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Human Factors Affecting Groundwater in the Desert of Karbala Center District

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Abstract

The study area is located in the southwestern part of Karbala governorate, between latitudes (32o.38'-32o.18' in the north and longitudes (44o.17'-44o.58') in the east, and it is a semi-high plateau with an area of up to (482.82) km 2, the study area occupied the northwestern part of the Euphrates sub-region, which represents the western part of the Mesopotamia area in the stable pavement, centered within the desert surface of the Karbala governorate. The study area depends primarily on groundwater, specifically in agriculture, as it lacks surface water. Therefore, the study aimed to clarify the impact of various human factors (agricultural, industrial, municipal activity) on the characteristics of groundwater and the degree of this effect on the qualitative and quantitative characteristics of the aquifer (Al-Dibdibba) within the desert flat of the study area. Where the factor of agricultural activity had an impact on groundwater through the amount of water withdrawn from wells to irrigate crops and the extent of its impact on the (strategic) underground storage, as well as the effect of fertilizers (organic, chemical) and pesticides on the qualitative characteristics of the water of that reservoir. As for the factor of industrial activity, it was the impact on groundwater appeared through the number of pollutants emitted from industrial activities, as well as the role of these activities in the decline in the area of agricultural land in the study area and its replacement with industrial establishments within the sector (public, private). As for the municipal factor, its impact on groundwater was through municipal activities represented in the amount of waste and waste prevalent in the study area and the resulting solid and liquid pollutants that pose a threat to the quality of groundwater after filtering to the level of that water.

Introduction

Groundwater is represented by the water under the surface of the earth in the pores of rocks and soil and in the fractures of rock formations, where the unit of unconsolidated rocks or sediments is called (aquifer), then it can produce a usable amount of water, called the depth at which the areas of soil pores or voids are saturated. The rocks that are completely watered (the groundwater table). The impact of various activities on groundwater is shown through various practices by farmers, industrial project owners and residents with their waste (waste) within the study area, where the desert region extending between the governorates of (Karbala - Najaf) was invested for agricultural purposes in the basic degree and is currently exploited for industrial activity as a result of its

importance and location Strategically, many water wells were drilled, penetrating the upper aquifer represented by the Al-Dibdibba sand formation, which spreads in the form of a fan. These activities resulted in negative effects that were reflected on the hydrological layer of the reservoir. Groundwater is affected by various surface activities that may lead to pollution depending on its location. The groundwater potential for pollution increases if the aquifer is found freely and near the ground level, and also if the reservoir is found in a low rocky area or with gravel components of regular granules and high permeability. confined) as well as the high permeability of the soil of the study area, and thus the possibility of contamination became great.

Study area boundaries:

Astronomically, the study area is located at latitude (32o.38´- 32o.18´) north and longitude (44o.17´- 44o.58´) to the east. The southwestern part of Karbala governorate is within what is known as (the Karbala plateau). As for geographically it is bordered by Al-Hassainya district to the north, Al-Hindi district to the east, Al-Hur district to the west and northwest, and Najaf governorate to the south. km2 and was calculated according to the program (ARC.GIS (10.8).

Discussion and results:

Within the study area, there are a number of activities that have a clear impact on groundwater, including:

1. Agricultural Activities:

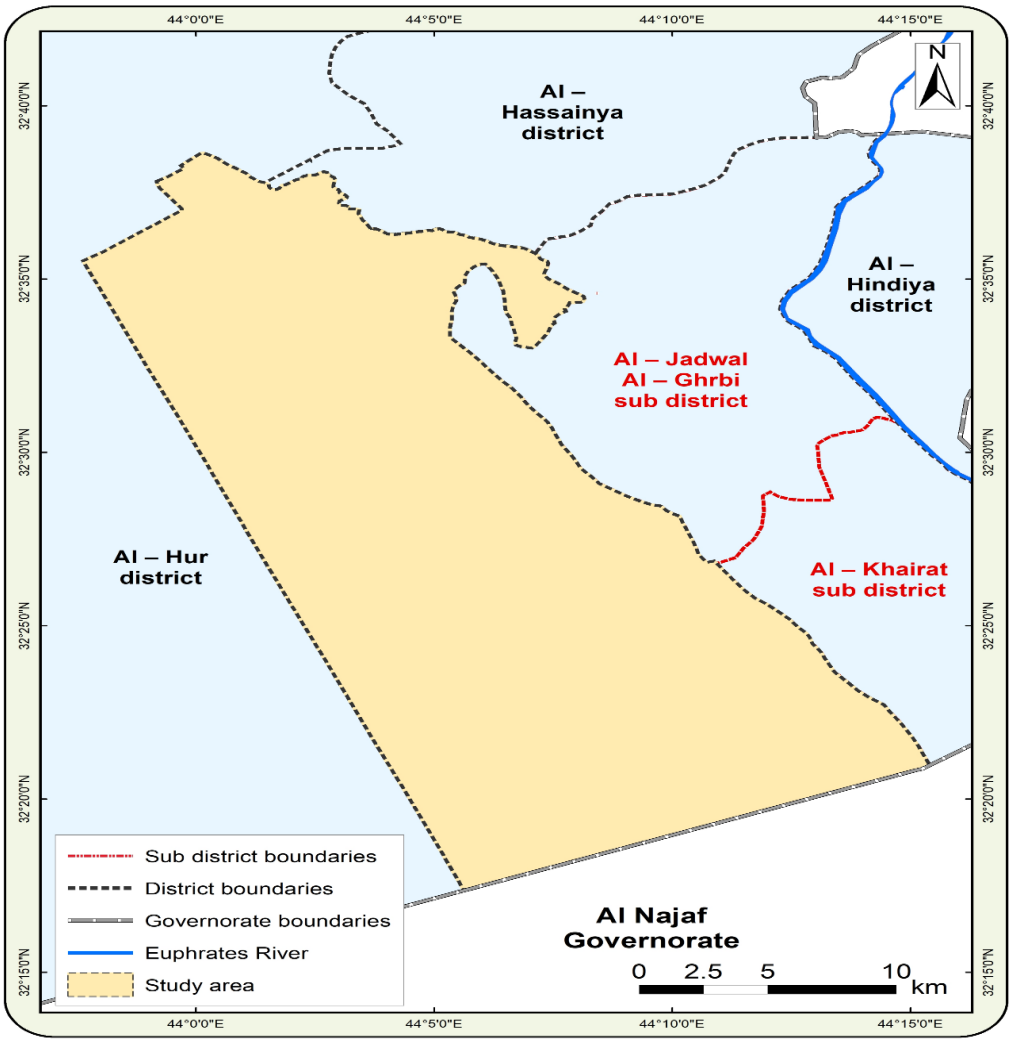
Agricultural activity is one of the activities that consume water resources, especially groundwater (within the study area), as most of the water used for this purpose will be lost either through the evaporation of that water or through evaporation from the plant and the amount of water used in this area depends on factors Main ones:

A - The type of plant grown.

B - The nature of the prevailing climate within the cultivated area.

C - the prevailing soil quality.

The exploitation of groundwater to irrigate agricultural crops is evidence of insufficient rainfall to meet the requirements of those crops. This exploitation determines the total concentration of dissolved salts in groundwater in the extent of its suitability for irrigation.



