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## Calculation of properties of aquifer formulae by using C language

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**Abstract**

The use of technology, ICT tools etc. area unit growing because the world goes ahead. Thus it's become very necessary to stay everything in-tuned with computers. With advancement in science & technology, the new operating development has been arisen. In our country, largely within the town area unites varied on-line systems are getting used for varied functions i.e. everything is computerized to save lots of area unit time & efforts. It additionally saves our work. A water well is a hydraulic hole in the earth down to a supply of water excavated for the purpose of bringing groundwater to the surface. Irrigation wells differ from those used to supply water for domestic purposes because of large volume of water that have to be pumped from them for irrigating even small farms. Efficient and economical utilization of ground water through wells depends upon design of wells and properties of aquifers to best suit the characteristics of water bearing formulations. Thus, by using C languages, the calculations are completed in a very short span of time as the formulae are pre-defined in the software. The complete design was done using C language in a very less time and with accuracy. Turbo C++, version 3.0 was used for this purpose. It contains the main page where, the formulae are given. By entering the values of each value, the calculation of formulae for properties of aquifer. The results obtained were verified with the manual calculation and it was found that the results were accurate. Thus, this software programme is very efficient for calculating formula for open channel.

**Keywords:** Technology, ICT, Aquifer, Digitalization, Computerized

**Introduction**

At the end of 1980s, the term 'computers' was replaced by 'IT' (information technology) representing a change of focus from computing technology to the capacity to store and also retrieve the more information (Pelgrum and Law, 2003) [1]. Which was followed by the introduction of the term 'ICT' (information and communication technology) around 1992, when e-mail started to become available to the general public (Pelgrum and Law, 2003) [1]. United Nations reported that (1999) ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries, documentation network-based information services, and other related information and activities. The field of education also has been affected by ICTs, with teaching, learning, and research (Yusuf, 2005). The Agriculture and the education departments are two elements where the ICT can play the very important role in the development of the country (V. D. Jadhav, 2018) [5].

A water well is a hydraulic hole in the earth down to a supply of water excavated for the purpose of bringing groundwater to the surface. Irrigation wells differ from those used to supply water for domestic purposes because of large volume of water that have to be pumped from them for irrigating even small farms. Efficient and economical utilization of ground water through wells depends upon design of wells and properties of aquifers to best suit the characteristics of water bearing formulations.

The outer part of the earth's crust is porous to varying depths at different places. In the surface strata the openings are partially filled with water, this strata is called zone of aeration. When the openings completely filled with water then the strata is called zone of saturation. Formations or strata within the saturated zone below the ground surface from which groundwater can be obtained for beneficial use is called aquifer. The properties of the aquifer that influence well performance are depth and areal extent of the aquifer, number of aquifers exposed to the well and the hydraulic properties of the aquifer. An aquifer performs two functions that is storage function and conduit function. Attempt has been made to simplify the calculation using C language with the project entitled, calculation of aquifer properties using C

language with the focus on following objectives:

1. To get acquainted with the software turbo C++, Version 3.0
2. To simplify the calculations to determine properties of aquifers by using different methods using C language.
3. To reduce the time required for determining the properties of aquifer.

### 1. Existing System

The Existing system is completely manual. The drop spillway calculation contains different formulas calculate the various values of drop spillways. These formulas are very complex to calculate with the use of calculators. It is purely paper based to store the records of the onetime calculated values of those formulas. The calculations are done with calculator by entering the each value of formula manually in the calculator.

#### 1.1 Limitations in Present System

There are certain limitations in system, which areas follow:-

1. There are various steps or formulae involved in drop spillway structure, so it is difficult to handle manually.
2. Manually calculations are difficult to estimating various parameters in this design with different dimensions and also more time required.
3. For recording purpose it should be note down in some paper, thus chances of losing the data is increases.
4. Manually calculations include more errors with less accuracy.
5. To require the man power for calculation on the field and make it secure.

### 2. Proposed system

To remove the complexities, errors and difficulties the proposed system is developed. These difficulties can takes place at the time of managing the jobs at institution. Today the digitalization is directly comes with computerization, so the students, researchers are coming under the one roof to learn about digitalization and computerization. Calculate the aquifer properties formulas manually on the paper are very complex method to find the accurate value of the specific component. Since these works does manually thus it takes more time and there are chances of errors such as wrong details, wrong value at wrong place etc.

So to reduce these faults "ICT Application to measure aquifer properties" has been developed. The proposed system "ICT Application to measure drop spillways" deals with all the activities which are done by the agriculturist for measure the aquifer properties. This paper is all about how can information communication technology reduce the manual work load and give the accurate results of the proper formulas. The data will store sequentially in the database and we can access it whenever we need it.

