COMPUTERISED BOREHOLE INFORMATION MANGEMENT SYSTEM
(A CASE STUDY OF RUWATSAN PROJECT MINNA)

BY

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PGD-MCS-191/96

Being Project Work Submitted
In Partial Fulfillment Of The Requirement For
The Award Of Post Graduate Diploma (Pgd) In Computer Science,
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DECEMBER, 1999.

APPROVAL PAGE

This project has been read and approve for the partial fulfillment for the award of post graduate diploma in Computer Science.

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DEDICATION

To Alhaji Haruna Yahaya and Hajiya Amina Z. Yahaya for being a source of inspiration to me. May the Almighty Allah reward them abundantly (Amen).

ACKNOWLEDGEMENT

First and foremost I wish to thank Almighty Allah for guiding me and also given

me the strength to pursue this program .

I am grateful to my Supervisor Prof. Adeboye without whom this work will not

have been possible.

My thanks also goes to all the academic staff of math's/computer who have

contributed immensely to the realization of this program.

My sincere thanks goes to me Badmos the co-ordinator of this program for his words

of wisdom.

I wish to also thank my Director and officers of RUWATSAN project for covering

and supporting me during the course of this project.

Finally I wish to thank my Brothers, Sisters Friends and well wishers especially

Mal. Idris Nda Abdullahi, Mall. Aliyu Babadoko, Mall Ahmed Ode, Mrs. Amina Sidi

and others too numerous to mentioned.

A B S T R A C T

Application of computer technology is used in designing an expert systems to keep bore hole data during and after drilling. These will give a general overview of the hydrogeological condition. These takes care of the problems face by the traditional method of using log book. Since report generation becomes readily and reliably available by the new system. Management decision making becomes easier and faster.

CHAPTER ONE

INTRODUCTION

Groundwater has made a very significant contribution to the water needs of the people of Nigeria. This point is underscored by the fact that groundwater availability is taken for granted all over the country, an unfortunate assumption in the formulation of the water resource development policy in the country.

It has been shown that to be able to manage the country's water resources,i.e. both surface and underground water resource, a policy that recognises the interdependence of the two sources of water must be formulated. Such a policy should take cognisance of the contrasting and often problematic geological conditions in which groundwater is known to occur. As a result, the approach to groundwater resources development is expected to be more systematic than is presently being practised.

Unfortunately, with the pancity of data, the effective treatment of this vast and and complex subject will almost be impossible to achieve with the present state of country's water resources development. However having set up the outline, it is frame possible to begin to re-orientate the strategy for data acquisition and fit them into the proposed work as they are obtained. Hence with more and more data becoming available, through a better planned hydrogeological investigation program .
It should be less difficult to quantify the groundwater resources and provide the required data for modeling.

1.2 HISTORY OF GROUNDWATER DEVELOPMENT IN NIGERIA

One of the main objective of the Nigeria Geological survey since it's inception

In 1917 was to search for groundwater in the semi arid areas of the former Northern

Nigeria. These activities culminated in the commencement in 1928, of a systematic

investigation of towns and villages for the digging of hand-dug wells. The concrete

lined well sinking technique designed and evolved by the Geological Survey are

still in use all over the country. (GSN Bull. No.16)

Later in 1938, a water drilling section of the survey was set up. By 1947 the

engineering aspect of the water supply section was handed over to the public works

department, the forerunner of today's Ministry of Works, while the geological

survey maintained the exploration department.

The importance of groundwater was underlined by the fact that during those years,

practically, all the geologist of the geological surveys were involved directly or indirectly

in groundwater supply.In the groundwater section, the main function of the GSN was to

collect data on groundwater occurrence, distribution,quality and quantity.

These surveys appear to have laid the basis for the setting up of the present ground-

water agency throughout the country. The last major step in the development of ground-

water resources in Nigeria can be seen in the establishment of the Federal Ministry of

Water Resources. And the merging of the water section of the Geological survey with

this ministry. It is hoped that this would lead to the evolution of a successful groundwater

policy in Nigeria.

1.3 RURAL WATER AND SANITATION (RUWATSAN) PROJECT.

In February, 1985 the Niger state chapter of the expanded program on Immunization (EPI) and Oral Rehydration Therapy (ORT) was lunched by the then military governor Col. D.A.B Mark and the UNICEF country representative in Minna.

