Upgrading of the Bulk Water Distribution System between Leliefontein Reservoir (Paarl) and Con Marine Reservoir (Wellington)

Funding Implementation Plan for Infrastructure Investment Programme for South Africa Funding

Drakenstein Municipality

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Contents

Figures

Tables

1 Introduction

Consistent with the Municipal Water Master Plan, Drakenstein Municipality implemented various bulk water supply upgrades over the past ten years to increase the assured supply of water for the Newton, Wellington and Mbekweni areas. These water requirement upgrades were initiated due to rapid urban expansion. Furthermore, the upgrades facilitated further development within the Drakenstein Municipal region, while ensuring an adequate water supply to the existing communities.

The Wemmershoek – Leliefontein – Con Marine gravity supply scheme is an integral part of the water supply infrastructure for Newton, Wellington and Mbekweni. The Wemmershoek – Leliefontein – Newton – Wellington bulk water supply upgrade scheme comprises various phases as part of the broader master plan, of which the following phases have been implemented:

Phase 1: Bulk supply network amplification between Con Marine Reservoir and the proposed new 2 x 11 Mℓ Newton Reservoirs.

Phase 2: Construction of the 2 x 11 Mℓ Newton Reservoirs and new supply pipeline from the Leliefontein bulk supply pipeline as well as the distribution pipeline linking to the Phase 1 pipeline.

Phase 3: Construction of the Leliefontein Booster Pumpstation to accommodate peak demand from Newton, Wellington and Mbekweni in the summer months. The pumpstation is a Pump-as-Turbine (PAT) system using the head in the Wemmershoek bulk supply pipeline (supplying the Leliefontein Reservoirs) to generate electricity during the months when pumping to Wellington is not required (approx. 10 months of the year).

Funding for the implemented phases was a combination of Municipal Infrastructure Grant funding and counter funding from Drakenstein Municipality. The bulk supply pipeline upgrade between the Leliefontein Reservoirs in Paarl and the Con Marine Reservoir in Wellington is the final phase (Phase 4) in securing an assured supply of water to the Newton, Wellington and Mbekweni areas.

This report serves as an implementation plan for the funding required to plan the final phase (Phase 4) of the Leliefontein – Newton – Wellington bulk water supply upgrade scheme. Consequently, this report indicates how the project team will utilise the proposed funding amount of R4,400,000 (excl. VAT) for this important project.

2 Background

HISTORICAL WATER REQUIREMENTS FOR PAARL & WELLINGTON

Various historical records of water requirements for Paarl and Wellington were obtained from the Drakenstein Municipality, the City of Cape Town (CCT) and most recently, from the Drakenstein Municipality's updated information to December 2017. The historical annual water demand volumes for Paarl and Wellington, as obtained from the 2009 Bulk Water Study and extended to 2016 using records made available by the Municipality, are shown in Figure 1.

