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Studying the quality of the main outfall drain water in Al Qadisiyah area and its suitability for some agricultural uses / Iraq

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Summary:

The present study was conducted for the period from November 2011 to October 2012. Three sites were identified in this study to measure some of the physical and chemical properties of the main outfall drain water, the passer Al-Qadisiyah Governorate to determine the quality of the public water, physical and chemical, and its suitability for irrigation. The results of the current study showed that the values of the air temperature ranged between (4 - 45 C°) and water (9.5-30C°). The pH values were bent to the basic side and ranged from (7.7-8.4), dissolved oxygen values (5.1-10.8) mg / l and electrical conductivity was ranged from(3380-11520) µs / cm, Salinity ranged between(2.1 -7.3g / L), where water is classified as oligohalic, The total dissolved solids values ranged between (3310 - 7650) mg / L. The high alkalinity in the study , total alkalinity ranged from (1140 -2280mg CaCo3/ L), Calcium ions were recorded (131.4 -320-mg CaCo3 / L), and Magnesium (135.9-401.2 mg CaCo3/ L). The values of sodium exceeded the Iraqi and international standard limits and ranged between (708.7-1256mg/l), Potassium values ranged between (13.3 -28.2mg / L), The values of chloride were high, ranging between (849.7 -1939.3mg / L) and sulphate (734.8-1074.2) mg / l), The ratio of sodium adsorption exceeded the permissible limits for irrigation of agricultural crops according to the classification of the American salinity laboratory (1954) ranging from (35.973.5 %). The results of the study showed that the MOD water is physically and chemically unfit for the determinants identified in this study, and that its use by cattle and poultry can cause health problems and are not suitable for irrigating crops according to the classification of the American salinity laboratory. It should be noted, however, that researchers in the current study found that some of the farmers adjacent to their land to the public post cultivated wheat and barley crops on the ground, Which leads us to question the actual salinity Borne by those crops.

1-1 Introduction:

The future carries a growing concern about the scarcity of fresh water resources for different uses. Hence, we must use different types of water that vary according to use in order to make the most of water resources (Diwani, 2000) **.** Water quality is one of the most important topics through which water is measured and suitability for use by humans, animals and plants (Warren,1971), It has been mentioned (Al-Omar,2000) The most important indicators that determine the quality of water are chemical properties (salts and other chemical compounds), physical (heat and radiation), bio (organisms) and sensory (taste, color and smell). He explained (Misak ,1995)That all the chemical reactions that accompany the activities of water during the water cycle from the entry and even out of the ground, in addition to the various human activities; have an impact on the physical, chemical and bio characteristics of water.

1-2 Study area:

Al-Qadisiyah Governorate was selected as a (figure. 1) for the present study, which included knowledge of the physical and chemical properties and their feasibility for irrigation. Geographically, the province lies south of Iraq, 200 km south of Baghdad. the MOD is one of the oldest drainage that was established in Iraq in the early fifties of the last century, where the company Tams American report called for the use of estuaries to get rid of water drainage and suggested this company several estuaries, including the downstream. The Tigris and Euphrates rivers pass through the agricultural lands that depend on the Tigris and Euphrates rivers. The entire length of the MOD is about 565 km between Tigris and Euphrates. It is extended from the north of Baghdad to towards Shat Al-Aarab.

Three sites selected on the MOD Which passes of the Al-Qadisiyah Governorate. the first site is located on the borders of the province of Qadisiyah with the province of Babylon near the bridge that connects the district of Nu'maniyah and Shomali district before the feeding channel, which feeds Lake Dalamj. The second site is located after the feeding channel south of the first site and about (45 km) away .The third site is located after the drainage channel and near the fast traffic bridge (Fajr - Diwaniya) and is located south of the second station It is about (30 km) away (figure. 1).

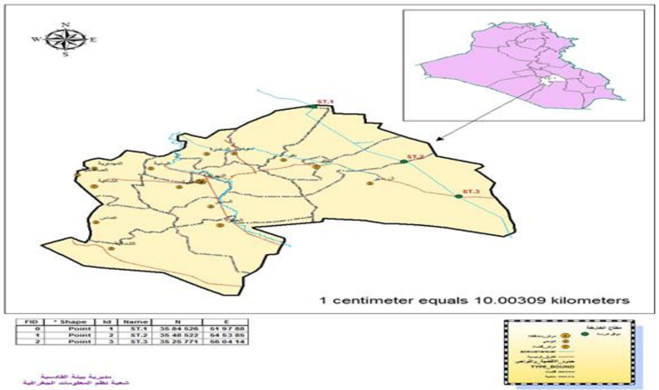

Figure (1) sites of study

2- Materials and methods:

2-1 Sampling:

Water samples were collected monthly from the MOD in Qadisiyah Governorate from November 2011 until October 2012 at a rate of once per month and at a depth of approximately 30 cm below water. From the first site to the third site, samples were collected from the study sites using plastic bottles (5)ltr.

