
Output (ton/ha)	2.5
TOTAL	**8325**
Directly allocatable costs	
Seed	704
Fertilizer	1947
Lime and gypsum	161
Herbicides	524
Insecticides	127
Disease control	363
Insurance	38
Marketing costs	138
Seasonal labour	6
Contract work	24
Soil analyses	44
Cultivation cost:	
Fuel	584
Repairs	535
Other allocatable costs	253
Total	**5448**
Gross Margin(GM)	**R 2 877**
Source: Overberg Agri (Edms) Bpk., Moorreesburg, October 2016.	

---

*The contribution of Mr Wynand Heunis, farm financial modelling expert, Overberg Agri (Edms) Bpk., Moorreesburg, October, 2016, is hereby acknowledged.

Table 6.3: Expected costs of the medic crop production practices, Gouda, 2015/16

		Medic grazing
Gross Production value from crops		**Rand/ha**
Producers price (R/ton)		0
Output (ton/ha)		0
TOTAL		**0**
Directly allocatable costs		
Seed		0
Fertilizer		0
Lime and gypsum		0
Herbicides		650
Disease control		38
Seasonal labour		13
Soil analyses		44
Cultivation cost:		
Fuel		63
Repairs		83
Other allocatable costs		353
Total		**1244**
Gross Margin(GM)		**-R 1 244**
Source: Overberg Agri (Edms) Bpk., Moorreesburg, October 2016.		

Table 6.4: Expected profitability of the meat type Merino sheep production practices, Gouda, 2015/16

		Merino: Meat type
Gross Production value		**Rand/ewe**
Meat sales		1458
Wool sales		530
TOTAL		**1949**
Directly allocatable costs		
Concentrates		620
Grazing		0
Lick blocks		57
Verenary & medecine		87
Seasonal labour		30
Marketing costs		40
Contract work		0
Fuel & repairs		25
Other		20
Total		**879**
Gross Margin(GM)		**R 1 070**
Key Assumptions:		
* Lambing %: 120		
*Weaning %: 105		
Source: Overberg Agri (Edms) Bpk., Moorreesburg, October 2016.		

Table 6.5: Expected profitability of the assumed production strategy for a typical wheat / grazing crop farm, Gouda, 2015/16

Item	Units	GM/unit (Rand)	Total GM(Rand)
Wheat(ha)	300	R 2 877	863100
Oats/Triticale	0	0	0
Medics grazing	300	-R 1 244	-373200
Meat type Merino sheep (ewes)	450	R 1 070	481500
TOTAL GROSS MARGIN			**R 971 400**
GROSS MARGIN/ha FARM			**R 1 619**

It is clear, based on the tables above, that this production situation should be profitable (i.e. an income above running costs of **R1619/ha farm)**.

6.2 Vineyards

Both table grapes and wine grapes are produced on land close enough to the river to enable irrigation thereof. Both are perennial crops, thus the present value of the average yearly profit margin during the life cycle of 25 years will serve as an indicator of the relative negative impact of alternative layouts on agricultural land planted with vineyards. The higher the expected yearly profit to be lost, the more negative the impact of that alternative. The most profitable alternative, namely table grapes, will serve to illustrate the negative impact on agriculture of alternative routes for the proposed pipeline and access roads. Relevant financial information is presented in Tables 6.6 to 6.9.

Table 6.6: Expected full-bearing income per ha for a relevant table grape cultivar mix

Block number	Cultivar	Yield (crt/ha)*	Price** (R/crt)	Income (R/ha)	Pressed grapes (R/ha)	Total income (R/ha)
1	Allison	4750	70	332500	2610	335110
2	White S	4750	70	332500	2610	335110
3	Sweet Cel	4750	70	332500	2610	335110
4	Tawney	4750	70	332500	2610	335110
5	Sweet Cel	4750	70	332500	2610	335110
Weighted Income (R/ha)						**R 335 110**

* Full bearing yield and income per ha per year

** Payment per carton minus packing costs of R15/carton

Table 6.7: Expected yearly running costs per ha table grape

ITEM	(R/ha)
Fertilizer	8543
Pesticides & Herbicides	19384
Mechanization:	
Fuel, repairs and maintenance	20940
Insurance and licences	1604
Irrigation:	
Water	0
Electricity	8253
General:	
Electricity	2850
Admin	4741
Seasonal labour	50445
Transport	1079
Other	701
TOTAL	R 118 540

