General Manager: Water and Sanitation
City of Tshwane Metropolitan Municipality
PO Box 6338
PRETORIA
0001

ATTENTION: Mr. Olebogeng Asieng

Dear Sir,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP/REZONING – THE HILLS

The attached request from Civil Concepts (Tanya van Niekerk) dated 19 May 2014 with regards to accommodating the proposed development in the Tshwane water and sewer systems refers.

Although the City of Tshwane has water and sewer master plans, you requested this further analysis and report because:

- The development is considered to be a large development (i.e. > than 250 housing units).
- The development has large fire flow requirements (e.g. 20ℓ/s, 25ℓ/s or 50ℓ/s which is usually the case for higher density cluster developments, industry, general business, shopping centres or high-rise flats >= 4 storeys).

This report is a technical report stating upgrades required in the distribution networks in the vicinity of the proposed development. The City of Tshwane engineer (yourself) will accept the report or suggest changes and will make a final decision on works to be implemented by the proposed development.

This analysis and report is based on the 2010 water and sewer master plans which are updated every quarter. The latest master plans which were used in this analysis were the July 2014 master plans.

All costs shown in this report are estimates only and include 40% surcharge for P&Gs, contingencies and fees but exclude VAT.
1 WATER DISTRIBUTION NETWORK

1.1 Distribution Zone

The proposed development was taken into consideration in the above mentioned water master plan as part of Rietfontein Future 2 future development area.

The master plan indicates that the proposed development falls in no reservoir zone at present but will fall in both the Zwavelpoort and Mooikloof South reservoir zones in future as shown in Figure 1 (Water) attached.

1.2 Revised Water Demand

The combined AADD for the proposed development as originally calculated and used in the analysis of the water distribution network in the master plan was 2 855 kl/d.

The revised AADD, peak flow and fire flow calculated for the proposed development and used in the re-analysis of the water distribution network was:

<table>
<thead>
<tr>
<th>Anticipated Landuse</th>
<th>New Dev. Area (ha)</th>
<th>Density (Units/ha)</th>
<th>FSR</th>
<th>Floor space (ha)</th>
<th>No. of Units</th>
<th>FSR Units</th>
<th>UWD Inc.UAW</th>
<th>AADD (kl/d) Incl. UAW</th>
<th>PDDWF (kl/d)</th>
<th>Water Sewer Ratio</th>
<th>IPDWF (l)</th>
<th>IPWFF (l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High rise flats (≤ 50m² per unit) + FSR residential</td>
<td>8.386</td>
<td>30</td>
<td>511</td>
<td>1</td>
<td>0.60 Kl/unit</td>
<td>30</td>
<td>236</td>
<td>97%</td>
<td>4.3</td>
<td>6.4</td>
<td></td>
<td></td>
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<tr>
<td>Cluster housing 41 up to 60 units per hectare</td>
<td>9.882</td>
<td>60</td>
<td>379</td>
<td>21</td>
<td>0.60 Kl/unit</td>
<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
<td>23.9</td>
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<tr>
<td>Cluster housing 61 up to 80 units per hectare</td>
<td>8.75</td>
<td>60</td>
<td>373</td>
<td>21</td>
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<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
<td>23.9</td>
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<tr>
<td>Cluster housing 81 up to 100 units per hectare</td>
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<td>60</td>
<td>372</td>
<td>21</td>
<td>0.60 Kl/unit</td>
<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
<td>23.9</td>
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<td>Cluster housing 101 up to 120 units per hectare</td>
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<td>60</td>
<td>372</td>
<td>21</td>
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<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
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<td>Cluster housing 121 up to 140 units per hectare</td>
<td>7.155</td>
<td>60</td>
<td>361</td>
<td>21</td>
<td>0.60 Kl/unit</td>
<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
<td>23.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster housing 141 up to 160 units per hectare</td>
<td>4.356</td>
<td>60</td>
<td>349</td>
<td>21</td>
<td>0.60 Kl/unit</td>
<td>20</td>
<td>171</td>
<td>10%</td>
<td>2.3</td>
<td>23.9</td>
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<tr>
<td>Residential, commercial, institutional buildings</td>
<td>4.699</td>
<td>1.15</td>
<td>1.454</td>
<td>148</td>
<td>1.00 L/100m²</td>
<td>84</td>
<td>59</td>
<td>74%</td>
<td>1.1</td>
<td>1.1</td>
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<tr>
<td>Cluster housing up to 20 units per hectare</td>
<td>5.245</td>
<td>20</td>
<td>105</td>
<td>1.00 Kl/unit</td>
<td>102</td>
<td>74%</td>
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<td>1.1</td>
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<tr>
<td>Cluster housing 21 up to 40 units per hectare</td>
<td>8.599</td>
<td>40</td>
<td>334</td>
<td>1.00 Kl/unit</td>
<td>204</td>
<td>76%</td>
<td>3.1</td>
<td>4.7</td>
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<tr>
<td>High rise flats (≤ 50m² per unit) + FSR residential</td>
<td>9.499</td>
<td>30</td>
<td>677</td>
<td>1.00 Kl/unit</td>
<td>402</td>
<td>76%</td>
<td>3.1</td>
<td>4.7</td>
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<tr>
<td>Private open space</td>
<td>0.747</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Private open space</td>
<td>0.747</td>
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<tr>
<td>Roads</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Cluster housing 21 up to 40 units per hectare</td>
<td>16.653</td>
<td>40</td>
<td>646</td>
<td>0.60 Kl/unit</td>
<td>209</td>
<td>59%</td>
<td>6.4</td>
<td>9.2</td>
<td></td>
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<tr>
<td>General Business with no FSR</td>
<td>5.356</td>
<td>0.40</td>
<td>0.743</td>
<td>214</td>
<td>0.60 L/100m²</td>
<td>171</td>
<td>125</td>
<td>75%</td>
<td>2.4</td>
<td>3.5</td>
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<tr>
<td>Cluster housing 21 up to 40 units per hectare</td>
<td>6.584</td>
<td>40</td>
<td>262</td>
<td>0.60 Kl/unit</td>
<td>210</td>
<td>125</td>
<td>75%</td>
<td>2.4</td>
<td>3.5</td>
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<tr>
<td>Roads</td>
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<tr>
<td>New Master Plan Total</td>
<td>142.761</td>
<td>4400</td>
<td>382</td>
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<td>3882</td>
<td>2797</td>
<td>71%</td>
<td>43.5</td>
<td>63.5</td>
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</tr>
</tbody>
</table>