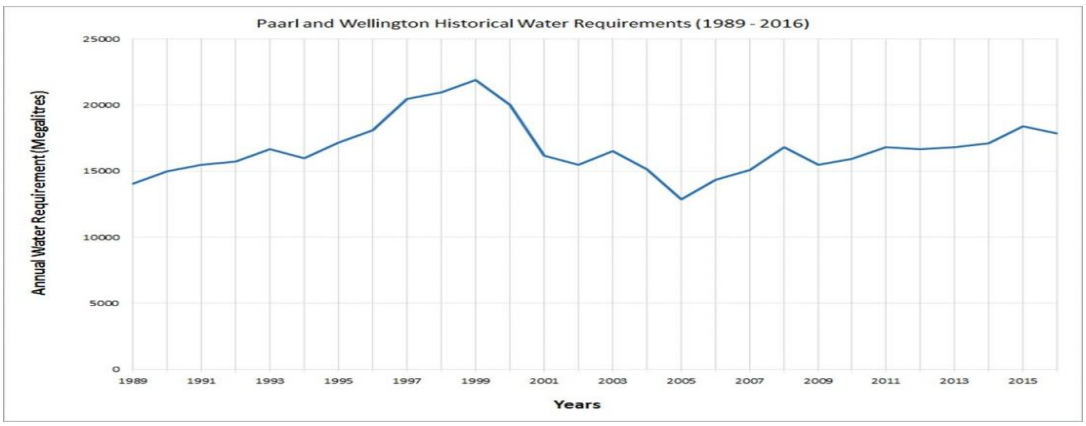


Figure 1 Total Historical Bulk Water Demands for Paarl and Wellington

Figure 1 shows that Drakenstein Municipality's introduction of Water Demand Management (WDM) in the late 1990s proved to be extremely successful and reduced the water demand of the two towns significantly. The effects of the WDM program can be seen in Figure 1, where a rapid increase in water demand was observed through the 1990s but after WDM was introduced in 2000, a dramatic decrease in demand occurred. In 2007 the water demand was 53% lower than the projected water demand for that year (projected from the peak demand experienced in 1999). The demand in 2006 was the same as the demand in 1989 and was 6 700 Mℓ less than the historical peak demand of 1999.

In 2016/2017 the Towns of Paarl and Wellington consumed approx. 14 220 Mℓ of potable water. Some of this demand was met from local sources (approx. 903 Mℓ), but the bulk (13 317 Mℓ) was supplied by the City of Cape Town (CCT) from their Wemmershoek Dam and Water Treatment Works (WTW). Based on agreements dating back to 1952 and 1980, 830 Mℓ of this water is supplied free to Paarl, and 332 Mℓ free to Wellington, per annum. A further 6 170 Mℓ per annum is supplied to Paarl, and 2 168 Mℓ per annum to Wellington, at a tariff of only 1.2831 c/kℓ. The remaining 3 817 Mℓ of water was purchased from CCT at their full tariff.

PROJECTED FUTURE WATER DEMANDS FOR PAARL & WELLINGTON

The approach taken was to assess the actual growth in water requirements between 2007 and 2015 shown in Figure 1. The average growth in water requirements between 2007 and 2015 was 2.9%, the demand in 2015 being significantly higher than the demands in the immediately preceding years. It then fell to 14 220 Ml/a in 2017. This decrease is attributed to the severe water restrictions that were implemented because of the serious drought experienced in the Western Cape at the time.

It is likely that when restrictions are lifted there will be a bounce-back period before the demands normalise. It also seems likely that some of the measures implemented by the Municipality and by the users will permanently suppress the future growth of water demands. Therefore, future demands have been projected from the relatively high 2015 demand of 19.05 million m^3/annum for the following low, medium and high growth rate scenarios:

- Scenario 1: High Water Requirement Scenario 3.1%
- Scenario 2: Medium Water Requirement Scenario 2.3%
- Scenario 1: Low Water Requirement Scenario 1.4%

The resulting water requirement projections to 2040 for each of these scenarios are shown in Figure 2. The projected medium growth requirement of 34.4 million m^3/annum in the year 2041 is slightly higher than the projection of a requirement of 31.8 million m^3/annum by 2041 contained in the 2017/2018 Water Services Development Plan, which was determined using the WSDP Model.