Table 6.8: Expected costs of establishment per ha table grapes

ITEM	(R/ha)
Land preperation	30000
Amelioration	15432
Draining	22300
Trellising	142948
Tractor and implements	12815
Irrigation:	
Inland	35200
Planting material	50189
Labour	45171
Soil samples	1228
TOTAL	355283

Table 6.9: Expected income and costs structure per ha table grapes (25 years)*

Year	Income	Running Costs	Cap Costs**	Man and labour	Margin	Present Value
0	0	0	380 283		-380 283	-380 283
1	0	118 540			-118 540	-115 277
2	0	118 540			-118 540	-112 105
3	134 044	118 540			15 504	14 259
4	201 066	118 540			82 526	73 809
5	335 110	118 540			216 570	188 363
6	335 110	118 540			216 570	183 179
7	335 110	118 540			216 570	178 137
8	335 110	118 540			216 570	173 234
9	335 110	118 540			216 570	168 466
10	335 110	118 540			216 570	163 829
11	335 110	118 540			216 570	159 320
12	335 110	118 540			216 570	154 935
13	335 110	118 540			216 570	150 671
14	335 110	118 540			216 570	146 524
15	335 110	118 540			216 570	142 491
16	335 110	118 540			216 570	138 570
17	335 110	118 540			216 570	134 756
18	335 110	118 540			216 570	131 047
19	335 110	118 540			216 570	127 440
20	335 110	118 540			216 570	123 933
21	335 110	118 540			216 570	120 522
22	335 110	118 540			216 570	117 205
23	268 088	118 540			149 548	78 706
24	201 066	118 540			82 526	42 237
25	134 044	118 540			15 504	7 717
Expected lifetime(years):			25			
Nominal interest rate:			9.0%			
Inflasion rate:			6.0%			
Real discounting rate***:			2.8%			
Net Present Value (NPV)****:			R 2 311 684			
Annuity of the NPV*****:			**R 130 256**			

* Based on a typical farm unit of 20 ha

** Accumulated value of the bare land, costs of establishment, fixed improvements and equipment.

*** The calculations are based on the assumption that the present profit margin wil be maintained during the planning period of 20 years (i.e. constant prices). This assumption thus implies that future money values have to be discounted at the real interest rate to calculate the Present Value(PV) thereof. The real discounting rate presents the ratio of (1+nominal interest rate) to (1+ inflation rate).

**** Present value of the expected yearly profit margins.

***** Present value of the **average yearly Profit Margin** during the planning period of 25 years.

The estimated yearly loss (i.e. the negative impact, should the pipeline/service road impede with agricultural production practices of this kind) is estimated at **R130 256 per hectare** (refer to Table 6.9).

7 ESTIMATED LOSS OF AGRICULTURAL PRODUCTION DUE TO THE WATER SCHEME

Farming activities are practiced on a continuous basis on the agricultural land where the water system is considered to be constructed. It can thus be deduced that the farming activities that are practiced are profitable for the farmers (refer also to Tables 6.5 and 6.9). The impact of the project on the financial situation of the farms that are involved, will thus be determined by, *inter alia*, the following aspects:

- Production possibilities and the profitability levels thereof
- Loss of farming income due to the impact of the project, for example the negative effect of the loss of land on agricultural output.

The loss of farming income will be determined by, *inter alia*, the following aspects:

- The footprint of the infra structure (i.e. mainly pipe lines and access road servitudes) on agricultural land will determine the area of land-loss and thus the loss of income from farming.
- Expropriation of farmland, if applicable.
- Appropriate mitigation measures, like the conservation of the top-soil, the proper rehabilitation of the construction sites and the synchronization of construction with the off-season of farming activities.

The loss of farming income due to the project will thus be determined mainly by the future loss of productive land due to areas to be taken up by the footprints of the water scheme development and the access roads. Approximately 20 to 50ha of agricultural land will be lost in this regard, depending on which option is chosen.