2-2 Physical and Chemical measurement:

2-2-1 Air and water temperature degrees:

The air and water temperature were Measured directly in the field by a mercurial mercury gradient (0-100) C°.

2-2-2 PH:

Water hydrogen it concentration (PH) was measured in the field by a pH meter and then calibrated with Buffer Solution with pH 4,7,9.

2-2-3 Dissolved Oxygen(DO):

The azide modulation method was used for the Winclar method described by the American Public Health Association (APHA) and expressed in mg / l.

2-2-4 Electrical conductivity and salinity:

Measured by the electrical conductivity meter type L17 made by Milwaukee American company and expressed the results in units of microsemens / cm. The salinity value was calculated in terms of the results of the electrical conductivity multiplied by 0.00064 and expressed the results in a unit by a thousand (‰).

2-2-5 Total Dissolved Solids (TDS):

It measured by the American Public Health Association (APHA) and expressed results mg / L units.

2-2-6 Total Alkalinity:

Total Alkalinity expressed by calcium carbonate mg / L ,and followed the mixed indictors method (APHA). The results were expressed results CaCo3 / l.

2-2-7 Total Water Hardness:

The method shown in (APHA) is following was corrected with (EDTA 2Na) and by using Erichrome Black T (E.B.T.) evidence and expressed the result in calcium carbonate mg/l units.

2-2-8 Calcium (Ca^{+2}).:

To Measure Calcium we following suggested method by (APHA) using titration with solution (EDTA2Na) After adding(NaOH) (1Normaly) and using the Murexid dye as an indicators and expressed the results CaCo3/l.

2-2-9 Magnesium (Mg^{+2}):

Magnesium values were extracted using the computational method and the equations shown in (APHA) and the results were expressed in CaCo3 / l.

2-2-10 Sodium and potassium:

The sodium and potassium concentrations were measured by the (Flame photometer) and the results were expressed in mg / l (APHA).

2-2-11 Sulfates:

Sulphates were measured in the brownish manner mentioned in (APHA). It is measured at a wavelength 420 cm and expressed as mg / L.

2-2-12 Chlorides:

The chlorides were measured by the turbidity method that was mentioned in (APHA) the samples were titration with the standard silver nitrate solution and the correction process stops when the reddish brown color appears.

2-2-13 Sodium adsorption ratio:

This ratio expresses the effectiveness of sodium ion relative to calcium and magnesium ions and is calculated by the following law{5}:

$$SAR= Na / \sqrt{Ca + Mg / 2}$$

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3- Results:

3-1 The water temperature:

The water temperature for the area of study ranged between (9.5-35)C°, The lowest was in station 3 (9.5) C° at January , while the highest in station 3 in July . These results are shown in figure (2).

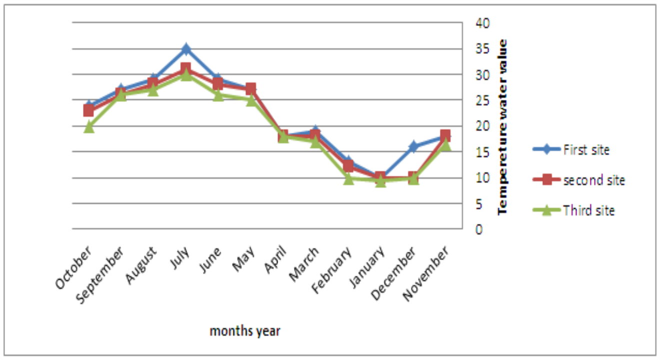
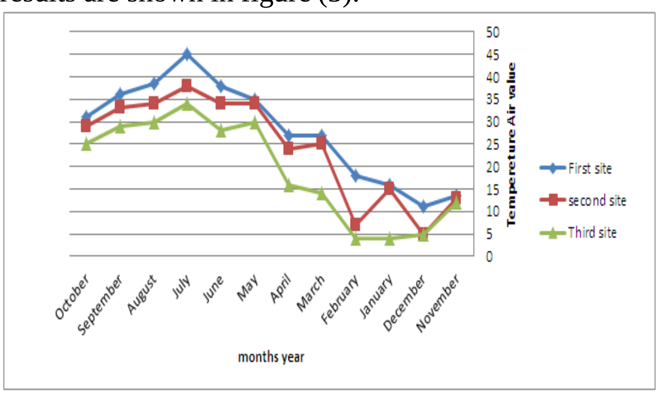


Figure (2) Monthly changes of water temperature values at the three sites during the study months

3-2 The air temperature:

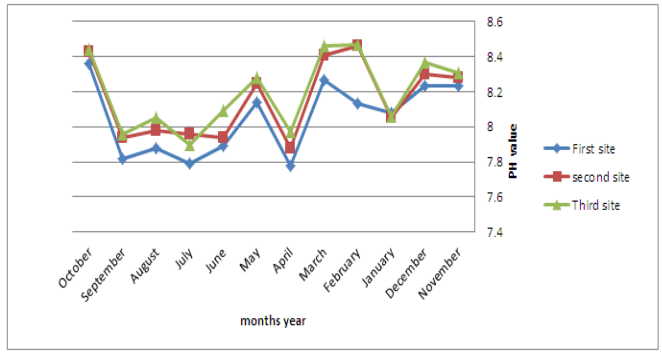
The air temperature for the area of study ranged between (4 - 45)C°, The lowest was in station 3 at January , while the highest in station 1 in July . These results are shown in figure (3).