In June, 1985 UNICEF officials visited the state with a view of assessing the state performance. During the visit UNICEF was approached for assistance towards providing potable drinking water for the health institution and eradicating guineaworm in the state.

By February, 1986 thirty-nine (39) Borehole were drilled in the Rural Health Centers and Basic Health Clinics. These were equipped with Indian mark // pumps. Seeing the effectiveness of these boreholes the state pursued the issue of guineaworm eradication vigorously with UNICEF.

In June, 1987 a "Memorandum of understanding and cooperation" was signed by UNICEF, Niger state government and the federal ministry of health ; with the signing of this document the project was created.

The basic objective of the project is improving the quality of life in the rural areas by the:-

(a) Provision of potable drinking water to the rural areas through :-

Handpump equipped boreholes.
Natural spring development
Development of handdug wells and
Rain harvesting.

(b) Provision of safe excreta disposal methods by training artisans toward ventilated improved pit latrine (VIP) construction and moblising resources in the LGA'S and the communities for the provision of community and household VIP toilets.

(c) Providing health education in the rural areas towards self hygiene, good living, water use, excreta disposal, ante-natal care, family health, guineaworm eradication, control of childhood diarrhea diseases, immunization and general health messages; and

(d)Community mobilisation towards self help, maintenance culture, ownership of facilities.

UNICEF provided all the equipment, Rigs, Handpumps and initially provided five(5) technical staff to train Niger state staff working in the project.

ACHIEVEMENT AND PROSPECTS

Drilling activities started on February, 1988 and so far a total of One Thousand Four Hundred and Ninety Two (1492) boreholes had been drilled and equipped as at the end of January, 1997: In all the LGA's of the state. Other organisation have constructed about seven hundred and sixty one boreholes in the states.

The project is looking forward towards increased funding from the state and Local governments. Since UNICEF has long reduced both financial and material support. If these come through we are certain that by the year 2000 the project will not only eradicate guineaworm completely but also will be able to provide each village in Niger State with safe drinking water and safe means of waste disposal.

1.4 SIGNIFICANCE OF THE STUDY

Nigeria being a developing country is in dire need of scientific and technological break through in her bid for a comprehensive groundwater policy, therefore adequate use of computer system is of great help. The realization of the importance of compute-rized groundwater data have been growing round the world, this did not stop in developed nations alone, since all recent water projects in Nigeria now comes with associated micro computers, e.g. UNICEF, ADP, UNDP etc.

Some of these computers are under uterlized due to inadequate software package for Geophysical investigation, drilling and design programs.

Hence prompt development of software package which is a computerized ground-water data system is needed so that effective measures can be taken to tackle the problem of hard tasking of data processing.

The development of software package in this study would help in overcoming some of such problems, taking into consideration the accurate and rapid processing of data, vast storage, prompt retrieval system and performance of computation and logical operations leading to generation of very detailed reliable and complex report.

1.5 SCOPE AND LIMITATION OF THE STUDY

This work will be limited to the computerization of only the borehole data generated during and after drilling operation and localities were these boreholes are situated.

The geophysical survey is not discussed here because of the existing software packages already in the market. The interpretation of geophysical data involves some master curves which is far beyond the scope of this project.

However, provision has been made for more different borehole data assessment not presently being carried out. Due to lack of chemical and operational materials but are included in the program.

CHAPTER TWO

SYSTEM ANALYSIS

2.1 PROBLEM DEFINITION

In the traditional method of keeping borehole data each time the result of a particular Borehole is required, we have to start checking through the log book sometimes not found, this could be very cumbersome considering the number of boreholes drilled since inception.

The security of drilling reports and that of the log book is also a problem in that it is portable and sometimes in loose sheets which can easily be destroyed or lost. This can lead to total loss of data recorded on that particular sheet or book.

In the existing system, it is often difficult and time consuming to perform computation and logical operations on geophysical data, leading to the generation of say accurate geophysical interpretation.

2.2 FEASIBILITY STUDY

Feasibility studies are the process of carrying out preliminary investigation of a system organisation.

The existing system is such that each stage of groundwater data is recorded separately. These includes geophysical interpretation and drilling/installation data.

Apart from this log book there is also a ruled paper designed to carry daily, monthly report on the number of boreholes drilled. But this is inadequate, an improved system using computer will be more adequate to help in management decision making.

Feasibility study therefore is a significant phase of system development, this is embarked upon to determine whether or not the proposed project is desirable and feasible. A set of selection procedure and an effective decision making process is developed to be sure that the researcher is working on the right problem and in the right sequence.