The income in excess of the running costs to be incurred to generate that income thus present the expected net loss of agricultural production value due to the envisaged water scheme. Farm overhead costs will not be influenced by the relative small loss of agricultural production practices on existing farms. The financial analyses were thus performed to the profit-level of **gross margin per ha** (i.e. the income in excess of the running costs to be incurred to generate that income, refer to Table 7.1). The total footprint (i.e. the layout of the pipeline/service road) of alternative layouts was presented in Table 6.1.

Table 7.1: Expected farming loss per year for alternative lay outs of the pipe lines and access roads for the proposed Berg River-Voëlvlei Augmentation Scheme, 2015/16

PIPE LINE AREA (ha)**			
Alternative A*	**Suitability**	**Profit margin (R/ha)**	**Yearly loss (Rand)**
4.8	Table grapes	130256	625229
5.2	Grain/grazing crops	1619	8419
11.1	Grain/grazing crops	1619	17971
12.8	Grain/grazing crops	1619	20723
TOTAL			**R 672 342**
Alternative B*			
4.8	Table grapes	130256	625229
5.2	Grain/grazing crops	1619	8419
11.1	Grain/grazing crops	1619	17971
TOTAL			**R 651 619**
Alternative C*			
4.8	Table grapes	130256	625229
5.2	Grain/grazing crops	1619	8419
11.1	Grain/grazing crops	1619	17971
TOTAL			**R 651 619**
ACCESS ROAD (ha*)**			
Alternative 1	**Road west**		
17.7	Grain/grazing crops	1619	28578
TOTAL			**R 28 578**
Alternative 2	**Road near river**		
0.9	Table grapes	130256	117230
5.2	Grain/grazing crops	1619	8415
TOTAL			**R 125 645**
WEIR (ha)			
3.5	Table grapes	130236	454491
TOTAL			**R 454 491**
*** Including 1ha for Construction camp footprint (medium suitability for Grain/Grazing crops rotation).**			
**** Pipe line 1.7 metre wide with servitude of 25 metre on each side.**			
***** Access road 6 metre wide with servitude of 10 metre on each side.**			

As far as the pipeline alternatives are concerned, the harm to agricultural production is more severe, especially when it crosses land with perennial crops (i.e. vineyards). It seems that Alternatives B or C of the pipeline alternatives will be marginally less harm full than Alternative 1.

It is thus foreseen that the access roads will be used as farm roads and/or firebreaks, while as much as possible of the existing farm roads will also be used in the layout.

The expropriation of the farmland is expected to be costly and should be calculated in detail by an expert in this regard. It is further assumed that appropriate mitigation measures, like the conservation of the top-soil, the proper rehabilitation of the construction sites and the proper construction of service roads (i.e. to prevent erosion, see Section A and paragraph 8.5) will be implemented.

This yearly loss in agricultural production value of between **R1 253 000** and **R1 135 000**, (depending on the alternative chosen for the pipe line and access road) must, however, be weighed against, *inter alia*, the contribution of the project to the regional water system that is under continuous pressure due to the rising water demand from a rapidly increasing population in the Cape Metropolitan area.

SECTION C

IMPACT OF PROJECT: AGRICULTURAL PERSPECTIVE

8 PROJECT ACTIVITIES THAT MAY IMPACT ON PRESENT AND FUTURE AGRICULTURAL PRODUCTION ACTIVITIES

8.1 GENERAL

This section describes the potential impacts of the envisaged water scheme on the future agricultural production potential of farming in the region. The impacts can either be positive or negative on the existence (i.e. existing role, contribution or function) of an entity (i.e. the farms impacted). For example, the construction of the proposed water scheme would impact negatively on the natural resource base of the relevant farms in the Gouda region should it take up a large portion of the farmland that can be used for the production of winter grain/grazing crops and vineyards. On the other hand, the additional water from the Berg River-Voëlvlei Augmentation Scheme will contribute to the water volume in the dam to be utilized by the Cape metropolitan area.

8.2 IMPACT IDENTIFICATION

The negative impacts on farming will thus be the loss of agricultural land and thus production value (farming income) due to the construction of:

- The pipeline and servitude footprint area
- Internal Access Roads
- Construction Laydown Area
- The possible negative impact for irrigation farmers downstream due to a decrease in the winter flow of the Berg river downstream.

