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Environmental Impact Assessment of Al-Hilla City Wastewater Treatment Plants

A research

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By

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

﴿ يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ ۚ
وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ ﴾

صَدَقَ اللَّهُ الْعَظِيمُ

سوره المجادله (11)

Supervisor Certification

I certify that the research of this research entitled **" Environmental Impact Assessment of Al-Hilla City Wastewater Treatment Plants "** prepared by **" Sara Muhammed Abdullah "** has been carried out completely under my supervision at the Department of Civil Engineering, College of Engineering ,University of Babylon, as a partial fulfillment of the requirements for the degree of Higher Diploma of Science in Civil Engineering.

Signature:

Name: Prof. Dr. Saif Salah Alquzweeni

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Date: / / 2022

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Sara Muhammed Abdullah

Abstract

Wastewater treatment plants (WWTPs) are operational treatments include different processes working to avoid or minimize damage of sewage. The goal of this research is to evaluate the environmental performance of the new Al-Muamirah WWTP located in Babylon Governorate (Iraq). In order to evaluate wastewater treatment plant, the quality of the effluent treated wastewater has been monitored over the year. The parameters (BOD_5 demand for bio-oxygen, COD demand for chemical oxygen, TSS total suspended solids, NH_3 ammonia, PO_4 phosphorus, and potential of Hydrogen pH) are selected to evaluate the environmental impact of the new Al-muamirah WWTP. The results of environmental impact assessment of the new Al-muamirah WWTP showed that the concentrations of all pollutants in the effluent wastewater has met the Iraqi standards. And for the purpose of assessing the wastewater treatment plant, two methods of assessing environmental impact were used and the difference between them were stated, , Leopold matrix has shown that the total impact of the pollutants d = -17.27 these value showed that the quality of water has negligible (not harm) effect on the river water and the reason for this finding that the plant is not working at full capacity as the transmission lines was not link to the station yet. The checklist method was also used to find the environmental impacts of the plant on the river water. As this method works on all environmental elements and discussed the impact of the plant on them. The checklist depends on the opinion of the experts, so they put some negative, positive or neglected impacts from the effluent water quality of the plant on the water quality in the shat Al-Hilla river, so it is considered a complement to the (Leopold) matrix method.

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Symbol	Description
BOD_5	Biochemical Oxygen Demand
CBA	Cost Benefit Analysis
COD	Chemical Oxygen Demand
EIA	Environmental Impact Assessment
LCA	Life cycle assessment
MLD	Megaliter per day
MO	Microorganisms
NEPA	National Environmental Policy Act
NH_3	total ammonia
TOR	Terms of Reference
pH	Potential of Hydrogen
PO_4	Phosphorus
WWTP	Waste Water Treatment Plant

Chapter One
Introduction

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1.1 Background

Iraq is one of the countries that is suffering from water shortage problems and, for this reason, wastewater treatment plants become a necessity to minimize this problem. **(Alanbari et al., 2015)** . However, as the world's population grows, the required for freshwater increases. This adds to the stress already placed on water treatment systems. Furthermore, due to the increasing expansion of industrial operations, water contamination has increasing significantly **(Al-wardy, 2021)** .

Therefore, the concept of environmental impact assessment was born, which is a tool for discovering as well as evaluating potential environment impacts resulting from the industrial project, evaluating the available alternatives, and designing appropriate procedures to verify the environmental impacts of any activity and their impact on the environment and human health. Environmental impact assessment is an important part of planning, legislation, policies and environmental programs. Impact evaluation has increased in important as a decision-making process in the project development, and its role has been publicly stated by Principle No. 17 of the 1992 Rio Declaration on Development and Environment, which states: Environmental impact assessment is a practical instrument that must be used for proposed operations that are expected to have a significant environmental impact and are subject to the permission of the experienced governmental authorities . A foundation of the evaluation was laid in 1970-1975 in the United States of America, the focus was increased and high techniques were introduced into the process (risk assessment) in 1980. Experience and practice were activated in reviewing the environmental impact assessment in the late eighties, and the idea of

environmental impact assessment continued to develop and move towards sustainability since 1990 until now. The industrial projects that are subject to an environmental impact assessment are the assessment of the potential environmental impacts of new industrial projects that are still in the planning stage (that is, the factory has not been built and has not started work yet), and the assessment of the environmental impacts actually resulting from an existing productive industry **(Barry Sadler, 2000).** Due to the steady depletion of global water resources and the large amounts of polluted water in industrial cities give wastewater treatment operations play an important role in reducing water loss. Simultaneously, as cities become larger, the volume of chemical and physical loadings on existing plants will obviously increase, demanding more effective wastewater treatment methods. After it has been used for a variety of reasons, wastewater becomes the community's water supply. When sewage water accumulates and is allowed to septic system, the organic matter in it dissolved, producing noxious gases. Furthermore, wastewater contains bacteria that live in the human intestine. It also provides nutrients that could help underwater plants develop as well as harmful compounds or substances that might cause cancer or mutation **(Syed R. Qasim, 2009)**.

Human excrement, bodily fluids, kitchen wastes, domestic maintenance materials, and bath water are the essential components of sewage obtained from commercial, industry, and housing sources, and also a wide range of additional organic and inorganic compounds at tiny proportions.

(Metcalf & Eddy., 1991) .

Wastewater treatment Plants (WWTPs) are often developed using empirical formulas and simpler system specifications that can be used for planning and sizing treatment units by choosing sewage parameters and

operational requirements, as well as calculating the sewage demand **(Arif et al, 2018)** .

In the wastewater treatment process, dynamic modeling and simulation are increasingly frequently used to evaluate different processes, better design, and cost evaluation and analysis. (SIMBA, Hydromantis GPSX 8, AQUASIM, Bio-Win, and EFOR) are the most common programs for simulation and modeling in sanitary engineering. the GPS-X 8.0 program was using to recreate an oxidation ditch of a waste water treatment plant in order to evaluate its efficiency and show its capacity and reliability **(Al-wardy, 2021) .**

1.2 Problem Statement

While wastewater is the primary source of pollution and illness in the environment. The problem must be resolved just for people's convenience, environment protection, and population health. As a result, wastewater treatment plants should effectively treat wastewater that must be deposited into rivers in permitted limitations in addition to their performance evaluating. The new Al-Muamirah wastewater treatment plant, a newly established plant with a design capacity 107000 m^3/d, that began operation in 2019 and served Al- Hilla city by processing wastewater and then depositing it into Al-Hilla River, regarded quite useful for its great performance.

1.3 Study Significance

Wastewater treatment plants modeling is one of the most important methods for determining how the plant will respond to variations in wastewater characteristics, hydraulic load fluctuation, operational circumstances, etc.

the significance of wastewater treatment plant environmental impact assessments is:

1- Encouraging and stimulating the project's environmental sustainability, and subsequently attaining sustainable development at the regional and national levels.
2- Lowering the costs of procedures for regulating the environmental impacts of undirected development processes.
3- Avoiding major alterations to the project in the future because of the negative effects it has on the environment.
4- Determining whether the proposed or current project has negative consequences for the environment, people, or other economic activities.
5- Assisting in the creation of project alternatives based on the information gathered throughout the review phase about the project's negative effects.
6- Preventing the pollution of natural, nonrenewable environmental resources and protecting their long-term viability.
7- Finding a balance between developmental and environmental objectives.

