water & sanitation

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Environmental Impact Assessment for the Proposed Surface Water Developments for Augmentation of the Western Cape Water Supply System

INTEGRATED WATER USE LICENSE APPLICATION TECHNICAL REPORT

Draft

February 2017

Title and Approval

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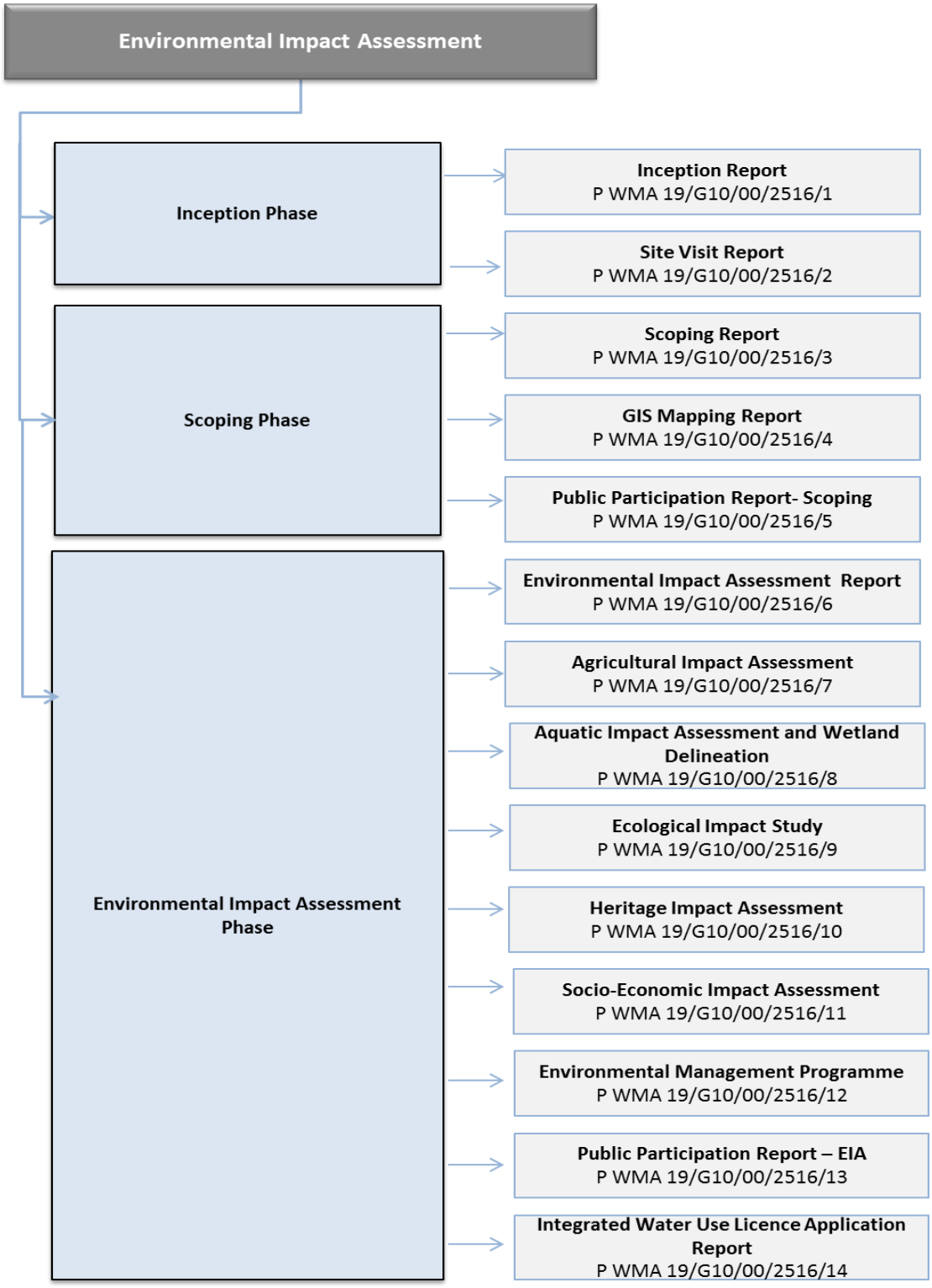
List of Study Reports



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Amendments Page

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Executive Summary

Nemai Consulting was appointed by the Department of Water and Sanitation as the Environmental Assessment Practitioner to undertake the Environmental Impact Assessment and Integrated Water Use License Application for the proposed surface water developments for augmentation of the Western Cape Water Supply System.

The proposed augmentation triggers activities contained in the 2014 Environmental Impact Assessment Regulations (Government Notice 983, Government Notice 984 and Government Notice 985 of 4 December 2014) and thus a Scoping and Environmental Impact Assessment Process is required. Further, as the project occurs within a regulated area of a watercourse and involves abstraction of water, it triggers activities that are listed under Section 21 (a), (c) and (i) of the National Water Act (Act No. 36 of 1998). As such a Water Use Licence Application process will also be undertaken.

The Western Cape Water Supply System serves the City of Cape Town, surrounding urban centres 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 utilised 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 i.e. the yield of the dam would be 23 million m^3 per annum more than it is currently.

The proposed project is situated in Western Cape in the Drakenstein Local Municipality of the Cape Winelands District as well as the Swartland Local Municipality of the West Coast District.

The proposed developments fall within the Berg River Catchment of the Berg–Olifants Water Management Area. Both Voëlvlei Dam and the Lorelei abstraction site are located in quaternary catchment G10F of the Berg River Catchment.

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;
- A potential new summer release connection at the existing Swartland Water Treatment Works 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 authorisation need to be assessed as part of the Environmental Impact Assessment. 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).

Three pipeline route alternatives and associated discharge points are assessed. The feasible options will be taken forward in the impact assessment phase, where the potential positive and adverse effects to the environmental features and attributes are examined further. The Environmental Impact Assessment phase will include a detailed comparative analysis of the project's feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations. This will ultimately result in the selection of a Best Practicable Environmental Option.

The proposed surface water developments for augmentation of the Western Cape Water Supply System requires authorisation from the Department of Water and Sanitation. In terms of Section 40 of the National Water Act (Act No. 36 of 1998), each party proposing a water use, as defined in Section 21 of the Act, must seek authorisation before such water use can commence.

Water Use Type		Project Activities
Section 21(a)	Taking water from a water resource	• Water abstraction from the Berg River into Voëlvlei Dam.
Section 21(c)	Impeding or diverting the flow of water in a watercourse	• Instream works.

Water Use Type		Project Activities
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse	• Traversing of delineated wetlands and riparian zone. • Developments within 500m of wetlands (regulated area): the rising main pipeline, access roads, weir, and pump station. • The encroachment of the 1:100 floodlines by the rising main pipeline, access roads, weir, and pump station. • Discharge of water from the Berg River into Voëlvlei Dam.

The profile of the receiving aquatic environment provides a general description of the status quo of the receiving environment in the project area, and also provides local and site-specific discussions on those environmental features investigated by the respective specialists.

The study area includes the entire footprint of all the project components, which includes the construction domain and surrounding receiving aquatic environment.

The receiving aquatic environment is assessed and discussed in terms of the following:

- Surface Water:
    - Hydrology;
    - Affected Watercourses;
    - Ecological Status;
    - Water Quality
    - Riparian Habitat; and
    - Estuary.

The following Specialist Study was conducted as part of the Integrated Water Use License Application:

- Riparian Habitat and Wetland Delineation Impact Assessment.

This Integrated Water Use License Application Technical Report focuses on the pertinent environmental impacts on the delineated watercourses identified that could potentially be caused by the proposed surface water developments for augmentation of the Western Cape Water Supply System during the pre-construction, construction and operational phases of the project.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme provides a comprehensive list of mitigation measures for specific elements of the project,

which extends beyond the impacts evaluated in the body of the Integrated Water Use License Application Technical Report.

The Public Participation Process that was followed for the proposed project is governed by National Environmental Management Act and Government Notice No. R. 982.

The Integrated Water Use License Application Technical Report provides a full account of the public participation process that was followed for the Scoping and Environmental Impact Assessment phases for the proposed project.

The authority and public review of the Draft Integrated Water Use License Application Technical Report will occur for a 30-Day review period **from 15 February 2017 to 17 March 2017**.

Attention is drawn to specific sensitive environmental features (with an accompanying sensitivity map) for which mitigation measures are included in the Integrated Water Use License Application Technical Report and Environmental Management Programme.

An Environmental Impact Statement is provided and critical environmental activities that need to be executed during the project lifecycle are also presented. The Water Use License Application Technical Report is concluded with key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant).

With the selection of the Best Practicable Environmental Option (Alternative 3), the adoption of the mitigation measures included in this report and the Environmental Authorisation, and the dedicated implementation of the Environmental Management Programme, it is believed that the significant environmental aspects and impact associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialist and the impact assessment, through the compliance with the identified environmental management provisions. In conclusion, it is recommended that the proposed surface water developments for augmentation of the Western Cape Water Supply System should be authorised.

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List of Abbreviations

AGIS	Agricultural Geographic Information System
BBTS	Breede-Berg Transfer Scheme
BID	Background Information Document
BPEO	Best Practicable Environmental Option
BRVAS	Berg River – Voëlvlei Augmentation Scheme
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Areas
CCT	City of Cape Town
CCTMM	City of Cape Town Metropolitan Municipality
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CFR	Cape Floristic Region
CPS	Cape Piscatorial Society
CR	Critically Endangered
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DAFF	Department of Forestry and Fisheries
DMR	Department of Mineral Resources
DWA	Department of Water and Sanitation
DWAF	Department of Water and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EBA	Endemic Bird Area
ECO	Environmental Control Officer
EDC	Endocrine Disrupting Compounds
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Areas
ESAge	Early Stone Age
EWR	Environmental Water Requirements
FAII	Fish Assemblage Integrity Index
GDP	Gross Domestic Product
GI	Geomorphical Index
GIS	Geographic Information System
GN	Government Notice

GRP	Glass-Fibre Reinforced Polyester
HIA	Heritage Impact Assessment
IAPs	Interested and Affected Parties
IBA	Important Bird and Biodiversity Areas
IMI	Index of Habitat Integrity
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resource Management
MRPDA	Mineral Resources and Petroleum Development Act (No 28 of 2002)
NEMA	National Environmental Management Act (No 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEM:PA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management Waste Act (Act No. 56 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act (No 36 of 1998)
NWRP	National Water Resources Planning
OHS	Occupational Health and Safety
PES	Present Ecological Status
PIP	Public Involvement Process
POP	Persistent Organic Pollutants
PRESIS	Pretoria Computerised Information System
PSC	Project Steering Committee
PSP	Professional Service Provider
QDS	Quarter Degree Squares
RID	Record of Implementation Decision
RMP	Resource Management Plan
RVI	Riparian Vegetation Index
SABAP	Southern African Bird Atlas Project
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SASS	South African Scoring System
SAWS	South African Weather Services
SDF	Spatial Development Framework
SIP	Strategic Infrastructure Project
TAC	Tulbagh Angling Club
ToR	Terms of Reference
VU	Vulnerable
VYC	Vogelvlei Yacht Club
WAC	Witzenberg Angling Club
WCAD	Western Cape Adventure

WC DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
WCDM	West Coast District Municipality
WCH	Western Cape Heritage
WCRSS	Western Cape Reconciliation Strategy Study
WCWC-JV	Western Cape Water Consultants Joint Venture
WCWSS	Western Cape Water Supply System
WIP	Weeds and Invasive Plants
WMA	Water Management Area
WPALAS	Western Province Artificial Lure Angling Society
WPFAA	Western Province Freshwater Angler's Association
WTW	Water Treatment Works
WULA	Water Use Licence Application
WWTW	Waste Water Treatment Works

1 PURPOSE OF THIS DOCUMENT

The purpose of this report is to provide the necessary information to Department of Water and Sanitation (DWS) for the Integrated Water Use License Application (IWULA) for the proposed surface water developments for augmentation of the Western Cape Water Supply System (WCWSS), which is also known as the First Phase Augmentation of Voëlvlei Dam.

The following water uses, as defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), are being applied for (application forms are attached in **Appendix 5**):

- Section 21 (a) – Taking water from a water resource;
- Section 21 (c) – Impeding or diverting the flow of water in a watercourse; and
- Section 21 (i) – Altering the bed, banks course or characteristics of a watercourse.

The information documented in this report is intended to meet all requirements of the DWS relating to water use authorisation in terms of Section 21(a), (c) and (i) of the NWA and to provide the necessary information to facilitate decision-making thereby allowing the Department to gain a full understanding of the proposed project and associated water uses.

2 DOCUMENT ROADMAP

This document serves as the Technical Report for the IWULA for the proposed surface water developments for augmentation of the WCWSS.

As a minimum, the IWULA Technical Report aims to satisfy the requirements listed in **Table 1**, which is based on the External Guideline: Generic Water Use Authorisation Application Process (Department of Water Affairs and Forestry, 2007).

Table 1: Document Roadmap for IWULA Technical Report in relation to DWS Checklist

Correlation with External Guideline: Generic Water Use Authorisation Application Process Checklist	Corresponding IWULA Chapter
Are applicant, property, ownership, and occupancy forms for all applicants and properties correctly filled in, signed, and included in the application?	• Appendix 5 – License Application Forms
Are the appropriate water use forms correctly filled in, signed, and included in the application?	
Are all required supplementary forms indicated in the water use forms marked off in the water use forms, correctly filled in, signed, and included in the application?	
Is a brief report describing the proposed water use, the development that requires the water use, and the expected impacts of the water use signed and included in the application?	• Chapter 5 – Project Overview

Correlation with External Guideline: Generic Water Use Authorisation Application Process Checklist	Corresponding IWULA Chapter
	• Chapter 6 – Legislation and Guidelines Considered • Chapter 7 – WULA Process • Chapter 8 – Triggered Water Use Activities • Chapter 9 – Section 27 of the National Water Act, 1998 • Chapter 11 – Specialist Studies • Chapter 12 – Impact Assessment
Is a map showing the properties, water resources, water works, development requiring the water use, and the affected users included in the application?	• Chapter 5 – Project Overview • Chapter 8 – Triggered Water Use Activities • Chapter 10 – Profile of Receiving Environment • Chapter 12 – Impact Assessment
Is all the information identified in the pre-application consultation included in the report?	• Appendix 11 – DWS Correspondence
Have all the consultations identified in the pre-application consultation been done and the information included in the application?	• Chapter 13 – Public Participation Process
Is the licence application fee or proof of payment included in the application?	• Proof of payment will be available with the Final IWULA.

3 APPLICANT

DWS have appointed Nemai Consulting as its EAP to undertake an IWULA in terms of the NWA for the water use associated with the proposed surface water developments for augmentation of the WCWSS. In order to proceed with the water uses triggered by the project, authorisation (i.e. IWUL) is required from the DWS. The details of the applicant, The DWS, are tabulated below (**Table 3**).

Table 2: Applicant Details

Applicant:	Department of Water and Sanitation
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4 PROJECT BACKGROUND AND MOTIVATION

4.1 The Western Cape Water Supply System

The WCWSS serves the City of Cape Town (CCT), surrounding urban centres and irrigators. It consists of infrastructure components owned and operated by both the CCT and the DWS (Department of Water Affairs, 2012). In 2007, the WCRSS was commissioned by DWS (then the Department of Water Affairs and Forestry – DWAF) to facilitate the reconciliation of predicted future water requirement scenarios for a 25 year planning horizon. The WCRSS investigated a number of options such as desalination, effluent treatment for re-use, groundwater development and possible surface water augmentation options (DWAF, 2007).

According to the WCRSS undertaken in 2007, the WCWSS's total present water use was estimated at about 465 million m^3/a with the existing sources yielding only about 475 million m^3/a (DWAF, 2007). The study also noted that whilst the Berg Water Project (Berg River Dam and its supplement scheme) would increase the yield to 582 million m^3/a from 2007, the estimated water requirement (even with water conservation and demand management) by 2019 could exceed this. The implication is that the system supply would then be fully utilised and thus additional interventions would thus be required to come online by that time (**Figure 1**) (DWAF, 2007).

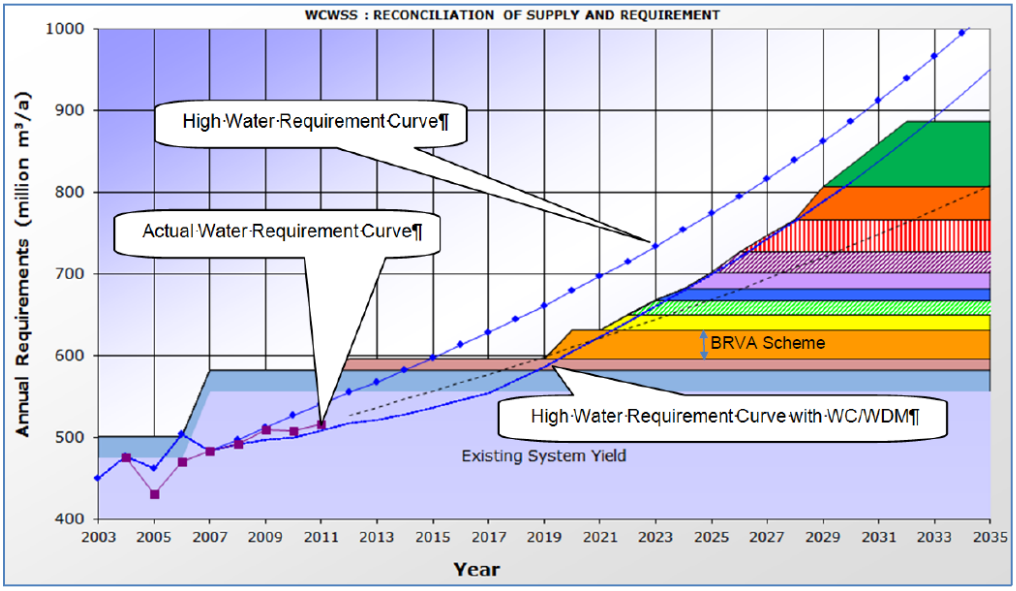


Figure 1: WCWSS Reconciliation of Supply and Requirements (DWA, 2012a)

Based on the figure above, the WCRSS has therefore identified the need for augmentation of the WCWSS by 2019. Based on this, the DWS appointed the Western Cape Water Consultants Joint Venture (WCWC JV) to undertake pre-feasibility level (Phase 1) investigations into six potential surface water development options. These options included the following:

- Michell's Pass Diversion Scheme;
- First Phase Augmentation of Voëlvlei Dam;
- Further Phases of Voëlvlei Dam Augmentation;
- Molenaars River Diversion;
- Upper Wit River Diversion; and
- Further Phases of the Palmiet Transfer Scheme.

The location of the six possible options is shown in **Figure 2**.

Both DWS and the CCT are currently also undertaking further feasibility studies into alternative sources, such as sea water desalination, groundwater abstraction from the Table Mountain Group Aquifer, and water reclamation. These further studies are being undertaken in order to timeously identify the next most feasible option for further augmentation of the system in the future.

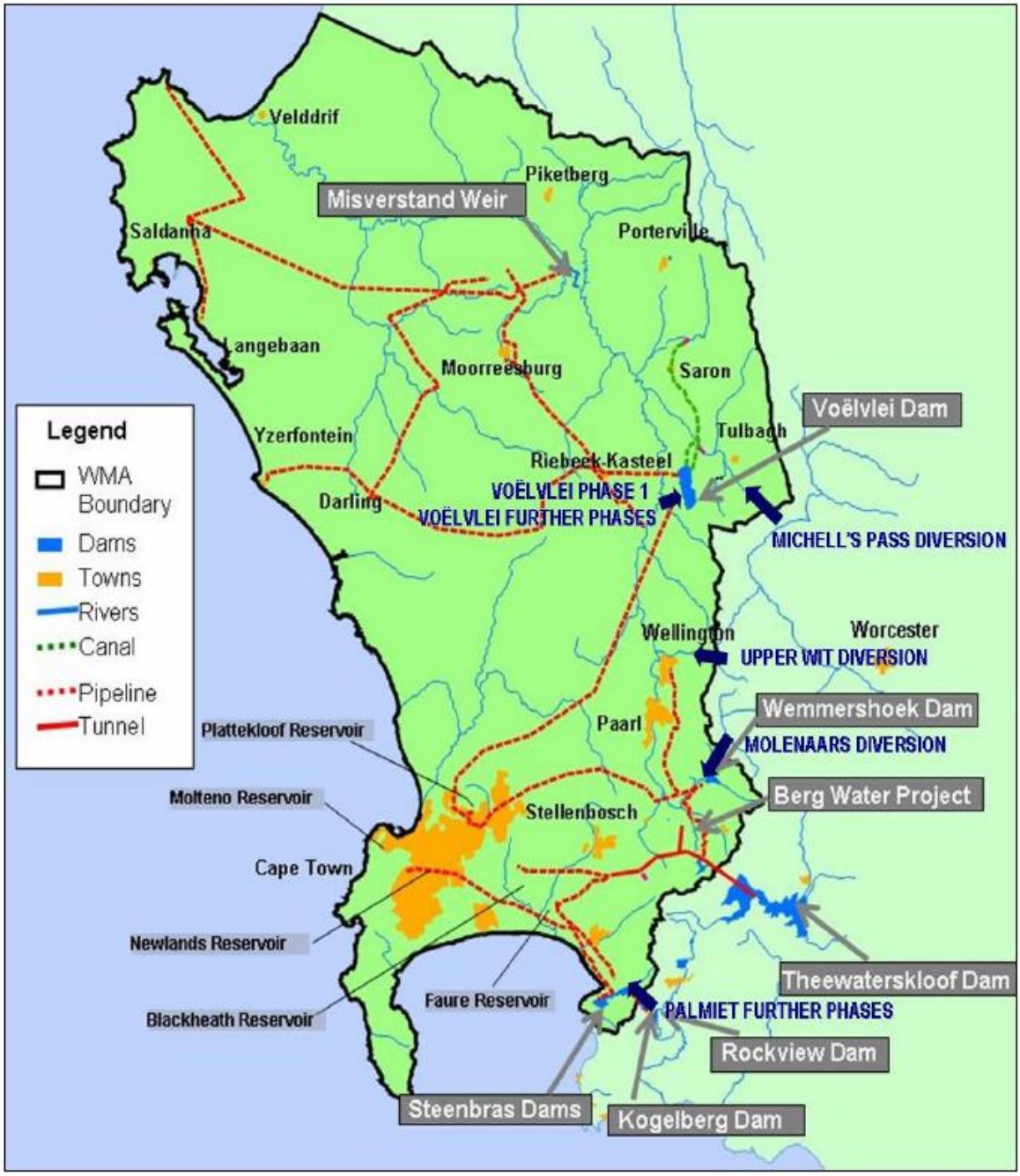


Figure 2: The WCWSS and the Location of the Options Investigated (DWA, 2010)

Based on the findings of the pre-feasibility study, the six possible options investigated were then prioritized to identify the two most viable options for further investigation at a Feasibility Study level in Phase 2. The Phase 1 outcome indicated the following two priority schemes.

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

Both of these schemes would be based on the overall operating rule that only surplus winter water would be abstracted and only such amounts after provision is made for the downstream ecological flow requirements. No abstraction will take place outside of those periods.

The Feasibility Study recommended that the BRVAS option was the most favourable of the size potential schemes for a number of reasons which include the following:

- The proposed abstraction site from the Berg River at Lorelei Farm has favourable geology and sedimentation control characteristics. It would also provide the shortest possible pipeline route to convey the abstracted water in winter into the Voëlvlei Dam, where it would be stored;
- The proposed pipeline route offers opportunity to limit environmental impacts on the Voëlvlei Conservancy;
- The proposed rising main from the Berg River to Voëlvlei Dam could also serve as a closed conduit for making releases from the dam in summer, back into the Berg River. These releases are required for providing water to downstream users including irrigators and parts of the West Coast District Municipality. This could replace the existing open discharge concrete canal which currently serves to make those releases, but which experiences substantial losses;
- The water quality impacts of transferring winter water from the Berg River into the Voëlvlei Dam have been investigated and are not considered to be a limitation on the implementation of the scheme;
- Planning by the CCT's Bulk Water Department for future reservoirs and link pipelines to the existing CCT pipeline (feeding the Plattekloof Reservoir) would facilitate improved integration of this scheme into the WCWSS;
- The estimated capital cost of BRVAS scheme is relatively attractive; and
- The potential delivery of water by the BRVAS scheme could be possible by 2019, which is when the next water supply scheme to augment the WCWSS would be required.

4.2 Existing Voëlvlei Government Water Scheme

Voëlvlei Dam was commissioned in 1952 and was the first large water supply scheme in the Berg River Catchment. It was constructed by impounding the natural Vogelvlei Lake near Gouda in the Drakenstein Local Municipality (DWAF 2004). The natural catchment of the Dam is very small (only 31 km^2) and additional water was obtained via a concrete lined canal feeding water from the Klein Berg River to the dam (max 1.3 million cubic metres per day; DWAF 2004). In 1969, Cape Town's increasing water demand resulted in the dam wall being raised. Additional water was then abstracted from the Klein Berg River (max. 1.7 million cubic metres per day). In addition, a new canal was constructed to divert water from the Twenty Four River and Leeu River (max. 2.9 million cubic metres per day) into the dam.

The main purpose of the dam is to supply water for domestic use to the West Coast District Municipality (WCDM) including Riebeek-Kasteel, Riebeek-Wes, Malmesbury, Darling, Moorreesburg and the CCT Metropolitan Municipality. The dam also supplies water for irrigation purposes along the Lower Berg River.

Voëlvlei Dam is owned by DWS and has an estimated yield of 105 million m^3/annum which supplies the City of Cape Town, the Lower Berg River irrigators and the WCDM. Therefore, the dam is currently over-allocated. It has a very small incremented catchment over and above the transfers (31km^2) and thus relies on existing diversion schemes from the Klein Berg River, as well as the Leeu River and the Twenty Four River whereby water from these rivers is diverted into two canal systems into the dam (DWA, 2012b). The Klein Berg canal is 8 km long and has a capacity of 20 m^3/s whilst the canal from the Leeu River and Twenty Four River is 29 km long with a capacity of 34 m^3/s (DWA, 2012a).

Both the WCDM and the CCT own and operate Water Treatment Works (WTW) which are supplied from the Voëlvlei Dam. From the CCT WTW, a 1.5 m diameter pipeline of 80 km length conveys treated water that is pumped from the WTW to the City's Plattekloof Reservoir. This pipeline only has spare capacity in winter and this places a key constraint on the future uptake of water from the proposed scheme.

In addition, treated water is supplied to users in the WCDM (Malmesbury to St Helena Bay) via the Swartland WTWs (owned and operated by the WCDM) at the Voëlvlei Dam. Water is also released from the Voëlvlei Dam via the existing outlet canal into the Berg River from whence abstraction takes place at Misverstand Dam into the Withoogte WTW (also owned and operated by the WCDM) (DWA, 2012a).

As the dam is located within a winter rainfall area, characterised by wet winters and dry summers, it is filled during the wet winter months, from May to October, when about 90% of the annual runoff occurs. During this period the water requirement comprises only about 30% of the annual requirement. During the dry summer months, from November to April, inflows to the dam in the Western Cape are small and irrigation and garden watering requirements in the urban areas are large. Approximately 50% of the dams' storage is required for storage during the winter so that the high water requirement during the summer can be met. The remaining 50% of the dams' storage is required to provide long-term carry-over storage for periods of drought (DWA, 2012a).

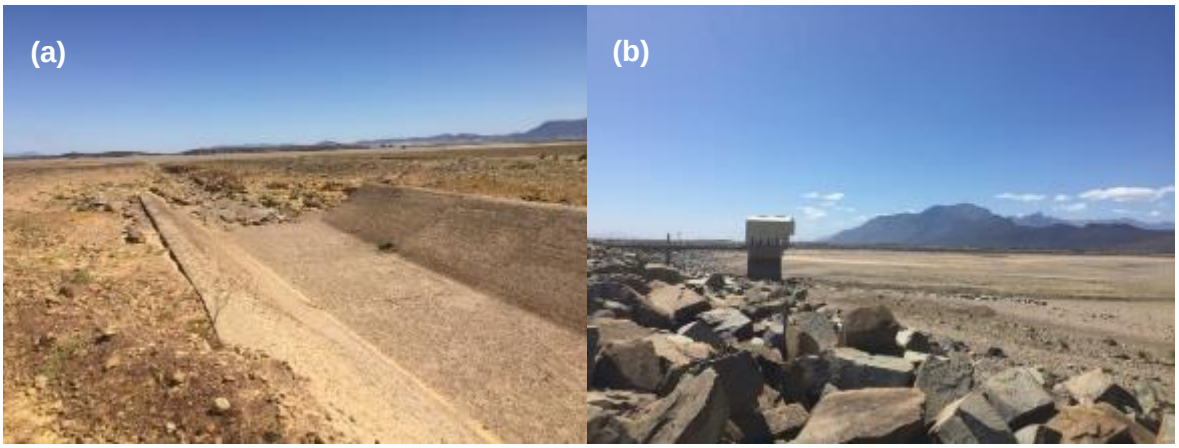


Figure 3: Canal feeding Voëlvlei Dam (a) and a dry Intake tower at Voëlvlei Dam (during the summer of 2016 (b)

5 PROJECT LOCATION AND CATCHMENT CONTEXT

The project area is situated in Western Cape in the Drakenstein Local Municipality of the Cape Winelands District Municipality as well as the Swartland Local Municipality of the West Coast District Municipality (**Figures 6** and **7**). A locality map is provided in **Figure 4**. Please note larger maps are provided in **Appendix B** of the EIA Report**.**

The proposed development falls within the Berg River Catchment of the Berg–Olifants Water Management Area (WMA). The Berg River Catchment covers an area of almost 9 000 km^2 in the Western Cape Province, and is subdivided into 12 quaternary catchments ranging in size from 125 km^2 near the headwaters to 2000 km^2 in the drier western parts of the catchment (**Figure 5**) (C.A.P.E., 2008). Both Voëlvlei Dam and the proposed Berg River abstraction site are located in quaternary catchment, G10F of the Berg River Catchment.

The Berg River Catchment receives most precipitation during the winter rainfall season, with the east of the catchment receiving relatively high volumes of rain (ca. 5 000 mm per annum) in contrast to the lower-lying foothills and floodplains to the west receiving only 400 – 500 mm per annum, decreasing towards the sea. The river headwaters (perennial and semi-perennial mountain streams that rise in the Franschhoek and Drakenstein Mountains) therefore supply most of the water to the system. Mean annual runoff for the entire catchment is approximately 682 Mm^3 (C.A.P.E., 2008).

