

Consulting Analytical & Industrial Chemists
Specialists in Water & Waste Water Treatment
Telephone (021)448 6340/1
After Hours (021)712 0940
Telefax (021)448 6342
e-Mail Address :
info@alabbott.co.za



No. 1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915
SOUTH AFRICA

Certificate of Analysis

BERG RIVER MUNICIPALITY

SAMPLE : Ten Samples of Reticulation Water

DATE SAMPLED : 4 October 2011

YOUR REF. : Tender 8/3/18 - 2010

OUR REF. : bm/017/2/1/3973
14 October 2011

LAB DATA SHEET NO. : 11/2726

| Location : | S33°0.75' E18°59.66' | S33°1.25' E18°59.19' | S32°54.52' E18°45.48' | S32°47.035' E18°09.850' | SANS 241 – 2006 (Drinking Water) | | |
|--|------------------------------------|---------------------------|----------------------------------|--------------------------------|---|---|---|
| Sample Marked : | Porterville Municipal Office | Porterville Biblioteek | Piketberg Municipal Office | Veldrif Municipal Office | Class I (Recomm. Operation. Limit) | Class II (Maximum Allowable for Limited Duration) | Class II Water Consump. Period, ^a max. |
| pH (at 25°C) | 6,61 | 6,85 | 6,96 | 7,65 | 5.0-9.5 | 4.0-10.0 | No Limit ^c |
| Conductivity (at 25°C) (mS/m) | 4,4 | 4,7 | 43,5 | 88,3 | <150 | 150-370 | 7 years |
| Turbidity (NTU) | 0,73 | 0,66 | 1,1 | 0,37 | <1 | 1-5 | No Limit ^d |
| Langelier Saturation Index | -3,50 | -3,04 | -1,57 | -0,70 | - | - | - |
| | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | |
| Colour (as Pt) | 10 | 7 | 9 | 9 | <20 | 20-50 | No Limit ^b |
| CaCO ₃ Precipitation Potential | -17,4 | -14,4 | -19,4 | -5,2 | - | - | - |
| Total Alkalinity (as CaCO ₃) | 12,0 | 16,0 | 40,0 | 56,0 | - | - | - |
| Total Hardness (as CaCO ₃) | 12,0 | 7,5 | 99,4 | 170 | - | - | - |
| Calcium Hardness (as CaCO ₃) | 3,8 | 4,8 | 58,8 | 75,3 | - | - | - |
| Calcium (as Ca) | 1,5 | 1,9 | 23,5 | 30,1 | <150 | 150-300 | 7 years |
| Magnesium Hardness (as CaCO ₃) | 8,2 | 2,7 | 40,6 | 94,3 | - | - | - |
| Magnesium (as Mg) | 2,0 | 0,66 | 9,9 | 23,0 | <70 | 70-100 | 7 years |
| Sodium (as Na) | 5,2 | 5,0 | 47,2 | 120 | <200 | 200-400 | 7 years |
| Potassium (as K) | <0,09 | <0,09 | 0,88 | 1,9 | <50 | 50-100 | 7 years |
| Zinc (as Zn) | <0,01 | <0,01 | <0,01 | <0,01 | <5.0 | 5.0-10.0 | 1 year |
| Chloride (as Cl) | 19,5 | 15,6 | 85,7 | 214 | <200 | 200-600 | 7 years |
| Fluoride (as F) | <0,10 | <0,10 | <0,10 | 0,13 | <1.0 | 1.0-1.5 | 1 year |
| Sulphate (as SO ₄) | <4,0 | <4,0 | 44,0 | 50,0 | <400 | 400-600 | 7 years |