1.4 Study Objectives

The main objective of this study is:

1- Evaluate the environmental impact assessment of new Al-Muamirah WWTP by using two environmental impact methods (Leopold matrix and Checklist) method.

2- Compare both methods and find the best.

Chapter Two
Theoretical Concepts & Literature Review

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Theoretical Concepts & Literature Review

2.1 Introduction

Water treatment plants have two types of treatment; clean water and wastewater treatment. The difference between the two types of water treatments is the source of water. For clean water treatment plants, generally the water is taken from surface water, rainwater or groundwater which is distributed and cleaned for human consumption. However, wastewater treatment plants collect sewerage and other wastewater from various locations (such as from Industrial wastewater, Domestic wastewater, Infiltration water, Storm water, Commercial and governmental) cleans it and return it to the environment at a level that is safe for humans, fish and plants **(Mustafa Hussain ., 2021)** .

Wastewater is water that have physical, chemical or biological properties altered as a result of the addition of compounds that render it for certain uses, such as drinking.

Wastewater treatment is the method and technique for removing proportion of toxins found in wastewater in order to protect the environment and good public health. Wastewater management, Thus, refers to the treatment of wastewater in order to secure the environment while also ensuring public health, economic, social and political stability.

In addition, untreated Wastewater contains a pathogens, Human waste, fluids, drugs, and genotoxic substances properties, chemicals, heavy metals, and radioactive wastes. This may threaten public health and well-being, and contribute to the demand for oxygen loading nutrients from water bodies and in the process of promoting toxic algae bloom and lead to unstable aquatic

ecosystem, if discharged untreated, into water bodies **(Zahraa Maarij ., 2020).**

At some point, the wastewater collected from towns and communities must be received or recycled. The design engineer and public health officials are faced with a difficult question: What levels of treatment above those required by discharge permits must be reached in a given application to ensure that human health and environment are protected? To answer this question, needs careful examinations of specific conditions and requirements, the use of scientific evidence and engineering judgment based on prior experience, and consideration of federal, state, and local regulations. In some scenarios, a suitable risk assessment may be necessary **(Metcalf & Eddy., 1991)** .

Water treatment plants should be designed to meet water quality standards with a minimum of effort and expense. Seasonal variations, as well as long-term changes in water quality and future wastewater restrictions, should all be accounted for in the design. As a result, good planning and design must be built on five following steps :**(Steel, 1979)**

1- Assessment of the water source and final water quality objectives.
2- Predesign studies, for alternative process development and final process train selection.
3- Complete design of the chosen alternative.
4- Construction.
5- Operation and repair of the finally completed facility.

Engineers, scientists, and financial analysts must apply principles from a variety of disciplines to build a water treatment system, including: engineering, chemistry, microbiology, geology, architecture, and economics **(Syed R. Qasim, 2009)** .

2.2 Composition and characteristics of wastewater:

Wastewater contains over 99.9 percent water; the remaining materials include suspended and dissolved organic and inorganic matter as well as microorganisms. These materials give physical, chemical and biological qualities that are characteristics of residential and industrial wastewater **(Fatima Hussine, 2011)** .

2.2.1 Physical properties

Temperature, color odor, density, and turbidity are all described as physical properties of municipal wastewater. The following physical parameters are: **(Syed R. Qasim 2. , 2018)**

1- Temperature: Temperature effects upon solubility of gases, bacterial activity, and the viscosity. It was from 15 to 25 ◦C.
2- Color: wastewater is light gray in color, with dark gray or black color.
3- Odor: fresh wastewater may have a soapy or greasy odor, whereas the odor of residential wastewater is caused by gases released by organic matter decomposition. hydrogen sulfide (H_2S) and other decomposition products are the most odorous gas in septic wastewater.
4- Turbidity.

5-Density: ranges from 1.02 to 1.05 kg/m^3.

2.2.2 Chemical properties

Chemical properties of wastewater are represented in terms of inorganic and organic components; residential wastewater contains approximately 50 inorganic and 50 organic substances. The organic components, total suspended particles, and inorganic proportion of wastewater are discussed in more detail below **(Syed R. Qasim, 2009)**

1- pH ranges from 6 to 8.

2- Biological Oxygen Demand (BOD): the amount of dissolved oxygen required by bacteria to stabilize the organic materials in wastewater, under typical incubation conditions of 20 ◦C for five days.

3- Chemical Oxygen Demand (COD): It is a measure of organic material that quantifies the amount of oxygen needed by a strong oxidizing chemical agent (potassium dichromate) to chemically stabilize all organic matter (bio-degradable and non-biodegradable) under acidic conditions.

   COD: BOD = 3: 2

4- Hydrogen sulfide

5- Nitrogen (ammonia)

6- Nitrites and nitrates are two types of nitrates.

7- Chlorides

2.2.3 Biological characteristics

Wastewater contains groups of microorganisms that include bacteria, fungus, algae, protozoa, viruses and harmful bacteria are among the microorganisms found in wastewater. E-coli, coliforms, and fecal coliforms are pathogen indicators **(Steel, 1979) .**

2.3 Wastewater treatment processes for Al-Muamirah (WWTP)

The processes of this plant are:

2.3.1 Preliminary treatment units

It's the first stage in the treatment process .The aim of preliminary treatment is to ensure that effluent and sludge final products are acceptable quality as well as to defend the primary treatment process from failure due to accumulation of screenings, silt , inorganic grit, high dirt accumulation or low in efficiency caused by grease or oil films or fat quantities. It includes the following parts **(Anne Butler et al., 1995)**.

2.3.1.1- Screens: In a WWTP, Screening is usually the first unit operation. The screens are used to remove large objects such as rags, paper, plastics, metals, and like. If not removed, these objects can harm pumping machinery and sludge removal, as well as hangover wires, and block valves, causing major problems in plant operation and maintenance **(Benefiled, 1980)** .

Screening equipment are divided into three types: **(Metcalf & Eddy., 1991)**

1- Coarse Screening is (50-150) mm spacing.
2- Medium Screening is (20-50) mm spacing.
3- Fine Screening is (5-20) mm spacing

∴ Just for protection , a preliminary screening is frequently performed before the fine screens. Screens can be divided into two types: Manually cleaned and Mechanically cleaned:

1- Screening removal: bar rakes that have been manually cleaned contain sloping bars that make hand raking faster. For drainage and storage, the screening is placed atop a perforated plate. Mechanically cleaned bar rakes are either front or back –cleaning, in both cases, the screens are moved upward and dropped into a collection bin or conveyor by the traveling rake **(Steel, 1979)**.