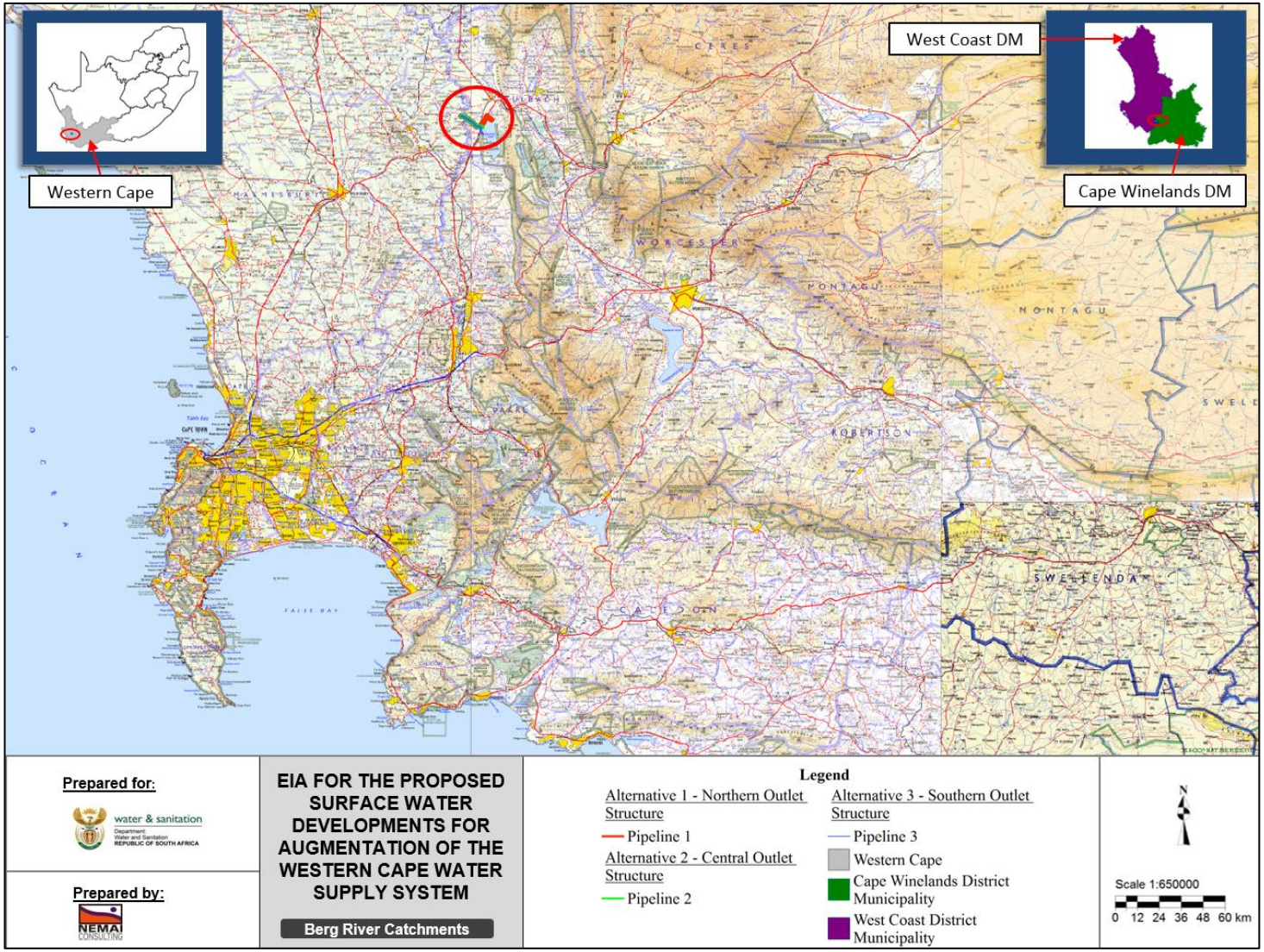


Figure 4: Locality Map

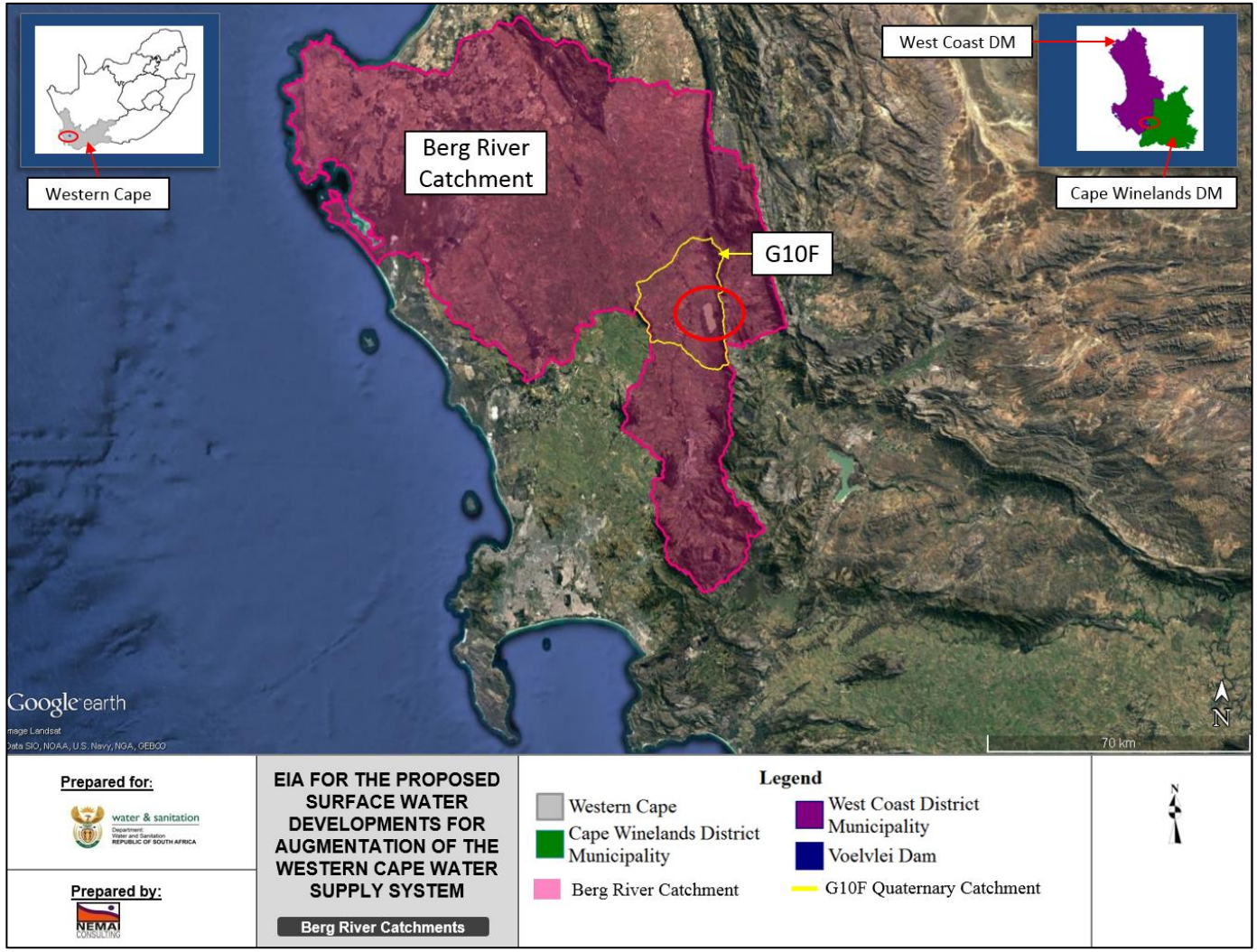


Figure 5: Berg WMA and Berg River Catchment

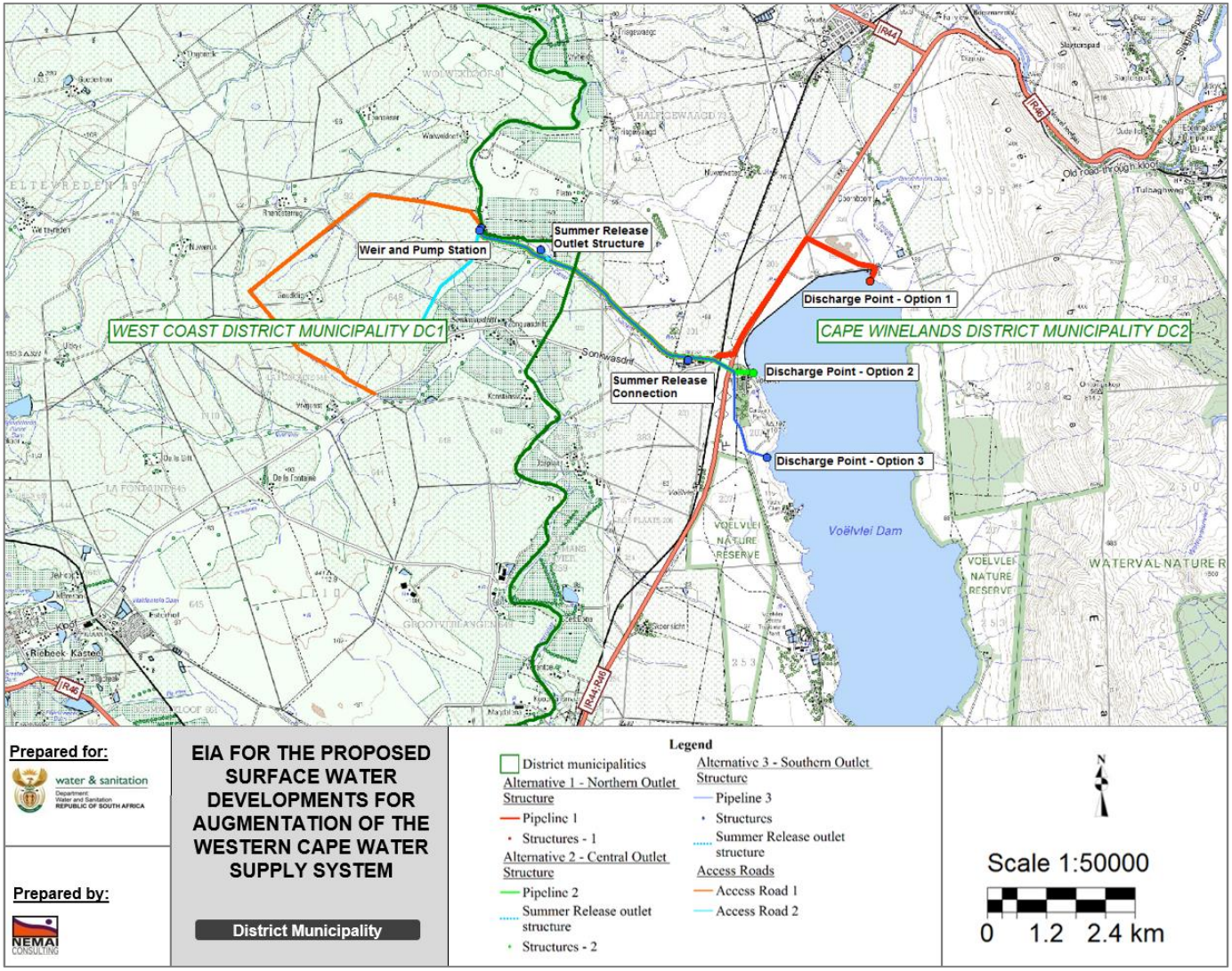


Figure 6: District Municipalities Map

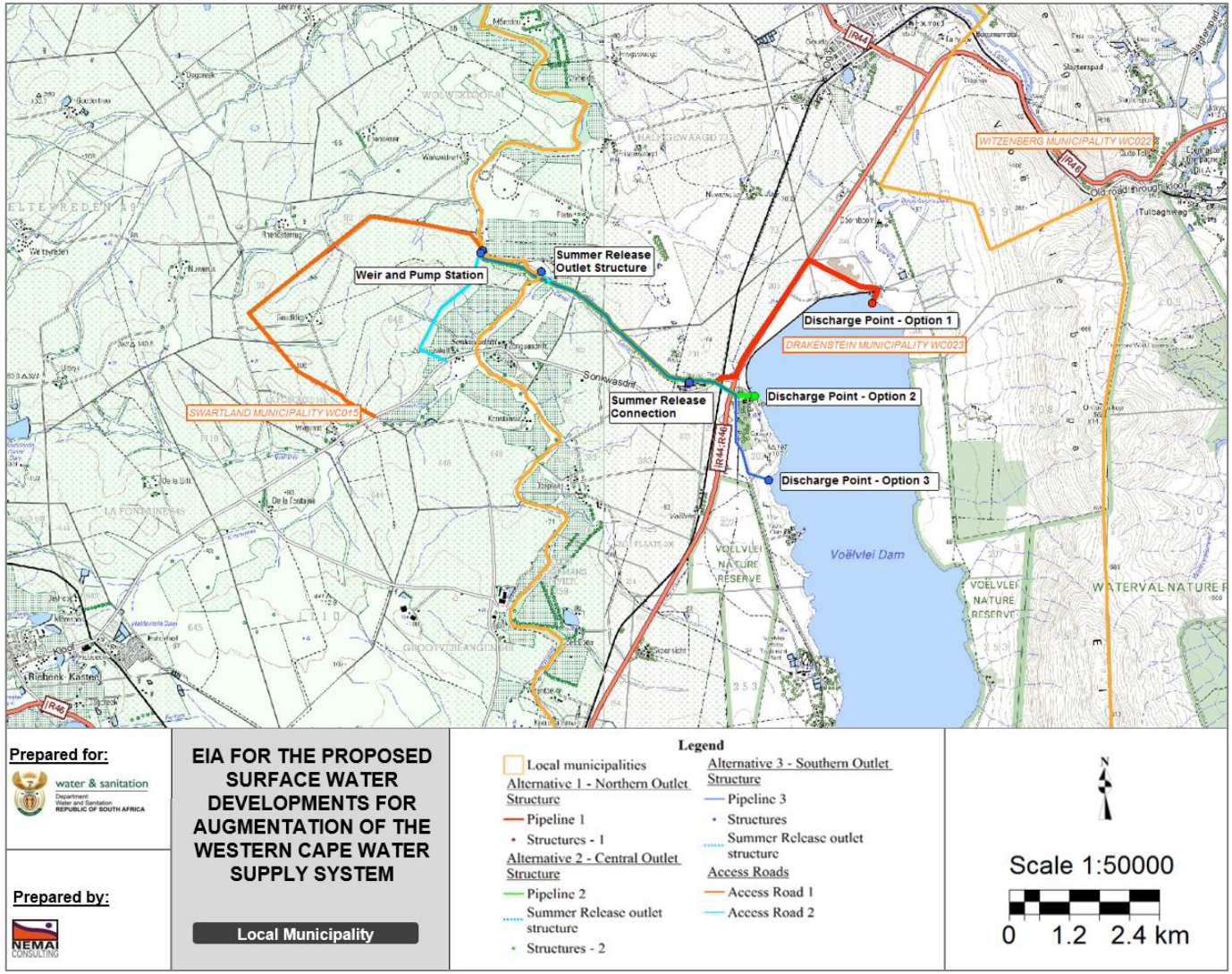


Figure 7: Local Municipalities Map

The closest town to the proposed scheme is Gouda and it is located approximately 5km away from the proposed developments. The project developments are mostly located on privately-owned properties that are primarily used for agricultural practices, except for one property located north of the proposed pipeline which is owned by the Drakenstein Local Municipality, as well as properties around Voëlvlei Dam that are owned by DWS. The properties that are directly affected by the proposed development are shown in **Figure 8** and listed in **Table 5**.

Table 3: Directly affected properties

Project Component	Farm Name	Portion	SG Code
Pipeline and associated Discharge Points	Half Gewaagd 73	21	C07500000000007300021
	Sonquas Doordrift 647	2	C04600000000064700002
	Tulburgh Road 441	0	C07500000000044100000
	Tulburgh Road 412	0	C07500000000041200000
	Tulburgh Road 412	0	C07500000000041200000
	Farm 201	2	C07500000000020100002
	Doorn Boom 199	1	C07500000000019900001
	Farm 200	0	C07500000000020000000
	Vogel Valley 207	0	C07500000000020700000
	Sonquas Doordrift 648	1	C04600000000064800001
	Zonquasdrif 1129	3	C04600000000112900003
	Half Gewaagd 73	25	C07500000000007300025
	Farm 392	0	C07500000000039200000
	Farm 201	1	C07500000000020100001
Pump Station	Sonquas Doordrift 648	1	C04600000000064800001
Weir	Sonquas Doordrift 648	1	C04600000000064800001
Access Roads	Sonquas Doordrift 648	1	C04600000000064800001
	Sonquas Doordrift 648	2	C04600000000064800002
	Zonquasdrift 1129	5	C04600000000112900005
	Zonquasdrift 1129	0	C04600000000112900000
	Zonquasdrift 1129	6	C04600000000112900006
	Farm 441 Tulbugh Road	-	C07500000000044100000
	Farm 392	0	C07500000000039200000

Project Component	Farm Name	Portion	SG Code
	Farm 422	0	C07500000000042200000
	Farm 92	2	C07500000000009200002
Construction Camps	Vogel Valley 207	0	C07500000000020700000
	Sonquas Doordrift 648	1	C04600000000064800001

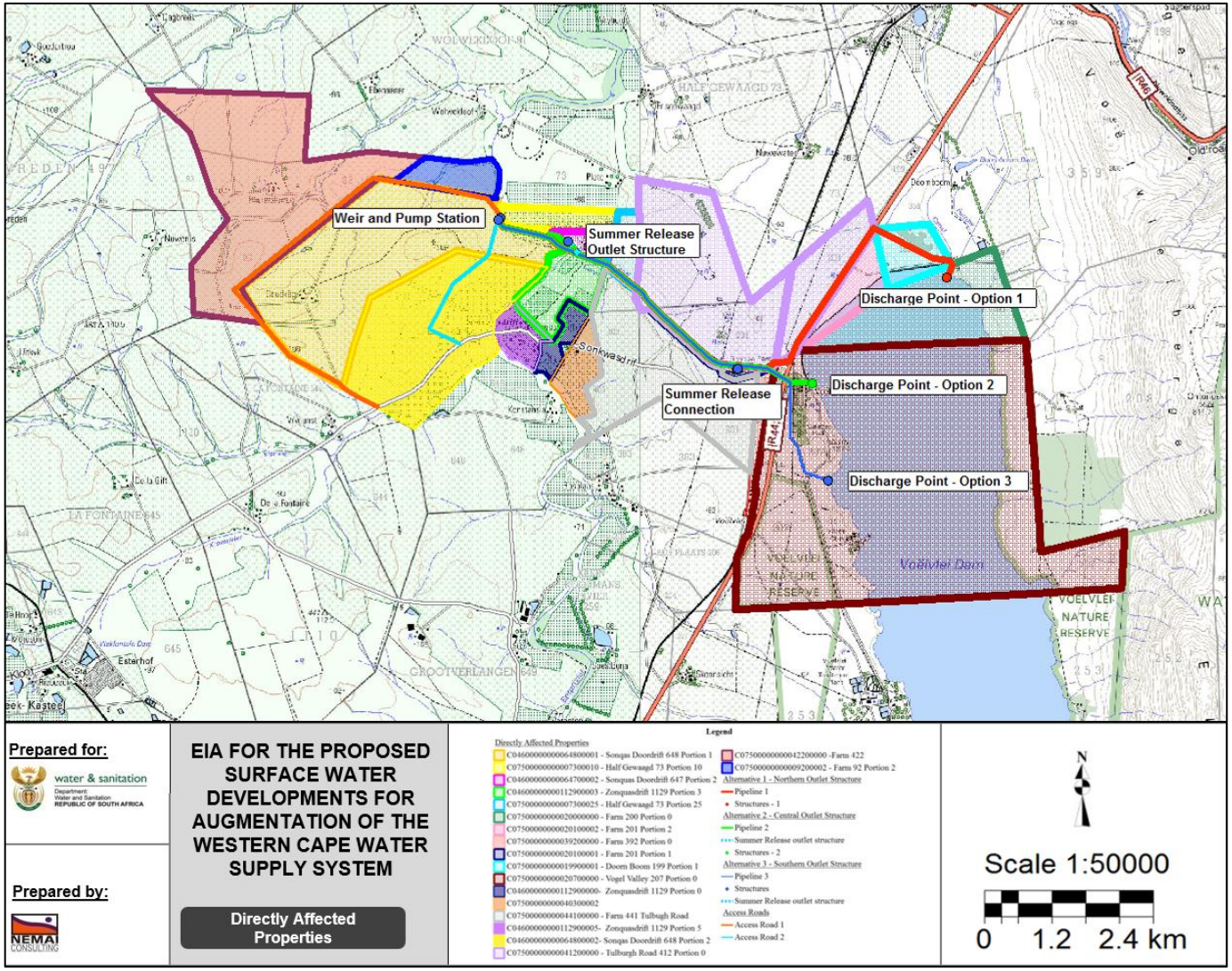


Figure 8: Directly affected properties

6 LEGISLATION AND GUIDELINES CONSIDERED

6.1 Overview of Legislation

Some of the pertinent environmental legislation that has bearing on the proposed development is captured below (**Table 6**). More detailed information is provided in **Section 7.2.** to **7.14**.

Table 4: Environmental Statutory Framework

Legislation	Relevance
Constitution of the Republic of South Africa (Act No. 108 of 1996)	Chapter 2 – Bill of Rights. Section 24 – environmental rights.
National Environmental Management Act (Act No. 107 of 1998)	Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). Section 28 – Duty of care and remediation of environmental damage. Environmental management principles. Authority – DEA.
Government Notice No. R. 982 of 04 December 2014	Purpose – regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.
Government Notice No. R. 983 of 04 December 2014 (Listing Notice 1)	Process for undertaking Basic Assessment / Scoping and EIA process.
Government Notice No. R. 984 of 04 December 2014 (Listing Notice 2)	Activities that need to be assessed through a Basic Assessment process.
Government Notice No. R. 985 of 04 December 2014 (Listing Notice 3)	Activities that need to be assessed through a Scoping and EIA process.
National Water Act (Act No. 36 of 1998)	Chapter 3 – Protection of water resources. Section 19 – Prevention and remedying effects of pollution. Section 20 – Control of emergency incidents. Chapter 4 – Water use. Chapter 12 – Safety of dams Authority – DWS.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes. Authority –DEA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Air quality management. Section 32 – dust control. Section 34 – noise control. Authority – DEA.

Legislation	Relevance
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Management and conservation of the country's biodiversity. Protection of species and ecosystems. Authority – DEA.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Chapter 5 – licensing requirements for listed waste activities (Schedule 1). Authority – Minister (DEA) or MEC (provincial authority)
Occupational Health & Safety Act (Act No. 85 of 1993)	Provisions for Occupational Health & Safety. Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – protection of structure older than 60 years. Section 35 – protection of heritage resources. Section 36 – protection of graves and burial grounds. Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent. Authority – Western Cape Heritage (WCH).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	Control measures for erosion. Control measures for alien and invasive plant species. Authority – Department of Forestry and Fisheries (DAFF).
National Forestry Act (Act No. 84 of 1998)	Section 15 – authorisation required for impacts to protected trees. Authority – DAFF.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Permit required for borrow pits. Authority – Department of Mineral Resources (DMR).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	Control measures for erosion. Control measures for alien and invasive plant species. Authority – Department of Agriculture.
National Road Traffic Act (Act No. 93 of 1996)	Authority – Western Cape Department of Roads and Public Works.
Tourism Act of 1993	Authority – South African Tourism Board.

6.2 The Constitution (Act No. 108 of 1996)

The Constitution of the Republic of South Africa, Act No. 108 of 1996, is the supreme law of the land and provides amongst others the legal framework for legislation regulating coastal management in general. It also emphasises the need for co-operative governance. In addition, the Environmental clause in Section 24 of the Constitution provides that:

"Everyone has the right –

a) To an environment which is not harmful to their health or wellbeing;

b) To have the environment protected for the benefit of present and future generations through reasonable legislation and other measures that:

I. Prevent pollution and ecological degradation;
II. Promotes conservation;
III. Secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development".

The Constitution provides the overarching framework for sustainable development.

6.3 The National Environmental Management Act (Act No. 107 of 1998)

The proposed surface water developments for augmentation of WCWSS requires authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), and the EIA will be undertaken in accordance with the EIA Regulations (04 December 2014).

The 2014 EIA Regulations consist of the following:

- EIA procedures - Government Notice No. R. 982;
- Listing Notice 1 - Government Notice No. R. 983;
- Listing Notice 2 - Government Notice No. R. 984; and
- Listing Notice 3 - Government Notice No. R. 985.

The proposed developments triggered activities under Listing Notices 1 and 2, and thus a Scoping and EIA process needs to be undertaken.

6.4 The National Environmental Management: Waste Act (Act No. 59 of 2008)

The National Environmental Management Waste Act (NEM: WA) (Act No. 56 of 2008) regulates waste management in order to protect the health and environment of South African citizens. This is achieved through pollution prevention, institutional arrangements and planning matters, national norms and standards and the licensing and control of waste management activities.

The list of waste management activities that have or are likely to have a detrimental effect (GN No. 921 of 29 November 2013) contains activities listed in Categories A and B that would require licensing from the provincial or national authorities and activities contained in Category C which would require meeting the requirements of various Norms and Standards.

The purpose of the Norms and Standards for the Storage of Waste is to provide a uniform approach to the management of waste storage facilities, ensure best practice is the management of waste storage facilities and provide minimum standards for the design and operation of new and existing waste storage facilities.

The Norms and Standards require registration of new storage facilities. They also provide details on the management of all storage facilities in terms of access control and notices, operation, general requirements of waste storage containers, minimum requirements for above ground storage facilities and minimum requirements for below ground storage facilities.

The Norms and Standards also require that training be undertaken and an emergency preparedness plan be compiled. In addition, specific monitoring and inspections need to be undertaken as well as internal and external audits.

As part of the operation of the facility, waste will be stored temporarily on site prior to disposal. These storage facilities will be managed in line with the Norms and Standards for Storage.

No authorisation will be required in terms of the NEM: WA (Act No. 59 of 2008), as the project will not include any listed waste management activities.

The following should be noted with regards to waste management during the Construction Phase:

- Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM: WA; and
- The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste.

6.5 The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)

The purpose of the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) is to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources and to provide for matters related thereto. This act defines mining as "any operation or activity for the purposes of winning any mineral on, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto".

Under Section 106(1) of the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002), DWS is exempt from the provisions of Sections 16, 20, 22 and 27 "*in respect of any activity to remove any mineral for road construction, building of dams or other purpose which may be identified in such notice*".

No Mining Permits are required for the proposed developments as borrow pit material (e.g. soil, gravel or sand) will be sourced from a commercial source.

6.6 The National Water Act (Act No. 36 of 1998)

The National Water Act (NWA) (Act No. 36 of 1998) regulates the water resource of South Africa and aims to achieve the sustainable use water for the benefit of all users. Water is considered a scarce commodity and should therefore be adequately protected. Amongst others, the act deals with the protection of water sources, water uses, water management strategies and catchment management, dam safety and general powers and functions, as well as water quality.

The purpose of the act is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled, and for achieving this purpose, to establish

suitable institutions and to ensure that they have appropriate community, racial and gender representation.

The NWA definition for a Water Resource includes:

1. A Watercourse;
2. Surface Water;
3. An Estuary; and
4. An Aquifer.

The NWA defines a watercourse as follows:

a) A river or spring;
b) A natural channel in which water flows regularly or intermittently;
c) A wetland, lake or dam into which, or from which, water flows; and
d) Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse include, where relevant, its bed and banks.

Section 21 of the NWA provides information on what water uses require approval. These include:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity;
e) Engaging in a controlled activity;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

The project entails the following activities that constitute water uses in terms of Section 21 of NWA:

(a) Taking water from a water resource (water abstraction from the Berg River);

(c) Impeding or diverting the flow of water in a watercourse (instream works for the weir, pipeline, and access roads); and

(i) Altering the bed, banks, course or characteristics of a watercourse (instream works for the weir, pipeline, and access roads).

The NWA specifies that for a S21(i) water use the applicant must delineate the watercourse and riparian habitat using the DWAF guideline: "*A practical field procedure for identification and delineation of wetlands and riparian areas*" and indicate the proposed activity location in relation to the riparian area, the 1:50 and 1:100 year floodlines on a map of appropriate scale.

Any development within the riparian habitat or 1:100 year floodline whichever is the greatest distance from the watercourse, will require an authorisation from the Department.

As the proposed developments occur within a regulated area of a watercourse and involves abstraction of water, an IWULA is required in terms of Sections 21 (a), (c) and (i). In addition, an Aquatic and Wetland Delineation Report has been prepared as part of the EIA Phase and can be referred to in **Appendix G** of the EIA Report.

6.7 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) was promulgated for the management and conservation of South Africa's biodiversity through the protection of species and ecosystems and the sustainable use of indigenous biological resources.

The main implication of this act is the protection of biodiversity.

6.8 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

The aim of the National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable.

The proposed developments do occur near a Protected Areas, namely the Voëlvlei Nature Reserve managed by Cape Nature. However, the proposed developments do not encroach on the Reserve.

6.9 The Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) requires the maintenance of riparian vegetation and provides a list of invasive alien vegetation that must be controlled or eradicated.

The proposed developments partly contains agricultural land. The impacts of the proposed developments will be assessed in the EIA phase as there will be a complete loss of the existing

agricultural land. In addition, an Agricultural Impact Assessment has been conducted as part of the EIA Phase and can be referred to in **Appendix G** of the EIA Report.

6.10 National Forest Act (Act 84 of 1998)

In terms of the National Forests Act (Act 84, 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the DAFF.

This Act has considered in the Terrestrial Ecological Impact Assessment (**Appendix F1** of the EIA Report) in terms of the occurrence of any Protected Trees on the proposed study area.

6.11 National Heritage Resources Act (Act No. 25 of 1999)

The National Heritage Resources Act (Act No. 25 of 1999) was promulgated for the protection of National Heritage Resources and the empowerment of civil society to conserve their heritage resources.

The proposed developments will trigger certain categories as listed below that require a heritage impact assessment (HIA) in terms of Section 38 of the National Heritage Resources Act. These categories are:

- Any development or other activity which will change the character of a site
    - Exceeding 5 000 m^2 in extent; or
    - Involving three or more existing erven or subdivisions thereof; or
    - Involving three or more erven or divisions thereof which have been consolidated within the past five years;
    - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority; or
    - Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

The Act also makes provision for General Protections, which apply automatically to certain categories of heritage resources such as archaeological and paleontological sites, cemeteries and graves, and structures older than 60 years.

A Notice of Intent to Develop was submitted to HWC. In their response, dated 30 September 2016 (but only received by Nemai Consulting on 27 October 2016), HWC stated:

“You are hereby notified that since there is no reason to believe that the proposed water distribution lines and associated infrastructure will impact on heritage resources, no further

action under Section 38 of the National Heritage Resources Act (Act 25 of 1999) is required". However, a Phase 1 HIA was still compiled.