The objectives which this project feasibility hopes to accomplish are to

i.   identify what is being done, what is required, why it is required.
ii.   determine the size of the project which will help in estimating the
      amount of time and number of people required to develop the project
iii. access cost and benefits of the proposal and it's alternative approaches.

2.3   RESEARCH PROCEDURES

The research method adopted in this work includes collection of groundwater data from the various sections of water supply unit; vis-a-vis geophysical report, drilling and installation data . The researcher also uses unstructured interview to uncover some of the inherent problems and short coming of the existing system.

Direct observation of the system under study was principally employed, since the researcher is a member of staff of the project. I was then able to access and determine which forms and procedures are adequate and which ones are inadequate and need improvement.

2.4 OPERATIONAL AND ECONOMICAL FEASIBILITY

The operational feasibility is primarily concerned with the acceptability, workability and usability of the proposed system when developed and installed by those who work in the relevant application areas. The importance of the operational feasibility cannot be overemphasized in that it is common to see a well conceived and designed system not being successfully utilized.

It is important to consider whether the project received the support of the management or whether it will cause complication in the political and managerial environment in which the system will be implemented.

Through discussion with the management. We could establish the general acceptance From the management and the operating staff of the project; As this work will go along way to compliment the existing software in RUWATSAN project.

Economic feasibility is another important criterion, the new system will enhance operational cost-effectiveness by reducing the number and time of report generation.

Work formally accomplished on overtime like generation of complex computation and interpretation will be carried out within minutes with the new system.

Generally, we consider the cost of the new system to the savings that can accrue and added benefits to be derived which include:-

- Elimination of cover lapping reports
- Increase in speed and accuracy in the processing of data and preparation of reports.
- General improvement in the co-ordination of activities between the various departments and the management.

It is obvious that the new system is far more expensive than the existing system. However organisation have found out that computerization pay off not in reduced cost but is more meaningful and timing information

2.4   LITERATURE REVIEW

The STORET system, acronym of storage and retrieval of water quality data, was conceived in 1961 by basic Data branch, Division of water supply ad pollution control of united state public health service. The first version become operational in 1963 using a Honeywell 400 computer to store data on water quality.

The introduction of computer in RUWATSAN project is as old as the project itself; Due to lack of relevant software, the impact of the computerized groundwater data is not felt until recently. However a lot of work still has to be done to produce software that will be relevant to the project. So that we can put the computer into maximum use.

Many factors contribute to the excellence of any state or federal water agency. One of such factors, is a good computerized groundwater data system.

Sandy and Martin Hintz in (1983) says instead of having to store bulky data on a paper in a file cabinet, a computerized system can be used which can recall in a

flash whatever information is desired. Generally computers makes scientific process easier, but scientists still must give the computers the correct information.

A major development has been achieved by the introduction of a micro computer

program into a selected Aquifer test evaluation methods SATEM by Y. Bonstra.

several water organisation has since adopted these program for their groundwater data

evaluation.

Application of computer into water and groundwater quality control took place in

1975. By that time, computerization of groundwater quality and data banks of several

European countries, the federal republic of Germany, Poland, Romania, Hungary

have undergone active development simultaneously, F.A. Et al (1975).

A completely revised Analysis and Evaluation of pumping test Data has been a

Tremendous help in acquisition of pumping test data in groundwater evaluation in

Netherlands, publication 47 G.P. Kruseman and N.A de Ridder 1991.

Groundwater in Hard Rocks. A United Nation documentation project 8.6 of the

International Hydrological program has developed a more recent approach to

Evaluation of hydrogeological condition in Hardrocks. UNESCO publication France

1984.

A comprehensive groundwater evaluation program is needed to be worked on.

as the programs is existing only with specific groundwater data system. However

this is so because specific information is needed by the various professionals involved

in groundwater management system.

UNICEF has since taken the lead in evolving a computer program acronym in RIMS Rig information management system. It encompasses some of the groundwater evaluation and management system. However programs on Geophysical, lithological and Aquifer nature needed to be included to make it a whole lot.

CHAPTER THREE

PROGRAMME DESIGN AND METHODOLOGY

3.1 COMPUTERIZED SYSTEM

The computerized system will take care of assembling groundwater data generated daily, monthly and annual reports for the management. This chapter is also concerned with the plan, structured of and strategy for developing the software package that will take care of the problems arising from the traditional method of keeping borehole data using log book.