- Peak flow using zone peak hour factor of: 3.6\(^\dagger\) = 161.2 l/s
- Fire flow for type: Industrial/Business – moderate risk = 50 l/s @ 15 m

1.3 PERMANENT Accommodation of Proposed Development in the Existing Water Distribution Network (Zwavelpoort and Mooikloof South Reservoirs)

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the existing water distribution network as indicated in Figure 1 (Water) attached:

\(^\dagger\) Higher peak flow factors might be applicable for internal networks.
1.3.1 **Bulk Items**

Items required to alleviate existing problems in the bulk water system:

- MKB.4a 5 m x 400 mm Ø main pipe  
  R 76 300 *
- MKB.3 1 530.1 m EGL 355 mm Ø PRV to install  
  R 834 400 *
- MKB.3b 15 m x 600 mm Ø new pipe  
  R 593 320 *
- MKB.5d 695 t/s x 68 m pump Station  
  R 7 949 480 *
- MKB.5 1 910 m x 700 mm Ø main feeder pipe  
  R 12 118 540 *
- MKB.K10 1 870 m x 500 mm Ø main feeder pipe  
  R 8 855 700 *
- MKB.K11 345 m x 400 mm Ø main feeder pipe  
  R 883 680 *
- MKB.K14 3 400 m x 450 mm Ø main feeder pipe  
  R 14 742 840 *
- MKB.K12 120 t/s x 315 mm Ø FCV  
  R 301 000 *
- MKB.K13 10 000 m³ x 1 505 m TWL, new Zwavelpoort reservoir  
  R 16 380 000 *
- MKB.K15 125 t/s x 315 mm Ø FCV  
  R 301 000 *
- MKB.K16 10 000 m³ x 1 551 m TWL, new Mooikloof South reservoir  
  R 16 380 000 *

1.3.2 **Reticulation Items**

Items required to alleviate existing problems in the water distribution network:

- None

Items required to accommodate the proposed development (excluding fire flow requirements):