2- Screenings disposal: Traditionally, there have been a few options for screening disposal: Land Filling or Incineration. Screens are frequently ground and returned to the wastewater treatment plants **(Syed R. Qasim 2. , 2018).**

3- Design considerations for screens: **(Fatima Hussine, 2011)**
   1- slope (degrees) from horizontal (45-70).
   2- The distance between bars in (mm) (10-40).
   3- Rack velocity in (meters per second) (0.3-1).

4- Maximum head loss with a clogged screen (mm) of 150.

5- Due to clogged screen, the maximum head loss(mm) is 800

4- Comminutor devices: Comminutes are crushers that break up the particles has been retained after it has passed through screens. It is used in conjunction with coarse screens. large objects are crushed that pass-through thin openings (0.6-1) cm, and comminutes are almost submerged They use revolving drums with cutting teeth or shredding devices that pass through stationary combs, disks, or screens **(Metcalf & Eddy., 1991)** .

Fig (2-1): Mechanical Bar Screens (slide share; Qingdao yimei Enviroment project co.,Ltd)

2.3.1.2- Grit champers: are a necessary basin for removing grits, sand, glass and heavy solids, dirt, bone chips, crops, and other items that are heavier than organic matter from wastewater., the main functions of grit champers are: **(Benefiled, 1980)**

1- Protecting movement mechanical equipment and pumps from unnecessary wear and abrasion.

2- keep heavy pipes in channels from clogging

3- Protect the bottoms of sludge digesters and primary sedimentation tanks from cementing.

5- Reducing the accumulation of inorganic component in aerated tanks and effluent digesters that results in a reduction of useful quantity.

Properties of grit chamber include: **(Steel, 1979)**

It is utilized in treatment plants that are medium and large in size. They have a number of benefits over velocity – controlled grit channels. Here are a few benefits:

1- A grit removal chamber may be utilized as primary treatment head for Chemical adding, mixing, and flocculation.

2- Because Wastewater was cured by air, odors are reduced and greater BOD_5 is removed, the environmental may be more affected.

3- If skimming is available, grease can be removed.

4- Grit may be reduced at any size by changing the air supply

Grit Collection and cleaning: It can also be cleaned manually (as small grit chambers), or mechanically (as large grit chambers). cutters, dowels, containers, or some addition of these are used to collect mechanical grit in velocity- controlled canals and grit removal chambers **(Al-wardy, 2021)**.

Grit removal methods: Land filling, soil spread, and sludge incinerator are all options for grit disposal. So that the remaining organic material could be a problem, it's better to bury grit and cover small and medium-size plants **(Fatima Hussine, 2011)**

Types of grit chamber **(Syed R. Qasim .. , 2009)**

1- An Aerated grit chamber.

2 – Horizontal flow grit chamber

Fig (2-2): An Aerated Grit Chamber (slide share; General Engineering company).

2.3.2 Primary Treatment: The purpose of primary treatment is to remove the settleable suspended solids and floating solids. After passing the coarse suspended preliminary treatment units, sewage still contains non-solids, which can be partially removed in sedimentation units. (**Marcos, 2007)**

2.3.2.1- Primary sedimentation tanks

Mechanical skimmers collected settling sediments in a chute, after that they are delivered to the sludge-processing area, where grease, oils, and other float materials are scraped off the surface. Weirs direct the sewage into a collection basin. **(Benefiled, 1980)**

primary sedimentation tanks come in a variety of shapes and sizes: **(Marcos, 2007)**

The common types of horizontal flow clarifiers are rectangular, circular or square.

Design criteria (Fatima Hussine, 2011)

1-Detention time = 2-4 hrs.

2-SOR =Average flow 25 -60 m/d & maximum flow 80 – 120 m/d

3-Vf = 0.6-3.6 m/min

4- Dimension: Rectangular L=15 -100 m3/m/d, W= 3-30 m, Circular D=less than 60 m.

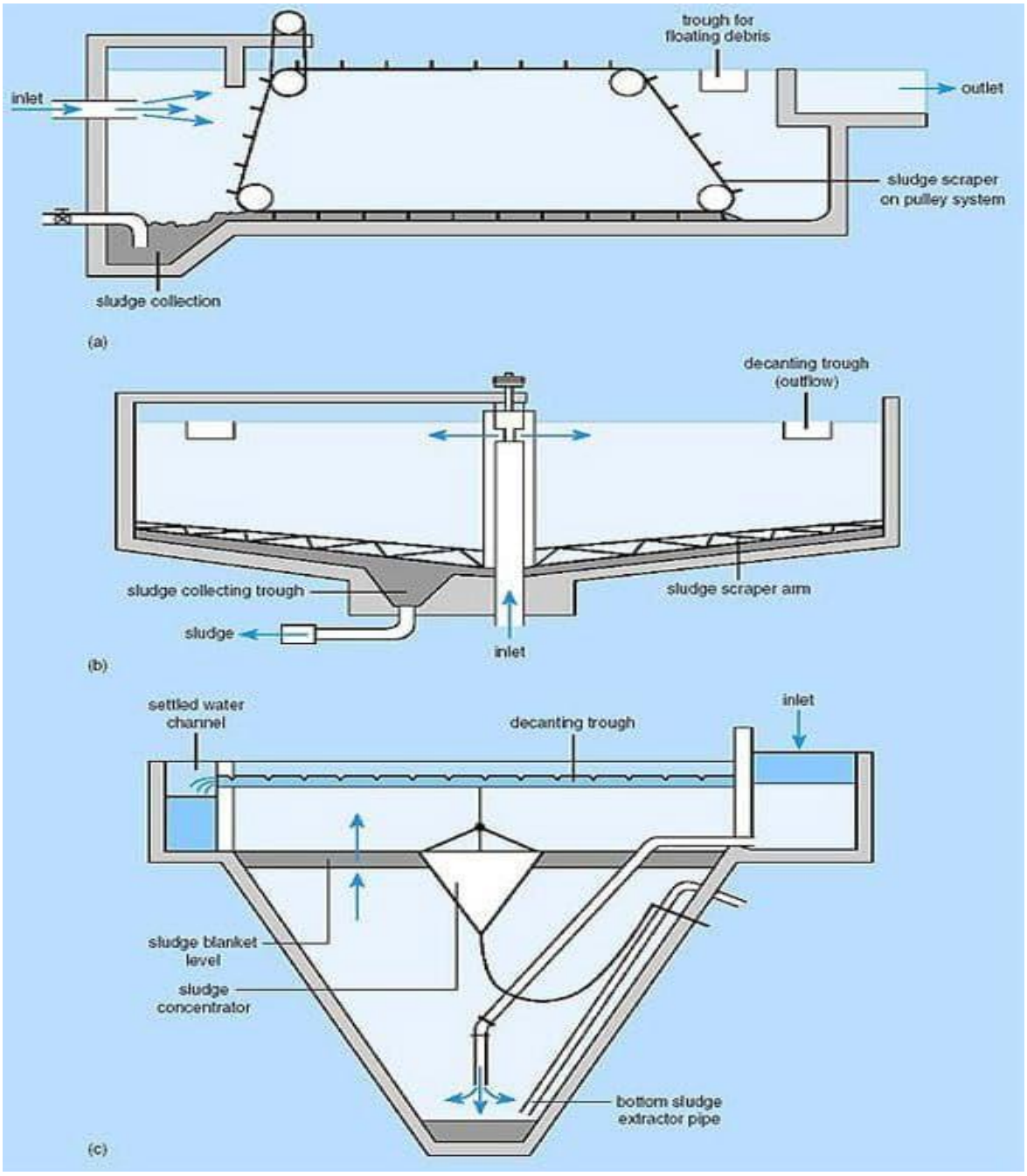


Fig (2-3): Typical sedimentation tanks: a-Rectangular tank with horizontal flow, b-circular tank with radial or spiral flow, c-Hopper bottom tank with vertical flow. (slide share; OpenLearn)