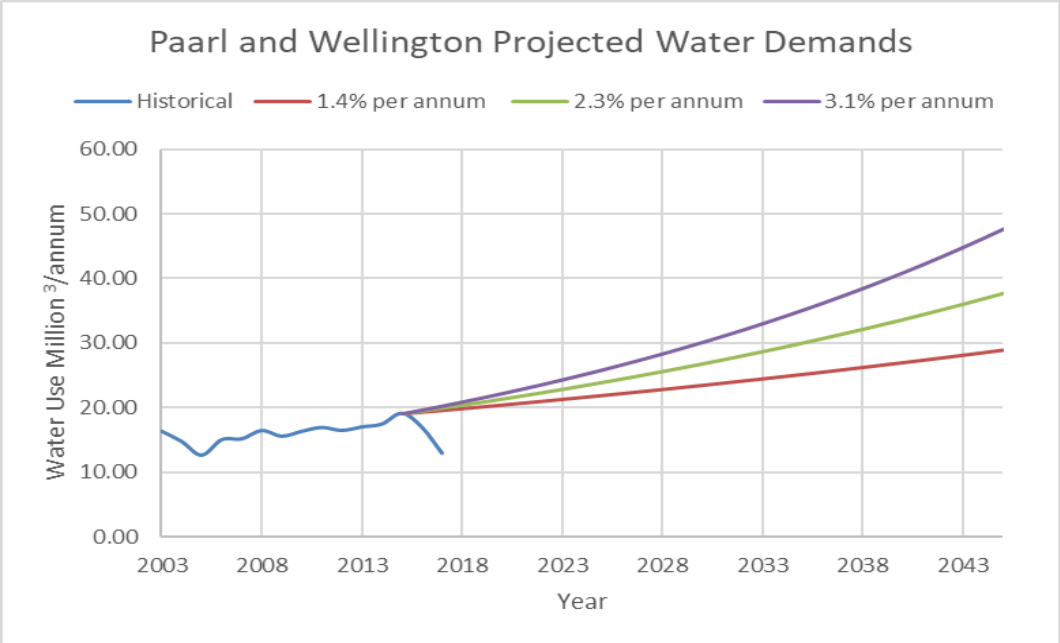


Figure 2 Future Water Requirement Scenarios

BULK WATER SUPPLY SYSTEM TO PAARL & WELLINGTON

The bulk supply infrastructure that supplies water from Wemmershoek Dam to Paarl and Wellington consists of a 14 km 1 000 mm diameter asbestos cement pipeline from the CCT Wemmershoek pipeline to Leliefontein Reservoirs, and a 5 km 700 mm diameter and 1.7 km 525 mm diameter line from the CCT pipeline to Courtrai Reservoirs. A pipeline links the Leliefontein Reservoirs above Paarl with Con Marine Reservoir in Wellington. This line consists of a 500/450 mm diameter asbestos cement pipeline approx. 11 km long. The maximum flow in the Wemmershoek to Leliefontein pipeline is affected by the head in the Wemmershoek to Cape Town pipeline. Figure 3 indicates the extent of the existing pipeline route between the Leliefontein and Con Marine Reservoirs.

