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Assessment Of Runoff Risks Of Wadi Beshadim Basin In Duhok Governorate

By

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Abstract

The study aims to assess the geomorphological risks of the Bashadim Valley Basin in Zakho district, Dohuk Governorate, northeastern Iraq, with an area of (113,723 km 2), where the geology of the study area was studied and it was found that it is located within the unstable range within the belt (Sulaymaniyah - Zakho), and the chronological age of formations and sediments varies. The basin is between the third time (the Pliocene), which includes the formations (Fatha, Bey Hassan, Injana, Blasby, and Muqdadiya) and the deposits of the fourth time (the Holocene). And from the study of the characteristics of the runoff, it was found that there are different risks between the basins in the study area

The problem of the study: It is a question that the researcher puts in his mind in order to answer it, including:

What is the size of the prevailing hydro geomorphological hazards in Wadi Beshadim basin? The study hypothesis: It is the primary answers to the study problem:

A set of mathematical coefficients is calculated to find out the risk of runoff on different human activities in the study area.

Objectives of the study :

Evaluating the size of the hydrogeomorphological risks of the basins of the study area and classifying their degree of severity.

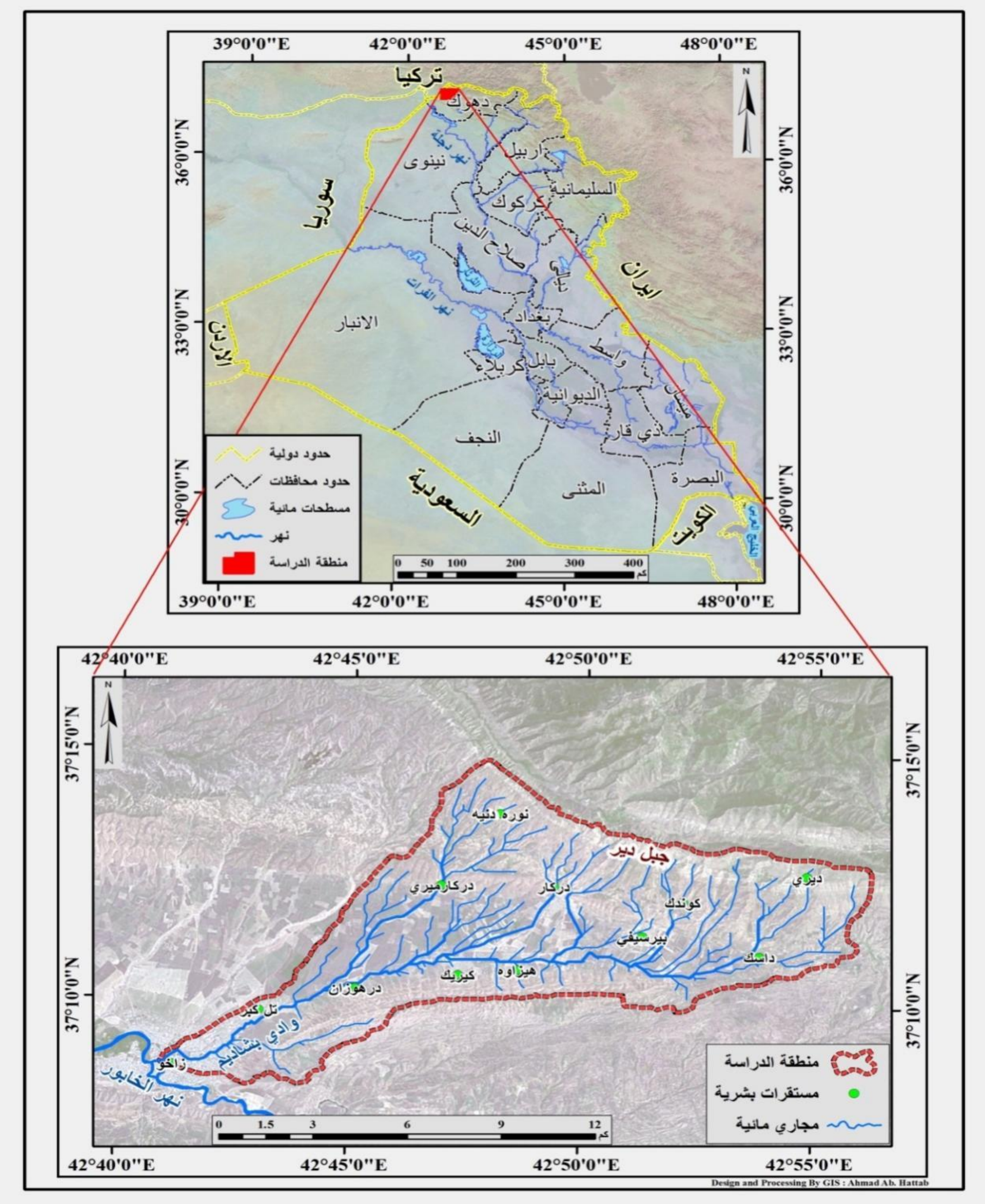
Study area location:

The study area is located in the northwestern part of Iraq in Dohuk Governorate, within the administrative borders of Zakho district, map (1), and the area of the Bashadim Valley basin is (113.723 km2), which constitutes (8.25%) of the area of Zakho city, which is about (1378). km 2), and from the astronomical point of view, the study area is located between longitudes (47" 40' 42 H) (04" 56' H 42) east, and two latitudes (12" 08' 37 H) (15" 16' 37 H) north. The time dimension of the study was based on climatic data for the period between (2010-2022 AD) for Zakho and Dohuk stations.

First: the natural characteristics of the study area

1 . geological structure

Iraq occupies part of the northern and northeastern edge of the Arabian plate, which is bounded from the north and northeast by the Taurus-Zakros zone, from the west by the Red Sea and the levant fracture zone, and from the south by the Gulf of Aden and the Oman fracture zone.



Map (1) *the location of the study area*

The region was subjected to terrestrial movements and tectonic pressures for many eras that were submerged by the waters of the Tish Sea, during the second and early third times, and many twists resulted, and the Asia Minor mass rushed towards the highly resistant mass, and the Arabian plate moved in an anti-clockwise direction. The hour, that is, towards the north and northeast due to the rifting movement (rifting) Gulf of Aden _ Red Sea, the occurrence of the alpine movement led to the collision of the Arabian plate with the Persian plate and resulted in the emergence of high lands interspersed with deep valleys due to the two processes of pressure and tension resulting from the land mass from the north, east and south on Northern Iraq, and thus a complex area of torsion was formed, which is called (the area of creeping faults), and this led to severe torsion in its layers with the occurrence of structural distortions represented by fractures and cracks, and thus the mountain chain (Taurus-Zakros) was formed. Buday proposed in 1973 AD the following tectonic divisions ( )

a. Nubian Arabian Platform
B. Geoyncline Basin Area Alpine

Bodi also divided each of the two aforementioned domains into sub zones and into blocks. The bilateral tectonic division of Bodi was adopted in 1973 in this study because it is the most recent division that illustrates the structural and dynamic features of the tectonic regions in Iraq. It is also the most detailed division in clarifying these features. It represents a comprehensive study that relied on geological studies. Based on this study, the study area is located Within the scope of the unstable pavement within the (Sulaymaniyah -Zakho) belt.

2. Stratification of the study area:

The stratigraphy of the study area is divided into two parts. Map (2) is noted: Tertiary formations (Pliocene)

The formations of the triple time occupy large areas of surface detectors and subsurface sections, and these formations mostly go back to the middle Miocene and upper Miocene era, and it begins with a layer of chalky limestone forming rocky lands that represent an area for the source of many valleys ( ), and this time includes the following formations

a . Fathe formation

Formerly called Al-Fares Al-Asfaql, the first deposits of this formation appeared in the middle Miocene era in the form of thick gypsum layers, .

