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RESEARCH ARTICLE

USING GIS TO DEFINE THE AREAS TO BE DAMAGED WHEN MOSEL DAM COLLAPSES.

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Abstract

This research involves making use of the American National Aeronautics and Space Administration (NASA) site by downloading data on the study area and inferring the area coordinates. Several processes were carried out using related programs, Mosel Dam site has been selected as the study area because the Dam collapse has recently become the public main talking point because of the site weak soil. Also it has become clear that GIS systems have gained popularity in specifying areas likely to be damaged as a result of floods or dam failure. Moreover, they can be used in building digital elevation models for any area.

The right side of the study area that is on the right bank of Tigris is more likely to get damaged than the left side for Sectors (B,C). The difference is 107.816,101.387 sq m respectively. On the other hand, the Sectors (A,D) are less likely to get damaged because the difference is 42.401,32.170 respectively. The total area of the four sectors is 445.293 sq m

Introduction:-

DEM is short for the expression Digital Elevation Model which is characterized by its capability to deal with terrain levels. There are many sources which provide data on coordinates and levels which are necessary for building Digital Elevation Models of the known points. Among these sources are radar topographic data which are regarded one of the main pillars used in many specialized programs which deal with spatial analysis used drawing, building, and studying the characteristics of terrain of any area. They are used in engineering projects such as dam building, reservoirs and road making and so on. Data sources vary with the type of satellite[(1)]. This will use SRTM, the American Model. The Digital Elevation Model is the latest development in topographic survey. The model is a three dimensional digital matrix interconnected by (X,Y,Z) coordinates. The value of Z dimension represents the value of height above sea level [(2)]

Dams and natural reservoirs are regarded as the main terrain features which can be represented in three dimensions as well as being used for storing water (whether from rivers or rain) which should be kept and used efficiently and used when need arises . Building such more than traditional one .For example Al Razzazha Lake digital elevation model was made based on radar topographic data.[(3)] This is illustrated in Fig (1)

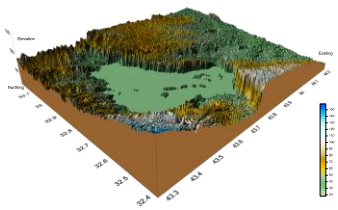

Fig 1:- Building a digital model elevation of Al Razzazha Lake, Iraq.

Research aim:-

The research aims to build a solid digital model elevation of the study area by using radar data to find out which areas are likely to be affected by water resulting from the Dam collapse (God forbid) so that precautionary are taken to reduce water effect.

Research problem:-

It is represented by the fact the soil on the dam was built is weak, being composed of gypsum.

Research hypothesis:-

The research is based on hypothesis that the dam collapse will be complete and fast. The water level will be 275 m up to 40 km then25h every 40 km up to Qayarra area.

Research methods and materials:-

Research procedure:-

The research consists of two parts; the first being theoretical covers the dam history, some of its specifications and dam importance while the second part covers building a digital elevation model of the study area and calculating the area which are likely to be damaged as well as giving the conclusions and recommendations.

The first part: Mosel Dam (Study area):-

Mosel Dam lies within the boundaries of Mosel Governorate which is one there governorates in north Iraq. It stores water of Tigris which springs up in Turkey. Its length is 3.2 km and height is 131 km and is considered the largest dam in Iraq and the fourth largest dam in the dam in the Middle East. It lies about 50 km 50 km north of Mosel City whose population is more than 1,5 million .Fig (2) shows the dam site in relation to the countries bordering Iraq and Fig (3) shows the dam reservoir [4]

Fig 2:- shows the Dam site relative to Iraq.

Fig 3:- illustrates Dam reservoir.

Dam importance:-

The main goals behind building Mosel Dam were building four big projects to provide irrigation water to fertile land totaling (5) million acre on both sides of Tigris and meet the water needs of summer crops in central and southern Iraq as well as generating electrical power through four units with capacity of generating (187) Megawatt each and fisheries development. Tourism was expected to flourish in the area. However, the main goal was to control Tigris water and protect the areas to the south of Tigris from flood which overflowed in spring causing damage to farms, people and towns nearby especially Mosel where engineering army had to be called in to deal with water and protect people and towns. Fig (4) illustrates the Dam construction

Fig 4:- illustrates the Dam construction.