2.3.3 Biological Treatment:

It considered the most important stage of water treatment plants. Where biological waste treatment is adding active microbial growth to the wastewater so that the pollutants can be consumed as food. A wide range of microorganisms, including bacteria, protozoa, algae, fungi, and others, play a role in this. All those microorganisms in the presence of oxygen convert the degrading organic material into carbon dioxide more cell material, water and other inert substances, biological removal of organic matter is carried out through the processes of anaerobic and aerobic decomposition, the combination of aerobic, anaerobic processes is the main processes used for biological treatment **(Steel, 1979)**.

There are two types of biological treatment processes:

2.3.3.1 Activated sludge process

Microorganisms (MO) are combined well with the organics in the activated sludge process such that they might develop as well as maintain the organics. when they develop and then are mixing by air movement, they accumulate around each other (flocculate) to produce an effective mass of microbiological floc known " activated sludge" a combination of the activated sludge and wastewater in the aeration tank is known as " combined fluid " and it tends to flow from the aeration tanks to a secondary clarifiers where activated sludge would be collected . To maintain an optimum food -to- MO amount to allow quick decomposition of the organic material, a part of the collected sludge is passed to the aeration tank, Because of this process produced larger activated sludge than is used , most of that is lost from aeration basin or sludge return line to sludge treatment plants for a removal. Diffusers or mechanical mixers are used to introduce air into the aeration basin **(Fatima Hussine, 2011)**.

2.3.3.2 - Aeration Methods

In the activated sludge process, there are two main types of aeration systems. These are the following:

(1) Diffused aeration: air is introduced into the tank through porous diffusers or air vents at the bottom. Air diffusers come in a variety of shapes and sizes, including bubble diffusers, tube diffusers, and jetting diffusers.

(2) Mechanical aeration: Oxygen is produced from the environment. Aerators are formed from impellers that are immersed or partially immersed that are connected into motors that are installed on floats or stationary structure.

2.3.4 Sludge Treatment

At municipal sewage treatment plants, a primary sedimentation tank and a secondary clarifier are the two main forms of sludge. If plant has these operations, more sewage might flow through chemicals precipitate, nitrogen removal, screens and crushers, and filtering systems.

A sludge produced in both operations is frequently treated with treatment facilities, and removed as primary or secondary sludge. Secondary sludge was usually brought back to the primary settling tank, resulting in a single flow of mixed sludge. There is a lot of water in sludge.

A little fraction solid in the sludge is very toxic. As a result, the problem of sludge handling and disposal is complicated. thickening, stabilization, dewatering, and disposal are common sludge management procedures **(Fatima Hussine, 2011)** .

2.3.4.1-Sludge conditioning and dewatering

Sludge dewatering was required to reduce liquid from the sludge so that it could be transport by trucks and composted, landfilled or incineration. municipal sludge contains extremely fine solid particles, that are hydrated, and electrostatically charged. Dewatering sludge solids is difficult due to their properties. Sludge conditioning is required to destabilize the suspension and enable the use of proper sludge- dewatering systems. Sludge dewatering systems can range from simple mechanical processes to very complicated ones. Spontaneous evaporation, and leakage from sludge lagoons or drying beds are all used in simple process. Sludge conditioning, centrifugal, vacuum filtrating, filter presser, and belt filtration are all used in complex mechanical systems. The amount and type of sludge, as well as the ultimate disposal method must all be considered when selecting a device **(Marcos, 2007).**

2.3.4.2-Drying Beds

Sludge drying is an earliest process removing water from sludge. Dewatering digested sludge with these is still common in small- to medium – sized plants. Typical sand beds have a 15-25 cm layer of a coarse sand on top of a graded gravel bed with selected files or perforated pipe for rain protection. There are also Paved drying beds. Each part of the bed (8x 30) m has watertight walls, below drainage system, with vehicle tracks for sludge cake disposal. Sludge was put out over the bed in thicknesses of 20-30 (cm) 8 -12 (in) and left to dry. The liquid that was not fully drained is came back to the plant. The cake dried for (10-15) day also has a water content of 60-70 percent. Sludge that has not been completely digested can produce smell problems. Depending just on weather conditions and smell management, the drying bed may be opened or closed, Based upon the Requirements. The sludge from

drying beds includes 20-40 % solids, with solids capture about 90-100 percent **(Syed R. Qasim, 2009).**

2.4 Environmental Impact Assessment (EIA)

The expression ‘environmental assessment’ refers to a process and a strategy through which details a project environmental effects is prepared, both by the developer and from other sources, and considered by the planning authority when deciding whether or not to continue with development. The world association of impact analysis considered EIA as ‘the operation of detecting, estimating, analyzing, and minimizing the physical, sociological, as well as other significant impacts of planned development plans prior to major judgments and agreements. This emphasis on process was currently being investigated further.

In essence, an EIA is a process, a systematic process that estimating the environmental effects of development actions. In opposed to many other environmental protection methods, the emphasis was on preventing. Of course, administrators always have evaluated the environment impact of developments, and not necessarily in the methodically, integrated and multi-disciplinary manner demanded for EIA **(John Glasson et al ., 2012)**.

The National Environmental Policy Act of 1969 (NEPA) was established to make sure that government agencies include environment considerations into their judgments evaluate these issues using an interdisciplinary approach. The EIA should assess all, "benefit", "negative" "major" and "minor" impacts which may come from the development of a water treatment plant. The major effects are those which are directly related to the construction and operation of the waterworks project. The minor effects are indirect, coming from development or changes in land use induced or

assisted by the construction of associated water lines. The detailed EIA report should address the following areas: **(Syed R. Qasim, 2009)**.

1. Environmental setting or existing conditions.
2. The proposed action of environmental impact.
3. Any negative environment impacts which are unprevented if the idea is carried out.
4. Alternative options to the action that has been suggested.
5. A Connection with both locally short-term human environment applications and long-term development maintenance with enhancement.
6. Any irrevocable and un acceptable resources commitments that would be involved in the suggestion action if it were to be completed out.