B . lnjana Formation

It is called the High Knight, and its geological age dates back to the Upper Miocene era, and it consists of sandy and leaden brown stone, (). 7.908 %) from the study area.

c. Mudadyah Formation

This formation appears in the eastern and northwestern parts of the study area, as well as in limited areas in the southeast of the basin, and it occupies an area of (15.42561 km2) with a rate of (13.564%) of the study area.

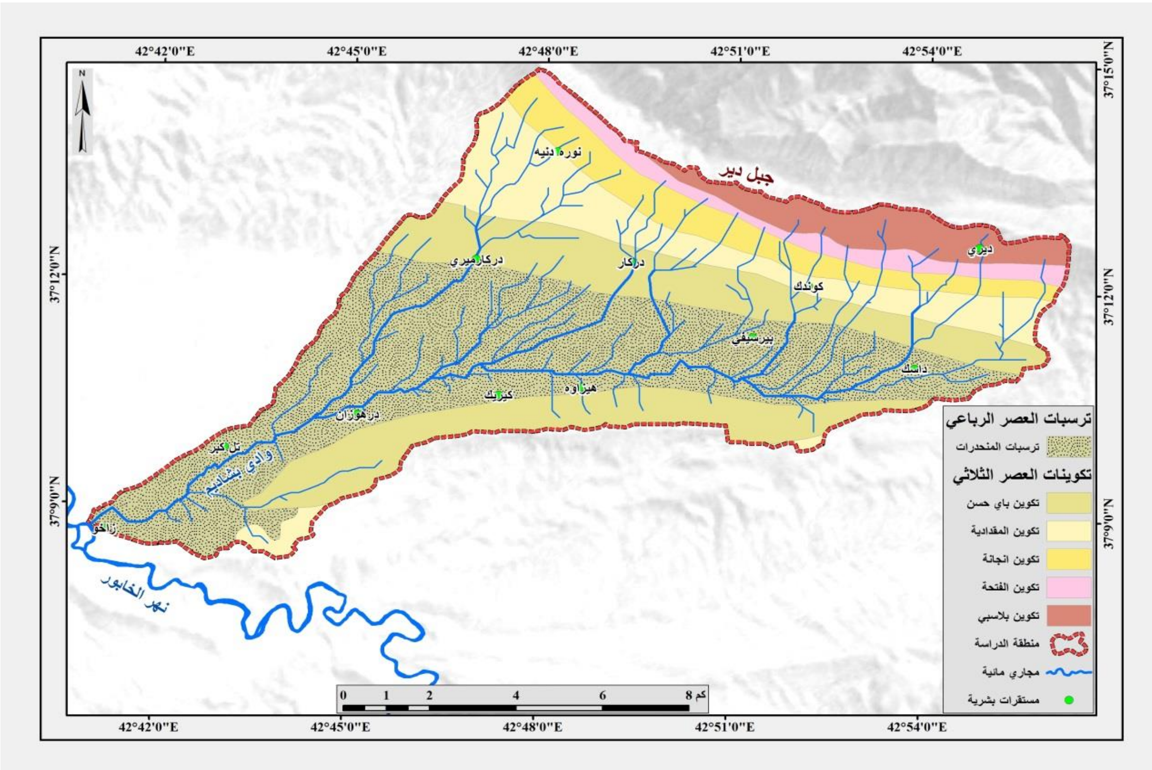
D.. Bai Hassan Formation

It dates back to the Pliocene era and is considered one of the most recent formations in the Tertiary period. Its upper part consists of thick clay stones with conglomerates, usually severe weathering and erosion. Its sediments are thick and coarse. The thickness of the agglomerate’s ranges from (50_60) meters, and the components of this formation vary from the pebbles of the kingdoms. And thin sandstones, reddish-brown sand, silt and clay. The stones of the kingdoms often contain silica, carbonates and many other elements (). This formation appears in the central parts of the basin in the form of a strip extending from east to west, as well as in the southern and southeastern parts. The formation area is (28.6413 km2), with a rate of (28.190%) of the study area

