13 A UNIQUE WAY TO PLAN AND START IMPLEMENTING A WCWDM PROGRAM QUICKLY AND EASILY, FROM A ROBUST FOUNDATION

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ABSTRACT

It has become abundantly clear that all Water Services Authorities (WSAs) need to achieve No Drop certification as soon as practical, which is estimated to be between 4 and 6 years. This is not just because South Africa is a water scarce country. A lack of Water Conservation/Water Demand Management (WCWDM) programs has also resulted in wasted capital expenditure on supply augmentation, and in the water services sections of many WSAs being financially bankrupt. The resultant reliability of water supplies is so poor, that it has resulted in violent protests with substantial damage to property and even deaths.

The author of the paper believes that WSAs are slow to start implementing WCWDM programs because officials do not recognise how to measure their current situation or how to estimate the water savings and financial gains of implementing such a program. The author therefore explains how these WSA requirements can be achieved. The current situation can be evaluated easily using simple water volume and money balances. The paper describes how to do this. Estimating what a WCWDM program can achieve is more challenging, as it requires a sound estimate of the minimum economically achievable System Input Volume (SIV). This SIV will be made up of the water that needs to be supplied to customers and the total water losses that will occur in the water distribution system, assuming it is well managed. The paper describes how to calculate these two variables and how to use the results to estimate the potential water savings and financial gains.

Except for the domestic water demands, all the information should be readily available from the WSA's own records. The author has therefore calculated the domestic water demands for each of the approximately 20 000 sub- and main-places, LMs, Metros, and DCs for each of South Africa's nine Provinces, using the results of the 2011 Census. It is planned to make the results available on the DWS or WISA website. The paper describes how the demands have been calculated.

The paper also includes a case study. It ends by describing how to plan a WCWDM program, and recommending how to get the program approved by the Municipal Council.

INTRODUCTION

Background

WSAs are constantly being advised about the importance of implementing WCWDM, because South Africa is a water stressed country, ranked the 30th driest country in the world, and because the lack of WCWDM has a negative impact on WSAs' financial wellbeing and, frequently, on the reliability of the water supply services to many communities.

Despite this advice, 58% of South Africa's 147 WSAs do not know how much of the water entering their supply systems is Non-Revenue Water (NRW), and an even greater percentage have no idea to what extent the implementation of WCWDM would reduce the amount of water entering their systems or increase the revenue they receive from their customers.

The aims of this paper

Having examined South Africa's current approach to measuring a WSA's current situation, this paper explains how WSAs should simplify and

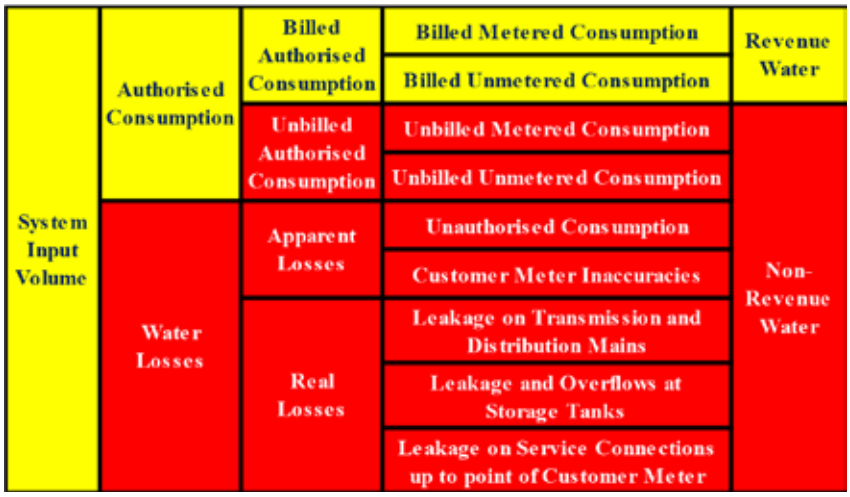

FIGURE 1: Standard IWA water volume balance (Source WRC report no TT300-07 pdf page 21)