- ZPR.1 185 m x 600 mm Ø main outflow pipe  
  R 1 478 540 *
- ZPR.2 1 305 m x 500 mm Ø main outflow pipe  
  R 6 211 380 *
- ZPR.3 635 m x 450 mm Ø main outflow pipe  
  R 2 824 080 *
- ZPR.4 255 m x 315 mm Ø main outflow pipe  
  R 450 800 *
- ZPR.F3 390 m x 250 mm Ø main outflow pipe  
  R 485 800 *
- MSR.1 515 m x 600 mm Ø main outflow pipe  
  R 3 196 620 *
- MSR.2 455 m x 450 mm Ø main outflow pipe  
  R 2 048 200 *
- MSR.3 395 m x 400 mm Ø main outflow pipe  
  R 1 002 400 *
- MSR.F2 35 m x 315 mm Ø main outflow pipe  
  R 100 520 *

Items required to accommodate the proposed development (including fire flow requirements):

- As above.

The proposed connection point to the existing water distribution system is shown in Figure 1 (Water) attached.

1.4 **Internal Reticulation**

The internal network design on the property of the proposed development is beyond the scope of this report. However, the consulting engineer for the development is required to allow for the fire flow demand as listed in 1.2 above on the internal networks.

For internal network design purposes the water distribution network provides the following energy gradelines (EGLs) at the proposed connection point (see Figure 1 (Water)):
1.5 Adjustments to the Master Plan

No adjustments to the water master plan are required due to the revised AADD of the proposed development.

1.6 TEMPORARY Accommodation of Proposed Development in the Existing Water Distribution Network (Grootfontein Reservoir)

Consideration was made for temporary water supply for the proposed development from the Grootfontein reservoir. However, the Grootfontein reservoir(s) does not have capacity as shown in the spreadsheet below. The current AADD excluding the proposed development is 4406 kℓ/d. With the two Grootfontein reservoirs being very small at 2 Mℓ each there is only 10 kℓ/d spare capacity which is in effect no spare capacity.

Supplying the proposed development from the Grootfontein reservoirs will further prejudice supply to The Hills X3 to X6 who are already experiencing intermittent water supply problems (due to pressure issues as opposed to lack of capacity in the reservoirs).
Should the proposed development still be given permission to go ahead with temporary supply from the Grootfontein reservoirs the pipeline route that could be considered is shown in Figure 1 (Water) as items:

Item 2, RFR.7, RFR.8a, RFR.8, RFR.10, Item 1, MSR.6, MSR.2, MSR.3, Item 3 and Item 4 (PRV).

The comments above in section 1.6 indicate that the Zwavelpoort and Mooikloof South reservoirs are required for the proposed development to go ahead and that a temporary connection to the Grootfontein reservoir is not advisable.

2 SEWER NETWORK

2.1 Drainage Area

The proposed development was taken into consideration in the above mentioned sewer master plan as part of Rietfontein Future 2 future development area.

The master plan indicates that the proposed development falls in the Baviaanspoort drainage area as shown in Figure 2 (Sewer) attached.

2.2 Revised Sewer Flow

The combined peak day dry weather flow (PDDWF) for the proposed development as originally calculated and used in the analysis of the sewer system in the master plan was 2 166 kl/d.

The revised PDDWF calculated for the proposed development and used in the re-analysis of the sewer system was 2 757 kl/d with an instantaneous peak dry weather flow (IPDWF) of 44.5 l/s. The design flow, or instantaneous peak wet weather flow (IPWWF), is 63.5 l/s.

2.3 PERMANENT Accommodation of the Proposed Development in the Existing Baviaanspoort Sewer System

Accommodation of the proposed development, with its revised PDDWF, requires implementation of the following additions and adjustments to the existing sewer reticulation network as indicated in Figure 2 (Sewer) attached:
Items required to alleviate existing problems in the sewer system:

- None

Items required to accommodate the proposed development in the existing sewer system:

- BP_F203.18 515 mm Ø new pipe Design Flow = 346 ℓ/s R 1 537 000 ¥
- BP_F203.17 549 mm Ø new pipe Design Flow = 374 ℓ/s R 1 728 500 ¥
- BP_F203.16 764 mm Ø new pipe Design Flow = 391 ℓ/s R 2 379 200 ¥
- BP_F203.15 734 mm Ø new pipe Design Flow = 422 ℓ/s R 2 291 500 ¥
- BP_F203.14 175 mm Ø new pipe Design Flow = 460 ℓ/s R 648 000 ¥
- BP_F203.13 134 mm Ø new pipe Design Flow = 680 ℓ/s R 658 600 ¥
- BP_F203.12 364 mm Ø new pipe Design Flow = 757 ℓ/s R 1 665 800 ¥
- BP_F203.19 1 085 mm Ø new pipe Design Flow = 824 ℓ/s R 8 071 000 ¥
- BP_F203.11 392 mm Ø new pipe Design Flow = 827 ℓ/s R 3 012 000 ¥
- BP_F203.10 708 mm Ø new pipe Design Flow = 839 ℓ/s R 4 600 000 ¥
- BP_F203.09 502 mm Ø new pipe Design Flow = 881 ℓ/s R 3 800 000 ¥
- BP_F203.08 267 mm Ø new pipe Design Flow = 884 ℓ/s R 1 174 000 ¥
- BP_F203.07 422 mm Ø new pipe Design Flow = 894 ℓ/s R 3 417 900 ¥
- BP_F203.06 354 mm Ø new pipe Design Flow = 896 ℓ/s R 1 621 700 ¥
- BP_F203.05 381 mm Ø new pipe Design Flow = 929 ℓ/s R 2 557 000 ¥
- BP_F203.04 111 mm Ø new pipe Design Flow = 935 ℓ/s R 1 020 700 ¥
- BP_F203.03 890 mm Ø new pipe Design Flow = 946 ℓ/s R 6 063 000 ¥
- BP_F203.02 1 074 mm Ø new pipe Design Flow = 968 ℓ/s R 5 827 000 ¥
- BP_F203.01 575 mm Ø new pipe Design Flow = 974 ℓ/s R 3 162 000 ¥
- BP_F203.00 326 mm Ø new pipe Design Flow = 977 ℓ/s R 1 702 600 ¥
- BP_F203.09 99 mm Ø new pipe Design Flow = 993 ℓ/s R 624 000 ¥
- BP_F203.08 451 mm Ø new pipe Design Flow = 1 000 ℓ/s R 2 502 000 ¥
- BP_F203.07 1 083 mm Ø new pipe Design Flow = 1 039 ℓ/s R 5 875 000 ¥
- BP_F203.06 85 mm Ø new pipe Design Flow = 1 041 ℓ/s R 698 100 ¥
- BP_F203.05 834 mm Ø new pipe Design Flow = 1 067 ℓ/s R 5 770 500 ¥
- BP_F203.04 747 mm Ø new pipe Design Flow = 1 161 ℓ/s R 5 179 300 ¥
- BP_F203.03 515 mm Ø new pipe Design Flow = 1 253 ℓ/s R 3 914 000 ¥
- BP_F203.02 84 mm Ø new pipe Design Flow = 1 257 ℓ/s R 767 000 ¥
- BP_F203.00 284 mm Ø new pipe Design Flow = 1 260 ℓ/s R 2 233 000 ¥
- BP_F203.01 182 mm Ø new pipe Design Flow = 1 261 ℓ/s R 1 487 000 ¥
- BP_F203.00 839 mm Ø new pipe Design Flow = 1 266 ℓ/s R 5 500 000 ¥
- BP_F203.00 818 mm Ø new pipe Design Flow = 1 360 ℓ/s R 6 130 000 ¥
- BP_F203.00 366 mm Ø new pipe Design Flow = 1 313 ℓ/s R 2 992 600 ¥
- BP_F203.00 176 mm Ø new pipe Design Flow = 1 313 ℓ/s R 1 529 600 ¥
- BP_F203.00 647 mm Ø new pipe Design Flow = 1 318 ℓ/s R 5 154 800 ¥
- BP_F203.00 440 mm Ø new pipe Design Flow = 1 344 ℓ/s R 4 395 800 ¥
- BP_F203.00 mm Ø Upgrade Flow Diversion Design Flow = 1 672 ℓ/s R 1 197 000 ¥

The proposed connection points, A, B, C, D and E to the sewer system are shown in Figure 2 (Sewer) attached.

