Study the Effect of AL Shuwaja Depression Flood On Ground Water of East Tigris River in Wasit Province

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ABSTRACT

Present study was conducted at al Shuwaja depression east of wasit to evaluate the impact of surface water and it is effect on regional ground water. The study done with a system of 38 wells along line of 38 km passes the area of study. The work divided the line of study area in to three regions, one called the mid-section locate in the path of flood flow, and the other first and third on shoulder of the depression, right and lift. To assess the level of the pollution in ground water. The study shows an effect of the surface water on concentration of Mg, Cl and Na by increasing the concentration in depression in comparism with the other sector's first and third. Also the study show that the effect of flood on ground water was to decrease the concentration of total dissolved solids (TDS), TSS, NaCl, and SO_4. The study suggest to avoid the harem effect of water in depression on ground water by optimize and reduce the detention time of the flood water by pumping it to Tigris River at effluent of depression.

دراسة تأثير مياه منخفض الشويجة على المياه الجوفية في منطقة شرق دجلة في واسط

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الخلاصة

تعتبر المياه الجوفية من المصادر المهمة للمياه في العالم ومن المصادر المهمة في العراق تم في هذا البحث دراسة تأثير المياه المتجمعة في منخفض الشويجة في واسط وتراكيزها على تراكيز ونوعية المياه الجوفية في المنطقة قيد الدراسة. استخدمت في هذه الدراسة منظومة من الابار تم حفرها على طول خط الدراسة البالغ (38 كم) وبمسافة (1كم) بين بئر واخر . وتم تقسم خط الدراسة الى ثلاثة مناطق المنطقة الاولى من (0-7 كم) ايسر والمنطقة الثانية من (7-29 كم) وهي منطقة منخفض الشويجة والمنطقة الثالثة من (29-38كم) على يمين المنخفض. تم في هذا البحث دراسة تأثير مياه الفيضانات المتجمعة في منخفض الشويجة من خلال تقييم تأثير انتشار الملوثات المتمثلة في الأس الهيدروجيني (PH)، المواد الذائبة الكلية (TDS)، ايونات الكبريتات وايونات الصوديوم على نوعية المياه الجوفية ضمن منطقة الدراسة. تم التوصل من خلال الفحوصات المختبرية ضمن شهر ايار لعام 2008 الى ان تأثير مياه منخفض الشويجة على المياه الجوفية يؤدي الى زيادة في تراكيز المغنسيوم (Mg)، الصوديوم (Na) و اوكسيد الكبريت (SO_4) ضمن المسافة (7-29 كم) و كذلك يودي الى انخفاض في تراكيز ال (CL) و (TSS) و (TDS) و (NaCl) ضمن المنخفض. بينت الدراسة ارتفاع عالي في تراكيز المكونات في المياه الجوفية بصورة عامة عن مقبوليتها ضمن المعايير العالمية. و اوصت الدراسة ان يتم تقليل فترة البقاء لمياه الفيضانات المتجمعة ضمن منخفض الشويجة الى اقل فترة ممكنة لتلافي زيادة التراكيز في المياه المتجمعة نتيجة التبخر وعمل معادلة موازنة مائية يتم بموجبها اطلاق التصاريف الى نهر دجلة في منطقة اتصال المنخفض بالنهر.

Introduction

Ground water is rain water or water from surface water bodies. Like lakes or streams, that soaks into soil and bed rock and is stored underground in the tiny spaces between rocks and particles of soil. Groundwater pollution occurs when hazardous substances come into contact and dissolve in the water that has socked into the soil. Ground water pollution is a type of pollution which is occurs when ground water becomes contaminated. Around the world ground water pollution is very serious and costly.

Problem, and many governments have started to take aggressive action to address it. once contaminated, ground water is very expensive to clean up and make usable again, and in some cases, an aquifer may be so contaminated that it has to be abandoned, which can put tremendous pressure on community as it attempts to find a new supply of water .

There are several different types of ground water, ranging from water which flows freely through the ground water and interacts with surface water to closed aquifers, which are theoretically very hard to contaminate. Ground water becomes polluted when materials seep through the soil and reach the water, which can happen when rainfall washes contamination into the ground, when polluted surface water connects with ground water.

