HESSEQUA MUNICIPALITY

CONSTRUCTION OF NEW HEIDELBERG WATER TREATMENT WORKS

TECHNICAL REPORT

JANUARY 2026 (Revision 1)

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Contents

LIST OF ABREVIATIONS

µg/L	Microgram per Litre
AADD	Annual Average Daily Demand
AWWA	American Water Works Association
EIA	Environmental Impact Assessment
IDP	Integrated Development Plan
Kl/d	Kilolitres/day
m^3/hr	Cubic Meter per Hour
MCC	Motor Control Centre
mg/L	Milligram per Litre
OWB	Overberg Water Board
WSA	Water Services Authority
WSP	Water Services Provider
WSS	Water Supply Scheme
WTW	Water Treatment Works
WULA	Water Use Licence Application

EXECUTIVE SUMMARY

The only water supply source for Heidelberg and Slangrivier, is from the Overberg Water Supply System. The required assurance of supply has been compromised for several years. The projected increase in summer seasonal water demand in these towns, is predicted to exceed supply from the current source within the next 2 years.

Several water augmentation schemes have been investigated by Hessequa Municipality as possible solutions to the predicted supply shortage. Options investigated to date included Boreholes, Desalination and the proposed Heidelberg Water Scheme Project.

The Overberg WSS is fully developed and there are no further infrastructure options available to improve the system yield unless expanded. The proposed Heidelberg water scheme comprises the utilisation of the existing Bloekombos Dam, a new Water Treatment Works and a potable water pipeline from the WTW to Muir Street where it connects the Uitkyk Reservoir via a 200mm dia uPVC pipeline.

This report outlines the design, implementation, and key considerations for the construction of a new water treatment plant. The proposed plant aims to provide an efficient solution for treating water from the Duivenhoks Dam in addition to the present supply from the Overberg WSS, ensuring a consistent supply of high-quality water for residential and industrial use.

A site survey and a site geotechnical survey has been completed. An EIA practitioner has been appointed and this report will feed the required project information into the EIA process.

TERMS OF REFERENCE

Background

The Town of Heidelberg is currently supplied with potable water from the Duivenhoks WTW operated by the Overberg Water Board. The existing water allocation for Hessequa Municipality is inadequate to meet the towns current peak demands and future growth projections. Poor quality water and shortages in summer, necessitated the Hessequa Council to take action.

A new WTW for Heidelberg town was included under Item 12.18 of the Amended 2022-2027 IDP for Hessequa Municipality. Council approved the Amended 2022-2027 IDP at its meeting held on 31 May 2023.

The new WTW will ensure a sustainable, compliant potable water supply to meet the town's current and future demands. The new works must comply with SANS 241 standards and provide a reliable supply, taking into account operational and maintenance requirements.

Objectives

The project will be managed and implemented by the Hessequa municipality's technical department who will be responsible -

- To source technical support to design and compile tender documents for the construction of a fit-for-purpose 3 Ml/d Water Treatment Works.
- To ensure compliance with all relevant water quality standards and regulatory requirements, inter alia Safety and Environmental requirements.
- To deliver a cost-effective and energy-efficient facility which will minimize water losses by recycling of filtered water where possible.
- To ensure full testing, commissioning, and handover of a fully functional WTW.
- To supply the treatment works with a reliable power supply from the most cost effective point of source.
- To ensure that an Operating & Maintenance Manual is compiled within 6 months after completion and commissioning.

AUGMENTATION OF HEIDELBERG WATER SUPPLY

TECHNICAL REPORT

1 Introduction

1.1 Background

Heidelberg and Slangrivier forms part of the Hessequa Local Municipality in the Western Cape. The municipality is the Water Services Authority for the area and distribute potable water in all the towns within its area of jurisdiction. The towns of Heidelberg and Slangrivier receive at present all of their potable water from Overberg Water.

