The performance audit of the Ministry of Health and Environment policy to construct and follow up the remote sensing projects for monitoring water bodies throughout Iraq

Federal Board of Supreme Audit

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Sub./ the performance audit of the Ministry of Health and Environment policy to construct and follow up the remote sensing projects for monitoring water bodies throughout Iraq

Pursuant to the provisions of Article (6) of the Federal Board of Supreme Audit Act No. (31) of 2011 (amended), the audit team conducts the performance audit of the Ministry of Health and Environment policy programme to construct and follow up the remote sensing projects for monitoring water bodies throughout Iraq and in this regard we have the following:

1 - Introduction to the audit subject

a- Scope of the audit

The audit team audits the performance of the Ministry of Health and Environment policy program to construct and follow up the remote sensing projects for monitoring water bodies throughout Iraq:

- Ministry of Health and Environment / Technical office / Environment dept.
- Ministry of Health and Environment / Planning and Follow-up Department / Environment
- Ministry of Health and Environment / Office of Environmental Protection and Improvement in the midland region
- Ministry of Health and Environment / Office of Environmental Protection and Improvement in the Southern Region
- Ministry of Health and Environment / Office of Environmental Protection and Improvement in the Middle Euphrates Region
- Ministry of Health and Environment / Office of Environmental Protection and Improvement in the Northern Region

- Baghdad Municipality (Baghdad Water Office and Baghdad Sewage Service)
- Ministry of Construction, Housing, Municipalities and Public Works / Directorate General of Water

b- <u>The audit problem and its impact on society:</u>

Preliminary studies carried out by the audit team during the strategic planning phase showed that the phenomenon of pollution spread and low quality of water bodies in Iraq have been exacerbated due to the weak implementation and follow-up of remote sensing stations projects to monitor the water bodies. It considers the main problem that has affected several sub-problems which includes:

- The presence of many service activities, industrial and oil, which put their pollutants into the water bodies without treatment
- Failure to achieve the main objectives for which remote sensing and early detection stations were established
- The delay of Ministry of Health and Environment in completion of remote sensing projects and early detection.
- Not include all governorates with remote sensing and early detection projects

<u>2- Methodology of audit process</u>

In order to identify the causes of the main problem, the team carried out the following during the detailed audit phase

a- Risk analysis and related phenomena:

The risks and negative phenomena were analyzed according to their importance related to the main problem, as shown in the attached table (1). In the light of the risk matrix, the main sub problems related to the same problem are: failure to achieve the main objectives for which the remote sensing and early detection stations were established which has affected by several problems according to its priority in the audit:

- Poor coordination between the Ministry of Health and the Environment and the ministries concerned
- The data transmission service has stopped in real time that projects have lost their importance
- Lack of accuracy in the selection of sites for some environmental monitoring stations for waters
- all necessary tests that give a complete picture of the contaminants size are no included
- The sensors life has expired in the remote sensing stations.

b- Objective of audit

The main objective of performance audit on pollution phenomenon and the water awareness deterioration in the water bodies in Iraq is to evaluate the procedures taken by the Ministry of Health and Environment to improve the environmental reality of these areas through the implementation of remote sensing and early detection projects due to their importance in monitoring and discovering different sources of Pollution that include chemical and physical pollution, heavy and toxic elements pollution, sewage water, and oil pollution of water sources, as well as the recording of the readings of pollutants instantly through modern systems and stations with advanced technology to take appropriate and rapid treatment of pollution in coordination with the relevant authorities to get to a healthy environment and water is suitable for human consumption.

c- Audit Questions

Q1 Have the objectives of the completed projects been made advantage ? And what is the technical situation whether it is working or not?

Q2 which tests read by sensors of these stations? Is it sufficient? Are they needed to develop or add new sensors?

Q3 Which projects need maintenance and completion? Why?

Q4 to what extent is the cooperation between the Ministry of Health and the Environment with the relevant authorities to monitor and treat pollution cases?

Q5 what are the numbers and locations of remote sensing projects?

d- Auditing Standards

First: Environmental legislations issued by the office of Environmental Protection and Improvement of 1988.

Second: Law of the Ministry of Environment No. (37) of 2008.

Third: Law of Protection and Improvement of the Environment No. (27) of 2009.

Fourth: The system of overwhole maintenance of rivers and water No. (25) of 1967 (amended).

Fifth: determinants of the World Health Organization on potable water.

Sixth: The previous specialized reports of the Federal Board Of Supreme Audit .

3- the Results

The team conducted personal interviews and fieldvisits and directed memos, questions and inquiries to the relevant offices , the results of the audit process according to the projects are below:

a- The Ministry of Health and Environment has constructed strategic projects for monitoring pollution in the water bodies in Baghdad and some governorates, including:

	Project Name	Starting Year

1	Remote sensing project for monitoring water resources	2011
2	Remote sensing project for monitoring sewage	2011
3	Project of early detection of oil pollution	2012

However, we noticed that the ministry was unsuccessful in achieving the goal of constructing these projects, is to control water bodies of pollution caused by the industrial, service, oil and other institutions. This is due to the failure of transmit readings in real time and accurately from the monitoring substations to the central stations for analysis and investigation of the causes and sources of pollution and coordination with the authorities concerned to treat pollution and take the necessary precautionary measures, we list below the most important observations that have been made by us for these projects.