It is, however, assumed that the proposed abstraction water scheme will not impact negatively on agricultural activities further downstream due to the fact that it will be excess winter water to be stored in Voëlvlei Dam (Personal communication with Dr Mike Shand, Aurecon Consulting Engineers, Cape Town, 29 September 2016).

Approximately 20 to 50ha of agricultural land will be lost for the footprint, depending on which option is chosen.

The ***on-farm impact*** of the proposed water scheme is thus situated in the yearly loss of net agricultural production value due to the envisaged project.

The impacts associated with the ***"no-go" option*** are the following:

- Farming activities will continue as in the past. The estimated net yearly loss of future agricultural production value that is associated with the development of the water scheme will thus *not* be realized.

8.3 IMPACT ASSESSMENT METHODOLOGY

The impacts associated with the proposed water scheme and the "no-go" option were analysed and assessed with the emphases on the agricultural production potential of the relevant areas that are considered for the project.

The significance of each potential impact (Department of Environmental Affairs and Development Planning. 2010 and Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005), with and without the implementation of the proposed mitigation measures, can be assessed based on the following variables (evaluation components):

- **Extent** (spatial scale);
- **Magnitude (positive or negative)**;
- **Duration** (time scale);
- **Probability** of occurrence;
- **Irreplaceable** loss of resources; and
- **Reversibility** of the impact.

The evaluation components, ranking scales and descriptions to be used to assess these are provided in **Table 8.1** below. Once the evaluation components have been ranked for each impact, the **significance** of the potential impact are calculated using the following formula:

SP (Significance Points) =

(Magnitude + Duration + Extent + Irreplaceable + Reversibility) X Probability

The maximum value is **150 SP** (Significance Points).

Table 8.1: **Evaluation components, ranking scales and descriptions (assessment criteria) of an impact analyses.**

Evaluation Component	Ranking Scale and Description (Criteria)
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	**10 - Very high (negative)**: Biophysical and/or social functions and/or processes might be *severely* altered. **8 - High (negative)**: Biophysical and/or social functions and/or processes might be *considerably* altered. **6 - Medium (negative)**: Biophysical and/or social functions and/or processes might be *notably* altered. **4 - Low (negative)**: Biophysical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low (negative)**: Biophysical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Biophysical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Biophysical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Biophysical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Biophysical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Biophysical and/or social functions and/or processes might be *slightly* enhanced. **2 - Very Low (positive)**: Biophysical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero**: Biophysical and/or social functions and/or processes will remain *unaltered.*
DURATION	**5 – Permanent** **4 - Long term**: Impact ceases after Operational Phase/life of the activity (~ 20 years). **3 - Medium term**: Impact might occur during the Operational Phase/life of the activity (0 to 20 years). **2 - Short term**: Impact might occur during the Construction Phase (~ 1 year). **1 – Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 –** None
IRREPLACEABLE (loss of resources)	**5 - Definite** loss of irreplaceable resources. **4 - High** potential for loss of irreplaceable resources. **3 - Moderate** potential for loss of irreplaceable resources. **2 - Low** potential for loss of irreplaceable resources. **1 - Very low** potential for loss of irreplaceable resources. **0 – None**
REVERSIBILITY (of impact)	**5 -** Impact **cannot** be reversed. **4 - Low** potential that impact might be reversed. **3 - Moderate** potential that impact might be reversed. **2 - High** potential that impact might be reversed. **1 -** Impact **will be** reversible. **0 -** No impact.
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring. **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.

The **CONFIDENCE** criterion of an impact analyses present the plausibility thereof and can be:

high: when it is based on sound original research

medium: when it is based on, for example, expert opinion and supported only by a 'desk-top' analysis of available information

low: when it is mainly based on conjecture.

Table 8.2 below provides the definitions of the calculated significance ratings.

Table 8.2: Definition of significance ratings (positive and negative).