Map (1) The location of the study area within the districts and governorates

Source:

1. Republic of Iraq, Ministry of Water Resources, General Authority of Survey, Grander of Iraq 's administrative, scale1000000/1)), general (2012)
2. Republic of Iraq, Ministry of Water Resources, General Directorate of Survey, Karbala administrative map, measured by s (500000/1), general (2007).
3. program output (ARC.GIS -10.8).

The agricultural activity within the study area is classified into two main types:

- **Field Crops style**: featuring this style both:

•Cereal crops (wheat, barley)

•Vegetable crops (winter, summer)

•Tuberous crops (onions, potatoes)

•horticultural crops.

•fruit crops

-Livestock pattern: Livestock represents the second dominant pattern within the study area, which is no less important than field crops, depending on groundwater for the purpose of animal

consumption. The total number of animals within the study area for a year (2020-2021) around (802.275) straight, except for poultry fields within the desert of Karbala district (3).

The role of agricultural activity in influencing groundwater through the agricultural methods that farmers follow during farming and the extent of the effects resulting from those methods, and among those methods is the excessive use of chemical fertilizers, pesticides and fertilizers, thinking that the increase in their use increases agricultural production, forgetting that impact negative caused by while stability in the soil and the leakage part of the groundwater , leading thereby to pollution and change in the quality of their characteristics, and other wrong methods used by farmers is irrigation non - standardized, which works on the depletion of a large part of the groundwater (4) , where the irrigation excessive Reducing high groundwater levels, which results in problems, is represented in increasing soil salinity as a result of wrong irrigation, which requires the conservation of groundwater using a specific form of drainage in the subsurface layer (5) .

The agricultural activity in the study area is as follows:

1. Agricultural areas and type of crop:

The total cultivated area within the study area for the year (2020-2021) around (49,892)/ acers, of which was exploited (19,830.) acers and unused (30,062) / acers distributed within the Al-Jezira District (61) Plot No (3) Within the desert area of Karbala district (6).

The study area depends mainly on groundwater for irrigation of agricultural crops, as the expansion of agricultural areas requires an increase in the amount of irrigation by withdrawing water from wells, especially in the summer as a result of high temperatures, lack of rain and an increase in the number of daylight hours, as well as the role The negative that the farmer performs by not following the water regulations for crops, which leads to a large waste of irrigation water.

It is evident from Table (1) that the agricultural areas in the study area vary in time for the winter and summer seasons, which results in a variance in the water needs of those crops.(27228)acers for the agricultural season (2020-2021) Where the wheat crop occupied the first place in the cultivated area for the winter crops with the limits of (12556) acres, with a productivity of (34,529) tons, i.e., with a production rate of (2750) kg/ton per acre, the wheat crop needs a number of irrigations during its growth period. However, if the crop is in the case of irregular rainfall, it needs irrigation water of (6-5) Regular irrigation, as the date of the first irrigation of the crop begins after (21) A Day from planting, after which the irrigation process for the crop continues every two weeks after the date of the first irrigation, and then the irrigation periods are reduced until irrigation is stopped when the plant reaches the maturity period, as the period of growth of the crop continues (6-7) months.

As for the barley crop, the cultivated area reached (420) acres, with a productivity of (781.2)kg / ton , the barley crop needs irrigation in the absence of rain, although the barley crop is a drought-tolerant cereal crop, but it is affected by the lack of water, especially in some stages of its growth, its growth period continues (5) months starting from mid-November, and the date of harvest and ripening is in late April, and the date of irrigation is immediately after planting, and it is irrigated before the ripening process in the first ten of April (8) .

As for winter vegetables (covered eggplant, green onions, tomatoes) covered, covered cucumber) it has reached an area (4622,4446,4861,323) acres, respectively, and productivity reached (9000,10,000,26,000,10,000) kg / ton, respectively, figure (1) is noted , while the summer vegetables (tomato, cucumber) have reached an area (2400,2400) Acre, respectively, and the total

has arrived (4 800) acres, with a productivity of (21.600 to 32.600) straight ton , shape (2) ,The winter and summer vegetables are among the vegetables that consume water, and that water is an essential element in the composition of their cells, as the percentage of water in them reaches from (90-95) % [9] .

Summer vegetables need irrigation water more than winter vegetables, winter vegetables need during the period of their growth (5-7) Waterings, as for summer vegetables, they need up to(4-13) Watering, vegetables are very sensitive to any lack of soil moisture, as the moisture content in the soil decreases, which leads to a delay in plant growth and flower drop, as well as yellowing of leaves, and usually needs regular irrigation at the beginning of its growth to be a good vegetative group (10).

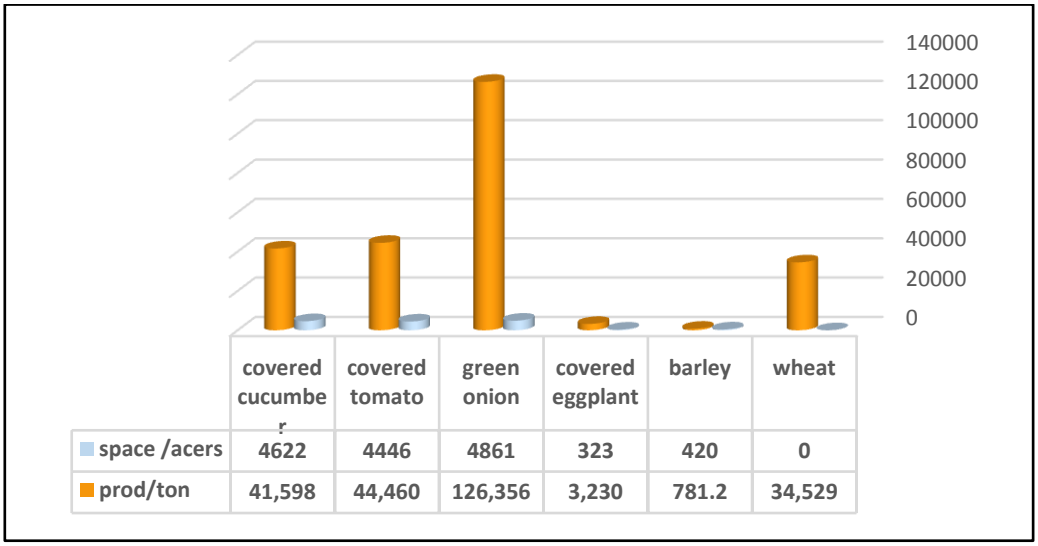
As for the palm orchards, they reached (1021)acers for a year (2020-2021), as shown in the table (2), palm trees vary within these areas, and their numbers vary between ascetic (4850) palms, Al-Khastawi (225) palms, Al Khadraoui (2000) palm tree propane (30) Palm, Altbrzel(205) Palm, palm trees depend primarily on the drip irrigation system for their irrigation, with its only source of groundwater. The number of drip irrigation systems for palm orchard crops (75) A system distributed between government projects and the people.