3.2 DATABASE MANAGEMENT

Data base is a set of programs which deals with database management activities including updating , deleting, and editing records. It can also be referred to as a collection of software which provides the database administration with a range of facilities for monitoring and controlling the use of the database. The software allows the data to be redefined, restructured and reorganised without affecting any existing application program that use the data; the security of the database is also addressed ensuring that data are only accessed by authorized users. The integrity of the data is also considered, making sure that any changes in the data are consistent with the overall picture of the database and it's usage.

The database management system in addition to the above enables the user to Validate, sort, search and print records from the database as well as also provides

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Facilities for performing calculations and maintaining a dictionary. It also allows the program to access the complex relationship of the data by means of standard programming languages e.g. the structural theory language (STL).

One of the sterling qualities of the DBMS is that it makes data accessible to the programmer whenever it is needed even though, from time to time they may be physically reorganized by the database administrator. Records can be displayed on the screen and browsed through, making amendments as may be necessary. There are different types of DBMS. Some of the most familiar ones are dbase II, dbase III, dbase III plus, dbase IV e.t.c. Most of them worked base on either relational or hierachial database structure.

3.3   NORMALIZATION

The term normalization can be defined as the process of separating items which are independent of one another into groups for recording in different files. It is necessary to ensure that each file has a key which uniquely identifies the object the the data describes.

The relationship between the fields must be established. Since we are dealing with large volume of groundwater data, this normalization process is very useful in that it makes the data easier to understand and manipulate.

3.4 SAMPLING PROCEDURE

A case study of RUWATSAN project was taken because of the unique position of the researcher within the water supply unit.

RUWATSAN project is unique in the sense that it is the only water supply agency that cover the nooks and corners of Niger State. UNICEF and indeed Niger State Government pays much attention to these project because of their primary role in guineaworm eradication, provision of potable drinking water and formulation of groundwater development and management policy.

This study is therefore carriedout through adequate studying of geophysical reports and Borehole log, the problems encountered and how these problems are often solved.

3.5 SYSTEM DESIGN

After the system analysis phase which provides a useful justification for the design phase, the detail system design is effected. In designing the proposed system. the following requirements are considered

- Users friendly-Allowing the user opportunity to make his/her choice.

- Portability-the proposed system can be transferred from one system to the other yet performing the same operation.

- Flexibility-providing room for modification i.e. in case of big increase or decrease in the volume of data to be processed.

-   Efficiency-The design is such that the best terms of the system can be made, especially as it concerns storage and running time.

-   Security-No unauthorized user can gain access to the program.

-   Volume –The system can handle large volume of data.

-   Repetitiveness-The system can process cycles that repeat themselves several times as they are ideally suitable for the proposed system.

-   Reliable –the system must be reliable.

In developing the new system dbase IV was chosen as the programming language. This choice was made because in addition to its vast storage and fast retrieval ability it can also bring unprecedented efficiency to a wide variety of task, such as logical operation and computation.

3.6   AIM OF SYSTEM DESIGN

This system is design to provide information or software package to all water agencies who should, as a matter of urgency computerize their groundwater information in a bid to enhance efficiency and development of sustainable water management policy.

CHAPTER FOUR

SYSTEM REQUIREMENT, IMPLEMENTATION AND TESTING.

4.1   INPUT AND OUTPUT SPECIFICATION

This state of programming is primarily concerned with what exactly the

Program is going to produce (output) and what data are available to produce that

Information (input).

In specifying the input, two major database files are required, the drilling report

and local government area coverage report file.

4..2 HARDWARE AND SOFTWARE REQUIREMET HARDWARE REQUIREMENT

An IBM PC compatible having a minimum of 256 kb of memory is required for

running this software.

SOFTWARE REQUIREMENT

The operating system for running this system is the disk operating system i.e.

System disk are contained in the disks and are accessed through the use of commands.

4.3   SYSTEM REQUIREMENT

Requirements for this system include

a) Large storage facilities
b) Fast speed
c) Need for accuracy
d) Fast accessibility to information
e) Automation in terms of generation of reports.

The above features are contained in the new system thereby enhancing its ability
to perform.

4.4 MODULAR PROGRAM STRUCTURE

DATA ENTRY ROUTINE

This normally takes the most basic part of any database system. It is used to
enter information that involves the creation of formatted screen displays, verifications,
and maintenance of necessary index files.

