

**A detailed report on the Baghdad Municipality's  
policies of providing drinking water and setting  
up treatment stations and plants and the  
establishment and maintenance of drinking water  
and raw water networks**

**Board of Supreme Audit  
Iraq**

**2016**

**Sub/ A detailed report on the Baghdad Municipality's policies of providing drinking water and setting up treatment stations and plants and the establishment and maintenance of drinking water and raw water networks**

1. Audit objective

The main objective of the process of evaluating the performance of providing drinking water and set up treatment stations and plants and the establishment and maintenance of drinking water and raw water networks is providing the drinking water of good quality and in quantities sufficient needs of the population of the capital Baghdad.

2. Adopted standards

First: WHO determinants in terms of drinking water.

Second: system of maintenance and public water No (25) for 1967 (amended)

Third: Environmental legislation issued by protecting and improving the environment for 1988 ( which contains of different laws and regulations and standard specifications and health control systems related to the environment).

Fourth: Act of the ministry of environment No (37) for 2008

Fifth: act of protecting and improving environment numbered (27) for/2009

Sixth: Iraqi standards specifications numbered (417) for 2009 issued by Iraq Central Organization for Standardization and Quality Control.

Seventh: previous specialized reports of FBSA

3- adopted auditing methods

A-the environment auditing in a method of commitment of laws, Regulations and legislation.

B-environmental auditing in a method of technical laboratory test.

Where the method of environmental auditing by Commitment Center rules and regulations and legislation style issued by related ministries like the ministry of environment and law of environment No (37) for 2008.

law of Protection and improvement of the environment No (27) for 2009 and maintenance system of the public water system and rivers from pollution no (25) for 1967 and the determinants of the World Health Organization in regard to drinking water as well as the use of environmental auditing way manner by laboratory test method through comparing the tests that were made by the laboratories quality control of the Department of Water Baghdad and laboratories of the World Health Department / Ministry of Health has been shown to repeat the failure in some of the results of tests conducted by the Ministry of Health .through tests that were made by the labs of auditing control of department of Baghdad water office and labs of department of public health/ministry of health and protecting and improving the environment law, No. 27 of 2009 and the maintenance of public water from contamination No. 25 of 1967 and determiners of World Health Organization with regard to drinking water as well as the use of environmental auditing by laboratory testing through comparing the tests that have been conducted by the laboratories quality control of the mayoralty of Baghdad and laboratories of the public Health Service / Ministry of Health and the repetition of failure in some of the results of tests conducted by the Ministry of Health / public Health Service for some projects ,plants and water plants related to the mayoralty of Baghdad, such as checking turbidity or the presence of biological contamination of certain types of bacteria due to the high level of turbidity as a result of rain or because of sudden break for projects and plants as a result of power cuts ,as well as there are numbers of polluting models (biologically and physically) examined by the office of public Health, which has shown invalidity of drinking water of some health centers and institutions and Houses of citizens because of broken networks and pipelines and entering sewage and groundwater to the networks.

#### **4. The problem of the subject of the evaluation and its impact on society:**

The Preliminary studies made by the evaluation team through the strategic planning of the inadequacy and insufficiency of water produced in Baghdad is the main problem, which was affected by several sub-problems, the most important weakness is the measures of Baghdad Municipality in providing drinking water and set up stations and liquidation plants and the creation and maintenance of drinking water networks and crude water, which include:-

- Lack and obsolete of some drinking water projects, stations and plants.
- Lack of water pumping stations and the closure of most of its networks
- Water networks and pipelines are obsolete and there are many damages and illegal connections.
- delay in implementation some of the producing drinking water projects Which resulted in the failure to provide drinking water of good quality and in quantities sufficient need for the population of the capital Baghdad, and especially in the summer

### 5-Results:

The work team conducted personal interviews, field visits, and memorandums, questions, and questionnaires preparation, noted evaluation results below:

- a- Through studying the initial documents regarding insufficient and old stations, projects and potable water compounds, we noted the following:

First: most of water treatment projects in Baghdad are old, although maintenance and rehabilitation operations are carried out which impact produced water amount due to expiry of operational lifetime (25 years) of most projects as shown below:

No.	Project name	Implementation date	Operation date
1	Al Karkh water project	1980-1985	1985
2	East Dajla water project - First expansion - Second expansion	1971-1975 2002-2004 2007-2012	1975 2004 2012
3	Al-karama water project - First line - Second line - Third line	1953 1955 1980-1983	1953 1955 1983
4	Al-durra water project	1980-1983	1983
5	Al-wahda water project - First line - Second line	1953 1955	1953 1955
6	Alwathba project	1934	1934

	- First line - Second line - Third line	1972 2005-2007	1972 2007
7	Al-Rasheed project	1963	1963
8	Al-kadasia water project	1963-1972	1972
9	Alsadeer water project	2005-2008	2008
10	Aljadrea project	2006-2008	2008
11	Al-kadamia water project	2007-2012	2012
12	Albaladiat water project	2007-2013	2013