Table(1) **Cultivated areas of winter and summer crops(Acers)and productivity (tons) In the desert of Karbala district for the agricultural season**(**2021-2020)**

summer crops				winter crops			
production (ton)	yield / kg) (acres	Cultivated A area (Acers)	the crop	output (tons)	yield / kg) (acres	Cultivated (acres) area	the crop
_	_	_	_	34,529	2750	12 , 556	wheat
_	_	_	_	781.2	1860	420	barley
_	_	_	_	3,230	10,000	323	covered eggplant
_	_	_	_	126,356	26000	4861	green onion
33,600	14,000	2 400	tomato	44,460	10,000	4446	covered tomato
21,600	9,000	2 4 00	Option	41,598	9,000	4622	covered cucumber
55,200	23,000	4 8 00	Total	250,954	59,610	27228	Total

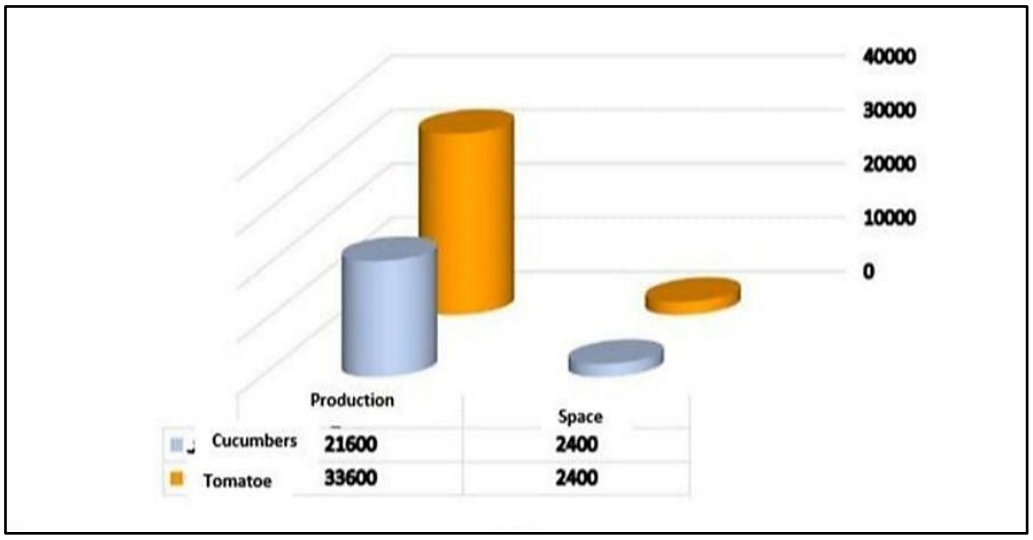
Source:
Ministry of Agriculture ,Karbala Governorate Agriculture Directorate, Statistics Department, unpublished data (2021).

Figure (1) Cultivated area (Acers) and production (tons) for the winter agricultural season (2021-2020)



Source: Using Table (1) data.

Figure (2) Cultivated area (Acers) and production (tons) for the summer agricultural season (2021-2020)



Source: Using Table (1) data.

As for the fruit trees within the desert of the Center district, they varied in their numbers and types, according to their need for water, table (3), as fruit crops such as (figs, olives, pomegranates, apricots, grapes) need water throughout the year at the rate of (22-24) times of irrigation, and the number of irrigations of these crops increases during the summer.

It is clear from the foregoing that the area of agricultural land expands during the winter season as a result of the multiplicity of types of cultivated crops and the resulting increase in water consumption during this season despite the drop in temperatures, as it exceeded in its area the area of summer vegetables. The expansion of agriculture within the study area during the previous years is considered A positive indication of the exploitation of groundwater and its investment in agricultural

production, depending on the withdrawal of water through wells to irrigate crops. However, this expansion corresponds to the continuous withdrawal of water and the occurrence of a shortage in the groundwater reserves, thus affecting the volume of the groundwater reserves in the region, which mainly depends on its nutrition on rainfall. There is no other source of nutrition, which made this reservoir (Al-Dibdiba) in constant decline.

Table(2): Palm trees and their preparation according to the irrigation method in the desert of Karbala Center (2021- 2020)

Number of drip irrigation systems	/ exploited The area Acres	prepare it	Palm trees
(75)	(1021)	4850	ascetic
		225	Khastawi
		504	brim
		774	maktum
		205	defecate
		2000	Khadraoui
		70	Omran
		30	propane
		6162	Barhi
		100	mtok
		16144	other kinds
75	1021	31064	Total

Source: Directorate of Agriculture in Karbala Governorate, Statistics ,Ministry of Agriculture Department, unpublished data, (2021).

Table(3): Fruit trees and their preparation within the desert area of the center for a year (2020-2021).

NS	types of trees	prepare it	piece number	interrupt	irrigation method
1	Fig	710	3	Island61	dotting
2	orange	26	3	Island61	the rasterized Of
3	pomegranate	5125	3	Island61	the rasterized Of
4	apricot	three hundred fifty	3	Island61	the rasterized Of
5	apple	150	3	Island61	the rasterized Of
6	olive	6000	3	Island61	the rasterized Of
7	lemon	100	3	Island61	the rasterized Of
8	berries	30	3	Island61	the rasterized Of
9	buckthorn	900	3	Island61	the rasterized Of
10	peach	60	3	Island61	the rasterized Of
11	the lanki	30	3	Island61	the rasterized Of
12	the stump	70	3	Island61	the rasterized Of

13	grapes	3000	3	Island61	the rasterized Of
Total		16,551			

Source:Ministry of Agriculture, Directorate of Agriculture of Karbala Governorate, Planning Department, unpublished data(2021).

Irrigation Method:

The method of irrigation followed in the study area is the method of irrigation by means, which is the process of delivering water to agricultural lands by pumps after withdrawing that water from wells and collecting it in special basins (Fig.2) and ,(3) the number of pumps in the study area for a year(2021) number(2081) pump, as shown in the table(4) ,the study area depends mainly on wells in irrigating agricultural crops, as the number of agricultural wells affiliated with the government sector working and non-operating) for the year (2020- 2021) around(78) a well, while the number of wells within the private sector increases to) 842A well, as shown in Table(5).

Table (4): Number of Covered Houses and Agricultural Tunnels According to Irrigation Method in the Desert of Karbala Center District for (202 1).

Number of houses according to irrigation method			The area used for the houses / acres	number of houses covered
wasta	sih	dotting		
2081	_	925	185000	925

Number of tunnels according to irrigation method			Area used for tunnels / acres	Prepare plastic tunnels
wasta	sih	dotting		
_	_	152526	4622	15226

Source:Ministry of Agriculture ,Karbala Governorate Agriculture Directorate, Statistics Department, unpublished data. (2021).

Table (5) Number of wells with agricultural use in the desert of Karbala Center District for a year(2021).

Number of private sector wells			Number of public sector wells		
Total private sector wells (operating and non-operating)	not working	working	Total government sector wells (operating and non-operating)	not working	working
842	_	842	78	9	69

Source: Ministry of Agriculture ,Karbala Governorate Agriculture Directorate, Statistics Department, unpublished data. (202 1)

2. Industrial Activities

The industrial activity is considered the most dangerous activity for groundwater pollution and depends on the extent of its impact on the type of industry and the method of disposal of its products. The following are the most important industrial activities within the study area:

A. Karbala Gassy Station

The Karbala gas station is located within the desert area of the Central District, at a distance of(20) Km south of the design basis for the city of Karbala, on an area of up to (200) acres, the station was opened in the year (2012) The plant is considered one of the industrial activities that pollute the environment, class (A) within the determinants of the Iraqi environment.

It is clear from table (6) that the number of operating units in the Karbala gas station has reached two producing units and a production capacity of(165) Megawatts per hour in previous years up to a year(2021)If one of the units was referred to maintenance, the type of fuel used in the station up to a year(2021) is gasoil (Crude)the value of the fuel used in the station was about(35) M $/^{3}$ h equivalent (tank) within a single production unit and the equivalent of (70) m $/^{3}$ hour within the two units, and the production capacity of the plant in a year(2020) has reached(100) megawatts per hour, and the amount of fuel ranged(32) m $/^{3}$ hour.