Overberg Water is a water board that was established under the Water Services Act (Act 108 of 1997). It operates three rural water supply schemes namely Ruensveld-wes, Ruensveld oos and Duivenhoks schemes. In total OWB supplied 4.17 million m^3 water per year through its plus minus 1480 km pipelines to both urban and rural consumers. Of particular interest to Hessequa Municipality is the Duivenhoks Regional Water Supply Scheme. This scheme sources water from the Duivenhoks dam, via the Duivenhoks River and distribute the potable water to towns and farms within its control area.

1.2 Current water supply

Overberg Water abstracts raw water for the Duivenhoks Scheme from the Duivenhoks River which is treated at the Duivenhoks WTW, outside Heidelberg. From the treatment works the water is pumped to a reservoir R8 at TWL +/-200 m MSL. From reservoir R8, a 2km x 160 mm dia. gravity pipeline feeds into the Skoolkop (TWL 146,0 m MSL) and a further 2,93 km x 200 mm diameter pipeline into the Uitkyk (TWL 158,0 m MSL) reservoirs in Heidelberg. A rising main taps off this line and potable water is pumped over some 8.4 km x 160 mm uPVC pipeline into the Slangrivier reservoirs (TWL 213,7 m MSL).

The current water allocations from OWB is summarised in Table 2.

2 Water Demand

2.1 Population Growth

The population growth for Heidelberg and Slangrivier based on the 2001 and 2011 Census datasets, were used to estimate population growth in the Hessequa Annual Report 2023/24. The population figures, based on official Stats SA, were over the period 2001-2011 some 1.5% per annum for Heidelberg and some 2.5% per annum for Slangrivier. The projections for 5 year intervals is summarised in Table 1 below.

Table 1: Actual and estimated population growth figures

Town	**2001** Stats SA	**2011** Stats SA	**2015** Est	**2020** Est	**2025** Est
Heidelberg [1.5%]	7125	8259	*8762*	*9433*	*10156*
Slangrivier [2.5%]	2352	3011	*3324*	*3761*	*4255*

2.2 Water Usage

The treated water allocation from OWB for Heidelberg and Slangrivier is summarised in Table 2.

Table2: Summary of OWB allocations

Town	Allocation (Kl/d)	Allocation (Kl/month)	Allocation (Ml/y)
Heidelberg	1694.39	51 508	618
Slangrivier	336	10 221	122

The Water Master Plan compiled by GLS Consulting for Hessequa Municipality (June 2019), indicated the bulk water input/demands (Table HEW3.1) for Heidelberg and Slangrivier for **2018/2019** as follows:

Table 3: Summary of OBW allocations vs 2018/19 Water Demand

Town	AADD 2018/19 (Kl/d)	Annual 2018/19 Demand (Ml/y)	Allocation from OWB (Ml/y)	All stands Future Demand (Ml/d)
Heidelberg	1113	406.1	618	655
Slangrivier	241	87.9	122	235

Measurements were conducted since 2019 for OBW by Flo-Check on the Duivenhoks canal supply:

- 1 July 2020 – 30 June 2021 = Ave. usage 26 500 m³ per week (1.378 million m³/annum), against allocation of 23 000 m³ per week (1,303.6 m³/annum).
- 1 July 2021 – 30 June 2022 = Ave. usage 28 400 m³ per week (1.476 million m³/annum), against allocation of 23 000 m3 per week.

It is clear that no additional allocations will be possible in future, since the total irrigation water releases exceeded the allocations in recent years.

The 2018/19 water demand figures were applied as the base demands and increased by 1.5% and 2.5% for Heidelberg and Slangrivier, respectively. For Heidelberg, the peak month demand was calculated at 1.4 x AADD and the peak week demand at 1.7 x AADD. For Slangrivier, the peak month demand was calculated at 1.3 x AADD and the peak week demand at 1.6 x AADD. This is due to the lower income life style.