Dam specification:-

It is an aggregated dam which is located 50 km north west of Mosel. The reservoir has an area of 417 sq. m with storage of 115 billion cubic meter and length is 3500 m and its height is 129 m, and its discharge is about 17500 cubic meter per second. Work on the Dam started in 1980 and completed in 1986.The Dam is used for water storage and flood control and power generation in the range from800 – 1000 megawatt per annum in addition to irritating an area of 3.5 million acres in Al Jazeera area which is irrigated from the Reservoir through a 65 km canal whose discharge is 170 cubic meter per second. The water inflow to Tigris near the Dam is 18.44 billion cubic meter per annum [(5)]

Many researches were conducted on Mosel Dam in terms of its effect the height of flood water in the area through which it flows and different other situations. One research estimates the flood water will reach Mosel City in five and half hours after the Dam collapses and the water depth will be (25.3) m above Tigris river bottom [(6)]

Reasons for fear from the Dam collapse:-

During the last decade, four dams collapsed in the Arab region. They were in Saudi Arabia, Morocco and two in Syria The fear that Mosel Dam will collapse is because[(7)]

- The dam was built on gypsum base and calcium sulfate which easily dissolve in water. Therefore cavities are in the Dam body which need continuous injection with a special type of cement
- All previous solution were prosthesis. In addition work on Bakhma Dam and Badush Dam has been held ate since 1991
- The little resistance to earthquakes and weak aftershock tremors which took place since the dam was constructed. The fault in design as well as the little resistance to earthquakes has aggravated the problem of cracks and cavities in dam base. If for example the Dam suffers earthquake of 5 magnitudes on Richter scale, it will collapse completely. In addition any big explosion close to the Dam will cause partial or total collapse.

The second part:- Building the digital elevation model for the study area.

Steps in building the digital elevation model:-

There are several methods to build the model. Below are the steps of one of these methods.

1- Entering the site below:-

http://srtm.csi.cgiar.org/SELECTION/listImages.asp

related to spatial data (coordinates and and levels). The study area and its neighboring areas. then the related data are downloaded. They are in the form of STRM model

Fig (5) shows the above site window.

Fig 5:- shows the main window of the site for downloading STRM data.

2-The study area adopted by the researcher for Tigris starts from Mosel Dam up to an area south of Qayarra which is 160 km from the Dam Fig (6) illustrates this
area

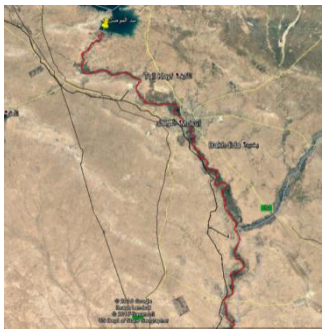

Fig 6:- illustrates the path of study.

3-In order to read this data and representing it in a map, Global Mapper was used which deals with STRM model. With the help of this program data on the study area was stored in the form of digital elevation model (DEM) after it was processed. Fig (7) illustrates this.

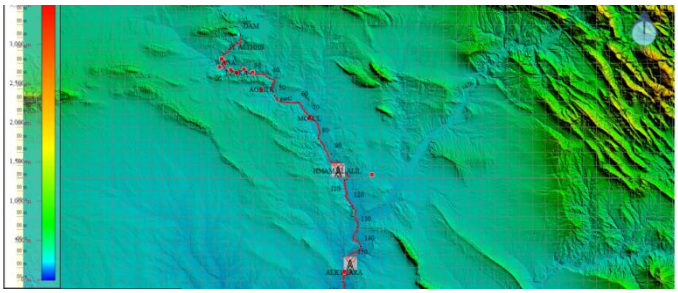

Fig 7:- illustrates the study area was represented in (DEM) by using Global Mapper.

The source: researcher

4 - The researcher Four sectors were defined within Tigris course starting from the Dam so that the length of a sector is 40 km to facilitate the calculation of the area likely to be damaged as a result of the Dam collapse.

These sectors are:-
First sector (0-40 km):-
The areas and villages through which the sector passes are (Tel Al thahab village,Nahiya center of Wana. Eski Mosel, Monastry of Umtota,Lazaa village,Dawaasa,Messrag village, Tanba *village,* Kafridge village, Telsfr village, Uoowana (Alsh0ta,Almeh).

Second sector (40-80 km):-
The areas through which the sector passes are (Alabeetir,Khaja jaleel,alsubeyh, Badush, Al Sheikh Mohammed, Aljamaliyah,Alhumaydat, Aldamichi Alsagir, QuwIN Village, Haleela, Shereekhan, Mosel, Mosel airport.

Third sector (80-120 km):-
The areas and villages through which the sector passes are(Albu Yosif, Lezaka, Ksbir Allabid, Hammam Alaleel, Alsa;amiya Village, Saf al tooth Village).