Figure(3) Monthly changes of air temperature values at the three sites during the study months

3-3 PH:

Ranged pH value between (7.7) during April in station 1, while the highest in station 3 as recorded (8.4) during February, fig.(4) explains this.



Figure(4) Monthly changes of pH values in the three sites during the study months

3-4 Dissolved Oxygen (DO):

That's concentrates DO for the stations of study ranged between (5.1-10.8) mg/l, the lowest was in station 2 at July, while the highest in station 3 during January. These results are shown in fig (5).

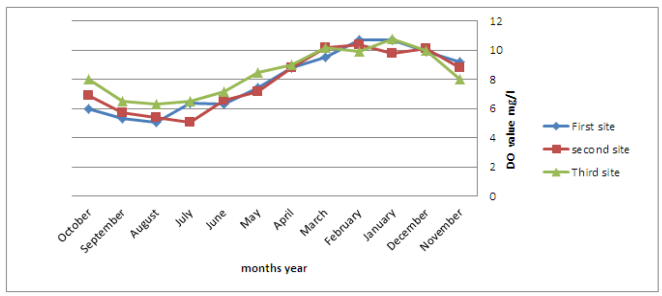
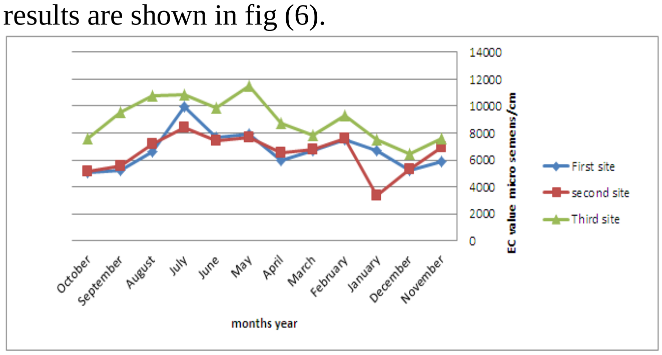


Figure (5) Monthly changes of dissolved oxygen values at the three sites during the study months

3-5 Electric Conductivity (EC):

The values of EC fluctuated between the lowest value(3380) µs/cm during January in station 2 to highest value (11520) µs/cm in station 3 during May, results are shown in fig (6).



Figure(6)Monthly changes of Electric Conductivity values at the three sites during the study months

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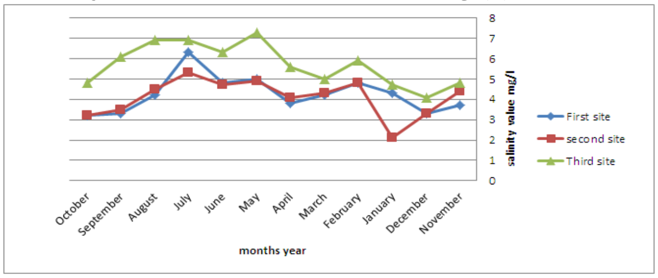
3-6 Salinity:

Salinity is one of the most important factors in water classification, in the present study ranged the salinity value between (2.1-7.3)‰ , the lowest was in station 2 (2.1) ‰ at January, while the highest in station 3 in May. These results are shown in fig (7).



Figure(7)Monthly changes of Salinity values at the three sites during the study months

3-7 Total dissolved solids(TDS):

The TDS recorded lowest value (3320)mg/l in station 2 at January, while the third station 3 recorded the highest value (7560)mg/l in July. These results are shown in fig.(8).

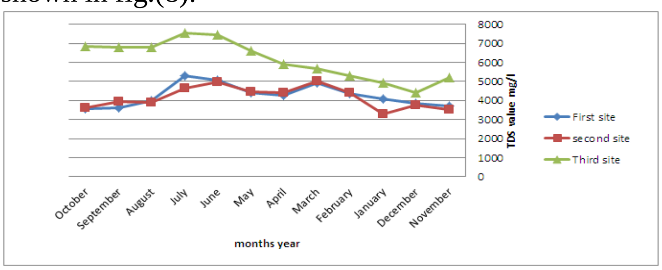


Figure (8)Monthly changes of TDS values at the three sites during the study months

3-8 Total alkalinity:

Iraqi waters are classification as basic, in the study present the total alkalinity value ranged between (139-250)CaCo3/l, the lowest was in station 2 at November, while the highest in the same as the station in October. These results are shown in fig.(9).