| Sample Marked : | Porterville Municipal Office | Porterville Biblioteek | Piketberg Municipal Office | Veldrif Municipal Office | SANS 241 – 2006 (Drinking Water) | | |
|-----------------------------------|---|---------------------------|----------------------------------|--------------------------------|---|---|---|
| | | | | | Class I (Recomm. Operation. Limit) | Class II (Maximum Allowable for Limited Duration) | Class II Water Consump. Period, ^a max. |
| | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | |
| Total Dissolved Solids | 60 | 60 | 400 | 680 | <1000 | 1000-2400 | 7 years |
| Ammonia Nitrogen (as N) | <0,15 | <0,15 | <0,15 | <0,15 | <1.0 | 1.0-2.0 | No Limit ^d |
| Nitrate & Nitrite Nitrogen (as N) | 0,10 | 0,35 | 0,79 | 0,54 | <10 | 10-20 | 7 years |
| Total Chlorine | 0,03 | 0,04 | 0,07 | 0,06 | - | - | - |
| Free Chlorine | 0,02 | 0,02 | 0,05 | 0,03 | - | - | - |
| | µg/l | µg/l | µg/l | µg/l | µg/l | µg/l | |
| Iron (as Fe) | 80 | <10 | 40 | 60 | <200 | 200-2 000 | 7 years ^b |
| Manganese (as Mn) | <40 | <40 | <40 | <40 | <100 | 100-1 000 | 7 years |
| Aluminium (as Al) | 160 | <14 | 340 | 80 | <300 | 300-500 | 1 year |
| ^a | The limits for the consumption of Class II water are based on the consumption of 2 litres of water per day by a person of mass 70 kg over a period of 70 years. | | | | | | |
| ^b | The limits given are based on aesthetic aspects. | | | | | | |
| ^c | No primary health effect – low pH values can result in structural problems in the distribution system. | | | | | | |
| ^d | These values can indicate process efficiency and risks associated with pathogens. | | | | | | |

MICROBIOLOGICAL REQUIREMENTS
SANS 241 - 2006 (Drinking Water)

| 1 | 2 | | | | 3 | 4 | 5 |
|--|---|---------------------------|----------------------------------|--------------------------------|--|---------------------------|---------------------------|
| Determinand | Porterville Municipal Office | Porterville Biblioteek | Piketberg Municipal Office | Veldrif Municipal Office | Allowable Compliance Contribution ^e | | |
| | | | | | 95% of samples, min. | 4% of samples, max. | 1% of samples, max. |
| | | | | | Upper Limits | | |
| <i>E.coli</i> ^f (count/100 ml) | Nil | Nil | Nil | Nil | Not Detected | Not Detected | 1 |
| Total Coliform Bacteria ^g (count/100 ml) | Nil | Nil | Nil | 74800 | - | - | - |
| Heterotrophic Plate Count ^h (count/ml) | 64 | Nil | >5000 | >5000 | - | - | - |
| ^e | The allowable compliance contribution shall be at least 95% to the limits indicated in column 3, with a maximum of 4% and 1% respectively, to the limits indicated in column 4 and column 5. The objective of disinfection should, nevertheless be to attain 100% compliance to the limits indicated in column 3. | | | | | | |
| ^f | Definitive preferred indicator of faecal pollution. | | | | | | |
| ^g | Only used as an alert indicator of possible problems. Alert level 10 organisms per 100 ml. | | | | | | |
| ^h | Only used as an alert indicator of possible problems. Alert level 5 000 organisms per ml. | | | | | | |