First: Remote sensing project for monitoring water sources:

The technical feasibility of the project is to enable specialists in the Ministry of Health and the Environment to access continuous and timely data on the water quality in water resources throughout Iraq such as (rivers, pipelines, plant and plant waste, etc.) in order to identify the sources of pollution and contaminants, chemical and physiological variables and their rates in the locations specified within the water source and then address the authorities concerned to treat pollution, through the audit of documents and field-visits, we noticed the following observations:

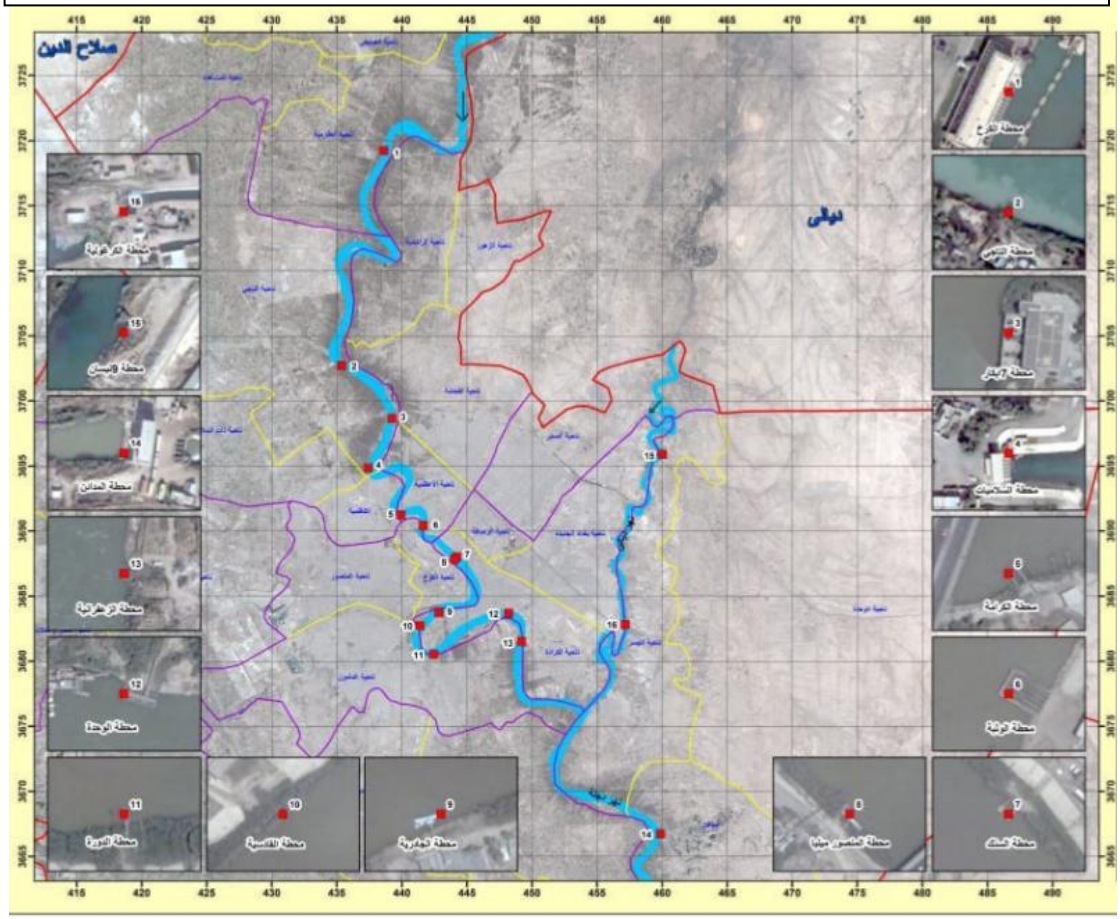
1- The construction of remote sensing projects to control water resources in some governorates (Basrah, Kirkuk, Nineveh, Salah al-Din, Muthanna and Missan) were not addressed. This led to the lack of knowledge of the results of possible chemical and physical variables in the water dumped from service activities and Industrial plants and others in order to compare them with the national determinants to strengthen the oversight role of the environmental directorates in terms of registration of

timely tests and data in the above governorates, similar to the governorates have these projects.

2- (17) monitoring points were selected in different locations in Baghdad governorate as shown in the table and the map below:

A	Name of water source	Station name	Location
1	Main drain	Abu Ghraib Station	Located on the bank of the main drain
2	The Tigris	Doura Station	Located on the outtake of the Doura Water Project
3	The Tigris	Al Karama Station	Located on the outtake of Al Karama water project
4	The Tigris	Krughlia station	Located on the outtake of the Karagulya pumping station
5	The Tigris	Al Sanak Station	Located on the outtake of the Sanak water complex
6	The Tigris	Mansour Melia Station	Located on the River Police Marina / Mansour Milia hotel
7	The Tigris	Station Sebaa Abkar	Located on the outtake of Sebaa Abkar water project
8	The Tigris	Al Wathba Station	Located on the outtake of Al Wathba water project
9	The Tigris	Al Wahda Station	Located on the outtake of the Al Wahda water project
10	The Tigris	Al - Jadriya Station	Located on the marina of the river police headquarters
11	The Tigris	Tarmiyah Station	Located on the outtake of Karkh water project
12	The Tigris	Al Madaen Station	Located on the outtake of Madaen pumping stations
13	The Tigris	Al Shatt Taji Station	Located on the outtake of Taji beach complex
14	The Tigris	Al Qadisiyah Station	Located on the water project of Al Qadisiya
15	The Tigris	Al Zaafaraniya Station	Located on the Zafaraniya water project
16	The Tigris	Salamiyat Station	Located on the outtake of the Salamiyat pumping station
17	Diyala River	Station (9) Nissan	Located on the outtake of (9) Nissan station

Map of remote sensing stations in the province of Baghdad



The table and map above shows that the monitoring stations are not located where oil refineries and power generation stations exist as opposed to the technical feasibility and objectives set forth to find out the sources of contamination. After reviewing the documentations presented, we observed the following.

