Using Of Shields Parameter As A Determinate For The Sediment Movement In Irrigation And Drainage Channels(A Case Study in Central Region of Iraq)

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Abstract

Shields parameter is an important non dimensional number used to calculate initiation of moving of sediment in channels. This research aims to evaluate sediment movement by using this parameters as a determinant , and to find the appropriate equation to explain this effect in calculating of sediment discharge in irrigation and drainage channels in Iraq. The field and the laboratory works have been achieved within a period of 12 months from March 2015 to March 2016 due to cover the seasonal variability of the data. The results shows that the soil texture is silty sand with a small rate of clay and specific gravity value of soil samples ranged between 2.66-2.73. Moreover, the study found that the Shields parameter values (θ) for the movement are larger than the critical values (θcr) in all channels, also; the transmission of sediment is located along the channels. Two logarithmic equations have been developed to estimate discharge of sediment by using the Shields parameter. The correlation coefficients is 0.93 for the flow in irrigation channels and 0.61 in drainage channel . This indicated that there is a high correlation level between shields parameter and the movement of sediment in irrigation channels. While there is a slightly low level of correlation in the drainage channels. This mirrors the need to develop a periodic program for maintenance of those channels and to maintain hydraulic flow specifications.

Key Words: Sediment transport, Shields Parameter, Critical Shields Parameter Irrigation channels, Drainage channels

الخلاصة

يهدف البحث إلى تقييم استخدام معامل شيلدز كمحدد لحركة الرسوبيات ، بالإضافة إلى إعداد معادلة ملائمة لبيان تأثير هذا المعامل في حساب تصريف الرسوبيات في قنوات الري و البزل في العراق. استمرت فترة البحث لمدة ١٢ شهرا بدءا من شهر آذار2015 مستوفية التغاير الموسمي أثناء فترة الفحص . أظهرت النتائج إن نسجه التربة لقاع القنوات كانت رملية غرينية مع نسبة قليلة من الطين .وان الوزن النوعي للتربة تراوح بين ٢.٦٦-٢.٧٣ . لقد أوضح البحث إن قيم معامل شيلدز(θ) كانت اكبر من قيمه الحرجة(θcr) في كافة القنوات (موضوع البحث)، وتقع ضمن منطقة حركة وانتقال الرسوبيات على امتداد طول تلك القنوات. تم استنباط معادلة لوغاريتمية يكون فيها معامل شيلدز كعامل رئيسي في حساب تصريف الرسوبيات لكل من قنوات الري والبزل، وبمعامل ارتباط ذو قيمة عالية (٠.٩٣ للجريان في قنوات الري و ٠.٦١ للجريان في قناة البزل). أثبتت نتائج البحث ضعف تطبيق العلاقة بين معامل شيلدز وحركة الرسوبيات في قنوات البزل مقارنة بحالة الرسوبيات والجريان في قنوات الري. كذلك أوضحت النتائج مدى الحاجة إلى تطوير برنامج دوري لصيانة تلك القنوات والمحافظة على المواصفات الهيدروليكية لها .

كلمات مفتاحية : رسوبيات ، معامل شيلدز ، معامل شيلدز الحرج ، قنوات الري ، قنوات البزل

Introduction

There are many factors such as environmental variables of climatic conditions, movement of agricultural production and human activities which play a major role in sediment movement in irrigation and drainage channels. These factors are considered as a part of the hydraulic dynamics of flow in these channels (Liu , 2001). The hydrological of sediment movement works to change channel section, stability and hydraulic parameters of the flow. Shield parameter is one of the main factors influencing on the sediment movement (Liu, 2001; Zadeh, 2012). The effects of environmental and hydraulic variables have been studied to determine the volume of sediment load by many researchers. Many researches in Iraq have been studied sediment movement in irrigation channels. (Al-Omran *et.al.* , 1995) described and analyzed the sediment distribution in the Musayib project channel, also; (Al-Delewy , 2004) studied the factors affecting on the inception of sediment movement in irrigation channels and their relation to the Shields diagram. In (Al-Delewy , 2005) clarifies the relationship of sediment particle size with the bed load on the bottom of irrigation channels. Some studiess classified the effect of size and movement of sediment particle on the volume of sediment load in irrigation channels (Ahmed *et.al.*, 2007). Also; (Brownlie , 1983) studied the dimensional analysis for several hydraulic parameters such as the effects of a critical Froude number of particles, critical shear stress of flow, Reynolds's number of particles to calculate the amount of sediment load in irrigation and drainage channels. (Van-Rijn , 2012) conducted extensive studies on the effect of hydraulic variables such as bed shear stress, the diameter of sediment particle to calculate the bed sediment load, and he also explained the effect of shape factor of sediment particle , flow velocity and reference concentration of sediment to determine the volume of suspended sediment load . Some research studies stated the effect of energy dispersion of flow on the sediment distribution by studying the non-dimensional analysis rate of the turbulent energy to the flow depth in channels, and by preparing mathematical coefficients include these variables to calculate the volume of sediment load (Ahmed *et.al.*, 2007). (Choden , 2009 ; Kheder *et.al*., 2014; Kwan *et.al.,*2010; McDonald *et.al*., 2010 ; and Osman et al. 2011) have set up mathematical models and simulation system for the movement and distribution of sediments, also they also studies the effects of some variables such as diameter of sediment particle, settling velocity and shear stress of flow to construct these models. This research aims to evaluate the use of shields parameter as a determinant sediment movement.The study also the preparation an appropriate equation to explain the effect of using this parameter on calculating the sediment discharge in irrigation and drainage channels in Iraq , In addititION to the study of the relationship between shields parameter and other hydraulic variables of flow in these channels. This work is carried out in irrigation and drainage channels in the central region of Iraq.