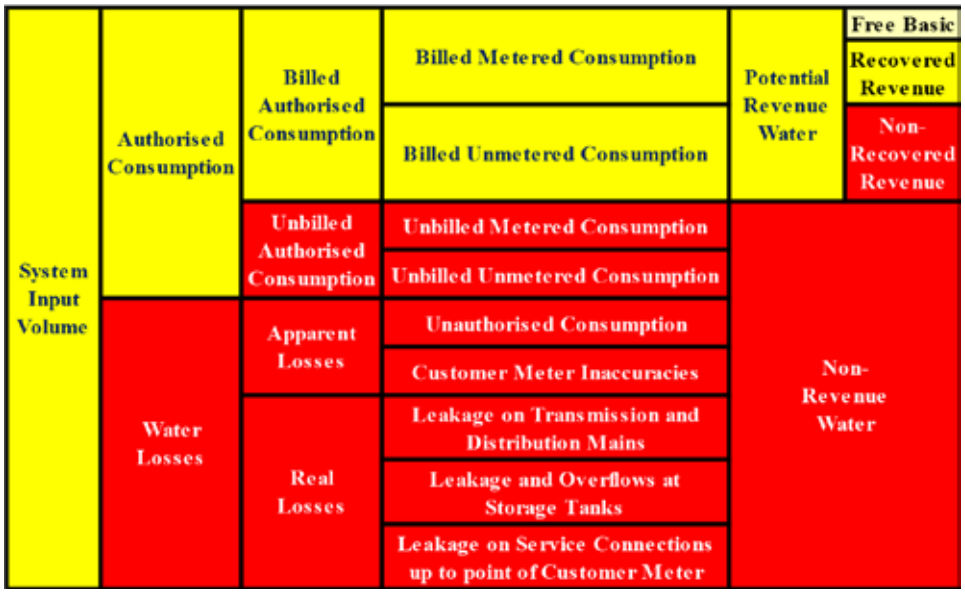

FIGURE 2: Modified IWA water volume balance for South Africa (Source WRC report no TT300-07 pdf page 22)

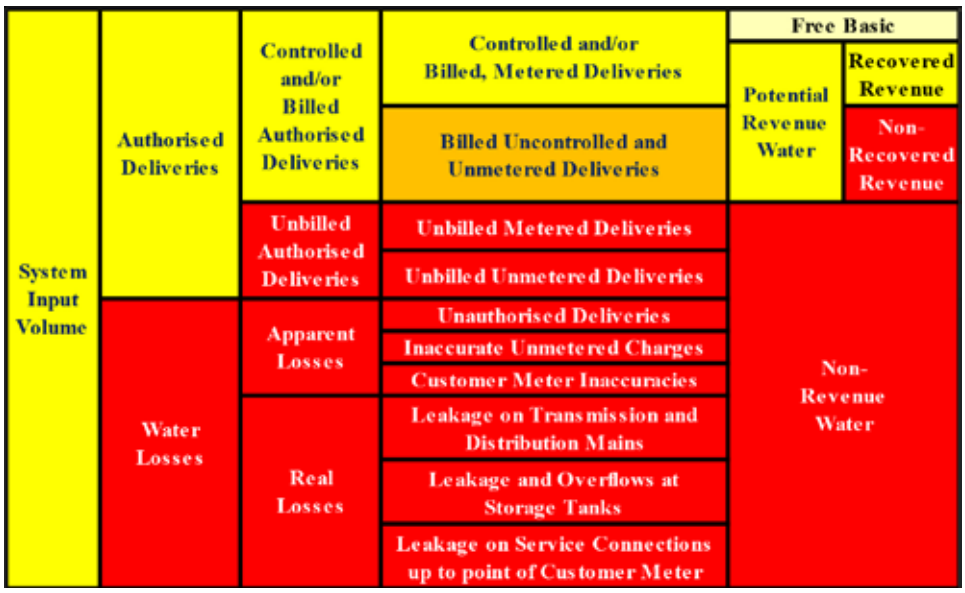

FIGURE 3: Recommended modified IWA water volume balance for South Africa

modify this approach, so that they obtain a clearer overall picture of their current situation. It then goes on to explain how WSAs should estimate how implementing WCWDM will change their water demand and their financial situation.

MEASURING THE CURRENT SITUATION

The most common method used in South Africa

In South Africa it is common practice to use the standard International Water Association (IWA) water balance diagram to obtain a picture of the state of a WSA's water wastage. Figure 1 is a representation of this IWA balance.

The water balances have two primary aims, namely to measure:

- the efficiency with which the water services provider delivers the water to customers, and
- the completeness and accuracy of the volume of billed water

These aims are an essential part of effective water delivery everywhere, but are not sufficient in the South African context.

Recommended modifications

For this reason the WRC report no TT300-07 recommends the same water balance, but with two modifications. Figure 2 is a representation of this modified IWA balance.

The first modification is to indicate that free basic water should be included with the revenue water since, assuming it is properly managed, this water does not reflect any inefficiency on the part of the service provider. The second modification splits the rest of the billed consumption into two parts, the actual recovered revenue and the non-recovered revenue. That is, it indicates water that has been billed and paid for separately from water that has been billed but subsequently has not been paid for. It is recommended that this modified water balance is always used, as measuring and managing non-recovered revenue is also an essential part of water supply management in South Africa.

Figure 3 is essentially the same as figure 2 but with terminology that is more accurate in the South African context. Hence the word "charged" has been used instead of "billed" because bills are not issued when prepayment meters are used. The word "deliveries" has been used instead of "consumption" because water delivered includes efficient usage, inefficient usage or wastage, and leakage from the pipework and plumbing fittings on customers' properties. The last mentioned can be substantial in some areas.

