

# SUMMARY SHEET FOR LEAKAGE BENCHMARKING IN SOUTH AFRICA

C00059-001

## S1. SYSTEM NAME AND CONTACT DETAILS

Name of Water Undertaking	Swartland Municipality (Darling)		
Name of Water Supply System	Voëlivlei Scheme West Coast District Municipality		
Contact Details:	Name	Mr L Zikman	
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## S2. Performance Indicators of Water Loss

Viewpoint	Level	Parameter	Typical Range			Actual PI	Units
			Excellent	Good	Poor		
Operations management of distribution system at current pressure	Basic	% of year system is pressurised	100	100	<100	100	%
		Current Annual Real Losses (CARL) (when system is pressurised - see note 2)	30 to 100	100 to 200	>200	97	Litres/connection/day
	Detailed	Unavoidable Annual Real Losses (UARL) (see note 3)	n/a	n/a	n/a	56	Litres/connection/day
		Consumption	n/a	n/a	n/a	578	Litres/connection/day
		Infrastructure Leakage Index (ILI) (= CARL/UARL : see note 4)	1	2	>3.0	1.7	non dimensional
Financial management aspects of water losses	Basic	Volume of non-revenue water as a% of system input volume (see note 5)	<10%	20%	30%	17	%
	Detailed	Value of non-revenue water as a % of annual cost of running the system (see note 6)	<5%	10%	15%	11	%

### Notes:

Note 1: taken from data in "AQUA" article, December 1999 or estimated by WRP

Note 2: takes account of % of time system is pressurised, but not system pressure, density of connections or customer meter location

Note 3: takes account of density of connections and customer meter location at current pressure

Note 4: measures overall efficiency of management of distribution system at current operating pressure

Note 5: strongly influenced by average consumption per service connection

Note 6: Allows different values of Rand/m3 for different components of non-revenue water

## S3. Key Operating Parameters which influence Unavoidable Annual Real Losses (UARL)

Variable	Typical Range			Actual PI	Units
	Low	Medium	High		
Average Operating Pressure	30	45	100	50	Metres
Density of connections	20	45	120	58	per km of mains

## 4. Key Components of Annual System Input Volume

Component	m3/year	m3/connection/day	% of System Input Volume
Water Exported		not applicable	
Authorised Consumption excluding exports	550322	0.58	83.3
Apparent Losses	18815	0.02	2.8
Actual Consumption excluding exports	569137	0.60	86.1
Real Losses	91863	0.10	13.9
System Input Volume	661000	0.69	100.0

## DATA ENTRY SHEET FOR LEAKAGE BENCHMARKING IN SOUTH AFRICA

**Note:** Note: An example has been included to assist you in completing this data sheet. The example input data can be seen in the pale blue shaded areas. Your input data should appear in the pale yellow shaded areas. The light green shaded areas are protected calculation fields and nothing can be entered in these fields.  
Use the units as shown. If you have to use other units; you have to change the appropriate cells.

### D1. GENERAL

<b>Name of Water Undertaking</b>	Swartland Municipality (Darling)	
<b>Name of Water Supply System</b>	Voëlvrlei Scheme West Coast District Municipality	
<b>Contact Details:</b>	<b>Name</b>	Mr L Zikman
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		Malmesbury
		7299
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### D2. SYSTEM DATA

Input Description	Variable	Example Data	Actual Data	Units	
Length of Mains (Transmission + Distribution)	Lm	1500	45	km	
Number of Service Connections	Ns	60000	2607	Number	See Notes 1 & 2
Density of Service Connections (per km of mains)	Ns/Lm	40	58	Per km	
Percentage of time system is pressurised during year	T	100	100	%	See Note 3
Average operating pressure when system pressurised	P	45	50	metres	See Note 4
Population served by the supply system	Pop	100000	11279	Number	

**Note 1:** The number of service connections is not always the same as the number of meters or billed accounts. For South African conditions, however, you can use the total of the number of metered accounts plus the estimated number of unmetered connections

**Note 2:** In South Africa customer meters are usually located close to the street/stand boundary. If this is not the case for your system, then add a note here.

Average number of consumer units for 2015/2016, as taken from the Financial System = 2607

**Note 3:** Use T in % eg. If T = 80%, use 80 and not 0.8

**Note 4:** If you do not have an accurate figure, please make a best estimate and provide brief details of how you derived it.