2.5 The objectives of the environmental impact assessment:

There are several objectives of environmental impact assessment include: **(Rasha ali, 2017)**

1- Ensure that any proposed activities or development plans are environmentally sound and ensure sustainability .
2- Avoiding any delay in project activities as a result of carrying out corrective operations after the start of implementation, thus saving operating costs.
3- Commitment to environmental controls within the planning process to avoid any penalties determined by the governing laws .
4- Providing any complete environmental information that includes the environmental factors affecting or affected by the proposed projects.
5- Reducing the costs of controlling the environmental impacts resulting from development operations.
6- Providing alternatives to projects according to the information provided by the evaluation process on the negative effects of the project.

2.6 Methodologies for EIA:

The most EIA techniques and procedures, as well as information to assist in selecting the best suitable method for a given case. EIA methodologies vary in complexity, needing various types of information, varying input types, and differing degrees of experience and technical complexity for analysis. Precision and certainty of the analyses they produce varies. When choosing a method, all of these considerations should be taken into account. In order to prepare an EIA report, the EIA practitioner must collect and analyze a large amount of raw and sometimes unstructured information.

The most effective techniques able to: **(Bindu N. Lohani et al, 1997)**

1-Allow data summarization.

1- Organize a large mass of heterogenous data.

3-Divide the data down into smaller groups with the least amount of information loss.

4-Present the raw data as well as the generated information in a clear and understandable manner.

EIA methods and techniques for identifying, measuring, and assessing impacts are: **(Pacifica F. Ogola, 2007)**

1- Ad Hoc method

Ad hoc method isn't actually technique because it doesn't organize the problem in a way that makes it easier to analyze. A team of experts established for a short period of time to perform an EIA is a good example of an ad hoc technique. The results reached by each expert are based on a unique mix of experience, training, and intuition. These results are presented in this report. This is sometimes the only essential or viable option. **(Bindu N. Lohani et al, 1997)**

2- **Checklists**

Checklists are typical lists of the different types of impacts that come with a specific project. The use of checklists is mostly for organizing data or ensuring that no effects are neglected. They consist of a list of questions about the project's features and its effects on the environment. They are of a generic nature and are utilized as assessment aids **(Pacifica F. Ogola, 2007)**

3- **Matrices**

Interactions between project actions and environmental characteristics and components are identified using matrix techniques. They include a list of project activities as well as a checklist of environmental elements that these activities may affect. These two lists are combined to create a matrix of potential interactions (putting one on vertical axis and other on horizontal axis). They should generally include both the development and operation phases of the project, as the former might sometimes have higher effects. Matrixes, but from the other hand, have a several problems, such the ability that they do not explicitly express spatial or temporal considerations and do not fully address synergistic effects. **(Bindu N. Lohani et al, 1997)** .

4- **Networks:** are cause-and-effect flow diagrams that aid in tracing the web relations between different activities and the environmental systems with which they connect. They're also useful for determining direct and cumulative effects. They are more complicated and require specialized knowledge to use well **(Pacifica F. Ogola, 2007)**.

5- **Consultation:** To ensure that all potential impacts are detected, consultations with decision-makers, impacted communities, and

environmental interest organizations are held. However, when extensive consultation is done and certain unjustifiable impacts are included in the ToR, there is a risk **(Pacifica F. Ogola, 2007)**

6- **Overlays Method:** McHarg (1969) is attributed by Shopley and Fuggle (1984) with the creation of map overlays. An overlay is made up of a series of transparent maps, each of which shows the spatial distribution of a different environmental parameter (for example, susceptibility to erosion). For conventional geographical units within the research region, data for a range of variables is collected and recorded on a number of maps, typically one for each variable. To create a composite, these maps are overlaid. The composite maps that result characterize physiological, sociological, biological, land use, as well as other important characteristics of region in relation to planned development's site. whatever numbers of project selection can be placed on finished map to examine degree of connected effects **(Bindu N. Lohani et al, 1997)**

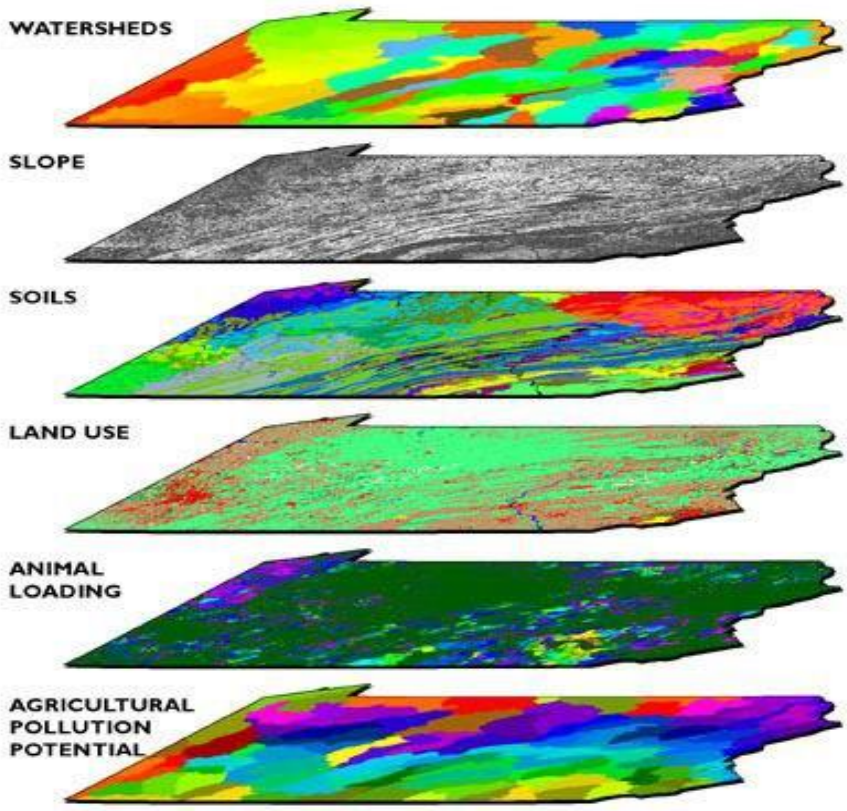


Fig 2-4 Example of overlay method (Slide share: Education institute-penn state)

7- **Cost Benefit Analysis:** State transportation agencies can utilize Cost Benefit Analysis (CBA to compare construction projects options across modes of transportation and determine whether discount value of features surpasses costs. Policymakers can use CBA to comparison potential project suggestions to a basic scenario, as well as political establishment, under that no investment are done. CBA is use to determine whether plan is best investment ideally, Project which maximize benefits while lowering costs must be chosen. **(Bryan Gibson et al, 2016)**

2.7 Types of environmental impacts: (Rasha ali, 2017)

A- The environmental impacts that must be included in the assessment process are**:**

1. Air pollutants,
2. Water pollutants,
3. Noise,
4. Solid waste,
5. Radiation,
6. Toxic (hazardous) materials.

B- Environmental impacts on natural plants and other living organisms include :

1. Geological environmental influences.
2. Effects on climate.
3. Environmental impacts as a result of the use of land.
4. Residential plots.
5. Medical influence.