a. Three sensors of the detection stations, Abu Ghraib station, Tarmiyah station, Taji beach station, were removed to the headquarters of Baghdad Directorate for Environment as they are erected at the river in remote areas completely isolated from the cities. This indicates that the Ministry of Health and Environment role in selecting sites is weak due to the lack of a prior thorough objective study of the process, moreover, storing

these sensors at the Department Headquarters adversely affected the efficiency of these sensors because of non-use.

b. Not all the necessary tests for detecting pollutants were used. The tests currently used in these stations do not give a clear indication of the presence or absence of a pollutant, whether generated from service institutions, industrial plants or power plants, so that the body responsible for dumping these wastes to the river water can be identified. This has led to poor detection of pollutants since 2011. Additionally, new sensor for such stations has not been developed or created to strengthen the oversight role of MOH through these tests and to enhance the development in this regard. The table below shows the case:

No.	Tests in sensors	No.	Tests not included in sensors and its importance
1	sensor for measuring PH and the acidic and alkaline function of water	1	The sensor of chlorides to measure grams of chlorine in the water
2	Total Dissolved Solids sensor T.D.S	2	Phosphate test which affects the water environment
3	Turbidity sensor checks water turbidity	3	test of pesticides affecting aquatic organisms
4	Temperature sensor checks water temperature	4	Biochemical *Oxygen Demand* test B.O.D
5	test dissolved oxygen sensor D.O	5	Ozone test Know the percentage of ozone in water that affects living organisms
6	blue-green algae B.G.A. sensor	6	test killer and decoration cyanide
7	Chlorophyll sensor for plants nutrition richness	7	test of ammonia affecting aquatic organisms
8	Conductivity sensor	8	Chloroform test of organic solvents and their presence is considered contaminant
		9	Heavy metals (lead, copper, silver, arsenic, mercury) and their presence are toxic to water
		10	Radioactive elements such as poisonous and carcinogens radium
		11	Electrical conductivity: knowledge of the cause and the possibility of connecting electrons in water

c. A remote sensor was not re-installed to monitor the water resources at Al-Sinak water station because it was shut down by the Municipality of Baghdad. The sensors of the station were removed to the directorate's headquarters without making use of them which indicates MOH's weakness regarding the selection of alternative sites for station installation. The storage of sensors affect the reduction of technical efficiency to perform its function properly, which led to the failure to register cases of monitoring or diagnosis of water resources since 2016 when the Sinak water project was terminated by the Municipality of Baghdad.
d. The sensors were not changed in all water resource control stations despite the expiry of its lifespan (five years only except for the pH sensor which is one year only), which led to the lack of accurate results. In addition, no titration solutions have been added since 2011, which titrate the sensors to ensure their proper operation.
e. The readings of the remote sensing station for monitoring water resources at Al-Mansour Melia Hotel have not been obtained since 2015 as it was difficult for the staff of Baghdad Environment Directorate to reach the station because of the strict security measures at the Iraqi Opera House. Therefore, the station was not utilized and the readings database was not obtained.
f. Al-Karama station stopped working because of the malfunction of the cable that transfers the readings from the sensor to the data processing unit (modem) since the year 2015, which led to the failure to store the data for this station and consequently failure to use the station in pollution detection and control.

3. Although the Ministry of Health and Environment provided remote sensing stations to monitor the chemical variables in the water sources in Diyala governorate, which included:

No.	Station site	Reason for creation
1	Buharz Station on the Diyala River	Monitoring of pollutants from a lift

		station in the Bharaz drain
2	Sadia Station on the Khursan River	Monitoring a water channel to feed Diyala Governorate
3	Al - Sadour station at Diyala dam in Al-Sadour area	Monitoring contaminated water to feed water projects
4	Kanaan Station on the Mehrut brook in the Canaan Water Project	Monitoring of contaminated water in Kanaan area

By reviewing the documentations we noticed the following.

(A) The work of these stations ceased due to terrorist acts and the lack of financial allocations for the maintenance of these stations, which led to the failure to record the state of contamination or knowledge of water quality since the start of work in the project.

(B) Inadequate stations above and low coverage of water resources in Diyala Governorate, such as Al-wind River in Khanaqin, the Rose stream in Baladrouz and the Al-Khalis brook in Hamrin Lake, which requires the inclusion of all water resources to enhance the monitoring role of the Diyala Environment Directorate and to ensure all tests are obtained including the possible chemical changes in water resources.

4. The absence of a complete statistical data on the number of pollutants monitored by remote sensing projects for monitoring water resources, remote sensing projects for monitoring sewage and early detection projects for oil pollution. We have been provided by the Environment Protection and Improvement office in the Central Region / Baghdad Environment Directorate with the total readings only for all stations without detailed numbers since (2011 to 2018) for each station, indicating that there is no periodic follow-up to obtain a database for readings of the above sensor stations.

5. There are some strategic projects operating in some provinces, which need maintenance to perform its work efficiently, that affected the process of transferring readings in a non-realistic manner and not achieving the objectives of the project as in the following table:

No.	Project name	Beneficiary party	Notes

1	Remote sensing project for monitoring water resources	Babylon Environment	Stations need maintenance
2	Remote sensing project to control the quality of water resources	Wassit Environment	Sensors need maintenance

6. The existence of some strategic projects in some governorates, that need to develop at some stage to be more efficient as shown in the following table:

No.	Project name	Governorates	The reason for the need for development	Procedures
1	Remote sensing of oil pollution in water sources	Kirkuk and Salah al-Din	Damaged by ISIS	A complete inventory of the damage has been carried out and needs to be rehabilitated
2	Remote sensing project for monitoring water resources	Wasit	Provide a large cost of communication fees from the sites of remote sensing stations to the main station in the Directorate in addition to the speed of transmission	Coordinate with the company to obtain an estimate statement for development

7. Field Visits: Through the visit of the Al-wihda , Jadriya , Sabee Ebakkar and Al-wathbaa in Baghdad, the following notes were noted:-

(A) The transfer of readings from (14) remote sensing stations to monitor water resources to the control center in Baghdad Environment Directorate was stopped due to the interruption of the communication and Internet service , resulting in the loss of the project its technical objectives for which the data was transferred to the control center in time. Data transfer is currently through the USB data transmission device and for sporadic and irregular periods, which may lead

to pollution in water sources without detecting it directly to avoid damage caused by

(B) The project has not recorded any pollution cases since the beginning of operation (2011) until now.