Surface water can be found over the land surface in streams, ponds, marshes, lakes or other fresh (not salty) sources. Other than the location, one of the primary differences between surface and ground water is that ground water moves much slower than surface water. This is because ground water experiences far more friction as it moves through the pores in soil then surface water experiences as it flows over the earth's surface. Surface-water can be affected by numerous physical variables such as topography, land cover, soil conditions, mineralogy and ground-water conditions, all of which may be affected by geologic conditions. Surface water is also more easily contaminated than ground water. Filtration through the soil helps clean ground water.

The tendency for chemical contaminants to move between ground water and surface water is a key consideration in managing water resources. With an increasing emphasis on watersheds as a focus for managing water quality, coordination between watershed-management and groundwater-protection programs will be essential to protect the quality of drinking water [1]

The Shuwaja depression is recharge from Galal Badra River Basin and it is divided into two parts where the first part located in Iran, and this part supports most of the discharge of the river basin according to achieved runoff within the area. Second part of the river basin is located in Iraq covering area of (300 km^2). Depending on climate data measured in Badra meteorological station for the period (2001-1994), the climate was characterized to be continental semi-arid with annual total rainfall reached (221mm) and the evaporation from basin class A reached (3156mm). And the annual recharge of ground water from surface water was (41.29*10^6 m^3) [2].

MATERIALS AND METHODS

General description of the Project environment

Al Shuwaja depression is located in the land of wasit government, east of Tigers River. Water resources of this area was from Iraq –Iran mounted area by flooding in rainy season and fill the area with water, in other years the area was dry figure (1), the dark shaded area when filling with water where as in the year of study was drying Figure (2) .

Figure (1) Location of study area, Wasit Province (1996 rainy year)

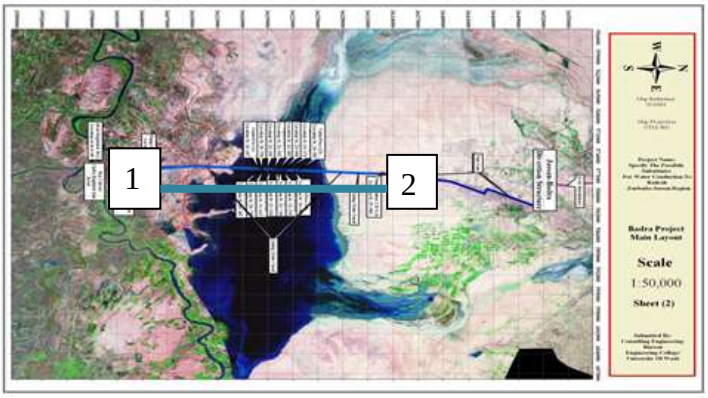

Figure (2) Shuwaja depression in year of study (dry year- 2008) Wasit Province.

Water sampling

Collection of water samples was done in year 2008. From 38 wells along segment of A-B through AL Shuwaja depression fig.(3) .Theses samples were collected using Grab method which according to World Bank,1988[3]; Samples were collected into clean 2liter plastic bottles and were stored in an ice box of 4ºC and were taken to the laboratory within twenty-four hours for analysis. Water samples were collected by lowering plastic pipe with suction small pump into the bottom of the water well body, (30cm) deep of water level in well, and allowed to over flow before withdrawing. 38 sampling points were used and the sampling points are approximately (1km) away from each other. A total 38 samples were analyzed. Three reigns of range. The first range was

(7km). The second range was (22 km) (depression). The third range was (11km). The study was carried out through three ranges for 1 month.

Figure (3) well of system of 38 wels along a line of study

Physicochemical Analyses

Naturally, ground water contains mineral ions. These ions slowly dissolve from soil particles, sediments, and rocks as the water travels along mineral surfaces in the pores or fractures of the unsaturated zone and the aquifer. They are referred to as dissolved solids. Some dissolved solids may have originated in the precipitation water or river water that recharges the aquifer. A dissolved solid in any water can be divided into three groups: major constituents, minor constituents, and trace elements. The total mass of dissolved constituents is referred to as the total dissolved solids (TDS) concentration. In water, all of the dissolved solids are either positively charged ions (cations) or negatively charged ions (anions). The total negative charge of the anions always equals the total positive charge of the cations. A higher TDS means that there in partnership with Farm Water are more cations and anions in the water. With more ions in the water, the water's electrical conductivity (EC) increases. By measuring the water's electrical conductivity, we can indirectly determine its TDS concentration. At a high TDS concentration, water becomes saline. Water with a TDS above 500 mg/l is not recommended for use as drinking water (EPA secondary drinking water guidelines).Water with a TDS above 1,500 to 2,600 mg/l (EC greater than 2.25 to 4 mmho/cm) is generally considered problematic for irrigation use on crops with low or medium salt tolerance (4). Following the parameters were analyzed by the study.