Water Master Plan

### D3. UNAVOIDABLE ANNUAL REAL LOSSES (UARL)

Details	Calculation	Example Result	Actual Data	Units
On mains	$18 \times \text{Lm} \times \text{P} \times 365 \times \text{T}/10^8$	443	15	$10^3 \text{ m}^3/\text{yr}$
On Service Connections	$0.8 \times \text{Ns} \times \text{P} \times 365 \times \text{T}/10^8$	788	38	$10^3 \text{ m}^3/\text{yr}$
Total Volume of UARL		1232	53	$10^3 \text{ m}^3/\text{yr}$
UARL in litres/service conn./day when the system is pressurised	Annual Volume of UARL $\times 10^6 / (\text{Ns} \times 365 \times \text{T}/100)$	56	56	Litres/ conn./day

## D4. ANNUAL WATER BALANCE DATA

### D4a. Data Period

12-MONTH PERIOD FOR WHICH DATA APPLIES	Example Data		Actual Data	
	Start Date	April 1, 1998	July 1, 2015	
	End Date	March 31, 1999	June 30, 2016	

### D4b. System Input Volume

Water Supplied	Example Data				Actual Data					
	Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Correction to Source Meter data		Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Total 10 <sup>3</sup> m <sup>3</sup> /yr	Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Correction to Source Meter data		Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Total 10 <sup>3</sup> m <sup>3</sup> /yr
		+/- %	10 <sup>3</sup> m <sup>3</sup> /yr				+/- %	10 <sup>3</sup> m <sup>3</sup> /yr		
From Own Sources:	36000	2.00%	720		36720					
From Other Suppliers:	1000			280	1280	661				661
<b>Total:</b>	<b>37000</b>		<b>720</b>	<b>280</b>	<b>38000</b>	<b>661</b>				<b>661</b>

### D4c. Components of Authorised Consumption

Components of Authorised Consumption	Example Data					Actual Data				
	Billed Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Billed Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Unbilled Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Unbilled Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Total 10 <sup>3</sup> m <sup>3</sup> /yr	Billed Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Billed Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Unbilled Metered 10 <sup>3</sup> m <sup>3</sup> /yr	Unbilled Unmetered 10 <sup>3</sup> m <sup>3</sup> /yr	Total 10 <sup>3</sup> m <sup>3</sup> /yr
Water Exported:	1500				1500					
Households:	24500	500			25000	353				353
Non-households:	6900	100			7000	145				145
Standpipes:		500	10		510					
Firefighting:				100	100				1	1
Mains Flushing:				100	100				1	1
Building water:	1040				1040					
Other (specify): Other						51				51
Other (specify):										
<b>TOTALS:</b>	<b>33940</b>	<b>1100</b>	<b>10</b>	<b>200</b>	<b>35250</b>	<b>549</b>			<b>1</b>	<b>550</b>

### D4d. Components of Water Losses

Details	Example Result	Actual Result	Units
Water Losses = System Input – Authorised Consumption	2750	111	10 <sup>3</sup> m <sup>3</sup> /yr
Percentage of Total Losses estimated to represent the Apparent Losses	20	17	%
Apparent Losses	550	19	10 <sup>3</sup> m <sup>3</sup> /yr
<b>Annual Real Losses (ARL) = Water Losses – Apparent Losses</b>	<b>2200</b>	<b>92</b>	<b>10<sup>3</sup> m<sup>3</sup>/yr</b>

## D5. SELECTED OPERATIONAL PERFORMANCE INDICATORS

### D5a. Current Annual Real Losses per Connection (CARL) at Current Pressures

Details	Calculation	Example Result	Actual Result	Units
CARL is expressed in Litres/service connection/day, when system is pressurised	$ARL \times 10^6 / (Ns \times T/100 \times 365)$	100	97	Litres /conn./day
Consumption in litres/conn./day		1610	578	Litres /conn./day

### D5b. Infrastructure Leakage Index (ILI)

Details	Calculation	Example Result	Actual Result
ILI is the ratio of Current Annual Real Losses (CARL) to Unavoidable Annual Real Losses	$CARL / UARL$	1.79	1.74