Second: insufficiency of drinking water produced by Baghdad water department to meet the need of population, about 1022000000 m<sup>3</sup>/year. The actual population need was calculated according to following equation:

Standard daily requirement per person= 0, 4 m<sup>3</sup> /day/person (according to data of Baghdad water department)

Standard annual requirement per person= 0, 4 m<sup>3</sup> /day/person x 365 day/year=146 m<sup>3</sup>/year/person

Actual requirement of Baghdad = 146 m<sup>3</sup>/year/person x number of Baghdad population which amount 7000000 person (according to data of Baghdad water department) = 1022000000 m<sup>3</sup>/year.

The following table shows the annual produced water, annual wasted water and actual water amount provided to customers and the rate of annual shortage.

year	Annual production 1000 m <sup>3</sup> /year	Annual waste 1000 m <sup>3</sup> /year	provided amount 1000 m <sup>3</sup> /year	Actual requirement 1000 m <sup>3</sup> /year	Shortage amount 1000 m <sup>3</sup> /year	Shortage rate
2012	916967	311769	605198	1022000	416802	41%
2013	892718	294596	598122	1022000	423878	41%
2014	918263	275479	642784	1022000	379216	37%
201	974776	282385	692391	1022000	329609	32%

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\*The amount of annual waste includes breaks, illegal connections and transferred quantities to areas outside Baghdad and other.

Third: declined actual capacities against design and available capacities for most projects of drinking water liquidation as result of obsolete operation working hours and power outage which lead to shortage of water amount of these projects, so in some projects reached to 36% of design capacities and the following table show that:

<b>Project name</b>	<b>Designed capacity 1000 (m<sup>3</sup>/year) (1)</b>	<b>Available capacity 1000 (m<sup>3</sup>/year) (2)</b>	<b>Real capacity 1000 (m<sup>3</sup>/year) (3)</b>	<b>Rate (3/2)</b>	<b>Rate (3/1)</b>
AL Karkh	491400	442260	436100	99%	89%
First East Tigris	269700	242730	218811	90%	81%
Second East Tigris	66960	55000	53950	98%	81%
Dora	41400	37260	27985	75%	68%
karama	79200	63360	56163	89%	71%
Qadisiyah	74640	59712	26883	45%	36%
Wathba	48900	39120	27130	69%	55%
Rashid	24480	19584	17629	90%	72%
AL wahda	25920	23328	15815	68%	61%
Sadr water	34560	32832	32396	99%	94%
Jadiriya water	21120	19000	14844	78%	70%
Kadhimiya water	32400	25920	15004	85%	46%
AL Baladiate	35000	33000	32066	97%	92%

Forth: most flow meter devices are unavailable or malfunctioning in most projects, therefore water quality inflows and outflows of the project and is unknown which is substituted by estimated calculations, the table below shows that:

No	Project name	Existence of flow meter at the outlet	Existence of flow meter for actual produced water of project
1	AL Karkh water project	available but no readings	available but no readings
2	First East of Tigris water project	available but no readings	available but no readings
3	Second east of Tigris water project	available but no readings	available but no readings
4	Dora water project	none	available but no readings
5	karama water project	2 exist and give reading	available but no readings
6	Qadisiyah water project	exists and give reading	available but no readings
7	Wathba water project	none	none
8	Rashid water project	none	none
9	AL Wahda water project	exists and give reading	available and give a reading
10	Sadr water project	exists and give reading	exists and give a reading
11	Jadiriya water project	none	none
12	Kadhimiya water project	none	none

Fifth. Contrary to the instructions that require every project to have integrated lab, we noticed the absence of an integrated laboratory (physical, chemical, Biological) in Alrasheed water project and most of the department's water purification compounds, but rather an examination of chlorine and turbidity. As a result, these tests are made over quite long periods (weekly and monthly) and this does not give indication of the quality of water produced, and that make potential chemical and biological contaminants unidentified in those compounds and on a daily basis. Such tests are sent to projects laboratories by geographical area which makes it

difficult to send those checks from one location to another and take time and effort due to the difficulty of movement between these locations.

Sixth. the existing tests were not conducted as per Standard specifications by quality control laboratory of Baghdad water department for various reasons, including a lack of quality control laboratories to sufficient experience in the field of specialized and technical expertise that enable them to run devices and conduct testes us shown in the table below:

<b>No</b>	<b>the non conducted test</b>	<b>Reason</b>
1	Organic compounds (Hydrocarbons) and pesticides and by-products of	Lack of qualified staff trained to work on a gas chromatograph used for conducting this examination
2	Radiological tests	This test is exclusive to radiation prevention center

Seventh- through our audit works to results of water tests conducted by the Ministry of Health / Public Health Service and the results of laboratory tests of Baghdad's water Department that show us the existence of deviations of the results of tests conducted by the Public Health Service of the water produced from the projects and compounds and houses and health centers while tests laboratories Baghdad water Department did not indicate the existence of deviations only in small numbers, which requires coordination between two departments to reach a common outcome because the water topic important and has a direct impact on the health of citizens, the following table shows, for example, number of polluted tests (Biologic and physicist) and made by the Department of public Health.