PH

The hydrogen ion concentration is the indicator of acidity and alkalinity of any aqueous system. The indicator for acidity, alkalinity, or basic is known as the pH value. A pH value of 7 means a substance is neutral. The lower value indicates acidity, and a higher value is a sign of alkalinity during present investigation pH was measured with the help of a pH meter.

Total Dissolved Solids

TDS Test by Filtration Followed by Oven Drying200 ml (V) of sample was filtered by filter paper to separate the suspended solid, then the beaker was weighted (A) and filled by the filtered sample, the sample was dried in the oven at 105C˚ for 5 hours ,the

Beaker with the dissolved solid was weighted again (B) [7].Then TDS was calculated by:

$$TDS = \frac{B - A}{V} \quad \text{.....1}$$

Where:
V= volume of sample, (L).
A=weight of beaker filled by filtered sample, (mg).
B= weight of beaker with the dissolved solid, (mg).

Total hardness (T.H)

Total hardness (T.H) test as $CaCO_3$ is done by titration method. A solution was prepared from 10 ml of water sample (V1) and 10 drops of buffer solution (pH=10) in order to give the alkalinity characteristics, the none drop (10 mg) of Erio chrome black T reagent was added, so the solution became pink. This solution was titrated with (1 normality) (N) of H_2SO_4 acid until the solution became blue, the volume of acid was records (V) [9].
The total hardness was calculated by:

$$\text{Total Hardness} = \frac{V \times N \times Mw}{V1} \times 1000 \text{.....3}$$

Where:
V= volume of H_2SO_4.
N= normality of H_2SO4.
M_W = the molecular weight of $CaCO_3$
V1= volume of water sample, ml.

Na^+ Test by Photometer (S6) Method

This method was done by using Atomic Absorption Spectrometry using Photometer (Model: WTW S6, Germany).This photometer allows measurement of convenient rapid tests by inserting the coded cuvette (Na^+) and read the result directly.

SO_4^- Test by Photometer (S6) Method

This method was done by using Atomic Absorption Spectrometry using Photometer (Model: WTW S6, Germany).This photometer allows measurement of convenient rapid tests by inserting the coded cuvette (SO_4^-) and read the result directly (5).

RESULTS

The study classified the region of study for three regions approximately a long line of study (A-B). The first region from 0-7 km (lift the depression), and the second region from 7-29 km where the depression was begging and finishing, and the third region from 29-38 km (right the depression).
From the laboratory tests, the concentration of (Mg) at the first region was 600-800 mg/l, the second region concentration was 6000-7000 mg/l, and in the third region the concentration was 2000-900 mg/l, (Fig.4) which is higher than the permissible value according to the Iraqi standards

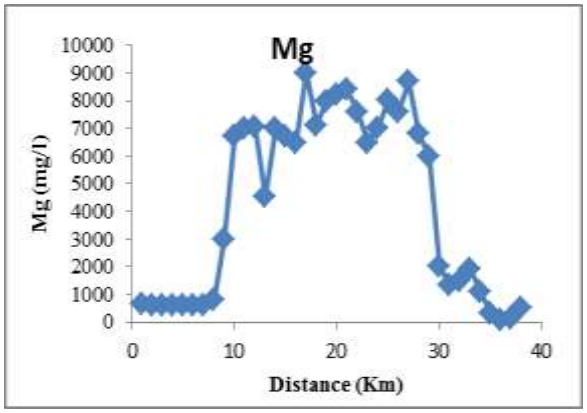

Figure (4) Variation of Mg concentration with distance

2- The Na concentration level at the second region was 900-1000 mg/l, whereas at the other regions were 300-750 mg/l (Fig.5).