2.8 Literature Review

K.Kumar et al, (2010) evaluated performance efficiency of a wastewater treatment plant. The case study of a wastewater treatment plant operating on biological treatment method (Activated Sludge Process) with an average wastewater inflow of 23 MLD was considered. Each unit's pollution performance efficiency was estimated. In addition, the plant's overall performance was calculated. The results obtained were particularly useful in identifying and resolving operational and maintenance problems as well as the plant's future expansion to meet higher hydraulic and organic loadings.

Alanbari et al. (2015) studied the environment impact of Al-Hilla wastewater treatment plant (WWTP). According to the results of the life cycle assessment (LCA), Al-Hilla WWTP has a 41 points negative impact and on the environment for every 1 m^3 of treated wastewater. The study showed that many of the effects are the result of the use of cement, steel and electricity consumption. Global warming, respiratory inorganics and non-renewable energy had the highest potential environmental impactions.

AL-Dosary et al. (2015) studied the environment effects of two Wastewater Treatment Plants (WWTPs) in Cairo, as well as the impact of WWTP design capacity on the total environmental damage. The first WWTP (Zenien) uses secondary treatment and has a capacity of 429000 m^3/day whereas the second WWTP (6th of october) uses tertiary treatment and has a capacity of 150000 m^3/day. Damages to caused people's health, ecosystems and resource were estimated as a result of a development and operation of these environmental loads. CO_2 emission and energy waste caused the most environment damages value while lower capacity WWTP showed higher damages value per the accepted function unit.

Hegaze et al. (2016) present in Egypt a research to assess a WWTP

With the results appeared which COD, BOD, and TSS removal efficiency is over 90%. This indicates that the plant performance was satisfactory and the specifications were agreed upon.

Alyaseri et al. (2017) studied the environmental performance of the sludge incineration process in a wastewater treatment plant and alternative is proposed that can reduce the environmental impact. To show the damages caused by the treatment processes, the study aimed to assessing the processes' effects on people health, ecological condition, and resources. The environment impacts from the waste processing unit were analyzed in 2011 at

Bissell Point wastewater treatment plant in saint louis, Missouri, United State, and the results showed that anaerobic digestion would have the best overall environment efficiency.

Rasha ali (2017) studied the EIA of the WWTP in Al-Maaimarah in Babil Governorate and evaluated the treatment processes therein. She collected data on some chemical and physical factors affecting water in 2015, which included 14 factors, and compared them with the standard determinants of these pollutants. She noticed a discrepancy in concentrations, some of which fall within the limits and the other exceeds the limit in some months. As a result of the work and analysis, it was found that the total impact of pollutants is more than 200, meaning that the water is very poor and polluted. It was noted that the reason for this result is the failure of some units during the year and the lack of efficiency in wastewater treatment.

Abugdera et al. (2018) studied the environment impacts assessment (EIA) for Wastewater Treatment Plants are carried out to guidance the project planning, wastewater distribution networks, construction, operation and maintenance staff training and future expansions. Failure to do so has negative impacts that could lead to the project sanction, as it did with in most of Libyan wastewater treatment plants. The purpose of the research is to evaluate the environmental impact of Sabratha (WWTP) that will be built in Ruwaisa district.

Xiaodi hao et al. (2019) studied traditional waste water treatment plant (WWTP) clean wastewater with decrease pollution problems during this, they pollute the air and require power generation, resulting in emissions. However, resource recovering (for example: water reuse) and energy recover (for example: anaerobic digestion) help us to minimize the negative environment implications of waste water treatment. To assess the environmental implications of WWTPs, life cycle assessments (LCA) have

been applied. There's also a necessity to develop for resource recovering applications which have a net-zero environment impacts on WWTPs. This study shows, an extremely effective energy and resource recovering scheme (specially for heat energy) is presented and evaluated. The environment impact of a traditional WWTP compared to a scheme presented here, which included recovery of energy resources, was estimated and explained with using to LCA method .The data certainly showed that traditional WWTPs do not benefits overall environmental as a whole while the new plan has benefitted the overall environment through operations based on resource/energy recovery .Among other things, heat energy recovering play an important role towards the analysis of net-zero LCA (about 40%) indicating that it deserves greater attention and investigation.

Siti safirah Rashid et al. (2019) studied the impact of rainwater on the environment implications of concentrated waste water treatment plants.

In wet and dry seasons, the relationships with rainwater, influent flow rate and wastewater contents with two sewage systems, namely combined and separate sewer systems, were principally determined. To understand the temporal environmental burdens in wet and dry seasons, life cycle assessment (LCA) have been using to assess environment consequences.

The results show that, rather than a combined or separate sewer system the environmental impacts produced by WWTPs, such as eutrophication with greenhouse effect, were depending on the correlations of rainwater intensity and waste water quantity and quality instead of. This might be applied to guide a more severe eutrophication controls in a more vulnerable receiving waters during a more sensitive season.

Al-wardy (2021) assess the efficiency of the Al-Muamirah WWTP in Babylon Governorate, and also modeling of the plant using the GPS - X

program and four cases. The performance of the influent untreated waste water and the effluent treated waste water has been evaluated over the year 2021 in order to examine wastewater treatment plants. To estimate the performance capacity of Al-Muamirah WWTP, the variables ((BOD) Biochemical Oxygen Demand, (COD) Chemical Oxygen Demand, (TSS) Total Suspended Solids, (NH_3) Ammonia, (PO_4) Phosphorus, and the quantified measurement of acidity or alkalinity (PH)) were chosen. Each variable 's removal efficiency in influent and effluent waste water is determined and compare to Iraqi standards. the removing efficiency values for (BOD and TSS) and (COD, PO_4) and (NH_3) may clearly be justified and satisfied, in both. According to the inputs and outputs variables in actual and virtual cases, the results of modeling and analysis of Al-Muamirah WWTP use GPS - X achieved good performance with high efficiency. A pollutants variables BOD, COD, and TSS concentrations in the effluent wastewater remained within the allowable limit after the four scenarios were applied to the model. This reflects the excellent efficiency of the plant's treatment system, as well as the adequacy and suitability of its design capacity.

Joanna Bak et al. (2021) studied in Poland, The Deming cycle can be used to environmental management in facilities like wastewater treatment plants (WWTPs), and as a result, continuous improvement in environment impacts mitigation. The present condition's correct assessment of operation of the WWTPs, as well as the identifying of assessment of features which might have a significant impact on environmental, are critical. A study looked into the sources of WWTPs' negative impacts of the natural environmental. energy consumption, noise and the formation of bioaerosols and odor nuisances were all takes into consideration, among other problems, Different methods of analyzing the environment impact of waste water treatment plants were collected, keeping into account the requirement to evaluate not only

technology process as well as the building that are used in the process. The results of methods for analyzing the environmental impact of wastewater treatment plants in various countries were also compared as well.