Fig. 1: Estimated water demands for Heidelberg (2019 – 2030)

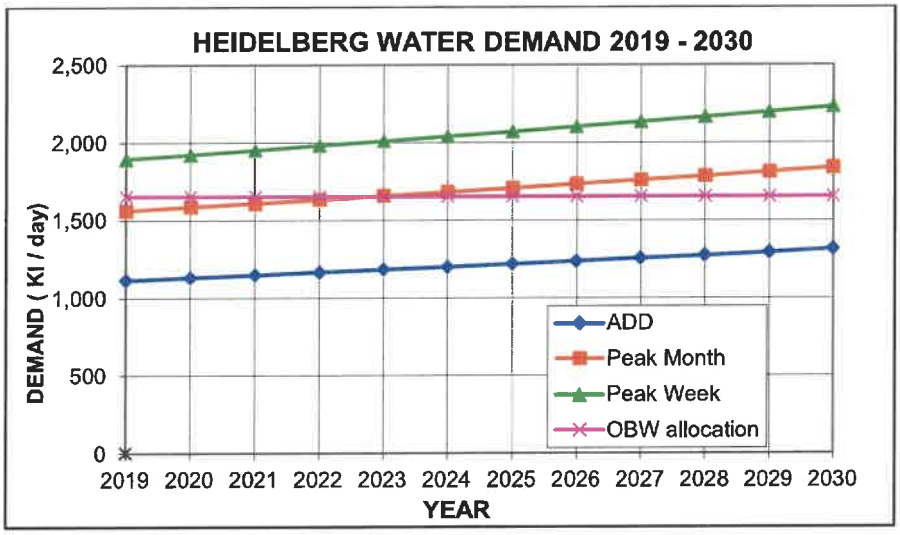
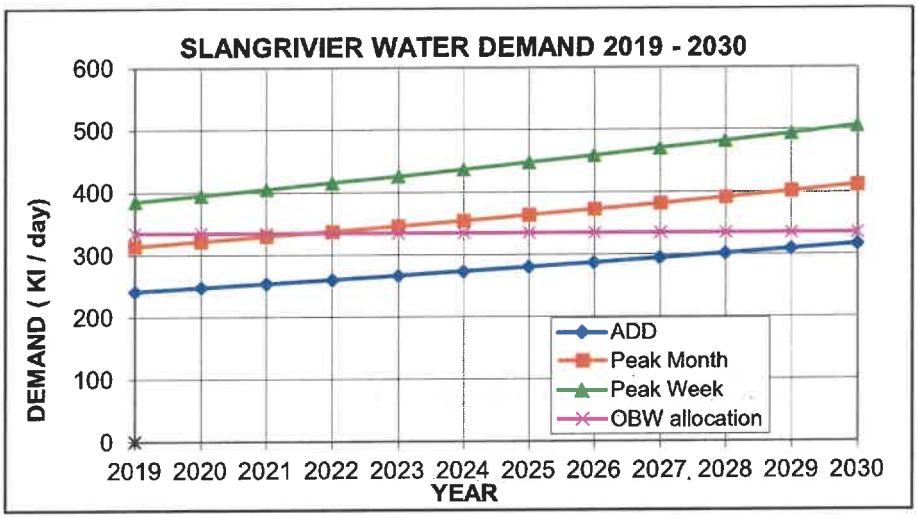


Fig.1 confirms that the peak month demand for the town of Heidelberg, has already been exceeding the allocated water from OBW in 2023/24 and the peak week demand could not be met by supply. The town has been subjected to strict summer water restrictions in order to bridge the peak summer short falls.

Fig.2 confirms that the peak month demand for the town of Slangrivier, has been exceeding the allocated water from OBW since 2022/23 and the peak week demand could not be met by supply. The town has been subjected to strict summer water restrictions in order to bridge the peak summer short falls.

Fig. 2: Estimated water demands for Slangrivier (2019 – 2030)



2.3 Treated water capacity required

The peak week figures give the best indication of the required water treatment capacity. In Table 4 the 2025 AADD and peak week water demands are escalated by 1.5% and 2.5% respectively for Heidelberg and Slangrivier.

Table 4: Predicted water demands for 2040

Heidelberg 2025		Heidelberg 2040	
AADD (Kl/d)	Peak Week (Kl/d)	AADD (Kl/d)	Peak Week (Kl/d)
1217	2069	1522	2587
Slangrivier 2025		Slangrivier 2040	
279	447	405	648

In 2040 the estimated peak week demand for both towns is estimated at **3235** Kl/d. A new WTW /water source of 3000 Kl/d capacity, is required.