2. Methodology

2.1 Study Area

This research is carried out in central region of Iraq. The study area is located between from latitude (32 to 33) N and longitude (44 to 45) E **(Figure 1)** .The study area is characterized by sedimentary soil with a diversity of water resources and hydraulic specification, therefore it has been chosen for the purpose of the research

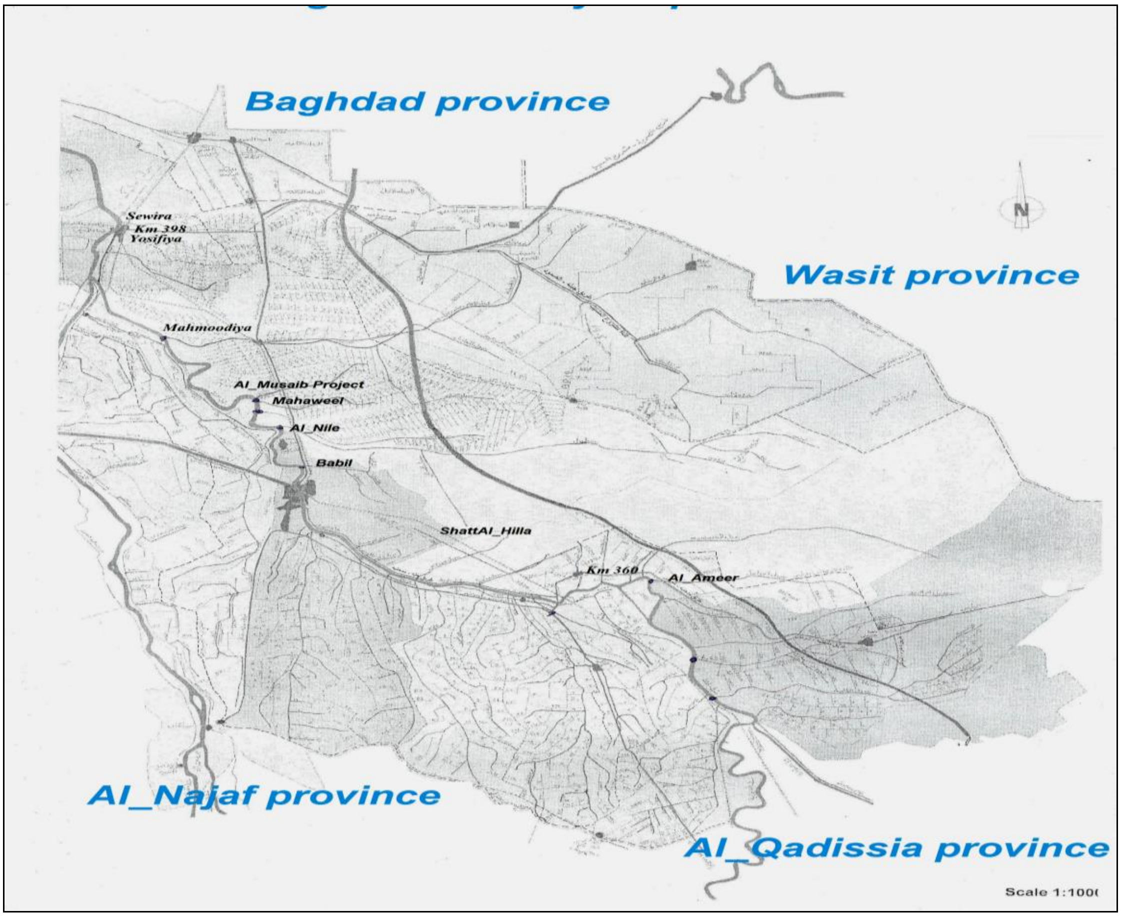


Figure 1. Illustrate the study area located central region in Iraq

2.2 Shields Parameter Mathematical Model

Sediment movement in irrigation and drainage channels is affected by the hydrodynamic forces and this movement is classified as unstable due to the impact of the turbulence fluctuation of flow. There are three types of movement that can be identified for the sediment particles, rolling & sliding, saltation and suspension. Hydrodynamic forces are working on activating movement of sediment particles, in case of any increase in these forces, the sediment particles start to move irregularly (rolling & sliding). When the hydrodynamic forces reach the threshold of movement of suspended particles then particles will begin to diffuse through the flow section. Hydrodynamic forces it is commonly prescribed by the amount of effective shear stress at the bottom of channels as shown below (Liu ,2001; Zadeh ,2012):

$$\tau < \tau_{cr} \qquad no\ motiom \qquad \ldots(1)$$

$$\tau_{cr} \leq \tau \leq \bar{\tau}_{cr} \qquad bed\ load\ transport \qquad \ldots(2)$$

$$\tau > \bar{\tau}_{cr} \qquad bed\ \&\ suspended\ loads\ transport \qquad \ldots(3)$$

Where τ is bed shear stress, τ_{cr} is critical shear stress for initiation of particle motion, $\bar{\tau}_{cr}$ is critical shear stress for initiation of suspended particle.