In Figure 2 (Sewer) attached pipes in future development areas are indicated schematically.

The above Design Flows (or IPWWF) and thus pipe sizes were calculated taking cognizance of future developments upstream of the proposed development. In this regard, sewer pipes within the proposed development must be designed (layout and sizing) to receive the following Design Flows of (see Figure 2 (Sewer)):
• 40 t/s from “Point 1”
• 1 t/s from “Point 2”
• 1 t/s from “Point 3”
• 255 t/s from “Point 4”.

As the Design Flow already accommodates stormwater ingress, the pipe can be designed to flow 100% full with the above Design Flows or IPWWFs.

2.4 Adjustments to the Master Plan

No adjustments to the sewer master plan are required due to the revised PDDWF of the proposed development.

2.5 TEMPORARY Accommodation of the Proposed Development in the Existing Sewer System

There are 2 options available to accommodate the sewer from the proposed development. The options are as follows (see Figure 2a (Sewer)):

Option 1: Gravity feed to a temporary “Bronberg” pump station which pumps sewer back into the Moreletaspruit sewer network.

Option 2: Gravity feed to a temporary “Zwavelpoort” pump station which pumps sewer back to existing pipes in Silver Lakes which is part of the Baviaanspoort drainage system.

Option 2 will require increasing the sizes of pipes through Silver Lakes to such an extent that it will be comparable to merely completing the main outfall sewer along the Pienaars River as per the master plan (2.3 above). Furthermore, in future these large diameter pipes through Silver Lakes will not be required and thus part of the invested capital will become redundant and sewer flows will be small in relation to large pipe diameters.

Only option 1 has been presented in this report.

Accommodation of the proposed development, with its revised PDDWF, requires implementation of the following additions and adjustments to the existing sewer reticulation network as indicated in Figure 2 (Sewer) attached:

2.5.1 Sewer Bulk Items

Items required to alleviate existing problems in the bulk sewer system i.e. WWTWs:
• None

Items required to accommodate the proposed development in the bulk sewer system i.e. WWTWs:
• None
2.5.2 Sewer Reticulation Items

Items required to alleviate existing problems in the existing sewer system:
- None

Items required to accommodate the proposed development in the existing sewer system:
- **BP_F203.18** 515 m x 525 mm Ø new pipe  Design Flow = 346 ℓ/s  R 1 537 000 *
- **BP_F203.17** 549 m x 525 mm Ø new pipe  Design Flow = 374 ℓ/s  R 1 728 500 *
- **BP_F203.16** 764 m x 600 mm Ø new pipe  Design Flow = 391 ℓ/s  R 2 379 200 *
- **BP_F203.15** 734 m x 525 mm Ø new pipe  Design Flow = 422 ℓ/s  R 2 291 500 *
- **BP_F203.14** 175 m x 600 mm Ø new pipe  Design Flow = 460 ℓ/s  R 648 000 *
- **BP_F203.13** 134 m x 675 mm Ø new pipe  Design Flow = 680 ℓ/s  R 658 600 *
- **BP_F203.12** 364 m x 675 mm Ø new pipe  Design Flow = 757 ℓ/s  R 1 665 800 *
- **BP_F203.19** 1 085 m x 1050 mm Ø new pipe  Design Flow = 824 ℓ/s  R 8 071 000 *
- **BP_300.01** flow diversion  R 40 500 *
- **BP_300.02** 10 m x 600 mm Ø new pipe  R 92 500 *
- **BP_300.03** 180 ℓ/s pump station  R 2 242 800 *
- **BP_300.04** 3 686 m x 500 mm Ø new rising main  R 16 349 100 *
- **MS_F42.02** 542 m x 315 mm Ø new pipe  R 1 034 000 *
- **MS_F42.01** 745 m x 315 mm Ø new pipe  R 1 392 000 *

The proposed connection point F to the existing sewer system is shown in Figure 2 (Sewer) attached.

In Figure 2 (Sewer) attached pipes in future development areas are indicated schematically.

2.6 Adjustments to the Master Plan

No adjustments to the sewer master plan are required due to the revised PDDWF of the proposed development.

Yours sincerely,

Per: Dr BF Loubser
GLS Consulting

* Year 2013/14 Rand value which includes 40% surcharge for P&Gs, contingencies and fees but excludes VAT.