H . Pilsspi Formation: This formation was deposited during the late middle and upper Eocene era, and the thickness of the formation ranges between 150-40 meters ( ), there are ancient clay layers formed at the top and chalky limestone at the bottom of the formation, as well as a necklace of flint stone, the formation was deposited in the lakes environment Shallow at the end of the Middle Eocene (), this formation appears in the northern parts of the study area. The area of the formation is (7.71403 km2), or 6.25% of the area of the basin.

1 Formation of the fourth time (slope deposits)

The Quaternary time deposits are among the modern deposits, whose components go back to the rainy era (Pleistocene) and the modern era (Holocene), as the deposits of this time appear in the stomachs of valleys and depressions and in the soil of the slopes. They are represented by heterogeneous river deposits. Sediments range between (0.5-5) m, in the areas of valleys and depressions ,these deposits appear in a large area in the study area, where they occupy the southwestern and central parts of the basin, with an area of 48.82830 km2 (with a rate of (42.93%)).



Map (2) *the geological formations in the study area*

Zakho plate, scale 250000:1, General Company for Geological Survey and Mining, Ministry of Industry and Minerals, Baghdad, Iraq, first edition, 2008.

The Climate

The climate in Dohuk Governorate is considered within the Mediterranean climate, as it is characterized by moderation in summer in most parts of the governorate, and severe in winter, with very low temperatures, snowfall, and heavy rain. Zakho) reached (11.5 hours/day) during the summer in the month of August, while the lowest values of solar radiation were (4.3 hours/day) during the winter in December. In the hours of brightness and chroma The sky during summer and summer, while the maximum temperature was recorded in July (38.9 C) as the highest degree, and (9.3 C) in January as the lowest degree, while the minimum temperature was recorded as the highest in August (24.7 C) and the lowest It was recorded during the month of January, when it reached (4°C), this variation in the maximum and minimum temperatures plays on the increase in weathering activity and the weakness of the rocks' resistance to erosion processes.), and it does not exist during the months of May and August, and rain contributes to an increase in the activity of geomorphological processes through laminar erosion, transport and sedimentation, while the relative humidity values also varied between the months where they were The highest values were during the months (November, December and January) (60.8, 70.3, 77), while the lowest values were recorded during the months (July, August and June) (26.1, 23.9, 36.1).

The Soil .

Soils in the study area are divided into two types:

1. Shallow, Stony And Sloping Chestnut Soil

It is located in the plains of the mountainous region and its valleys and terraces. It is fragile soil in its upper parts and its color is dark brown. It contains organic materials. This soil is spread in the north-east, west and south-east of the basin. Its area is (64.89513) km 2, or 57% of the area of the basin.

2. Chestnut Soil With A Deep Thickness

It is spread in the central and southwestern parts of the basin. The area of this soil is (48.82803) km2, with a rate of (43%) of the area of the basin. It is distinguished by its thickness, the diversity of its content of mineral substances, and its richness in organic substances, and for this richness it is called dark

Natural Plant

The natural vegetation in the study area can be divided according to what was seen during the field study and the sources and data obtained from the Duhok Agriculture Division to the following:

1. Plants Of The Slopes

They are plants that grow on the slopes of mountain slopes of varying heights, in which trees mix with weeds, and often among the most important trees that grow on these slopes are mostly small-sized oaks, which are usually of the type called evergreen dry oak.

2. Plants Of The Plains And The Stomachs Of The Valleys

These areas include different plants, including tall ones and short plants, and they are different in terms of their life cycle. Some of them are permanent and perennial, and some are annuals that do not last except for a short period of the year, and among its plants are carcasses and daffodils. As for the mountain valleys, where there is plenty of water, trees like lavenders crowd, and they grow. Al-Junnar trees, and there are other valleys whose floodplain is covered with oleander trees, as is the case in Gali Zakho, in which mint and rhizome bushes also grow.