6.12 The National Environmental Management: Air Quality Act (Act No. 39 of 2004)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004) provides for the setting of national norms and standards for regulating air quality monitoring, management and control and describes specific air quality measures so as to protect the environment and human health or well-being by:

- Preventing pollution and ecological degradation; and
- Promoting sustainable development through reasonable resource use.

It also includes the establishment of national ambient dust fall out levels that may be relevant to the construction.

6.13 The Occupational Health and Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (Act No. 85 of 1993) provides for the health and safety of people at work as well as the health and safety of persons using plant and machinery.

This act will need to be taken into account should the proposed development be approved.

6.14 Policy, Programmes, Guidelines and Plans

6.14.1 Guidelines

The following guidelines were used in the preparation of this report.

- Integrated Environmental Management Information Series, in particular Series 2 – Scoping (DEAT, 2002);
- Guideline on Alternatives: NEMA Environmental Impact Assessment Regulations (prepared by the Western Cape Department of Environmental Affairs and Development Planning, 2006);
- Guideline 3: General Guide to the Environmental Impact Assessment Regulations, 2005. Integrated Environmental Management Guideline Series (DEAT, 2005a);
- Guideline 4: Public Participation, in support of the EIA Regulations. Integrated Environmental Management Guideline Series (DEAT, 2005);
- Guideline on Need and Desirability, NEMA Environmental Impact Assessment Regulations Guideline and Information Document Series. Department of Environmental Affairs and Development Planning (DEADP, 2009); and

- Assessment of alternatives and impacts (Guideline 5) in support of the EIA Regulations, Department of Environmental Affairs and Tourism, Pretoria (DEAT, 2006).

6.14.2 Regional Plans

The following regional plans will be considered during the execution of the EIA:

- National Development Plan;
- Western Cape Provincial Spatial Development Framework (SDF);
- West Coast District IDP;
- Cape Winelands SDF;
- Voëlvlei Resource Management Plan (RMP); and
- Relevant provincial, district and local policies and strategies.

The need for the proposed development may be linked to these existing policies and strategies.

7 PROJECT DESCRIPTION

The following Pre-Feasibility and Technical Feasibility Study reports compiled by the WCWC-JV in 2012 informed the project design for the augmentation of the Voëlvlei Dam:

- **Report Number 1**: **Ecological Water Requirements**. **Volume 1** – Riverine Environmental Water Requirements
  - Appendix 3: EWR data for the Berg River
- **Report Number 1**: **Ecological Water Requirements**. **Volume 3** - Berg Estuary Environmental Water Requirements
  - Appendix C: Specialist Report – Physical dynamics and water quality
  - Appendix D: Specialist Report – Modelling
  - Appendix E: Specialist Report – Microalgae
  - Appendix F: Specialist Report – Invertebrates
  - Appendix G: Specialist Report – Fish
  - Appendix H: Specialist Report – Birds
  - Appendix I: Specialist Report – The economic value of the Berg River Estuary
- **Report Number 2: Preliminary Assessment of Options**
  - Appendix 1: Scheme Yield Assessments and Diversion Functions
  - Appendix 2: Unit Reference Value Calculation Sheets
  - Appendix 3: Yield Analysis and Dam Size Optimization

- Appendix 4: Dam Design Inputs
- Appendix 5: Diversion Weir Layout Drawings
- Appendix 6: Voëlvlei Dam Water Quality Assessment
- Appendix 7: Botanical Considerations
- Appendix 8: Heritage Considerations
- Appendix 9: Agricultural Economic Considerations

- **Report Number 3: Feasibility Studies. Volume 1** - Berg River - Voëlvlei Augmentation Scheme

  - Appendix 1: Updating of the Western Cape Water Supply System Analysis for the Berg River-Voëlvlei Augmentation Scheme
  - Appendix 2: Configuration, Calibration and Application of the CEQUAL-W2 model to Voëlvlei Dam for the Berg River-Voëlvlei Augmentation Scheme
  - Appendix 3: Monitoring Water Quality During Flood Events in the Middle Berg River (Winter 2011), for the Berg River-Voëlvlei Augmentation Scheme
  - Appendix 4: Dispersion Modelling in Voëlvlei Dam from Berg River Water Transfers for the Berg River-Voëlvlei Augmentation Scheme
  - Appendix 5: Scheme Operation and Yield Analyses with Ecological Flow Requirements for the Breede-Berg (Michell's Pass) Water Transfer Scheme
  - Appendix 7: Ecological Water Requirements Assessment Summary for the Berg River-Voëlvlei Augmentation Scheme, and the Breede Berg (Michell's Pass) Water Transfer Scheme
  - Appendix 8: Geotechnical Investigations for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
  - Appendix 10: Conveyance Infrastructure Design Report, for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
  - Appendix 11: Diversion Weirs Design for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme

7.1 Project Components

The project components are illustrated in **Figure 9** below and 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 authorisation 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).

The major components of the project are discussed in the sub-sections to follow.

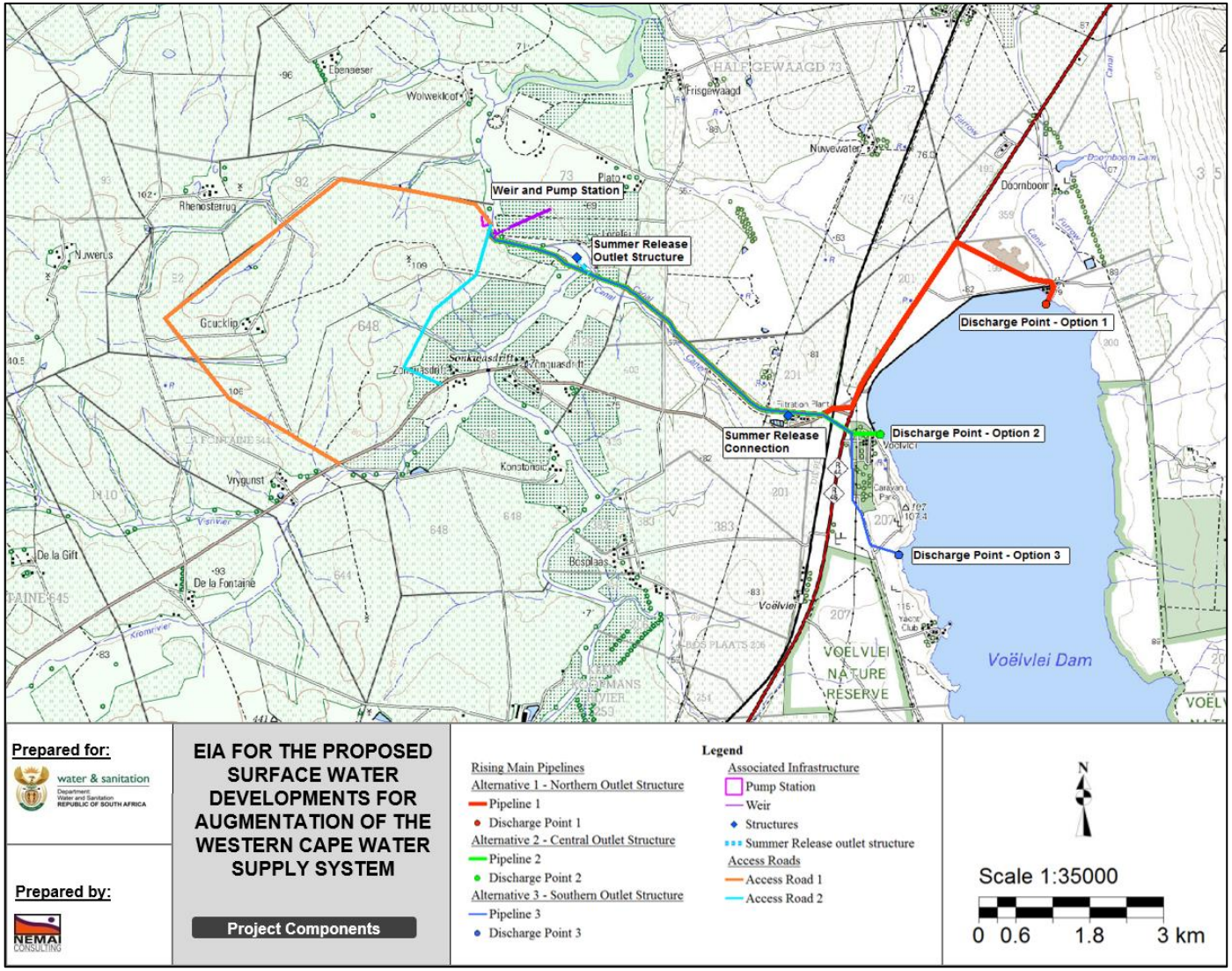


Figure 9: Project components

7.1.1 Diversion Weir and Abstraction Works

The proposed diversion weir will be located on the outer (western) bank of the Berg River (**Figures 10** and **11**).

Figure 10: Google Earth image of the weir location

Figure 11: Berg River at the Proposed Weir Site

The Technical Feasibility Study found that the flow depth would be about 10.4 m during the 1 in 100 year flood and the flow velocity about 2 m/s due to the wide floodplain (DWA, 2012a).

The study also found that although the right bank floodplain would be inundated during floods, as the flow velocities would be low and the flow depth shallower, it would be possible to construct a weir/embankment on the floodplain without significantly increasing the flood levels upstream (DWA, 2012a). The proposed layout of the abstraction works is provided in **Figures 12** and **13**.

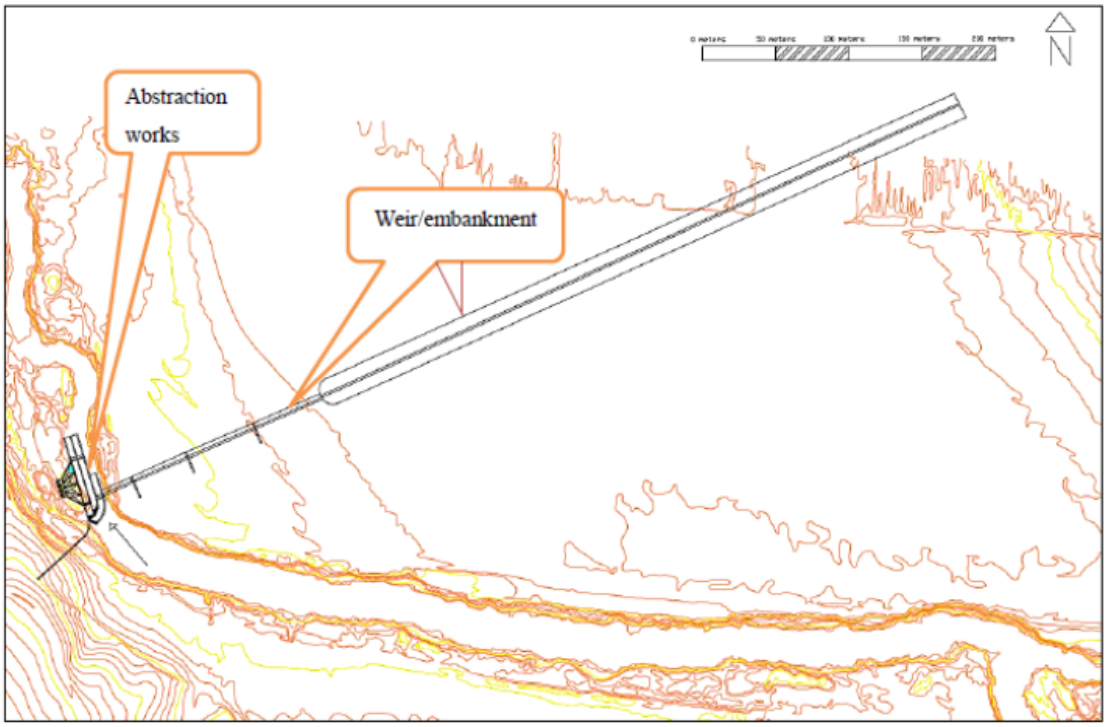


Figure 12: Layout of Abstraction Works, Weir and Embankment (DWA, 2012)

Figure 12 illustrates these works which would comprise the following components:

- An abstraction weir;
- A protected embankment on the right bank floodplain to be designed to be overtopped;
- A boulder trap with a radial gate to flush sediments;
- A gravel trap comprising two canals and a dividing wall, with radial gates downstream for flushing;
- An underwater opening would allow water to be diverted to supply the pumps, while keeping floating debris away from the trashracks; and
- The pumps would be located in a dry well and flushing durations are expected to be less than 30 minutes.

In order to minimise the increase in upstream water levels, the design would require the use of a hopper and jet pumps which would rely on the main pumps to provide a high head, whereas the preferred solution would be longer sand trap canals downstream of the trashracks that would be flushed by gravity and would also act as pump sumps.

The abstraction weir has been designed as a 3 m high (average low notch height) weir with a 21 m long low notch next to the boulder trap. The crest level of the low notch is 47.9 masl while the lowest bed level is 44.923 masl. The total weir length is 160 m, consisting of four notches (**Figure 13**). The weir will be founded on solid rock, and therefore no energy dissipation structure has been added.

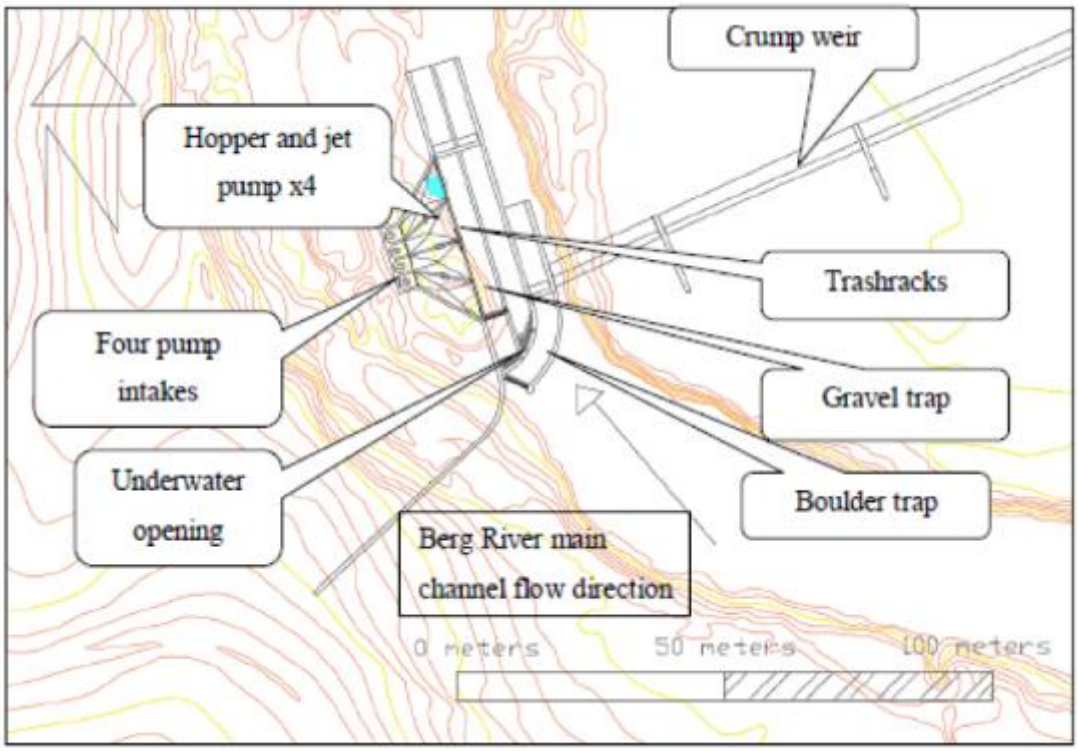


Figure 13: Components of the Proposed Abstraction Works (DWA, 2012)

A canoe chute may be required since the weir would be situated on the route of the annual Berg River Canoe Marathon. A fishway, comprising a rock-ramp type was recommended by the Aquatic and Wetland Specialist.

In addition, the weir has been designed as a low structure with a series of notches in it to minimise the impact of inundation. **Figure 14** shows that the upstream damming caused by the proposed abstraction works and weir is very limited (for example, for the 100 year flood, the upstream water level will only be approximately 0.6m higher with the weir in place, than would be the case if the weir were not there).

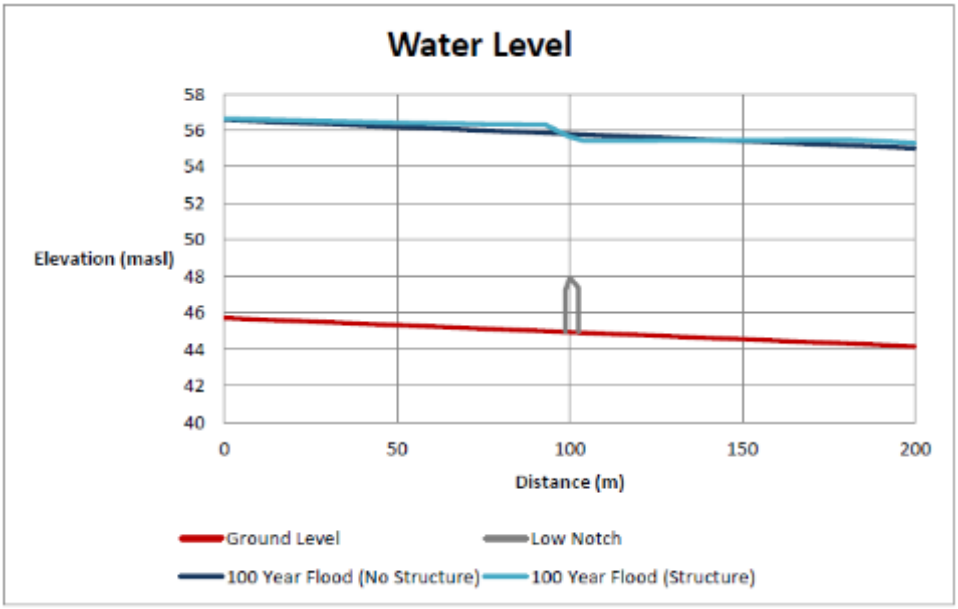


Figure 14: 100 year flood levels with the Weir in place (blue) and without the Weir in place (black)

7.1.2 Rising Main

As shown in **Figure 10,** three pipeline routes were investigated during the Technical Feasibility Study and was assessed as part of the EIA. These routes are related to three potential discharge options into the dam from the diversion weir site. These routes are as follows:

- Pipeline route to Northern Discharge Point = 8 115 m;
- Pipeline route to Central Discharge Point = 5 000 m; and
- Pipeline route to Southern Discharge Point = 6 300 m.

The servitude for the pipeline is 25m, while the pipeline itself is 1.7m wide.

Whilst design flows of 4 and 6 m^3/s were considered for the rising main during the Technical Feasibility Study, the EIA only assesses the 4 m^3/s option which was deemed most feasible during the Technical Feasibility Study.

The average pipe depths required for the pipeline are about 3.5 m with a minimum cover of 1 m. **Table 5** shows the design parameters adopted for the rising main between the diversion weir and Voëlvlei Dam.

Table 5: Design Parameters for the rising main between the Diversion Weir and Voëlvlei Dam

Design Parameter	4m^3/s Design Flow
Rising Main Properties	1700 mm diameter GRP
Static Head	28.0 m
Dynamic Head	35.8 m
Maximum Flow Velocity	1.762 m/s

7.1.3 Pump Station

The design parameters adopted for the 4m^3/s Pump Station are provided in **Table 6**.

Table 6: Design Parameters for the 4m3/s Pump Station

Design Parameter	4m^3/s Design Flow
Abstraction	Raw water from Berg River in Winter
Rising Main Static Pressure	28.0 m
Friction Losses	7.8 m
Inlet Static Pressure	1.8 m
Pump Duty	34.0 m

During the winter abstraction period, water from the Berg River will flow into the sump at the pump station. A level transmitter on the diversion weir will provide an input value for the flow calculation to determine the amount of water to be abstracted and pumped to the Voëlvlei Dam (DWA, 2012a).

At the commencement of pumping, the pipeline could be partially empty and as such the first pump will start by means of a variable speed drive and slowly fill the pipeline until water is discharged into the dam. Flow will be measured at the pump station in order to monitor the volumes abstracted and the abstraction rates. The 4 m^3/s abstraction will be based on a step-pumping operating rule, allowing a minimum flow (spill) of 1 m^3/s past the abstraction point down the Berg River at all times, after abstraction. The pumps are in sets each with a 1 m^3/s capacity. Each pump starts up when the river inflow to the site exceeds the sum of the required environmental base flow of 1 m^3/s and the abstraction, in 1 m^3/s steps (DWA, 2012a).

A schematic diagram indicating the section through the abstraction point at the proposed pump station is shown in **Figure 16**.

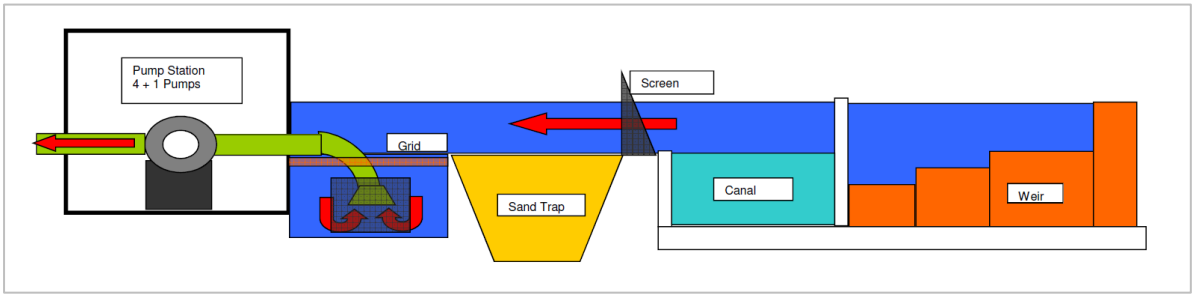


Figure 15: Abstraction point at the proposed pump station

The proposed location of the Pump Station is provided in **Figure 17**.

Figure 16: Location of the Pump Station (DWA, 2012)

The pump station will have water and sanitation facilities, both incorporated into the footprint of the site. The sanitation facility would either be a septic tank (with a French drain), as is the case for all farm homesteads or a conservancy tank which would then require a service provider to routinely come and empty and dispose at the closest WWTW.

7.1.4 Access Roads

As most of the pipeline route follows an existing farm road, construction vehicles will be able to access the pipeline construction site from this road. Access roads to the weir and pump station site will be via existing unnamed farm roads in the study area (**Figure 18**). However, access road 2 will be constructed as a new access road to the weir and pump station. The servitude for the roads are 10m (the access road width is approximately 6m).

Figure 17: Proposed access to weir and pump station

7.1.5 Electrical Supply

Eskom will be responsible for electrical supply / infrastructure. The electrical supply will be built and supplied by Eskom, while DWS will apply for the supply to be installed.

7.1.6 Site Laydown Areas

Two site laydown areas are proposed at the discharge point of pipeline alternative 2, both approximately 0.4 hectares in size (**Figure 19**). Only one of these site laydown areas would be required. These site laydown areas would be accessible from the main road, R44 and are adjacent to the Voëlvlei Dam.

The main site laydown area is proposed at the pump station and weir site for purposes of construction (**Figure 20**). This laydown site is approximately 0.85 hectares in size and is adjacent to the Berg River. The site will be accessible from the existing unnamed farm roads.

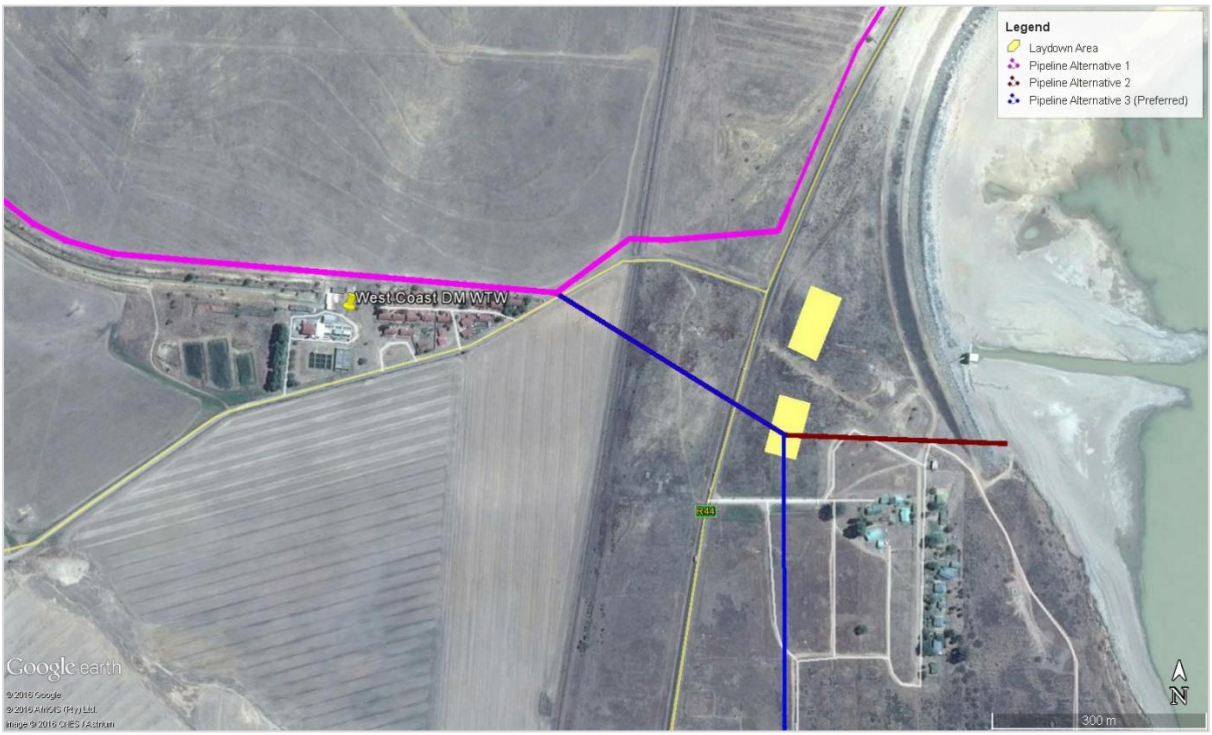


Figure 18: Location of the two proposed laydown areas adjacent to the Voëlvlei Dam

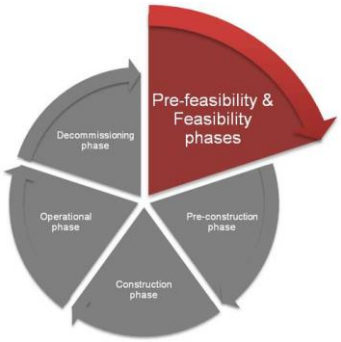
Figure 19: Proposed site laydown area at the pump station and weir site adjacent to the Berg River

7.2 Project Lifecycle

To adequately consider the impacts associated with the proposed surface water developments for the augmentation of the WCWSS, the major activities during each phase of the project lifecycle are listed in the sub-sections to follow.

7.2.1 Feasibility Studies

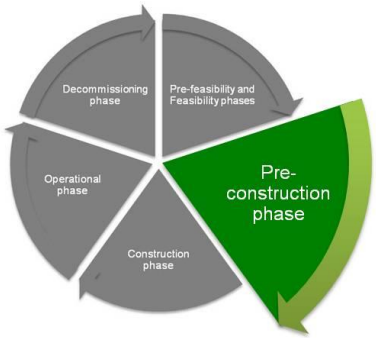
Major activities during the Feasibility Phase of the project included the following:



- Environmental screening of alternatives;
- Geotechnical investigations to confirm soil conditions (where needed);
- Technical and economic analysis; and
- Preliminary design.

7.2.2 Pre-Construction Phase

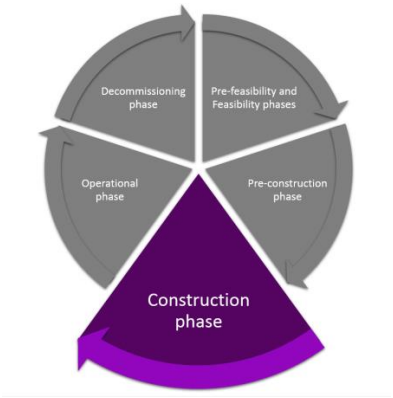
Major activities during the Pre-construction Phase of the project include the following:



- Detailed layouts and services designs;
- Detailed geotechnical investigations;
- Obtain Environmental Authorisation and IWULA;
- Tender for various construction works;
- Agreements with landowners regarding access; and
- Procurement of necessary materials.

7.2.3 Construction Phase

Major activities during the Construction Phase are as follows:



Appointments and site camp set up:

- Appoint Environmental Control Officer (ECO);
- Set up site camp with temporary offices and administrative facilities;
- Set up ablutions;
- Set up access control, security; signage and lighting;
- General materials storage and laydown areas
- Construction of chemicals storage facilities (oil, grease, solvents etc.) and associated infrastructure (bunds, secured / roofed areas etc.);
- Above ground fuel storage (e.g. gasoil/ petrol);
- Employment of construction labour;
- Workshops / areas (e.g. welding, mechanical repair, electrical etc.);
- Change-houses, chemical toilets and showering facilities (linked to conservancy tanks – removal of contents by exhauster vehicle and disposal at permitted facility); and
- Temporary waste storage areas; these shall be established and managed in accordance with EMPr requirements to be developed in the EIA phase.

Sourcing of construction materials and equipment:

- All bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; there will be no direct mining, harvesting or extraction of natural resources;

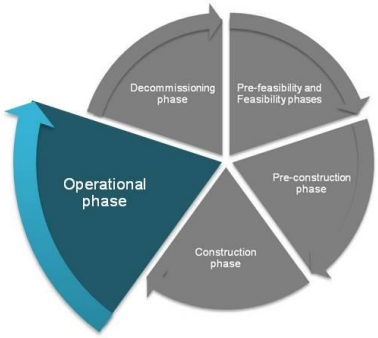
Excavation, earthworks and concreting

- Clearing of vegetation;
- Levelling and compaction using heavy machinery / earthmoving equipment;
- Potential for excavations and trenching in order to prepare foundations and laying of below ground level equipment (cables, pipes, sumps, drainage etc.);
- Potential for excavation dewatering in the event of water-table interception;
- Piling / drilling depending on the identified construction / founding technique;
- Use of general mechanical equipment within construction areas (generators, cutting and welding equipment, compressors etc.);
- Site establishment;
- Relocation of infrastructure;
- Prepare access roads;
- Establish construction laydown areas;
- Bulk fuel storage;
- Storage and handling of material;
- Employment of construction labour;
- Excavation;
- Blasting;
- Waste and wastewater management;
- Temporary river diversion for gauging weir and river crossings;
- Construction of embankment, outlet, and spillway;
- Concrete Works;
- Steel works;
- Mechanical and Electrical Works;
- Cut and cover activities;
- Stockpiling (sand, crushed stone, aggregate, etc.);
- Construction of gauging weir;

- Construction of pump station; and
- Construction of pipeline.