| Location : | S32°46.956' E18°10.141' | S32°40.176' E18°16.405' | S32°41.098' E18°53.053' | S32°28.621' E18°32.235' | SANS 241 – 2006 (Drinking Water) | | |
|--|---|------------------------------|----------------------------|-------------------------------------|---|---|---|
| Sample Marked : | Veldrif SDR | Dwarskersbos Water Toring | Eendekuil Kaap Agri. | Redelinghuys Municipal Office | Class I (Recomm. Operation. Limit) | Class II (Maximum Allowable for Limited Duration) | Class II Water Consump. Period, ^a max. |
| pH (at 25°C) | 7,98 | 8,24 | 9,33 | 8,40 | 5.0-9.5 | 4.0-10.0 | No Limit ^c |
| Conductivity (at 25°C) (mS/m) | 88,7 | 86,9 | 7,7 | 79,7 | <150 | 150-370 | 7 years |
| Turbidity (NTU) | 0,31 | 0,41 | 2,9 | 1,2 | <1 | 1-5 | No Limit ^d |
| Langelier Saturation Index | -0,37 | -0,10 | 0,06 | -0,14 | - | - | - |
| | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | |
| Colour (as Pt) | 11 | 8 | 14 | 36 | <20 | 20-50 | No Limit ^b |
| CaCO ₃ Precipitation Potential | -2,3 | -0,40 | 0,00 | -0,60 | - | - | - |
| Total Alkalinity (as CaCO ₃) | 60,0 | 60,0 | 28,0 | 48,0 | - | - | - |
| Total Hardness (as CaCO ₃) | 155 | 175 | 21,6 | 148 | - | - | - |
| Calcium Hardness (as CaCO ₃) | 70,3 | 70,8 | 11,8 | 55,0 | - | - | - |
| Calcium (as Ca) | 28,1 | 28,3 | 4,7 | 22,0 | <150 | 150-300 | 7 years |
| Magnesium Hardness (as CaCO ₃) | 84,9 | 104 | 9,8 | 92,7 | - | - | - |
| Magnesium (as Mg) | 20,7 | 25,3 | 2,4 | 22,6 | <70 | 70-100 | 7 years |
| Sodium (as Na) | 119 | 117 | 6,5 | 109 | <200 | 200-400 | 7 years |
| Potassium (as K) | 1,9 | 1,9 | 0,11 | 1,8 | <50 | 50-100 | 7 years |
| Zinc (as Zn) | <0,01 | 0,02 | <0,01 | <0,01 | <5.0 | 5.0-10.0 | 1 year |
| Chloride (as Cl) | 214 | 214 | 15,6 | 179 | <200 | 200-600 | 7 years |
| Fluoride (as F) | 0,14 | 0,13 | <0,10 | <0,10 | <1.0 | 1.0-1.5 | 1 year |
| Sulphate (as SO ₄) | 49,0 | 48,0 | 6,0 | 41,0 | <400 | 400-600 | 7 years |
| Total Dissolved Solids | 680 | 640 | 100 | 600 | <1000 | 1000-2400 | 7 years |
| Ammonia Nitrogen (as N) | <0,15 | <0,15 | <0,15 | <0,15 | <1.0 | 1.0-2.0 | No Limit ^d |
| Nitrate & Nitrite Nitrogen (as N) | 0,52 | 0,72 | <0,05 | 4,2 | <10 | 10-20 | 7 years |
| Total Chlorine | 0,07 | 0,08 | 0,15 | 0,07 | - | - | - |
| Free Chlorine | 0,05 | 0,02 | 0,09 | 0,04 | - | - | - |
| | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | |
| Iron (as Fe) | 40 | 20 | 40 | <10 | <200 | 200-2 000 | 7 years ^b |
| Manganese (as Mn) | <40 | <40 | <40 | <40 | <100 | 100-1 000 | 7 years |
| Aluminium (as Al) | 140 | <14 | 80 | 100 | <300 | 300-500 | 1 year |
| ^a | The limits for the consumption of Class II water are based on the consumption of 2 litres of water per day by a person of mass 70 kg over a period of 70 years. | | | | | | |
| ^b | The limits given are based on aesthetic aspects. | | | | | | |
| ^c | No primary health effect – low pH values can result in structural problems in the distribution system. | | | | | | |
| ^d | These values can indicate process efficiency and risks associated with pathogens. | | | | | | |