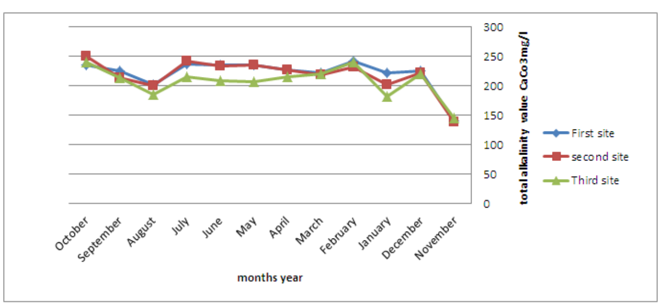


Figure (9)Monthly changes of Total alkalinity values at the three sites during the study months

3-9 Total water hardness:

The total hardness water for the area of study ranged between(1140-2280)mgCaCo3/l, the lowest was in station 2 (1140) mgCaCo3/l at December, while the highest in station 3 in September. These results are shown in fig.(10).

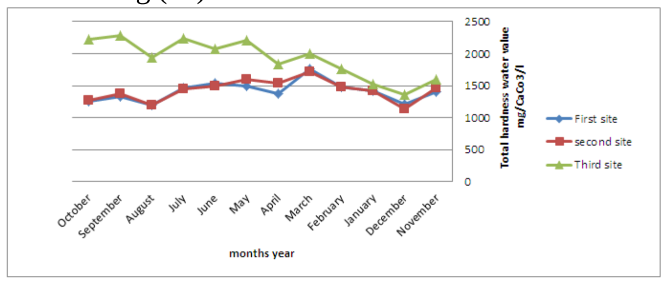


Figure (10)Monthly changes of hardness water values at the three sites during the study months

3-10 Calcium:

The lowest of calcium(131.4)mgCaCo3/l in station 2 at July, while the highest in station 3 (320.6) mgCaCo3/l in September. These results are shown in fig. (11).

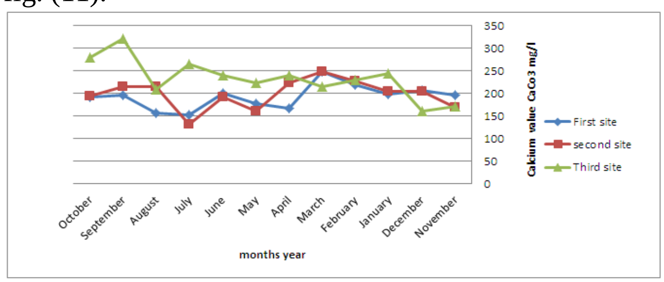


Figure (11) Monthly changes of Calcium values at the three sites during the study months

3-11 Magnesium:

The magnesium concentration were ranged between (135.9-401.2)mgCaCo3/l, the lowest was in station 2 (135.9) mgCaCo3/l at August, while the highest in station 3 in May. These results are shown in fig. (12).

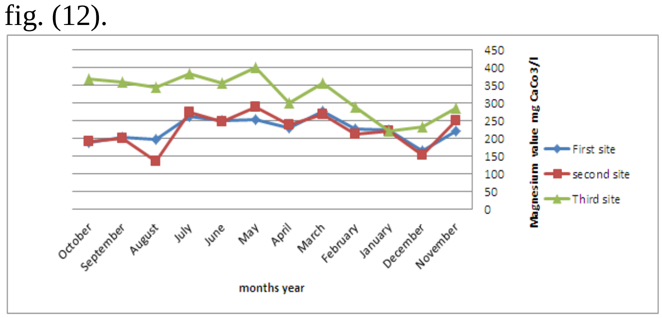


Figure (12) Monthly changes of Magnesium values at the three sites during the study months

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3-12 Sodium:

The sodium record has its lowest concentration(708.7)mg/l in station 1 during November, while the highest in station 3 (1256)mg/l in June. These results are shown in fig. (13).

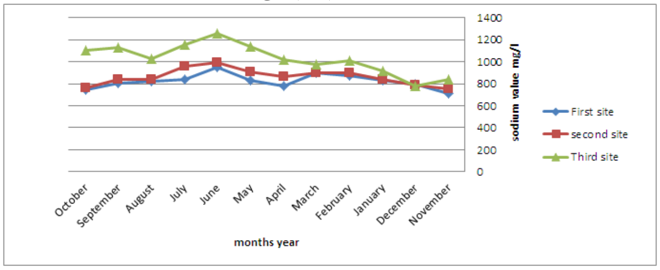

Figure (13) Monthly changes of Sodium values at the three sites during the study months

3-13 Potassium:

The values of potassium fluctuated from the lowest value (13.3)mg/l in station 1 at November to the highest value (28.2)mg/l in station 3 in June. These results are shown in fig. (14).