7.2.4 Operation Phase

Major activities during the Operation Phase of the project include the following:



- Operation of pump station and pipeline;
- Maintenance of infrastructure; and
- Ongoing consultation with directly affected parties.

7.2.5 Decommissioning Phase

Decommissioning of the proposed developments is not envisioned. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

8 ALTERNATIVES

8.1 Introduction

The 2014 EIA Regulations require that feasible project specific alternatives are identified (including the "do nothing" option). Alternatives are defined as following:

Different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- property on which or location where the activity is proposed to be undertaken;
- type of activity to be undertaken;
- design or layout of the activity;
- technology to be used in the activity; or
- operational aspects of the activity; and

- the option of not implementing the activity.

The sub-sections to follow discuss the project alternatives considered during the Scoping process. The EIA process will provide a detailed comparative analysis of feasible alternatives from environmental (including specialist input) and technical perspectives.

By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term".

8.2 Alternatives Considered

8.2.1 Alternatives screened during the Feasibility Phase

The WCRSS has reviewed the future water requirement scenarios and the reconciliation options for meeting these water requirements within a planning horizon to 2030. The WCRSS identified various alternative implementation options which can offer flexibility in planning, such that possible changes in the projected water requirement scenarios can be accommodated. One set of those implementation options is the potential to further develop the surface water resources of the Berg and Breede WMAs.

Therefore, the WCRSS identified the need for augmentation of the WCWSS by 2019. Based on this, the DWS appointed the WCWC JV to undertake pre-feasibility level investigations into six potential surface water development options (Phase 1). These options are detailed below:

1. Michell's Pass Diversion Scheme

This scheme involves a low level intake structure on the left bank of the Upper Breede River at Michell's Pass, adjacent to the existing DWS streamflow gauge at which the current irrigation diversion (Artois canal) takes place (**Figure 20**). This is an inter-basin transfer from the Breede WMA into the Berg WMA.

Figure 20: The existing Artois canal irrigation diversion at Michell's Pass

Surplus winter water would be diverted via a low weir (up to 2.5 m high) into a GRP pipeline of up to 2.0 m dia. The weir dimensions and pipeline diameter would depend on the diversion capacity of the scheme. The pressure pipeline would transfer the water under gravity over approximately 7.3 km to discharge into the Boontjies River, a tributary of the Klein Berg River, from where the water would be diverted into the existing Voëlvlei Dam via the existing Klein Berg Diversion. The use of a low intake weir limits the upstream inundation impact and avoids impacting on the Witels tributary, the confluence of which lies approximately 2.3 km upstream of the proposed weir location. Provisional designs of the weir structure to enable downstream releases to be made and to ensure that sedimentation and boulder accumulation can be managed, have been undertaken.

Storage would be provided in the existing Voëlvlei Dam and the water could be used to supply Cape Town by means of the spare capacity (3.16 m^3/s) in the existing pipeline from the City's WTW. This spare conveyance capacity is however only available in winter when water requirements are lower than during the dry summer months. This equates to a potential volume of 20 million m^3/a. The scheme could also be used to supply water to the West Coast Regional Schemes, of which the Saldanha scheme is anticipated to experience significant growth in water requirements.

2. First Phase Augmentation of Voëlvlei Dam

This potential scheme involves the pumped abstraction of winter water from the Berg River, once the requirements of the Environmental Water Requirements (EWR) have been met. A number of diversion sites and scheme operational aspects have been previously investigated by DWS and by the CCT, at various levels of detail. Since those investigations, the water quality characteristics within the dam have changed.

For the option involving storing Berg River water in Voëlvlei Dam, the potential demand centres that could be supplied include the CCT, the growing West Coast region, and addressing any irrigation over-allocation from Voëlvlei Dam.

3. Further Phases of Voëlvlei Dam Augmentation

The Further Phases of the Voëlvlei Dam Augmentation Option would involve the abstraction of water as described in Phase 1, namely at 6 m^3/s, with additional storage being made available in Voëlvlei Dam by means of a low raising of the existing dam wall.

4. Molenaars River Diversion

This inter-basin transfer scheme involves the potential transfer of surplus winter water from the Upper Molenaars River in the vicinity of the Eastern Tunnel Portal (Huguenot Tunnel) to the Berg River Dam (Berg WMA). Two potential options have been investigated, namely:

- Pumping from the Molenaars River; and
- Gravity Supply from the Elandspad tributary of the Molenaars River.

The first option involves a low level intake structure in the Molenaars River downstream of the entrance to the tunnel (from the Worcester side) and located at an existing causeway (**Figure 21**). Water would be pumped during surplus winter flow periods into a balancing tank above the tunnel entrance, from where it would gravitate into and through the existing 1.3m diameter pipeline installed in the tunnel during its construction. From the tunnel portal on the Paarl side the water would be conveyed under gravity over a distance of approximately 30 km via a new GRP pipeline (1.1m diameter.) into the Berg River Dam.

Figure 21: Molenaars River

The second option is an alternative and it involves the potential construction of a low level weir on the Elandspad River (a tributary of the Molenaars) upstream of the existing DWS flow gauging station (**Figure 22**). This would negate the need for infrastructure to be developed in the Molenaars River itself and would require no pumping.

Figure 22: Elandspad River

Water becoming available in winter from the scheme would be stored in the Berg River Dam and in this way integrated into the Western Cape Water Supply System. The option of storing the abstracted water in Wemmershoek Dam was also considered but is less favorable due to the limited capacity of the existing pipeline from Wemmershoek Dam to Cape Town. On the other hand, water delivered to the Berg River Dam could be delivered via the Dasbos Pumpstation either into Theewaterskloof Dam, or to Cape Town via the existing tunnel. The proposed Muldersvlei pipeline would enable delivery directly to Cape Town. For these reasons, use of the Berg River Dam for storage purposes offers greater flexibility.

5. Upper Wit River Diversion

This scheme involves the potential inter-basin transfer of surplus winter water from the Upper Wit River (**Figure 23**), a tributary of the Breede River, in the vicinity of Eerste Toll (Bain's Kloof), into the Berg River catchment. This would be achieved by constructing a low level weir (2m high) and intake on the left bank (looking downstream). Once the winter EWR requirements have been met, water would be diverted into a drop structure connecting to a 3m diameter tunnel, of about 350m length, under Bain's Kloof.

Figure 23: The Upper Wit River

The water could either be released into the Krom River from the dam, through an exchange with the Berg River Irrigators, for water currently allocated to them from Theewaterskloof Dam. Alternatively, the water could be piped under gravity to the Welvanpas WTW in Wellington during summer, via a 7,3km GRP pipeline of 600mm dia. The existing WTW would require upgrading. The water then could be used locally to supply Wellington, as well as Paarl via reverse pumping in the existing 450mm diameter pipeline between Paarl and Wellington.

6. Further Phases of the Palmiet Transfer Scheme

The potential of raising either the Upper or the Lower Steenbras Dam has been considered. However from an environmental, financial, technical and integration perspective, it became clear during initial assessments that raising the Lower Steenbras Dam was much more feasible.

The potential areas of supply would be the CCT. Water becoming available from this scheme would be transferred to the CCT's Faure WTW. The existing raw water pipeline to Faure has adequate spare capacity to deliver the water becoming available from this option.

The six possible options detailed above were then prioritised to identify the two most viable options for further investigation at the Feasibility Study level in Phase 2. The prioritisation indicated the following two priority schemes.

- BRVAS (also known as the First Phase Augmentation of Voëlvlei Dam); and
- BBTS (also known as the Michell's Pass Diversion Scheme).

Both schemes rely on the utilisation of the existing storage capacity in the Voëlvlei Dam, and on the existing capacity of the CCT's pipeline, from their WTWs at the dam, to their Plattekloof

reservoir in Cape Town. It was found that the BRVAS option was the more favourable surface water intervention option.

Three potential diversion sites were considered for the BRVAS scheme namely:

- Spes Bona;
- Sonquasdrift, and
- Lorelei.

The Spes Bona and Lorelei sites were considered to be best suited for the proposed options. Zonquasdrift was also considered but the former two sites proved preferable for alignment of pipelines and limiting the impacts on the Voëlvlei Conservancy. The Lorelei site was found to be the most feasible of the options for the following reasons:

- It is close to a bend on the Berg River which is favourable from a sedimentation management perspective. Geologically this is the only location of those considered at which any rock outcrop is evident for suitable founding conditions. From a hydraulic and geotechnical perspective this site was therefore recommended as the preferred location for the abstraction weir.
- Geotechnical conditions are generally favourable, and the weir design can be suitably accommodated at the proposed site. Machine excavation is expected to be possible along the pipeline route. Although there is potential for the use of excavated materials for backfilling, the final pipe type selection will influence the extent of selected fill material available insitu.

According to the Reserve for the Berg River Estuary the required stream flow into the estuary during the summer months should vary between 0.6 and 0.9 m^3/s. As the present day inflows into the estuary are not gauged (although DWS has plans to install a gauge), the present day inflow of 0.3 m^3/s was estimated from the gauged flows below Misverstand Dam, and from the downstream irrigation allocations which will be metered in the near future. In order to provide the required Reserve inflows to the estuary would require that additional releases of between 0.3 m^3/s and 0.6 m^3/s be made from Voëlvlei Dam, particularly during the four summer months from December to March. Therefore, the conservative assumption has been made in the system modelling of the proposed scheme that an additional release of 0.5 m^3/s should be made from Voëlvlei Dam for the four summer months. Two scheme options have been investigated, namely:

- Option 1: a 4 m^3/s pump station with a stepped-pump operating rule that works in 1 m^3/s increments up to a pump station capacity of 4 m^3/s and which allows a base flow of 1 m^3/s to pass the site at all times.

- Option 2: a 6 m^3/s pump station with variable speed drives so that the EWR requirement can be allowed to pass the site at all times, exactly, while the balance will be abstracted up to the pump station capacity of 6 m^3/s.

Of the two potential abstraction approaches investigated, namely a 4 m^3/s pump station with a stepped-pump operating rule, or a 6 m^3/s pump station with variable speed drives, the former appears to be more easily implemented and operated, as well as offering a slightly higher resulting yield (23 versus 20 million m^3/a).

Therefore, from an operational perspective, Option 1: 4m^3/s abstraction via a stepped-pumping operating rule was selected as the optimal pumping scheme for the proposed pump station.

8.2.2 Alternatives assessed as part of EIA

Of the six alternatives previously assessed during the pre-feasibility level investigations, two priority schemes were identified as feasible:

- BRVAS (also known as the First Phase Augmentation of Voëlvlei Dam); and
- BBTS (also known as the Michell's Pass Diversion Scheme).

It was then found that the BRVAS option was the more favourable surface water intervention option of the two, primarily due to lower environmental impacts. Three alternative pipeline routes are considered as part of the BRVAS scheme (**Figure 9**). These routes are related to three potential discharge options into the dam from the diversion weir site. These alternative routes are as follows:

- Option 1 (**Figure 24**): Pipeline route to Northern Discharge Point = 8 115 m;
- Option 2 (**Figure 25**): Pipeline route to Central Discharge Point = 5 000 m; and
- Option 3 (**Figure 26**): Pipeline route to Southern Discharge Point = 6 300 m.

From a technical perspective, Option 3 is the preferred option of the three route and discharge points:

- It is close to a bend on the Berg River which is favourable from a sedimentation management perspective. Geologically this is the only location of those considered at which any rock outcrop is evident for suitable founding conditions. From a hydraulic and geotechnical perspective this site is therefore recommended as the preferred location for the abstraction weir.
- Geotechnical conditions are generally favourable, and the weir design can be suitably accommodated at the proposed site. Machine excavation is expected to be possible along the pipeline route. Although there is potential for the use of excavated materials for backfilling, the final pipe type selection will influence the extent of selected fill material available insitu.

- It has the shortest conveyance length of all abstraction site options considered and enables the rising main to the Voëlvlei Dam to be aligned such that the least possible impact is made on the Renosterveld within the Voëlvlei Conservancy.
- A large portion of the servitude occurs on state owned land.

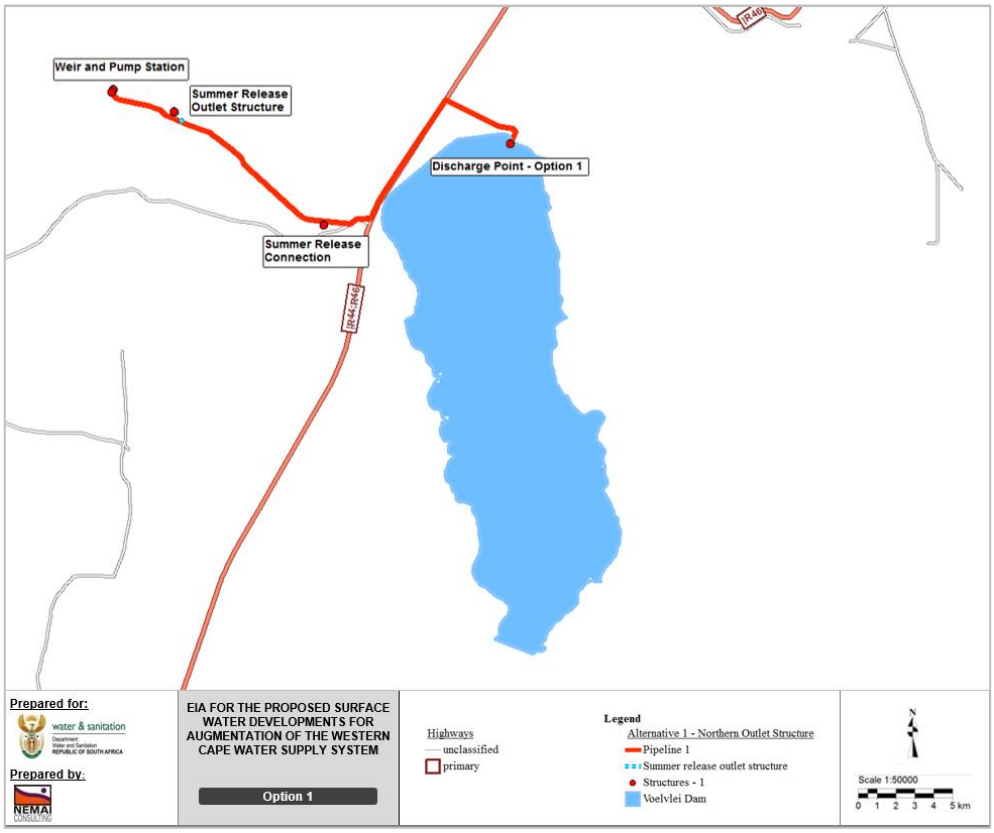


Figure 24: Option 1

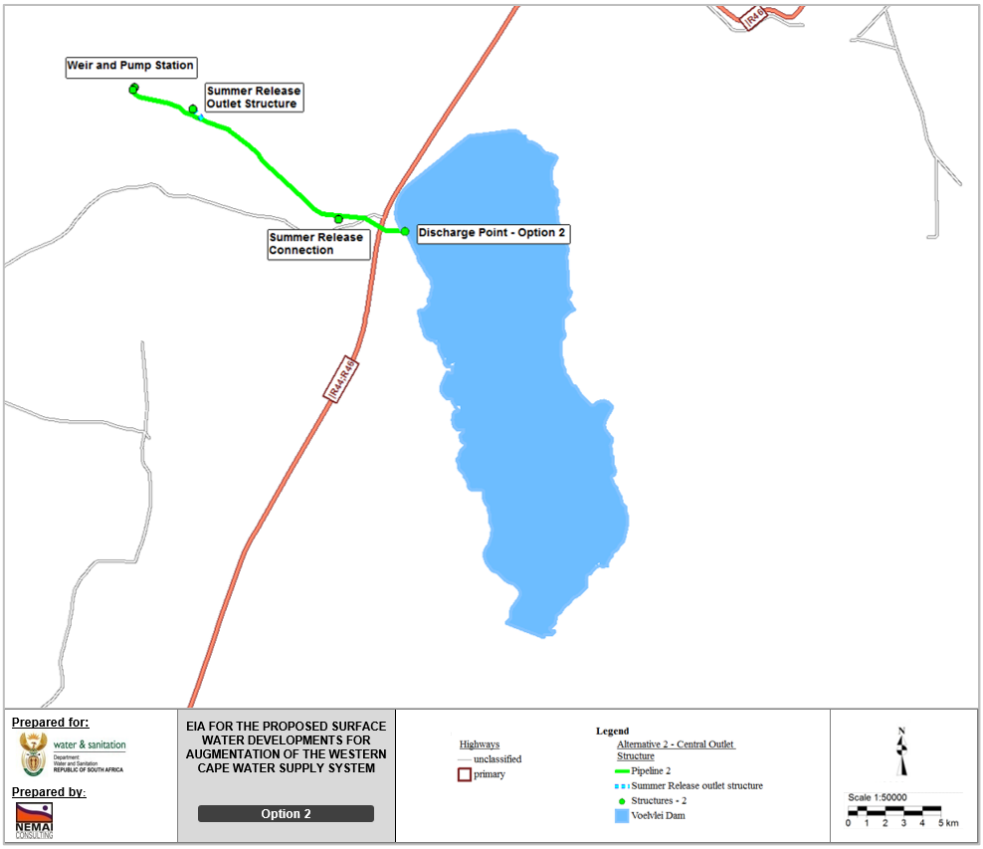


Figure 25: Option 2

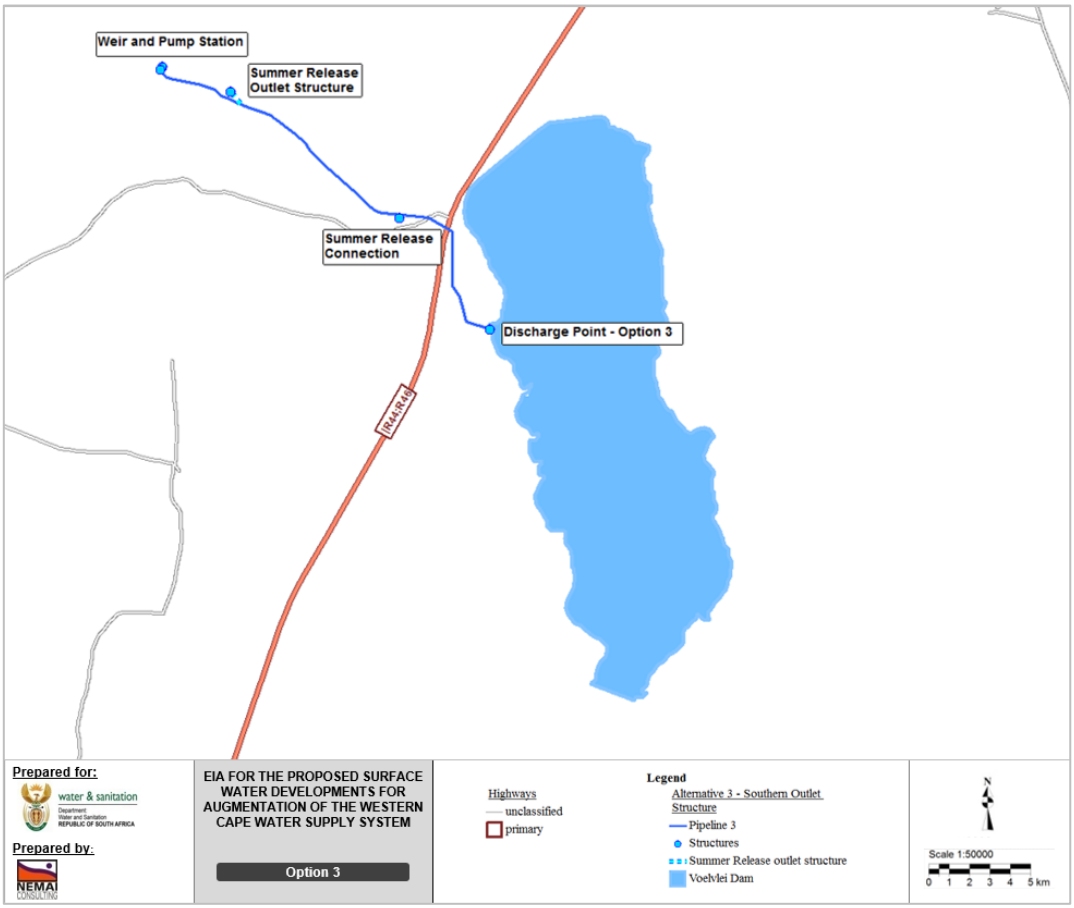


Figure 26: Option 3

8.3 No-go Alternative

The 'no-go' alternative refers to a situation where the proposed surface water development for augmentation of the WCWSS is not built. This would mean that there would not be the much needed increase in water supply to surrounding communities.

The future water requirement projections conducted in the WCWSS Reconciliation Strategy Study apply only to the CCT (including bulk water supplied by the CCT to Drakenstein and Stellenbosch Municipalities). The results of the future water requirements modelling indicate that the average growth in water demand for the high scenario is 3.09% per annum and for the low scenario is 1.43% per annum. The average of the two scenarios is approximately 2.26% per annum. In general, the average growth in water demand is lower than the economic growth rate and higher than the population growth rate.

Figure 27 shows the low water levels of the Voëlvlei Dam during the 2016 drought. If the augmentation of the WCWSS is not undertaken, these ow water levels will experienced frequently and the capacity of the dam will not be fully utilised and there would be no sufficient water to support the projected economic growth in the area. Future water requirements will not be met resulting in severe and frequent restrictions of supply. Even if the CCTs water conservation and water demand strategy remains successful, a severe limitation will be

evident in terms of the ability to support the projected growth and water requirements in the water supply area of the WCWSS.

Figure 27: Images of the low water levels of the Voëlvlei Dam

9 WULA PROCESS

9.1 Section 21 Water Uses

The proposed surface water developments for augmentation of the WCWSS requires authorisation from the DWS. In terms of Section 40 of the NWA, each party proposing a water use, as defined in Section 21 of the Act, must seek authorisation before such water use can commence. The water uses as set out in Section 21 of the Act apply to the proposed developments and therefore require authorisation are listed in **Table 9**:

Table 7: Water uses associated with the project

Water Use Type		Project Activities
Section 21(a)	Taking water from a water resource	• Water abstraction from the Berg River into Voëlvlei Dam.
Section 21(c)	Impeding or diverting the flow of water in a watercourse	• Instream works. • Traversing of delineated wetlands and riparian zone. • Developments within 500m of wetlands (regulated area): the rising main pipeline, access roads, weir, and pump station.
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse	

Water Use Type		Project Activities
		• The encroachment of the 1:100 floodlines by the rising main pipeline, access roads, weir, and pump station. • Discharge of water from the Berg River into Voëlvlei Dam.

According to Section 22 of the NWA a person may only use water under the following circumstances:

- Without a licence –
    - If that water use is permissible under Schedule 1;
    - If that water use is permissible as a continuation of an Existing Lawful Use; or
    - If that water use is permissible in terms of a General Authorisation issued under section 39;
- If the water use is authorised by a licence under this Act; or
- If the responsible authority has dispensed with a licence requirement under Section 22(3).

In the case of this project a licence is required to undertake the water uses that are associated with the project, based on the likely risk, nature, and extent of potential impacts of the proposed project on the affected water resources.

9.2 Formal Process

The broad administrative process for the water use authorisation is illustrated in **Figure 27**.

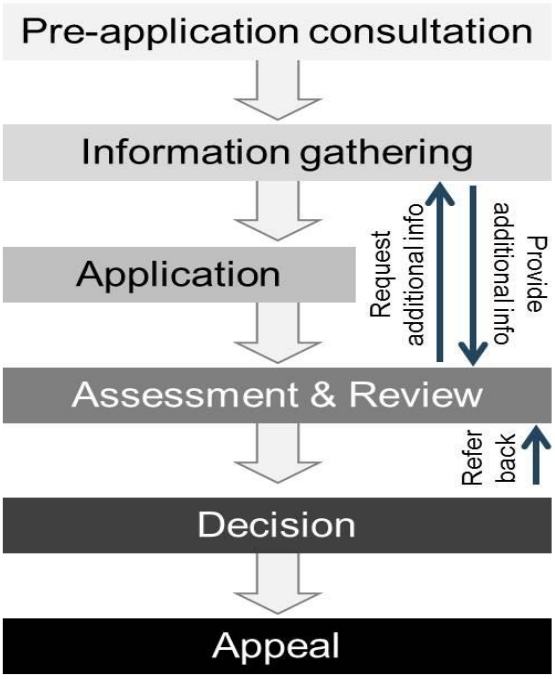


Figure 28: Generic Water Use Authorisation Business Process

9.3 Pre-Application Consultation Meeting

A pre-application consultation meeting and site visit will be conducted with the designated DWS official. Correspondence with DWS officials thus far regarding the project and the IWULA requirements can be referred to in **Appendix 11**.

9.4 Information Gathering

The primary sources of information presented in the IWULA include the following:

- Desktop evaluation (via literature review, specialist input, GIS, topographical maps and aerial photography) and site investigations;
- Technical Feasibility Study reports produced by DWS;
- Specialist studies conducted as part of the Scoping and EIA Process;
- Riparian Habitat and Wetland Delineation Impact Assessment;
- Input received from environmental Authorities; and
- Outcomes of the Public Participation Process.

The IWULA includes the following information:

1. Maps (**Appendix 1**);
2. Master Layout Plan showing locations and sizes of the construction camps (**Appendix 2**);
3. Technical Drawings and Method Statement (**Appendix 3**);

4. Stormwater Management Plan (**Appendix 4**);
5. IWULA Application and Supplementary Forms (**Appendix 5** and **Appendix 6**);
6. Riparian Habitat and Wetland Delineation Impact Assessment (**Appendix 7**);
7. EMPr (**Appendix 8**);
8. Monitoring Plan (**Appendix 9**);
9. Rehabilitation Plan (**Appendix 10**); and
10. DWS Correspondence.

9.5 License Application

The Licence Application Forms, as well as Supplementary Water Use Information Forms, are contained in **Appendix 5**.

The following Licence Application Forms were completed as part of the IWULA:

- Part 1:
  - DW757 Registration/Licensing Part 1 – Water Service Provider (Including Water Boards);
- Part 2 Application forms for water use licensing:
  - DW760 Licensing Part 2: Section 21(a) Taking Water from a Water Resource;
  - DW763 Licensing Part 2: Section 21(c) Impeding or Diverting the Flow of Water in a Watercourse;
  - DW768 Licensing Part 2: Section 21(i) Altering the Bed, Banks, Course or Characteristics of a Watercourse;
- Supplementary forms:
  - DW901 Property where water use occurs;
  - DW902 Details of Property Owner;
  - DW784pmp Taking Water from a Water Resource: Pump Technical Data; and
  - DW781 Supplementary Water Use Information - Section 21(c) and (i) Water Uses (Section 21(c) ~ impeding or diverting the flow of water in a watercourse, Section 21(i) ~ altering the bed, banks, course or characteristics of a watercourse).

9.6 Assessment and Review

This step involves the assessment and review of the IWULA by the designated DWS official at the Western Cape DWS Regional Office.

The official will study the licence application to determine if any additional information, investigations, or further consultation of Interested and Affected Parties (IAPs) is required. The applicant will be requested to meet any additional requirements.

When all the necessary information has been received, DWS will undertake a technical evaluation and assessment of the application. If issuing a licence is recommended, a draft licence containing the required conditions will be compiled. The Regional Office official will then submit the application, together with their recommendation, the draft licence, and the supporting documentation, to the relevant delegated authority, who will decide on the application after the Water Use Authorisation Assessment Advisory Committee (WUAAC) has adjudicated on the application.

9.7 Decision

The decision and the licence, if granted, will be returned by the relevant delegated authority to the official at the Western Cape DWS Regional Office, who will inform the applicant of the decision.

9.8 Appeal

The applicant, and any other person who has objected to the licence application, has a right of appeal to the Water Tribunal / Appeal Panel against the decision. An appeal must be made as prescribed in the NWA.

10 TRIGGERED WATER USE ACTIVITIES

10.1 Details of Water Uses

The proposed surface water developments for augmentation for the WCWSS traverses wetlands, falls within 500m of a wetland, encroaches the 1:100 year floodline, abstracts water from the Berg River at the weir and pump station location, and the rising main pipeline discharges the abstracted water into the Voëlvlei Dam.

Table 8 provides details of the intended water uses associated with the overall project.

Figures 29 to **36** provide the exact points for each water use trigger for the project. The maps are to be read in conjunction with **Table 8**.

The relevant Water Use License Forms for a Section 21 (a), (c) and (i) water use can be referred to in **Appendix 5**. The Supplementary Water Use Information for a Section 21 (a), (c) and (i) water use can be referred to in **Appendix 6**.