**MICROBIOLOGICAL REQUIREMENTS
SANS 241 - 2006 (Drinking Water)**

| 1 | 2 | | | | 3 | 4 | 5 |
|---|---|---------------------------|----------------------|-------------------------------|--|---------------------|---------------------|
| Determinand | Veldrif SDR | Dwarskersbos Water Toring | Eendekuil Kaap Agri. | Redelinghuys Municipal Office | Allowable Compliance Contribution ^e | | |
| | | | | | 95% of samples, min. | 4% of samples, max. | 1% of samples, max. |
| | | | | | Upper Limits | | |
| <i>E.coli</i>^f (count/100 ml) | Nil | Nil | Nil | Nil | Not Detected | Not Detected | 1 |
| Total Coliform Bacteria^g (count/100 ml) | 15400 | 46400 | Nil | 2300 | - | - | - |
| Heterotrophic Plate Count^h (count/ml) | >5000 | >5000 | 2 | >5000 | - | - | - |
| ^e | The allowable compliance contribution shall be at least 95% to the limits indicated in column 3, with a maximum of 4% and 1% respectively, to the limits indicated in column 4 and column 5. The objective of disinfection should, nevertheless be to attain 100% compliance to the limits indicated in column 3. | | | | | | |
| ^f | Definitive preferred indicator of faecal pollution. | | | | | | |
| ^g | Only used as an alert indicator of possible problems. Alert level 10 organisms per 100 ml. | | | | | | |
| ^h | Only used as an alert indicator of possible problems. Alert level 5 000 organisms per ml. | | | | | | |

| Location : | S32°42,482 E18°29,105' | S32°46,437' E18°09,962' | SANS 241 – 2006 (Drinking Water) | | |
|--|---|----------------------------|---|---|--|
| Sample Marked : | Aurora Municipal Office | Noordhoek Saal | Class I (Recomm. Operation. Limit) | Class II (Maximum Allowable for Limited Duration) | Class II Water Consump. Period, ^a max. |
| pH (at 25°C) | 7,51 | 8,13 | 5.0-9.5 | 4.0-10.0 | No Limit ^c |
| Conductivity (at 25°C) (mS/m) | 154 | 91,7 | <150 | 150-370 | 7 years |
| Turbidity (NTU) | 0,50 | 0,36 | <1 | 1-5 | No Limit ^d |
| Langelier Saturation Index | -1,65 | -0,21 | - | - | - |
| | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | <u>mg/l</u> | |
| Colour (as Pt) | 15 | 13 | <20 | 20-50 | No Limit ^b |
| CaCO ₃ Precipitation Potential | -5,4 | -1,1 | - | - | - |
| Total Alkalinity (as CaCO ₃) | 16,0 | 60,0 | - | - | - |
| Total Hardness (as CaCO ₃) | 254 | 187 | - | - | - |
| Calcium Hardness (as CaCO ₃) | 47,8 | 72,3 | - | - | - |
| Calcium (as Ca) | 19,1 | 28,9 | <150 | 150-300 | 7 years |
| Magnesium Hardness (as CaCO ₃) | 206 | 115 | - | - | - |
| Magnesium (as Mg) | 50,2 | 28,1 | <70 | 70-100 | 7 years |
| Sodium (as Na) | 223 | 123 | <200 | 200-400 | 7 years |
| Potassium (as K) | 0,66 | 2,0 | <50 | 50-100 | 7 years |
| Zinc (as Zn) | 0,02 | <0,01 | <5.0 | 5.0-10.0 | 1 year |
| Chloride (as Cl) | 444 | 226 | <200 | 200-600 | 7 years |
| Fluoride (as F) | 0,12 | <0,10 | <1.0 | 1.0-1.5 | 1 year |
| Sulphate (as SO ₄) | 34,0 | 50,0 | <400 | 400-600 | 7 years |
| Total Dissolved Solids | 1140 | 720 | <1000 | 1000-2400 | 7 years |
| Ammonia Nitrogen (as N) | <0,15 | <0,15 | <1.0 | 1.0-2.0 | No Limit ^d |
| Nitrate & Nitrite Nitrogen (as N) | 0,80 | 0,71 | <10 | 10-20 | 7 years |
| Total Chlorine | 0,01 | 0,07 | - | - | - |
| Freel Chlorine | 0,00 | 0,03 | - | - | - |
| | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | <u>µg/l</u> | |
| Iron (as Fe) | 80 | <10 | <200 | 200-2 000 | 7 years ^b |
| Manganese (as Mn) | 60 | <40 | <100 | 100-1 000 | 7 years |
| Aluminium (as Al) | <14 | 100 | <300 | 300-500 | 1 year |
| ^a | The limits for the consumption of Class II water are based on the consumption of 2 litres of water per day by a person of mass 70 kg over a period of 70 years. | | | | |
| ^b | The limits given are based on aesthetic aspects. | | | | |
| ^c | No primary health effect – low pH values can result in structural problems in the distribution system. | | | | |
| ^d | These values can indicate process efficiency and risks associated with pathogens. | | | | |