3 Proposed Supply Upgrade

3.1 Source Water

The land listed under the Duivenhoks irrigation scheme for Hessequa Municipality, is as follows:

Table 5: Summary of OWB listed annual volumes

Area listed (Ha)	Abstraction point	Annual Volume @ 6000 m^3 /Ha (m^3 / annum)
33,0	From Duivenhoks River	198 000
79,3	From earth canal into Bloekombos Dam	475 800

The listed allocation from the canal is 475,800 m3/annum (1303.6 m^3/d). At present none of this allocation is being used by Hessequa Municipality. Part of the water from Bloekombos Dam is presently sold off under contract to a private person.

The river water near Heidelberg was sampled and analysed. The contamination along the river bed flow result in high concentrations of manganese and aluminium, which, together with the higher turbidity, will require special treatment processes.

The water samples analysed from the canal and the Bloekombos Dam in November 2024 indicated that the raw water has low turbidity and colour levels which will be more easily treated in a conventional designed treatment plant.

Table 6: Typical raw water quality in Bloekombos Dam

Sampling Point	Canal	Inlet to dam	Middle of dam	Outlet in dam
Colour (mg/l as Pt)	550	471	474	548
Turbidity (NTU)	69	59	61	92

A full analysis of the water in the Bloekombos Dam by AL Abbot & Associates (Pty) Ltd (**Appendix B**) confirms that all water analysis criteria as specified by SANS 241-1:2015 for potable use, are met except for the following (which will require treatment by the new treatment works):

pH – 6.64; Turbidity – 12.4 NTU; Colour – 276 mg/L; Iron – 742 µg/L; Total Coliform Bacteria and Heterotrophic Plate Count.

3.2 Utilise Bloekombos Dam as Storage facility

Based on the assumption that Hessequa would change over to supply all its potable water from river abstractions combined with canal supply, Zutari in their 2023 Pre-Feasibility Report proposed the following two options:

(a) Raise the Bloekombos Dam by 4m to increase storage from present 172,000 m^3 to 300,000 m^3 – Estimated cost R 14,0 mill

or

(b) Construct a new off-channel dam with storage 150,000 m^3 to be operated together with present Bloekombos Dam – Estimated cost R 42,0 mill
(This cost included a link pipeline between new dam and Bloekombos Dam)

The option to raise Bloekombos dam together with a pump station at the river, a pipeline to the proposed treatment plant and the provision of a 3 Ml/day plant based on all possible variable raw water qualities in the river, was estimated at R 84,0 mill (excl. VAT). This high capital cost is beyond the affordability of the Hessequa Municipality and would result in unaffordable unit rates for water.

A potential site for a proposed water treatment plant has been identified on the left bank directly downstream of the Bloekombos Dam wall.

An analysis of the optimal water use from the canal only and utilisation of the present Bloekombos dam, indicated that with a minimum 60% balancing capacity at the beginning of summer season, more than 3 months storage will be possible.

Photo 1: Proposed site of Water Treatment Works at Bloekombos dam

The treated water supply from the OWB Duivenhoks WTW for Heidelberg and Slangrivier, is 624 Ml/y [Table 2] which amounts to some 1984 Kl/d. The Duivenhoks WTW has not been increased in capacity since its original implementation and OWB has struggled to meet its allocated monthly supplies in December/January months.