Several studies (Brownlie ,1981; Liu, 2001; Madsen ,1996; Van-Rijn, 2012; Zadeh,2012) used the critical shear stress parameter to describe the flow conditions affecting on the movement of sediment particles, and they stated that the Shields diagram is properly defined to describe that movement. Shields diagram represents the relationship between critical Shields parameter and the hydraulic conditions of the flow at the bottom of channel which is expressed in a Reynolds number of sediment particles. The amount of Reynolds number of the particles depends on the determining of particle′s diameter and the shear velocity values. Sediment particle starts moving when the mobility Shields parameter value becomes greater than a critical Shields parameter as it is shown in the following equations:

$$\theta_{cr} = \frac{U_{*cr}^2}{(s-1)*g*d_{50}} = \frac{\tau_{cr}}{(s-1)*\rho*g*d_{50}} \quad ...(4)$$

$$Re_* = \frac{U_{*cr}*d_{50}}{\upsilon} \quad ...(5)$$

$$\boldsymbol{\theta} = \frac{U_*^2}{(s-1)*g*d_{50}} = \frac{\tau}{(s-1)*\rho*g*d_{50}} \quad with \quad U_* = \sqrt{gRS} \quad ...(6)$$

Where θ is dimensionless mobility Shields parameter, θ_{cr} is dimensionless critical mobility Shields" parameter, Re_* is dimensionless particle Reynolds number U_* is shear velocity m/s, U_{*cr} is critical shear velocity m/s, τ is shear stress N/m^2, τ_{cr} critical shear stress n/m^2, υ is kinematics viscosity m^2/s, d_{50} is median diameter of particle m. So that the following equations are considered a mathematical formula to explain the start of sediment movement.

$$U_* > U_{*cr} \quad ...(7)$$

$$\tau_b > \tau_{bcr} \quad with \ \tau_{bcr} = \rho * U_{*cr} \quad ...(8)$$

$$\theta > \boldsymbol{\theta}_{cr} \quad with \ \boldsymbol{\theta}_{cr} = \frac{U_{*cr}^2}{(s-1)*g*d_{50}} \quad ...(9)$$

(Figure 2) illustrates Shields diagram, which represents the relationship between a critical mobility Shields parameter and a Reynolds number of sediment.

Indeed, (Madsen , 1996) pointed out the difficulty of applying the shields diagram due to the presence of $U*_{cr}$ in both axes of diagram. Therefore , Madsen worked to use a new variable instead of Reynolds number in the horizontal axis of diagram as it is shown in **(Figure 3)** . This Figure indicates the relation between the critical shields parameter in Y-axis and new variable which is sediment-fluid parameter S_* in the X-axis.

S_*Value is calculated from the following equation:

$$S_* = \frac{d_{50}}{4\upsilon}\sqrt{(s-1)gd_{50}} \quad ...(10)$$

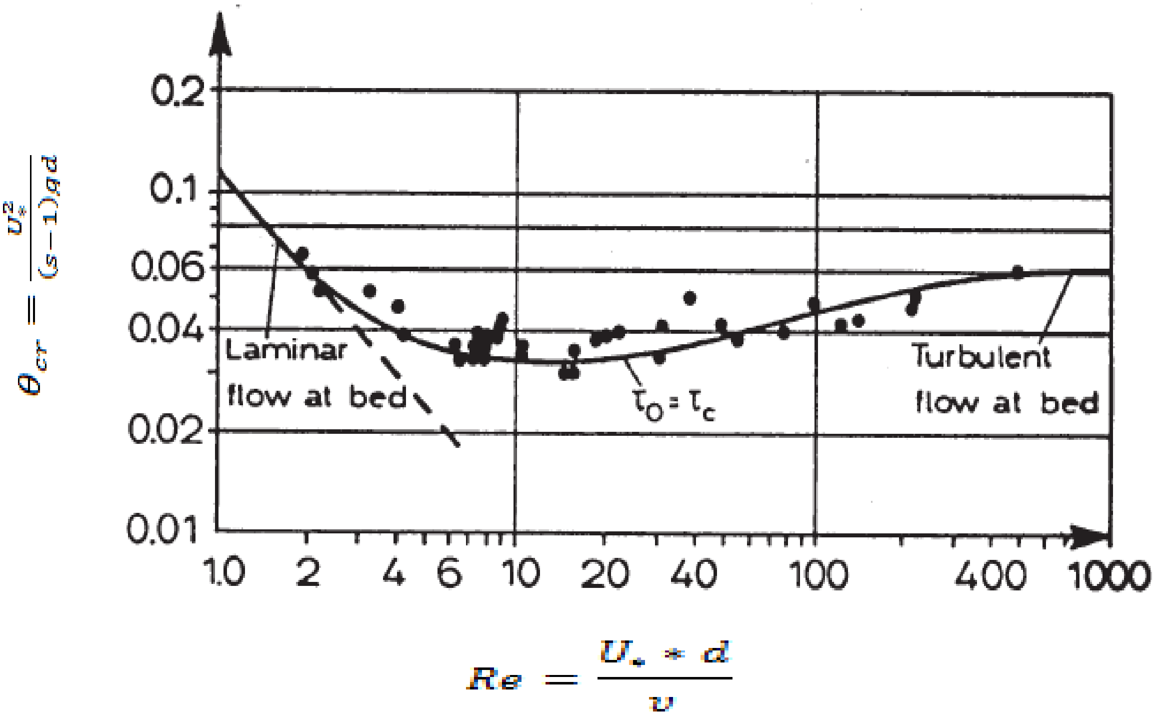


Figure. 2 illustrates Shields Diagram of Sediment Particles Movement,Liu (2001)