The station's waste varies between liquid and solid, as well as gaseous waste that results from burning fuel continuously to produce electric power. The table shows(4 1)The station effluents ranged up to a year(2021)Within the two units producing up to(3000)liters/month, while its percentage ranged during maintenance and stoppage of one of the operating units to(1500) liters / month, resulting from this waste from washing the units of the station and the accompanying water elements and chemical compounds that are capable of polluting the soil if it is leaked and then transferred to the groundwater level as a result of filtration through rain and repeated washing operations, while the station's waste reached solids from empty drums of motor oils before maintenance approx .(120)barrels/month, while during the maintenance period(60) Barrels / month ,[(12)] these barrels are often in contact with the surface of the soil at the station site and the consequent serious environmental impact on the soil as a result of what these barrels contain from the remnants of used fuel as well as the spilled oils as a result of accidental accidents at the station.[(13)]

The station's liquid waste is accompanied by a group of heavy elements and dangerous chemical compounds, most notably (nitrates, aluminum, arsenic, phosphates, nickel, lead, and boron) and it is considered one of the highly toxic elements to plants, soil, and then groundwater[(14)]

As for the gaseous pollutants of the plant resulting from fuel combustion and with a direct impact on environmental pollution, they include nitrogen oxides) (NO_2 ,)sulfur dioxide (SO_4 ,( )Carbon Dioxide) -(CO_2.)[(15)]

Nitrogen oxides, sulfur oxides, and carbon all contribute to air pollution through their interaction with its atoms, forming acid rain) Rain Acids (During rainfall, which seeps through the soil atoms to reach the groundwater level[(16)]

Table(6): Production capacity, liquid and solid waste of Karbala gas station

The plant's production capacity in 2018 / 7/23 history	fuel quantity	fuel type	Actual power	design energy	Unit	NS
	h $/^{3}$ 35M	- Crude Oil (Crude)	MW/hr 85	MW/hr 123	the first unit	1

	h / 3 35M	- Crude Oil (Crude)	MW/hr 85	megawatt- 123 hours	second unit	2
	The nature of solid waste		The nature of the liquid waste			
	Empty drums + motor barrel/month 120 oils		Washing units of the l/month 3000 station			3
The plant's production capacity by 2020 / 2/ 10 date	fuel quantity	fuel type	Actual power	design energy	Unit	
	h / 3 32M	- Crude Oil (Crude)	MWh 100	MW/hr 123	the first unit	4
	_	_	_	parked for maintenance	second unit	5
	The nature of solid waste		The nature of the liquid waste			
	Empty drums + motor barrel/month 60 oils		washing station l/month 1500 units			6

Source: Ministry of Electricity ,Directorate of Karbala Electricity ,Karbala Gas Station, Training and Follow-up Department, unpublished data, (2021)

It is clear from the above that the gas Karbala station is one of the industrial activities polluting the environment category,A through the liquid wastes that have the ability to leak to the underground water level and change its characteristics and quality events T .Louth and dangerous as well as emissions of toxic and which have the ability to interact with the air atoms Forming acid rain, which is harmful to plants and soil, and then groundwater after filtering through the soil section.

–Karbala OIL Refinery:

Oil refinery in the province of Karbala in the southern part of the province near the strategic line carrier crude oil , which in the middle of the distance between the city of Karbala and Najaf , or the so - called plateau (Karbala - Najaf) and location of this makes it among the many sites and other uses of them (houses Agricultural - Covered, Karbala Airport), the foundation stone of the refinery was laid in (2007) with an estimated area(16)km , (17) 2 and it may be claimed that it will be operated in the year(2022)production card(140,000)Barrels / day. (8 1)

As for its location within the study area, it occupies the southwestern part of the study area and is also in the middle of the distance between the two cities of (Karbala – Najaf)- (Karbala plateau) and is a distance of up to (31)How many.

Illustrated by the table(7) The most important products in the oil refinery, according to the degree of evaporation from the bottom of the tower (Chaina) to the top of the tower, are black reduced oil .The Wild (Crud),(gas oil) (GasOil,White Oil (Kerosene)Heavy and light naphtha,(liquid liquefied gas (LPG).

Table(7): Petroleum products in Karbala refinery and their most prominent uses.

Uses	Product Type
To operate electric power generators, refineries furnaces, and brick factories	Fuel oil (black reduced oil - Reduced Crude (RCD) or (Fuel Oil)
Automobile engines, diesel generators, agricultural pumps	Gas oil (Casual)) – (Gas .Oil)
To operate oil heaters and oil cookers	white oil - (Kerosene)
Intermediates for the chemical and petrochemical industries and a substance from which gasoline and gas are refined after sulfur extraction	Naphtha (light and heavy) - Nephtha (Heavy & Light)
Gas stoves and refrigeration equipment	liquefied gasliquid –(LPG)

Source:Riyadh Muhammad Ali Al-Masoudi, Zuhair Abdul-Wahhab Al-Jawahiri and Jamal Hamdan Rashid Al-Dulaimi, Geographical Characteristics of the Karbala Refinery Site (Proposed) and its Expected Repercussions, Journal of the Geographical Society ,,2011 s 12.

One of the most prominent emissions from the (refinery Oil) After its operation, it is represented by gas emissions harmful to the environment, and the oil refinery emissions are classified according to their source into two main groups, the first is the group of hydrocarbon emissions .Hydrocarbonsare toxic organic compounds that result from the leakage of hydrocarbons from vessels, pipelines and tanks, while the second group consists of the results of burning fuels in the furnaces of refining processes, water vapor generation plants and electric power, such as sulfur oxides (SOx) ,nitrogenoxides(NOx) and carbon dioxide(CO_2).

Carbon Oxides

Carbon dioxide is considered one of the compounds necessary for biological life and at natural levels it has no negative effects, but it may lead to damage to the environment when its percentage in the air exceeds the normal limits.[19]

This gas is emitted from the oil refinery mainly from pelletizing furnaces and carbon burning processes during the activation of the catalyst in the cracking units with the inhibitor catalyst)Catalytic your Cr fluidized Acking (And convert heavy Alqtnat to light by shortening the long hydrocarbon chains on the presence of a catalyst inhibitor form, as well as produced from the burning of excess gases in the torch system) Flame (As shown in Table ,(8) the oil refinery also emits carbon monoxide (CO) from burning fuel in refining operations and burning surplus gases in the torch, and carbon monoxide is considered(CO)more dangerous than carbon dioxide(CO_2)If its percentage increases in the air as it reacts with air atoms, forming what is known as acid rain (Acid Rain)During the fall of rain, which is considered to have a serious environmental impact on the soil, as it works on eroding it and filtering through it towards the ground, then it settles at the level of the subsurface layers at the groundwater level. [20]

–Oxides Of Sulfur(Sox):

Sulfur oxides are released as a result of the combustion of sulfur compounds in the fuel used in furnaces and water vapor production boilers, and from burning surplus gases in the torch .Flame Emissions of sulfur oxides have harmful effects on the environment and on groundwater as well as a result of their interaction with air moisture to form sulfur acid atoms or what is called acid rain .(Acid Rain) Which causes damage to crops and soil erosion, and then seeping into the depths towards the groundwater level, affecting its qualitative characteristics.(21)

- Nitrogen oxides(NOx):

Nitrogen oxides consist of toxic gases emitted from the refinery, and these gases vary in quantity according to the type of fuel used, its content of nitrogen compounds and hydrogen. (NOx) emitted, the effect of nitrogen oxides increases when they interact with volatile organic compounds during combustion, forming more dangerous molecules, which are nitrogen oxides(NOx) has a great ability to combine with air atoms, causing the formation of acid rain (Acid Rain).