<b>No</b>	<b>Year</b>	<b>Number of biologically polluted tests</b>	<b>Number of physically polluted tests</b>
1	2012	3011	566
2	2013	1974	780
3	2014	1929	3521
4	2015	1983	6308

Eight- existence of polluted models (biologically, physically) tested by Ministry of Health / Public Health Service that proved that water is unfit to drink in some centers, health institutions and houses.

Ninth- Repeated failures in some tests results conducted by the Ministry of Health /Public Health Service in some projects, compounds and water plants of Baghdad Water Department such as checking turbidity or the presence of biological pollution in certain types of bacteria.

b- By studying documents of pipelines and networks water obsolescence, the many broken water pipes and frequent excesses on it, the following observations were noted:

First: The lack of efficient water networks in some areas due to old constructions which have significant impact on the quality of delivering water to the citizens as a result of groundwater or sewage water networks interfere with water networks. The following table shows sector numbers in those areas:

<b>No</b>	<b>Region</b>	<b>Locality</b>
1	Sadder/2	561,564,555,557,504,531,533,545,523,512,522,514
2	Rasheed	801,809,819,821,815
3	Dora	804
4	Karkh center	228
5	Karada	951
6	Rusafa center	105
7	Shula	452,456,434,436,426,427
8	Mansour	624,639,641,643,626,637,636,634,640,606,618,649,685,673,628,629,627,620
9	Rusafa center	147,141
10	Shaab	309,329,321,337,353,327,319
11	New Baghdad	735,751,733
12	Ghadir	626

Second: the rate of wasted drinkable water was high due to the ruptures and encroachments on the network that negatively affected the amount of waters supplied to the citizens. Also, it cost the office huge amounts reached to (8149603000) (eight billions one hundred forty nine millions six hundred and three thousands dinars) for the years 2012-2015. The following table shows that:

Year	Produced amount (1000 m <sup>3</sup> )	Wasted amount (1000 m <sup>3</sup> )	Waste rate	Waste cost thousand/ dinars
2012	916967	311769	34%	2182383
2013	892718	294596	33%	2062172
2014	918263	275479	30%	1928353
2015	974776	282385	29%	1976695

Third: illegal connections by the citizens to drinkable water network have degraded them although they were founded few years ago. This affected the amount of waters supplied to the citizens. The following table shows the connections locations:

No.	Location	District
1	The other side of Safi El-deen al-Hilli's street	345
2	Recent violationns locations	317
3	Hay Al-Sadrein	346
4	The street paralleled to Al-Sadda/ Al-	357

	Sha'ab	
5	beyond Al-Sadda/ Baghdad Al-Jedida	745

Fourth: There are many ruptures in water networks' pipes due to old networks, other offices' works, services overlapped and the citizens' encroachments on these networks what cause an additional water's waste in the amount produced. The following table shows the number of cracks for the years (2012, 2013, 2014 and 2015):

No.	Year	Sector	Number of ruptures
1	2012	Al-Rusafa	113
		Al-Karkh	113
2	2013	Al-Rusafa	141
		Al-Karkh	174
3	2014	Al-Rusafa	159
		Al-Karkh	151
4	2015	Al-Rusafa	140
		Al-Karkh	156

Fifth: There are some problems and obstacles facing Baghdad Water Authority due to its work overlaps with that of the municipal offices in Baghdad the capital and as the follows:

1. Encroachments caused by the citizens on water distribution networks and linking lines led to:

a. Damaging the pipes and the lines of distributing drinkable water that cause water pollution as a result of the pollutants in the network. These pollutants are (rain water and sewers).

b. decreasing the pressure in the pipes for not using the network as planned.

2. Building houses illegally on water distribution pipes that obstacle maintenance.

3. Causing cracks in the network and the citizens are uncooperative in reporting on these cracks what lead to water waste.

4. The citizens refuse to pay water bills so amounts are accumulated what led to their inability to pay them.

5. Misusing water locks by the citizens what deprives some areas from drinkable water.

6. Changing the property type without informing the office; therefore, taxation is disrupted in addition to the overlap in database information and data on the participants.