### D5c. Non-Revenue Water as a % by Volume of System Input

Description of Unbilled Items	Example Result			Actual Result		
	Volume $10^3 \text{ m}^3/\text{yr}$	System Input $10^3 \text{ m}^3/\text{yr}$	% of System Input	Volume $10^3 \text{ m}^3/\text{yr}$	System Input $10^3 \text{ m}^3/\text{yr}$	% of System Input
Unbilled Consumption	210	38000	0.55	1	661	0.20
Apparent Losses:	550	38000	1.45	19	661	2.85
Real Losses:	2200	38000	5.79	92	661	13.90
<b>Total Unbilled:</b>	<b>2960</b>	<b>38000</b>	<b>7.79</b>	<b>112</b>	<b>661</b>	<b>16.94</b>

## D6. SELECTED FINANCIAL PERFORMANCE INDICATORS

### D6a. Local Valuation of Real and Apparent Losses

Details	Example Result	Actual Result	Units
Unit Value of Real Losses (eg bulk purchase price)	0.15	3.80	R /m <sup>3</sup>
Unit Value of Apparent Losses (eg selling price)	2.70	10.21	R /m <sup>3</sup>

### D6b. Annual Cost of Running System

Details	Example Cost	Actual Cost	Units
Annual Cost of running system in 1000's of Rand per year	45000	5180	$10^3 \text{ R/year}$

### D6c. Non-Revenue Water as % by Value of Cost of Running System

Description of Unbilled Items	Example Result				Actual Result			
	Volume $10^3 \text{ m}^3/\text{yr}$	Unit Value R /m <sup>3</sup>	Value $10^3 \text{ R/year}$	% of Annual Running Costs Costs	Volume $10^3 \text{ m}^3/\text{yr}$	Unit Value ( R /m <sup>3</sup> )	Value $10^3 \text{ R/year}$	% of Annual Running Costs Costs
Unbilled Consumption	210	2.70	567	1.26	1	10.21	13	0.26
Apparent Losses:	550	2.70	1485	3.30	19	10.21	192	3.71
Real Losses:	2200	0.15	330	0.73	92	3.80	349	6.74
<b>Total Unbilled:</b>	<b>2960</b>		<b>2382</b>	<b>5.29</b>	<b>112</b>		<b>555</b>	<b>10.71</b>

## D7. RELATIONSHIP BETWEEN REAL LOSSES EXPRESSED AS % OF SYSTEM INPUT

### D7a. Real losses curve definition

Curve Definition					
Consumption litres/serv conn/day	Real losses in litres/service connection/day				
	50	100	200	500	1000
100	33.3	50.0	66.7	83.3	90.9
250	16.7	28.6	44.4	66.7	80.0
500	9.1	16.7	28.6	50.0	66.7
1000	4.8	9.1	16.7	33.3	50.0
2000	2.4	4.8	9.1	20.0	33.3
3000	1.6	3.2	6.3	14.3	25.0
5000	1.0	2.0	3.8	9.1	16.7
10000	0.5	1.0	2.0	4.8	9.1

### D7b. Components of water balance in litres/service connection/day (Actual Results)

System Input Volume = 695	Total Consumption = 598	Billed Authorised Consumption = 577	Authorised Consumption = 578	Revenue Water = 577
		Unbilled Authorised Consumption = 1		Non-Revenue Water = 118
		Apparent Losses = 20	Total Losses = 116	
		Real Losses = 97		

### D7c. Current Real Losses as % of System Input Volume

Details	Calculation	Actual Result	Units
System Input Volume	from D7b	695	Litres/conn/day
Total Consumption	from D7b	598	Litres/conn/day
Annual Real Losses	from D7b	97	Litres/conn/day
ARL as % of System Input	$ARL / \text{System input volume} \times 100$	14	%

### D7d. Potential Real Losses as % of System Input Volume

Details	Calculation	Actual Result	Units
Unavoidable Annual Real Losses (UARL)	from D3	56	Litres/conn/day
Target Loss Factor (TLF)	User defined for each system	2	Dimensionless
Target Annual Real Losses (TARL)	$TLF \times UARL$	111	Litres/conn/day
Current Annual Real Losses (CARL)	CARL from D5a	97	Litres/conn/day
Potential savings	$CARL - TARL$	-15	Litres/conn/day
Potential ARL as % of System Input	$TARL / (\text{System input volume} - \text{Potential savings}) \times 100$	16	%

### D7e. Real Losses as a % of System Input Volume versus Consumption in litres/service connection/day for different values of Real Losses in litres/service connection/day