#### 2.1 Advantages of Proposed System

1. Calculations are done very fast and it saves the time.
2. No need to data note down on the paper because it stores digitally in computer.
3. System includes the various security features.
4. System should be window based, user-friendly and efficient.
5. Appropriate master tables must be present to record relevant data.
6. Accuracy can be maintained

### 1. Material

This paper deals with the calculation of aquifer formulae. It includes different design formulae and those were used while developing the software. It also encapsulates the configuration of the system and information about the used to develop software.

### 4. System Requirements

#### 4.1 Hardware Requirements

Content	Description
HDD	250 GB Min, 40 GB Recommended
RAM	2 GB Min, 1 GB Recommended

#### 4.2 Software Requirements:-

Content	Description
OS	Windows XP or Higher Operating System
Database	MS-Access 2007
Technologies	ASP.NET with C#.NET
IDE	Ms-Visual Studio. Net 2017

### 5. About the Platform

#### 5.1 Development Platform

The system is developed in the high level computer language that is, C# with the net framework. To develop and edit the software we have used the Microsoft visual studio 2017 version.

#### 5.2 Platforms to run on

To run or use this software your system must have to fulfill the above software as well as hardware specifications respectively.

### 6. The various aquifer properties formulae are given below

#### 6.1. Porosity

Porosity of the aquifer is defined as volume of void space to the total volume of the soil mass. It is expressed in percentage.

$$p(\%) = \frac{V_w}{V} \times 100 \quad (3.1)$$

Where,

$p$  = porosity (%)

$V_w$  = volume of water required to fill ( $\text{cm}^3$ )

$V$  = total volume of soil mass

#### 6.2. Hydraulic Conductivity

The hydraulic conductivity of the aquifer is defined as the rate of flow of water in litres per day through a horizontal cross sectional area of one square metre of the aquifer under a hydraulic gradient of measurement. The hydraulic gradient formula is given by Darcy is given below,

$$K = v \times \frac{l}{h_1 - h_2} \quad (3.2)$$

Where,

$K$  = Hydraulic conductivity of aquifer (m/day)

$v$  = Velocity of flow (m/day)

$h_1 - h_2$  = Difference in hydraulic head (m)

$l$  = Distance along the flow path (m)

### 6.3. Transmissibility

Transmissibility defined as the rate at which water will flow through a vertical strip of the aquifer one metre wide and extending through the full saturated thickness of the aquifer under a unit hydraulic gradient. The flow through each metre width of aquifer is given by following formula,

$$q = Kbi \quad (3.3)$$

Where,

q= Transmissibility

K= The average hydraulic conductivity of aquifer (m/day)

B= Thickness of the aquifer (m)

i= Hydraulic gradient

### 6.4. Specific Yield

Specific yield is the ratio of the volume of water which a soil after being saturated will yield by gravity and other inherent soil moisture tensions, to the volume of soil. The quantity of the water that a unit volume of the aquifer will yield when drained by gravity is called its specific yield. It is expressed as,

$$S_y = V_d/V \quad (3.4)$$

Where,

S<sub>y</sub>= Specific yield (%)

V<sub>d</sub>= Volume of water drained (cm<sup>3</sup>)

V= Total volume of saturated rock (cm<sup>3</sup>)

### 6.5. Specific Retention

The part of the water retained in the aquifer mass is held against force of gravity by molecular attraction and capillary. The quantity of water that a unit volume of aquifer retains when subjected to gravity drainage is called as specific retention. The specific retention of the aquifer is calculated by given formula,

$$S_r = W_r/V \quad (3.5)$$

Where,

S<sub>r</sub>= Specific Retention (%)

W<sub>r</sub>= Volume occupied by the retained water (cm<sup>3</sup>)

V= Gross volume of the rock or soil (cm<sup>3</sup>)

### 6.6. Hydraulic Resistance

The hydraulic resistance also called reciprocal leakage. The value of hydraulic resistance is evaluated on the basis of the pumping test data using following equation,

$$c = \frac{B^2}{Kb} \quad (3.6)$$

Where,

c= Hydraulic resistance (Days)

B= Leakage factor (m)

K= Hydraulic conductivity of the aquifer (m/days)

b= Thickness of the aquifer (m)