Table 8: Water uses to be authorised for the Surface Water Developments for Augmentation of the WCWSS

Project Component (BPEO)	Map Ref	Property Description	21 Digit Code	Water Use	Watercourse	Centre Point Coordinate	Catchment
Diversion Weir	1A	Portion 10 of Farm Half Gewaagd 73	C07500000000007300010	21 (a)	Wetland Abstraction	33°19'42.17"S 18°58'48.85"E	G10F
				21 (c) and (i)	Wetland Crossing		
	1B	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'44.00"S 18°58'48.18"E	
	1C	Portion 20 of Farm Half Gewaagd 73	C07500000000007300020	21 (c) and (i)	Floodline Encroachment	33°19'35.32"S 18°59'9.33"E	
Raising Main Pipeline	2A	Portion 3 of Farm Zonquasdrif 1129	C04600000000112900003	21 (c) and (i)	Wetland Crossing	33°19'54.88"S 18°59'23.29"E	
	2B	Portion 2 of Farm Sonquas Doordrift 648	C04600000000064800002	21 (c) and (i)	Wetland Crossing	33°19'58.24"S 18°59'33.06"E	
	2C	Portion 3 of Farm Zonquasdrif 1129	C04600000000112900003	21 (c) and (i)	Wetland Crossing	33°20'00.59"S 18°59'40.89"E	
	2D	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'43.01"S 18°58'47.13"E	
	2E	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'44.07"S 18°58'48.22"E	
	2F	Portion 0 of Farm Tulburgh Road 412	C07500000000041200000	21 (c) and (i)	Wetland 500m Buffer Encroachment	33°20'20.57"S 19°00'03.71"E	
Access Road 1	3A	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Wetland Crossing	33°19'40.30"S 18°57'17.93"E	
	3B	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Wetland Crossing	33°20'43.00"S 18°57'01.28"E	
	3C	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Wetland Crossing	33°20'58.37"S 18°57'32.09"E	
	3D	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'37.73"S 18°58'45.79"E	
Access Road 2	4A	Portion 2 of Farm Sonquas Doordrift 648	C04600000000064800002	21 (c) and (i)	Wetland Crossing	33°20'16.55"S 18°58'18.41"E	
	4B	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'42.25"S 18°58'45.88"E	

Project Component (BPEO)	Map Ref	Property Description	21 Digit Code	Water Use	Watercourse	Centre Point Coordinate	Catchment
Pump Station	5A	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'37.88"S 18°58'45.67"E	
	5B	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'38.55"S 18°58'45.78"E	
	5C	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'39.23"S 18°58'45.89"E	
	5D	Portion 1 of Farm Sonquas Doordrift 648	C04600000000064800001	21 (c) and (i)	Floodline Encroachment	33°19'39.49"S 18°58'45.70"E	
Summer Release Connection	6A	Portion 2 of Farm Sonquas Doordrift 648	C04600000000064800002	21 (c) and (i)	Wetland Crossing	33°19'53.37"S 18°59'25.37"E	
	6B	Portion 1 of Farm 201	C07500000000020100001	21 (c) and (i)	Wetland 500m Buffer Encroachment	33°20'46.77"S 19°0'52.28"E	
Discharge Point	7A	Portion 0 of Farm Vogel Valley	C07500000000020700000	21 (c) and (i)	Voëlvlei Dam	33°21'35.98"S 19°01'38.96"E	
Developments within 500m of wetlands: • Diversion Weir • Raising Main Pipeline • Access Road 1 and 2 • Pump Station • Summer Release Connection	All refs above	All properties described above	All properties described above	21 (c) and (i)	Wetlands 500m Buffer Encroachment	All Coordinates provided above	

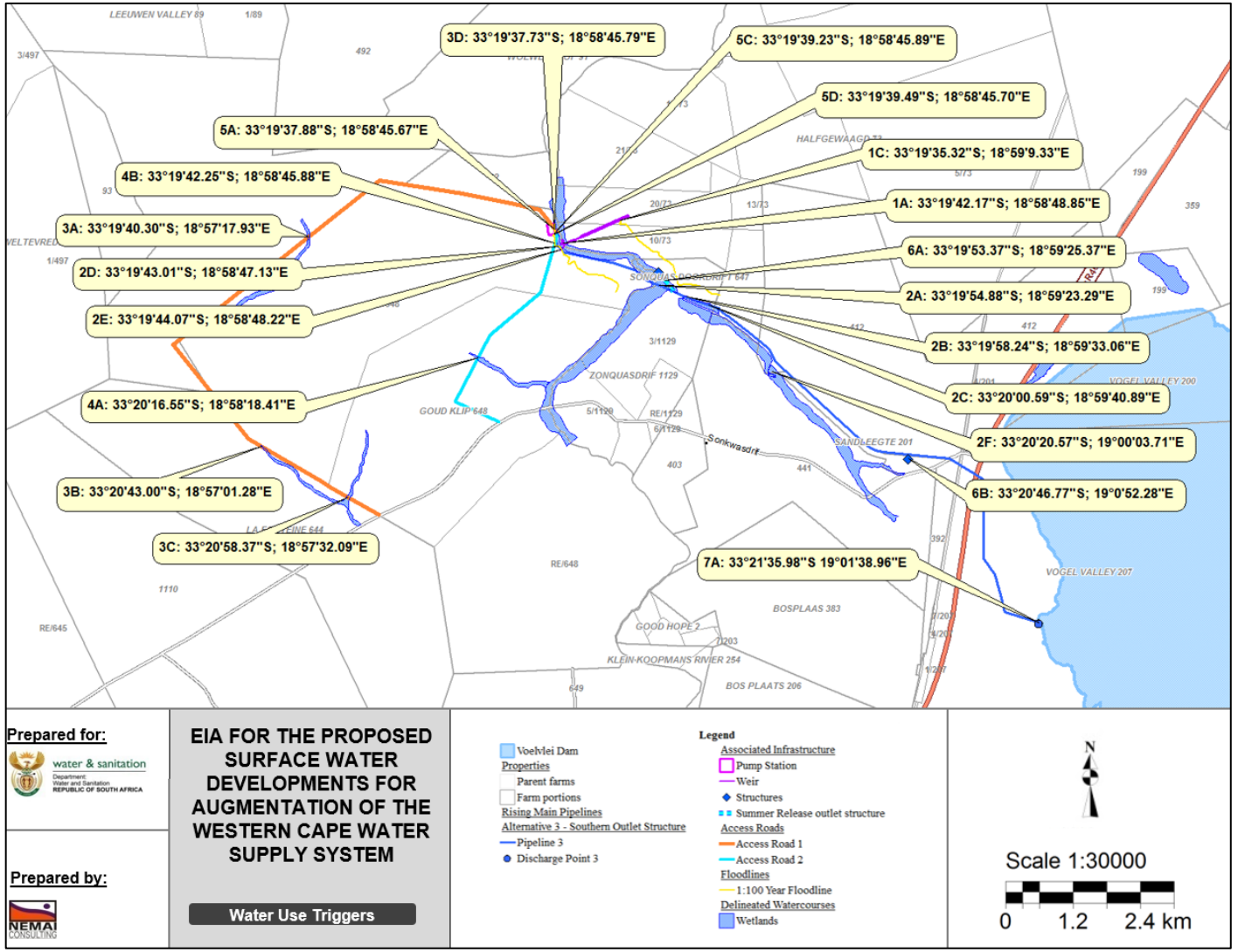


Figure 29: Water Use Triggers for Proposed Surface Water Developments for Augmentation of the WCWSS

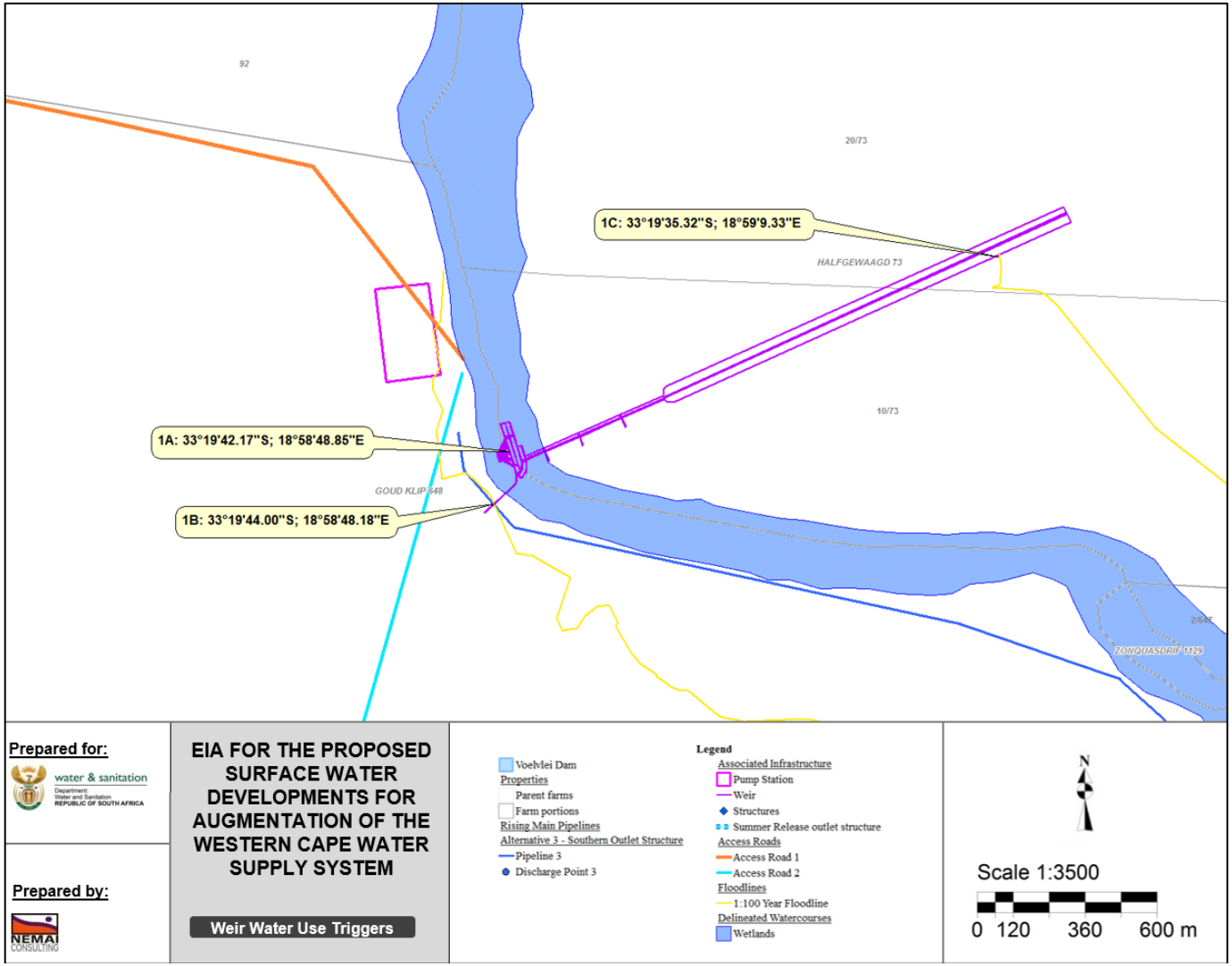


Figure 30: Water use triggers for the weir

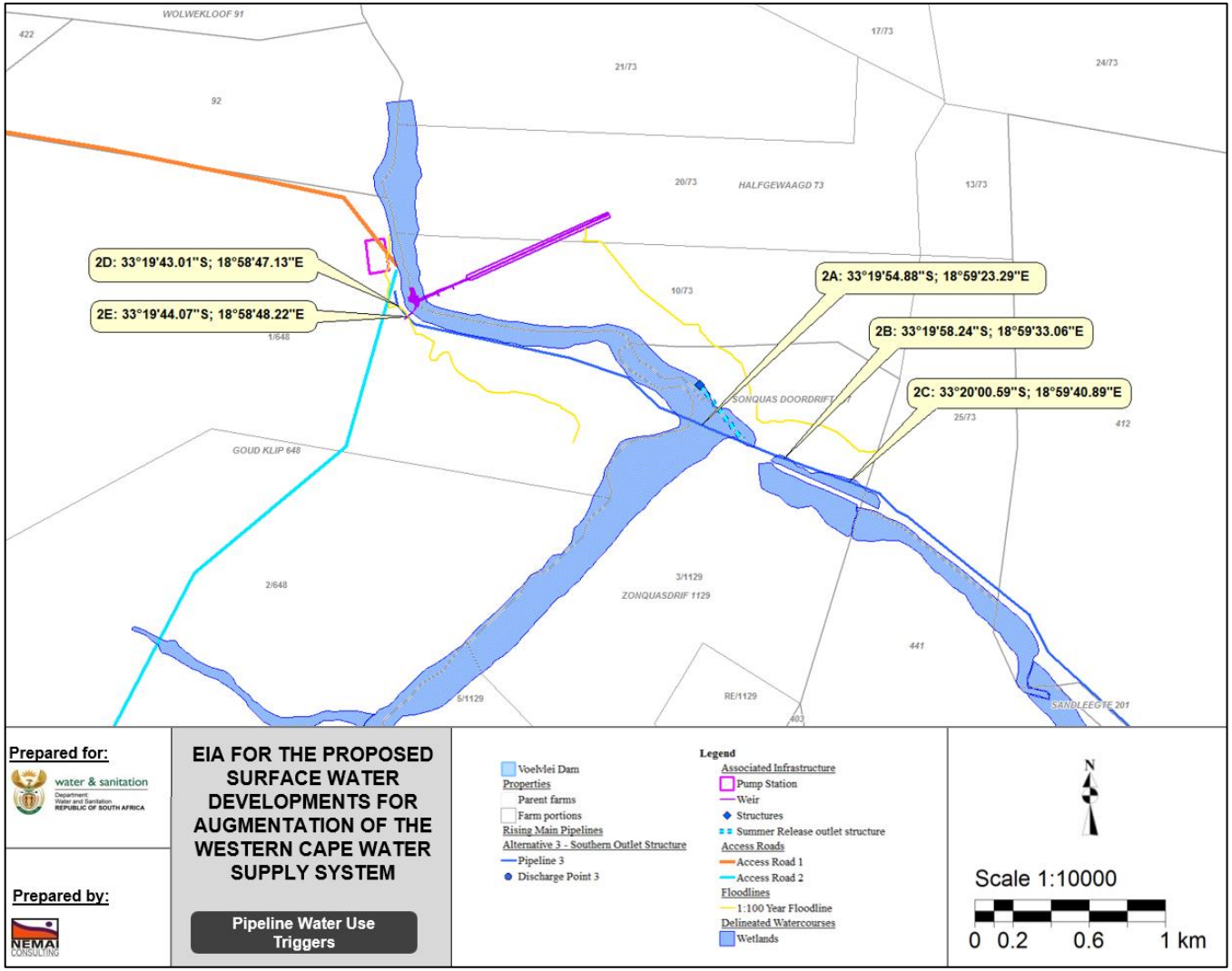


Figure 31: Water use triggers for the rising main pipeline

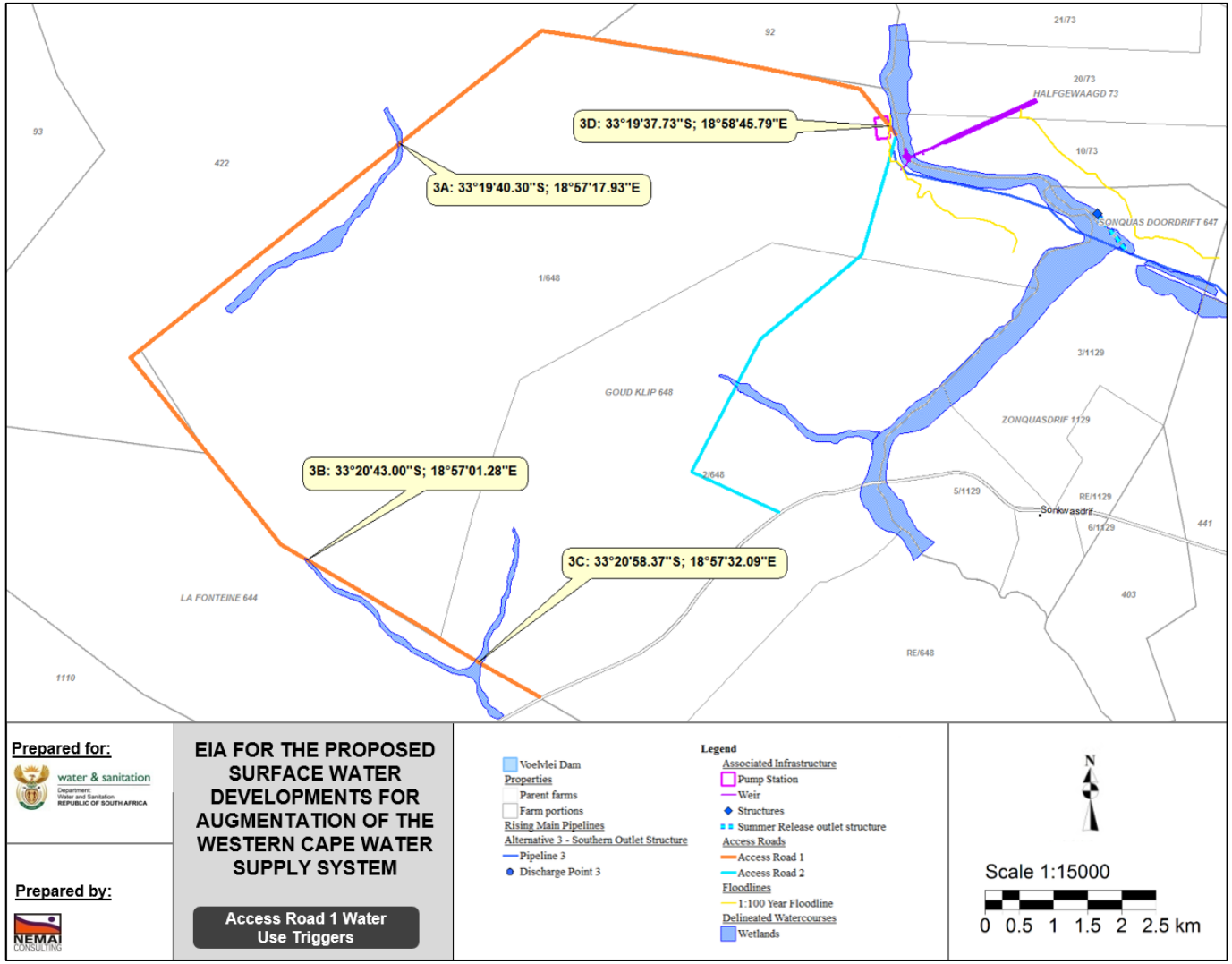


Figure 32: Water use triggers for access road 1

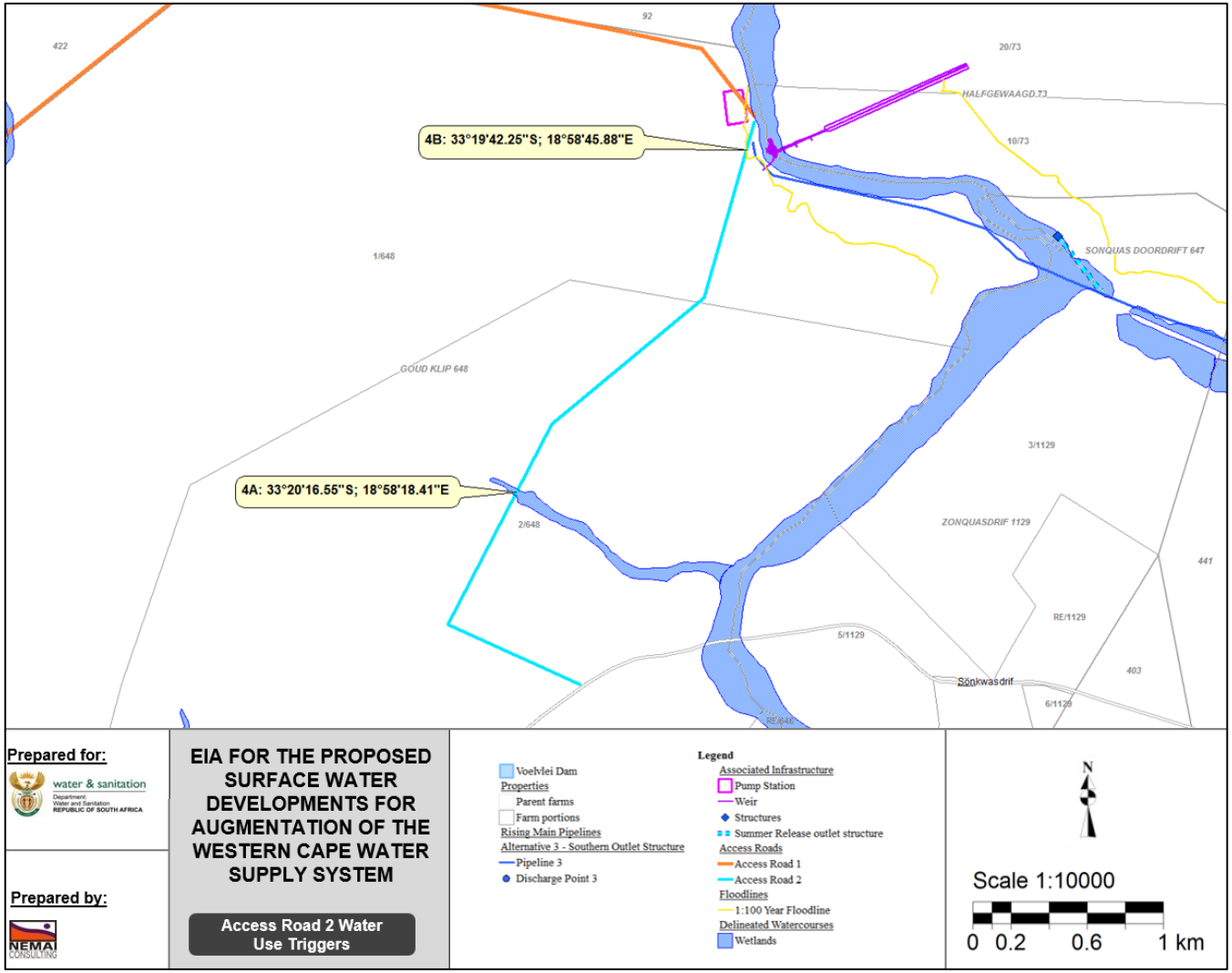


Figure 33: Water use triggers for access road 2

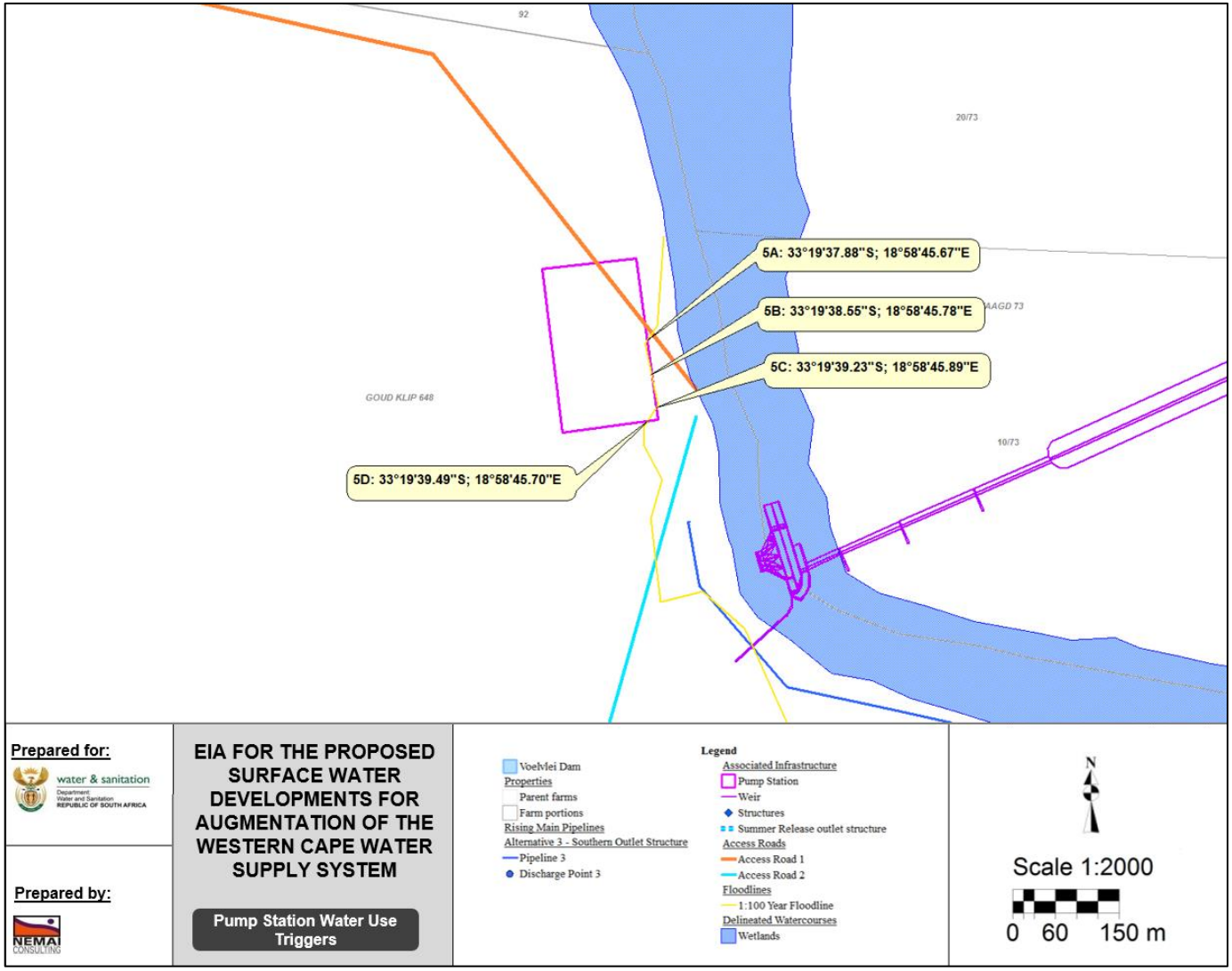


Figure 34: Water use triggers for the pump station

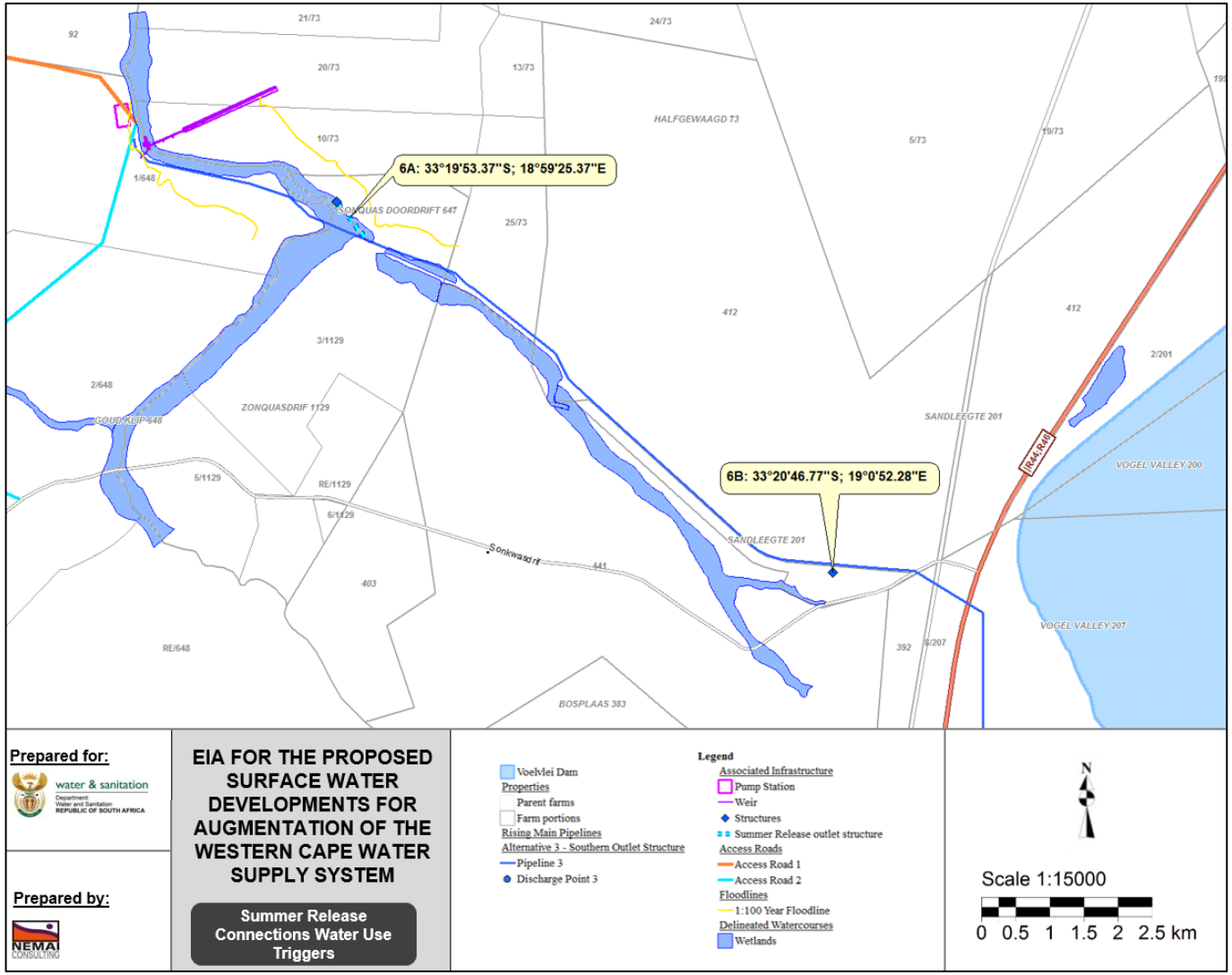


Figure 35: Water use triggers for the summer release connections

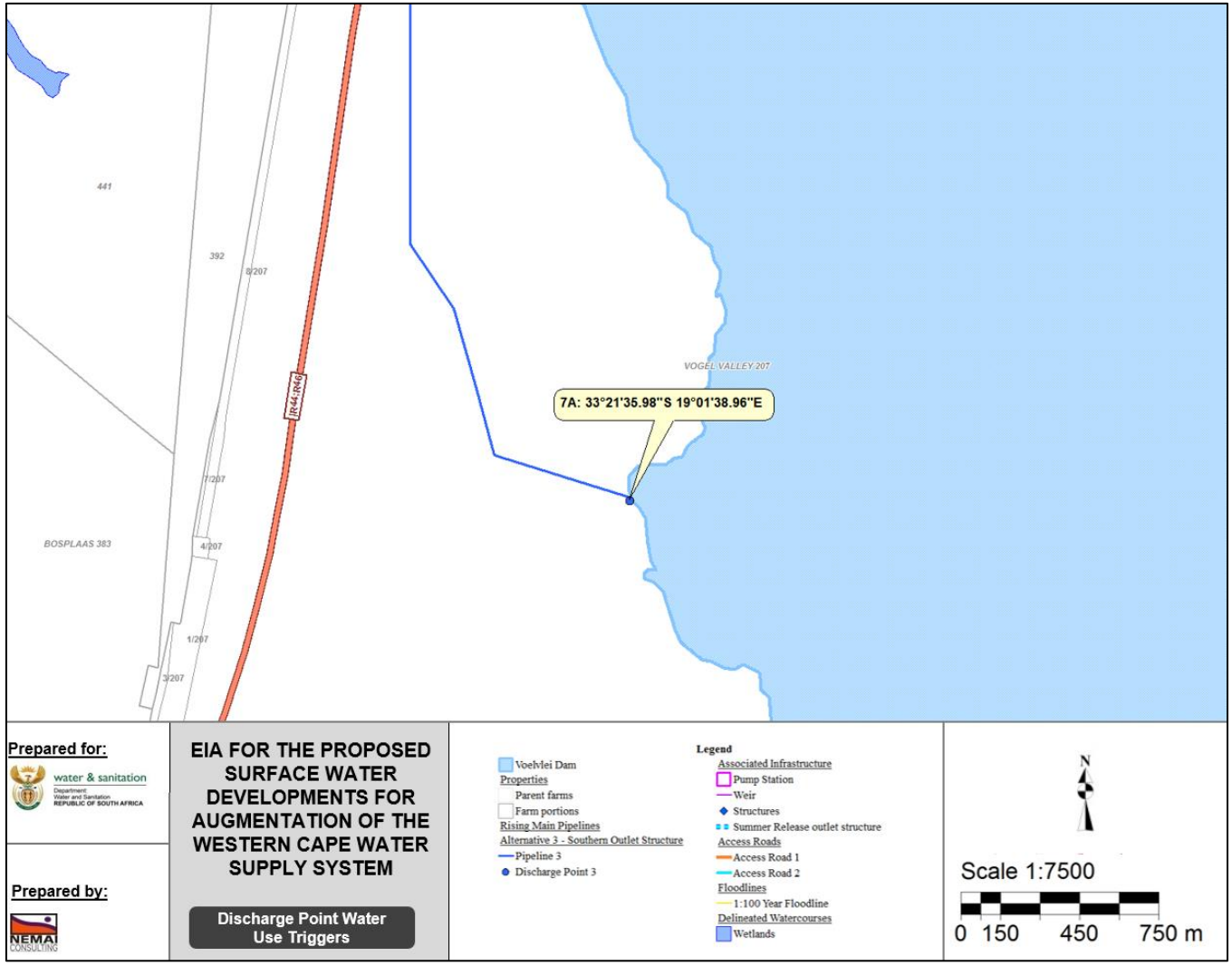


Figure 36: Water use triggers for the discharge point

10.2 Explanation of Water Uses

10.2.1 Section 21(a) – Taking water from a water resource

The proposed surface water developments for augmentation for the WCWSS involves the pumped abstraction of winter water from the Berg River, once the requirements of the EWR have been met.