RETRIVAL EDIT ROUTINE.

This routine is different from the entry routine because they raise the problem of
locating data after they have been entered into database file. Retrieval is more
complicated than simple entry because one often forgets how the data were entered.
The key to retrieval routine is that they should offer the user as much flexibility as
possible in finding information stored in the files.

Generally modular programming structure is a structure which shows the logical
relationships between the processes and the way in which data have to be mouse
to support these activities.

In this structure, each process has it's duty to perform in the proposed system.

MAINMENU

This display the main menu of the system consisting of

1. Append

2. Modify

3. Delete

4. Enquiry

5. Report

6. Exit

1. Append - This command adds a data records to the end of the active database file. In addition, displays the fields on the computer screen.

2. Modify – This command is used to modify the contents of the specified data fields in the active database file. This is done by replacing the content of a field with the new value.

3. Delete – These delete any record of interest. This is similar to the data editing routine because the record has to be searched for before the deleting procedures.

4. Enquiry – This command takes you to the two main program files

    a. Borehole report file
    b. Local government report file.

5. Report – This command prints reports on

    a. Borehole file
    b. L.G.A. code file

6. Exit - This command takes you back to C prompt

4.5   SYSTEM IMPLIMENTATION.

This is the final step in system development. These can be achieved through the use of written programs after which the programs are tested to ensure the correctness.

Also the personnel that will use the system are trained and any data existing in the old system are converted to the new system. Implementation is completed by installing the new system. The installation should be carried out by a computer expert.

4.6 SYSTEM TESTING

System testing involves testing of the program before being used for production runs. This is achieved through integration and acceptance testing.

- Integration testing- The components of the software is integrated through the use of traditional strategy into a functional whole.

- Acceptance testing- Involves the planning and execution of function test. The testing starts by

1. Loading dbase into the computer, if the computer already has dbase. After booting the system we receive at C Prompt

C:/ >

Then type

C:/>DBASE [enter]

Press escape key and the system takes you to the dot prompt.

2. Set your diskette containing the system in the drive and switch to the by using

   the command

   .Set default to A

3. Open the directory with command

   .dir * .prg (enter)

4. Run the program by using the command

   .Do Boremenu (enter)

CHAPTER FIVE

SYSTEM CONVERSION, MAINTENANCE AND CONCLUSION

5.1 SYSTEM CONVERSION

The changing over from the manual system to the computerized system is the system conversion. In converting into a new system some parameters must be taken into consideration, viz-a-viz

a. The type of conversion to be adopted
b. How good are the people to operate the system

Parallel approach:- This is the most reliable approach, since both the new and the old system are used together before gradual changing over to a new system.

The only disadvantage of this system is the cost of running the two system concurrently and the fact that adequate attention may not be given to the new system due to high cost of purchasing hardware component, constant power supply and the technical expertise.

However a distinct advantage of this system is that in case of failure of the new system the organization can easily fall back to the old system.

5.2 SYSTEM MAINTENANCE

Maintenance can be in the form of hardware or software maintenance.

In order to protect against interruption of computer services, hardware requires regular maintenance. In large installations preventive maintenance may be carried out each day at a specific time that is allotted for this purpose. If so, maintenance personnel may be assigned to the installation on a full time basis.

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Preventive maintenance involves identifying and replacement of components that

are likely to fail and keeping mechanical parts properly adjusted.

Software maintenance however is the term used to describe the software

engineering activities that occur following the delivery of a software product to the

user. Maintenance therefore involves adapting products to the new environment and

modifying the software to suit the new environment. This adoption may involves

moving the software to different machines, or modifying the software to accommodate

new additional modules.

5.3 RECOMMENDATION

1. Further work is suggested on the subject matter to incorporate the geological log and other relevant information necessary for individual projects or organization.

2. Through detailed cost benefit analysis was not conducted in the course of this study, it is recommended that all water related agencies both private and public sector with financial capability should embark on computerizing their borehole data. this will serve as a data bank for National groundwater hydrogeological map construction and reviews.

3. The new system is recommended for its accuracy, reliability and comprehensive generation of reports.

4. In the course of this study it is found out that most water agencies already have computer for use. All that is needed is the software to keep borehole data and the training of personnel to man the computers. It is therefore important to enlighten the various agencies on the importance of computerize bore data.

5.4 CONCLUSION

An expert approach to borehole information management system (BIMS). A case study of RUWATSAN project Minna was carried out to design a software package to keep borehole data during and after construction.