### 6.7. Source code

```
#include<stdio.h>
```

```
#include<math.h>
```

```
#include<conio.h>
void Porosity ();
void Hydraulic_Conductivity ();
void Transmissibility ();
void Specific_Yield ();
void Specific_Retention ();
void Hydraulic_Resistance ();
void main ()
{
    clrscr();
    int choice=0;
    char ch;
    clrscr ();
    while statement start
    while (choice!=7)
    {
        clrscr ();
        setcolor (10);//
        Printf
        ("*****
        *****");
        printf ("\n\t*Department of Irrigation and Drainage
        Engineering*\n\n\t");
        printf ("\tIrrigation Efficiencies\n\n");
        printf ("1. Porosity\n");
        printf ("2. Hydraulic Conductivity\n");
        printf ("3. Transmissibility\n");
        printf ("4. Specific Yield\n");
        printf ("5. Specific Retention\n");
        printf ("6. Hydraulic Resistance\n");
        printf ("7. EXIT \n");
        printf ("\n\tEnter Your Choice <1-7>\t");
        scanf ("%d",&choice);
        printf
        ("*****
        *****");
        switch (choice)
        {
            case 1: /*** Porosity ***/
            {
                clrscr ();
                Porosity ();
                fflush (stdin);
                printf ("\n\nPress any key to go main screen : ");
                scanf ("%c",&ch);
                break;
            }
            case 2: /*** Hydraulic Conductivity ***/
            {
                clrscr ();
                Hydraulic_Conductivity ();
                fflush (stdin);
                printf ("\n\nPress any key to go main screen : ");
                scanf ("%c",&ch);
                break;
            }
            Case 3: /*** Transmissibility ***/
            {
                clrscr ();
                Transmissibility ();
                fflush(stdin);
                printf ("\n\nPress any key to go main screen : ");
                scanf ("%c",&ch);
                break;
            }
        }
    }
}
```

```

}
case 4: /*** Specific Yield ***/
{
//clrscr ();
Specific_Yield ();
fflush (stdin);
printf ("\n\nPress any key to go main screen : ");
scanf ("%c",&ch);
break;
}
case 5: /*** Specific Retention ***/
{
//clrscr ();
Specific_Retention ();
fflush (stdin);
printf ("\n\nPress any key to go main screen : ");
scanf ("%c",&ch);
break;
}
Case 6: /*** Hydraulic Resistance ***/
{
//clrscr ();
Hydraulic_Resistance ();
fflush (stdin);
printf ("\n\nPress any key to go main screen : ");
scanf ("%c",&ch);
break;
}
}
}
}
void Porosity()
{
float Vw, V,P;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Porosity\n");
printf ("\t Enter the volume of water required to fill Vw=");
scanf ("%f",& Vw);
printf ("\t Enter total volume of soil V=");
scanf ("%f", & V);
P= ((Vw/V)*100);
Print f ("\t Porosity P=%f", P);
}
void Hydraulic_Conductivity()
{
float K,V,l,h1,h2;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Hydraulic_Conductivity\n");
printf ("\t Enter the distance between the points h1 and h2
l=");
scanf ("%f",&l);
printf ("\t Enter the velocity of flow V=");
scanf ("%f",&V);
printf ("\t Enter the value of first Hydraulic head h1=");
scanf ("%f",&h1);
printf ("\t Enter the value of second Hydraulic head h2=");
scanf ("%f",&h2);
K= (V*l)/(h1-h2);
Printf ("\n\t Hydraulic_Conductivity K=%f",K);
}
void Transmissibility()

```

```

float k,b,i,q;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Transmissibility\n");
printf ("\t Enter the value of Hydraulic conductivity k=");
scanf ("%f",&k);
printf ("\t Enter thickness of aquifer b=");
scanf ("%f",&b);
printf ("\t Enter the value of Hydraulic gradient i=");
scanf ("%f",&i);
q= k*b*i;
printf ("\n\t Transmissibility q=%f",q);
}
void Specific_Yield ()
{
float Sy, Vd,V;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Specific Yield\n");
printf ("\t Enter the volume of water drained Vd=");
scanf ("%f",& Vd);
printf ("\t Enter total volume of saturated rock V=");
scanf ("%f",&V);
Sy= ((Vd/V)*100);
printf ("\n\t Specific Yield Sy=%f",Sy);
}
void Specific_Retention ()
{
float Sr,Wr,V;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Specific Retention\n");
printf ("\t Enter the volume occupied by water Wr=");
scanf ("%f",&Wr);
printf ("\t Enter gross volume of soil V=");
scanf ("%f",&V);
Sr= ((Wr/V)*100);
Printf ("\n\t Specific Retention Sr=%f",Sr);
}
void Hydraulic_Resistance()
{
float c,B,k,b;
printf ("\n\t\t*** Department of Irrigation and Drainage
Engineering *** \n\n");
printf ("\n\t Hydraulic Resistance\n");
printf ("\t Enter the value of Leakage factor B=");
scanf ("%f",&B);
printf ("\t Enter the value of Hydraulic conductivity k=");
scanf ("%f",&k);
printf ("\t Enter thickness of aquifer b=");
scanf ("%f",&b);
c= (B*B)/(k*b);
printf ("\n\t Hydraulic Resistance c=%f",c);
}