(C) The absence of a plan for the maintenance of stations at the Directorate of the environment of Baghdad The team noted the accumulation of dust and silt on the parts of monitoring stations in addition to the accumulation of dust on the solar panels, which leads to lack of accurate readings of the state of water resources.

(D) The team noted that most stations were installed at the water outlet of projects and complexes for the production of water to draw water from the water sources to the project, while these stations should be located at a certain distance from these stations and there to be sufficient time in the management of these projects to stop work when pollution took place. Such as the Wathba Water Project, which installed the remote sensing station between the six water outlet of the project.

(8) Field visits to the remote sensing project for monitoring water resources in Dhi Qar Governorate:

(6) monitoring sites were selected in Dhi Qar governorate by Dhi Qar Environment Directorate and included the following:

No.	Station name	monitoring sites	Water resource
1	Aifajer Station	Aifajer area	Gharraf River
2	Al-Rifai station	Gharaf area	Gharraf River
3	Wafaa El Shaab Station	Shatrah district	Gharraf River
4	Al Gharraf Station	Gharaf district	Gharraf River
5	Al Batha Station	Batha area	Euphrates River
6	Nasiriyah Station	Nasiriyah district	Euphrates River
7	Central station	The headquarters of the Directorate of Environment Dhi Qar to receive readings	Euphrates River

Regarding the station above we have the following:-

A- Although the DhiQar Environment Directorate paid monthly contributions to Telecommunications Company which has activated the timely SMS feature from substations to Central Station, this feature has not been activated due to a problem has not been determined by the contracting company. These six stations above lost the importance of (timely transmission readings), since the current method is to transfer readings by the data transmission device (U.S.B), download and transfer it to the central station headquarters for the purpose of analysis, therefore, this method is considered outdated and is not compatible with these stations.

B- There is a clear negligence of remote sensing stations that monitors water sources in Al-Fager area of Dhi Qar province which some parts of that station have been stolen; this led to lack of knowledge of water quality since 2015. In addition, No alternative site was selected in this area or sensors were equipped, despite there are a backup sensors at the headquarters of the Environment Directorate in Dhi Qar governorate.

C- The remote sensing station for monitoring the water resources in Nasiriyah suspended completely due to malfunction of sensors and the need for titration solutions. In addition, the low water levels led to silting inside the sensors then water quality has not been identified since 2016. This indicates that there is no prior follow-up by the Ministry of Health and the Environment regarding station sensors and the provision of titration solutions to ensure the continuous operation of the stations without obstacles.

D- The silting in sensors of remote sensing station to monitor the water sources in Rifai area led to the suspension of station entirely due to the silt. This refers to the weakness of Dhi Qar Environment Directorate in maintaining these stations and therefore the pollution has not been identified since 2016.

E- The necessary tests for identifying the water quality in the water sources have not been fully completed. The current tests in the stations' sensors (Wafaa El Shaab station, Shatrah station) do not fulfill the purpose of the monitoring where accurate results were not obtained with regard to water quality.

No	The currently available test in the sensors	No	The necessary and unavailable test in the sensors.
1	PH sensor to test the acidity and alkalinity functions of water	1	The chloride sensor to identify grams of chlorine in the water
2	(T.D.S) sensor to test the total soulable substances	2	The sensor of choliform (test faecal coliform bacteria)
3	The sensor of turbidity	3	The sensor of chloroform (organic solvent testing)
4	The sensor of Chlorophyll for plants	4	The sensor of heavy metals (lead, brass, arsenic, iron, silver) etc.
5	The sensor of dissolved oxygen (D.O)	5	The sensor of electrical conductivity (E.C)
6	The sensor of blue green algae B.G.A	6	The sensor of test the biochemical oxygen demand B.O.D
7	The sensor of OIL at Wafaa Al Shaab Station	7	The sensor of chemical requirement of oxygen C.O.D

F- The sensors for remote sensing stations to monitor the water resources in Wafaa El Shaab and Shatrah stations are inefficient due to they are not replaced since 2015. This led to the failure to obtain accurate results of water quality in water resources.

G- The Ministry of Health and Environment did not construct remote sensing projects to monitor sewage and early detection of oil pollution in Dhi Qar governorate, despite they construct projects to monitor water resources and add only one sensor for measuring oils (OIL) at Wafa El Shaab station. This does not give an environmental indication for volume of oil pollution in power plants, oil refineries and industrial plants, as well as the quality of wastewater discharged from sewage treatment plants

in Dhi Qar. As in Basra, there is no project of remote sensing to monitor the water resources , sewage water and early detection of oil pollution where there is no consideration to the number of service activities, industrial, oil and power generation plants and their pollution to the river.

H- Due to wrong selection of Gharraf station site in Dhi Qar governorate which works to withdraw water from the lifting stations to Al Gharraf project, this led to the lack of an indication of water quality prior to its withdrawal or before its entry into the project and therefore not to take advantage of them. Accordingly, the project workers should know the type of water before starting drinking water purification projects to take into account the non-withdrawal of contaminated water when chemical variables is identified by informing them timely of pollution to protect the health of citizens.