Sixth: Some uninhabitant residential districts are not provided with drinkable water networks. This is shown in the following table:

No.	Separated lot's name and number	District no.	Comments
1	Al-Thi'alba 2/4	369	These separated lots were not expanded for the lack of services
2	Separated lots within the districts (375m 373)	375, 373	A field survey is performed and pressures are checked to supply Al-Tha'alba by extending a (900)mm diameter pipe
3	Rakia and fadhil 1/1/43	484, 486	Hydraulic study was prepared, necessary surveys were made and extending emergency pipe to facilitate the citizens' building process
4	Salamiyat 5/2	484, 490	Hydraulic study was prepared, necessary surveys were made and extending emergency pipe to facilitate the citizens' building process
5	Alruwad 1/596	444, 492	Hydraulic study was prepared, necessary surveys were made and extending emergency pipe to facilitate the citizens' building process
6	Al-Sabiyat 4/1	474, 472, 470, 468, 482, 480, 478, 476	Hydraulic study was prepared, necessary surveys were made and extending emergency pipe to facilitate the citizens' building process

7	Al-Tajiat 21/1/28	-	Hydraulic study was prepared, necessary surveys were made and extending emergency pipe to facilitate the citizens' building process
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c. Through studying the initial documents presented to us on the lack of raw water pumping stations and closing most of their networks, the following observations have been written down:

First: The actual production in comparison to the designed and available capacities of most raw water station decreased due to the lock of pipelines supplying the residential places with raw water and reached 34% in some stations, as shown in the following table:

Name of the station	Designed capacity (m <sup>3</sup> /hour) (1)	Available capacity (m <sup>3</sup> /hour) (2)	Actual production ((m <sup>3</sup> /hour) (3)	ratio 2/3	Ratio 3/1
Al-Qanat raw water	28580	27000	25200	93%	88%
Al-Etifiya raw water	28580	12600	10800	86%	38%
Abu Nu'as raw water	18000	16200	16200	100%	90%
Al-Jadriya raw water	28580	12600	10800	86%	38%
Al-Za'afaraniya raw water	20980	7200	7200	100%	34%

Second: Most raw water pumping stations suffer from the absence of water flow meter that feed some of the projects and plants; consequently the station's actual production is unknown as shown in the following table:

No.	station	Name of the project or complex fed by the station	The availability of flow meter devices to identify the station actual production
1	Al-Qanat raw water station	Al-Sadr project, plants of Rusafa sector but Al-Zu'franiya	Not available
2	Al-Etifiya raw water station	Al-Kadhumiya and Al-Krama projects	Not available
3	Abu Nu'as raw water station	Al-Baladiyat project and plants of Rusafa sector but Al-Zu'franiya	Available and provide measurements
4	Al-Jadriya raw water station	The airport street, Al-Ridhwaniya plants	Not available
5	Al-Za'afaraniya raw water station	Alza'afaraniya, Al-Ameen, Al-Kamaliya and al-Obaiby plants	Available and provide measurements

Third: Many lines and raw water networks were closed because of the lack of continuous maintenance, obsolescence of the networks, over encroachments and cracks. This caused using drinkable water in watering gardens in these residential places. As a result of that, drinkable water is wasted.

Fourth: Currently, water plants and water projects are provided with water by raw water stations which is against the reasons behind establishing these stations as they were established for the green belt, but gradually they transferred into raw water pumps for the projects and plants.

d. Through preliminary studies presented to us on completing some drinkable water projects, we noticed that some projects were lagging in implementation; therefore, lacking of drinkable water continued especially in summer. The following table illustrates these projects:

Project name	Contract no	Dated	Company name	Contract price (thousand dinar)	Commencement date	Contract period
Alrasafa Grand water project	1/2007	16/12/2008	Almabrook, Alessam, Franch Decroment	1131324700	21/1/2009	28 months
Establishing 4 projects (Albaladiat 1, Albaladiat 2, Kadhimiya and Kadisiya )	3/030100002	15/12/2006	Water Master	12188590	10/7/2008	12 months
variation orders in separated contract to establish four projects (Albaladiat 1, Albaladiat	16/2/2013	19/10/2013	Aswar Lebanon	6292218	30/10/2013	120 days

2 ,Kadhimiya and Kadisiya)						
Rasheed water project	1/2008	6/12/2008	Alghadeq company	69621944	4/1/2009	2years

The details of above contracts are as below:

First- contract no 1/2007 Rasafa Grand water project

- 1- The actual achievement of the project reached (97%) despite the expiration of the contract period and the additional periods
- 2- an additional period of the contract of 23.7 months was granted, representing 85% of the original project period
- 3- delay period to achieve project is 33 months after the end of the original and additional period

Second: contract No.(3/030100002),establishment four projects (Albaladiat 1,Albaladiat 2 ,Kadhimiya and Kadisiya)

1- Project achievement rate as follow:

No.	Project name	The actual achievement rate for water master company
1	Albelediat (1) water project	95%
2	Albelediat (1) water project	98%
3	Kadhimiya water project	98%

4	Qadisiya new water project	37%
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2- Additional period of the contract amounting to 383 days was granted, representing 100% of the original contract period

3-Total duration of the delay in achieving the project is 37 months after the end of the original and additional periods

4- Work was withdrawn on 10/3/2015 and the project was not awarded on shirker account until the date of this report