Hydrological Characteristics Of The Basins Of The Study Area

The hydrological characteristics are among the factors affecting the surface runoff process and the water budget of the drainage basins, as they are considered a reflection of the terrain and climatic conditions of the basins of the study area, and the study of these characteristics helps in predicting the quantities of runoff water for the basins and the size of their utilization in human uses and various fields of development, in addition to the dangers of floods Concerning lives and property, the study area is among the most affected northern Iraqi governorates by torrential manifestations, due to the abundance of rain that falls on it and the high elevations that cause the erosion of a lot of mud and rockfall. The hydrological characteristics include the following variables, Table (2).

1. Concentration Time Tc:

It is the time it takes for the water to move from the farthest point from the drainage basin to the outlet of the basin, i.e. the time required for the water flow to reach its highest level and stability at this discharge no matter how long the rainstorm is, the concentration time from the hydrological point of view is the most important variable in the water basin as seen To rainstorms whose duration exceeds the concentration time as a unit of time capable of forming a surface water runoff inside the basin causing torrential and destructive torrents and floods, the basins that record a long period of time indicate that the basin is characterized by low risk rates, while the basins that record a short period of time It indicates a high probability of risk, and the time of concentration was found in the basins of the study area according to the following equation .[(1)]

$$TC = 75\frac{4(s)^{0.5} + (1.5l)}{0.8(H)^{0.5}}$$

After applying the equation to the basins of the study area, as in Table (2), it is clear that the lowest value was recorded in the first and sixth basins, with values of (2.26, 2.45) hours, and the highest value recorded in the main basin (3.23) hours. As for the other basins, the second basin recorded (3.13 hours, the third basin 3.02 hours, the fourth basin 3.01 hours, and the fifth basin 3.40 hours. Water bodies receive a large water momentum that could pose destructive hazards along the course.Also, the concentration time has a positive relationship with the risk of flooding and an inverse relationship with the areal characteristics of the basin.

2. Deceleration Time Tp:

It means the time between the onset of rain and the beginning of the generation of runoff, and the study of the slowdown time is useful in identifying the time required for the start of surface runoff in each basin, as well as calculating the leakage loss during time, which is also useful in calculating the total losses in the drainage basins (), and there is an inverse relationship between the degree of severity And the time of deceleration, as the degree of risk increases with a decrease in the deceleration time because of the decrease in the period of time required for rainwater to occur surface water runoff, and therefore the shrinking of the time period leads to a decrease in the amount that is exposed to evaporation and leakage. The (SNYDER) equation was relied upon to extract the deceleration time, which is [(2).]

$$Tp(hr) = Ct(lb\ lca)^{0.3}$$

After applying the equation and as in Table (2), the main basin recorded the highest value of (8.67) hours, then the first and sixth basins, which recorded close ratios (4.34, 4.66) hours, then the fourth basin (3.40) hours, while the second, third and fifth basins recorded the lowest. The values are (2.34, 2.76, 2.67) hours, and these low rates are very dangerous. There are several factors that led to a decrease in the values of these basins, including the high rates of leakage in the stream. stream slope

3. Base Time For Torrents:

It expresses the time or period of time required for the basin to drain the entire amount of water from the source to the downstream ,The following equation is used to extract the base time [(3)]

$$Tb(hr) = Tp \times 4$$

By applying the above equation and as in Table (2), it became clear that the highest value of the base time amounted to (34.68) / hour, in the main basin (Pashadim), while the lowest value was (11.4) / hour, in the second basin, while the rest of the basins were (17.36). (1 hour / for the first basin, (11.88) hours / for the third basin, (13.6) hours / for the fourth basin, (11.24 hours / for the fifth basin, and (18.68) hours / for the sixth basin.