Having gone through the manual system of keeping borehole data, the application of computer technology has proven to be the best. The employees and the employer stand to gain from the accuracy, reliability, timeliness, large storage capacity, portability and even automated generation of reports.

The program is designed to be flexible so as to allow for modification and also it is user friendly.

```
return to master
    * endif
    enddo
endif
ENDDO
endif
enddo
```

```
SET STATUS OFF
SET ECHO OFF
SET TALK OFF
SET SCOREBOARD OFF
CLEAR
USE borehole.dbf
****    ***    ****
*** ** * DUPLICATE ENTRY CHECK *****
do while .t.
mborenumb=space(25)
SET COLO TO W+/GB
@3,5 CLEAR TO 20,75
@3,5 TO 20,75 DOUBLE
SET COLO TO
@2,3 TO 21,77 DOUBLE
set colo to w+/r*
@2,17 say " YOU ARE ABOUT TO DELETE AN EXISTING ENTRY "
set colo to w+/b+
@5,10 SAY "BORE INFORMATION MANAGEMENT SYSTEM RUWATSAN PROJECT."
@6,28 SAY " WATER  SUPPLY   UNIT "
set colo to w+/gb+
@7,31 say "( BOREHOLE LOG ) "
@15,18 say " OR PRESS ENTER  TO QUIT TO THE DOT PROMPT "
@12,28 say " ENTER BOREHOLE NUMBER "
@13,27 get mborenumb pict "@!"
read
if mborenumb= " "
set colo to
   exit
 endif
index on mborenumb to water
locate for mborenumb=borenumb
 if  EOF()
@22,26 say " BOREHOLE NUMBER NOT FOUND "
@23,29 say " Press any key to continue "
wait""
set colo to
@22,25 say space(34)
@23,28 say space(29)
Loop
endif
 *** ** *  valid entry * ** ***
 *close database
  SET COLO TO
  CLEAR
  SET COLOR TO B+/B+
  @3,6 CLEAR TO 24,77
  SET COLOR TO BG+/BG+
  @2,2 CLEAR TO 23,76
  @2,2 TO 24,76 DOUBLE
  SET COLOR TO n+/bg
  @4,60 SAY "DATE: "+dtoc(DATE())
  ***** ****  ******
  ***** ****  ******
  @2,10 SAY "BORE INFORMATION MANAGEMENT SYSTEM RUWATSAN PROJECT."
  @3,28 SAY " WATER  SUPPLY   UNIT "
  @4,26 SAY " *** BOREHOLE LOG ***"
```

```
@4,26 SAY " *** BOREHOLE LOG ***"
set colo to w/bg+
@6,5 SAY "BOREHOLE NUMBER:"
@8,5 SAY "LOCAL GOVERNMENT AREA:"
@8,42 SAY "LOCAL GOVERNMENT CODE:"
@10,5 SAY "NAME OF VILLAGE:"
@12,5 SAY "TOTAL DEPTH:"
@12,35 SAY "DRILLED BY:"
@14,5 SAY "STATIC WATER LEVEL:"
@14,40 SAY "DYNAMIC WATER LEVEL:"
@16,5 SAY "PUMPING RATE:"
@16,40 SAY "DRILLING RIG NUMBER:"
@18,5 SAY "LOGGED BY:"
@20,5 SAY "WATER TEMPERATURE:"
@22,5 SAY "CONDUCTIVITY:"
@22,40 SAY "PH:"
***************
set colo to w+/w
@6,22 GET mborenumb PICTURE "@!"
@8,27 GET mlga PICTURE "@!"
@8,64 GET mlgacode PICTURE "@!"
@10,22 GET mvillage PICTURE "@!"
@12,17 GET mtotaldepth PICTURE "999.99"
@12,46 GET mdrilledby PICTURE "@!"
@14,24 GET mstaticwat PICTURE "999.99"
@14,60 GET mdynamicwat PICTURE "999.99"
@16,18 GET mpumprate PICTURE "@!"
@16,60 GET mdrillnumb PICTURE "@!"
@18,15 GET mloggedby PICTURE "@!"
@20,23 GET mwatertemp PICTURE "@!"
@22,18 GET mconduct PICTURE "@!"
@22,43 GET mph PICTURE "@!"
****  ***  ****
read
store space(1) to ok
set color to w+/b
@24,14 say " SHOULD I SAVE THE DATA ENTERED? (Y/N) "get ok pict "!"
 read
if ok = "Y"
append blank
****  ***  ****

REPLACE borenumb WITH mborenumb,village WITH mvillage
REPLACE drilledby WITH mdrilledby,staticwat WITH mstaticwat
REPLACE dynamicwat WITH mdynamicwat,pumprate WITH mpumprate
REPLACE loggedby WITH mloggedby,watertemp WITH mwatertemp,conduct WITH 1
REPLACE ph WITH mph,totaldepth WITH mtotaldepth,drillnumb WITH mdrillnur
REPLACE lga WITH mlga, lgacode WITH mlgacode
close databases
else
set colo to
clear
exit
endif
@24,15 say "    DO YOU WANT TO ADD MORE RECORD? (Y/N)" get ok Pict "!"
READ
IF OK = "Y"
```

```
return
endif
enddo
```