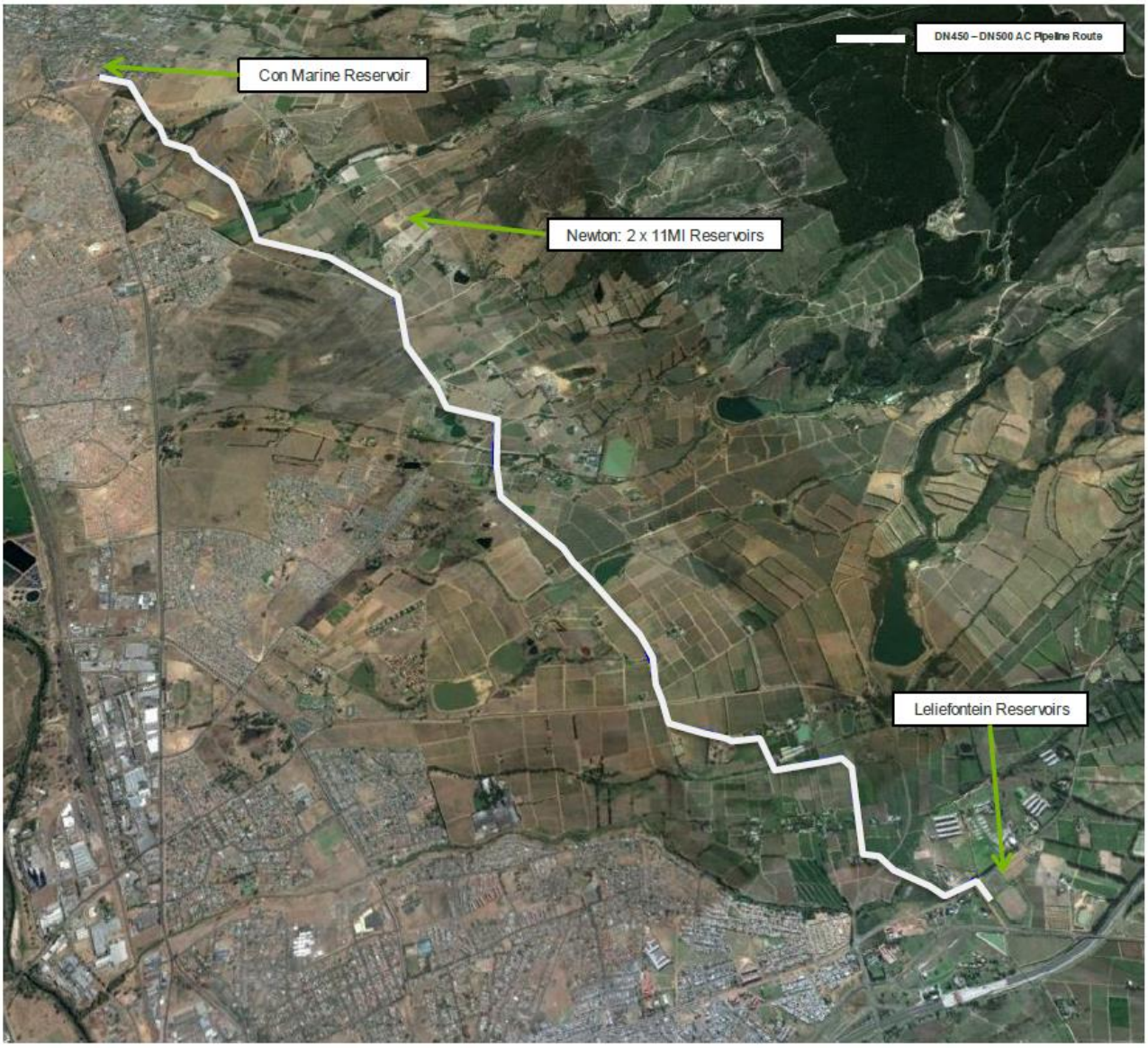


Figure 3 Existing pipeline route between the Leliefontein and Con Marine Reservoirs

PROJECTED FUTURE WATER DEMAND FOR WELLINGTON

Paarl / Wellington demand distribution = approx. 73% / 27%

For the Medium Water Requirement Scenario (Figure 2), the future demand is estimated as follows:

The projected maximum Monthly Water Demand for Wellington in January 2030 = approx. 26 Mℓ/d

The projected maximum Monthly Water Demand for Wellington in January 2040 = approx. 33 Mℓ/d

The projected maximum Monthly Water Demand for Wellington in January 2050 = approx. 40 Mℓ/d

BULK WATER SUPPLY SYSTEM CAPACITY

Wemmershoek - Leliefontein	:	105 Mℓ/d	=	1 224 ℓ/s (No flow to Con Marine)
Leliefontein - Con Marine	:	24 Mℓ/d	=	282 ℓ/s (No Paarl Demand, under gravity from Wemmershoek))
Leliefontein - Con Marine	:	20 Mℓ/d	=	239 ℓ/s (with 73% to Paarl)
Leliefontein - Con Marine	:	11 Mℓ/d	=	130 ℓ/s (under gravity from Leliefontein, Wemmershoek supply inactive)
Booster Pumpstation (PAT)	:	30 Mℓ/d	=	347 ℓ/s @ 70m (from Leliefontein to Con Marine)

CONCLUSION

Existing DN500/DN450 Leliefontein – Con Marine pipeline:

- When the Wemmershoek supply is inactive, the existing Leliefontein - Con Marine pipeline is unable to supply the current peak water demand to Wellington under gravity.
- The Leliefontein Booster Pumpstation is then used to increase the capacity to Con Marine.
- The existing Leliefontein - Con Marine pipeline will be able to supply the peak water demand to Wellington under gravity up to approx. 2020.
- Beyond 2020, the Leliefontein Booster Pumpstation will be used more frequently to supply the peak water demand to Wellington.
- The Leliefontein Booster Pumpstation will not be able to supply the peak water demand to Wellington when the peak demand is higher than 30 Mℓ/d (approx. 2035).
- The pressure rating of the existing Leliefontein - Con Marine pipeline governs the maximum capacity of 30 Mℓ/d.
- A preliminary Visual Condition Assessment Report on the Leliefontein - Con Marine pipeline was completed in August 2015. Replacement of various old/damaged fittings was identified to enable the pipeline to function effectively at the pressure levels required.

