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#### OPERATION AND MAINTENANCE OF SEMI-URBAN WATER SUPPLY STATIONS IN KANO STATE

In Kano State the term Semi Urban water supply station means all water supply systems, except Kano City where machinery is used to lift water to the consumer.

The scope of this paper is limited to the experience in the Chad Basin, where water is supplied from a system of boreholes rather than the basement complex, where the water mostly comes from impounded sources. (See Map 1.)

The paper is not meant to be the solution to water problems in similar areas but simply serves to illustrate a method of approach to analysis and solution of the problem. By detailed observation and rational planning.

At present there are over sixty water supply stations successfully operating - reliably, which when referred to water supply stems nothing less than 100% availability is envisaged.

The following is a brief summary of how the system developed.

Before 1970 the number of boreholes were limited and the pumps used were diesel driven. This requires an engine and an operator at each borehole, also the cost of standby capacity, essential for reliability was enormous.

To minimise operational, maintenance and standby capacity costs in 1970 it was decided to go over to electric submersible pumps and generating sets. This enables two or more pumps to be run by one engine and operator. Hence every water supply system was run from one central station cutting down running cost and also standby generating set.

But however at this stage the importance of certain factors e.g. cooling air circulation for generating sets, standardisation of equipment to minimise stock of spares and

inclusion of measuring and metering equipment to facilitate trouble shooting were not fully realised.

So in 1974 a comprehensive survey was carried out, by the then Chief Water Engineer Mr. C.J. Cox, to determine the causes of water shortages in places where there are water supply systems.

The following guidelines were adopted for the survey :

1. Ease and speed of erection and expansion.
2. Ease of maintenance.
3. Minimising stock of spares and running costs.
4. Full utilisation of equipment and personnel.

The survey carried out established the following reasons as the main causes of water shortages.

1. Lack of boreholes.
2. Silting of existing boreholes.
3. Inadequate distribution system.
4. Inadequate storage leading to partial shortages during peak periods.
5. Frequent breakdown of generating sets.
6. Frequent breakdown of pumps.
7. Inaccessibility of stations due to lack of motorable roads and vehicles.

Causes 1 & 2 can only be cured by drilling

more boreholes using correct sizes of screen and selecting correct size of pump for each borehole. Or alternatively, if geologically feasible, obtain water from dams and rivers, which entails extra treatment and pumping long distances.

Causes 3 and 4 can only be cured by proper design of distribution networks having correct size of pipes and adequate storage capacity of cover the peaks.

It should be appreciated that these first four problems are comparatively easier to cure but can take a long time and cost a large amount of money.

Cause 5 on further analysis was found to be mainly due to :

- a. Overheating of sets due to inadequate ventilation of generator houses.
- b. Inadequate and badly executed repairs and overhauls.
- c. Inadequate maintenance.
- d. Lack of trained personnel.

The classic vicious circle situation has been reached. The generators were breaking down due to inadequate maintenance, because the staff who should be doing the maintenance were fully occupied in carrying out repairs.

Cause 6 was found to be due to the following :

- a. Voltage at the pumps was found to be below the acceptable minimum.
- b. Sand in the boreholes.
- c. Unnoticed single phasing of the motors.
- d. Prolonged running in the wrong direction.

As discussed Causes 5 - 7 are the most crucial as they have to be checked from day to day.

On the basis of this survey and analysis of each factor (Mr. Cox recommended) the following solution which was adopted.

#### 1. ORGANISATION

The whole set up to be divided into three separate sections namely

- a. Reinforcement of the drilling section who will drill boreholes and occasionally clean them out.
- b. Reinforcement of the Semi Urban Water Supply section who will design and construct the riser main, distribution network and storage tanks. They will also run the pumps and generators but do no maintenance on them apart from checking engine oil.
- c. Establishment of the Challawa Workshop Section, who will do all the electro-mechanical installation and maintenance and should have a base workshop.

#### 2. EQUIPMENT

The following steps were taken to facilitate ease of erection and maintenance, minimise running costs and stock of spares and make possible trouble shooting.

- a. All machinery and equipment were standardised e.g. direction of rotation of generators, phase sequence, switchgear and starters of pumps, riser main, borehole head work etc.

This allows for the exchange of any unit with a new or reconditioned part from the base workshop.

- b. A generator house was designed which provides adequate ventilation. This generator house takes any two of the standard generating sets in use i.e. Lister HR 2, 3, 4 and 6 with only minor changes in the exhaust assembly.

An 800 gallon fuel tank was incorporated outside the generator house and in areas of limited accessibility two or more.

A separate fuel pipe runs from the tank to the engine fuel filter eliminating the use of drums, dirty cans, etc. likely to introduce dirt in the engine fuel system.

Fuel meter and water separator were also included.

- c. Inclusion of measuring and metering equipment.

#### 3. PERSONNEL TRAINING

Instructors from the manufacturers were brought in to train the staff which proved cheaper than sending the staff abroad.

#### 4. SCHEDULE OF MAINTENANCE FOR EFFECTIVE REPAIR AND MAINTENANCE

1. A group of travelling gangs in Land Rovers were formed and they visit every station fortnightly to carry out routine maintenance, i.e. roughly to change oil and filter also adjust tappets.
2. Monthly a gang of electricians to visit every station, roughly they blow out the generators and check for loose contacts.
3. If anything more is required the whole set is changed and the old one returned to the base workshop where the repairs will be carried out with proper tools and under good supervision and then tested and load.

This unit exchange system enables a small number of fully trained staff to oversee repair and overhaul of the equipments.

#### 5. FUTURE DEVELOPMENT

To make possible continued rational planning a monitoring system in the form of weekly reports was introduced (Fig. 2)

In this are recorded quantity of water supplied by each pump, quantity of diesel used, power generated by each set and number of hours run by each equipment.

From these data the efficiency, rate of growth of demand and deterioration of equipment are determined.