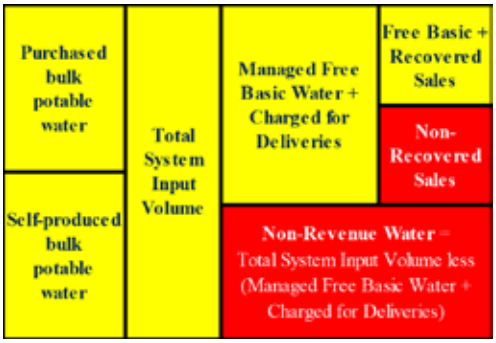

FIGURE 4: Simplified overall picture, water volume balance for South Africa

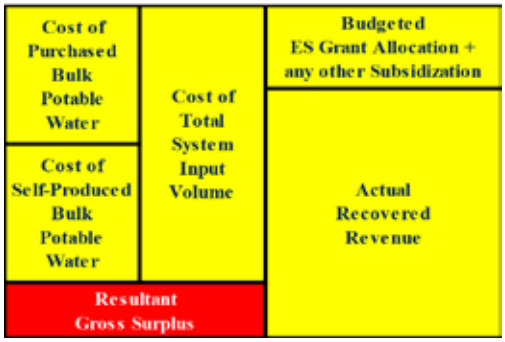

FIGURE 5: Simple overall picture, water money balance for South Africa

How WSAs can obtain a clear overall picture of their current situation

Information with the level of detail shown in figure 3 provides an excellent water volume balance that should be considered by WSAs once they begin drawing up a detailed WCWDM implementation strategy and business plan. However, to obtain a clear overall picture of their current situation, it is recommended that this water volume balance is simplified and that, concurrently, an equivalent water money balance is developed. Figures 4 and 5 represent these water volume and money balances respectively.

If a WSA purchases bulk potable and/or bulk raw water, it can use the supply invoices to measure all these portions of the System Input Volume (SIV). If there is any additional SIV, it is likely to be sourced from ground water. Each associated borehole pump should have a water meter installed shortly after its delivery point to measure the water abstracted from each borehole. These meters will then measure the remaining portions of the SIV. If no meters are fitted, the water abstracted from the boreholes can be estimated from the pump performance details combined with either their hours of operation or the quantity of electricity or fuel used to power them.

Whilst examining the WSA's retail customer billing, free basic water and payment records, in order to draw up the water delivery, billing and recovered revenue figures for figures 4 and 5, it is recommended that the water deliveries to non-domestic consumers' be recorded separately from the domestic records, because the former will be used again, without altering them, to estimate the results of implementing WCWDM. The number of non-domestic customers should also be noted.

After all the records required for figures 4 and 5 have been assembled, and the current NRW and resultant gross surplus results calculated, it is necessary to be cautious about how these overall pictures are interpreted. For example, the resultant percentages of NRW and non-recovered revenue, in figure 4, do indicate roughly how well or how poorly a WSA is managed. Nevertheless, the outcomes from reducing these percentages are never clear. For example reducing the non-recovered revenue may cause the customers in debt to use less water, rather than increasing their payments to the WSA. As the non-recovered revenue is reduced, it is tempting to assume that the total SIV, and therefore its cost, in figure 5, will also reduce significantly. However, in a very poorly managed WSA, the outcome may well be that customers who previously received practically no water, will now receive a reliable service. As a result these customers' water usage will increase, and the total SIV may not decrease significantly.

Referring to figure 5 therefore, without estimating the true demand and resultant recovered revenue from a well-managed scheme, as explained in the next section, it is impossible to predict the extent to which the resultant gross surplus will improve as a result of improved management interventions. The only certainty is that if the current gross surplus is low, starting to implement WCWDM without additional funding will be a severe challenge.

ESTIMATING THE RESULTS OF IMPLEMENTING WCWDM

The approach

To estimate the outcome of implementing WCWDM it is necessary to estimate the minimum economically achievable (SIV). The SIV is made up of two components:

- customers' true water demand, assuming cost recovery is well managed, and
- the total losses that will occur in the water distribution system, assuming it is well managed.

The customers' total true water demand is made up of two categories of customers: domestic customers, and non-domestic customers. On average, domestic customers reflect about 90% of the demand. Because this demand is the higher, and the more difficult one to estimate, the author of this paper has estimated the water demand for each of the approximately 20 000 sub- and main-places, LMs, Metros, and DCs for each of South Africa's nine provinces using the results of the 2011 Census. Once the domestic water demand has been estimated, the WSA's tariffs are used to calculate the potential revenue from this demand. WSAs are expected to use their billing system records to estimate the demand and potential revenue from their non-domestic customers. Once both demands have been estimated, the total losses that will occur in the water distribution system, assuming it is well managed, are estimated. Finally, once all these variables have been estimated, new water volume and money balances are drawn up, as represented in figures 6 and 7 respectively. These figures reflect the outcomes of implementing WCWDM and therefore represent the targets that ought to be striven for.

In figure 6 the *resultant total system input volume* is qualified by adding the word "*acceptable*" with a question mark after