COMPUTERISED BORE INFORMATION MANAGEMENT SYSTEM

[WATER SUPPLY UNIT (BOREHOLE LOG), RUWATSAN, MINNA.]

```
+----------------------------------------------------------+
|  MAINTENANCE        ENQUIRY         REPORT        EXIT    |
|  +-----------+                                            |
|  | APPEND    |                                            |
|  | MODIFY    |                                            |
|  | DELETE    |                                            |
|  +-----------+                                            |
|                                                          |
+----------------------------------------------------------+
```

USE THE ↑ AND ↓ TO SELECT YOUR OPTION   THEN PRESS ↵

WRITTEN BY: ABUBAKAR SADIQ IDRIS
             PGD/MCS/191/97

```
╔═════════[ YOU ARE ABOUT TO GENERATE A REPORT ]═════════╗
║  ┌────────────────────────────────────────────────┐  ║
║  │        BORE INFORMATION MANAGEMENT SYSTEM        │  ║
║  │           RUWATSAN PROJECT, MINNA.               │  ║
║  │                                                  │  ║
║  │                                                  │  ║
║  │        TYPE BOREHOLE NUMBER                      │  ║
║  │                                                  │  ║
║  │                                                  │  ║
║  │        OR JUST PRESS ENTER TO EXIT               │  ║
║  │                                                  │  ║
║  └────────────────────────────────────────────────┘  ║
╚════════════════════════════════════════════════════════╝
```

DATE : 10/12/98

BORE INFORMATION MANAGEMENT SYSTEM RUWATSAN PROJECT, MINNA

BOREHOLE LOG
****

BOREHOLE NUMBER: AGA/A-10TDS/001/97
NAME OF VILLAGE: ETSUWASA
TOTAL DEPTH: 28.00
DRILLED BY: MALLAM GIMBA NDASAPKO
STATIC WATER LEVEL: 6.00
DYNAMIC WATER LEVEL: 6.00
PUMPING RATE: 1/MIN
DRILLING RIG NO.:   01(A-10TDS)
LOGGED BY: MADAM GOGO MOCHIMO GANA
WATER TEMPERATURE: 25°C
CONDUCTIVITY: 12
PH: 12
.ess any key to continue...

```
┌─────────[ YOU ARE ABOUT TO GENERATE A REPORT ]═════════┐
│  ┌──────────────────────────────────────────────────┐  │
│  │        BORE INFORMATION MANAGEMENT SYSTEM         │  │
│  │        RUWATSAN PROJECT, MINNA.                   │  │
│  │                                                   │  │
│  │                                                   │  │
│  │          TYPE LOCAL GOVERNMENT CODE               │  │
│  │                  01                               │  │
│  │                                                   │  │
│  │          OR JUST PRESS ENTER TO EXIT              │  │
│  │                                                   │  │
│  └──────────────────────────────────────────────────┘  │
└────────────────────────────────────────────────────────┘
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BORE INFORMATION MANAGEMENT SYSTEM
RUWATSAN PROJECT, MINNA.

Page : 1

LOCAL GOVT. AREA: AGAIE

DATE: 10/12/98

S/NO.	BOREHOLE NUMBER	DRILLING RIG NO.	LOCATION
1.	AGA/A-10TDS/001/97	01(A-10TDS)	ETSUWASA
2.	AGA/A-12TDS/003/97	03(A-12TDS)	CHACHA
3.	AGA/A-13TDS/004/97	04(A-13TDS)	KAKADU
4.	AGA/A-19TDS/006/97	06(A-19TDS)	GALADANCHI