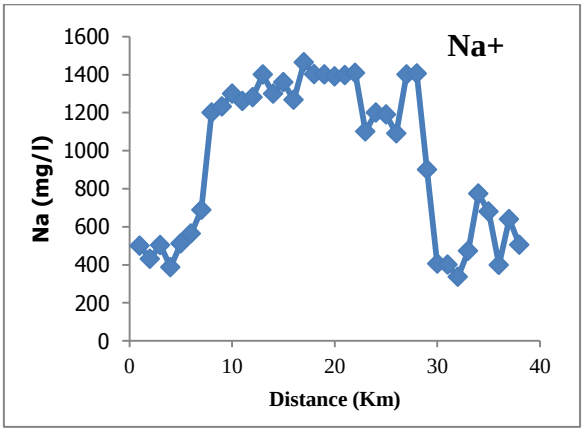

Figure (5) Variation of Na + concentration with distance

3-The total dissolved solid (TDS) concentrations varied between 7000-12000 mg/l, in the second and third region .whereas in the mid region was range from 7000-8000 mg/l (Fig.6).

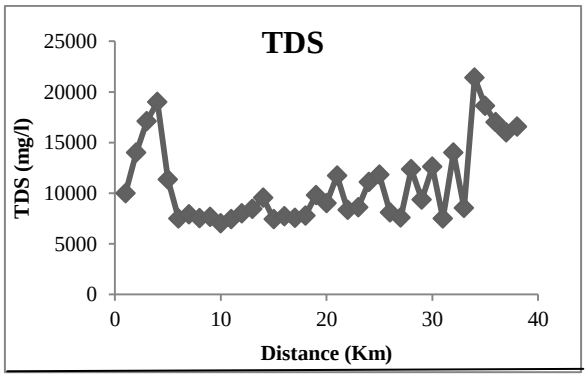

Figure (6) Variation of TDS concentration with

4- The concentration of the TSS vary from 9000-30000 mg/l along the line of study and fluctuation it seen clearly, there is a low concentration in TSS in the med region in comparison with the other regions Fig (7) shows that the variation of the TSS concentration.

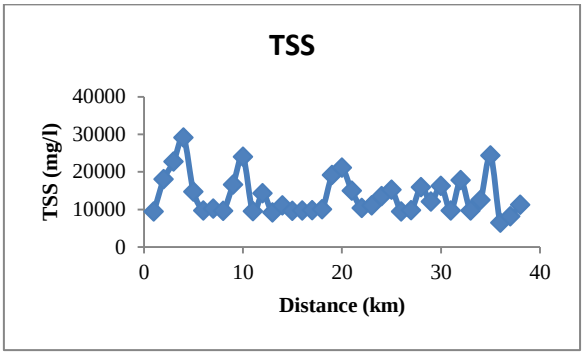

Figure (7) Variation of TSS concentration with distance

5 -The pH trend along the line of study (A-B) values increases toward the point B, Fig (8). All the values of pH at the 38 stations were at the acceptable range of Iraqi standards.

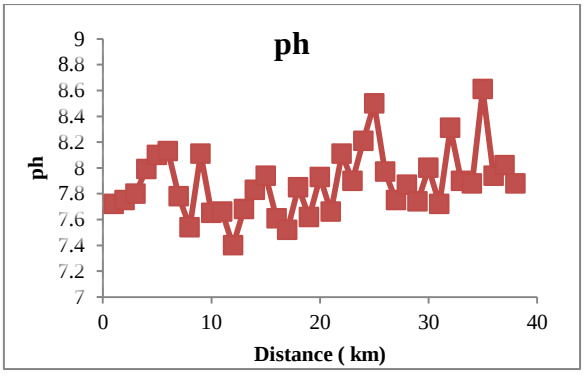

Figure (8) Variation of pH concentration with distance

5-The CL concentrations were higher in the two regions , the first and the third about (4000-1100) mg/l , but its low concentration in med region in comparison with the other regions about (1900-3000) mg/l .as shown in fig (9).