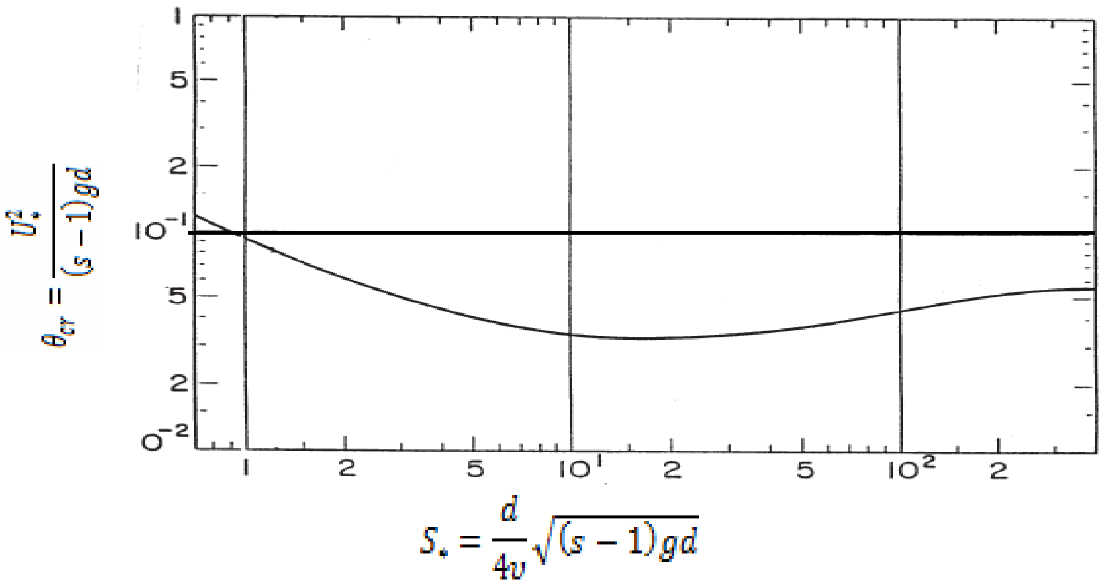


Figure 3. Indicates the Relation Between the Critical Shields Parameter θ_{cr} and Sediment-Fluid ParameterS_*, Liu (2001)

This approach is used to calculate S_* value. The calculated value used to determine the amount of critical Shields parameter θ_{cr} by using **(Figure 3)** which will help in describing the velocity of particle movement, and the possibility of deposition of particles occurred at the flow cross-section.

3. Field and Laboratory Works

Field and laboratory works have been carried out in the central region of Iraq in some of irrigation and drainage channels for 12 months from March 2015 to March 2016 due to cover the seasonal variability of the data. These channels are characterized by different amounts of flow discharge and hydraulic parameters. The selected channels for this work are Shatt al-Hilla, Musayib project channel, small irrigation channels branching from the Shatt al-Hilla, and the various locations on the main drainage channel Al-Masab Al-A”am as it is shown in **(Figure 1)**.

3.1 Flow Discharge in Irrigation and Drainage Channels

Flow discharge measurements have been done on the target channels by using a current meter device to measure the flow velocity. In each channel one location has been selected to accomplish the work of tests. This location should be characterized by the necessary specifications to give a good general idea of the hydraulic parameters for each channel. By current meter measurements , flow velocity can be then obtained by the multiplication of this value by the cross section area and the outcome leads to determine total discharge in each channel or drain. Hydraulic data can be shown in **Table 1**.

3.2 Soil size Analysis in Irrigation and Drainage Channels

Soil samples have been collected from channels and drains in the studied area. Three samples in each cross-section were taken . One of these samples is taken from the middle and others are taken from each side of the cross- section. The purpose behind of taking three samples is to obtain an accurate distribution of the sediment particles. An analysis of the distribution of sediment particles was conducted in accordance with the classification based on the size of the soil particles. The analysis alsodetermined the required specifications to calculate the volume of sediment discharge.

3.3 Concentration of Sediments in Irrigation and Drainage Channels

Several water samples were taken to determine concentration of sediment by using a device bottle type designated for that purpose. The standard method for measurements has been done which it is divided cross section for many segments. Samples were taken from different heights of the water depths then one sample was selected for each flow discharge. For some channels two samples were taken for the tests due to cover the seasonal variations summer and winter seasons of data search. The concentration of sediment at each test location is calculated by taking the concentration value of each segment multiplied by its area, and then collecting them. The collecting result was divided by the total area of cross section for obtaining the sediment concentration rate of each amount discharge per location at each channel. The unit of concentration measurement is ppm. Concentrations of sediment in the water of those channels are shown in **Table 2.**

4. Results and Discussion

4.1 Soil Texture and Specifications of Bed Channels

Results of soil particle- size which is shown in **Table 2** illustrate that there is a convergence in the sizes of particles diameter. The soil classification of samples showed that the soil texture was silty sand with a small rate of clay. Value of specific gravity of soil samples ranged between 2.66-2.73. Soil analysis also indicated that the percent finer of soil particles-size ranged between (d_{35}=0.028-0.148 mm, d_{50}=0.062-0.237 mm, d_{65}=0.097-0.385 mm). Moreover; soil classification showed that there is an increasing in the soil particle diameter in the drainage channels, When compared to the counter parts the irrigation channels to this notion is be cause drainage water carried different chemical contaminants and soil erosion of agricultural land .