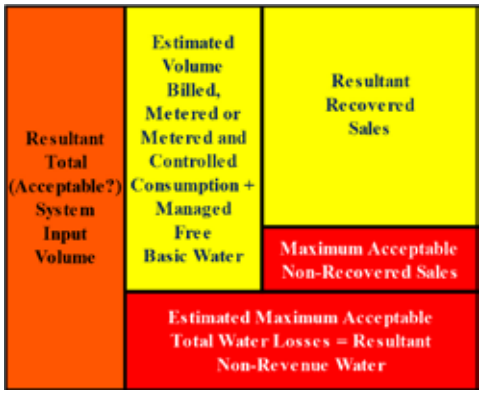

FIGURE 6: Resultant water volume balance after implementing WCWDM

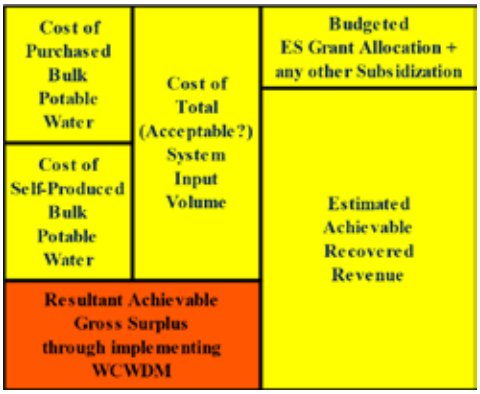

FIGURE 7: Resultant budgeted water money balance through implementing WCWDM

it and the cell is shaded in orange rather than yellow. This is because first level WCWDM as implemented by a WSA does not normally try to reduce the volume of water used by rich paying customers and the estimated water demand reflects this practice. However, if there is a water shortage in the area it will be necessary to discuss this situation with these high usage customers and decide how their high demand is to be reduced or managed in the present circumstances.

In figure 7 the cell containing the *resultant achievable gross surplus through implementing WCWDM* is also shaded in orange rather than yellow. This is because this figure reflects the results of implementing WCWDM only, but it assumes that all costs, tariffs, and budgeted ES grant allocations and any other subsidization remain unaltered. In practice, if the water supply services operating, monitoring and maintenance budget was previously grossly inadequate, it is unlikely that implementing WCWDM on its own will increase the available budget sufficiently, to enable the WSA to maintain its reduced NRW and improved cost recovery, without the ongoing injection of special external project funding, In such cases, a higher gross surplus will have to be generated by improved budgeting and/or more efficient management techniques will have to be introduced.

The next few sections of the paper explain, in more detail, how the domestic water demand and the water distribution losses are estimated and used to develop the target water volume and money balances depicted in figures 6 and 7.

Estimating the true domestic water demand, assuming cost recovery is well managed

The true domestic demand to be estimated is *the estimated volume of billed, metered or metered and controlled consumption, plus the volume of managed free basic water* presented in the second column of figure 6

To estimate the true domestic demand, the following Census 2011 results for each of the approximately 20 000 main- and sub-places in South Africa were first obtained from StatsSA:

- Area, population and no of households
- Household access to piped water
- Household source of water
- Household toilet facilities
- Household income category.

This information was then integrated into a single Excel spreadsheet, to build up a rational set of domestic water demands. These demands were based on the assumptions indicated in table 1.

The table 1 assumptions are only valid if all delivered water, above the free basic allowance, is billed, and the non-recovered revenue is kept to a minimum. **These domestic water demands are a fundamental part of estimating the gains that can be achieved from implementing WCWDM.**

Average annual demands per day (based on CSIR Red Book table 9.11)	Demand Components	Total Demands	
		Dry San	Wet San
	l/cap/day		
Basic	35	35	35
Yard connection dry sanitation	25	60	60
Waterborne sanitation	50		110
Household income Rand per annum			
=<9600/annum	0	60	110
>9600 to 38 200	20	80	130
>38 200 to 76 400	30	110	160
>76 400 to 153 800	50	160	210
>153 800 to 307 600	90	250	300
>307 600	150	400	450
Hostels per resident		80	130

TABLE 1: Basic assumptions for the estimation of domestic water demands

NOTE: When calculating the domestic water demand, the table 1 assumptions are entered in a separate sheet that is linked to the main sheet in the Excel workbook. Thus any of the component figures in table 1 can be altered, and the figures on the corresponding columns on every row of the main sheet will be updated automatically

The demands generated reflect the domestic water demands of all households in South Africa, **including** those who do not rely in any way on their WSA, or a WSP appointed by their WSA, to supply the water they use. This is only significant in a small minority of cases, and probably exclusively in places designated as non-urban (NU) by StatsSA. Thus when checking demands for the whole WSA the discrepancy can be ignored.

To complete the picture the following Census 2011 results for the main- and sub-places were also obtained:

- Household water supply interruptions
- Household water supply interruptions lasting longer than two days.

In contrast to the other household figures, these figures reflect the reliability of domestic water supplies to households that are supplied with water by their WSA, or a WSP appointed by their WSA only. Thus, they **exclude** households which are not dependent on their WSA for the water they use. Using these figures it is therefore possible to check the significance of the number of households not receiving water from their WSA, and to adjust the estimated true water demand figures accordingly, when checking the effectiveness of implementing WCWDM measures in a relevant small zone.

Adjusting the true domestic water demand for the period 2011 to the present

The estimated true domestic water demand figures relate to 2011, when the last Census was carried out. An allowance must be made for the increase in the percentage of households and flush toilets, and in the population since then. Many WSAs regularly update these figures. If they do not do so, the percentages will have to be estimated from the billing system, and/or from the WSA's records of new developments and new household connections and flush toilet installations related to housing already existing in 2011. If the population increase is not available, one can check the increase in population between the 2001 and 2011 censuses and make a proportional adjustment for the number years elapsed since 2011. Note: calculation of the demand is related to population and not number of households. Therefore, although the number of households, used for example by National Treasury to calculate the Equitable Share, is increasing faster than the population in most WSAs, this increase should not be used. The level of service percentage figures are entered in additional cells, which allows users to change the census percentages. With reference to the population increase, it is recommended to enter this in a newly inserted row. The same average demand per access point as has been estimated for the 2011 domestic population can be used for the population increase.