RECOMMENDATIONS

- The existing Leliefontein - Con Marine pipeline is an old asbestos cement pipeline and some concern exists about the remaining strength of the pipes. The pipeline was installed in 1980, thus approaching its theoretical useful life.
- Beyond 2020, the Leliefontein Booster Pumpstation will be used more frequently to supply the peak water demand to Wellington. The constant variation in pressure might result in serious pipe failures which are not advisable for a bulk supply pipeline.
- GLS Consulting (who performs the water master planning for Drakenstein Municipality) indicates on their latest Bulk Water Masterplan the addition of a parallel DN700 pipeline between Leliefontein and the Newton Reservoirs and a parallel DN500 pipeline between the Newton Reservoirs and Con Marine. The new pipelines are proposed to operate in parallel with the existing DN500/DN450 pipelines.
- The existing pipeline route traverses areas which have become inaccessible for the construction of a new parallel pipeline due to structures constructed over the pipeline servitude. It is thus proposed that in these areas the new pipeline will have to be re-routed.
- Drakenstein Municipality requested GLS Consulting to investigate the option to rather replace the old pipes with new pipes instead of constructing new parallel pipes to operate in conjunction with the old pipes.

- Due to the above factors, the proposal is to replace the existing old pipeline with a new larger diameter pipeline, which will be able to meet the expected future water demands of Newton, Wellington and Mbekweni as well as the planned future developments for at least the next 30 years.
- It is proposed that the new pipeline installation be undertaken in two phases, as defined below:

    - Phase 1 (0 - 5 year plan): replace the existing 7,500m DN500 Leliefontein / Con Marine pipeline with a DN900 pipeline between the Leliefontein Reservoirs and the supply point to the Newton Reservoirs.
    - Phase 2 (5 - 10 year plan): replace the existing 4,500m DN450 Leliefontein / Con Marine pipeline with a DN800 pipeline between the supply point to the Newton Reservoirs and the Con Marine Reservoir.

3 Funding required for the project

Drakenstein Municipality will explore all possible avenues to secure funding for this project, for example submitting a proposal for large infrastructure projects to the National Budget Facility for Infrastructure.

The current Project Cost (including all investigations, studies, professional fees and construction) is estimated as follows:

Phase 1 (0 – 5 year plan) : R 85,410,000 (excluding VAT)

Phase 2 (5 – 10 year plan) : R 47,940,000 (excluding VAT)

Total current Project Cost : R 133,350,000 (excluding VAT)

Project Cost breakdown:

PHASE	CONSTRUCTION	FEES	TOTAL
Phase 1	R 80,090,000.00	R 5,320,000.00	**R 85,410,000.00**
Phase 2	R 44,470,000.00	R 3,470,000.00	**R 47,940,000.00**
TOTAL	**R 124,560,000.00**	**R 8,790,000.00**	**R 133,350,000.00**
Cost estimate based on GRP Class 16 pipes			
GRP pipe/m (supply & install)	R 5,442.00		
HDPE/m (supply & install)	R 10,117.00		

At this stage however, it is important to secure the necessary funding for the planning aspects to ensure being able to advance the project.

The FY 19/20 Funding Requirement by Drakenstein Municipality is approx. R4,400,000 (excluding VAT) to enable proper planning of the project and to submit proposals for the funding of the remainder of the project.

4 Funding Implementation plan

The R4,400,000 (excluding VAT) funding, for project planning purposes, will be spent according to the summary proposed implementation plan as indicated in Table 1 below.