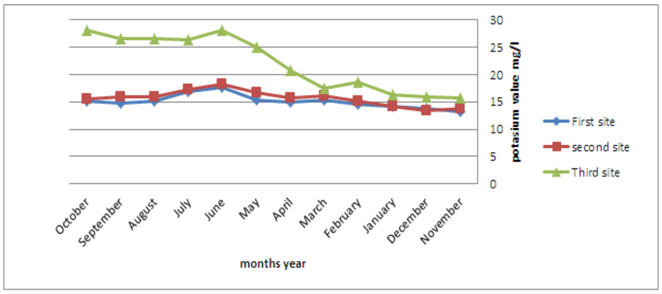

Figure (14) Monthly changes of Potassium values at the three sites during the study months

3-14 Sulfates:

The sulfates for the area of study ranged between (734.8-1074)mg/l, the lowest was in station 1 (734.8)mg/l at December, while the highest in the same station in March. These results are shown in fig. (15).

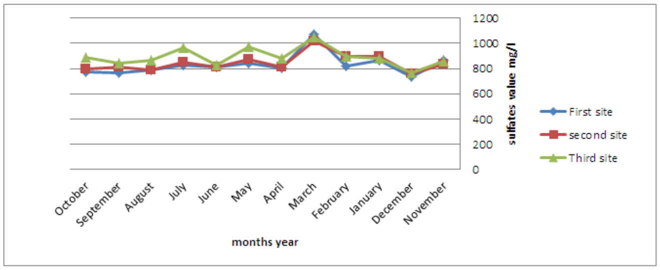

Figure (15) Monthly changes of Sulfates values at the three sites during the study months

3-15 Chlorides:

The lowest of Chlorides (849.7)mg/l in station 1 at October, while the highest in station 3 (1939.3) mg/l in September. These results are shown in fig. (16).

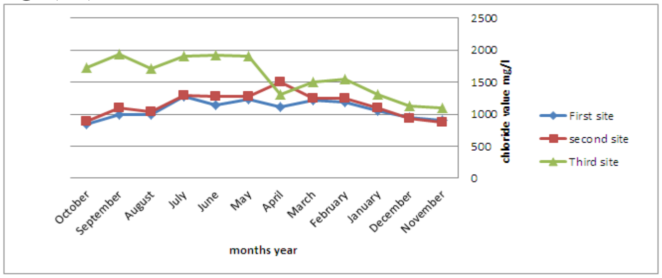

Figure (16) Monthly changes of Chloride values at the three sites during the study months

4- Discussion:

The temperature of the air showed clear monthly variations, and this may be due to differences in climatic conditions in terms of the brightness of the sun and the length of the day (Al-Shawi *et al*.,2007). The water temperature was associated with air temperature and was affected during the study months except in some cases. Water temperature is higher than air. This difference in water temperatures may be due to the properties of water and solar radiation on the surface of the water, which affect the solubility of gases, the viscosity of water and the physiological state of bio organisms (Saadallah,1988) Such a condition was observed by (Al-Kubaisi,1990), the water in the Saqlawiyah drainage during winter and spring This phenomenon has been explained As it is due to the properties of thermal water as the speed of acquisition and loss of heat vary between air and water. The pH values in narrow areas were characterized in the present study in all study sites due to the high regulation in hardness water, alkalinity and rich in bicarbonate (Tale and Al- Bahrawi,2000). Fig. (2 and 3).

In this study, pH values were found to be close in all locations and within the base trend, and were within limits (6.5-8.5) Which is the preferred range of aquatic life (WHO,2004), this is consistent with previous studies conducted on Iraqi inland waters (Al-Azzawi, 2004). The water under study showed pH values that never reached low or high values. This may be due to increased saline content of the MOD water. figure(4).

The dissolved oxygen results showed monthly changes in all study sites, with the highest values recorded during the cold months (December, January, February, March 2012), In all study sites and may be due to the fact that cold water has a greater ability to dissolve larger amounts of gases such as oxygen compared to hot water or the increase in dissolved oxygen values may be due to an increase in the number of phytoplankton and its process of photosynthesis (AL-Saadi *et al*.,1975) while the lowest values were recorded during the hot months (June, July, August, September 2012) at all study stations, Which may be attributed to higher temperatures, which leads to increased activity of microorganisms in the decomposition of organic matter, which leads to increased consumption of oxygen and dissolved oxygen concentrations are affected by other factors Of which:(Photosynthesis and surface area exposed to air and mixing processes) which play a key role in that the results of this study are consistent with a number of studies conducted on the Iraqi water bodies of which (Alnashee, 2012), Figure(5). Electrical conductivity of MOD water recorded the lowest values was recorded the second location at January 2012 and the highest values in the third station at May 2012, Which may be attributed to the agricultural activities of phosphate fertilizers and other during the summer months due to low water level and high temperature and high evaporation rate mainly added to what the groundwater and agricultural activities and population and topography of the region of the effects, that the lowest values recorded during the winter months in all sites and the results of the current study agree with (Alnashee, 2012). figure (6) . In the current study, salinity values were lowest (2.1 g / L) during January 2012 at the second site This may be due to precipitation, rising water levels in neighboring rivers and increasing water velocity leading to water degradation and reduced salinity concentrations (Al-Khalidi, 2003), and above (7.3 g / L) during May of the same year. The high salinity values are due to the lack of rainfall during the winter and spring and the presence of subsurface bifurcations that are fed to the main spindle and may be due to low flow velocity (Floder and Burns, 2004) may be attributed to the use of different fertilizers in agricultural activities, Figure(7). The values of T.D.S were consistent with conductivity, salinity, total hardness, calcium, magnesium and sodium in elevation and decrease in all study sites. This may be due to the same reasons mentioned previously in the electrical conductivity and salinity This is consistent with the findings (Alnashee, 2012), figure (8). That the rates of values recorded for the alkalinity during the current study fall within the range of natural water, ranging between (139-250 mg / l) That these rates have been recorded at the second site that high basal values may be attributed to the increase in phytoplankton growth that increases the efficiency of photosynthesis and the increased consumption of carbon dioxide gas leads to higher basal values through the use of bicarbonate ions as a source of carbon in photosynthesis (Golterman *et al*.,1978) , low alkalinity values are due to high water levels and resulting mitigation about him. Figure(8). That the total values of total hardness, which exceed the total alkalinity values at the three sites during the months of the study, are due to the presence of ions other than calcium and magnesium ions in the formation of the so-called non-carbon (Lind,1979).