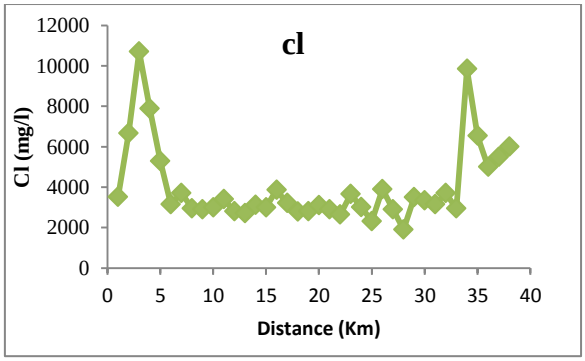

Figure (9) Variation of CL concentration with distance

7- The effect of the water in the depression was clearly on NaCl concentration. It was in the med region (4000-7000) mg/l whereas very high concentrations in the other region were reached to 18500 mg/l as shown in fig. (10).

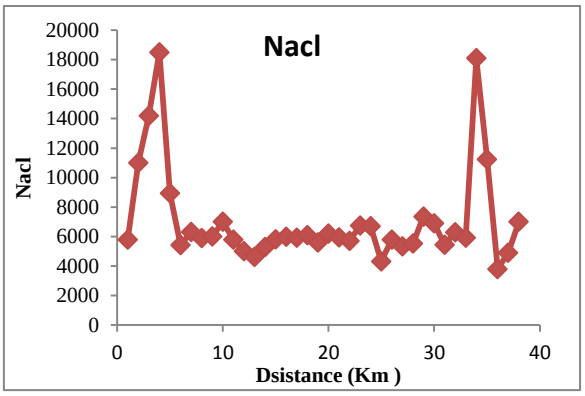

Figure (10) Variation of $NaCl^{+}$ concentration with distance

8- The SO_4 concentrations were higher in the mid-section in comparison with other side. And low in the other shoulder. The concentration of SO_4 in med-section about 2500 mg/l

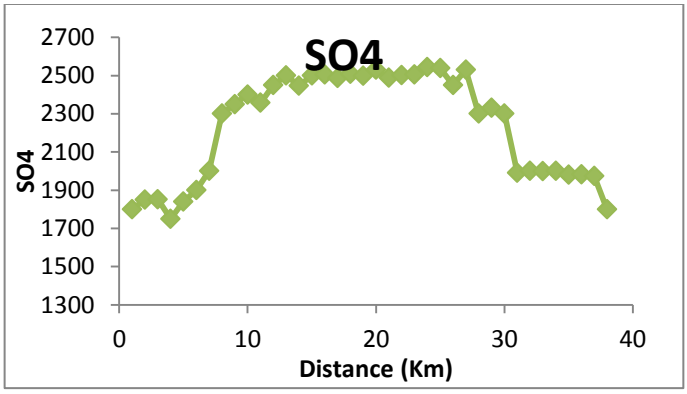

Figure (11) Variation of SO_4 concentration with distance

DISCUSSION

The most prevalent forms of groundwater pollution from nonpoint sources are salt and nitrate contamination, the degree of groundwater pollution depends on a number of factors:

•Percolation rate. The rate of percolation from the land surface to ground water. A significant amount of chemicals or pathogens may reach ground water when the water percolation rate is high.

•Natural attenuation. The ability of the soil or aquifer to retain or degrade the chemical before it reaches a well, spring, stream, or lake. The more a chemical is degraded or retained in the subsurface, the less likely it will be to reach a nearby well or stream.

Groundwater pollution occurs on a different time scale than surface water pollution. Ground water naturally flows at a speed that may range from a few tens of feet per year in poorly producing aquifers to a few thousand feet per year in very productive aquifers. In very sandy or gravelly aquifers and in some highly porous or cavernous volcanic and Kars tic aquifers, groundwater speed may be 10,000 feet (roughly 2 miles) per year or more. Nonpoint source to delineate the contamination plumes. The ground water pollution of the study area may show by the fig (12) .the ground water depth along the line of study show that the ground water level was close to land about 1-4 m, that mean the chance of contamination from surface water is high.