The Duivenhoks supply into the Heidelberg supply system over January/December months in recent years were as follows:

Table 7: Heidelberg bulk water supply by OWB

Allocation [Kl/month]	Jan 2022 [Kl]	Dec 2022 [Kl]	Jan 2023 [Kl]	Dec 2023 [Kl]	Jan 2024 [Kl]	Dec 2024 [Kl]
51 508	39 369	38687		49 238	32 342	41 178

Table 8: Slangrivier bulk water supply by OWB

Allocation [Kl/month]	Jan 2022 [Kl]	Dec 2022 [Kl]	Jan 2023 [Kl]	Dec 2023 [Kl]	Jan 2024 [Kl]	Dec 2024 [Kl]
10 221	8 841	9 114		12 595	10 807	10 968

Estimated ADD for **Heidelberg** – 2040 [Table 4]	1522	Kl/d
Estimated peak season demand – 2040 [PF 1.4]	2131	Kl/d
Est. treated water low supply scenario from OWB	1000	Kl/d
Peak season daily drought shortfall in 2040	**1131**	Kl/d .....(1)

If, in the event of Dec-Jan water restrictions on irrigation water (say) to 40% of allocations, then -

Canal water into Bloekombos (40% x 1303 Kl/d)	**520**	Kl/d .....(2)
Capacity of Bloekombos dam	172 000	m^3
For 60% active capacity in Dam, volume available	103 200	m^3 .....(3)
Available supply period with Zero canal inflow (3) / (1)	**91 days**	
Available supply period with a 520 Kl/d inflow (3)/ (2)-(1)	**171 days**	

The "drought" scenarios considered above, confirm that the Bloekombos dam will still have sufficient balancing storage capacity to bridge 3 months of peak season demand with zero inflow from canal and 5,6 months with a reduced inflow from the canal.

3.3 Proposed Water Treatment Works

The proposed WTW will be based on the following:

1. Maximum capacity of 3,000 m^3/day (3 Ml/day);
2. Surface abstraction by floating pumps from Bloekombos Dam on a variable demand basis;
3. Treatment processes as discussed in Section 4.;

4. Sludge dams for backwash water collections and sludge settlement;
5. A collector sump and pumps for return flow of supernatant from sludge dams into Bloekombos dam to optimise water use. Return flow water to be pumped along an underground 110mm x 87 m long uPVC pipe to the canal inlet point at the Dam;
6. A pump station and 200mm x 650 m uPVC pipeline for final water distribution from the WTW into the existing bulk distribution system in Heidelberg;

3.4 Power Supply

The proposed treatment plant will require a 3 phase 400/230V nominal supply at 50 Hz and will be made available from the nearest pole mounted transformer.

Photo 2: Point of power supply to WTW

The supply from the transformer to the plant control room, will be an underground cable some 55m long as shown on Site Layout Plan (Appendix D).

4 Process Considerations

The proposed process train is depicted in the Process Flow Diagram in **Appendix A.** The process can be summarised as follows:

i Raw water abstraction (floating pumps and pipeline;
ii pH Adjustment (Caustic Soda dosing);
iii Coagulant dosing (ZetaFloc 2348);
iv Flash mixing and flocculation (floc conditioning);
v Filtration & backwash water collection/recycling;
vi Final disinfection (Chlorine);
vii Final water distribution pumps.

4.1 Unit Treatment Capacities

4.1.1 Raw water analysis

The analysis of raw water sampled from Bloekombos Dam (Appendix B), confirmed that the only quality criteria which do not comply with the SANS 241-1:2015 standards for potable water, are pH – 6.64; Turbidity – 12.4 NTU; Colour – 276 mg/L; Iron – 742 µg/L; Total Coliform Bacteria and Heterotrophic Plate Count.

The following treatment processes will be incorporated to ensure that the final water complies in all respects.

4.1.2 pH Adjustment (Caustic Soda)

Caustic Soda will be dosed upstream of the works to ensure that the incoming water is at pH 8, which is optimum for iron removal. An inline orifice plate will create the point of dosing and turbulence required.

The Caustic Soda dosing rate will vary between 10 – 15 mg/l depending on the incoming pH. Two dosing pumps shall be provided, one duty and one standby.

A continuous sampler and pH controller will be installed in the raw water sump. Each dosing pump shall be variable speed controlled and the dosage rate directed from the controller. Dosing pumps shall each be rated at a 5 l/hr capacity.