Chapter Three

Field and Experimental Works

Chapter Three

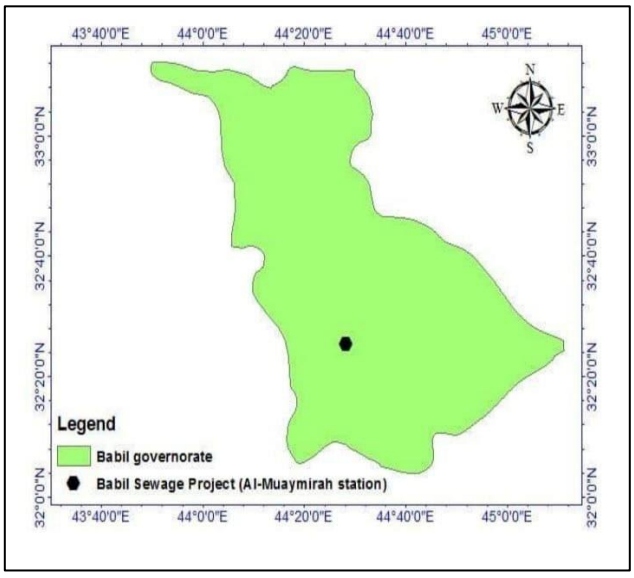
Field and Experimental Works

3.1 Area of study

A current studying was carried out for the new Al-Muamirah wastewater treatment plant, which is situated in south of Al-Hilla city in Iraq, approximately 100 kilometers Baghdad's south. plant's geographic coordinates are 32.425821 N, 44.472889 E. Figures (3-1-a and b), as well as Figure (3-2), represent aerial views of plant. This plant covers 57 acres and has a maximum capacity of 107000 m3/d. It is of extraordinary importance because of its situation on Euphrates River **(AL- Wotaify & Al-Mamuri, 2019) .**

The new Al-Muamirah WWTP project, which has a design capacity of 107,000 m^3/day, opened in 2019 to service the entire city of Al-Hilla (on two sides of the river), which has a population of about 970,000 people. The Hilla city sewers' conveyors and network, on the other hand, are still under construction. As a result, the plant's influent wastewater capacity is about a fourth of the 30,000 m^3/day designed capacity. The Al-Muamirah WWTP plant comprises of preliminary, secondary, and sludge treatment units, as well as a chlorination unit, with no primary treatment stage because this plant's secondary stage uses a technique for oxidation ditches (extended aeration process), This ensures adequate period for hydraulic retention and could take place of the primary settling tanks seen in initial treatment stage. Waste water is pushed to plant by a maim pumping station, which is comprised of four pumps submerged, each with 2,400 m^3 / hour capacities, that bring water to the first receiver unit via protection screening. **(Al-wardy, 2021) .**

(a) Babylon's location within the Iraqi province.



(b) Location of Al-Muamirah WWTP within Babylon's borders

Figure 3-1 (a,b) the location of the Al-Muamirah WWTP

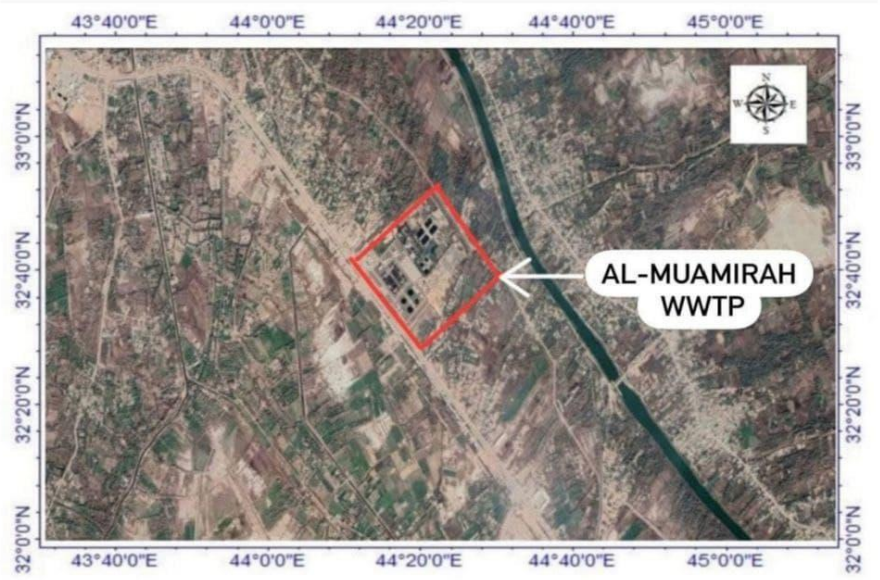


Figure 3-2. Google Earth satellite picture of the Muamirah WWTP plant

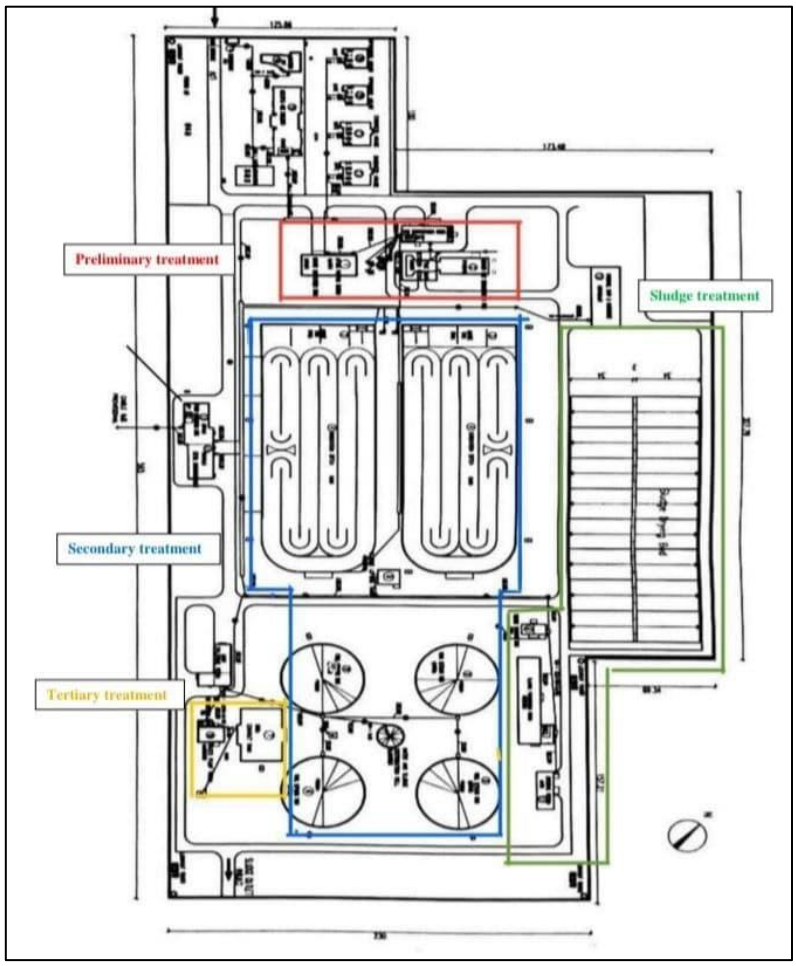


Figure 3-3 The Muamirah Plant Schematic Diagram **(Al-wardy, 2021)**

3.2 The most basic EIA methods

EIA methods range from simple to complex, requiring different kinds of data, different data formats, and varying levels of expertise and technological sophistication for their interpretation. The analyses they produce have differing levels of precision and certainty. All of these factors should be considered when selecting a method.