-Volatile Organic Compounds (VOC):

The volatile organic compounds consist of gaseous hydrocarbons containing atoms (carbon, nitrogen, methane, ethylene, propane, propylene, butane), in addition to polycyclic aromatic hydrocarbons .Poly Aromatic Hydrocarbons (PAH) ,(as well as inorganic gases, ammonia and toxic hydrogen sulfide(H_2S) These compounds are emitted in the form of hydrocarbon clouds scattered in the atmosphere Fugitive Emission .(24)

As for the most important sources of volatile organic compounds emission, it is represented by its leakage from pipe connections and valves or from oil basins and equipment of polluted treatment units, from crude oil tanks and from oil products, and the processes of unloading and filling containers of crude oil and its derivatives ,(25) as shown in Table.(9)

The effect of volatile organic compounds appears through their union with nitrogen oxides and sulfur atoms, forming toxic compounds that are very dangerous to groundwater, as they were leaked into it.(26)

As for the liquid waste of the refinery, it is represented by the water resulting from washing the refinery units in the refinery, as well as the water used for cooling, which contains carbon compounds resulting from oil residues, which are separated from the water and collected in special sedimentation basins that have the ability to seep through them through the soil and then reach a level Groundwater, which affects the characteristics of the water quality and pollutes the aquifer.

We conclude from the foregoing that the oil refinery in the study area is considered one of the industrial activities polluting the environment, class (A) within the determinants of the Iraqi environment because of its dangerous environmental impact represented in the gaseous emissions and toxic compounds that have the ability to pollute the air and then the transfer of those pollutants to the soil after Rainfall and its stability in the soil and then its transfer to the groundwater level, as well as liquid waste, which is considered more dangerous because of its ability to seep out faster through the soil section. Such industrial activities have a negative impact on the environment and

groundwater aquifers, which in turn is reflected in the growth of production. agriculture in the study area .

Table (9): The most important emissions from the oil refinery and their sources.

NS	Emissions	References
1	Carbon oxides- (Cox)	Refining furnaces - steam boilers and electric power generation -Activate the catalyst in units (FCC) - torch system(Flame)
2	Sulfur oxides – (Sox)	Refining furnaces - steam boilers and electric power generation -Activate the catalyst in units (FCC) - (torch system Flame) -(Sulfur recovery unit - Recovery the Process sulfur meaning the)
3	Nitrogen oxides (NOx)	Refining furnaces - steam boilers and electric power generation -Activate the catalyst in units (FCC) - torch system Flame)
4	volatile organic compounds(VOC)	Storage, transportation and loading of crude oil and petroleum derivatives Contaminated water treatment units - venting vessels to relieve pressure -Hydrocarbon leak - Hydrocarbons) (of equipment
5	solid particles – Particulate Matter(PM)	Refining furnaces - steam boilers and electric power generation -Activate the catalyst in units (FCC) - burning gases in the flame.

:Source: the researcher based on

J. Mike Brown, (2014), "The Oil & Gas Supply Chania from the ground to the Pump on Refining", Independence Oilfield Chemical, Available at http://www.segcs.org .

C - Sand Quarries:

The sandy wealth in the study area is no less important than the other natural resources located within the Karbala governorate due to its containing good quality quantities of sand and other raw materials such as gypsum, limestone and gravel, which are of great importance and are included in many important construction industries.

Within the study area, a number of quarries are concentrated within the province)(61 Island, lot number 3)They numbered about (7 quarries) (2) Of which it is managed within the Directorate of Karbala Quarries (the General Company for Production Industries) to extract the mixed gravel and sand filters with an area of up to) (10.7 .) acres, respectively, with productivity up to(120,000-103,000) m^3 straight table10) ,And(5)of which it is managed by investors represented by Al-Rasheed Construction Contracting Company with an area of up to(15) acres and production capacity) 90,000m^3 , the area of the other laboratories (Al-Sadiq, Al-Mustafa, Barakat Umm Al-Baneen Factory, Al-Baqer Factory) reached about) (8,8,8,10respectively ,with a productivity of(89,000-80,000-40,000-88,000) M^3 respectively ,these quarries by the Geological Survey (USGS) awarded contracts in the province of Karbala , and the approval of these contracts by the Directorate

of property in the province of Karbala, is in the first phase remove the cover layer ranging from (2-1)m, which consists of unfit sands of dust and coarse sand, after removing the first layer, the second layer, represented by the limestone layer, appears, and its height is about(50) cm or more, according to the nature of the area, and through continuous excavation, pure sand appears, which is primarily used in the construction industries.[27]

That the exercise of such mining activities will shift the exploited area to the low lands are prone to combine solid waste and wastewater, as the depletion of sand in this way has the impact of serious environmental on inventories underground in the rock layers as the uprooting of sand contributes to the erosion of the soil surface and reduce the proportion of fertility than Affects environmental diversity, sandy lands are considered rainwater traps, and therefore the depletion of these resources negatively will affect groundwater aquifers and lead to groundwater approaching the surface of the earth and subject to continuous evaporation and pollution .[28]

It is clear from the foregoing that such activities are considered activities affecting groundwater, its levels, the extent of its pollution and the degree of that pollution depending on the size of these activities, which have become a continuous increase as a result of the continuous movement in industrial activity and population growth within Karbala governorate, in addition to the granting of many agricultural lands in the form of contracts agricultural in order to turn it into sand quarries.

3. Activity of municipal data(Municipal Activities):

It is determined by the municipal activities in the study area population which is waste Bemata **A** for waste(Landfills and sanitary landfills)Sanitary Landfills which is considered to have a direct environmental impact on groundwater pollution, and the number of waste dumps has increased as a result of the population increase in the Karbala district over the years.

A - Evolution of population numbers (Development Population)

The district of the Karbala Center has witnessed a clear increase in the number of the population over the years. In general, and the district of Karbala Center in particular, as it is considered one of the important religious centers that have an important role in attracting large numbers of residents from the central and southern Iraqi provinces.

It is clear from Table (11) and Figure (3) the clear development in the population of the Central District over the years, where the total population for the year(1997) a round (347,632)people, in which the urban population for the same year(323,317)people, rural population (24,315) ,as for the year (2007)According to the annual population estimates, the total population of the district has reached) 511,434)people, in which the urban population reached(473,736) people, while the rural population has reached(37,698) people, while the total number of the district's population for the year was (2017)a round (520.741)people. As for the urban population for the same year, it reached) (465,882) people, while the rural population (54,859) People, has a total of statistical estimates year (2020) For the residents of Karbala district (562,965) people, in which the number of urban residents a round(503,651) people, while the rural population reached (59,305)breeze.