I- No remote sensing stations have been established to monitor the water resources in the Dhi Qar marshes to determine the quality of water, as well as the potential chemical, physiological and biological properties that may adversely affect aquatic life and biological diversity.

Second: <u>the remote sensing project to monitor sewage water:</u>

The projects objective is to obtain the Ministry of Health specialists the data of treated wastewater of pumping stations and sewage projects discharged to water sources timely by contacting the circuit switched data (CSD) of withdrawal readings from substations to central station (control center) at Environment Directorate Building. After reviewing the documents presented to us, discussing them with project members, requesting the information and conducting the field visits, we include the following observations:

1. the remote sensing projects have not been completed or established to monitor sewage water in all governorates except Baghdad which led to lack of the knowledge of water quality discharged to rivers in these governorates. Consequently, a

database of environmental readings was not obtained to enhance the oversight role of the environmental directorates in the governorates. The project has been implemented in the province of Baghdad only. Five stations to monitor the sewage water resulting from sewage projects and pumping stations has been selected to identify water quality discharged to rivers in Baghdad and as shown in the following table:

No	Places of monitoring points
1	The sensor station of sewage water at Albuitha
2	The sensor station of sewage water at Southern Rustum
3	The sensor station of sewage water at Northern Rustmiya
4	The sensor station of sewage water at Rasheed area near the General Company for Vegetable Oils (T.S.I)
5	The sensor station of sewage water at Al-Saydiya area (P.N)

2. All chemical, physiological and bacteriological tests are not included in these stations, despite their importance in detecting the hazardous pollutants on water bodies. This led to failure of these stations to obtain a comprehensive assessment of all tests of sewage water discharged to the rivers. This is contrary to technical feasibility of the project to find out the pollution percentage in water discharged to rivers which lead to negative effects on the public health of citizens and aquatic life as shown in the table below:

No	The available test in the sensors	No	The necessary test has to be provided
1	The heat water sensors	**1**	The test of electrical conductivity E.C
2	The sensor of turbidity	**2**	The test of ammonium, total phosphorus, positive and negative ions, and heavy metals for toxicity detection (NI,CD,ZN,MN,PB,CU,FE)
3	The sensor of dissolved oxygen D.O	**3**	(T.D.S) test the total dissolved solids
4	The sensor of blue green algae	**4**	(T.S.S) test the total suspended

	B.G.A		Solids
5	The sensor of Nitrate (NO3)	**5**	Test the choliform (fecal coliform bacteria) to assess the extent of biological pollution
6	PH sensor to test the acidity and alkalinity functions of water	**6**	Test the choliform means the nutritional enrichment of marine plants, i.e photosynthesis indicates the direct drainage on the river
		7	Test of chloroform which is an organic solvent and considers one of the pollutants.

3. The monitoring station sensors have not been changed since the start of operation in 2011, despite that their life span is expired. This resulted inaccurate results from these sensors that indicates there is no pre technical follow-up for the purpose of providing spare parts for these sensors as shown in table below :

No	**The current available sensors in the station**	**Lifespan**
1	Wiper Kit	Two months
2	PH Probe	One year
3	Turbidity Probe	Three years
4	DO Probe	Three years
5	DO Membrane Kit	One year
6	Conductivity Temp Probe	Three years
7	NO_3 Sensor	Six months
8	Blue Green Algae Algae	Three years
9	Zinc Anode Kit	One year
10	Copper Tope	One year
11	Conductivity Standard 10000	One year
12	Assorted PH Buffers	One year
13	Turbidity Standard,0 NTU	One year
14	Turbidity Standard,10 NTU	One year
15	Turbidity Standard,100 NTU	One year

4. The sensors of sewage monitoring stations need titration solutions to continue the tests correctly and ensure accurate results as shown in table below:

No	**solutions**	**The required number**	**The Sensors**

1	0 NTU	3	Turbidity
2	10 NTU	3	
3	100 NTU	4	
4	100 mg /L	500 ml	NO_3
5	10 mg /L	500 ml	
6	1 mg /L	500 ml	
7	PH_4 , 7, 10	1	PH
8	Conductivity 10.000 us cm	1	Conductivity

5. Some spare parts are not available that are required to operate the remote sensing project to monitor swage wastewater. This resulted in the project is not worked properly as shown below :

No	Required material	Number
1	Solar panels 40-w	1
2	The device of regulating and charging batteries from Solar panels	2
3	Data transfer cable between the oil sensor (C3) and (Datalogger)	5
4	Data Transfer Cable for flow meter device (SW (Soutek)	4

(6) No alternative site was chosen for the remote sensing station to monitor sewage water in Albo-Itha, which was withdrawn due to the rehabilitation of Karkh old Sewage Project. The rehabilitation works lead to the draining of the amounts of water discharged to the rivers thus causing damage to the station sensors. Water quality has not been monitored during the rehabilitation works period from 2015 till now.

(7) A device (C3 sensor) for oil testing was removed from Saidiya station (PN) because of the integration of the transmission cable and the reading transfer cable that is connected to (sensor) device to the plant (the cabinet).This led to short circuit in the other sensor devices namely the sensor holder device (YSI). However, the justification given by the office was the expiration of the lifespan of the devise and this shows the poor procedures taken by the beneficiary regarding the maintenance of equipment and the misuse

of the cables of the station .Accordingly ,the sensing station fails to monitor the quality of water and the main objective has not been achieved. In addition, storing and non utilization of sensors negatively affect their effectiveness especially those withdrawn from this station based on the Protection and Improvement of the Environment (Central Region) Directorate letter (/ 2/7/949) on 15/04/2015 which states that (the sensors are affected by the conditions of storage as well).