According to the Reserve for the Berg River Estuary, the required stream flow into the estuary during the summer months should vary between 0.6 and 0.9 m^3/s. To provide the required Reserve inflows to the estuary would require that additional releases of between 0.3 m^3/s and 0.6 m^3/s be made from Voëlvlei Dam, particularly during the four summer months from December to March. Therefore, the conservative assumption has been made in the system modelling of the proposed scheme that an additional release of 0.5 m^3/s should be made from Voëlvlei Dam for the four summer months.

The scheme therefore proposes to construct a 4 m^3/s pump station with a stepped-pump operating rule that works in 1 m^3/s increments up to a pump station capacity of 4 m^3/s and allows a base flow of 1 m^3/s to pass the site at all times.

10.2.2 Section 21(c) – Impeding or diverting the flow of water in a watercourse

The following definitions from NWA apply to this water use:

- "Impeding the flow" means the temporary or permanent obstruction or hindrance to the flow of water in a watercourse by a structure built either fully or partially in or across a watercourse; and
- "Diverting the flow" means a temporary or permanent structure causing the flow of water to be rerouted.

The flow of water will be impeded and diverted to allow for construction work to be undertaken within watercourses, by creating dry works areas and safe working environments, whilst minimising impacts to the downstream flow regime. This applies to all the proposed surface water developments for augmentation of the WCWSS as the developments falls within 500m of a wetland, encroach on the 1:100 year floodline, and traverse wetlands.

10.2.3 Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse

This water use means any change affecting the resource quality of a watercourse, which constitutes the following:

1. The quantity, pattern, timing, water level and assurance of instream flow;
2. The water quality, including the physical, chemical and biological characteristics of the water;
3. The character and condition of the instream and riparian habitat; and

4. The characteristics, condition and distribution of the aquatic biota.

This use applies to the regulated area of a watercourse, which is the riparian habitat or the 1:100 year floodline, whichever is the greater distance; as well as any area within 500m of a wetland.

This water use applies to all the proposed surface water developments for augmentation of the WCWSS as discussed in Section 11.2.2.

11 SECTION 27 OF THE NATIONAL WATER ACT, 1998

11.1 Section 27 (1)(a) – Existing Lawful Water Users

The IWULA for the proposed surface water developments for augmentation of the WCWSS constitutes a new water use, and therefore there are no existing water use licenses previously issued for the site.

11.2 Section 27 (1)(b) – Contributions to Redress the Results of Past Racial and Gender Discrimination

The construction phase of the project will contribute to redressing the results of past racial and gender discrimination by taking full advantage of the employment opportunities that will be generated for local labourers. Employment opportunities will be created during the construction phase and operational phase. The proposed development will also provide water services to the area. This project will allow further economic growth and development within the area and therefore is of importance as the local area will benefit from this development in general.

11.3 Section 27 (1)(c) – Efficient and Beneficial Use of Water in the Public Interest

The implementation of the proposed developments will uplift the community and surrounding agricultural areas through the increased water supply to the area. In addition, the project will ensure that less water is lost through leakages and breakages.

11.4 Section 27 (1)(d)i – The Socio-Economic Impact of the Water Use/s if Authorised

The surrounding agricultural areas, WTWs, and the two District Municipalities receive water from the dam and there is currently an increased demand for water that becomes more difficult

to address due to water shortages, therefore an increase in the amount of water supplied is needed in the area.

The granting of the water use license will allow for the proposed development to increase the water supply to surrounding communities and provide future water to the area, therefore maintain the health and the standard of living for the community, as well as maintain the farming activities within the area.

With regards to the construction phase of the project, employment opportunities will be provided to emerging contractors and labour (previously disadvantaged individuals).

11.5 Section 27 (1)(d)ii – The Socio-Economic Impact of the Water Use if not Authorised

If the proposed surface water development for augmentation of the WCWSS is not built, there would not be the much needed increase in water supply to surrounding communities and agricultural areas.

The future water requirement projections conducted in the WCWSS Reconciliation Strategy Study apply only to the CCT (including bulk water supplied by the CCT to Drakenstein and Stellenbosch Municipalities). The results of the future water requirements modelling indicate that the average growth in water demand for the high scenario is 3.09% per annum and for the low scenario is 1.43% per annum. The average of the two scenarios is approximately 2.26% per annum. In general, the average growth in water demand is lower than the economic growth rate and higher than the population growth rate.

If the augmentation of the WCWSS is not undertaken, the low water levels will experienced frequently and the capacity of the dam will not be fully utilised and there would be no sufficient water to support the projected economic growth in the area. Future water requirements will not be met resulting in severe and frequent restrictions of supply. Even if the CCTs water conservation and water demand strategy remains successful, a severe limitation will be evident in terms of the ability to support the projected growth and water requirements in the water supply area of the WCWSS.

The socio-economic benefits, including additional economic activity in the region, and employment opportunities will not be realised.

11.6 Section 27 (1)(e) – Relevant Catchment Management Strategies and Local Government Planning Frameworks that Support the Proposed Water Use/s

The Berg River Catchment covers an area of almost 9 000 km^2 and is the largest catchment in the Western Cape Province. The Berg River Catchment comprises 12 quaternary catchments that vary significantly in size.

Much of the catchment area is flat, with an average topographical gradient between Paarl and the mouth of the Berg River at Laaiplek of 0.001. Topographically, a north-trending ridge of mountains (Piketberg, Swartberg) divides the catchment in two, with the Berg River flowing through a poort between Koringberg and De Hoek. Mountains that reach in excess of 1 000m elevation flank the north trending valley in the eastern part of the catchment, including the Groot Winterhoek Mountains, Kasteelberg, Perdeberg, Paarl Mountain and the Wemmershoek Mountains.

The Berg River Catchment experiences a Mediterranean climate with warm dry summers and cool wet winters. Rainfall is of a cyclonic nature, extending normally over a few days with significant periods of clear weather in between. Little rain falls during summer, with the rainy season extending from April through to October.

Current government objectives for managing water resources in South Africa are set out in the National Water Resources Strategy (NWRS) as follows:

- To achieve equitable access to water.
- To achieve sustainable use of water.
- To achieve efficient and effective water use.

There is an urgent need to provide water services to communities within South Africa.

A range of schemes to increase water supply to both agricultural and urban users within the Berg River Catchment are either in progress or planned. Some of these are within the Berg River catchment, whilst others involve interbasin transfers into the Berg River or its tributaries. The BRVAS scheme is one of the schemes highlighted to increase water supply, therefore the current proposed project falls within the management strategy and governmental planning for the area.

11.7 Section 27 (1)(f) – The Likely Effect of the Water Use on the Water Resource and on other Water Users

The impacts of the project on the water resources and water users are assessed in **Section 15**.

11.8 Section 27 (1)(g) – Class and Resource Quality Objectives (RQO"s) of the Water Use/s

The project area is situated in the Berg WMA in quaternary catchment G10F (**Figure 36**).

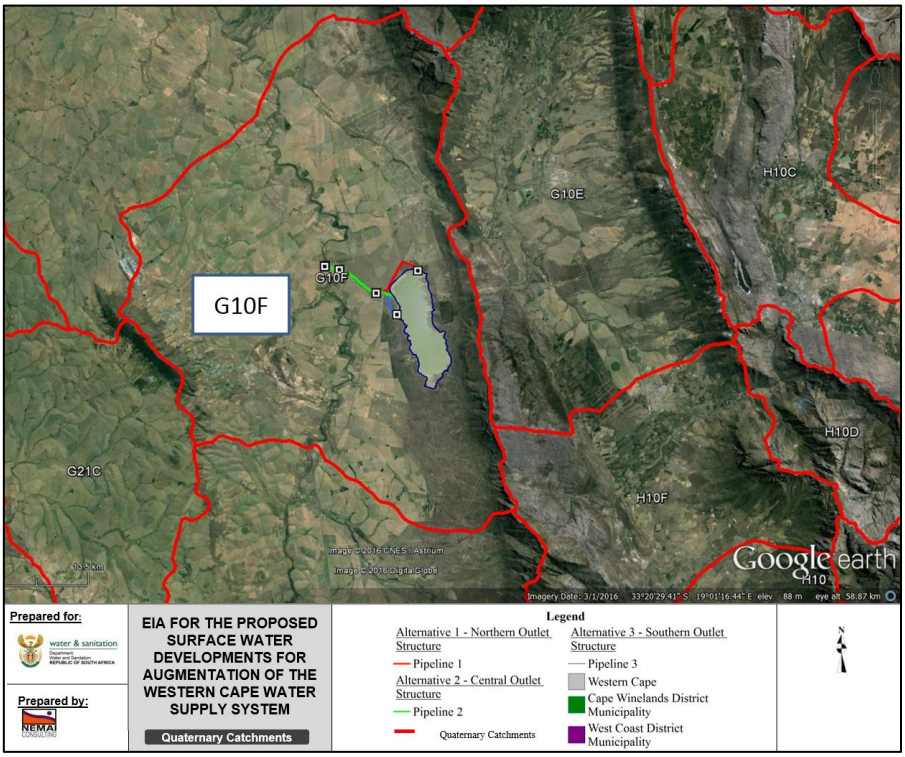


Figure 37: Quaternary Catchment Map

During the Feasibility Studies conducted for the potential development of further surface water supply schemes for WC, an Ecological Water Requirement Assessment for the Berg River Estuary was compiled.

In addition to being categorised as a 'highly important estuary', the Berg River Estuary has also been targeted as a Desired Protected Area (DWAF 2004a). Therefore, according to the guidelines for assigning a recommended ERC, the condition of the estuary should be elevated to a Category A or the Best Attainable State (BAS).

Table 9 below summarises future runoff scenarios that were evaluated during the Feasibility Studies conducted.

Table 9: A summary of the suite of future runoff scenarios evaluated. Each comprises different inflow scenarios from the Berg catchment.

Scenario Name	Scenario Description	Summer lowflow (m^3s-1)	Historic Firm Yield (Mm^3)	Historic Firm Yield: wrt. BRD (%)	Revised Estuary MAR (1920-2004)
Present state	Present day with Berg River Dam in Place	0.3	547	0	500

Scenario Name	Scenario Description	Summer lowflow (m^3s-1)	Historic Firm Yield (Mm^3)	Historic Firm Yield: wrt. BRD (%)	Revised Estuary MAR (1920-2004)
Scenario 1	Present day without Berg River Dam	0.3	462	-85	594
Scenario 2	Augmentation of Voelvlei dam - Phase1 - No raising. $3m^3s^{-1}$ diversion	0.3	574	27	471
Scenario 3	Augmentation of Voelvlei dam - Phase2a - No raising. $20m^3s^{-1}$ diversion	0.3	591	44	450
Scenario 4	Augmentation of Voelvlei dam - Phase2b - $20m^3s^{-1}$ diversion, raise Voelvlei dam by 9 m	0.3	613	66	394

11.9 Section 27 (1)(h) – Investments already made and to be made by the Water User in respect of the proposed Water

Investment has been made in the planning and design of the proposed surface water developments for augmentation of the WCWSS.

11.10 Section 27(1)(i) – The strategic importance of the water use to be authorised

The proposed surface water developments for augmentation of the WCWSS will ensure that the much needed increase in water supply to surrounding communities and agricultural areas is implemented. There will also be socio-economic benefits, including additional economic activity in the region, and employment opportunities.

11.11 Section 27 (1)(j) – Quality of Water in the Water Resource which may be required for the reserve and for Meeting International Obligations (S27 (1)(j))

The water quality of the Berg Estuary and Berg River was considered during the Feasibility Studies conducted.

Day (2007) noted that there are no water quality records for the Berg River in an unimpacted state (reference condition). However, based on the catchment geology and the earliest data that are available, the river can be characterised in its upper reaches by naturally acid, low-nutrient, low conductivity waters. These characteristics altered with distance downstream, being highly dependent on both the underlying geology and flow conditions. Therefore even under the reference condition, the river would have shown a strong trend of increasing conductivity, increasing nutrients and increasing pH with distance downstream.

No recent data were available on toxic substance accumulation in the Great Berg Estuary. However, given the strong influence of agriculture in the catchment, the use of pesticides is assumed to be widespread and the likelihood of pesticide-contaminated runoff reaching the estuary is high. Also, the fishing harbour and marina in the lower reaches of the estuary is likely to introduce some trace metal and hydrocarbon pollutants into the system.

Voëlvlei Dan has been experiencing more frequent algal blooms since the drought of 2004/5 changed the character of the dam from a stable clear water dam dominated by rooted water plants and predatory fish to a stable turbid dominated by free-floating algae (phytoplankton) and bottom feeding fish.

The option to transfer water from the Berg River would, in the short term, probably not have a significant impact on salinity in Voëlvlei Dam. However, such a transfer would probably have a detrimental impact on the in-lake nitrogen and chlorophyll a concentrations, leading to increased problems with nuisance algae and the associated cost of treating the water to potable water standards.

The quality of the watercourses that are impacted on by the proposed surface water developments for augmentation of the WCWSS is discussed in more detail in Section 14. The full Riparian Habitat and Wetland Delineation Impact Assessment can be referred to in **Appendix G**.

11.12 Section 27 (1)(k) – The Probable Duration of any Undertaking for which a Water Use is to be Authorised

Maximum duration is applied for. No decommissioning phase of the surface water developments for augmentation of the WCWSS is anticipated.

12 PROFILE OF THE RECEIVING AQUATIC ENVIRONMENT

This section provides a general description of the status quo of the receiving environment in the project area for aquatic resources only. The entire receiving environment can be referred to in the Draft EIA Report. It also allows for an appreciation of aquatic sensitive environmental features and possible receptors of the effects of the proposed surface water developments for augmentation of the WCWSS.

Refer to **Section 14** for more elaborate explanations of the Specialist Studies and their findings for specific environmental features. The potential impacts to the receiving environment are discussed further in **Section 15**.

12.1 Surface Water

12.1.1 Hydrology

Voëlvlei Dam falls within the Berg River Catchment which is approximately 9 000 km^2 in size (DWAF, 2007). The catchment also falls within the Berg WMA within the Quaternary Catchment G10F (**Figure 38**).

The Berg River is a naturally perennial system, which rises near Dwarsberg in the Franschoek and Drakenstein mountains at an altitude of 1 500 m. It drains an area of approximately 8 980 km² (DWAF 2004), before passing into the Atlantic Ocean via the Berg River Estuary, near Veldrif, some 285 km away, on the West Coast (RHP, 2004) (DLM, 2009). The Berg River has 19 major tributaries, with a total natural runoff from its catchment amounting to ca. 931 Mm^3/a (DWA, 2007).

The major perennial tributaries of the Berg River include the Franschoek, Wemmershoek, Dwars, Matjies, Klein Berg and Twenty Four Rivers/Leeu Rivers (DLM, 2009). Total natural runoff from the Berg River Catchment amounts to 931 million m^3/a, 45% of which is generated in quaternary catchments G10A, G10B and G10C (DWAF, 2007).

Three major dams have been built in the catchment (DLM, 2009). The Wemmershoek Dam south east of Paarl has a surface area of 3 km^2 and a storage capacity of 66 Mm^3. The Berg River Dam in close proximity to the Wemmershoek Dam covers an area of 5 km^2 and has a storage capacity of 130 Mm^3. The Vöelvlei Dam west of Tulbagh covers an area of 15 km^2 and has a storage capacity of 170 Mm^3. Numerous smaller farm dams are found throughout the eastern part of the catchment. Despite all the dams, which have controlled natural flood regimes in the downstream catchment, the Berg River in the Drakenstein region has a very high energy potential and regularly overflows its banks. In certain areas the banks are eroded causing damage to farmlands (DLM, 2009).

DWAF (1993) estimated present-day annual runoff of the Berg River amounted to 682 million m^3/a, with the modified flow attributed to direct abstraction from the river for irrigation, storage and abstraction for urban water supply, development of forestry within the basin, irrigation return flow, and releases from the Voëlvlei, Wemmershoek and Theewaterskloof Dams (the latter via the Berg River Syphon).

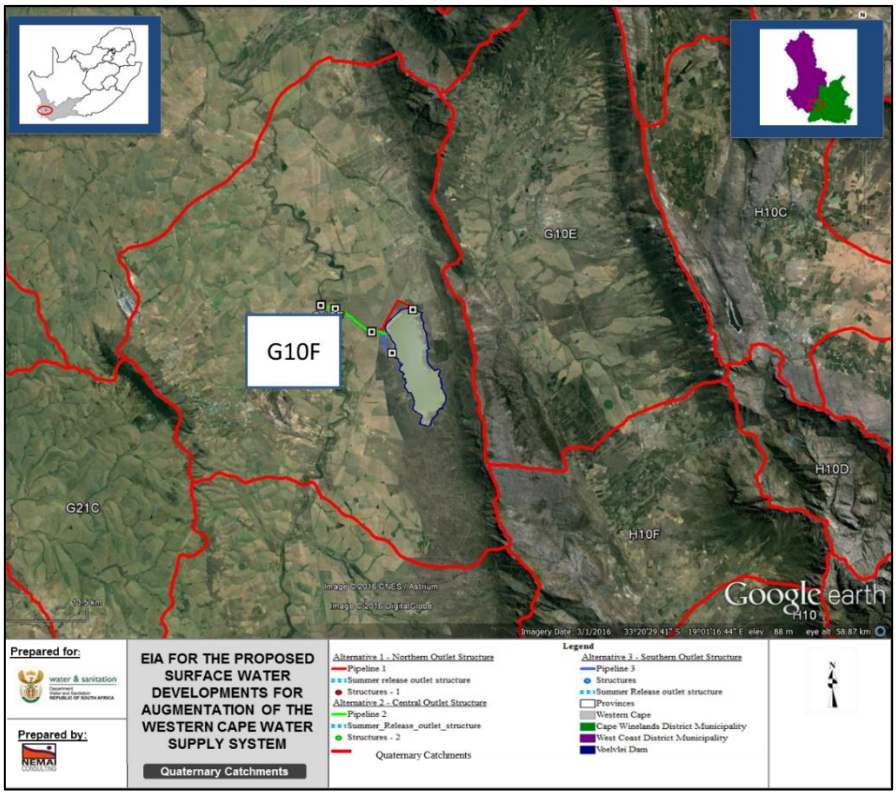


Figure 38: Quaternary Catchment

The IHAS results for the survey are presented in **Table 10**. According to the IHAS results, habitat availability for aquatic macroinvertebrates was **Good** in the Berg River. The Berg River reach sampled was characterised mostly by deep slow water with adequate marginal vegetation. These deep runs were mostly too deep to sample. A short section of shallow water was sampled. This section consisted of alternating areas of slow to fast flowing waters over stones, sand and gravel with some mud parches. Fair marginal vegetation was present. The section was characterised by a variety of riffles, runs and pools. The water clarity was somewhat limited due to eutrophic conditions experienced, blocking light penetration through the water column.

Table 10: IHAS score at the two sites during the survey

Site	Berg River	Voëlvlei Dam
Score	79	N/A
Suitability	**Good**	**N/A**

Site	Berg River	Voëlvlei Dam
Flow	0.2 - 0.4 m/s	Dam (75% full)
Clarity (cm)	35cm (Eutrophic)	20cm (Turbid)

12.1.2 Affected Watercourses

The proposed developments will be located along the Berg River (**Figure 39**) and associated tributaries, as well as be discharging into the Voëlvlei Dam (**Figure 40**). There are also a number of National Freshwater Ecosystem Priority Areas (NFEPA) wetlands identified within the vicinity of the Voëlvlei Dam.

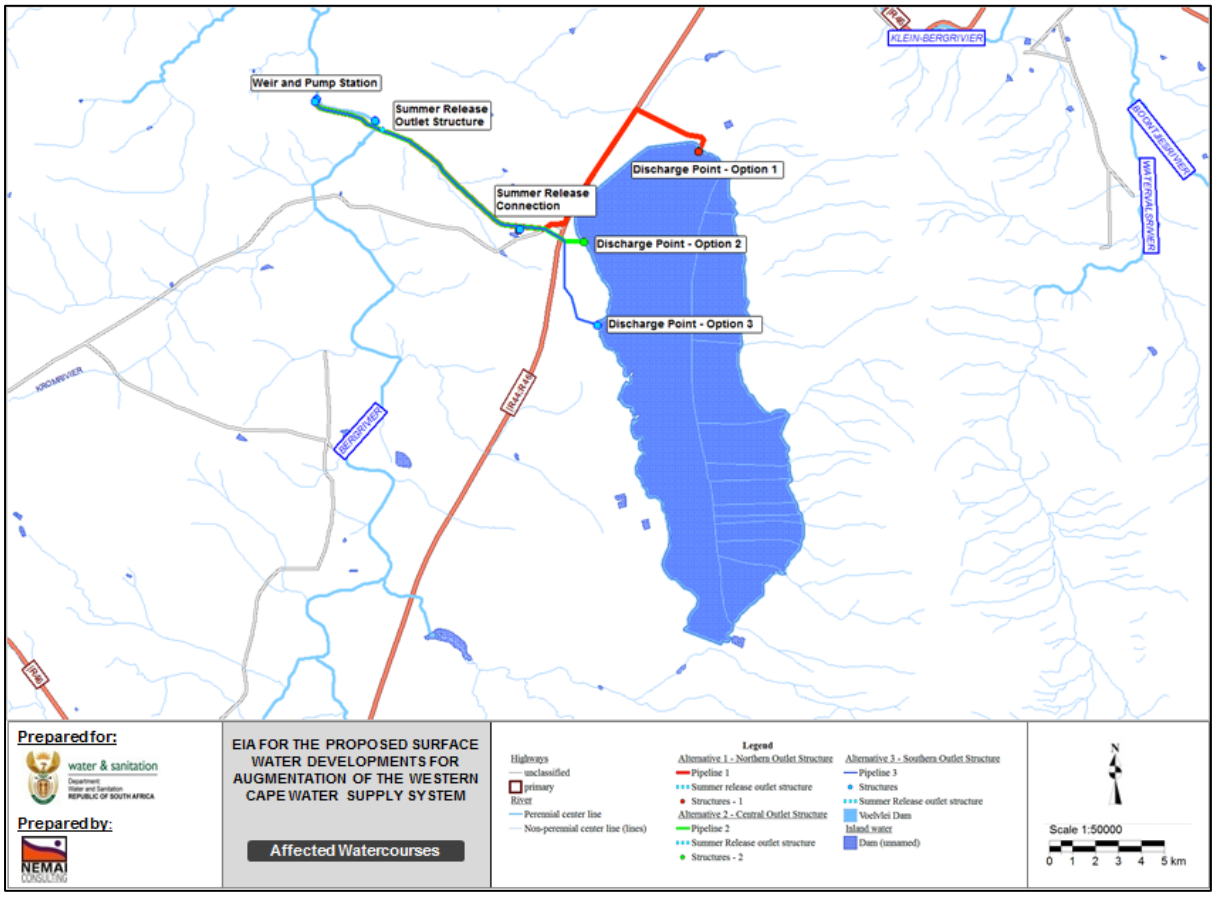


Figure 39: Affected Watercourses according to the NFEPA database

Figure 40: Berg River

The NFEPA data does not identify any wetlands occurring along the pipeline route. However, during a site assessment, a wetland was identified along the route that may be affected by the proposed developments (**Figure 41**).

Figure 41: Wetland identified along the pipeline route

Numerous wetland types were identified and delineated for the study. These include valley bottom systems, hillslope seeps, depressions and the Berg River floodplain. The extent of the delineated wetland (and riparian) areas for the project, and the corresponding HGM types is presented in **Figure 42** and listed in **Table 11**.

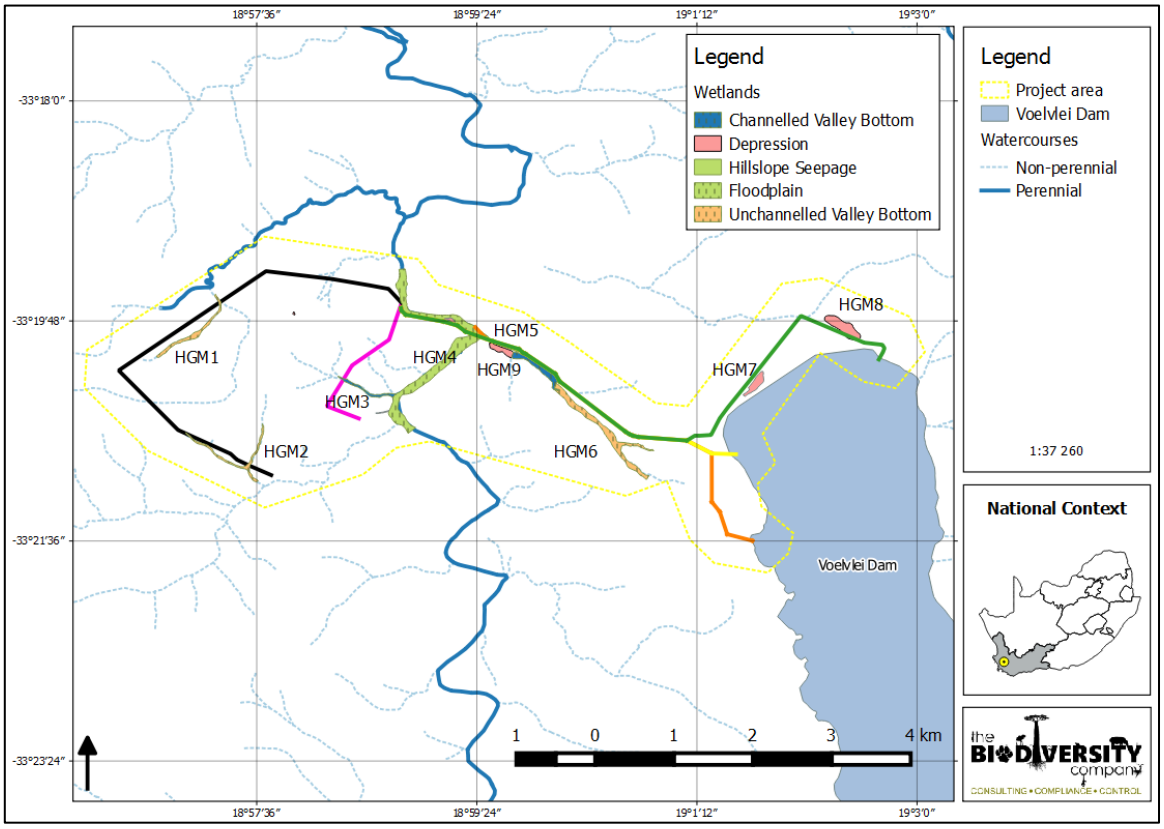


Figure 42: The delineated wetland HGM units for the study

Table 11: An indication of the identified wetland types for each HGM unit

System	HGM Type
HGM1	Unchannelled valley bottom wetland
HGM2	Unchannelled valley bottom wetland
HGM3	Channelled valley bottom wetland
HGM4	Floodplain
HGM5	Hillslope Seepage
HGM6	Unchannelled valley bottom wetland
HGM7	Depression
HGM8	Depression
HGM9	Depression

12.1.3 Ecological Status

The Current Ecological Status results for the October 2016 survey are presented in **Table 12**. The PES result is shown for each of the assessment components. Based on this assessment, the Current Ecological Status of the Berg River reach is considered to be seriously modified

(Class E), while the Voëlvlei Dam is considered to be largely modified (Class D). However, it should be noted that, as the results are based on single survey, the confidence level for the Current Ecological Status assessment is considered to be low.

Table 12: Current Ecological Status assessment based on the PES of the various assessment components

Assessment Components	PES Score	
	Berg River	Voëlvlei Dam
Instream Habitat	D	N/A
Riparian Habitat	D	N/A
Macroinvertebrates	C	N/A
Fish	Seriously modified	Seriously modified
Current Ecological Status	**E**	**D**

The riparian habitat associated with the Berg River was determined to be largely modified (PES category D) indicating a system that has experienced a large loss of natural habitat, biota and basic ecosystem function.

The PES of the wetland systems varied from largely moderately modified (Class C) to largely modified (Class D), with none of the systems considered to be natural or largely modified.

12.1.4 Aquatic Biota

The health of the Berg River system was investigated in the State of Rivers Report: Berg River System conducted in 2004. The proposed study area is located in the Lower Middle Berg River section of the Berg River. Overall, the present state of the study area is poor to fair.

Diversion weirs in the Klein Berg and Twenty Four rivers have altered flow patterns. Alien fish (bass and banded tilapia) are widespread and have led to the disappearance of indigenous fish (Berg River redfin and whitefish). River health is also reduced by the effects of agriculture (levees and pesticide residues). Water quality and habitat integrity near Tulbagh are poor.

The aquatic macroinvertebrate results for the Berg River sampling reach is presented in **Table 13**. Based on the ASPT scores, the aquatic macroinvertebrate communities for the sampling reach comprised primarily of tolerant taxa (Intolerance Rating < 5) in high abundances. The macroinvertebrate communities also included some semi-intolerant taxa (Intolerance Rating 5 - 10) in low abundances. Findings from aquatic macroinvertebrate assessment indicated the community comprised primarily of tolerant taxa, suggesting a level of water quality impairment for the system. The status of the macroinvertebrate community was determined to be moderately modified.

Table 13: Macroinvertebrate assessment results

Site	Berg River
SASS Score	50
No. of Taxa	12
ASPT*	4.17
Category	C

*ASPT: Average score per taxon

12.1.5 Water Quality

The water quality at Voëlvlei Dam has been monitored by DWS since 1969. However sampling has not occurred since 2011.

In general, poor quality effluent discharged from the Tulbagh Waste Water Treatment Works (WWTW), winery effluent discharged into the Klein Berg River, and pollution from informal settlements contributes to the poor water quality in the river and therefore at the Dam. Vandalism and pipe blockages in the reticulation system cause spills from manholes into the stormwater system. In addition, the water quality problem in the Klein Berg River is exacerbated at the start of winter due to diffuse pollution being washed into the river from adjacent informal settlements. As a result it is desirable that the runoff from the first winter rains is not diverted into Voëlvlei Dam (DWAF, 2004).