```

## 7. Results and Screen Layouts

```

C:\Users\YASH\Desktop\pcode.exe
*****
*Department of Irrigation and Drainage Engineering*
*****

Irrigation Efficiencies

1. Porosity
2. Hydraulic Conductivity
3. Transmissibility
4. Specific Yield
5. Specific Retention
6. Hydraulic Resistance
7. EXIT

Enter Your Choice <1-7>

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering ***
*****

Specific Retention

Enter the volume occupied by water  $W_r=44$ 
Enter gross volume of soil  $V=23$ 

Specific Retention  $S_r=191.304352$ 

Press any key to go main screen :

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering **
*****

Porosity

Enter the volume of water required to fill  $V_w=55$ 
Enter total volume of soil  $V=45$ 

Porosity  $P=122.222221$ 

Press any key to go main screen :

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering ***
*****

Hydraulic Resistance

Enter the value of Leakage factor  $B=43$ 
Enter the value of Hydraulic conductivity  $k=44$ 
Enter thickness of aquifer  $b=66$ 

Hydraulic Resistance  $c=0.636708$ 

Press any key to go main screen :

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering
*****

Hydraulic_Conductivity

Enter the distance between the points  $h_1$  and  $h_2$   $l=43$ 
Enter the velocity of flow  $V=56$ 
Enter the value of first Hydraulic head  $h_1=32$ 
Enter the value of second Hydraulic head  $h_2=20$ 

Hydraulic_Conductivity  $K=200.666672$ 

Press any key to go main screen :

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering **
*****

Transmissibility

Enter the value of Hydraulic conductivity  $k=56$ 
Enter thickness of aquifer  $b=32$ 
Enter the value of Hydraulic gradient  $i=30$ 

Transmissibility  $q=53760.000000$ 

Press any key to go main screen :

```

```

C:\Users\YASH\Desktop\pcode.exe
*****
*** Department of Irrigation and Drainage Engineering *
*****

Specific Yield

Enter the volume of water drained  $V_d=43$ 
Enter total volume of saturated rock  $V=45$ 

Specific Yield  $S_y=95.555557$ 

Press any key to go main screen :

```

## 8. Conclusion

By using C languages, the calculations are completed in a very short span of time as the formulae are pre-defined in the software. The complete design was done using C language in a very less time and with accuracy. Turbo C++, version 3.0 was used for this purpose. It contains the main page where, the formulae are given. By entering the values of each value, the calculation of formulae for properties of aquifer. The all formulae results were computerized and require less manpower. When we calculate these properties manually the results had approximate values of properties but by using this software the results were accurate digits. This software was very user friendly and time efficient. The results obtained were verified with the manual calculation and it was found that the results were accurate. Thus, this software programme is very efficient for calculating aquifer properties by using formulae.

## 9. References

1. Pelgrum WJ, Law N. "ICT in Education around the World: Trends, Problems and Prospects". UNESCO, International Institute for Educational Planning, 2003.
2. Syed Noor-Ul-Amin. An Effective use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience: ICT as a Change Agent for Education, 1-13.
3. Yusuf MO. Information and communication education: Analyzing the Nigerian national policy for information technology. International Education Journal. 2005;6(3):316-321.
4. [http://uir.unisa.ac.za/bitstream/handle/10500/4245/05Chap%204\\_Research%20methodology%20and%20design.pdf](http://uir.unisa.ac.za/bitstream/handle/10500/4245/05Chap%204_Research%20methodology%20and%20design.pdf)
5. Jadhav VD. "Use of Information Communication Technology in Education Services" (IRJET, 2018-19Feb, 6(2)).
6. Michael AM, Ojha TP. Principles of agricultural engineering, Jain brothers New Delhi. 2012, 2.
7. Khepar SD, Michael AM, Sondhi SK. Water Wells and Pumps, 2<sup>nd</sup> Edition, McGraw Hill Book, company Ltd, 1976, 52-58.
8. Punmia BC. Irrigation and Water Power Engineering, 5<sup>TH</sup>

Edition. 2003, 200-215.

9. Yiqu N, Ping Yang, Jie Zhou, Jingjing Yan. Groundwater Engineering, 2<sup>nd</sup> Edition, 1998.
10. Kuniaki Sato and Iwasa, Groundwater Hydraulics, 3<sup>rd</sup> Edition, 2002.
11. Ozza TP, Michael AM. Principles of Agricultural Engineering, 9<sup>TH</sup> Edition 2005, 2.
12. Balagurusamy E. Programming in ANSI C. Tata.MC Grew-Hill Publishing Company Limited, New Delhi, 1992.
13. Tan A. C programming for engineers and computer science. McGraw-Hill, New York, 1999.