It is clear from the population estimates of the previous years that the district of the center has increased its population within the countryside as well as urban, as a general census (1997) The center's judiciary included both the judiciary unit as well as the Al-Hur district. As for the estimates

Which represented the inventory and numbering for the year (2007)It has included updated design basis for each of the center and spend the free hand has been calculated to prepare the population (rural, urban) for each of the center and spend , [29] either a year(2017) In it, estimates were determined for both the Center district and the Al-Hur sub-district, which represents the population increase in the Al-Hur sub-district in a year (2017) for urban residents(203,483)people, as for the rural population, it reached (31,051)people. [30]

Table (10) The quarries of sand within the study area.

invested material	Energy Productivity (m3)	power source	Area (acres)	county number	piece number	my event (X) s	)juvenile (Y	Lab name	NS
sand filters	103,000	power generator	7	Island 61	3	416900	3590010	The General Company for Construction Industries (first contract)	1
grit chopper	120,000	power generator	10	Island 61	3	416606	3589580	The General Company for Construction Industries (second contract)	2
grit chopper	90,000	power generator	15th	Island 61	3	421944	3578061	Al Rasheed Construction Contracting Company (Tahrir Quarry)	3
sifted sand	88,000	power generator	10	Island 61	3	414828	3588175	Sadiq lab	4
sifted sand	40,000	power generator	8	Island 61	3	418011	3588050	Al-Mustafa lab	5
normal sand	80,000	power generator	8	Island 61	3	416196	3589479	Barakat Commander of the Faithful Laborator	6

								y	
crushed gravel	89,000	power generator	8	Island 61	3	41732 3	3587801	Al-Baqer Laboratory	7
610.000			66			Total			

Source:

1. Ministry of Industry and Minerals ,Geological Survey ,Quarries Department, unpublished data ,)(2021).
2. Holy Karbala Provincial Council,Property Department, unpublished data) ,(2021).

Table(11) : The evolution of urban and rural population numbers in Karbala district for the period(1997-2020)

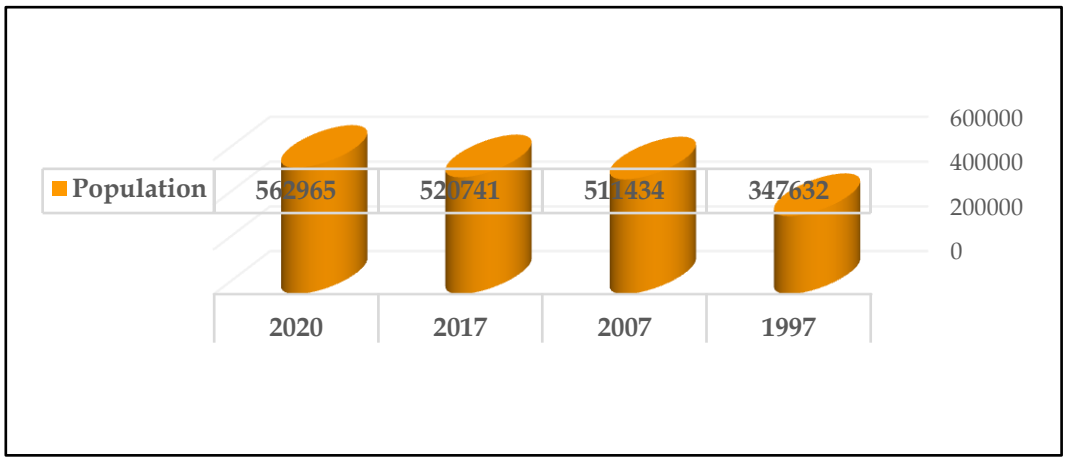
Total	Country	urban	Karbala Center District
347,632	24,315	323,317	1997
511,434	37,698	473,736	2007
520.741	54,859	465,882	2017
562,965	59,305	503,651	2020

Source:
Ministry of Planning, Central Statistical Organization, Karbala Governorate, unpublished data. (2021).

The continuous increase in the population has an impact in two aspects (negative, positive) on the groundwater, the negative side is that the increase in the population will affect the water in terms of the large demand for agricultural crops, which in turn requires irrigation water for those crops, so farmers in the desert area To digging wells for the purpose of obtaining irrigation water, the increase in drilling wells in the desert area and the continuous process of withdrawal of that water will directly affect the amount of water in the aquifer deposit of the Dibdiba reservoir and thus cause a change in the characteristics of the quality water because the continuous withdrawal process of that water and the absence of a source Continuous feeding except for the seasonal rains of the area will work to concentrate the salts in high proportions.

As for the positive side of the population increase, it is limited to the increase in population numbers in the countryside, which provides agricultural labor that contributes to the development of agricultural production in the district in particular and Karbala governorate in general.

Figure (3): The evolution of population numbers in Karbala district over the years



Source: Using Table (11) data.

B. Landfills & Sanitary Landfills:

Landfills are defined as a method of landfilling non-working waste to dispose of waste with a percentage of (90)%, most of which are from Domestic waste, it is dealt with through the use of abandoned quarries and pits to bury the waste .The study area suffers from the amount of waste generated by the residents of the district center annually, as it is considered the largest unit Administrative in the volume of waste generated from it, the site of landfills is concentrated at the end of the Karbala city center and at the forefront .The desert area of the study area, which is concentrated in the southern part of the city of Karbala, within the administrative boundaries of the center of the district after the green belt with an area of (650) acers, the amount of waste increases annually in Karbala governorate. In general, and for the district of the center in particular, as the amount of waste generated ranged during (2015-2020) (205-106) tons, as shown in Table (12), in a full-fledged acreage (44-461)tons.

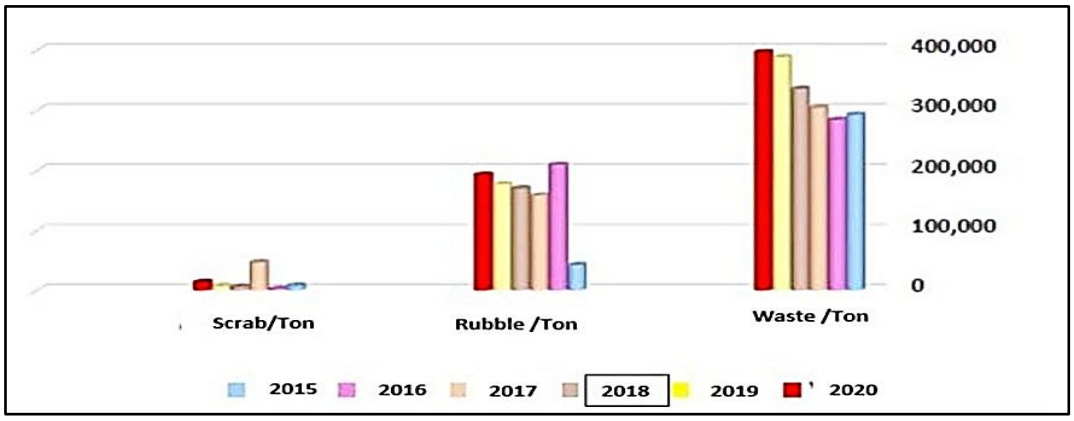
Table(12): The volume of waste residuals within the Karbala city district center for the year (2015-2020).

NS	the year	scrap / ton	rubble/ton	waste/ton
1	2015	8,428	43,036	293,134
2	2016	3,024	209,905	285,082
3	2017	47,124	159,013	304,842
4	2018	6,736	170,384	336,428
5	2019	7,752	177,536	389,039
6	2020	13,809	193,676	396,581
Total		44,461	953,550	205,106

Source: Karbala Municipality Directorate, Environment Department, Fifth Sector, unpublished data, (2021).