4.1.3 Coagulation (Poly Electrolyte dosing)

Flocculation beaker tests performed by Metsi Chem iKapa (2021) on raw water from the Duivenhoks Dam, confirmed that an optimum dosage of 80 mg/L of ZetaFloc measured as un-filtered water, will result in sufficient iron, turbidity and colour removal.
The flocculant dosing pumps shall be sized accordingly.

4.1.4 Post Chlorination

Coliform bacteria and other contaminants will be removed by oxidation through chlorine dosing. The post chlorine dosing rate will vary between 0.6 – 1.5 mg/l. Two injectors shall be provided, one duty and one standby. Each injector shall have a dosing capacity of 1.5 mg/l. The clear water sump will have a division wall to prevent short-circuiting and enough contact time for disinfection. A sampling point for water samples will be provided on the outlet pipes to the final water pumps.

4.1.5 Filtration

The raw water quality is of such a nature that no standard settling tank will be required. Direct filtration onto 3 x 2.3m diameter pressure filters will be required.

WTW Design flow		3	Ml/d
	i.e.	125,0	Kl/hr
Number pressure filters		3	
Flow /filter		41,7	m3/hr
Filtration rate		10	m/hr
Required area/filter		4,17	m2
Filter diameter		2,30	m

Filter media shall be a 900mm bed of glass media, effective grain size (d_e) 0.6-1.4mm with uniformity coefficient (P_{60}/P_{10}) of 1.0. The glass filter medium will be supported on a gravel bed 150mm thick.

The gravel layer shall be silica and have an effective size (d_e) 3-5mm and a uniformity coefficient < 2.5.

4.1.6 Sludge Handling

The option to dispose of the backwash water into the municipal sewer system and thus finally dispose into the waster water treatment works, was considered. The proposed WTW is located on the far end of Heidelberg and the volumes discharged during backwashing is much higher than what the sewer design capacities on the outskirts can transfer. This option is also not contributing to water saving and economic water usage.

In order to minimise on water losses during water treatment, three concrete lined lagoons, with ground level dimensions 27m x 12m and 1.8m deep, will be incorporated for the recovery of backwash and filter rinsing water, as detailed in Appendix E – Pond Elevations Profile. The top two lagoons will be operated as settling dams and the third lagoon will operate as an artificial reed bed, with all the backwash settled water passing through the reed bed and be fully returned into Bloekombos Dam. Only the site rainwater runoff will be piped into the non-perennial stream.

Filters will be backwashed at 4 hours intervals to enable the recycle pump to draw the settled sludge supernatant water down at a constant rate. The recycle pump (+ standby) will pump the controlled flow of supernatant from the artificial reed bed at 3.0 L/s along a 100mm diameter uPVC underground pipeline to the inlet point of the irrigation canal into Bloekombos Dam.

Surface water discharged from the sludge settling dam will be collected from the surface by a floated outlet pipe, floating just below the surface. In this manner the minimum sludge will be carried over into the artificial reed bed, where the final discharge will then be carried over into the return flow sump. This will also ensure that in the event of sump pump failure, a controlled overflow from the plant with minimal risk for contamination, is in place. The overflow water (after settling) will contain low concentrations dissolved iron (a natural environmental metal) and some colour (organic origins) and turbidity (natural surface soil origins).

Settled sludge collected in the lagoons will require to be emptied twice per annum. Access for a suction tanker to each lagoon will enable sludge to be abstracted and transferred to the Heidelberg landfill site. The two settling lagoons will be cleaned (desludged) one at a time while the other lagoon is operational.

Return flow from the artificial reed bed into the Bloekombos Dam will be at an estimated ratio of *Inflow canal/return flow = 20/1*. Artificial reed beds are highly efficient in Fe removal form streams and waste water. Fe levels as high as 40 mg/l can be treated with some 80-90% removal, based on the design parameters selected.

All of the backwash settled water passing through the reed bed will be fully returned to the Bloekombos Dam. Only the site stormwater runoff will be piped into the natural stream. This is the preferred option since the natural regrowth of natural wetland species will be supported.