Third- contract No. (2013/٩/16) work variation orders in separated contract with office related to four projects (Albaladiat 1,Albaladiat 2 ,Kadhimiya and Kadisiya)

(1)project completion percentage is as below :

No	Project name	Actual achievement percentage for Aswar Lebanon company	Project state
	Albelediat (1) water project	60%	Work partly 20%
	Albelediat (1) water project	40%	Working at full
	Kadhimiya water project	85%	Working at full
	Qadisiya water project	Zero%	Stopped

2- delay period in projects achievement 12 months after expiry the original period

3- works were withdrawn on 6/3/2015 and the project was not awarded to the shirker account until the date of this report

Forth – contract no 2008/1Rasheed water project :-

(1) The actual achievement of the project reached (55%) despite the expiration of the contract period and the extra periods

2- Granted an additional period of the contract of 11 months, representing 46% of the original project period

3- delay period to achieve project is 33 months after the end of the original and additional period

4- Work was withdraw on 1/11/2013 and the project was not awarded on shirker account until the date of this report

e- By studies documents of debts and penalties and its impact on the continuity of the Baghdad water office work in providing its services as the best and reduce abuses <the fallowing notes was recorded :

first- total debts on citizens about (60786413555)dinars until 30/6/2015 as in the next table :

year	Sum million/dinar		Accumulate debt Million dinar
2012	47593	12530	39202
2013	57980	12232	46690
2014	68031	10982	58336
	72649	7242	60768

Second- total debt on states office is(25990030821)dinar some of it belongs to resolved offices before 2003

Third- weakness in actions taken against abstainers to pay debt

(1) Reserving71 units (Residential, commercial and industrial) from total (304354) units until 2015 in ratio 230.0 %, it represents a very small ratio

with due debts owed by its owners for Baghdad water office, its sums explained in the previous item

(2)The number of residential, trade and industrial units the water supply of which was cut off , was 17292 out of 304354 units till 2015. It represents only 5.7% and their owners have due debts to Baghdad water supply office. The table below shows the units number the water supply of which was cut off for the years 2006 till 2015 cumulatively.

Year	Debtors no.(1)	Debtors whose water supply was cut off (2)	Rate (2/1)
2006	206238	15116	7.3%
2007	259982	15128	5.8%
2008	228777	15096	6.6%
2009	226238	17411	7.7%
2010	254660	17359	6.8%
2011	143510	17365	12.1%
2012	273803	17340	6.3%
2013	285636	17376	6%
2014	294736	17315	5.9%
2015	304354	17292	5.7%

3. No procedures were taken against the debited governmental institutions and bodies in the previous years except cutting off water supply for 30 government institutions and bodies and this procedure has been taken in 2016 and the attached table no. 6 shows these bodies.

Fourth: The rules and regulations adopted by Baghdad water supply office are not updated. This does not cope with the current situation. These rules and instructions dated back to more than 40 years as depicted below:

- Water supply pipeline system no. 4 of 1966
- regulations no. 3 of 1966
- water management system for Baghdad no. 52 of 1969

Fifth: Baghdad water supply office procedures are weak in collecting the fines imposed on water networks violators. The unpaid fees balance was

(1936030557) dinars (one billion nine hundred and thirty six million and thirty five hundred and fifty seven dinars) till 30/06/2015.

Sixth: the number of units which do not have water meters is 425767 .It represents 70% of the total units covered by this service for the year 2015. This negatively affects the supplied water quantity due to the fact that fees are calculated in an estimative manner .This resulted in waste of the supplied water quantity ,as shown in the table below for the years 2012 till 2015:

Year	Units no. covered by the service	The number of units which have meters	The number of units which do not have meters	The rate of units which do not have meters
2012	589553	137204	452349	77%
2013	593743	139061	454682	77%
2014	601772	174452	427320	71%
2015	606274	180507	425767	70%

Seventh: there is no calculation for the costs of supplied water till now thus, making the office unable to get to the actual cost of water for calculating a suitable price that suits the current situation. Moreover, the office is unable to calculate the wasted and produced water for; it depends on the price of supplied water in calculating these costs which is not the real price. Noting that the cost of one cubic meter is calculated as 7 dinars and it is not a real cost but it is the price of the cubic meter supplied to citizens for the purpose of fees amounts calculation.