**MICROBIOLOGICAL REQUIREMENTS
SANS 241 - 2006 (Drinking Water)**

| 1 | 2 | | 3 | 4 | 5 |
|--|---|-------------------|--|------------------------|------------------------|
| Determinand | Aurora Municipal Office | Noordhoek Saal | Allowable Compliance Contribution ^e | | |
| | | | 95% of samples, min. | 4% of samples, max. | 1% of samples, max. |
| | | | Upper Limits | | |
| <i>E.coli</i> ^f (count/100 ml) | Nil | Nil | Not Detected | Not Detected | 1 |
| Total Coliform Bacteria ^g (count/100 ml) | Nil | 39600 | - | - | - |
| Heterotrophic Plate Count ^h (count/ml) | >5000 | >5000 | - | - | - |
| ^e | The allowable compliance contribution shall be at least 95% to the limits indicated in column 3, with a maximum of 4% and 1% respectively, to the limits indicated in column 4 and column 5. The objective of disinfection should, nevertheless be to attain 100% compliance to the limits indicated in column 3. | | | | |
| ^f | Definitive preferred indicator of faecal pollution. | | | | |
| ^g | Only used as an alert indicator of possible problems. Alert level 10 organisms per 100 ml. | | | | |
| ^h | Only used as an alert indicator of possible problems. Alert level 5 000 organisms per ml. | | | | |

.....
**N. VAN BINSBERGEN Pr.Sci.Nat.
 DIRECTOR**

**BERG RIVER MUNICIPALITY
 P O Box 60
 PIKETBERG
 7320**

Att. : MR JACO BREUNISSEN (breunissenj@bergmun.org.za)

TERMS AND CONDITIONS OF BUSINESS

All work is undertaken by A.L. Abbott and Associates (Pty) Ltd, (hereinafter called “the Company”) on the following conditions :

- (i) That the total liability of the Company, its officers, servants, agents or sub-contractors for any loss or damage caused by or resulting from improper or negligent performance, purported performance or non-performance of such work shall not exceed the sum equal to fifteen times the fee payable by the client or R6000, whichever is the lesser sum.
- (ii) That the person with whom the Company shall have contracted to have performed the said work will indemnify the Company, its said officers, servants, agents and sub-contractors against all claims made by the third parties consequent upon the performance, purported performance or non-performance of such work to the extent to which the aggregate of such claims exceeds the maximum liability specified in paragraph (i) above.
- (iii) Without the prejudice to the foregoing every person who is or becomes an officer, servant, agent or sub-contractor of the Company shall have the benefit of the limitation of liability and indemnity contained in these conditions as if they were expressly made for his benefit and so far as relates to such conditions any contract entered into by the Company is entered into not only on its own benefit but also as agent and trustee for every such person as aforesaid.
- (iv) No employee, agent or representative of the Company (other than a Director) has authority to alter or waive or make any representation which will in any way conflict with or override any of the terms of these conditions.
- (v) The present conditions shall be governed by South African law and all disputes arising in relation thereto and/or in connection therewith shall be determined by the South African courts.