(8) Site visits: Site visits were carried out for all the operating stations in Baghdad . below are our observations:

(A) Repeated high nitrate test (NO3) rates which negatively affects the aquatic organisms and all sensor sites. It was also noted that there is no action was taken by the project managers to inform the party responsible for this rise and address it as is the case with the Northern Rostumiya Sewage station and Al-Rasheed Rain station (T.S1).

(B) Non replacement of the special sensors for all stations despite the expiration of their lifespan .This in turn led to their poor performance and inaccurate readings or the inability to detect some of the components of pollution.

(C) The accumulation of dust on the solar panels of all stations negatively affects the efficiency of these panels in the production of electric power for the stations despite the weekly maintenance plan of the Environment Directorate to visit two stations according to the letter of the Directorate No. (38) on 19/04/2018.

(D) Not replacement of the sensor batteries installed since 2011 led to the reduction of energy and caused sensors to stop working or transfer of inaccurate data and this indicates a clear weakness in the process of monitoring these sensors and all stations.

(E) The transfer of data from all the sensors in the stations to the control center was suspended due to the interruption of the direct

communication service which led to losing the technical importance of the project in timely monitoring the contamination. Thus there may be a case of pollution that occurs without being detected as the adopted current method is to withdraw data from the stations from time to time by (USB).

Third: The project of Oil Pollution Early detection:

The project aims at monitoring the oil pollution resulting from different sources and accurately identifying the source of pollution i.e. the cause and leaks generated by the oil refineries, power plants and others by means of installing remote sensing stations erected on the river and connected to central stations . Text messages (SMS) are used through a communication company to transmit the readings in a timely and accurate manner .Ultimately, identifying the source of pollution related to the entity responsible without returning to the station site to withdraw the readings. The authorities concerned such as water purification plants are informed for the purpose of taking the necessary measures to prevent oil spills entering the station. Through reviewing the documentation of the project , inquiring the members of the project and make the site visits, the following observations are noticed :

(1) Non inclusion of all the provinces by early detection projects for oil pollution and hydrocarbon pollutants, except for the provinces of Baghdad, Kirkuk and Salahuddin. Accordingly , no monitoring is conducted for potential contaminants in the water resources discharged by oil refineries, industrial plants and electric stations, as well as spills resulting from oil accidents and others as in the provinces of (Najaf, Wasit, Babel, Karbala, Diyala, Maysan, Diwaniyah and Basra) for example. The number of oil and industrial activities, power plants and the like is not being considered.

(2) Lack of the detection feature for concentrations of oil spills in all sensors of early detection stations for oil pollution.the station work is confined to detecting whether there is oil spills or

pollution or not .Accordingly , no detailed information on the toxicity of these spills and their impact on human , aquatic life and the surrounding environment is found .The danger of the oil spills is that they contain many organic substances and hydrocarbon compounds that cause cancer and aquatic organisms death.

(3) Six monitoring points were selected by the Ministry of Health and Environment in Baghdad governorate starting from north of Baghdad to the south to identify the source of pollution resulting from the entity responsible and as shown in the table below:

No	Monitoring Points sites
1	Early Detection Station for Oil Pollution in Zafaraniyah Water Project
2	Early Detection Station for Oil Pollution in Dora Water Project
3	Early Detection Station for Oil Pollution in Taji beaches
4	Early Detection Station for Oil Pollution in Sinak Water catchment
5	a floater carrying the sensor for the early detection of oil pollution in Diyala bridge (Tigris River stream)
6	a floater carrying the sensor for the early detection of oil pollution near the thermal power plant south of Baghdad / Zaafaraniya

The following observations were made by reviewing the documentation of the project and through site visits:

(A) Failure to achieve the objectives of the project to control the oil pollution led to the reduction of the effectiveness of this project as a result of the non transferring of readings from the sensing stations to the central station (control center) in the Environment Directorate of Baghdad for the purpose of analysis .The reason behind is lack of funds needed to pay subscriptions to the Communications Company (Asiacell) to activate text messages service (SMS) and to make investigation to identify the entity causing the pollution. The mechanism used to transfer the readings is by saving the data on a USB flash drive and transferring it to the central station to analyze it and identify the size of the contaminants and

their toxicity .As a result the project's objective in identifying the pollutants and transferring the readings in a timely manner for the purpose of taking the necessary measures and informing the relevant authorities has not been achieved as is the case in the early detection stations working in the Zafaraniyah water project, the Dora water project and Taji beach project in the northern Baghdad entry area Al-Mansour General Company Headquarter).

(B) The absence of an annual or monthly plan to perform maintenance works and maintenance of sensors to ensure the permanence of its work in the stations to obtain the most accurate results.

(C) The sensor of the early detection of oil pollution was not re-installed as an alternative site to Sinak Water catchment due to its closure by the Municipality of Baghdad due to the suspension of the work of the purification complex where the sensors of the station were withdrawn to the headquarters of the Environment Directorate of Baghdad without benefiting from them in monitoring the oil pollution in water resources since 2016 up to now .For, the suspension of any detection station affects the accuracy of the detection and its follow-up because the oil spills spreads out and moves with water flow. This indicates a clear weakness of the Ministry of Health and Environment regarding the choice of alternative permanent sites for station installation in addition to storing these sensors leads to reducing their efficiency due to non utilization.

(D) Clear negligence by the Ministry of Health and Environment concerning the installation of the sensors. Fixed sensors installed instead of those carried by floaters . these floaters at the site of Diyala Bridge and the thermal power plant south of Baghdad / Zafaraniyah to tip over and sink .In addition, they did not take in to account the increase of water levels due to the works of cleaning rivers or paving the rivers shoulders by the Ministry of Water Resources .The increase of water releases has not been taken ito consideration. This indicates

the lack of a clear vision and a thorough objective study on the selection of non fixed sensors. As a result , no detection took place of any contaminants since 2016 due to tipping over or sinking of the floaters.