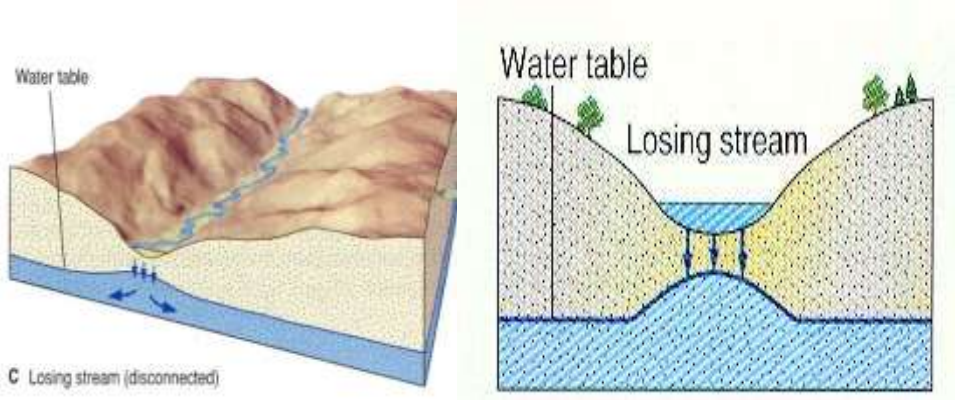

Fig (12): Stream losing water through stream bed

The concentration of ion and cations in the water surface that feed the ground water are list in table (1) from the beginning of catchment area to the effluent in al Shuwaja depression. The tables shows a high concentration SOh4, Cl, TDS, Ca, in comparison with [WHO] standards, whereas in comparison with resultant gathering from wells system the concentration are less than that of wells.

The effect of the flow through depression and the water it seep to ground water. The resultant of study shows that there is a high concentration of TDS, NaCl, CL, and TSS in the first and third region of study and the effect of flooding in depression to low the concentration in the mid-section of study area. The flood acting in this area as washing factors.

In other side the concentration of SO_4, NA, Mg are a high concentration in mid-section whereas a low in other side (left and right). The flood effect in this section was clearly on concentration of the parameters in ground water.

Depending on the factors affecting on the ground water contamination the study suggest to minimizing the detention time of the water in the depression by pumping the water sustain in the depression to the Tigris River .

Table (1): salinity and ions and cations in flood water of depression

HCO3		SO4		Cl		K		Na		Mg		Ca		TDS		الموقع	ت
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
212	200	995	930	286	255	4	3.5	243	228	63	60	365	304	2435	2025	صدر عرقات	1
184	184	1167	1022	408	376	4.6	4.2	339	336	70	62	410	338	2830	2465	وسط المجرى	2
234	292	1338	1456	590	622	5.65	5.5	446	484	86	88	483	512	3480	3630	اسفل النهر	3
95	148	1169	1405	606	393	3.9	4.2	339	359	77.8	70	411	426	2890	2910	جبل الحمرة	4
173	215	1134	2233	625	905	5.1	15	304	699	81.6	169	456	688	2915	5325	سيد صفر	5
216	284	1246	1506	709	650	5.1	5.5	483	499	73	85	435	510	3515	2720	مجاور الكلال/1	6
231	209	1340	1617	686	1141	5.7	5.5	499	833	71	113	466	476	3680	4365	مجاور الكلال/2	7
267	284	1002	1238	1041	873	4.5	4.8	639	667	66	65	395	387	3420	3475	حسن العلي	8
110	236	1572	2591	80	634	7.3	14.3	105	598	20.2	313	602	560	2350	5690	دشتك	9
167	160	1796	2123	208	190	17.1	18.5	199	203	149	168	549	606	3250	3825	الهشيمة	10
98	94	1475	1868	329	224	8.2	10	207	227	36.5	35.5	608	637	2975	3160	كهريز الكرمشية	11
299	322	1637	1825	512	1273	6.1	7.8	455	854	71	175	487	646	3550	5970	عين الفهوديات	12
127	121	1539	1681	1083	1106	6.2	6.1	639	695	98	96	544	540	4410	4250	زرباطية	13
142	157	1012	1036	1250	1292	5.65	5.5	750	833	62	70	376	372	3960	3770	الوالدة	14
221	161	799	1143	1008	874	4.5	4.8	639	639	57.2	57	323	347	3050	3110	الدهنوك	15
89	88	1652	1939	593	380	7	6.8	339	359	51.8	46.1	610	618	3425	3490	الكرمشية/2	16
115	82	2026	3040	1460	1708	12.9	17.8	1035	1334	146	182	644	864	5880	7760	الكرمشية/1	17
105	140	905	1186	490	652	4	4	470	563	53	63	502	600	2560	3200	سيد عزال	18
146	131	1465	1480	1936	1970	8.1	8.1	1001	973	115	134	776	744	6345	6080	مخفر شرطة الدراجي	19

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