APPENDIX 1 : Specific Methods used for the Analysis of Parameters indicated in this report.

| Parameter | Method | Estimated Uncertainty (%) |
|--|---|---------------------------|
| pH (at 25 °C) - Lab | SABS 11 : (1990 – 3 rd Revision) | 0,019 |
| pH (at 25 °C) – Field* | SABS 11 : (1990 – 3 rd Revision) | - |
| Langelier Saturation Index (at 25 °C)* | Calculation | - |
| Conductivity (mS/m) (at 25 °C) | STD Method 2501 A (1992) | 2,15 |
| Turbidity (NTU) | Hach 8237 | 1,81 |
| Colour (mg/l as Pt)* | Hach 8025 | - |
| Total Alkalinity (mg/l as CaCO ₃)* | STD Methods 2320 (1992) | - |
| Total Hardness (mg/l as CaCO ₃) | SABS SM 1265 (2000) | 0,09 |
| Calcium (mg/l as CaCO ₃) | SABS SM 1265 (2000) | 0,09 |
| Magnesium (mg/l as CaCO ₃) | SABS SM 1265 (2000) | 0,08 |
| Chloride (mg/l as Cl) | SABS 202 (2 nd Revision) | 0,08 |
| Fluoride (mg/l as F) | Hach 8029 | 0,19 |
| Iron (µg/l as Fe) | SANS 5207 (2004) | 0,09 |
| Manganese (µg/l as Mn) | SANS 5209 (2005) | 0,09 |
| Aluminium (µg/l as Al) | SANS 6169 (2005) | 0,14 |
| Calcium Carbonate Precipitation Potential* | Calculation | - |
| Free Chlorine (mg/l)* | Lovibond Method 3 | - |
| Sodium (mg/l as Na) | SANS 6050 (2004) | 0,08 |
| Potassium (mg/l as K) | STD Method 3111 B (1992) | 0,07 |
| Zinc (mg/l as Zn) | SANS 5214 (2005) | 0,08 |
| Nitrate Nitrogen (mg/l as N) | Hach 8150 | 0,12 |
| Nitrate Nitrogen (mg/l as N) | Lovibond Method using Brucine | 0,057 |
| Nitrite Nitrogen (mg/l as N) | Lovibond Method | 0,08 |
| Nitrate & Nitrite Nitrogen (mg/l as N) | Hach 8150 | - |
| Ammonia (mg/l as N) | STD Method 4500-NH ₃ :C (1992) | 0,07 |
| Sulphate (mg/l as SO ₄) | Hach 8051 | 0,17 |
| Total Dissolved Solids* | STD Method 2501 A (1992) | 1,63 |
| E.coli (organisms per 100 ml) | SABS 221 (2002) | - |
| Coliforms (organisms per 100 ml) | SABS 221 (2002) | - |
| Total Plate Count (organisms per ml) | Petrifilm™ | - |
| Faecal coliforms (organisms per 100 ml) | SABS SM 221 (2002) | - |
| Settleable Solids (ml/l)* | STD Method 2540 F (1992) | - |
| Chemical Oxygen Demand (mg/l) | SANS 6048 (2005) | 0,08 |
| Total Kjeldahl Nitrogen (mg/l)* | Hach 8075 | - |
| Dissolved Oxygen (mg/l)* | STD Method 4500 O-G | - |
| Total Suspended Solids (mg/l)* | STD Method 2540 D (1992) | - |
| Volatile Suspended Solids (mg/l)* | STD Method 2540 E (1992) | - |
| Total Phosphate (mg/l as P)* | STD Method 4500-PB (1992) / Hach 8114 | - |
| Ortho Phosphate (mg/l as P)* | Hach 8114 | - |
| Copper (µg/l as Cu) | SANS 5203 (2005) | 0,13 |

* Tests marked “Not SANAS Accredited” in this report are not included in the SANAS Schedule of Accreditation for this laboratory.