Table 1. Hydraulic Data for Irrigation and Drainage Channels in Study Area

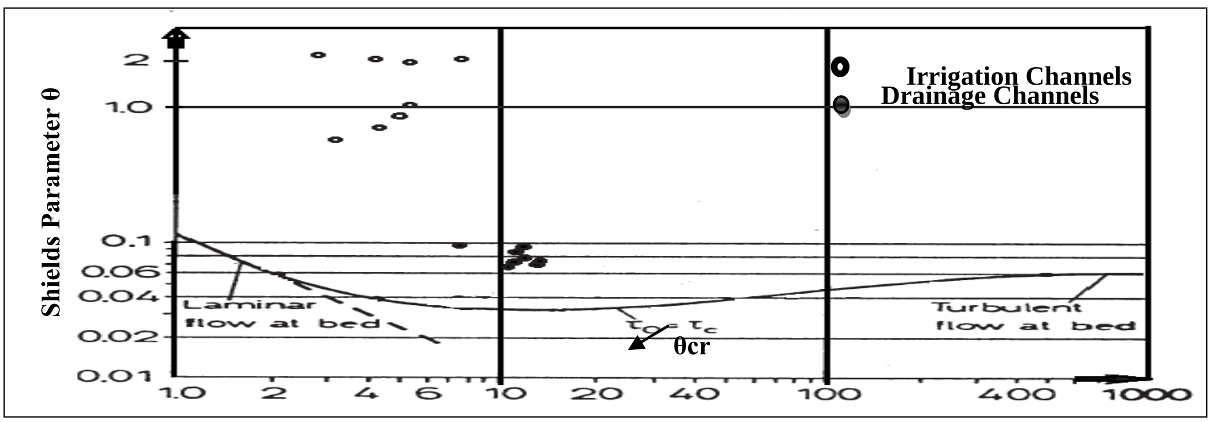
Channel name	Channel type	Sample Location	Bottom width, B (m)	Mean depth, d (m)	Area section, A (m2)	Hydraulic radius, R (m)	Mean velocity V (m/s)	Channel slope, S (cm/Km)	Manning coefficient, n	Discharge, Q (m^3/s)
Al_Mahaweel	Irrigation	Km 1	10.50	1.55	18.67	1.255	0.570	15	0.025	10.645
Al_Nile	Irrigation	Km 1	4.50	1.10	6.16	0.809	0.582	18	0.020	3.585
Babil	Irrigation	Km 1	6.40	1.30	10.01	0.993	0.545	12	0.020	5.455
Al_Ameer	Irrigation	Km 1	6.70	1.70	14.28	1.240	0.578	17	0.026	8.253
Al_Musaib Project	Irrigation	Km 1 Km 20 Km 35	19.47 19.26 18.90	2.88 2.33 1.80	64.36 50.30 37.26	2.289 1.945 1.553	0.781 0.724 0.653	13 14 15	0.025 0.025 0.025	50.260 36.411 23.821
Shatt Al_Hilla	Irrigation	Km 39	48.00	6.78	325.41	5.286	0.848	8	0.032	275.950
Al_Masab Al_A'am	Drainage	Yosifiya	20.00 20.00	4.973 4.747	107.709 124.919	2.550 3.030	0.210 0.235	10 10	0.089 0.089	22.619 29.356
		Mahmoodiya	20.50 20.50	4.329 4.976	109.212 144.935	2.740 3.390	0.222 0.246	10 9	0.088 0.087	24.245 35.654
		Sowira	20.80 20.80	4.211 6.298	119.185 168.223	3.312 3.866	0.238 0.256	8 8	0.087 0.086	28.366 43.065
		Km 360 Km 398	21.20 20.40	6.50 5.0	222.30 139.50	4.422 3.630	0.261 0.254	7 9	0.086 0.088	57.800 35.433

Table 2. Characteristics of Sediment load for the Irrigation and Drainage Channels in Study Area