Significance Points	Environmental Significance	Description
125 – 150	**Very high (VH)**	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options. **Cumulative Impacts:** The activity is one of several similar past, resent or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
75 – 99	**Medium-high (MH)**	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be re-evaluated at.
40-74	**Medium (M)**	If left unmanaged, an impact of medium significance could influence a decision about whether or not to proceed with a proposed project. **Cumulative Impacts:** The activity is one of a few similar past, resent or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. **Cumulative Impacts:** The activity is localised and might have a negligible cumulative impact.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

8.4 IMPACT ASSESSMENT

The impacts associated with the proposed development for the water scheme and the "no-go" option were analysed and assessed with the emphases on *agricultural production potential*. The significance rating of the unmitigated and mitigated scenarios for each impact-group was calculated and rated as indicated on **Table 8.3** below.

The analyses are largely based on sound original research and the results can thus be classified in the **'medium-high'** category as far as the ***confidence*** criterion is concerned (i.e. a high level of plausibility).

Table 8.3: Impact Matrix: Berg River-Voëlvlei Augmentation Scheme: Agricultural perspective.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																		MITIGATION
		BEFORE MITIGATION									AFTER MITIGATION									
		MAGNITUDE	DURATION	EXTENT	IRREPLACEABLE	REVERSIBILITY	PROBABILITY	TOTAL (SP)	SIGNIFICANCE	CUMULATIVE	MAGNITUDE	DURATION	EXTENT	IRREPLACEABLE	REVERSIBILITY	PROBABILITY	TOTAL (SP)	SIGNIFICANCE	CUMULATIVE	
	Potential impacts on soils and agricultural production potential																			
Project activity:	**Site clearance and construction**																			
Development of water scheme for the augmentation of Voëlvlei dam	On-farm impacts [1]	2	4	1	4	4	4	60	**M (-)**	**M (-)**	2	4	1	4	4	4	60	**L (-)**	**None**	Directives have been included in the EMP for the Construction Phase management and protection of soil and ground and surface water resources.
"No-go" alternative	The non-realization of the loss of scarce agricultural resources.	0	4	1	0	4	5	45	**M (-)**	**M (-)**	-	-	-	-	-	-	-	-	-	No mitigation would be applicable without the development.

1. Loss of agricultural land and thus by implication future agricultural production potential

The impact of the project is expected to be as follows:

- It can be seen as a permanent substitution of some agricultural land for the construction of the water scheme (i.e. footprint of access roads and pipelines).
- The possible decrease in winter water from the Berg River for irrigation utilization downstream of Gouda.
- The magnitude of the impact of the water scheme at the provincial level is expected to be more positive than negative (i.e. the positive contribution towards meeting the water needs of the increasing population of the Cape metropolitan area is expected to be more than the negative impact of the loss in agricultural output value).
- The duration of the project can be seen as long term (i.e. permanent).

The expected loss in farmland (20 to 50ha) comprises a relative small percentage of the farm land even if it applies to only one farm unit. The impact can, however, significantly be decreased (only 20ha) should existing roads be used as access roads to the project infra structure.

The **''no-go''** option will obviously be advantageous for the farms that are to be impacted by the water scheme development (local farming perspective), but it will at the same time be disadvantageous for the community of the Cape Metropolitan area (i.e. provincial level) as far as the provision of scarce household water sources is concerned.

The construction of the water scheme will, however have a **small negative impact** from an agricultural production point of view. A placing strategy for the footprint of the pipe lines and access roads that ensures that the minimum area of soils with relative better agricultural production potential will be utilized, **should further minimize the small negative impact** of the proposed water scheme developments on farming activities.

The project should, however, contribute by a **larger magnitude** to the national water supply network (i.e. provincial level) than the negative impact of the loss in agricultural output value on the farms. Cognition should be taken of appropriate mitigation measures during construction (refer to Section 8.5).

8.5 MITIGATION MEASURES

It seems, according to Section 8.4 that the development will have minor negative impacts on the current farming activities as well as on possible future farming developments. Contributing factors in this regard are, inter alia:

- The small areas influenced by the development. The development should have a small negative effect on the total agricultural output value of the farms.

Appropriate mitigation measures with regard to the conservation of the natural resource base should form an important part of the planning process, *inter alia* regarding the following aspects:

1. Avoiding of sensitive areas, if applicable (i.e. wetlands, slopes and existing soil conservation works such as contours), in order to prevent the degradation thereof.