Table 1 Funding required for the planning of the Upgrading of the Bulk Water Distribution System between Leliefontein Reservoir (Paarl) and Con Marine Reservoir (Wellington)

	Financial Years (Drakenstein Municipality):		FY 19/20
Item	Project Element	Description	Funding Amount Required
1	Planning	Planning, Studies, Investigations and Assessments	R 2,111,000
2	Inception	Schedule of required surveys, tests, analysis, site and other investigations	R 380,000
3	Concept and Viability	Concept Design, Preliminary Design and Cost Estimates	R 1,907,500
		Total for Financial Year:	**R 4,400,000**

4.1 Project Funding Subsections

The following subsections explain how the planning fees for each subcategory was calculated and what it will be used for during the planning stages of the project.

4.1.1 Planning

These typical services relate to carrying out studies and investigations as well as the preparation and submission of reports embodying preliminary proposals or initial feasibility studies and will normally be remunerated on a time and cost basis.

The typical services for this project to be provided are as follows:

- Consultation with the client. Study all existing information relevant to the project in consultation with the municipality's water master planners (GLS Consulting).
- Inspection of the site of the project. Determine the optimal route for the pipeline upgrade and liaise with landowners where applicable. A detailed scan using new underground services detection technology will be used to locate the existing pipe which will greatly assist with the planning and design of the project.
- Developing a scope of work.
- Preliminary investigation, route location, planning and a level of design appropriate to allow decisions on feasibility.
- Consultation with authorities having rights or powers of sanction as well as consultation with the public and stakeholder groups.
- Advice to the client as to regulatory and statutory requirements, including environmental management and the need for surveys, analysis, tests and site or other investigations, as well as approvals, where such are required for the completion of the report, and arranging for these to be carried out at the client's expense.
- Searching for, obtaining, investigating and collating available data, drawings and plans relating to the works.
- Investigating financial and economic implications relating to the proposals or feasibility studies. As part of this service, we will assist the municipality with project funding applications. Pipeline material investigations will also be undertaken to obtain the optimal type of pipeline (HDPE, DI, GRP, UPVC) in terms of feasibility, site conditions and long-term durability.
- Refer to Table 2 for a detailed list of activities to be performed under the Planning stage.

4.1.2 Inception

Establish client requirements and preferences, assess user needs and options, the appointment of necessary consultants, establish the project brief including project objectives, priorities, constraints, assumptions aspirations and strategies.

Deliverables will typically include:

- Agreed scope of services and scope of work.
- Signed agreements.
- Report on project, site and functional requirements.
- Schedule of required surveys, tests, analysis, site and other investigations.
- Schedule of consents and approvals.

Inception is part of Normal Services as defined by the Guideline Scope of Services and Tariff of Fees for Persons Registered in terms of the Engineering Profession Act (ECSA guidelines). Fees for Normal Services are calculated on the Cost of the Works. For Civil Engineering Projects, the Inception Stage represents normally 5% of the total Normal Fees.

4.1.3 Concept and Viability

Also referred to as Preliminary Design. Prepare and finalise the project concept in accordance with the brief, including project scope, scale, character, form and function, plus preliminary programme and viability of this project.

Deliverables will typically include:

- Concept design.
- Process design.
- Preliminary design.
- Cost estimates as required.

Concept and Viability are part of Normal Services as defined by the ECSA guidelines. Fees for Normal Services are calculated on the Cost of the Works. For Civil Engineering Projects, the Concept and Viability Stage represents normally 25% of the total Normal Fees.