(E) Accessing the floaters holding the sensors for maintenance and calibration has not been taken into consideration given the fact that there are no boats to perform these tasks. It is clear that no specialized scientific pre-study was conducted before the establishment of these sensors for deciding how to access them to ensure accurate results.

(F) The absence of special storage facilities for over or sinking floaters that tipped over or sank .Ultimately ,they got rusted and damaged as they are kept in the open air (the garage of the Department of Environmental Protection and Improvement in the central region). In this sense, the Ministry of Health and Environment fails to provide special stores for tools and related equipment to ensure protection for property.

(4) The work was suspended in the remote sensing stations for oil pollution in the water resources in the provinces of Kirkuk and Salahuddin because of the damage caused by ISIS and no action was taken to have the work resumed in the stations.This, in turn, led to losing the remote sensing station significance of detecting pollution in the two provinces, especially with the existence of many oil facilities and their frequent resulting oil leaks.

(5) The absence of early detection projects for oil pollution on the Euphrates River, especially in Anbar province as it is considered the first entrance of the Euphrates River . Any oil pollution caused by oil and electricity facilities in the province or from the water coming from Syrian territory can be detected these projects, if found. Pollution may spread out to other provinces without detection and treatment.

(6) During the site visit to Dhi Qar Environment Directorate, we checked the project of "Measuring hydrocarbons in soil and water adjacent to oil refineries and power generation plants by

OCMA500 device which was provided by the Ministry of Health and Environment . we have the following observations in this concern :

(A) This Project which consists of a station for testing hydrocarbon, does not cover all the areas included in the test in Dhi Qar province with all its towns and villages. This does not give a clear indication of the size of the hydrocarbon pollutants offered by service, industrial and oil activities.

(B) No accurate results of the diagnosis of hydrocarbons in water sources were obtained due to the fact that the station's workers do not use it correctly .They tend to thin the organic solvent (S-316) used in the diagnosis of hydrocarbons to avoid running out of this solvent because of the very small amount available. Adequate amounts of the Materials used in the diagnosis (organic solvent) are not made available .

(C) Continuous power cuts and failure to provide an emergency line adversely affected the final results of the sample examination (for soil and water).

(D) The absence of a plan for conducting tests . They are conducted according to what is provided or in response to a complaint by citizens or under the direction of the senior management of Dhi Qar Environment Directorate. As a result , no database for the hydrocarbons pollutants size is found in the province.

Z. there is no enough number of tested samples compared with the number of service and industrial activities in Dhi Qar Governorate and all activities are not included. (5) samples were examined in 2017and (2) models in 2018 only as shown in the table below:-

N.	sample collection location	Rate	The Specified rate of oils in soil	The Specified rate of oils in rivers	The Source of sample collection and its date
1	Nasiriyah Center near footbridge	7.7mg \ l	-0,5) (1,0mg\l	Zero	Electrical Power

	/Euphrates River				Station 2/7/2017
2	Al Nasriyah Center after sewage station/Euphrates River	10.4	-0,5) (1,0mg\l	Zero	Sewage Pumping Station 20/7/2017
3	Sample of RO water in Batha area drain	Zero	-0,5) (1,0mg\l	Zero	RO Government Station- Al Batha District 19/12/2017
4	Sample of soil collected From Nasiriyah oil field	3,9mg \ l	-0,5) (1,0mg\l	Zero	Nasiriyah oil field 17/8/2017
5	A Soil sample near to refinery of Dhi Qar	8,3mg\l	-0,5) (1,0mg\l	Zero	Dhi Qar Oil Refinery 13/9/2017
6	A sample of river water near to the oil refinery of Dhi Qar	4,0mg \ l	(1,0-0,5) mg\l	Zero	Dhi Qar Oil Refinery 18/3/2018
7	A Soil sample from thw site between Dhi Qar refinery and landfill site	6,3mg\l	-0,5) (1,0mg\l	Zero	Location between the refinery and the dumping site 18/3/2018

(7) **Field visits**

Field visits were carried out for the early detection stations of oil pollution in Baghdad and in this regard we notice the following:-

A- The transfer of data from the sensors to the central station has suspended due to the interruption of the direct communication service in all the stations. This led to the project to lose its technical importance in the monitoring of pollution timely. It could be a case of oil pollution and pass without monitoring because the current methods are to collect data from stations from time to time by (USB).

B- the location of the early detection station for oil pollution of the projects of Dura and Zafaraniya water treatments projects is near the water outtake of the project may result in the oil spill

entering inside the project (sedimentation and purification basins) because the sensor is near the outtake of the raw water of the project, there is not enough time to report on leakage and the project is suspended before the arrival of the oil spot.

C- The team was unable to see the station in the ALDURA water treatment project during the field visit on 17/4/2018 because there is no paved road due to the propagation of cane plants . This indicates that there is interest in this sensor, despite its importance due to the Dura electricity station is near to it and there is an indication of the discharge of liquid waste from the station and therefore this project is lost its important.

D- The solar panels are covered by dust which negatively affects their efficiency in the provision of power stations with electricity. The batteries of sensors are not replaced that have been installed since 2012, which leads to low energy and the sensors are suspended or transferred inaccurate data. It is supposed to clean these panels twice a week and this indicates a clear lack in the follow-up process of these sensors as in Dora and Zaafaraniya stations

B. The benefit of the projects through coordination with the beneficiaries:

the following is observed through addressing the letters to the relevant authorities on the results of the projects of remote sensing of water sources ,sewage and early detection of oil pollution represented by Baghdad Municipality (Baghdad sewage Service, Baghdad Water Department) and the Ministry of Construction, Housing, municipalities and Public Works (General Directorate of Water):-

A- There is no objective and accurate study in advance foe selection the location of remote sensing stations to monitor water sources in Baghdad. Three Sensors of monitoring stations (Abu Ghraib,Tarmiya & Taji Beach Stations) were removed to the headquarters of the Baghdad Environment Directorate in order to

install on the river in remote areas completely isolated from the cities. In addition, the storage of sensors at the department's headquarters has negatively affected its efficiency as a result of non-usage .