Channel name	Channel Type	Sample Location	Sediment Concentration ppm	Particle Diameter (mm)			Soil Specific Gravity, s	Sediment Discharge, Qs (m^3/s)
				d_{35}	d_{50}	d_{65}		
Al_Mahaweel	Irrigation	Km 1	185	0.078	0.115	0.210	2.69	$7.321 *10^{-4}$
Al_Nile	Irrigation	Km 1	182	0.069	0.100	0.195	2.68	$2.435 *10^{-4}$
Babil	Irrigation	Km 1	168	0.063	0.095	0.190	2.66	$3.419 *10^{-4}$
Al_Ameer	Irrigation	Km 1	181	0.078	0.115	0.210	2.66	$5.553 *10^{-4}$
Al_Musaib Project	Irrigation	Km 1	172	0.060	0.091	0.186	2.71	$31.899*10^{-4}$
		Km 20	184	0.052	0.081	0.152	2.70	$24.813*10^{-4}$
		Km 35	197	0.028	0.062	0.097	2.70	$17.380*10^{-4}$
Shatt Al_Hilla	Irrigation	Km 39	202	0.073	0.120	0.310	2.71	$205.68*10^{-4}$
Al_Masab Al_A'am	Drainage	Yosifiya	231	0.085	0.152	0.286	2.71	$19.280*10^{-4}$
			277	0.110	0.214	0.339	2.71	$30.000*10^{-4}$
		Mahmoodiya	286	0.098	0.218	0.335	2.72	$25.492*10^{-4}$
			317	0.126	0.236	0.360	2.73	$41.400*10^{-4}$
		Sowira	304	0.100	0.211	0.336	2.73	$31.587*10^{-4}$
			339	0.142	0.242	0.383	2.73	$53.470*10^{-4}$
		Km 360	388	0.148	0.244	0.385	2.72	$82.450*10^{-4}$
		Km 398	326	0.100	0.206	0.330	2.73	$42.312*10^{-4}$

4.2 Shields Parameter as a Determinant for Sediment Moving.

Table 3. illustrated the Reynolds number values for movement of sediment in irrigation and drainage channels. Those values ranged between (2.976 -7.680) in irrigation channels, while these values ranged between (7.600-13.420). These results indicated that movement of sediment located within hydraulic transitional flow ($2 \leq Re \leq 500$) which means that the thickness of particle size of sediment is the same as that of the viscous sub layer of flow which lead to the results recorded by critical Shields parameter values close to 0.032 (minimum limit) this result agrees with (Van- Rijn 2012). The results in **(Figure 4)** showed that shields parameter values (θ) of the movement of sediment were larger than values of critical those of the (θcr) located within the transmission and sediment moved along the length of the channels and it does not have any effected on of the amount of flow. In addition **(Figure 5)** shows that (θ) values were a bout 10 times greater than (θcr) in the irrigation channels . The exception was Shatt al Hilla channel whose shield parameter values were 26 times in the irrigation channles and 19 times in the drainage channels .Therefore; according to these results the sediment load is in motion and continuous transition through the flow section of channels which means that the cross-sections of the channels would have to change due to the erosion and sedimentation processes according to the hydraulic conditions of the channels which need more periodic maintenance for these channels to keep flow specifications.



Reynolds Number

Figure 4. Illustrate Location of θ Values Compared with θcr in Shields Diagram

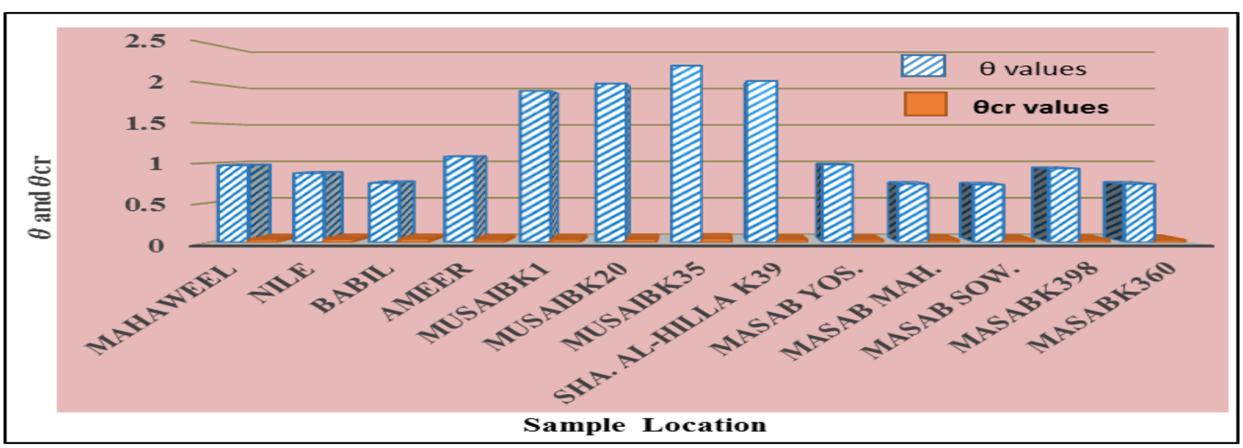


Figure 5. Shows Relation Between θ and θcr Values for Different Sample Locations

Table 3. Values of Shields Parameters for the Irrigation and Drainage Channels in Study Area