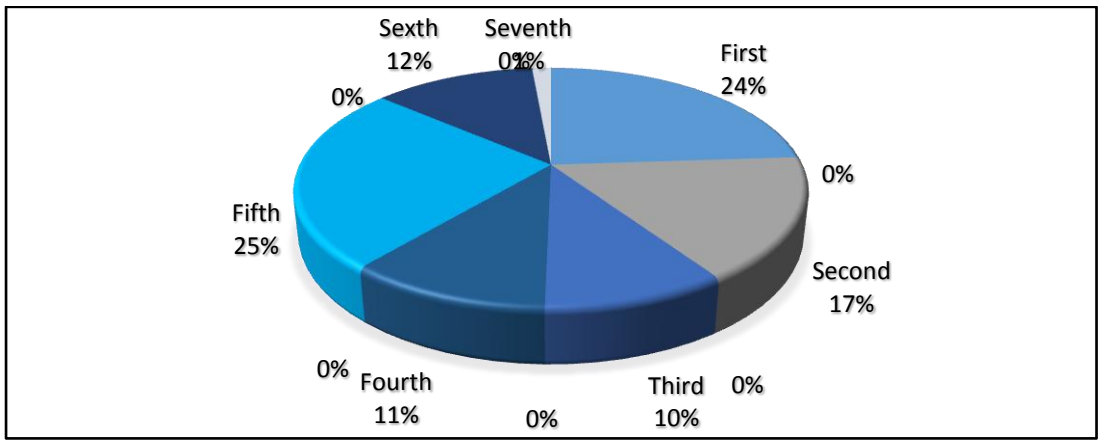
The amount of waste generated from the municipal section (first - seventh) during the year has reached(2020)about(50.186,44.250,90.198,39.172,35,312,59,624,86,164)tons respectively and in total) 360,807)Tons in addition to the amount of waste generated during the visit of the 10th of Muharram(10,000)ton and the fortieth visit(25,774)tons to reach the final total(396,581 tons, as shown in Table (13) and Figure .(5) While the amount of rubble generated from the municipal section (first - seventh) during the year reached (2020) around(3.512, 71.226, 27.354, 19.872, 21.829, 33.520, 16,372)tons respectively and in total(193.676)tons as shown in the table((1 4) and figure.(6) As for the amount of scrap waste, it reached the municipal department (first - seventh) within a year (2020) about) 186, 4.915, 6.520, 1.440, 273, 3.734, 1.196) tons respectively and in total(13,809) tons,it is noted in Table (1) and Figure .(7)Waste is dealt with by transferring it from the seven municipal departments of the district, and then transferring some of it from the municipal departments (the first section, the second section, the seventh section) to the transfer station in the industrial area near the Al-Kafeel Hospital and then transferred to the sanitary landfill site located behind Al-Resale neighborhood. The rest of the waste generated from the municipal departments (section three, fourth, fifth, sixth) is transferred directly to the sanitary landfill site and there is random and irregular sorting by waste seekers and then burial of various types of waste) medical, industrial, municipal, agricultural.

Figure (4): Quantity of waste, rubble and scrap / ton in Karbala Center district for the year (2015-2020).



Source: Using Table (13) data.

Figure (5): The amount of waste residues from the municipal departments of the study area in the year (2020).



Source: Using Table (13) data.

Table (13): The amount of waste for municipal departments during the year (2020)

Total	Canon the first	October The second	October the first	September	Father	July	June	May	April	March	February	January	Section municipality
86,164	6800	6576	12492	6700	5704	6800	6576	6808	7584	6840	6408	6876	Section the first
59,624	6013	5751	5949	5751	5055	5739	5977	5977	5887	2581	2388	2556	Section The second
35,312	3005	2900	3002	3007	2545	3002	3005	3000	2990	2975	2890	2990	Section the third
39,172	3318	3672	3512	3244	2664	3138	3138	3460	3188	3318	3160	3360	Section the fourth
90,198	7446	7658	7632	7632	6571	7595	7595	7580	7580	7817	7293	7799	Section Fifth
44,250	3850	3843	4158	3702	3235	3873	3873	3448	3448	3122	3315	3746	Section VI
5186	5186	_ _	_ _	_ _	_ _	_ _	_ _	_ _	_ _	_ _	_ _	_–	Section seventh
360,807	36,518	30,400	36,746	30,036	25,774	30,403	30,164	30,654	30,677	26,653	25,454	27,327	Total

Source: Municipality of Karbala Directorate, Department of the Environment ,Sector V, data is unpublished, (2021).

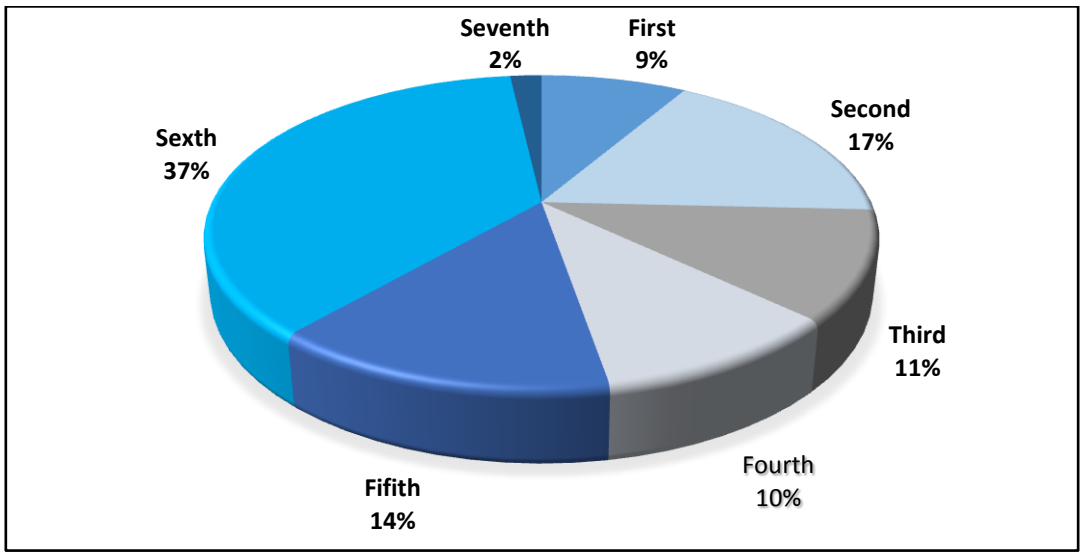
10,000 ton	visit ten
25,774	The fortieth visit
35,774	Total

Note: The total amount of waste raised during2020(35,774 + 360,807= 396,581 tons)

that sanitary landfill Sanitary Landfills In the study area, it does not conform to the international standards for sanitary landfills, where waste is often dealt with in an unorganized and random manner that does not adopt the tiring environmental standards in the countries of the world of collecting, sorting and landfilling of waste, and a new site has been proposed for the model sanitary landfill Typical Landfills Within the administrative borders of Karbala district and close to

the current landfill site, with an area of up to (900) acres, where implementation will be carried out by the Egyptian Chemotic Company.

Figure (6): The amount of rubble generated from the municipal sections of the study area in the year (2020)



Source: Using Table (14) data.