Non-domestic water demands

Individual non-domestic customers normally purchase more water than the average domestic customer. As a result, WSAs normally manage their non-domestic customers better than their domestic ones. In addition, the total non-domestic water delivered is normally only a small fraction of the water delivered to domestic customers. For these reasons, the demands and invoiced amounts abstracted from the WSA's billing system are used, without alteration.

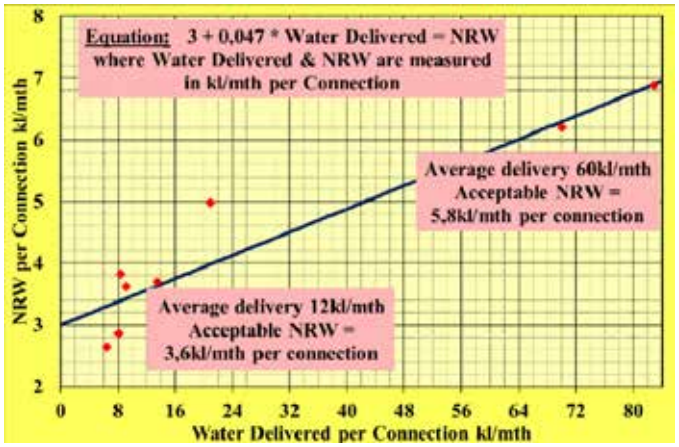

FIGURE 8: Water delivered and acceptable NRW per connection kl/mth (source WRC report no 521/1/98 pdf page 71)

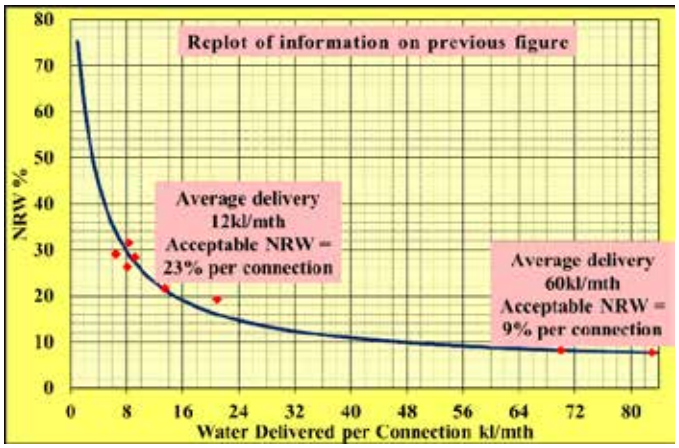

FIGURE 9: Water delivered per connection and acceptable NRW % (source WRC report no 521/1/98 pdf page 72

If the WSA is aware of some non-domestic customers that are not included in their billing system, such as schools, clinics and public offices, it should make a simple estimate of how much water is delivered to these customers, and calculate the resultant charges. These figures should then be added to the existing quantified demands, for the figure 6 and 7 calculations.

Estimating the NRW or total losses associated with supplying the true domestic water and non-domestic water demands in a well-managed water distribution system

As can be seen from figure 3, in a well-managed water distribution system there are no authorised unbilled deliveries other than managed free basic water. As a result the NRW and the total water losses, real plus apparent, are equal.

With respect to estimating an acceptable level of NRW, WRC report no 521/1/98 contains a simple method of doing so. It relates the acceptable level of NRW to the number of system connections or delivery points, and the average water delivered per connection, in accordance with the graph and equation presented in figure 8. Although the equation relates the non-revenues to the number of connections and the water delivered per connection, it needs to be noted that the result takes into account the water losses from all sources in a well-managed system. It is interesting to note that, as the water delivered per connection increases, so does the acceptable volume of NRW. **This method of calculating the acceptable level of NRW is the second fundamental part of estimating the gains that can be achieved from implementing WCWDM.** The level of NRW being estimated here is the *estimated maximum acceptable total water losses* presented in the bottom row of figure 6. The true water demand estimated in the previous section, plus this level of NRW, is equal to the *resultant total (acceptable?) system input volume* presented in the first column of figure 6.

Figure 9 is a replot of the information in figure 8, but the NRW is expressed as a percentage of the total water delivered rather than indicating the actual volume of water lost. This figure has been included to illustrate that quoting NRW as a percentage is not very informative. This is because the acceptable level drops from 23%, for systems where an average of 12 kl/mth is delivered per connection, to 9%, for systems where an average of 60 kl/mth is delivered per connection. This is despite the fact that, as can be seen from figure 6, in the former case the volume of water lost per connection is 3,6 kl/mth and in the latter the acceptable quantity of water lost has increased to 5,8 kl/mth.

With respect to estimating the acceptable level of NRW for the domestic demand there is one small challenge with respect to using the StatsSA figures uncritically. That is, if one assumes the number of households equals the number of connections, the number will be too high because public standpipes serve several households, and in non-family hostels, a large no of people use each connection. Even with respect to yard and house connections, the StatsSA definition of a household is different from WSAs' loose definition, which refers to a customer metering units. As a result, even for yard and house connections, the number of connections is fewer than the number of households. To overcome this discrepancy, the assumptions listed in Table 2 are used in estimating the average domestic demand per connection or access/delivery point.