The results of the current study showed a clear increase in the values of total hardness, with the highest values (2280 mg / L) recorded in September 2012 at the third location and the lowest values (1140 mg / L) during December 2011 in the second location. Figure(9). High total hardness values may be due to lower water levels, higher temperatures, increased evaporation, higher concentration of dissolved solids or reduced water levels in adjacent rivers, which decreased in September 2012 Which reflected on the waters of the drainage and thus on the MOD waters the third position also recorded the highest values of hardness The increase in total precipitation values at the third site, as well as salinity, is due to the nature of the area and the water discharged from neighboring lands This is dealing with (Matloob ,2004), their decline may be due to precipitation, rising water levels, attenuation and increased runoff, or may be due to the heavy growth of algae, which reduces the hardness to one third (Dharb,1992 and Al-Azzawi, 2006) .The results of the present study were similar to those of (Al-Kubaisi,1996) and (Alnashee, 2012), in the present study the values of magnesium ions were different during the study months and in different stations figure(10), but the rate of these values indicates that the rate of magnesium values is the predominant rate of calcium ion values and this is different from what is common in Iraqi waters that this may be due to the nature of the land passing by the drainage, the results of the present study are consistent with what is mentioned (Alnashee, 2012), but does not agree with the (Al-Azzawi, 2004) , that the high values of sodium ions in water may be due to the different quantities added to the river from household waste and the agricultural effects of the adjacent lands of the river where the water flows with high content of sodium salts, which lead to high concentration of sodium, The low values of sodium ions in water may be due to rising river water levels and mitigation figure (11) , As for potassium, high values were observed in the water during the spring months, which may be caused by the discharge of sewage from the river, as well as a percentage of chemical fertilizers that increase the concentration of potassium ions in water, The low values of potassium ions in the water were recorded during the autumn season, and this may be due to the fact that the water fed to the river in this season does not contain high concentrations of this element in addition to the difficulty of free from the rocks that contain it. figure (12) . The current study recorded values of chloride (849.6 mg / L) during October 2012 at the first and highest site (1939.3 mg / L) figure (13). That the decrease in chloride values may be due to the lack of rainfall and irrigation and the rise is due to precipitation that helps to dissolve the chloride ion from the lands adjacent to the banks of the MOD , in the present study, the lowest value of sulfur ions (734.8 mg / L) was at the first site in December 2011 and the highest values (1074.2 mg / L) during March 2012 at the same site figure (14), that the reason for the low sulfur values may be due to the process of dilution of this water by the continuous recharge of rivers, streams and adjacent waterways.

5-Validity of water:

5-1 Drinking water validity:

Some determinants have been adopted in assessing the suitability of the MOD water for drinking purposes, after comparing them with the specifications proposed by the (WHO,2004) and (Iraqi specifications ,1998) of the Department of Environmental Protection and Improvement of Iraq and some other international classifications for the standard concentrations of some environmental determinants of water. It was observed that the values of the environmental determinants of the water of all stations were not in conformity with international standards and Iraqi standards except for the values of pH, dissolved oxygen, potassium Are identical to those standards and therefore it can be emphasized that the water of the river is not drinkable chemically and physically, Table (1).