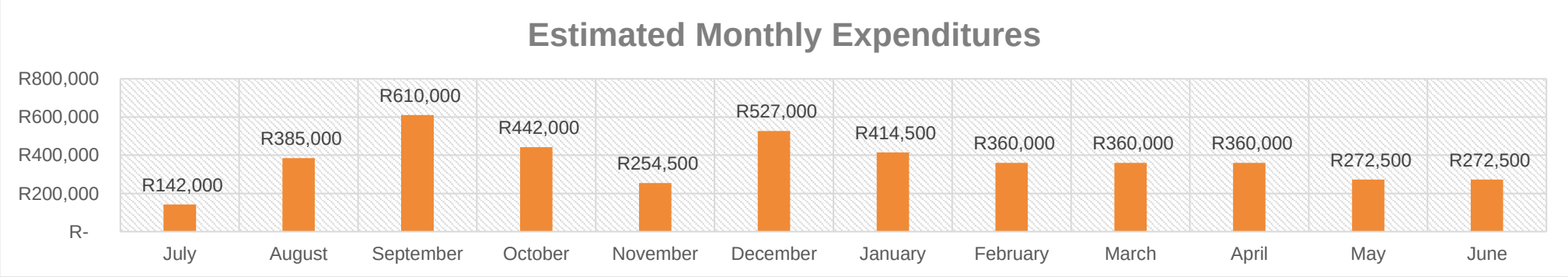
4.2 Funding Implementation Expected Cash Flow

The expected monthly cash flow is indicated in Table 2 on the following page. The expected monthly expenditure is illustrated in Figure 4.

Table 2 Expected Cash flow from July 2019 to June 2020

			2019						2020						
Project Element / ECSA Stages	**ECSA Stage % of total**	**Fee Required for Planning**	July	August	September	October	November	December	January	February	March	April	May	June	Sub Totals
Planning, Studies, Investigations & Assessments		**R 2,111,000**													
Study available information		R 25,000	R 25,000												R 25,000
Pipeline route investigation (Including scan)		R 486,000		R 243,000	R 243,000										R 486,000
Stakeholder liaison		R 25,000		R 25,000											R 25,000
Environmental compliance		R 250,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000	R 25,000			R 250,000
WULA requirements		R 100,000			R 12,500	R 12,500	R 12,500	R 12,500	R 12,500	R 12,500	R 12,500	R 12,500			R 100,000
Funding applications		R 150,000	R 37,500	R 37,500	R 37,500	R 37,500									R 150,000
Topographical survey		R 300,000			R 150,000	R 150,000									R 300,000
Geotechnical investigation		R 350,000			R 87,500	R 87,500	R 87,500	R 87,500							R 350,000
Soil Resisivity Testing		R 75,000				R 25,000	R 25,000	R 25,000							R 75,000
SRB Testing		R 75,000				R 25,000	R 25,000	R 25,000							R 75,000
AC Mitigation Survey		R 75,000				R 25,000	R 25,000	R 25,000							R 75,000
Pipeline material investigation		R 50,000							R 50,000						R 50,000
Surge / Hydraulic Analysis		R 150,000								R 50,000	R 50,000	R 50,000			R 150,000
Normal Services		**R 2,289,000**													
Construction estimate = R124,560,000															
Basic Fee (incl.15% discount) = R7.630m															
Inception	5%	R 381,500	R 54,500	R 54,500	R 54,500	R 54,500	R 54,500	R 54,500	R 54,500						R 381,500
Concept and Viability	25.00%	R 1,907,500						R 272,500	R 272,500	R 272,500	R 272,500	R 272,500	R 272,500	R 272,500	R 1,907,500
															R 4,400,000
		R 4,400,000	**R 142,000**	**R 385,000**	**R 610,000**	**R 442,000**	**R 254,500**	**R 527,000**	**R 414,500**	**R 360,000**	**R 360,000**	**R 360,000**	**R 272,500**	**R 272,500**	**R 4,400,000**

Figure 4 Estimated Monthly Expenditures on planning fees (July 2019 to June 2020)



5 Conclusion

The Wemmershoek – Leliefontein – Con Marine gravity supply scheme is an integral part of the water supply infrastructure for Newton, Wellington and Mbekweni. The project to upgrade this scheme requires funds for planning activities to ensure that the project is ready for implementation in terms of construction. This report outlines the required funds for the planning stages of the project and to which tasks/professionals the funds will generally be allocated. It can be concluded that the proposed R4,400,000 (excluding VAT) funding is a vital part to ensure that the project is delivered successfully. The estimated cash flows indicated that the funding can be spent before the end of June 2020.

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