Per yard or house connection	4
Per standpipe connection	80
Per non-family hostel connection	120

TABLE 2: Assumed estimated average number of persons served per connection for different levels of service

As per the basic assumptions for the estimation of domestic water demands recorded in table 1, these average number of persons served per connection are entered in a separate sheet that is linked to the main sheet in the Excel workbook. Thus any of the figures in table 2 can be altered, and the figures on the corresponding columns on every row of the main sheet will be updated automatically.

With respect to the non-domestic customers, the number of such customers should be noted, so that the average demand from these customers can be calculated. The acceptable NRW for the non-domestic connections is then calculated in exactly the same way as for the domestic connections.

Estimating the achievable revenue to be recovered from supplying the true domestic and non-domestic water demands

The achievable revenue is simply the total money billed from supplying the true domestic water demand less the bills not paid. It is estimated that in a well-managed system at least 95% of the total money billed will be recovered.

The total money billed for the domestic water delivered is calculated from the true demand table as follows:

- The estimated number of domestic Access Points: say = "a"
- The estimated Average Domestic demand in kl/Access Point/mth: say = "b" and

- The charge that would be levied for the estimated average demand per Access Point calculated from the WSA tariff: say ="c".

Then for WSAs that allocate free basic water to all their domestic customers, the total money billed per annum will be approximately = R 12 x "a" x "b" x "c"

If the WSA only allocates free basic water to its indigent customers, calculate the total money billed as stated above. Then find out how many indigent customers receive free basic water and calculate the money forfeited by the WSA as a result of these free deliveries.

The total money billed is labelled approximate because step tariffs result in the figure calculated being too low. This is generally regarded as sensible, since the extra income calculated from implementing WCWDM will be understated, rather than overstated. Should a more accurate figure be preferred, this can be calculated by examining the true water demands figures in detail and noting the percentage of customers receiving different quantities of water.

The total money billed for non-domestic water delivered is taken from the WSA's billing records.

Average annual demands per day (based on CSIR Red Book table 9.11)	**Table 1 Demand Components**	**Reduced Demand Components**	**Reduced Total Demands**	
			Dry San	**Wet San**
	l/cap/day			
Basic	35	25	25	25
Yard connection dry sanitation	25	20	45	45
Waterborne sanitation	50	45		90
Household income Rand per annum				
=<9 600	0	0	45	90
>9 600 to 38 200	20	20	65	110
>38 200 to 76 400	30	25	90	135
>76 400 to 153 800	50	35	125	170
>153 800 to 307 600	90	40	165	210
>307 600	150	50	215	260
Hostels per resident			80	125

TABLE 3: Basic assumptions for the estimation of Beaufort West domestic water demand

BEAUFORT WEST LM WSA CASE STUDY

General description of the WSA

To choose a suitable WSA for a case study the author sought a medium sized LM WSA, with a high no drop score, and yet with a high NRW figure. After examining the DWS first order no drop assessment provincial reports, the Beaufort West municipality was chosen. It is a medium sized LM WSA that received a good no drop score of 86% in its 2013 assessment, whilst having an extremely poor NRW figure, quoted as 50%.

Despite some challenges, it was an excellent choice because the municipality had also appointed a PSP to do a water audit for the 2014/2015 financial year in terms of clause 10 of the section 9 regulations gazetted in terms of the Water Services Act 108 0f 1997. The report is of a high standard, and this case study has been realized using the contents of this report, augmented in a few places with information taken from the municipality's 2014/15 annual report, and its integrated development plan (IDP) 2012–2017, 2nd Annual Review 2014/2015.

Planning the case study implementation

Before implementing the case study, the relevant sections of the municipality's water services audit report were considered. Important items noted were:

- the low quantity of water metered, despite practically all the municipal retail connections being metered
- the low average number of persons served per domestic water meter
- the widely different water tariffs used for the different water supply systems, and for the pre-paid meters and credit meters
- the fact that for one of the four water supply systems, the Murraysburg system, the information reported was scarce.

The low quantity of water metered was a concern because it was clear that, by using the domestic water demand figures recorded in table 1 the resultant target achievable recovered revenue would seem excessive when compared with the current actual recovered revenue. The results of the ten Western Cape LM WSAs with the highest no drop scores were then examined carefully. These results showed signs that domestic water usage in these municipalities **may** on average be only 80% of that specified in table 1. It was therefore decided to reduce the table 1 demands so that the domestic demand would be reduced by 20%. This will ensure that the calculated target achievable recovered revenue is likely to be understated rather than overstated. Particularly with respect to revenue, it is recommended that conservative outcomes are calculated, so that municipalities are not unnecessarily disappointed by not being able to meet the target. The lower demands used in drawing up the WCWDM targets are stated in table 3.

Level of service	**Original Table 2**	**Modified Figures**
Per yard or house connection	4	3,9
Per standpipe connection	80	43,3
Per non-family hostel connection	120	120,0

TABLE 4: Revised average number of persons served per connection for different levels of service in Beaufort West

The number of user connections, which reflects the low average number of persons served per connection, and in Beaufort West's case, per domestic water meter, is clearly stated in the Audit Report. The number has therefore been accepted, and modified lower figures for the average number of persons served per connection have been used in drawing up the WCWDM targets. The original default values from table 2 and the new modified values are stated in table 4.