B- All chemical, physiological and bacteriological tests are not included in remote sensing stations for water sources and sewage, although their important for the diagnosis of pollutants that are hazardous to the environment, especially those that are discharged by service institutions, industrial or power plants to identify the responsible agent for discharge these pollutants into the rivers.

C- The sensors of water sources and sewage monitoring stations in Baghdad and governorates have not been changed, despite life span is expired. In addition, titration solutions have not added since 2011, resulting in the failure to obtain accurate results and ensure the continuity of their work properly.

D- Remote sensing stations to monitor chemical variables in water sources are suspended in Diyala province that have been damaged by terrorist acts. The financial allocations for the maintenance of these stations are limited. These led to the failure to record contamination or identify water quality from the beginning of project.

E- There are no entire statistics of the number of pollutants monitored by remote sensing projects and early detection projects for oil pollution

F- Some strategic projects in some governorates need to be maintained to perform their work efficiently. This affected the process of transferring readings in real time as well as the objectives of the project are not achieved as in the governorates of Babylon and Wasit.

G- The transmission of readings from most remote sensing stations to monitor water sources, sewage and oil pollution to central stations in Baghdad and the provinces has suspended due to the interruption of the communications and the Internet service which resulted in the loss of the project's technical objectives of

transmission of data to the center timely. Currently, the data is transferred currently by (USB) for separate and irregular periods.

H- O. The remote sensing projects for water and sanitation and early detection of oil pollution did not achieve part of their technical goals. The ministry of health and environment has not notified the authorities concerned (Mayoralty of Baghdad, Baghdad Water Authority, Baghdad Sewage Directorate, Ministry of Construction and Housing and Municipalities and Public Works/Water Public Directory) that there are pollutants. There is no monitoring process for any chemical or oil pollution or discharge swage water beyond environmental controls by remote sensing stations, although some pollutants beyond the environmental controls have been through the laboratory testing in the labs of ministry of environment and the labs of the authorities concerned.

I- 5. recommendations

J- A. All governorates should be covered with the establishment of remote sensing projects to monitor the water resources in order to identify their water type.

K- B. a precise pre-study to select the sites of remote sensing stations sould be made to monitor water resources and accelerate the installation of the three sensors that have been removed.

L- C . The stations for monitoring water resources should be developed to include all necessary tests that give a full picture of the water quality.

M- D . The expired sensors of the remote sensing stations should be replaced so that these sensors can read correctly.

N- E . rehabilitating the remote sensing stations to monitor water resources.

O- F . developing a data base and archiving the tests results of the remote sensing projects to monitor water resources, sanitation and early detection of oil pollution.

P- G . conducting maintenance and rehabilitation of projects requiring maintenance.

Q- H – activating the communication services from the sub monitoring stations to the central station in Baghdad and the governorates so

that the reading s will be submitted instantly , which is the main objective of the project.

R- I. the marches are included in remote sensing projects to monitor water resources and oil pollution because they are one of the significant water bodies in the country and the non-detection of pollutants threatens their biodiversity.

S- J. all governorates are included with remote sensing projects to monitor waste water to ensure access to database on the treated waste water by projects.

T- K. all governorates are included with early detection projects of oil pollution to ensure the detection of oil leak in a timely manner.

U- L. developing the early detection stations of oil pollution to include the readings of oil strains and h hydrocarbons concentrations percentages because they are important in detecting the risk of these strains which in turn entailed economic and health implications .

V- M. rehabilitating early detection stations of oil pollution and water resources at Kirkuk and Salah-Aldeen governorates to ensure the detection of oil leak especially in the two governorates that contain oil fields and oil refineries.

W-N- there is need to establish early detection projects of oil pollution in the Euphrates river ,especially in Anbar governorate.

X- O – operating all remote sensing stations completely and inform the relevant authorities of the detected pollutants instantaneously so that they can take appropriate measures to avoid pollution.

Table (1)

Main risks matrix

Main problem	Undesirable events and issues	possibility	effect	Estimated risk	Risk area	response	Remaining risk	Priority
Pollution spread and degradation of water quality of the water bodies in Iraq	There are many oil and service activities that release its pollutants to the water bodies without treatment	7	8	56	Operational	25	31	2
	Failure to achieve the main objectives for which the sensing stations were established	9	9	81	Operational	45	36	1
	Ministry of health and environment is reluctant to achieve remote sensing projects and early detection	6	8	48	Operational	25	23	4
	All governorates have not been included in the remote sensing projects and early detection	7	7	49	Operational	20	29	3

Sub risks matrix

sub problem	Undesirable events and issues	probability	effect	Estimated risk	Risk area	response	Remaining risk	Priority
Failure to achieve the main objectives for which the remote sensing stations were established	Weak coordination between ministry of health and environment and the concerned ministries	8	9	72	Operational	35	37	1
	All necessary tests that gives complete image for the size of pollutants in the remote sensing stations have nor been included	6	7	42	Operational	25	17	4
	The data transfer service has stopped which leads to lose the importance of the projects	7	9	63	Operational	30	33	2
	Lack of accuracy in selecting sites for some of water environment monitor stations	7	8	56	Operational	30	26	3
	End of virtual life of sensors in the remote sensing stations	6	6	36	Operational	20	16	5