Table (1) Guide to the quality of drinking water and its conformity with international and Iraqi standards and the World Health Organization

Property	Rate Study of stations	Iraqi Standards 1998	The results with Iraqi Standards 1998	WHO 2004	The result with WHO 2004
pH	7.8	6.5-9.2	Matching	6.5-8.5	Matching
TDS	4851.9	500-1500	Non Matching	500-1500	Non Matching
DO	8	< 5	Matching	< 5	Matching
Cl^{-1}	1267	200-600	Non Matching	200-600	Non Matching
HCO_3^{-1}	215	20-210	Non Matching	20-200	Non Matching
SO_4^{-2}	857.3	200-400	Non Matching	200	Non Matching
PO_4^{-3}	0.21	0.4	Matching	0.4	Matching
Ca^{+2}	208.2	75-200	Non Matching	25-75	Non Matching
Mg^{+2}	261.2	50-150	Non Matching	50-75	Non Matching
TH	1585.9	200-500	Non Matching	100-500	Non Matching
Na^{+1}	905	200	Non Matching	200	Non Matching
K^{+1}	12.6	12	Non Matching	12	Non Matching

5-2 Water quality for livestock and poultry:

Excess amounts of salt in the water cause physiological problems or even death for cattle, table (2and3) presents the water quality guide for salinity for cattle and poultry(Altoviski,1962).

Table 2: Water quality index for salinity for cattle and poultry

Notes	EC(µmhos/cm)	TDS(mg / L)
Saline water is relatively small and excellent for all types of livestock and poultry	less than1500	less than1000
Water is very suitable for all types of cattle and poultry and is likely to cause temporary or moderate relief for non-recurrent livestock for such water.	5000-1500	3000-1000
Water is suitable for livestock, but can cause diarrhea or rejection by animals at first, especially for animals that do not return to such water and consider water is not good for poultry and can cause water release and reduce its growth, especially Chicken turkey	8000-5000	5000-3000
It can be safely used for cattle, milk, sheep, sheep and sheep, and it should not be used for pregnant animals and is not acceptable for drinking purposes for poultry.	11000-8000	7000-5000
Water is unusable for poultry and can cause problems for pregnant animals and small animals of cattle	16000-11000	10000-7000
They can never be recommended for poultry and Cattle and under any circumstances	More than16000	More than10000

Table (3) The validity of the water of the studied stations for drinking for both livestock and poultry based on the water quality index for salinity, livestock and poultry, depending on the seasonal rates of (TDS) and electrical conductivity of the studied stations.

Sites	TDS(mg / L)	EC(µmhos/cm)	Notes
1	4263.33	6700	Water is very suitable for all types of livestock and poultry and is likely to cause temporary or moderate relief for the unusual livestock of such water
2	4166.16	6487.5	Water is very suitable for all types of livestock and poultry and is likely to cause temporary or moderate relief for the unusual livestock of such water
3	6129.25	8959.1	Water is suitable for livestock, but can cause diarrhea or rejection by animals at first, especially for animals that do not return to such water and consider water is not good for poultry and can cause water release and reduce its growth, especially Chicken turkey

5-3 Validity of water for irrigation:

The study of the validity of MOD water for irrigation was based on the classification of irrigation water according to the American Salinity Laboratory (1954), which is based on each of the salinity factor, TDS, EC and the sodium adsorption rate (SAR) to evaluate the irrigation water, where the concentration of total dissolved solids and electrical conductivity is measured for salinity measurement and the (SAR) to measure the soda in water, as in tables {4,5,6}.

Table (4): Classification of irrigation water relative to salinity risk by US Salinity Laboratory

Validity of water	EC(µmhos/cm)	TDS(mg / L)	Type	Irrigation water category
Water is suitable for irrigation of all crops and in different soils	Less than 250	less than200	C_1	Water with low salinity
Water is suitable for irrigation of most medium-end crops	750-250	500- 200	C_2	Medium saline water
This water is used only with a network of effective cutters and high tolerant crops for salinity	2250-750	1500-500	C_3	High salinity water
Water is unsuitable for irrigation under normal conditions and can only be used in the case of soils with high permeability, good drainage and highly tolerant crops for salinity	5000-2250	3000-1500	C_4	Highly saline water

Table (5) Classification of the US Salinity Laboratory for Irrigation Water by the percentage of sodium adsorption

Validity of water	EC(µmhos/cm)	SAR	Type	Irrigation water category
Water is suitable for irrigation in all types of soil with little risk of forming hazardous concentrations of exchangeable sodium	100 250 750 2250	10-0 8-0 6-0 4-0	S_1	Low risk
Water suitable to irrigate sand or organic soil with good permeability. Damage to cultivated plants is expected to occur in high-density mixed-mix soil	100 250 750 2250	18-10 15-8 12-6 9-4	S_2	Medium Risk
Water is still suitable for the irrigation of gypsum-containing dust in most other soils and is expected to collect an exchangeable sodium that is harmful to plants	100 250 750 2250	26-18 22-15 18-12 14-9	S_3	Extremely risk
Water is not usually suitable for irrigation. May sometimes be used for irrigation when it contains very low concentrations of salts and the addition of gypsum or other soil enhancers.	100 250 750 2250	26< 22< 18< 14<	S_4	Extremely very risk

Table (6) Classification of irrigation water for the study sites according to the classification of the American salinity laboratory