4. celiac flow velocity V:

Measuring the velocity of the cathode flow is an indicator that shows the gravity of the drainage basin during the catalytic runoff, as well as its ability to sculpt and transport sediment (), and the velocity of the cathode flow can be extracted through the following equation[4].

$$v = TC/L$$

After applying the above equation and as in Table (2), it became clear that the fifth basin recorded the highest values, which amounted to (43.42) minutes / km, while the lowest values were recorded in the main basin, which amounted to (7.40) minutes / km. Among them, the first basin recorded (16.99) minutes/km, the second basin recorded (39.81) minutes/km, the third basin recorded (28.72) minutes/km, the fourth basin recorded (25.35) minutes/km, and the sixth basin recorded (13.97) minutes/km.

5.Ceiling flow volume, Qt:

It is the amount of water passing through the drainage network of the basins, if the amount of rain exceeds the amount of losses from the leakage process, due to the lack of evaporation losses during the period of rain, and it is extracted from the following equation .[5]

$$Qt(M^{3}/_{s}) = \sum (km)^{0.85}$$

After applying the above equation and as in Table (2), it became clear that the highest value was recorded in the main basin, which amounted to (151.357) m3/s, then comes the first basin with a value of (43.061) m3/s, then the fifth basin with a value of (35.386) m3/s. Second, the third basin ((22.609) m3/s, the fourth basin (15.513) m3/s, the fifth basin (13.922) m3/s, while the lowest value of the flow volume was (9.988) m3/s in the second basin.

5.Maximum torrent flow (peak discharge) QP:

The peak runoff occurs when the surface water in the water basins reaches its maximum and reaches the peak of its flow, which causes the occurrence of torrents. There is a strong relationship between the size, length and period of the rainstorm and the occurrence of the maximum flow of torrents. If the rainstorm is at the beginning of the rainy season, the soil will seep into it a large amount of Water because it is dry, so the occurrence of the maximum flow will be delayed, especially if the size and duration of the rainstorm are small. On the contrary, if the rainstorms are successive at the height of the rainy season, the soil receives small amounts of water because it is already saturated, and therefore the rain that falls turns directly into surface runoff, and the maximum flow can be extracted through the following equation [6]

$$QP(m^{3}\ /\mathrm{s}) = \frac{CP \times A}{tp(hr)}$$

After applying the above equation and as shown in Table (2), it is noted that the highest values for the maximum flow were recorded in the main basin, which amounted to (55.74) m3/s, while the lowest values for the flow were recorded in the second basin with a value of

(7.52) m3/s. As for the first, third and fourth basins The fifth and sixth values (25.73, 16.75, 9.19, 9.40, 19.74) m3/sec were recorded.

6.The ideal time for rain, Tr:

It expresses the time period required for rain to cause surface runoff from the beginning of rain until the occurrence of surface water runoff, and the factors of rock structure, composition and slope have a prominent role in the region for the occurrence of surface runoff during a rainstorm, and the ideal time period can be extracted through the following equation.[7]

$$Tr(hr) = \frac{tp(hr)}{5.5}$$

After applying the above equation and as in Table (2), it became clear that the highest peak precipitation time was recorded in the main basin (94.5/min), while the lowest values of the precipitation peak were recorded in the second basin (30.1)/min.

As for the basins (first, third, fourth, fifth, and sixth), they recorded (50.8, 30.6, 37, 32.4, 47.4) / min. All recorded values indicate that the time needed for rain to generate a water flow is considered very ideal, and therefore any rain falls Water runoff can occur, regardless of the rain sequence which will shorten the time for water flow to occur in the basin.