Turbidity is also an issue at the Dam and may be due to a number of issues including the proliferation of the illegally introduced alien sharptooth catfish (*Clarias gariepinus*). In addition, carp are known to increase turbidity as they are bottom feeders and stir up the sediment.

De Villiers (2007) investigated the long term trends of the nutrient status of the Berg River and found that inorganic nitrogen and phosphorus levels increase downstream by a factor of more than 10, in response to anthropogenic inputs. Similarly, nutrient levels fluctuate seasonally by more than an order of magnitude, in response to input from diffuse and point sources of pollution. These changes of more than 1 000% far exceed the 15% maximum change stipulated by the South African water quality guidelines for aquatic ecosystems.

Further, total phosphorus levels indicate that hypertrophic conditions prevail at least episodically at all of the Berg River monitoring stations and most of the time at some of them. Additionally, river water phosphate levels show a dramatic increase over the past 20 years. There is also strong evidence that the trophic status of the Berg River is very sensitive to reduced river runoff and thus the construction of Dams such as the Berg River Dam can act to exacerbate the trophic status (De Villiers, 2007).

Evidence for increased NOx levels during low runoff conditions suggests an increased number of point-sources of pollution. It is also suggested that overloading of water treatment plants

during high runoff conditions or flooding of informal human settlements during winter storm events may result in nutrient enrichment during high runoff, related to these 'point sources'.

The two most likely anthropogenic sources of nutrients along the Berg River are agricultural runoff and effluent from overloaded municipal sewage works and un-serviced communities. Both sources are expected to peak in magnitude along the middle section of the Berg River, between Paarl and Hermon, the most heavily cultivated and most populated area along the river. This includes informal human settlements that have developed along the banks of the river.

Diffuse nutrient sources, such as agricultural runoff, produce seasonal concentration profiles coincident with river runoff, i.e. concentrations that peak during high runoff conditions. In contrast, point sources such as sewage effluent from municipal WWTW generally result in seasonal concentration profiles that have no relation to runoff, i.e. relatively constant input throughout the year, or an inverse relation to river runoff (De Villiers, 2007).

The water quality in the Berg River has changed considerably over time, with the major impactors being agricultural return flows, irrigation releases, urban and industrial runoff and wastewater discharges.

In situ water quality analyses was conducted at in the Berg River. These results are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms. The results of the survey are presented in **Table 14**.

If the elevated pH and DO values persist for extended periods of time in the Berg River together with strong sunlight and vigorous photosynthetic activity, they may give rise to gas bubbles disease, fish kills and algal blooms (Alabaster and Llyod, 1982). These algal blooms may produce toxic by-products which may be an issue once water is pumped into the Voëlvlei Dam.

Table 14: In situ water quality results for the site with reference to the Target Water Quality Requirements (TWQR)

Site	pH	Conductivity (µS/cm)	DO (mg/l)	DO Saturation (%)	Temperature (°C)
TWQR	**6.5-9.0**	**<700**	**>5.00**	**80-120**	**5-30**
BR1	**10.37**	365	**10.2**	**178**	27.9

Red – exceeded TWQR

12.1.6 Riparian Habitat

The riparian area provides habitat for aquatic and terrestrial species, contributes towards maintaining the form of the river channel and serves as filters for sediment, nutrients and light.

As shown in **Figure 43**, the riparian habitat of the Berg River is relatively intact, but has however been disturbed and reduced due to adjacent agricultural activities.

Figure 43: Riparian habitat of the Berg River

12.1.7 Estuary

By definition, an estuary constitutes a partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. These systems form a transition zone between river and ocean environments and are subject to both marine influences (e.g. tides, waves, and the influx of saline water) and riverine influences (e.g. flows of fresh water and sediment). The high productivity in estuaries stems from the inflow of both seawater and freshwater, which provide high levels of nutrients in both the water column and sediment.

The Berg River Estuary is located approximately 130 km north of Cape Town on the West Coast of South Africa (**Figure 44**). The main channel of the estuary is about 100-200 m wide near the mouth, becoming progressively narrower and shallower upstream. Depth is about 3-5 m on average, but extends up to 9 m in places. The total volume of the estuary is estimated to be about 12 Mm^3. The catchment lies entirely within the Western Cape Province, which receives most precipitation during the winter rainfall season. Four major dams have been built in the catchment, including the Voëlvlei Dam (surface area = 15 km^2, storage capacity = 170 Mm^3/a).

The estuary reflects strong seasonal patterns. River inflow during winter creates more turbid, freshwater dominated conditions, with limited saline intrusion near the mouth. During summer,

the estuary becomes marine-dominated with less turbid saline waters penetrating up to about 40 km from the mouth. Upwelling during these summer months is a typical feature along the West Coast when colder, nutrient-rich seawater is introduced into the estuary. This seasonal variability drives the ecology of the estuary.

Figure 44: Geographical boundaries of the Berg River Estuary

The Present Ecological Status (PES) of the estuary is a C. Major drivers of change in the system were a significant reduction in river inflow (floods and baseflows), but it is likely that the estuary is on a negative trajectory of change, because of the extremely low lowflows under the present state (< 1 m^3s-1), particularly during the summer months. Maintaining the status quo would therefore likely result in a decline in condition. The estuary is considered highly important. The Estuarine Health Index scores allocated to the Berg River Estuary were:

Table 15: PES of the Berg River Estuary

VARIABLE	WEIGHT	Score	WEIGHTED score
Hydrology	25	72	18
Hydrodynamics and mouth condition	25	90	23
Water quality	25	40	10
Physical habitat alteration	25	59	15

VARIABLE	WEIGHT	Score	WEIGHTED score
Habitat health score			**65**
Microalgae	20	75	15
Macrophytes	20	54	11
Invertebrates	20	50	10
Fish	20	56	11
Birds	20	78	16
Biotic health score			**63**
ESTUARINE HEALTH SCORE			**64**

Storage and abstraction of water in the catchment have reduced freshwater inflow to the Berg River Estuary by 30%. This results in:

- extensive upstream intrusion of seawater into the estuary, particularly during summer;
- reduction in frequency and extent of floodplain inundation; and
- a decrease in the scouring of sediment within the estuary.

The extensive upstream intrusion is also exacerbated by the stabilisation of the mouth which keeps it permanently open via a constructed channel.

Livestock grazing and the construction of salt works and Port Owen Marina have resulted in extensive loss of natural habitat, mainly saltmarsh. Although the salt works has destroyed this habitat, the area now provides rich feeding grounds for flamingos and waders. Power boating activities, as well as the stabilisation and regular dredging of the mouth have resulted in increased bank erosion in the estuary, with the associated loss of saltmarsh habitat and a decline in floodplain vegetation.

Potential threats to water quality include wastewater discharges from a fish processing plant, seepage from the salt works, harbour activities (e.g. dumping of fish offal and petroleum oils). Agricultural return flow is another potential source of pollutants (nutrients and pesticides) to the system.

13 SUMMARY OF SPECIALIST STUDIES

13.1 Specialist studies undertaken

The following Specialist Studies undertaken as part of the BA process, include:

1. Agricultural Impact Assessment;
2. Heritage Impact Assessment;
3. Terrestrial Ecological Assessment Report;
4. Riparian Habitat and Wetland Delineation Impact Assessment; and
5. Socio-Economic Impact Assessment.

However, only the relevant aquatic study is discussed further in Section 14. Refer to **Appendix G** of the Draft EIA for the non-aquatic specialist studies.

13.2 Riparian Habitat and Wetland Delineation Impact Assessment

Specialist	
Organisation:	Biodiversity Company
Name:	Mr. Andrew Husted
Qualifications:	MSc (Aquatic Health)
Affiliation (if applicable):	Professional Natural Scientist with South African council for Natural Scientific Professions (SACNASP)

This section provides a summary of the Riparian Habitat and Wetland Delineation Impact Assessment contained in **Appendix G**. A single survey was conducted on from 25 – 27 October 2016, which is considered to be the onset of the dry season period.

13.2.1 Main Findings

13.2.1.1 Aquatic Ecology

The focus for the study is one study reach on the Berg River which feeds into the Atlantic Ocean and three points on the Voëlvlei Dam. The area surrounding the proposed project site consists of agricultural and livestock activities. The activities in the area and local land uses have had impacts to the aquatic system and visible disturbances were moderate. Due to these activities, the Berg River system and Voëlvlei Dam are regarded as largely modified at a desktop level.

Desktop Data for Sub-Quaternary Catchment G10F-8604 and G10F-8658, respectively

NFEPA's	**No NFEPAs listed**	**No NFEPAs listed**
Present Ecological Status	**Largely modified (Class D)**	**Largely modified (Class D)**

Ecological Importance	**Low**	**Moderate**
Ecological Sensitivity	**High**	**High**

In situ water quality analyses was conducted at in the Berg River (**Table 16**). These results are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms.

Table 16: In situ water quality results for the site with reference to the Target Water Quality Requirements (TWQR)

Site	pH	Conductivity (µS/cm)	DO (mg/l)	DO Saturation (%)	Temperature (°C)
TWQR	**6.5-9.0**	**<700**	**>5.00**	**80-120**	**5-30**
BR1	**10.37**	365	**10.2**	**178**	27.9

An elevated pH value of 10.37 was measured in the Berg River. This exceeded the recommended guideline range having a limiting effect on local aquatic biota at the time of the survey. This high pH value may be a concern to the Berg River biota and potentially the Voëlvlei Dam and aquatic biota if it persists at elevated levels once the water pipeline is operational.

The EC value measured in the Berg River (365 µS/cm) was below the recommended guideline value and would not be a limiting factor of aquatic biota at the time of the survey.

During the survey DO levels in the Berg River were above the maximum prescribed limits with a measurement of 178% recorded. This high reading is in excess of saturation (super-saturation of oxygen) which usually indicates eutrophication in a water body (DWAF, 1996). The conditions in the Berg River at the time of sampling were in agreement that the river was eutrophic (green in colour) which may stem from nutrient input from both WTW discharges and agricultural input in the catchment. Elevated oxygen concentrations (super saturation) may cause gas bubble disease in fish. Supersaturated conditions also tend to inhibit photosynthesis in green algae, favouring instead bluegreen algae, which are more tolerant of supersaturation, but which may become a nuisance to other water users (DWAF, 1996). Therefore, DO would have been a limiting factor of aquatic biota at the time of the survey if these high DO levels persist for extended periods (**Table 16**).

During the survey, a water temperature of 27.9°C was measured (**Table 16**). The water temperature was considered to be within recommended guideline levels and was not expected to have a negative effect on the aquatic ecosystem.

If the elevated pH and DO values persist for extended periods of time in the Berg River together with strong sunlight and vigorous photosynthetic activity, they may give rise to gas bubbles disease, fish kills and algal blooms (Alabaster and Llyod, 1982). These algal blooms

may produce toxic by-products which may be an issue once water is pumped into the Voëlvlei Dam.

According to the 2016 low flow season assessment, the state of the Berg River was in a largely modified state, which has led to modified macroinvertebrate and fish community assemblages. Furthermore, impacts to instream and riparian habitat and more notable water quality were evident.

Aquatic Assessment Results for the October 2016 survey

Site	Berg River	Voëlvlei Dam
In Situ Water Quality Parameters	**Poor**	**N/A**
Integrated Habitat Assessment System	**Good**	**N/A**
Flow	**0.2 - 0.4 m/s**	**Dam (75% full)**
Clarity	**35 cm (Eutrophic)**	**20cm (Turbid)**
Biotic Integrity Based on SASS5 Results	**C (Moderately modified)**	**N/A**
Fish	**Seriously modified**	**Seriously modified**
Current Ecological Status	**Seriously modified (E)**	**Largely modified (D)**

13.2.1.2 Wetland Assessment

The desktop study concluded with reasonable confidence that due to the distance of the Berg River estuary and floodplain from the project area, and also considering the nature of this project, no risks to the Berg River floodplain are expected.

The project area is associated with numerous NFEPA wetland types. These are largely associated with the Berg River and the Voelvlei Dam. None of the local NFEPA wetlands are classified as ecological priority areas.

Numerous wetland types were identified and delineated for the study. These include valley bottom systems, hillslope seeps, depressions and the Berg River floodplain. The extent of the delineated wetland (and riparian) areas for the project, and the corresponding HGM types is presented in **Figure 45** and listed in **Table 17**.

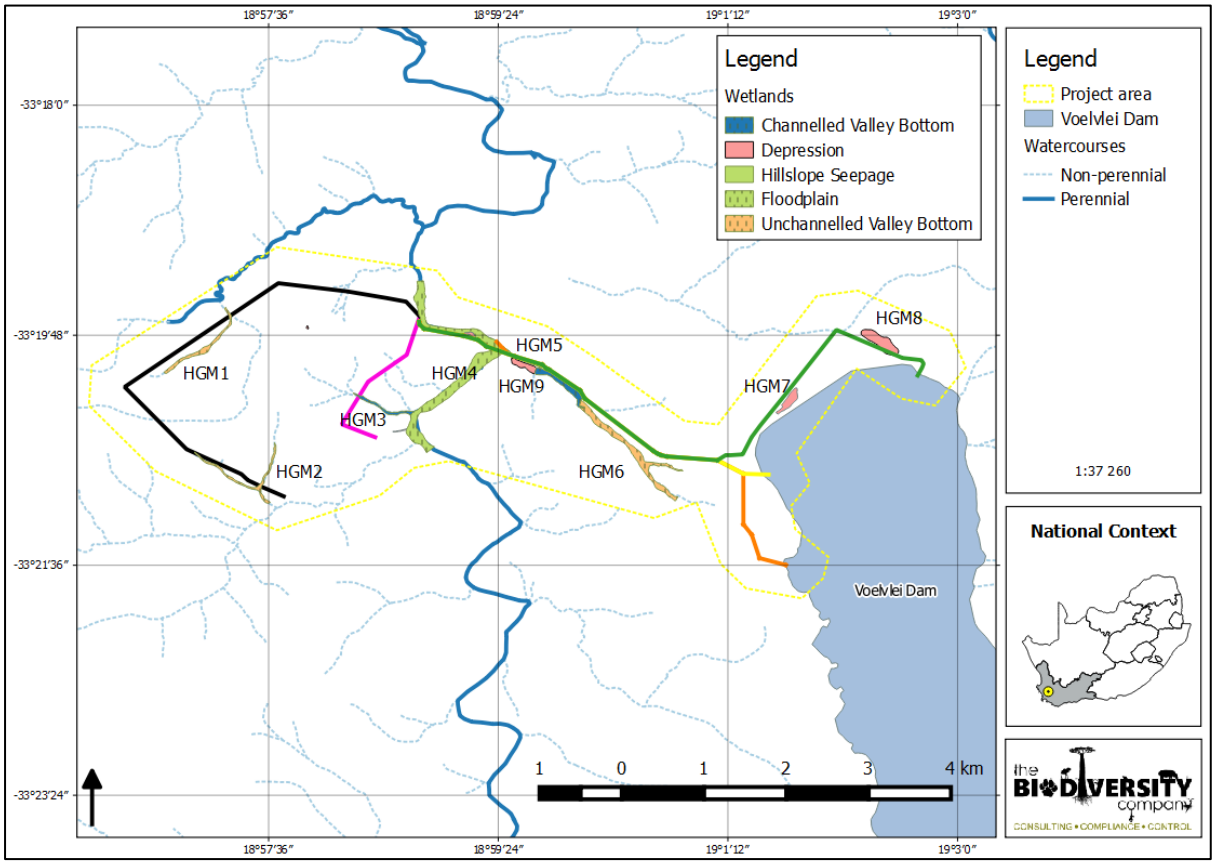


Figure 45: The delineated wetland HGM units for the study

Table 17: An indication of the identified wetland types for each HGM unit

System	HGM Type
HGM1	Unchannelled valley bottom wetland
HGM2	Unchannelled valley bottom wetland
HGM3	Channelled valley bottom wetland
HGM4	Floodplain
HGM5	Hillslope Seepage
HGM6	Unchannelled valley bottom wetland
HGM7	Depression
HGM8	Depression
HGM9	Depression

The riparian habitat associated with the Berg River was determined to be largely modified (PES category D) indicating a system that has experienced a large loss of natural habitat, biota and basic ecosystem function. Some of the noted impacts and disturbances to the riparian habitat include:

- Clearing of vegetation to accommodate large-scale agricultural activities on either side of the river, resulting in the narrowing and the loss of riparian habitat;
- Alien vegetation encroachment within the riparian zone. These species are outcompeting endemic species and becoming well established in the habitat; and
- The flooding regime of the Berg River has been altered as a result of surrounding land-uses, local water schemes and the development of the catchment. This has had an impact on the structuring and support of the riparian area.

A total of nine (9) HGM units were identified and delineated for the study. The PES for the assessed wetland systems is presented in **Table 18**.

Table 18: Summary of the scores for the wetland PES

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Description	Rating	Description	Rating	Description
HGM1	C	Moderately Modified	B	Largely Natural	B	Largely Natural
Overall PES Class					C: Moderately Modified	
HGM2	C	Moderately Modified	C	Moderately Modified	D	Largely Modified
Overall PES Class					C: Moderately Modified	
HGM3	D	Largely Modified	C	Moderately Modified	D	Largely Modified
Overall PES Class					D: Largely Modified	
HGM4	C	Moderately Modified	C	Moderately Modified	D	Largely Modified
Overall PES Class					C: Moderately Modified	
HGM5	C	Moderately Modified	C	Moderately Modified	E	Seriously Modified
Overall PES Class					D: Largely Modified	
HGM6	B	Largely Natural	C	Moderately Modified	D	Largely Modified
Overall PES Class					C: Moderately Modified	
HGM7	C	Moderately Modified	C	Moderately Modified	C	Moderately Modified
Overall PES Class					C: Moderately Modified	
HGM8	C	Moderately Modified	C	Moderately Modified	C	Moderately Modified
Overall PES Class					C: Moderately Modified	

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Description	Rating	Description	Rating	Description
HGM9	C	Moderately Modified	C	Moderately Modified	C	Moderately Modified
Overall PES Class					C: Moderately Modified	

The PES of the wetland systems varied from largely moderately modified (Class C) to largely modified (Class D), with none of the systems considered to be natural or largely modified. The local commercial agricultural activities and developments have contributed to the modifications of these systems.

13.2.1.3 Impacts

The proposed project will have both direct and indirect impacts on the local watercourses. The most significant risks are associated with the weir and fishway structures, with the level of risk determined to be moderate. The risks associated with the supporting activities and linear structures was determined to be low. Several concerns regarding the fishway design have been highlighted and need to be addressed for the fishway to be successful.

13.2.2 Conclusions and Recommendations

Results showed that the sampled reach of the Berg River is in a largely to seriously modified state. This was predominantly due to the modified state of the local aquatic biota and instream and riparian habitats. The Berg River showed great habitat availability, however poor water quality has resulted in modified macroinvertebrate and fish community assemblages.

A number of watercourses were identified and assessed for the project. These systems include the Berg River floodplain, valley bottom wetlands, hillslope seeps, depressions and numerous drainage channels. The ecological integrity of these systems varied from moderately to largely modified, with no systems determined to be in a natural or largely natural state.

The proposed project will have both direct and indirect impacts on the local watercourses. The most significant risks are associated with the weir and fishway structures, with the level of risk determined to be moderate. These moderate risks are expected for the construction and operation of the project. The risks associated with the supporting activities and linear structures was determined to be low.

In terms of the road options, Option 2 is the most preferred for the study. The least preferred road option is Option 1. With regards to the pipeline alternatives, Alternative 1 is not recommended, and the preferred alternative is Alternative 3.

It is recommended that an aquatic monitoring programme be implemented after construction activities should the proposed project commence. A buffer zone of 15m and 21m has been prescribed for the construction and operational phase respectively.

14 IMPACT ASSESSMENT

Water from the resource will not be used by the proposed development. However, the effect of the development on the delineated rivers and wetlands are discussed below.

The impacts and the proposed management thereof are first discussed on a qualitative level and thereafter quantitatively assessed by using the methodology provided below. Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

Information provided by specialists will be used to calculate an overall impact score by multiplying the product of the nature, magnitude and the significance of the impact by the sum of the extent, duration and probability based on the following equation:

Overall Score = (NxMxS)x(E+D+P)

Where: N = Nature
E = Extent
M = Magnitude
D = Duration
P= Probability
S = Significance

Table 19: Impact methodology table

Nature		
Negative	Neutral	Positive
-1	0	+1
Magnitude		
Low	Medium	High
1	2	3

Significance			
No impact/None	No impact after mitigation / Low	Residual impact after mitigation / Medium	Impact cannot be mitigated / High
0	1	2	3

Extent			
Local	Regional	National	International
1	2	3	4

Duration			
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent
1	2	3	4

Probability				
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5

The following definitions apply:

For the methodology of the impact assessment, the analysis is conducted on a quantitative basis with regard to the nature, extent, magnitude, duration, probability and significance of the impacts. The following definitions and scoring system apply:

Nature (/Status)

The project could have a positive, negative or neutral impact on the environment.

Extent

- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude

Degree to which impact may cause irreplaceable loss of resources.

- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

0 – Impact will not affect the environment. No mitigation necessary.

1 – No impact after mitigation.

2 – Residual impact after mitigation.

3 – Impact cannot be mitigated.

For example, the worst possible impact score of -117 would be achieved based on the following ratings:

N = Nature = -1

M = Magnitude = 3

S = Significance = 3

E = Extent = 4

D = Duration = 4

P= Probability = 5

Worst impact score = (-1 x 3 x 3) x (4+4+5) = -117

On the other hand, if the nature of an impact is 0 (neutral or no change) or the significance is 0 (no impact), then the impact will be 0.

Overall Impact Scores (OS) will therefore be ranked in the following way:

Table 20: Ranking of Overall Impact Scores

Impact Rating	Low/Acceptable	Medium	High	Very High
Score	0-30	-31-60	-61-90	-91-117

In the case of the Riparian Habitat and Wetland Delineation Assessment, the methodology of the impact assessment differs as the assessment was conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines.

The matrix assesses impacts in terms of consequence and likelihood. Consequence is calculated based on the following formula:

Consequence = Severity + Spatial Scale + Duration

Whereas likelihood is calculated as:

Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection

Significance is calculated as:

Significance \Risk= Consequence X Likelihood

The significance of the impact is calculated according to **Table 23**.

Table 21: Significance ratings matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.

Rating	Class	Management Description
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

The baseline assessment has concluded that the assessed water resources are predominantly in a modified state, largely as a result of local large-scale commercial farming activities, and also the development of the area.

Some of the potential impacts (or risks) that have been identified for the study and that will be considered for the risk assessment include the following:

- Erosion and scouring at the discharge area in the dam.
- The construction of a weir will result in modified flows across the Berg River system. This will include modifications to the flooding regime of the system.
- The weir may also create a migratory barrier for the movement of fish across the system.
- Inadequate measures to allow fish movement upstream of the weir, especially smaller species that cannot navigate strong flows (*Galaxias zebratus* and *Sandelia capensis* – if present).
- Inadequate measures to protect river bed material from flows immediately downstream of the weir resulting in scouring and erosion of substrates from below the structure.
- Exotic vegetation encroachment into the marginal and riparian zones may occur in cleared areas, resulting in competition and loss of indigenous vegetation.
- The placement of infrastructure within wetlands which will result in the loss of wetland resources.
- The traversing of wetlands by linear structures which may impact on these systems, potentially resulting in the partial loss of these systems. However, there is also the opportunity to improve upon existing crossings which will in turn improve the status and functioning of traversed wetlands.

The existing canal is concrete and does not sustain any of the adjacent wetland systems. Seepage and interflow is not facilitated by the current canal, and the proposed project does not pose a risk to the wetlands, due to the loss of these water movements.

Findings from the DWS aspect and impact register / risk assessment are provided below:

Table 22: Potential risks associated with the project

Phase	Activity	Aspect	Impact
Construction	Construction of low level weir	Damming and diversion of the Berg River for the weir	Impeding the flow of water Fish migration barrier Loss of aquatic habitat Siltation of watercourse Erosion of watercourse Flow sediment equilibrium change Altered flow dynamics Loss of wetland (seepage) areas Damage to wetlands (or loss) Impaired water quality
	Construction of pump station	Cutting/reshaping of river banks	
		Construction and upgrade of access routes	
	Digging of trenches	Construction (and upgrade) of crossings / causeways	
		Clearing of areas for infrastructure	
	Laying of pipelines	Interception of interflow by trenches	
		Additional associated infrastructure for staff	
	Upgrade of roads	Operation of equipment and machinery	
	Construction of roads	Excavations in and across watercourses	
		Use of temporary structures for river crossings	
	Upgrade of watercourse crossings	Construction of fishway in the system	
Operation	Weir and fishway	Weir structure	Impeding the flow of water Fish migration barrier Loss of aquatic habitat Siltation of watercourse Erosion of watercourse Flow sediment equilibrium change Altered flow dynamics Loss of wetland (seepage) areas Impaired water quality
		Drainage patterns change due to road extent and levels	
		Drainage patterns change due to crossing upgrades	
	Pumping of water	Increased extent of hardened surfaces	
		Loss of infiltration and seepage areas	
	Discharge of water	Operation of equipment and machinery	
	Vehicle access	Increased developed footprint area for the catchment	
		Water abstraction from the Berg River	
		Discharge of water into Voelvlei Dam	

Table 23: Risk rating assessment

Aspect	Severity							
	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Damming and diversion of the Berg River for the weir	4	2	4	3	**3.25**	**3**	**3**	**9.25**
Cutting/reshaping of river banks	2	2	3	2	**2.25**	2	2	**6.25**
Construction and upgrade of access routes	2	1	1	2	**1.5**	1	2	**4.5**
Construction (and upgrade) of crossings / causeways	3	3	2	2	**2.5**	2	2	**6.5**
Clearing of areas for infrastructure	1	1	2	2	**1.5**	1	2	**4.5**
Interception of interflow by trenches	3	1	1	1	**1.5**	1	2	**4.5**
Additional Associated Infrastructure for staff	1	1	2	1	**1.25**	1	1	**3.25**
Operation of equipment and machinery	1	3	1	2	**1.75**	1	2	**4.75**
Excavations in and across watercourses	3	4	3	3	**3.25**	2	2	**7.25**
Use of temporary structures for river crossings	3	2	2	2	**2.25**	2	2	**6.25**
Construction of fishway in the system	4	4	2	3	**3.25**	2	2	**7.25**
Operation Phase								
Weir structure	5	2	3	3	**3.25**	3	5	**11.25**
Drainage patterns change due to road extent and levels	2	1	1	1	**1.25**	1	5	**7.25**
Drainage patterns change due to crossing upgrades	2	2	1	2	**1.75**	2	5	**8.75**
Increased extent of hardened surfaces	2	1	1	1	**1.25**	2	4	**7.25**
Loss of infiltration and seepage areas	1	1	1	1	**1**	1	5	**7**
Operation of equipment and machinery	1	1	1	1	**1**	1	3	**5**
Increased developed footprint area for the catchment	2	1	1	1	**1.25**	2	5	**8.25**
Water abstraction from the Berg River	3	1	1	2	**1.75**	2	3	**6.75**
Discharge of water into Voelvlei Dam	1	2	1	2	**1.5**	1	3	**5.5**

Table 24: Risk rating assessment continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Risk Rating
Construction Phase							
Damming and diversion of the Berg River for the weir	**3**	**3**	**5**	**1**	**12**	**111**	**Moderate**
Cutting/reshaping of river banks	2	2	5	2	**11**	**68.75**	**Moderate***
Construction and upgrade of access routes	2	2	1	2	**7**	**31.5**	**Low**
Construction (and upgrade) of crossings / causeways	2	2	5	2	**11**	**71.5**	**Moderate***
Clearing of areas for infrastructure	2	2	1	2	**7**	**31.5**	**Low**
Interception of interflow by trenches	3	1	1	3	**8**	**36**	**Low**
Additional associated infrastructure for staff	1	1	1	1	**4**	**13**	**Low**
Operation of equipment and machinery	2	2	1	2	**7**	**33.25**	**Low**
Excavations in and across watercourses	2	2	5	2	**11**	**79.75**	**Moderate***
Use of temporary structures for river crossings	2	2	1	2	**7**	**43.75**	**Low**
Construction of fishway in the system	3	3	5	3	**14**	**101.5**	**Moderate**
Operation Phase							
Weir structure	4	4	1	3	**12**	**135**	**Moderate**
Drainage patterns change due to road extent and levels	3	1	1	2	**7**	**50.75**	**Low**
Drainage patterns change due to crossing upgrades	3	2	1	2	**8**	**70**	**Moderate***
Increased extent of hardened surfaces	3	2	1	1	**7**	**50.75**	**Low**
Loss of infiltration and seepage areas	3	1	1	3	**8**	**56**	**Moderate***
Operation of equipment and machinery	2	1	1	2	**6**	**30**	**Low**
Increased developed footprint area for the catchment	3	2	1	1	**7**	**57.75**	**Moderate***

Water abstraction from the Berg River	2	2	5	2	**11**	**74.25**	**Moderate***
Discharge of water into Voelvlei Dam	2	2	5	2	**11**	**60.5**	**Moderate***

The risk assessments indicated that the largest risks are associated with the weir structure specifically, and not the supporting activities and structures. The most significant risks were determined to be moderate, with the remaining risks determined to be low. The two moderate risks for the construction phase are associated with the damming and diversion of the Berg River, and also the construction of the fishway structure. The most significant risk (moderate) considered for the operational phase of the project is the weir structure itself.

The relatively low risk rating for the project may be attributed to the modified statuses of the assessed watercourses. In addition to this, the extent of the impacts, except for the formal weir structure, are generally expected to be both site and area specific.

Mitigations measures have been prescribed for the assessed risks, with due consideration for the moderate risks associated with the project.

The following weir construction specific mitigation measures are provided:

- The footprint area of the weir should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- Exposed river banks / soils must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the area;
- The weir should not concentrate flows at the overspill area. It is important to spread flows across the river system by having a wider overspill area, avoiding concentrated flows. Care must be taken not to spread flows outside of the existing channel path;
- It is imperative that the new low level weir cater for fish migration, especially during very low flows;
- A V-shaped centre positioned spillway is recommended for the weir design. This will allow for fish migration over the weir under different flow levels; and
- Large aggregate outsourced or from the project area (if available) can be used for energy dissipation in the channel downstream of the weir to reduce the likelihood of scouring the river bed and sedimentation of the catchment. It is preferable that larger aggregate be used to avoid flows removing aggregate material from the site.