Eighth: Baghdad water supply office does not transfer the dues to Baghdad sewage office that collects them with water supply fees for some years. It did not transfer the amount of (1691469345 dinars )( one billion six hundred ninety one million and four hundred sixty thousand and three hundred and forty five dinars). Noting that Baghdad water supply office collects the fees amounts despite the fact that they are two administratively and financially independent offices, as shown in the table below :

Year	The due amount / ID	The transferred amount /ID	Non transferred amount/ID	The observations
2006	-	-	-	The office has no information
2007	-	-	-	
2008	344123569	344123569	-	
2009	236805504	236805504	-	
2010	621693418	621693418	-	
2011	362845021	362845021	-	
2012	1208677582	1208677582	-	
2013	402506694	402506694	-	
2014	1624741789	558727310	1066014479	amounts for only 6 months are transferred
Till 30/08/2015	625454866	-	625454866	
Total	5426848443	3735379098	1691469345	

Ninth: the Mayoralty of Baghdad / Baghdad water supply office provides the areas that are out of its geographic area and that lie within the responsibility of Ministry of Municipalities namely Abu-Griab , and Mahmodiya districts ...etc. with a quantity of 131,300 m<sup>3</sup> /day . This affects negatively the supplied water quantity within Baghdad capital borders resulting in debts on the Ministry of municipalities since 1990 with an amount of 32273931274 IQD (thirty two billions two hundred seventy three and nine hundred thirty thousands and two hundred seventy four dinars) till 31/12/2013. These debts are not paid till now and the office does not provide us with any information for the years 2014 & 2015 due to the establishment of joint committee for the purpose of calculating the amounts.

Tenth : though Baghdad supply office paid the amount of ( 1429061771988 IQD ) ( one trillion four hundred and twenty nine billion sixty one million seventy one thousand and eighty eight dinars) from the current and

investment budgets and the amounts of regions development for the years 2006 till 2015 for the water projects ( maintenance , construction , expansion & rehabilitation ) as shown below :

The disbursing party	The amount / IQD
The current budget	10270771988
The investment budget	1125501000000
Regions development amounts	293290000000
Total	1429061771988

Baghdad is still suffering from the lack of water especially in summer in addition to many pollution cases as mentioned in some items of this report.

e. Field Visits : the audit team conducted the field visits to most projects ,compounds and plants of drinking water as well as the raw water plants to observe the work, and through these visits, we have the following observations :

First: there are some cracks in the sedimentation basins in some projects that affects the water quality as in the water supply projects of Eastern Tigris (first extension ) , Alwihda, Alwathba, Albaliadiyat 1 &2 , Albaladiat water 2 , Alrasheed , the old alqadisia water project and its extension , al ubur , abu-nawas compound (1&2) Al jumhoria , and ALfatih almbien projects)

Second: some sedimentation basins are made of the galvanized iron instead of concrete .This caused a damage for being exposed to erosion if they are not continually repainted with epoxy. This leads to pollution of water with corrosion (iron oxide) as in ( Alkadumia and eastern Tigris (1<sup>st</sup> extension )).

Third: the mud sweepers of the sedimentation basins that are used for get rid of mud resulting from raw water turbidity are out of order .This leads to aggregation of mud in these basins and affecting the quality of the produced water as in ( Eastern Tigris, aldura , al karma )projects.

Forth :Some projects filters ,which are responsible for cleaning the water, are inefficient due to a certain break down or non replacement or cleaning of filter fillings for a long time and as shown in the table below:

no.	filters break down	non replacement of filter filling for a long time
1	kadhimya water project	alwahda water project
2	\	aldora water project
3	\	alkrama water project
4	\	aljadrya water complex
5	\	Eastern Tigris water project

5<sup>th</sup>:The sedimentation tanks are not being periodically cleaned ,we noted that the tanks ,the clay sweeper and the filters contain vast quantities of alga and moss .Thus ,the quality of the produced water is affected negatively (as in alwathba water project, albaladiat project no1,2 and Eastern Tigris project).

6<sup>th</sup>: Irregular and off-specification chlorine gas cylinders submerging tanks or lack of them. Such tanks are necessary for preventing leakage that can cause suffocation inside the projects and the plants and as shown below:

no.	lack of submerging tanks	irregular submergence tanks
1	the old alqadisyah water project and the extended part	alfatih almobeen water plant
2	abu nuas plant no1,2	aljmhuria water plant
3	alrasheed water project	eastern Tigris water project (second extension)
4	aljadryiah water plant	alobor water plant
5	alkrama water project	\
6	albaladyat water project 1,2	\
7	eastern Tigris water project (first extension)	\
8	alkadhymiah water project	\

7<sup>th</sup>: Lack of overhead shades for chlorine gas cylinders in some projects ,instead the cylinders are stored outdoor which make them exposed to weather factors as in (eastern Tigris water project first and second extension , alwathba water project, alrasheed water project, aljadryiah water plant).

8<sup>th</sup>: Some of the projects and most of the plants lack the integrated labs or sometimes the tests are limited to turbidimetry ,measuring the percentage of

chlorine and the ph measuring as in the case of (alobor water plant, abu nuas plant no1,2, aljmhuria water plant , alfatih almobeen water plant, aljadryiah water plant, alrasheed water project, alwathba water project, eastern Tigris water project second extension)

9<sup>th</sup>: Lack of flow meters which measure the quantities of the water produced in some projects like(albaladyat water project 1,2, aljmhuria water plant , eastern Tigris water project (first extension), alrasheed water project, alqadisyah water project).