7. Torrent strength F:

It is one of the very important hydrological characteristics as it shows the power of the torrent in the water basins, which is produced by the peak of the rain storms, and this coefficient is mainly related to the nature of the slope of the basin and its spatial characteristics as well as the nature of the geological formation[8].

$$F = Qp(m^3/S)/\sqrt{A(Km2)}$$

After applying the above equation and as shown in Table (2), it was found that the second basin had the highest values, reaching (7.560) m3 / s / km 2, and the slope and the small area played a role in this for the basin, then it was followed by the first basin with a value of (5.020) m3 / s/km 2, while the lowest values were recorded in the fourth basin (3.390) m3/s/km 2, while the basins (the third, fifth, sixth and main basin) recorded values (4.886, 3.772, 4.206, 4.821) m3/s/km2

8.Fp fixed dropout value:

This coefficient measures the amount of water penetrating into the soil regions as a result of the groundwater seepage process, where the penetration is as much as possible at the beginning of the rainfall because the land is dry and then decreases when the soil reaches the saturation stage, and this coefficient is related to the slope of the land and the type of rocks that make up the soil regions as well The area of the drainage basin, where the leakage increases with the increase in the area of the drainage basin, and the value of leakage is extracted through the following equation [9].

$$Fp = A \times Tp \times 0.0156$$

After applying the above equation and as shown in Table (2), it was found that the highest value of groundwater seepage was recorded in the main basin with a value of (15,578 m3 / km2), then comes the first basin with a value of (1.802) m3 / km2, then the sixth basin

(1.57) m3 / km 2, while the basins (second, third, fourth and fifth) recorded values of (0.213, 0.550, 0.396, 0.276) m3 / km2.

9 . flood coefficient

It is one of the hydrological parameters of importance in knowing the size and risks of flooding in the waterways of the water basins. The longer the lengths and numbers of waterways within the boundaries of the area unit of the water basin, the greater the possibility of flooding. This coefficient is extracted through the following equation [(10)]:

Flood coefficient = longitudinal discharge density (km / km2) X frequency of first-order sewers (stream / km2)

After applying the above equation and as shown in Table (2), it is noted that the highest values were recorded in the fifth basin, (23.46 streams / km / km2), then comes the second basin with a value of (20.95 streams / km / km2), then the first basin with a value of (18.03 stream / km / km2, then the main basin (17.51 stream / km / km2), then the third basin with a value of (16.85 streams / km / km2, then the fourth and sixth basins with a value of (15.80), 14.46) stream / km / km2, that all of these The values are high and therefore have a high flood potential.

Hydrogeomorphological risk assessment

All hydrological transactions in the basins were given a degree or value based on the risk assessment that could result from them. These grades are (one degree) if the risk assessment is weak, (two degrees) if the risk assessment is medium, and (three degrees) if the risk assessment is moderate. The risk assessment was high, after that the risk scores are collected for each of the basins and a rating is given on the level of risk

1 . focus time

It is the time it takes for the water to flow from the source to the estuary at a fixed level. If the period is short, it means a rapid flow that results in a greater risk of erosion, erosion and demolition. From the observation of Table (2), we note that all values are very low, so they take a high risk level. (3).

2 . deceleration time

This coefficient refers to the time between the peak of precipitation and river discharge, i.e. the time that separates between the peak of rain fall and the occurrence of leakage, saturation and water runoff before the peak to the time of the peak in river discharge. If this period is low, it indicates a high level of risk, and from observing the values of Deceleration in schedule.

(2) We notice a decrease in all values in the basins, and therefore all basins take a high degree of risk (3)

3 . base time.

This coefficient expresses the period of time required for the basin to drain all its water, and low values are considered an indication of a high level of risk due to the inability to benefit from the water and its depletion very quickly, and from the observation of Table (2), the risk levels were evaluated as follows:

♣ More than 15 hours, high risk (3) (for basins II, III, IV, V)
♣ From 15-30 hours, medium risk (2) (for the first and sixth basins)

♣ More than 30 hours of low risk (1) the main basin (Bashdim).