2. Proper planning of road layout so that roads follow the contours as far as possible or where contours are crossed, proper structures be developed and implemented that will ensure proper functioning of the existing contours

3. Conservation of the topsoil during construction and the proper rehabilitation of the construction sites after construction.

4. Protection of the vegetation and veld by means of the construction of proper service roads and the proper maintenance thereof over time.

5. The construction of the project infrastructure should be synchronised, as far as possible with the seasonal pattern of farming activities in order to minimize the possible disturbance of the latter.

The proper execution of the mentioned planning principles, as far as the conservation of existing farming activities is concerned, should thus lead to the minor disturbance, if any, of agricultural production practices on the farms.

9 CONCLUSION

The proposed Berg River-Voëlvlei Augmentation Scheme is in the Boland sub-region of the Western Cape Province. This region is characterised by a variable rainfall. This factor, when seen together with the relatively low to medium low suitable soils, leads to a medium crop production suitability for the area. The shortage of lasting irrigation water sources limits the production of perennial crops on a large scale. The proposed site is situated in the winter-grain production region, but the production thereof will be risky due to:

- relatively low potential soils and thus, lower output
- relatively variable winter-rain volumes

The farms are currently used for agricultural purposes, including small-grain, cattle and sheep farming as well as small pieces of vineyards near the river. Farming activities are practiced on a continuous basis and it can thus be deduced that the farming activities that are practiced are profitable for the farmers, probably due to good managerial skills as far as risk management is concerned. The impact of the project on the financial situation of the farms that are involved, will thus be determined by, *inter alia*, the following aspects:

- Production possibilities and the profitability levels thereof.
- Loss of farming income due to the impact of the project, for example the negative effect of the loss of land on agricultural output.

The financial calculations were done with a typical farming model as a point of departure. This is a normal procedure when agricultural potential is studied as the managerial productivity differs between farmers. The typical farming model was developed with the aid of industry experts. The financial analyses showed a reasonable profit margin for the grain cropping production system as well as for the viticulture practices that were assumed.
The impact of the project is expected to be as follows:

- It can be seen as a permanent substitution of some agricultural land for the construction of the water scheme (i.e. footprint of access roads and pipe lines).
- The possible decrease in winter water from the Berg river for irrigation utilization downstream of Gouda.
- The magnitude of the impact of the water scheme at the provincial level is expected to be more positive than negative (i.e. the positive contribution towards meeting the water needs of the increasing population of the Cape metropolitan area is expected to be more than the negative impact of the loss in agricultural output value).
- The duration of the project can be seen as long term (i.e. permanent).

The loss of farming income due to the project will thus be determined mainly be the future loss of productive land due to areas to be taken up by the footprints of the water scheme infra structure and the access roads. The relevant areas in this regard were calculated as approximately 20 to 50 ha in total, depending on the option implemented for the access roads (refer to Table 7.1).
This relatively small yearly loss in agricultural output value must, however, be weighed against, *inter alia*, the contribution of the project to the national water supply network. It should obviously decrease the pressure of the increasing water demand from the rising population numbers of the Cape Metropolitan area.

The expected loss in farmland (20 to 50ha) comprises a relative small percentage of the farm land of the area.
The **''no-go''** option will obviously be advantageous for the farms that is to be involved in the water scheme development (local farming perspective), but it will at the same time be

disadvantageous for the community of the Cape Metropolitan area (i.e. provincial level) as far as the provision of scarce household water sources is concerned.

The most important mitigation measures with regard to the conservation of the natural resource base should form an integral part of the planning process. The proper execution of relevant planning principles, as far as the conservation of existing farming activities is concerned, should thus lead to the minor disturbance, if any, of agricultural production practices on the farms. The most important mitigation measures include:

- Proper planning of new road layout so that roads follow the contours as far as possible or where contours are crossed, proper structures be developed and implemented that will ensure proper functioning of the existing contours.
- Conservation of the topsoil during construction and the proper rehabilitation of the construction sites after construction.

10 REFERENCES

De Clercq, W.P., Ellis, F, Fey, M.V., Van Meirvenne, M., Engelbrecht, H. & De Smet, G. 2006.Water and soil quality information for intergrated water resource management. WRC Report: TT252/06, (ISBN No 1770053662)

Department of Environmental Affairs and Development Planning. 2010. *Information Document on Generic Terms of Reference for Environmental Assessment Practitioners and Project Schedules, EIA Guideline and Information Document Series*. Western Cape Department of Environmental Affairs and Development Planning.