10<sup>th</sup>: Contrary to the environmental instructions and requirements that stipulated a distance of 3 km from pollution sources should be kept before the project and 1 km after the project ,we noted there are some facilities that dump their polluted waste in the Tigris ,such as sewage stations , hospitals drainage , power stations and plants , with distances less than these determined according to environmental conditions (as in alwihda water project , aldora water project, alkarama water project, alfatih almobeen water plant, alrasheed water project, alwathba water project)

11<sup>th</sup>: During our visit to alwathba water project we noted that the initial mixing tanks contained some wastes like plastic bottles and bags ,which indicates the inadequacy of the grids in isolating them .

12<sup>th</sup>:Lack of power generators in albaladyat water project 1,2, abu nuas plant

13<sup>th</sup>: A shortage in maintenance and operation staff in aljadryiah water plant.

14<sup>th</sup>Lack of water storing container and as a result the water is pumped directly to the network (as in the case of alkadhymiah water project, eastern Tigris water project (second extension)

g- The questionnaire results showed that only 27% of the surveyed populations are using clean water for drinking and as shown below:

Water users for the purpose of drinking	Water users for the purpose of washing
27%	73%

2. The results of questionnaires stated that only 52% of the surveyed population considers the water quantity provided by Baghdad Water department is insufficient, as shown below:

citizens who consider water quantities as sufficient	citizens who consider water quantity as insufficient
48%	52%

3. The results of questionnaires stated that only 22% of the population confirmed that water supply is frequently or continuously cut off, as shown below:

Low water cut off	Moderate water cut off	frequent water cut off
31%	62%	27%

4. The results of questionnaires stated that only 27% of the population considers the water provided from Baghdad Water department of bad quality, as shown below:

Water users Who consider water of good quality	Water users Who consider water of medium quality	Water users Who consider water of bad quality
11%	62%	27%

5. The results of questionnaires stated that only 85% of the population uses water for watering, as shown below:

citizens who use water for the purpose of watering	citizens who do not use water for the purpose of watering
85%	15%

6. The results of questionnaires stated that many residential areas in Baghdad are not covered by raw water supply as shown below:

Areas covered by raw water supply system	Areas not covered by raw water supply system
45%	55%

7. The results of questionnaires stated that many people have raw water supply system but some have no service, as shown below:

People have raw water supply system	People have no raw water supply system
18%	82%

8. The results of questionnaires stated that only 40% have no water meters in their houses, as shown below:

Availability of water meters	Unavailability of water meters
60%	40%

9. The results of questionnaires stated that only 56% of citizens considers the procedures taken to reduce the drinking water shortage as poor, as shown below:

Absence of procedures	Poor procedures	Medium procedures	Good procedures
13%	56%	28%	3%

## **6. Conclusions**

- a. Most projects of water treatment in Baghdad are old thus affecting the quantity of produced water and the actual capacities became less than the design ones available to most water treatment projects due to the expiry of the operational life as shown in the attached detailed report.
- b. The drinking water produced by Baghdad Water department is not meeting the actual need of criticize which is (1022000000) Cubic meters / year. For example, the quantity of water that was provided to

citizens in 2015 was (692391000) Cubic meters / year at shortage percentage of 32%.

c. Most (Flow meter) in most projects, complexes, plants of drinking and raw water are unavailable and out of order. Thus leading to not knowing water amount inflowing to the project and out flowing from it .Quantities are calculated estimatively.

d. There is no integrated (physical, chemical, biological) laboratory at Al Rashid water project or most departments' water treatments plants. Only chlorine and turbidity are subject to test and this is not enough to reflect water quality in addition to the lack of knowledge regarding potential chemical and biological contaminants in water plants on a daily basis.

e. Some tests are not conducted by the laboratories quality control of the Department of Baghdad Water according to standard specifications, such as tests of organic compounds (hydrocarbons), pesticides, and occasional outputs of sterilization.

f. There is a discrepancy between the results of the tests recorded by the Ministry of Health/ Public Health Service and the laboratory tests results of Department of Baghdad Water, which showed that there are no deviations for most of the water tests results produced from the projects, complexes, houses and health centers. In addition, there are a large number of (biologically and physically) polluted samples and the water is undrinkable, as shown in the attached detailed report.

g. Water networks are weak and inefficient in some areas due to their obsolescence or citizens illegal connections, which largely affecting the quality of water supplied to citizens as a result of groundwater or sewage overlap with water networks.

h. Waste rates of drinking water are high due to cracks and illegal connections on water networks. This negatively impacts the water amount supplied to citizens, so waste rates reached a percentage of (29%) for the year 2015. The Department incurred large amounts of (8149603000) dinars for the years 2012 to 2015.