The impact of the buried waste on groundwater lies in the amount of leachate)Liquid Waste (filtered from the landfill towards the underground water storage, which is filtered through rainfall or through interactions that occur between liquid waste and solid waste, forming water-soluble substances that pose a major threat to the quality of groundwater.(34) It refers to the amount of rain falling and the quantity and type of waste that is disposed of, and it also contains many hazardous elements and compounds, and often these elements are actually present in groundwater, but within the natural limits, including dissolved minerals such as (iron, manganese) and salts such as (sodium, chloride) as well as Many other common elements such as (sulfates, bicarbonates), but they are present in the filtered water in dangerous proportions that affect the quality characteristics of groundwater, and the filtered leachate also contains some volatile organic compounds(VOC) and heavy metals.

Total	Decemb er	Novemb er	Octob er	Septemb er	Fath er	July	June	May	April	Marc h	Februar y	Janua ry	Municipa l Departm ent
16372	1669	1714	1827	1671	1788	1789	1706	854	811	842	782	913	section One
33520	3400	3400	5129	3400	2893	2547	2547	2364	1977	1999	1865	1999	second section
21829	1711	1710	1710	1711	1801	1801	1800	1800	1890	2790	1650	1455	third section
19872	1760	1696	1504	1504	1760	1728	1728	1664	1632	1760	1600	1536	Fourth Section
27345	2325	2325	2325	2325	2325	2325	2325	2325	2250	2215	2065	2215	Fifth Section
71226	2956	2876	25492	2352	2044	2034	1236	2868	2716	5648	7840	13164	Sixth Section
3512	3512	—	—	—	—	—	—	—	—	—	—	—	Seventh Section
1 936	17333	13721	37987	12963	1261	1222	1134	1187	11,27	1526	15802	2126	Total

76	1	4	2	5	6	0		

Table (14): The amount of rubble for municipal sections during (2020).

Source:Karbala MunicipalityDirectorate, Environment Department ,Fifth Sector ,unpublished data, (2021).

Total	December	November	October	September	Father	July	June	May	April	March	February	January	Municipal Department
1196	63	68	82	62	81	97	66	158	165	164	__	190	section One
3734	186	192	192	186	186	186	186	186	180	96	1865	93	second section
273	25	30	30	30	30	25	25	22	29	15th	__	17	third section
1440	160	144	128	128	128	112	112	144	144	144	2065	96	Fourth Section
2520	__	__	__	__	__	__	__	__	__	__	2065	__	Fifth Section
4915	26	26	26	26	20	23	16	26	30	25	4640	31	Sixth Section
186	186	__	__	__	__	__	__	__	__	__	__	__	Seventh Section
13,809	646	455	458	432	445	443	405	536	548	444	8570	327	Total

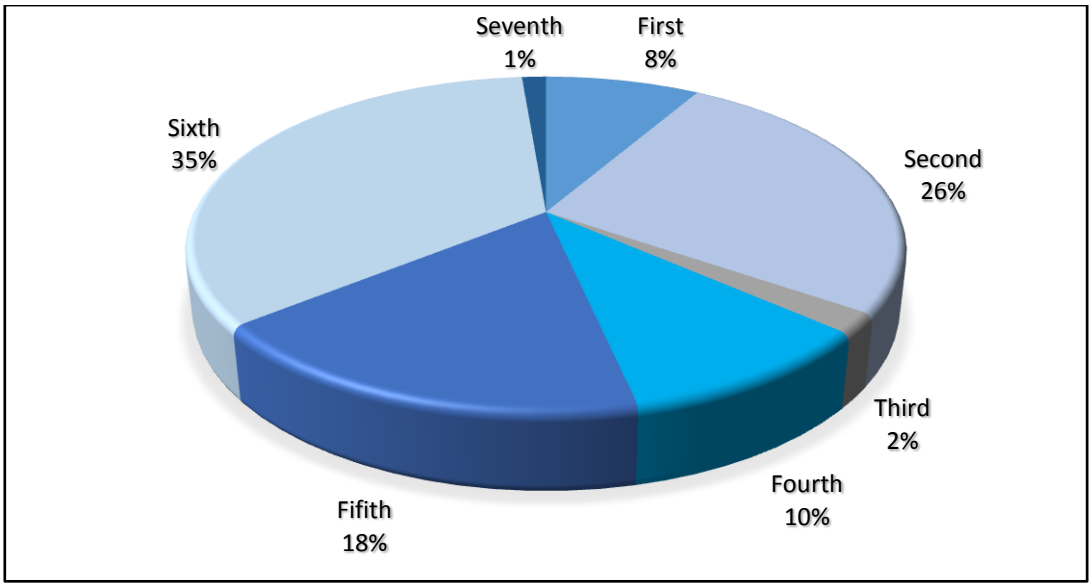
Table (15):The amount of scrap for municipal departments during a year (2020)

Source: Municipality of Karbala Directorate, Department of BBC I E, Sector V, unpublished (data, 2021).

The liquids filtered from waste into the ground cause many risks to the environment and human health, as the presence of compounds and chemical elements in groundwater in high rates contribute to making the aquifer unsuitable for most uses. Thus, it moves from the unsaturated layer of water to settle in the saturated (deaf) layer, and thus these leaching follow the hydraulic gradient of the groundwater system to spread pollution within the layers bearing that water.

It is clear from the above that the amount of waste in the study area occupies the first place within the Karbala governorate from municipal waste, rubble and scrap, thus affecting the groundwater within the landfill site approved by the governorate, where the amount of waste increased by an average of (10) tons of a year (2015) up to a year(2020) , that the process of burying waste without taking into account international environmental standards within the study area will contribute to the pollution of groundwater through what is filtered from these wastes of toxic materials, elements and compounds that change the qualitative characteristics of groundwater and thus affect the quality of agricultural production within the study area, which depends on Direct irrigation of crops on groundwater.

Figure (7): Quantity of scrap waste generated from municipal sections in the study area (2020).



Source: According to data table(15)

Conclusion:

The impact of human factors on the quantity and quality of groundwater appears through the activities prevailing within the study area, represented by the first main activity (agricultural), which shows its impact on water through the size of the agricultural areas within the study area and the extent of their exploitation of that water, in addition to the use of fertilizers, fertilizers and pesticides during agriculture, which Contributes to changing the chemical properties of that water during its leakage towards the groundwater level, which negatively affected the quality of irrigation within the study area, in addition to the environmental impact left by those farms through the establishment of projects for poultry fields and their non-compliance with international environmental standards because most farmers did not adhere to following the instructions Environmental and special health management in the management of these projects and the resulting residues touching the surface of the soil filtered into the water level during washing and drifting of the soil also affecting its qualitative and chemical characteristics, as for the industrial activity and the extent of its impact on the quality, characteristics and volume of groundwater, its impact has become clear through the existing activities In the region represented by the Karbala gas station, Karbala oil refinery and sand quarries within the region It has a direct impact in that water by adding gaseous pollutants that contribute to the pollution of groundwater after rain through the union of its atoms with the air, in addition to highly dangerous liquid waste as well as solid waste, as well as the direct impact of sand quarries on soil deterioration through uprooting the sand continuously , which contributed to the formation of depressions where the groundwater susceptible to evaporation and pollution, has been confined to the impact of municipal activities within the study area in the waste dumps health and landfill which has influence a serious change in the chemical properties of ground water during her candidacy into the depths as a result of the increase continued in the amount of waste The result of the continuous increase in the population will increase the risk of contamination of that water as a result of not following the environmental methods within the landfill of these wastes and their non-compliance with international environmental standards.

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