Channel name	Channel Type	Sample Location	Sediment Discharge , Qs (m^3/s)	Shear velocity, U_* (m/s)	Reynolds Number, Re_*	Sediment-Fluid Parameter, S_*	Shields Parameter, θ	Critical Shields Parameter, θ_{cr}	Critical Shear Velocity, U_{*cr} (m/s)
Al_Mahaweel	Irrigation	Km 1	$7.321 * 10^{-4}$	0.043	4.945	1.255	0.970	0.037	0.0084
Al_Nile	Irrigation	Km 1	$2.435 * 10^{-4}$	0.038	3.800	1.015	0.876	0.040	0.0081
Babil	Irrigation	Km 1	$3.419 * 10^{-4}$	0.034	3.230	0.934	0.747	0.042	0.0081
Al_Ameer	Irrigation	Km 1	$5.553 * 10^{-4}$	0.045	5.175	1.244	1.081	0.035	0.0081
Al_Musaib Project	Irrigation	Km 1	$31.899*10^{-4}$	0.054	4.914	0.889	1.910	0.037	0.0075
		Km 20	$24.813*10^{-4}$	0.052	4.212	0.744	2.002	0.039	0.0072
		Km 35	$17.380*10^{-4}$	0.048	2.976	0.498	2.228	0.046	0.0069
Shatt Al_Hilla	Irrigation	Km 39	$205.68*10^{-4}$	0.064	7.680	1.346	2.035	0.033	0.0082
Al_Masab Al_A'am	Drainage	Yosifiya	$19.280*10^{-4}$	0.050	7.600	1.918	0.980	0.033	0.0092
			$30.000*10^{-4}$	0.054	11.556	3.205	0.812	0.032	0.0107
		Mahmoodiya	$25.492*10^{-4}$	0.052	11.336	3.305	0.735	0.032	0.0108
			$41.400*10^{-4}$	0.055	12.980	3.734	0.755	0.032	0.0113
		Sowira	$31.587*10^{-4}$	0.051	10.761	3.157	0.726	0.032	0.0107
			$53.470*10^{-4}$	0.055	13.310	3.877	0.736	0.032	0.0114
		Km 360	$82.450*10^{-4}$	0.055	13.420	3.914	0.735	0.032	0.0114
		Km 398	$42.312*10^{-4}$	0.057	11.742	3.045	0.929	0.032	0.0105

4.3 Effect of Shields Parameter value on the Sediment Discharge

In this study a relationship between Shields parameter and the field discharge of sediments in the irrigation and drainage channels have been developed .A logarithmic equation has been revealed to estimate the discharge of sediment by using the Shields parameter as a main variable. This equation gives a high correlation coefficient value between two variables (θ_{cr}) & (Q_s/(ρ_s ((s-1) g $d^3)^{0.5}$), this value is about 0.93 for the flow in irrigation channels, however it is 0.٦١ in the drainage channels **(Figure 6).** the logarithmic equations are derived as follows:

$$\theta_{cr} = 0.3783\ \ln\left(\frac{Q_s}{\rho_s\sqrt{(s-1)gd^3}}\right) + 2.2732 \qquad \dots(11)$$

Using the implicit function (e^x) instead of ($\ln x$) for irrigation channels will give us the following equation:

$$\frac{Q_s}{\rho_s\sqrt{(s-1)gd^3}} = e^{\frac{\theta_{cr}-2.2732}{0.3783}} \qquad \dots(12)$$

Therefore; equation 12 will be as follows , for the irrigation channels :

$$Q_s = 2.46 * 10^{-3}\ \rho_s\ e^{2.64\theta_{cr}}\sqrt{(s-1)gd^3} \qquad \dots(13)$$

The logarithmic equation for drainage channels are derived as follows :

$$\theta_{cr} = 0.2681\ \ln\left(\frac{Q_s}{\rho_s\sqrt{(s-1)gd^3}}\right) + 1.4089 \qquad \dots(14)$$

Where as in the drainage channels the use of using the implicit function (e^x) instead of ($\ln x$), will give the equation below :

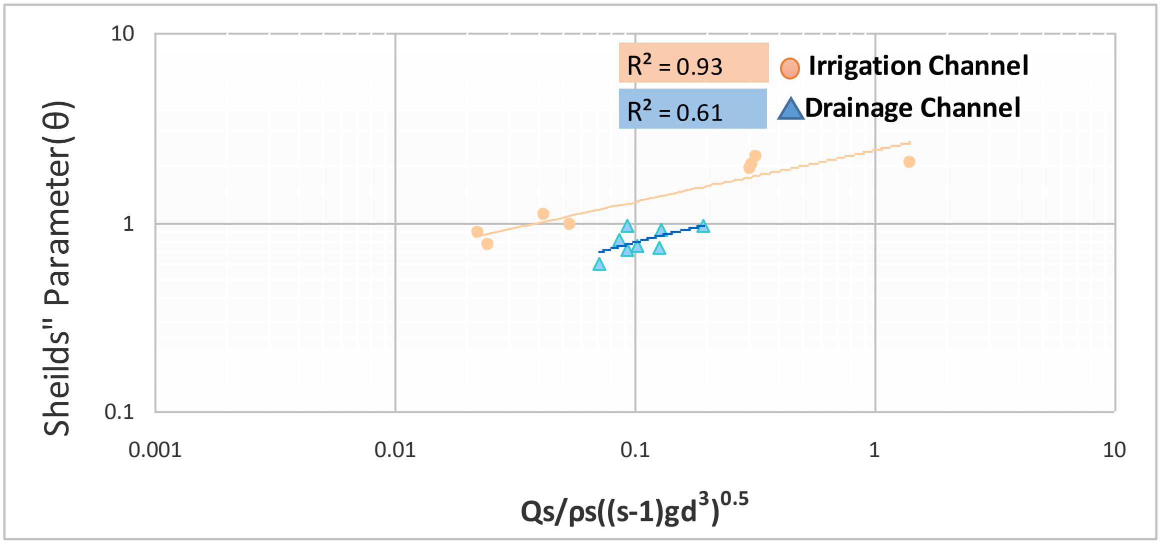


Figure 6. Shows Relation between Sediment discharge and Shields Parameter

$$\frac{Q_s}{\rho_s\sqrt{(s-1)gd^3}} = e^{\frac{\theta_{cr}-1.4089}{0.2681}} \quad \text{... (15)}$$