The following fishway construction specific mitigation measures are provided:

- The fishway should have water passing through it during both high flows and low flows to encourage fish to make use of the fishway no matter the flow levels. It may be required that an Instream Flow assessment be conducted for the project in order to prescribe water allowances for the system;
- The fishway should cater for both rheophilic (fast moving water) and anti-rheophilic (slow moving water) fish species. This can be achieved through having several different flow velocity areas across the fishway;

- It is recommended that a rough stone surface be cast into the fishway channel floor to cater for climbing and crawling species;
- Rocks used for the fishway should have flat sides with rounded edges (typical of quarried rock) rather than rounded rocks, as they provide a variety of water velocity and depths that easy for fish to navigate;
- Rock material needs to be concreted in place to prevent them from washing away during high flows;
- Rock should be placed with a cascade pattern creating numerous step-like riffles, but should also incorporate a large variety of rock sizes placed at random to create a diversity of hydraulic conditions (microhabitats) within the fishway;
- Pools or depressions of varying sizes and depths should be created at random throughout the length and width of the fishway and should be placed behind large rocks to create lower velocity resting areas (eddies) for fish. The more pools incorporated in the design, the more successful the fishway will be;
- Guidelines for fishway design:
    - **Channel slope** – between 1/8 and 1/10 is recommended for South African fish;
    - **Fishway entrance** – furthest point upstream that the fish can penetrate, usually in a suitable pool (low turbulence with sufficient depth) located at the base of the low level weir;
    - **Fishway exit** – located in a quiet area, sheltered, low velocity to prevent fish from being swept downstream and to afford protection from predators:
        - The invert level of the exit (i.e. water inflow) should be lower than that of the weir overflow to ensure the low flows are directed down the fishway;
    - **Depth of pool** – small fish (20 to 200 mm in length: at least 300 mm to reduce predation and limit turbulence;
        - Larger fish (>200 mm): at least 500 mm can be deeper to reduce turbulence, if necessary;
    - **Length of pool** – at least 2.5 times the length of the largest fish catered for;
    - **Drop height between pools/rock levels** – maximum of 100 mm to cater for small fish;
- The fishway should take into consideration the jumping and swimming abilities of the different species, allowing the smallest and weakest swimmers passage through the fishway without undue stress;

- The fishway should take into consideration that the migratory *Barbus andrewi* may be present in the Berg River while further introduction by Cape Nature will commence;
- Cape Nature are in the process of reintroducing Whitefish to the Berg River and recommend the introduction of the natural type rock ramp fishway on the proposed weir to aid in migration of the Whitefish across the proposed barrier; and
- An aquatic biomonitoring programme should be conducted after the construction phase has been completed in order to determine the effect, if any, on the local biota and migration of the fish species.

The following pipeline mitigation measures are provided:

- It is not advisable to only set a mesh on the pipeline at the abstraction point, due to the mesh becoming clogged with debris. It is recommended that an abstraction sump be considered for the design, in addition to the mesh. The sump will ensure no blockages of the pipeline, and the mesh will prevent the transfer of fish which may result in fish fatalities;
- Pipeline trenches and sandy bedding material may produce preferential flow paths for water across the project area perpendicular to the general direction of flow instead of angle. This risk can be reduced by installing clay plugs at intervals down the length of the trench to force water out of the trench and down the natural topographical gradient;
- Pipelines crossing watercourses should preferably span the systems above ground. This prevents disruptions to sub surface flow dynamics;
- When a pipeline spans a river, it should be attached to any existing crossing or bridge structures (if present). If pier support structures are needed for the pipeline to span a system, then piers should be placed outside of preferential flow paths with the least number of pier structures used as possible;
- Trenches and foundations should be side dug (where possible) from the existing access routes. In the absence of access routes, temporary routes may be considered;
- Trenches should be dug on-line (where applicable) creating narrower trenches;
- Where trench breakers are required, these must be imported appropriately and installed by the backfill crew, ahead of backfilling;
- Ensure careful separation of soil types/ strata as identified for the removal of soil. The soils must be removed in such a way that they can be easily reinstated in the reverse order for backfilling;

- To ensure correct backfilling, the soil that is removed from the trench at its deepest point must be laid closest to the trench. The first layer of topsoil must be laid furthest away from the trench;
- It may be necessary to import small amounts of padding material upon which the pipe safely rests in the trench prior to backfilling. This material must be stored outside the wetland areas until it is required to be placed within the trench, and bunded with sandbags;
- Any large boulders encountered during trenching operations must not be returned to the trench, but removed off site; and
- If any spoil is generated this can be transported to another location and re-used if it is required, removed correctly to a licensed facility, or offered to the landowner.

The following general mitigation measures are provided:

- The delineated aquatic and wetland areas outside of the specific project site area must be avoided where possible;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be beyond the aquatic and wetland areas;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;
- Temporary storm water channels and preferential flow paths should be filled with aggregate and logs (branches included) to dissipate and slow flows limiting erosion;
- Contamination of the Berg River system with unset cement or cement powder should be negated as it is detrimental to aquatic biota. Pre-cast structures should be made use of (where possible) to avoid the mixing of these materials on site, reducing the likelihood of cement in the river system;
- All chemicals and toxicants to be used for the Augmentation Scheme construction must be stored outside the channel system and in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as

the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;

- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the riparian and wetland areas. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Erosion and sedimentation into the channel must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed banks;
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- An alien invasive plant management plan needs to be compiled and implemented post construction to prevent the growth of invasives on cleared areas.

15 PUBLIC PARTICIPATION PROCESS

The purpose of the public participation process for the proposed development includes:

- Providing IAPs with an opportunity to obtain information about the project;
- Allowing IAPs to express their views, issues and concerns with regard to the project;
- Granting IAPs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and

- Enabling the project team to incorporate the needs, concerns and recommendations of IAPs into the project, where feasible.

The Public Participation Process that was followed for the proposed project is governed by NEMA and GN No. R. 982. A combined Public Participation Process was conducted in terms of NEMA and NWA.

All Public Participation material can be referred to in **Appendix F** of the Draft EIA.

15.1 Summary of Public Participation during Scoping Phase

15.1.1 Identification of IAPs and Compilation of IAP Database

IAPs were identified based on regulatory requirements and the specific site/project requirements. In summary, the database includes the following:

- Landowners, adjacent landowners/occupiers;
- Relevant Organs of State / Authorities including the following;
    - DEA;
    - DWS;
    - City of Cape Town;
    - West Coast District Municipality;
    - Drakenstein Local Municipality;
    - Cape Winelands District Municipality;
    - Swartland Local Municipality;
    - Western Cape DEA&DP;
    - Western Cape Department of Agriculture;
    - Department of Mineral Resources (DMR);
    - South African Heritage Resource Authority (SAHRA);
    - Western Cape Heritage;
    - Cape Nature;
    - Berg Water Use Association;
    - Western Cape Department of Roads;
    - Drakenstein Local Municipality Ward Councillor 31; and
    - Swartland Local Municipality Ward Councillor 12.
- General IAPs that may have an interest in the project.

Please note that a copy of the IAP database is available in **Appendix F3**.

15.1.2 IAP Registration Period

A 30 day registration period was conducted from 26 May 2016 to 27 June 2016 which provided the public with the chance to register as an IAP in order to review and provide comments on the draft reports, as well as be invited to the public meetings. The 30 day registration period

was advertised in the Daily Voice (published 26 May 2016) and the Paarl Post (published 26 May 2016).

15.1.3 Notification Process

The notification process undertaken is detailed in the sections to follow:

15.1.3.1 Landowner Notification

Written notification was given to the landowners / persons in control of the land. The details of the affected landowners are included in the IAP database which is contained in **Appendix F3**. Proof of written notification is included in **Appendix F2**.

15.1.3.2 Background Information Document

Background Information Documents (BIDs) (**Appendix F1**) and Reply Forms were distributed by email or hand delivered to IAPs contained in the IAP Database. In addition, BIDs were placed at the Gouda Library (**Figure 46**). BIDs contained a brief background and description of the project, as well as the EIA process, and listed the details for submitting comments regarding the proposed developments. The BID was compiled in both English and Afrikaans, the two predominant languages of the study area. The BID served to notify IAPs of the project and the details on how to register as an IAP.

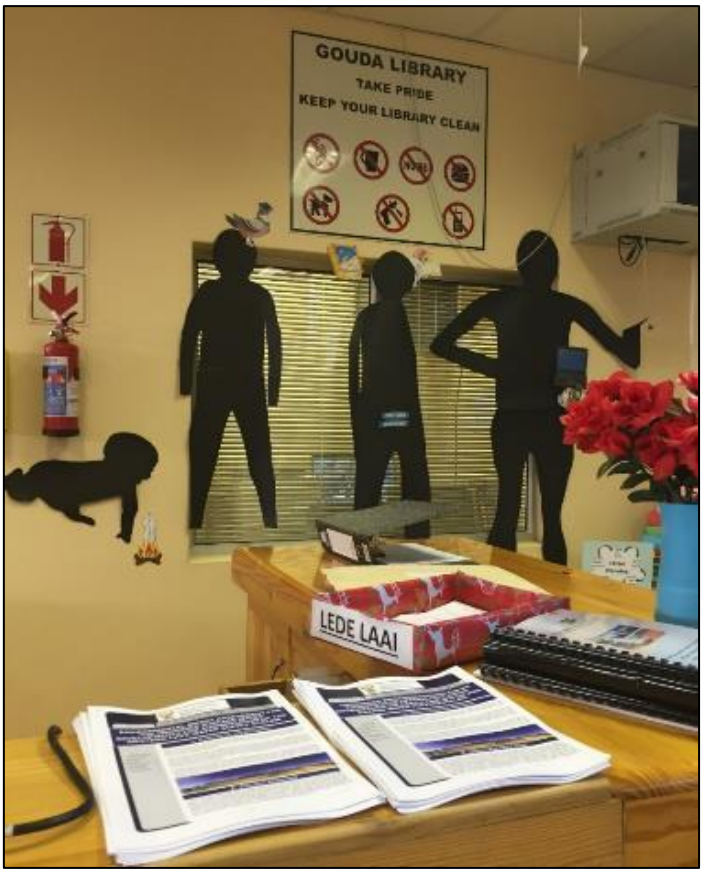


Figure 46: BIDs placed at the Gouda Library for the public

Notification of the proposed WCWSS developments took place on 24 May 2016. Proof of initial notification is provided in **Appendix F2**. All reply forms from registered IAPs and landowners to date are included in **Appendix F4**.

15.1.3.3 Onsite Notices

Eleven site notices were placed at strategic points along the proposed pipeline route and around the pump station and Dam locations. Notification of the proposed developments and how to register as an IAP were provided on the site notice. Onsite notices were primarily placed in proximity to the project components, based on the availability of public access.

Details of the locations of the onsite notices and accompanying photographs are contained in **Appendix F1**.

15.1.3.4 Newspaper Notices

Advertisements were placed in the following newspapers as notification of the project and how to register as an IAP (refer to copies of the newspaper advertisements contained in **Appendix F1**):

- The Daily Voice, published 26 May 2016; and
- The Paarl Post, published 26 May 2016.

15.1.4 Review Process for Draft Scoping Report

The Application Form was submitted to DEA on **22 September 2016** and the reference number was provided: 14/12/16/3/3/2/973.

Initially, the Application Form included Activity 14 of GN No R985 of 04 December 2014, however, WC DEA&DP stated that Activity 14 would not be applicable as the site is not located in a protected area in terms of NEMA; no environmental management framework and/or systematic biodiversity plans have been adopted by the competent authority; and the site is not located in a core area in a biosphere reserve. Therefore, an Amended Application Form was submitted to DEA on 28 October 2016 along with the Final Scoping Report.

15.1.4.1 Public Review

In accordance with GN. No. R. 982 of 04 December 2014, IAPs are granted an opportunity to review and comment on the Draft Scoping Report. Hardcopies of the document will be placed at the venue listed below (**Figure 47**). Emails and SMSes were sent to all registered IAPs to notify them of the review of the Draft Scoping Report. Proof of the notification of the public review period was included in the Final Scoping Report.

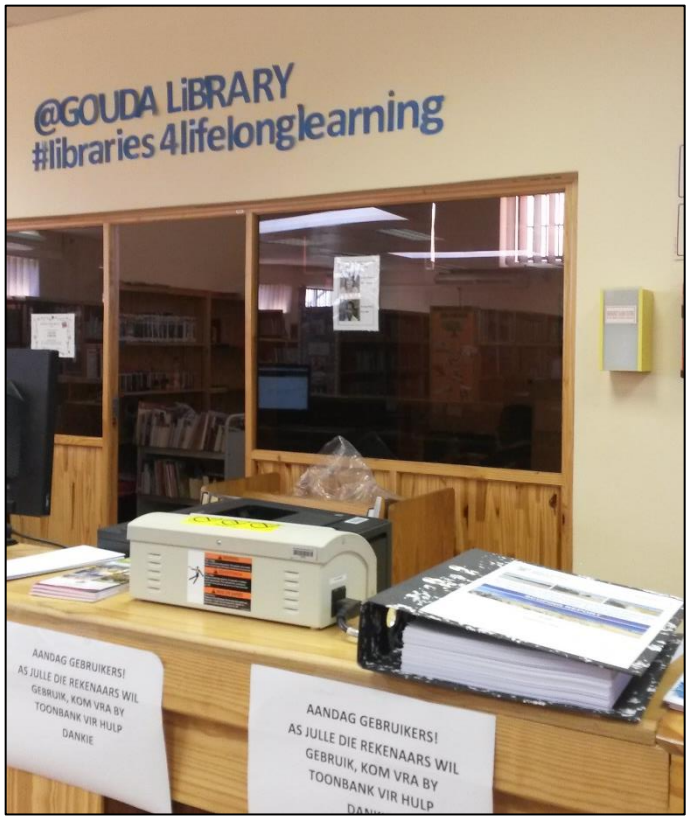


Figure 47: Draft Scoping Report at Gouda Library

15.1.4.2 Authority Review

Hardcopies of the document were also provided to the following key regulatory and commenting authorities for a 30 day review period.

15.1.5 Meetings

15.1.5.1 Authority Meeting and Site Visit

An authority meeting and site visit was conducted on 25 May 2016. Three locations along the proposed pipeline route were visited, being the weir location, a site near the wetland and the Discharge Point, and the Dam.

Details of the site visit are contained in the Comments and Responses Report in **Appendix F7** and the attendance register, meeting agenda, and minutes of the meeting are contained in **Appendix F6**.

15.1.5.2 Focus Group Meetings – Landowners

Meetings were arranged with most of the affected landowners on 27 September 2016 to discuss the potential impacts of the project components on their properties. The minutes and attendance registers of the focus group meetings are provided in **Appendix H**.

15.1.5.3 Public Meetings

A public meeting was held at the Gouda Library on 04 October 2016. The aim of the meeting was to present the Draft Scoping Report and to provide IAPs with a platform for project related discussions. The minutes and attendance registers of the meeting are provided in **Appendix F6**. All registered IAPs were notified of the public meeting via email or SMS.

15.1.6 Comments and Responses Report

The Comments and Response Report, which summarises the salient issues raised by I&APs and the project team's response to these matters, is contained in **Appendix F7**. The issues listed in the Comments and Response Report were identified from minutes of meetings, completed Reply Forms and other correspondence received to date.

The Scoping phase serves to identify and prioritise issues for further assessment during the EIA phase. Accordingly, the comments received from IAPs during public participation as part of Scoping will be afforded due consideration and further investigation during the pending EIA stage.

The main concerns raised by IAPs to date are as follows:

- The impacts of the proposed developments on the water quality of the Dam and the Berg River;
- The monitoring of overflow from the Dam;
- The impact of the project on flooding in the area;
- The redundancy of the existing canal;
- The impact to the project on landowners existing pumps; and
- The impact of access roads on existing properties.

15.2 Summary of Public Participation during EIA Phase

15.2.1 Updating of IAP Database

The IAP database will be updated as and when necessary during the execution of the EIA.

15.2.2 Amended Application Form

Based on comments received from DEA which requested more detailed indication of which Listed Activities are being applied for, as well as the fact that the electrical supply no longer being included in the scope of work for the proposed project, a second Amended Application Form will be submitted with the Draft EIA.

15.2.3 Public Review of Draft EIA and IWULA

In accordance with GN. No. R. 982 of 04 December 2014, IAPs are granted an opportunity to review and comment on the Draft Reports. Hardcopies of the Draft Reports will be placed at the venue listed below (**Table 25**). An electronic copy of the reports will also be available. Emails or SMSes was sent to all registered IAPs which will include the details of the review period of the Draft EIA and IWULA.

Table 25: Location of Draft EIA and IWULA Report for Review

Venue	Address	Contact Details
Gouda Library	Malva Street, Gouda	023 232 0841

The public review of the Draft EIA and IWULA will take place for a 30 day review period **from 15 February 2017 to 17 March 2017**.

15.2.4 Authority Review Period of Draft EIA and IWULA

Hardcopies of the Draft IWULA were delivered to the Western Cape Regional DWS Office for review. The authority review of the Draft EIA and IWULA will take place from **15 February 2017 to 17 March 2017**.

15.2.5 EIA Public Meeting

A public meeting will be held at the Gouda Library on 22 February 2017. The aim of the meeting was to present the Draft EIA Report and to provide IAPs with a platform for project related discussions. All registered IAPs were invited to attend the public meeting.

In addition, an Authority Meeting and site visit will take place on 23 February 2017 to present the findings of the Draft EIA Report.

15.2.6 Comments and Response Report

A Comments and Response Report will be compiled and included in the EIA Report, which will record the date that issues were raised, a summary of each issue, and the response of the team to address the issue. In addition, any unattended comments from the Scoping Phase or where the status of the responses has changed, will also be addressed in the Comments and Response Report for the EIA Phase.

15.2.7 Review of the Final EIA (including the IWULA)

Registered IAPs and authorities will be granted an opportunity to review and comment on the Final EIA and IWULA. A link containing the electronic Final Reports will be sent to Authorities and Registered IAPs only. Any further comments from Registered IAPs will be forwarded to the Competent Authority.

15.2.8 Notification of DEA's Decision

All authorities and registered IAPs will be notified via email or SMS after having received written notice from DEA on the final decision for the EIA. Advertisements will also be placed as notification of the Department's decision. These notifications will include the appeal procedure to the decision and key reasons for the decision. A copy of the decision will also be provided to IAPs on request.

16 CONCLUSION AND RECOMMENDATIONS

16.1 Sensitive Environmental Features

Within the context of the project area, cognisance must be taken of the following sensitive environmental features (shown in in **Figure 48**) for which mitigation measures are included in the Draft EIA, IWULA and EMPr:

- The EWR of the Berg Estuary and River.
- The existing agricultural activities and vineyards in the area.
- The affected landowners, farmers, and the existing water users in the area.
- The existing pumps located within the Berg River.
- All existing infrastructure and structures, including the powerlines and roads in the area, are regarded as sensitive and need to be safeguarded from construction activities.
- All traffic and pedestrians on the public roads are regarded as sensitive and measures need to be implemented to safeguard these road users.
- One of the two access roads will run along the northern boundary of the farm Sonquas Drift 648/1, which has been described and graded by CK Rumboldt & Partners (2014) as part of their Swartland Rural Heritage Survey as having a grading of IIIB.
- A collection of ESA artefacts, including a single handaxe were identified on the edge of a field and close to the Berg River and the location of the pump station and weir.
- A number of watercourses are affected by the project. These systems include the Berg River floodplain, valley bottom wetlands, hillslope seeps, depressions and numerous drainage channels.
- The proposed developments encroach on the 1:100 year floodline, traverse wetlands and thus fall within 500m of a wetland.

- Both pipeline Alternatives 1 and 3 fall within the CBA and ESA: restore categories. Discharge Point 2 falls within the CBA.
- One breeding pair of Blue Crane (*Anthropoides paradiseus)* was noted on Gouklip Farm, near the proposed Pump station and Laydown Area 3.
- The Great White Pelican (*Pelecanus onocrotalus*) was observed on site and is listed as Vulnerable.
- One endemic species recorded on site was the Jackal Buzzard (*Buteo rufofuscus*).
- The proposed developments fall within two Critically Endangered vegetation units: Swartland Alluvium Fynbos and Swartland Shale Renosterveld.
- Three Terrestrial Threatened Ecosystems are affected by the proposed developments: Atlantis Sand Fynbos, Swartland Alluvium Fynbos, and Swartland Shale Renosterveld.
- No threatened species or plant species of conservation importance were noted on the proposed development areas.
- The Voëlvlei Nature Reserve is located on the Dam but is not impacted on by the proposed developments.
- Alternative 3 is situated adjacent to the Voëlvlei Nature Reserve and there is high probability of encountering and destroying the habitat of the CR Geometric Tortoise.
- Two Red Data frog species are known to occur in the region of the proposed development sites-namely Cape Rain Frog (*Breviceps gibbosus*) and Cape Caco (*Cacosternum capense*), both listed as Vulnerable, and the probability of occurrence of these species on the study area is high.

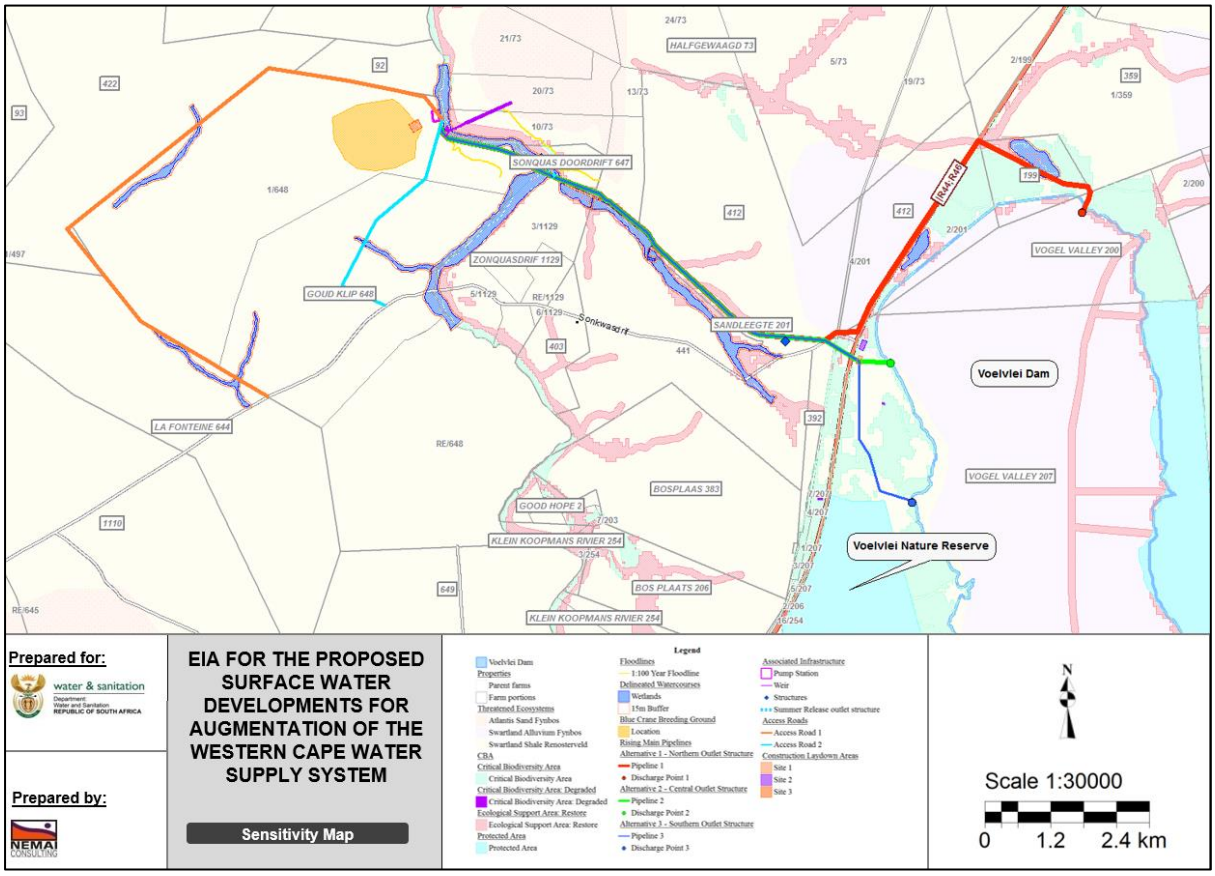


Figure 48: Sensitivity Map

The sensitivity map shown in **Figure 48** needs to be made available to the implementation team (including the Project Manager, Environmental Control Officer (ECO) and Contractor) in GIS format to allow for further consideration and adequate interpretation at an appropriate scale.

16.2 Environmental Impact Statement

The Western Cape Water Supply System serves the City of Cape Town, surrounding urban centres 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 utilised 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 i.e. the yield of the dam would be 23 million m^3 per annum more than it is currently.

Based on the location and nature of the proposed development, a Riparian Habitat and Wetland Delineation Impact Assessment was conducted.

The Aquatic and Wetland Specialist stated that according to the 2016 low flow season assessment, the state of the Berg River was in a largely modified state, which has led to modified macroinvertebrate and fish community assemblages. Furthermore, impacts to instream and riparian habitat and more notable water quality were evident. Numerous wetland types were identified and delineated for the study. These include valley bottom systems, hillslope seeps, depressions and the Berg River floodplain. The ecological status of the riparian area within the floodplain was determined to be largely modified. The integrity of the assessed wetland systems was determined to vary from moderately to largely modified. The local commercial agricultural activities and developments have contributed to the modifications of these systems.

The proposed project will have both direct and indirect impacts on the local watercourses. The most significant risks are associated with the weir and fishway structures, with the level of risk determined to be moderate. These moderate risks are expected for the construction and operation of the project. The risks associated with the supporting activities and linear structures was determined to be low. Several concerns regarding the fishway design have been highlighted and need to be addressed for the fishway to be successful.

In terms of the road options, Option 1 is the most preferred for the study from an aquatic and wetland perspective. The least preferred road option is Option 2. With regards to the pipeline alternatives, Alternative 1 is not recommended, and the preferred alternative is Alternative 3.

Critical environmental activities that need to be executed during the project life-cycle include the following:

- Pre-construction Phase
- Construction Phase
- Operational Phase

- Satisfy EWR; and
- Ongoing consultation with landowners, water users, and affected parties.

With the selection of the BPEO (Pipeline and Discharge Point Alternative 3), the adoption of the mitigation measures include in the EIA Report and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

16.3 Recommendations

Based on the information contained in this report, and taking into account the outcome of the impact assessment, opinions and recommendations included in the specialist studies as well as all supporting documentation, it is the recommendation of the practitioner that EA be granted by the DEA and DWS for the proposed surface water developments for the augmentation of the WCWSS.

The following pertinent conditions for inclusion in the WUL are recommended:

1. Alternative 3 Pipeline and Discharge Point Alternative 3 and Access Road Alternative 1 are recommended.
2. Appointment of an ECO to monitor compliance with the EA and the approved EMPr.
3. The operating rule for Voëlvlei Dam must ensure that the existing water use entitlements are not affected and that the EWR for the Berg River and Estuary are satisfied.
4. As discussed in the EMPr, various forms of monitoring are required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the project. The types of monitoring to be undertaken include:
    a. Baseline Monitoring needs to be undertaken to determine to the pre-construction state of the receiving environment, and serves as a reference to measure the residual impacts of the project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects;
    b. Environmental Monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded; and

c. Compliance Monitoring and Auditing for the independent Environmental Control Officer (ECO) to monitor and audit compliance against the EMPr and Environmental Authorisation.

5. Pertinent recommendations from the Riparian Habitat and Wetland Delineation Impact Assessment (The Biodiversity Company, 2016) include:
    a. The footprint area of the weir should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas.
    b. It is imperative that the new low level weir cater for fish migration, especially during very low flows.
    c. Pipeline trenches and sandy bedding material may produce preferential flow paths for water across the project area perpendicular to the general direction of flow instead of angle. This risk can be reduced by installing clay plugs at intervals down the length of the trench to force water out of the trench and down the natural topographical gradient
    d. Pipelines crossing watercourses should preferably span the systems above ground. This prevents disruptions to sub surface flow dynamics.
    e. The delineated aquatic and wetland areas outside of the specific project site area must be avoided where possible.
    f. The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access.
    g. Laydown yards, camps and storage areas must be beyond the aquatic and wetland areas.
    h. It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces.

If the above recommendations and the EMPr are strictly enforced to mitigate the identified possible impacts associated to it, then construction disruptions should have minimal lasting effect on the ecosystems of the proposed developments.

17 REFERENCES

Cape Action for People and the Environment. 2008. Berg Estuary Situation Assessment. C.A.P.E. Estuaries Management Programme. Produced by Anchor Environmental. – Downloaded from: http://www.fewlbnexus.uct.ac.za/sites/default/files/image_tool/images/91/Berg%20Estuary%20Management%20Plan%20-%20Situation%20Assessment.pdf

Cape Winelands District Municipality. 2007. Spatial Development Framework: District Management Area. Prepared by Envro Dinamik.

DEAT, 2002. Scoping, Integrated Environmental Management, Information Series 2, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT. 2002. "Integrated Environmental Management Information Series: Ecological Risk Assessment." Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT. 2005a. Guideline 3: General Guide to the Environmental Impact Assessment Regulations, 2005. Integrated Environmental Management Guideline Series. Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT. 2005b. Guideline 4: Public Participation, in terms of the EIA Regulations. Integrated Environmental Management Guideline Series. Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT. 2006. "Integrated Environmental Management Information Series 23: Risk Management." Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEA&DP. 2009. Guideline on Need and Desirability, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), Cape Town.

DEA&DP. 2011. Western Cape Integrated Water Resource Management Action Plan. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), Cape Town.

Department of Water Affairs, South Africa. 2010. Report No.2 : Preliminary Assessment of Options. Prepared by Western Cape Water Consultants Joint Venture, as part of the Pre-feasibility and Feasibility Studies for Augmentation of the Western Cape Water Supply System by Means of Further Surface Water Developments

Department of Water Affairs, South Africa. 2012a. Report No.3 : Feasibility Studies, Volume 1 – First Phase Augmentation of Voëlvlei Dam, Berg River-Voëlvlei Augmentation Scheme. Prepared by Western Cape Water Consultants Joint Venture, as part of the Pre-feasibility and Feasibility Studies for Augmentation of the Western Cape Water Supply System by Means of Further Surface Water Developments.

Department of Water Affairs, South Africa. 2012b. Report No.4 : Record of Implementation Decisions Regarding the First Phase Augmentation of Voëlvlei Dam. Prepared by Western Cape Water Consultants Joint Venture, as part of the Pre-feasibility and Feasibility Studies for Augmentation of the Western Cape Water Supply System by Means of Further Surface Water Developments.

Department of Water and Forestry, 2004. State of the rivers report.

Department of Water and Forestry, South Africa. 2007. Western Cape Water Supply System Reconciliation Strategy Study. Prepared by Ninham Shand (Pty) Ltd and UWP Consulting (Pty) Ltd.

Department of Water and Sanitation, South Africa. 2015. Final Resource Management Plan Voëlvlei Dam. Prepared by Nemai Consulting.

Mucinia, L., & Rutherford, M. (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19.

Statistics South Africa. (2011). Census 2011.

Western Cape Government, South Africa. 2013. Western Cape Provincial Spatial Development Framework.

West Coast District Municipality, South Africa. 2012. West Coast District Municipality Integrated Development Plan.

APPENDICES