i. Actual production of design capacities , which are available for most of raw water stations declined as a result of closing most pipelines that supply residential areas with raw water due to lack of ongoing maintenance, obsolescence of those networks, frequent illegal connections and cracks . Thus,, using drinking water for watering gardens in the areas covered by the raw water service and therefore led to waste in drinking water.

j. There is a delay in implementing some large projects to produce drinking water which leads to continuous water scarcity especially in summer as in the Al-Resafa large water project and projects of (Al- Baladiat 1 and 2, Al-Kadhimia and Al- Qadisia) and Al- Rasheed water project.

k. Baghdad municipality/ Baghdad water directorate supplies water to areas that are outside its geographic reach of which the Ministry of Municipalities is responsible for supplying water .it is 131300 m<sup>3</sup>/day, and this will effect negatively on supplied water amount inside Baghdad. Therefore ,the Ministry of Municipalities has had debts since 1990 amounted (32273931274) Dinars (thirty two billions two hundreds seventy three millions nine hundreds thirty one thousands and two hundred seventy four Dinars) till 31-12-2013 and they have not been paid till its date.

l. poor procedures taken by Baghdad water office towards state offices and beneficiaries who have debts and penalties. This, affects the continuity of Baghdad water office work to supply its services in abetter way and limit illegal connections.

m. Although Baghdad water office disbursed an amount of (1429061771988) Dinars (one trillion four hundred twenty nine billion sixty one million seven hundred seventy one thousand nine hundred eighty eight Dinars) from the current and investment budgets and amounts of regions development for 2006-2015 on water projects(maintenance, construction, expansion, rehabilitation).This did not improve the quality and quantity of drinking water for, Baghdad is still suffering from water scarcity especially in summer in addition of many cases of pollution as shown in the detailed attached report.

n. Contrary to the instructions and environmental determinants which stipulate that the water treatment project should be at 3km from pollution sources before the project and 1km after the project . We noticed during the field visits that there are some activities that dispose contaminated waste into the Tigris such as sewage stations, hospitals sewage, electricity stations and factories with distances less than those identified according to the environmental determinants. This, in turn, affected water quality of nearby projects such as (Al-Wihda water project, Al-Dora water project, Al-Karama water project, Al-Fatih Al-Mubeen complex, Al- Rasheed water project, Al-Wathba water project).

o. The mud sweepers in sedimentation basins responsible for disposal of mud resulting from turbidity of raw water are out of order. This led to accumulation of mud in sedimentation basins that affect the quality of produced water such as (Eastern Tigris water project, Doura water project and AL-Karama project).

## 7. Recommendations

- a) Rehabilitation of old projects and conducting a comprehensive maintenance on the projects to raise its productive capacity and improve the quality of produced water.
- b) Establishment of large water projects of high productive capacity to meet the water shortage that is supplied to citizens.
- c) Installation of flow-meters and repairing the broken down ones in all projects, plants and stations of raw water to control the in and out-flowing water from the projects.
- d) Establishment of integrated labs in all projects and plants to identify the quality of produced water and to detect any pollution directly.
- e) Providing laboratory requirements to conduct all tests within the Iraqi standard specifications in the laboratory of quality control.
- f) Forming joint committee between the ministry of health and Baghdad water department to identify the reasons of differences in the results of tests of water given the importance of the subject and its direct impact on the health of citizens.
- g) Exerting the necessary efforts and coordinating with the related parties to remove and prevent all illegal connections on the water

- networks because it is one of the causes of pollution and water scarcity .Also, this costs the department considerable amounts.
- h) Conducting a comprehensive maintenance on all raw water stations and networks that provide residential areas with raw water. Repairing the cracks in the networks and opening closed lines to prevent using the drinkable water for watering gardens.
  - i) Processing lagging projects and re-awarding these projects on the expense of the defaulter to resolve the problem of scarcity of water. Also, it is necessary to award the future projects to a reputable and experienced companies in this field with an emphasis on receiving the site without any illegal connections and obstacles to ensure achieving the project in the set date.
  - j) Compliance with laws, rules and instructions and not supplying the areas that fall outside the boundaries of the Municipality of Baghdad with drinkable water because it negatively affects the amount of water provided to Baghdad. In addition, there should be coordination with the concerned parties to obtain the fees of water from the ministry of municipalities and public works.
  - k) Emphasis on obtaining the debts owed by the departments and institutions of state and citizens because they are large amounts and form a resource to finance the department to be able to raise the service level provided to citizens.
  - l) Forming specialized technical committees to identify the reasons of the continuity of the phenomenon of water scarcity and the deterioration of its quality despite expending huge amounts by Baghdad water department.
  - m) Compliance with instructions and environmental site conditions when establishing the projects and plants of water to avoid the pollution resulted from activities that pollute the water due to the fact that this issue regards the citizens' health.
  - n) Rehabilitation of mud sweepers in sedimentation basins to avoid the high rates of turbidity due to the accumulation of mud in sedimentation basins.