4. Ceiling flow rate

The velocity of runoff has a direct relationship with the activity and actual increase of geomorphological processes such as demolition, carving, erosion and sedimentation, and thus increasing the risk values. Accordingly, and from the observation of Table (2), the degrees of risk in water basins can be classified as follows:

♣ Less than 15 km / min, high risk level (3) for basins (sixth, main)
♣ From 15-30 km / min, medium risk level (2) for basins
(first, third, fourth)
♣ Greater than 30 km / min, low level of danger (for basins, second and fifth)

5 . effluent volume

The volume of runoff reflects the total volume of water received by the basins from the tributaries feeding them. The application of the equation for finding the volume of runoff showed a variation in the volume of water received into the basins, as shown in Table (2), and accordingly, the risk levels were assessed as follows:

♣ High risk level (3) for the main basin
♣ Medium risk level (2) for the first and sixth basins
♣ Low risk level (1) for the second, third, fourth and fifth basins

6. The ideal time for rain

This factor means the time period necessary for rain to cause surface runoff from the beginning of the rain fall after the completion of the leakage process.

♣ Less than 33 minutes, a high risk level, as in basins (2, 3, 5).
♣ Between 33 _66 minutes, medium risk level as in the first, fourth and sixth basins
♣ Greater than 66 minutes, low risk level, as in the main basin (Bshadim)

7.Torrent strength

This coefficient refers to the power of the torrential rain that is produced by the rainstorm inside the water basins, and it is related to several factors, including the nature of the slope of the basin, the nature of the geological formation, and the area of the basin, and the level of risk is related to a direct relationship with the power of the torrent, and from the observation of Table (2) that all basins are of high risk (3)

8.flood coefficient

The results of this coefficient, as shown in Table (2), indicate that all basins have recorded high values for the possibility of flooding, which ranged between (14.46 _ 23.46 streams / km / km 2), so they take a high risk level (3)

Conclusions

We conclude from the foregoing that the study area is located at the feet of the mountains within the (Sulaymaniyah-Zakho) belt within the unstable range, as the study has proven through the evaluation of (10) hydrological parameters in the study area, that it is of high risk in all basins.

Recommendations

The recommendation of the Ministry of Transport and Communications to establish advanced monitoring stations to predict rain and its abundance and enable it to reduce the risks of runoff when severe rainstorms occur.

References

1.Jaton.J.F.Hydrologyic Dec reface(I ere partes) Emolument.De surface ET debitS Cruse .Cole poly Technidue.lnstae lnstitute De Genuine Rural,Lausanne,1980.p41

2.Dewey , G .F.pitman , w.Ryan,W,B.F,and Bonnim , " Plate tectoice and the evaluation of Alpinc systm " ,Geol. Soc. Am . Bull ., 1973 ,P.84. 3.lbrahim , M.W., shifting depositional axes of lraq an outilon of geosynclinals histore ,journal of Petrolem Geologe ,vol .2 . , 1979 . P .181

4.Buday , the Regional geology of lraq vo . Stratigraphy and paleogeography , Baghdad . 1984 P:1.

H.M. Raghunath, Hydrology , Princples .Analysis and Desing .John Wiley .New York , 2006,P150.

Wibur L. MeIeR, Jr, AnAlsIs of unIT hydrogrphs for small water Heds in Texas water eOmmtssio , Bulletin, 6414,1964,P3.

7.Federal Republic Of Nigeria Federal Ministry Of Works , Highway mannal part 1 : DESIGN VOLUME Iv , DRAING .2013. P 11.

8.Maala ,Kh ,eat . ,Report on the geological inverstgaton for native sulphur in the northern sector of the Fathe _ Mosul , Unpublished report ,no .1389,1988 P.95 _101.

sissakina , v .k Geoiogicsl Report Kirkuk Quadrangle, Sheer No .Nl _38_02 ,Seale 1:250000. Lrad Geological Survey , Baghdad ,lrad , p14.

10.Sissakian ,v .k Geologicsl mapof lrad Sheet no ,1 3rd ed .geol surt min , Baghdad 2000 .