5 Land requirements

Erf Re/557 on which Bloekombos Dam is situated, is zoned as Open Space Zone 1. The erven to the south of the Bloekombos Dam which have been identified as the proposed site for the new WTW and sludge dams, are at present zoned as follows:

- Erf 672 – Single Residential Zone 1 (Property Owner – Hessequa Municipality)
- Erf 676 – Agricultural Zone 1 (Property Owner – Hessequa Municipality)
- In the centre is a short section, zoned as road reserve.

In order to develop the new WTW and related infrastructure, all affected erven should be rezoned and consolidated into a single erf, zoned as Utility.

Photo 3: Land required for proposed Project

6 Cost Estimate

Table 9: Summary of Cost Estimate

SECTION	DESCRIPTION		AMOUNT R
1	PRELIMINARY & GENERAL (+/-12%)		R 3 490 000,00
2	SITE CLEARANCE		R 30 700,00
3	WATER TREATMENT Civil /Building		R 20 000 000,00
4	TREATMENT PONDS		R 1 200 000,00

5	PIPELINES & FITTINGS		R 3 000 000,00
6	ACCESS ROAD		R 200 000,00
7	ELECTRICAL & MECHANICAL EQUIPMENT		R 4 646 000,00
8	PROFESSIONAL FEES		R 200 000,00
	SUB-TOTAL A		**R 32 766 700,00**
	ADD 10% CONTINGENCIES		R 3 276 670,00
	SUB-TOTAL B		**R 36 043 370,00**
	ADD 15% VAT		R 5 406 505,50
	GRAND TOTAL		**R 41 449 875,50**

Hessequa Municipality will contribute R 3 450 000 (incl. VAT) of own funding while the remaining R 38 000 000 (incl. VAT) will be externally funded, to make up the total project cost of R 41 450 000 (incl. VAT).

7 Implementation

For the augmentation portion of the works there are two ways of implementing the contract, i.e.:

i Conventional separate civil and mechanical contracts;

ii Combined civil and mechanical contract.

The conventional separate civil and mechanical contracts approach requires that the civil contractor completes his portion of the works and leaves it ready as per the mechanical & electrical installation requirements. Under this contract, any scheduling overruns by either contractor are likely to have an impact on the other contractor.

Under the combined civil and mechanical contract one contractor takes responsibility for the civil, mechanical and electrical portion of the works. The appointed contractor would assume all responsibility and scheduling. This may result in a more costly contract owing to a single contractor taking all the risks.

It is recommended to make use of the conventional separate civil and mechanical contracts. This way ensures that the professional team has control over both the civil and mechanical contractors appointed.

8 Environmental Issues

The proposed upgrades will trigger an EIA process and it is recommended that an environmental consultant be included in the process. It is most likely that only a Basic Assessment Report is required for the proposed upgrades of the water supply upgrade.

The proposed cut and fill construction of the three sludge settling lagoons, will have 3.0m high support embankments whereas the capacity of each lagoon will be 518 m^3. These lagoons therefor do not trigger any dam safety registration requirements.

9 Conclusion and Recommendations

In order to upgrade the bulk treated water supply to the town of Heidelberg, the following recommendations are made:

i Construct a 3 Ml/day water treatment plant downstream of the Bloekombos dam;

ii Construct a new 200mm diameter pipeline for final water distribution into the Heidelberg bulk supply system;

iii Construct 3 x sludge settling ponds and return flow pumps to maximise water use and reduce waste water from the treatment plant.

iv Consolidate Erven 672 and 676 and rezone.

10 References

i. American Water Works Association: Water Quality & Treatment: Sixth Edition 2011;

ii. FA van Duuren: Water Purification Works Design: Water Research Commission;

iii. Zutari Consulting Engineers: Bulk Water Supply in Heidelberg Area – A Pre-Feasibility Study 2023;

iv. GLS Consulting: Hessequa Municipality: Water Master Plan June 2019.

11 Appendices

A WTW Flow Diagram

B Water Analysis – Bloekombos Dam

C Drawing - Site Layout Plan

D Drawing - Pond Elevation Profiles

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21 - 01 - 2026

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