Fourth sector : (120-160 km):-
The areas and villages through which the sector passes are (South of Saf al tooth Village, Tel Alshook, Telool Nassir. Alzuweya Village, Al Qayaarra) . fig No (8) illustrates all these sectors

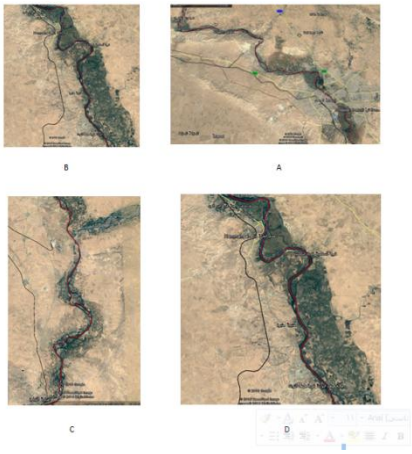

Fig 8:- illustrates the four sector of the study area.

5- The researcher has adopted the hypothesis that the water level after the Dam collapse will be 275 m (This average represents the water level before and after the Dam).This level continues to up to 40 km from the Dam. Thus, the water level for the four sectors will be as follows:

- First sector 275m
- Second sector 250m
- Third sector 225m

6- In order to specify the areas likely to be flooded after the Dam collapse, the researcher has adopted the following programs

-SUREFFER with which digit elevation of the study area was built to be used in later stages. Fig (9) illustrates the model for the study area, the course of the river and terrain on both sides of the river

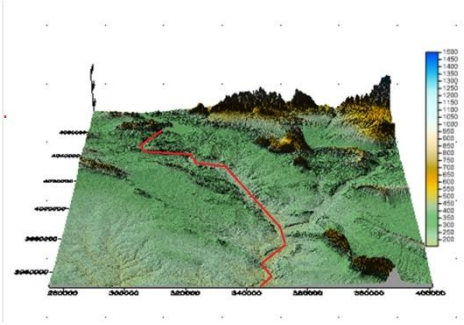

Fig 9:- illustrates the digital elevation model of the study area

- GLOBAR MAPPER with which the water level for each sector was specified as well as the areas likely to be flooded as shown in Fig (10) in the blue color represents the area that will be covered in each sector

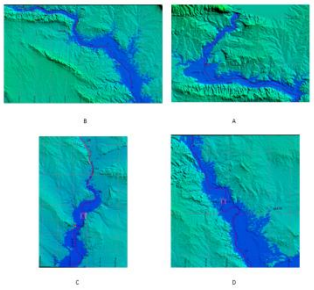

Fig 10:- illustrates the four sectors of the study area.

-ARC MAP: This program calculates the areas on river side's (both right and left sides separately) for each sector after some processes were carried out in this program.

Table (1) gives these areas

Table 1:- gives the areas to be affected by flood when the Dam collapses.

SECTORS	AREA(KM^2)		
	RIGHT SIDE	LEFT SIDE	TOTAL
A	37.219	42.401	79.620
B	107.816	47.320	155.136
C	101.387	48.890	150.277
D	28.190	32.170	60.360
TOTAL	274.512	170.781	445.293

Conclusions:-

1. The GIS programs play an important role in defining the areas likely to be damaged as a result of floods or dam collapse. They are also used in building digital elevation model of any area
2. Digital elevation models can be used to specify plain and rough terrain and show their elevation
3. The right side of the study area (right side of Tigris) is likely to receive more damage than the left side for sectors,(B,C) As for sectors (A, D) , their left side will be less damaged because it reaches 42.401,32.170 square kilometer
4. The terrain on the right side of sectors (B,C) is more plain and has less height than the other two sectors
5. The most water damaged sector is sector (B) because the area likely to be damaged is 155.136 square kilometer. The least damaged is sector (D) whose area is 60.360 square kilometer.
6. The total area of the four sectors which is likely to be damaged by water is445.293 square kilometer
7. The areas and villages close to Tigris which are likely to be damaged by water for each sector are

Sector A:-

Tel Thab Village, center of Wana Nahiya, Eski Mosel. Monastry UMtootha,Lezka Village, Aldawassa, Missrah Village, Tanba Village,, Kaffrig Village, Tel Usfur, Ewanna, Alshoota,Almlih

Section B:-

Alabitar, Khawaja Khalil,Alsabeeh, Badush, lsheikh mohammed, Aljamaliya, Alhemadat, the Small Damerjch Faween Village, Jaleela, Sherekhan, Mosel. Mosel airport,

Sector C:-

Albu Yousif, Lezaka, Kabir Albid. Hammam Alileel, Salamiya Vjllage ,Saf tooth Village.

Section D:-
South of Saf tooth Village, Tel alshook, Telool Nassir, Zeweya Village, Al Qayarra.

Recommendations:-

1. It is necessary to use GIS programs to specify water disasters and estimate the resulting damaged area.
2. The Central Government in Baghdad should take the necessary measures to reduce the damage expected from collapse of the Dam
3. It is necessary to earth barriers and concrete blocks as water barriers for sectors (B,C) because they are plain and have lower elevation,
4. The inhabitants of these areas should be told to leave their areas when the Dam collapses

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