Validity of water For irrigation	Type	SAR	EC(µs/cm)	TDS(mg / L)	Site
Water is not suitable for irrigation under normal conditions and can only be used in the case of soils with high permeability, good drainage and highly tolerant crops for salinity, which is very dangerous for sodium	C_4-S4	55.9	6700.8	4263.33	1
Water is not suitable for irrigation under normal conditions and can only be used in the case of soils with high permeability, good drainage and highly tolerant crops for salinity, which is very dangerous for sodium	C_4-S4	59.28	6487.5	4166.16	2
Water is not suitable for irrigation under normal conditions and can only be used in the case of soils with high permeability, good drainage and highly tolerant crops for salinity, which is very dangerous for sodium	C_4-S4	61.85	8959.1	6129.25	3

References:

Al Omar, Muthanna Abdul Razzaq (2000). Environmental pollution . Dar Wael Publishing. Amman Jordan. 295p.(in Arabic).

Al-Azzawi, Ahmed Jassim (2004). Environmental Study on Phytoplankton in Some Sections of the Northern Part of the Public Probe, M.sc, University of Baghdad..75 P .(in Arabic).

Al-Azzawi, Suad Ghali Kazem (2006). Use of some algae in the treatment of industrial waste water for Hilla textile factory. M.sc , Babylon University. 124 p .(in Arabic).

Al-Diwani, Saad Abdul-Hussein, (2000), Groundwater Feeding using Municipal Waste Water Treatment, Journal of Babylon University, Engineering Sciences 532-518: (5) 5.(in Arabic).

Al-Kubaisi, Abdul Rahman Abdul-Jabbar (1990), Environmental study of the diets and food content of the digestive tract of some fish in central Iraq, M.sc, University of Baghdad.115 p.(in Arabic).

Al-Kubaisi, Abdul Rahman Abdul-Jabbar, (1996), environmental status of the public post, PhD , Faculty of Education Ibn al-Haytham, Baghdad University. 143 p.(in Arabic).

Alnashee, Nasser Hussein (2012). Environmental study of algae attached to the bottom of the eastern Euphrates (Al-Hafar) site - Diwaniyah - Iraq, M.sc, Faculty of Education, University of Qadisiyah. 138 p. (in Arabic).

Al-Saadi, H.A.; Rafei,A.H. and Molla,F. H.(1975). Preliminary studies on phytoplankton of North west Arab Gulf Baghdad esh. J. Bosts (1): 9-12.

Al-Shawi, Imad Jassim, Al-Rubaie, Ayman Abdullatif and Abdullah Shakir Badr (2007). A study of the ideology of the southern part of the Tigris and Euphrates rivers and their impact on the physical and chemical properties of the Shatt al-Arab. Journal of the university teacher, 6 (11): 125-136.(in Arabic).

Altoviski, M. E. "Dictionary for Hydrgeologist. Gosgeolitchizdat." *USSR*, *Moscow* (1962).

APHA . American Public Health Association .(2003) .Standard Method for the examination of water and wastewater.20th ed. Washington . DC, USA.

Dharb, Hamoudi Haidar. (1992). Algae and Water Pollution, Modern Egyptian Printing Press, Cairo.(in Arabic).

Floder, S. and Burns, C.W.(2004). Phytoplankton diversity of shallow tidal lakes: influence of periodic salinity changes on diversity and species number of anatutal assemblage. Journal of Phycology, 40(1):54.

Golterman, H. L., Clyma, R. S. and Chustd, M. A. M. (1978). Methods for physical and chemical analysis of fresh water. 2nd. Ed. Black well scientific pub. 1. Ltd. Oxford, U. K. pp. 60-62.

Iraqi environmental legislation for the year 1998. Department of Protection and Improvement of the Iraqi Environment. 68 pages.(in Arabic).

Khalidi, Saher Hussein Hassan. (2003) Environmental and Pectrological Study in the Southern part of the Diyala River, M.sc, University of Baghdad. 115 p. (in Arabic).

Lind, T. W. (1979). Handbook of common methods in limnology. 2nd ed. London.

Matloob ,Taleb Hashim (2004). Environmental study on zooplankton in drainage, northern part of the estuary, M.sc, University of Baghdad. 94 p.(in Arabic).

Misak, Cheryl J. Verificationism: its history and prospects. Psychology Press, 1995.

Richards,L.A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. Hand Book U.A. Dep. Agric., Washington, U.S.A.

Saadallah, Hassan Ali Akbar. (1998). Environmental Study on the Effect of Hamrin Reservoir on Bacteriological and Invertebrate Invertebrates in the Diyala River, PhD Thesis, University of Baghdad.152 p. (in Arabic).

Tale, Abdul Aziz and Barhawi, Najwa Ibrahim (2000). Contamination of the Tigris River with residues north of Mosul. Journal of Education and Science, 21: 27-33.(in Arabic).

Warren, C.E. 1971. Biology and water pollution control W.B.Sunder Company. Philadelphia. London. Toronto. P:434.

WHO, world health organization (2004) . Guidelines for drinking –water quality. Vol. 2. 2ed ed. Amman, Jordan.