DEPARTEMENT OF ENVIRONMENTAL AFFAIRS 2014: Environmental Impact Assessment Regulations, 2014. National Environmental Act, 1998 (Act 107/1998)

Ellis, F, Lambrechts, JJN & Schloms, BHA (2009) SOIL SURVEY OF THE FARM HALFGEWAAGD, GOUDA, Internal Report, University of Stellenbosch.

Hoffmann, W.H. 2010. *Farm Modelling for Interactive Multidisciplinary Planning of Small Grain Production Systems in South Africa.* PhD Dissertation. University of Stellenbosch. Stellenbosch..

SCHULZE, R. E. 1997. *South African atlas of agrohydrology and -climatology. Report*

TT82/96, Pretoria, Water Research Commission

Soil Classification Working Group. 1991*. Soil Classification: A Taxonomic System for South Africa*. Mem Natural Agric. Resources for S.A. No. 15.

Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

ANNEXURE 1

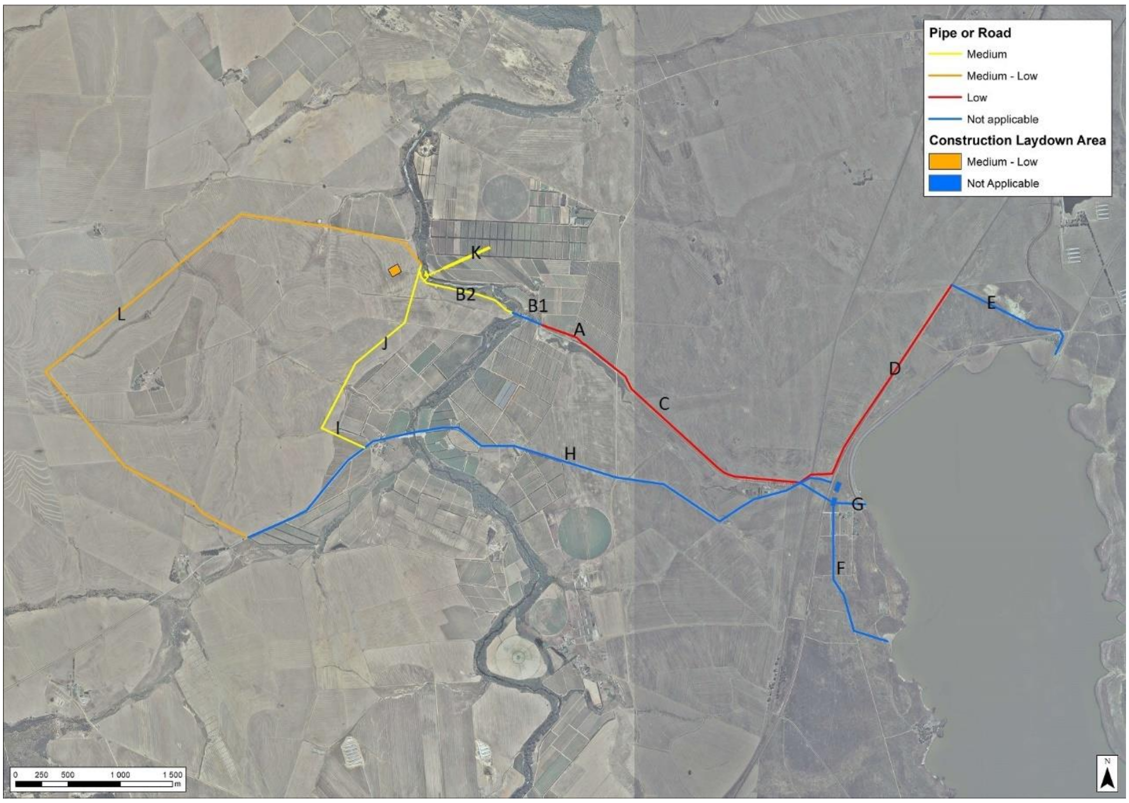

Figure 1 Soil suitability map of sites with symbols (A – L) used in the report