Beaufort West System
Merweville System
Nelspoort System
Murraysburg System
Total all 4 systems

FIGURE 10: Colour code for the WSA's water supply systems

Because of the widely different water tariffs used for the different water supply systems, it was decided to examine each system separately. Figure 10 indicates the names of these systems and the colour codes used later in figure 12. The number of pre-paid meters and credit meters installed and how the different meters were allocated to different income categories of customers was not stated anywhere in the Audit Report. Details of a 2012/2013 water reliability report quoted in the Audit Report were used

Water volume balance kl/annum				Water money balance R/annum	
System input volume (SIV)	Managed free basic water + charged for deliveries	NRW %	Free basic + recovered sales	Cost of total system input volume (SIV)	ES grant allocation + any other subsidization
			1 414 293 (91,5%)	5 808 133 allowed	8 035 000
3 382 954	1 545 675	54,31	Non-recovered sales	Resultant gross surplus	Actual recovered revenue
			131 382 (8,5%)		
	Non-revenue water			20 325 234	18 098 367
	1 837 279 (54,31%)			= R6,01/kl of SIV	= 91,5% of charged

FIGURE 11: Water supply services situation in Beaufort West; current water volume and money balances

to guestimate that 36% of the water meters are pre-paid meters. Then due to a lack of information it was further assumed that the pre-paid meters were exclusively used for domestic customers and that they are evenly divided between the different schemes and customer income categories. To check that these assumptions gave reasonable results, the method used to calculate the total target billed amount was used to calculate the current billed amount. The outcome was just 1,9% less than the actual current billed amount. This outcome is acceptable, so no further effort was made to seek more accurate information concerning the number of persons per connection or the municipality's use of pre-paid meters.

The lack of information reported for the Murraysburg Water Supply System was mainly overcome by subtracting the sum of figures related to the three other schemes from the total figures reported for all four schemes and using the differences as the figures for Murraysburg. Apart from the validity of the reasoning, all the results obtained for the Murraysburg System are consistent with those obtained for the other schemes.

The overall picture of their current situation

Having made the decisions reported above, the results for the current situation in Beaufort West were recorded in figure 11 in accordance with the norms defined in figures 4 and 5

Drawing up WCWDM targets

Based on the decisions made previously in **Planning the case study implementation,** and using the methodologies described in **ESTIMATING THE RESULTS OF IMPLEMENTING WCWDM** above, the target water demands and acceptable NRW for Beaufort West were drawn up. The results are summarized in table 5. The Beaufort West Non-Urban (NU) area has not been included in the totals, because these households are not supplied with water services by the municipality.

Lastly the results recorded in table 5 were transferred to figure 12 in accordance with the norms defined in figures 6 and 7 and the decisions made previously in Planning the case study implementation. This figure records all the volumetric and financial results to be expected from implementing WCWDM in the Beaufort West LM WSA.

RESULTS OF THE BEAUFORT WEST WSA CASE STUDY

An analysis of results of the case study

Changes	Current	Targets	Dif	% Change
Water volumes kl/annum				
SIV	3 382 954	2 955 896	-427 058	-12,6
Managed deliveries	1 545 675	2 418 437	872 762	56,5
NRW %	54,31	18,18	-36,13	-66,5
FBW + recovered sales	1 414 293	2 297 515	883 223	62,4
Non-recovered sales	131 382	120 922	-10 461	-8,0
Non-recovered sales %	8,5	5,0	-3,5	-41,2
Financial R/annum				
Cost of SIV	5 808 133	5 422 608	-385 525	-6,6
Total income	26 133 367	36 284 637	10 151 270	38,8
Gross surplus	20 325 234	30 862 029	10 536 795	51,8
G surplus R/kl of SIV	6,01	10,44	4,43	73,8

TABLE 6: Before and after WCWDM implementation comparisons

Table 6 presents a comparison between the current situation in the Beaufort West LM WSA and what could be achieved by implementing WCWDM alone, without making any changes to the tariffs or the subsidy allocation. It should be remembered that the reduced SIV is partially as a result of the decision to reduce the true demand, as specified in table 3. Therefore, if the water is available, a higher SIV can be accepted provided the NRW and non-recovered sales do not exceed the 18,18 and 5,0% targets respectively. If a higher SIV is accepted, the achieved recovered revenue will increase even further. It should also be noted that the present target recovered revenue was calculated after increasing the number of households receiving FBW from 5 790 to 6 989

Item Heading	Total People (& Non-domestic)	H'holds	Lvl of Serv Related Domestic Demand	Income Related Domestic Demand	Total Demand incl Non-Domestic	*Average Annual Demand AADD*	NRW	Tot Gross Demand incl Non-Domestic
Name	No	No	kl/annum	kl/annum	kl/annum	*l/cap.day*	%	kl/annum
Domestic demand 2011	42 445	10 993	1 385 222	592 080	1 977 301	128	19,72	2 462 992
Growth in domestic demand 2011 to 2014/15	1 913	493	62 465	29 066	91 531	131	19,52	113 728
Non-domestic demand 2014/15	(377)				349 605	(2541)	7,80	379 176
Totals 4 systems 2014/15	**44 358**	**11 486**	**1 447 687**	**621 145**	**2 418 437**	**149**	**18,18**	**2 955 896**