Then; equation 15 will be as follows which is used for the drainage channel:

$$Q_s = 5.2 * 10^{-3}\ \rho_s\ e^{3.73\theta_{cr}}\sqrt{(s-1)gd^3} \quad \text{... (16)}$$

Where:

Q_s : Sediment discharge Kg / s.m (m^3/ s.m),

θ_{cr} : Dimensionless critical Shields parameter,

d : Median diameter of particle (d_{50}) m, and

ρ_s : Mass density of sediment Kg / m^3

In the past all research studies focused and clarified the relationship between Shields parameter and the moving of sediment in irrigation channels; while resent research has attempted to clarify the applicability of that relationship in the drainage channels in addition to the interpretation of the irrigation channels. The results revealed weakness of application of this relationship in drainage channels due to the different mechanical specifications of the sediment and hydraulic variables of flow in these channels as compared to sediment status and flow in irrigation channels. Therefore;An extensive study to demonstrate the effect of Shields parameter on the movement and transport sediment in drainage channels. **Figure (7)** shows effect of the sediment-fluid parameter (S_*) on discharge of sediments (Q_s). The Logarithmic relationship emerged between these variables (S_* and Q_s) with a correlation coefficient of 0.73 for flow in the irrigation channels, though it decreased to 0.68 for flow in the drainage channel. The comparison between the relations of variables mentioned in **Figures (6 and 7)** shows the high degree of confidence in the relationship shown in **(Figure 6)**. It is due to the impact of interference between the hydraulic variables of flow and the mechanical specifications of sediment particle on the discharge of sediment, while in **Figure (7)** only the effect of sediment particle specifications appears on the discharge of sediment. So, the use of equations (13 & 16) .More accuracy and credibility to calculate the discharge of sediments in irrigation and drainage channels respectively . The application of those equations in other channels demonstrates its accuracy in calculating the sediment discharge.

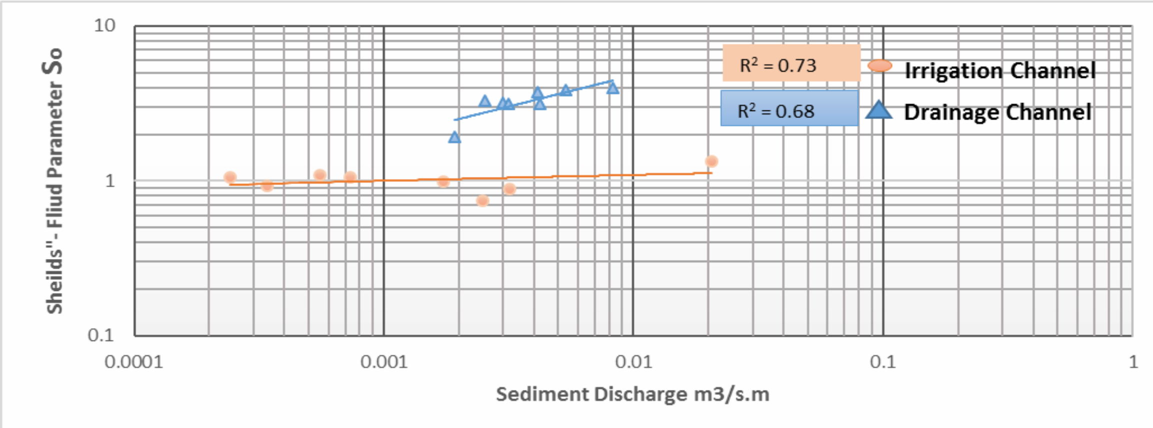


Figure 7. Illustrate the Relation between the Sediment Discharge and Sediment-Fluid Parameter

5. Conclusion

The hydrology of sediment movement works to change channel section, stability and the hydraulic parameters of the flow. Shield parameter is one of the main factor influencing the sediment movement. This research aims to evaluate sediment movement by using this parameter as a determinate. This work is carried out in irrigation and drainage channels in the central of Iraq. The results shows that Soil classification refers to the increase of soil particle diameter in the drainage channels as compared, comparing with the irrigation channels sites and soil texture was silty sand with a small rate of clay and the value of specific gravity of soil samples ranged between 2.66-2.73. The movement of sediment in irrigation and drainage channels is within the region of hydraulic transitional flow ($2 \leq Re \leq 500$) which means that the size of the sediment particle is the same in all the viscous sub layers of flow. Moreover; Shields parameter values (θ) of movement of sediment are larger than the values of critical values of (θcr) in all the studied channels, and they located within the transmission and the movement area of sediment along the length of the channels. The values of (θ) are greater than (θcr) by approximately 10 times in the irrigation channels, while these values are 19 times greater in the drainage channel, and they increased to 26 times in the Shatt al Hilla. Two Logarithmic equations have been developed to estimate the discharge of sediment by using the Shields parameter. The results revealed the weakness of the application of that relationship between shields parameter and the movement of sediment in the drainage channels as compared to the status of sediment and flow in irrigation channels. Studying and proposing the application of the suggested equations in other channels to demonstrate its accuracy in calculating the sediment discharge requires an extensive scientific effort to demonstrate the effect of Shields” parameter on the movement and transport of sediment in drainage channels.

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