# WATER RESOURCES INVESTIGATIONS FOR RURAL WATER SUPPLY DEVELOPMENT IN MALAWI
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## 1.0  INTRODUCTION

Rural water supply development has to go through a planning stage.  At this stage, water resources  investigations, inter alia, have to be carried out in order to establish the reliability of the water supply source, particularly a surface water supply source.  As it is often the case, these source points do not have readily available water resources data to be used in such investigations.  In most cases this information has to be developed through the use of "transfer" hydrological models.

Some hydrological models can be used to transfer information from where it is collected (gauging station) to where it is wanted (point of abstraction).  Drayton et al 1980 have attempted to develop regional techniques for assessing the availability, variability and reliability of the streamflows in Malawi.  However, due to inherent errors in the data used in the analysis, the above method has proved to be inadequate.  It is commonly accepted now to use different methods and compare their results or improve the Drayton's method by employing other methods.

## 2.0  STREAMFLOW ESTIMATION

There are several techniques which may be employed in streamflow estimation at an ungauged site. However, what influences the choice of one method over the other is the kind of data available and required.  In rural water supply perhaps one to ten day minimum flows are more important than 30 day minimum flows.  In irrigation and industrial rural water supplies 30 day minimum may be adequate enough.  The following hydrological models may be used to transfer (estimate) streamflow data

$$Q_{st} = Q_{gt}(A_s/A_g)$$

where  $Q_{st}$ = discharge at an ungauged site s during period t.

$Q_{gt}$ = discharge at gauged site g during period t.

$A_s$ and $A_g$ are catchment areas at site s and g respectively.

This model assumes that the sites s and g are within the vicinity of each other and the discharge per unit area is uniform.  The coefficient $(A_s/A_g)$ may be improved by plotting discharge measured at $A_s$ versus discharge recorded at g.  The slope of the graph, k, replaces $(A_s/A_g)$.  If several gauged sites exist, the above model may be improved by the following one.

$$Q_{st} = Q_{g(u)t}K_{g(u)}W(u)$$

where  $Q_{g(u)t}$ = discharge at gauge site u during period t.

and  $K_{g(u)}$ = $A_s/A(u)$ is the coefficient k for the gauged site u,

W(u) is a weight factor for gauged site u and

W(u)  = 1

These models need a good hydrometric network in the project area.  The experience in Malawi shows that most of the potential rural water supply sources in Malawi do not have adequate coverage.

## 3.0  WATER RESOURCES ASSESSMENT

Surface water resources assessment involve the determination of water resources availability and reliability.  The assessment of the availability of water resources include the analyses of hydrological data and water resources already committed in the catchment.  The Water Resources Board has records of abstractions and effluent discharges which can be used in assessing the existing water resources commitments in the catchment.  This information may be supplemented by field visits.

The flow duration curves for different periods of 1, 3, 7, or 10 day for domestic water supply may be used to determine the reliability of the water supply sources.  The actual flow duration period used may depend on the tolerance  associated with the accepted period under which the accepted period under which the water supply system may fail without adversely affecting its

objectives and goals. Generally, the domestic water supply source should have higher percentage of reliability than industrial and irrigation water supply sources.

Drayton et al (1980) give some equations for estimating quantiles for various percentiles. The 75 per cent quantile for duration period (D) is given as

$$Q75(D) = Q75(10) + 0.008\ 5(10)^{0.23}(D - 10)^{1.33} \quad \text{for}$$

D<10 days; Q75(10) is obtained from a map.

However, this equation may be used where data is insufficient, otherwise basic techniques are used to derive the necessary quantiles.

Regional methods are regarded as superior to the basic methods especially where data is scanty. However, the hydrological data available in Malawi is not adequate enough to be used in the development of regional methods. Some further processing may be required before the data can be used in a comprehensive low flow regional study.

## 4.0 CONCLUSION

Water Resources investigations in Malawi employ the regional techniques as well as existing water resources data. The hydrological analyses (regional and basic methods) are utilized in order to establish the availability and reliability of the surface water supplies. Due to lack of adequate hydrological information, interpretation of the analyses are done cautiously. Further work needs to be done on the available data and develop regional low flow analyses methods.

Water resources assessment should also look at the quality too, apart from the quantity and water usage. Water Resources Board keep both water abstractions and effluent discharge records. These may be used in water resources assessment.

## REFERENCES

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