TABLE 5: Summary of Beaufort West target water demands and corresponding acceptable NRW

CONCLUSIONS

It must be remembered that the main purpose of producing the targets contained in figure 10 and table 6 is to quantify the gains to be achieved through implementing WCWDM and not to pinpoint the causes of current situation. Therefore,

Water volume balance kl/annum				Water money balance R/annum	
Resultant total (acceptable?) system input volume (SIV)	Estimated volume billed, metered or metered and controlled deliveries + managed free basic water	NRW %	Resultant recovered sales	Cost of total (acceptable?) system input volume (SIV)	ES grant allocation + any other subsidization
			1 936 079		8 035 000
			72 200		
			76 936		Estimated achievable recovered revenue
	2 037 978	17,83	212 300		
	76 000	19,31	2 297 515	5 422 608	26 624 763
	80 985	19,17	Maximum acceptable non-recovered sales	Resultant achievable gross surplus through implementing WCWDM	349 738
2 480 163	223 474	20,57			514 122
94 184	2 418 437	18,18	120 922 (5%)		761 014
100 187	Estimated Maximum Acceptable Non-Revenue Water			30 862 029 = R10,44/kl of SIV	28 249 637 = 95% of charged
281 362					
2 955 896	537 459 (18,18%)				

FIGURE 12: Water supply services situation after implementing WCWDM; water volume and money balances

one has to be cautious about jumping to conclusions about the causes of the current somewhat unusual situation for a WSA with reasonable credit control and essentially all its retail connections metered. Thus whilst the obvious cause of a faulty billing/charging system is likely to exist, there are almost certainly other shortcomings that may be even more important. Thus all the items listed in the recommendations below need to be considered, plus any other items that come to light through, for example, conducting an in-depth SWOT analysis.

Recommendations with respect to Beaufort West

- The current SIV is very low, considering the high NRW and low metered deliveries. The reasons for this need to be thoroughly investigated as the outcome is likely to be that some customers have an unreliable water supply. The latter should also be checked.
- The target results do not show to what extent the high NRW is due to real losses, ie leakages. It is recommended that minimum night flow tests be carried out to indicate the seriousness of these real losses. Remember that minimum night flow tests also measure the leakages downstream of customers' connection points. No matter what the outcome, active leak detection and repair procedures need to be in place to sustain acceptable levels of NRW.
- Monitoring water losses and the management of payment systems from pre-paid water meter installations has been a challenge ever since such meters were first installed in 1998. Some of these challenges are recorded in an out-of-print DWAF report published in October 2000, titled: *Site evaluation of electronic prepayment water metering cost recovery systems*. Because of these challenges, to overcome the issue of monitoring water losses, it is recommended that where pre-paid meters are installed the meters are read manually once a month, just like credit meters. The manual readings can also be used to check if the water used has been paid for.

PLANNING TO IMPLEMENT THE WCWDM PROGRAM

The familiar reasons given in the introduction to this paper should be sufficient to cause the Technical Director and Water Services Manager of each WSA to have a wish to start a WCWDM program, assuming such a program does not already exist. The next step is for these two staff members to convince their CFO, MM and Municipal Council of the need for the program, and what the expected outcome can achieve.

This paper explains how to quantify the expected outcomes. Should the human resources or knowledge not exist within the WSA to complete the assessment confidently, a PSP should be appointed to guide and check the work. The DWS First Order No Drop 2015 Assessments indicate that the majority of WSAs will need help from a competent specialist PSP. However, asking the PSP to carry out all the work is not recommended.

Once the outcomes assessment has been completed, this knowledge should be combined with the WSA's general knowledge about its own challenges: an excessive demand in a water scarce area, a significant number of customers with an unreliable supply because of excessive upstream water leaks and/or wastage, and/or insufficient money to employ sufficient human resources and/or to implement effective infrastructure asset management.

A motivational report, for the approval of the MM and the Council, should then be drafted explaining in general terms the targets that need to be achieved from the WCWDM program. The outcomes assessment will also indicate if the bulk water supplies need to be expanded and if the operations, monitoring and maintenance budget may need to be further strengthened even after the WCWDM targets have been met, by increasing the tariffs and/or the equitable share (ES) grant subsidy. Ongoing subsidization of the water supply services from National Treasury's ES grant is encouraged, but long-term subsidization from any other source is strongly discouraged. These additional issues should also be covered by the report, but the WCWDM targets need to be stressed.

Should the MM, CFO or the Council ask for changes to be made to the report, these should be considered objectively, but if either party does not want any WCWDM program to be started, it must be stated clearly that such a program is required in terms of clauses 10 to 13 of the Compulsory National Standards gazetted on 8 June 2001 under section 9 of the Water Services Act No 108 of 1997.

Once the report has been approved, firm implementation proposals need to be included in an updated Water Services Development Plan (WSDP) and in the next WSA Integrated Development Plan (IDP).

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