In this chapter we will discuss two methods of EIA and use them to evaluate environmental impact assessment of WWTP of AL-Muamirah. **(Bindu N. Lohani et al, 1997)**

1- **Checklists**: are typical lists of the different types of impacts much more formalized variant of ad hoc techniques that which particular regions of influence were defined and procedures for analyzing impact were provided.

The following are examples of complex checklists:

1- Scales checklist is used to evaluated the reported effects in terms of their extent or severe.
2- weighting - Scaling checklist, through that a number of environment criteria were weighted (based on careful judgment) as well as an indicator has been produced to represent as a comparison tool between projects.

Checklists can be divided into four groups: **(Bindu N. Lohani et al, 1997)**

1- Simple Checklist: a list of environmental factors with no instructions for measuring or interpreting them.
2- Descriptive Checklist: provides a list of environmental parameters as well as instructions on how else to collect information on those variables.

3- Scales Checklists: comparable to the description checklist, however includes details on objective parameter scale.

4- Scales Weighting Checklists: comparable to a scale checklist, although with some more details for evaluating each parameter subjectively in relation to the other parameters.

Table (3-1) The general form of Checklist method for this study.

Project activities / Environ-Mental components	Solid waste	Effluent discharge	emission	Plant location	Plant construction	Electric power generators	Unpleasant odors	Raw material storage
Water quality								
Surface water								
Ground water								
Soil								
Agriculture								
Highways								
temperature								
winds								
Rains water								
noise								
Health								

Severe negative effects	...
Medium negative effects	..
Weak negative effects	.
Severe positive effects	+++
Medium positive effects	++
Weak positive effects	+
No effect	*
Undefined	/

2-Matrices

Leopold and his colleagues invented one of the first matrix techniques (1971). The columns of a Leopold matrix (and its derivatives) relate to project operations (such as flow changes), while the rows represent environmental factors (for example, water, temperature). The amount and significance of the impact related to the action columns and environmental condition row are described.

The assessment of environmental impacts requires identifying two aspects of the project, for which it is believed that environmental impacts will appear, according to a numerical scale ranging from (1-10), Which represents the intersection of magnitude and the importance of impact on the environmental elements , When evaluating, the cell that represents the intersection of an activity or project and the environmental element is divided diagonally, and put in the upper left corner the number indicating the force, while placed in the lower right corner the number indicating the importance. **(Pacifica F. Ogola, 2007)**

The Leopold matrix method is a technique for identifying impacts that uses a broad screening approach. It's a useful tool for describing affects

because it shows the effected elements and their reasons clearly. Evaluating rows and columns with relationships can provide more information and help with effect analysis. Matrix might also be used to identify effects at other stages of an entire - cycle, such as development, administration. **(Bindu N. Lohani et al, 1997)**

Table 3-2 The general form of Leopold matrix.

Contaminants / Environ-mental Media	BOD	COD	TSS	NH3	PO4	PH	Total
Water Quality	a / b						
	c						d

a-Magnitude of impact

b-Importance of impact (1-10)

c-Impact = a* b

d-Total impact

In order for the impact assessment to be not completely dependent on personal experience, we will calculate the magnitude of impact by dividing the concentration of each pollutant on the standard criterion specified for it. As for the importance of the impact, it will be taken from (10-1) on the basis

of its negative effects on water quality, taking into account the effect being negative or positive by putting a negative or positive sign.

Table 3-3 Monthly variation of the concentration values of the parameters BOD, COD, TSS, PO_4, NH_3, and pH in the effluent wastewater during the year 2021.

Month	COD	BOD	TSS	NH_3	PO_4	pH
Jan.	80	16	13	5	2	7.41
Feb.	50	15	13	4	1.3	7.74
Mar.	52.4	11.2	9.2	2.98	1.92	7.57
Apr.	43	13	7.75	3	2.6	7.65
May.	59	11	7	3.8	1	7.70
Jun.	43.5	11	11	3	2	7.70
Jul.	29	8.8	11.4	4.96	1.84	7.60
Aug.	26.75	10.25	6.5	7.33	1.8	7.44
Sep.	30	10.8	17	4.74	2.02	7.35
Oct.	47.7	13.3	10.7	2.3	3.2	7.49
Nov.	32	11.7	14.2	4.4	1.33	7.44
Dec.	45	10.4	9.8	1.6	0.83	7.59

Table 3-4 In comparison to Iraqi standard, the average yearly concentration values of the analyzed pollutant parameters in the effluent wastewater of Al-muamirah WWTP throughout 2021.

Parameters	The yearly average concentration in the effluent wastewater	Iraqi standard for effluent disposal	Importance Suggested
BOD (mg/L)	12	40	-6
COD (mg/L)	45	100	-7
TSS (mg/L)	11	60	-5
NH_3 (mg/L)	4	10	-10
PO_4 (mg/L)	2	3	-4
pH	7.5	6-9.5	-6

3.3 The advantages and disadvantages of Leopold matrix and checklist method.

Advantages of using checklist method:

Below the advantage of this method **(Pacifica F. Ogola, 2007):**

1- They are beneficial for condensing information so that it may be understood by specialists from other fields or decision-makers with minimal technical understanding.

2- Scaling checklists are used to do a preliminary analysis.

3- A strategy for adding information about ecosystem services is weighting.

Disadvantages of using checklist method:

The disadvantage of this method shows below **(Bindu N. Lohani et al, 1997):**

1- They are overly broad or lacking in detail;
2- They don't show connections between impacts.
3- Lots of options to review can be enormous, diverting attention away from the most important impacts.
4- Effects are identified in a qualitative and subjective manner.

Advantages of using Leopold method:

The Advantages of using Leopold method**: (Rasha ali, 2017)**

1- The matrix can be applied to one of the environmental elements against a number of activities or projects and to find the impact of these projects on a particular environmental element.

2- The possibility of creating several matrices to assess the environmental impacts for multiple periods of time, as this procedure aids in predicting the extent to which environmental factors will deteriorate in the future as a result of natural environment projects.

Leopold matrices also have their disadvantages:

The disadvantages of Leopold method**: (Barry Sadler, 2000)**

1- they tend to overly simplify impact pathways.
2- they do not explicitly represent spatial or temporal considerations.
3- they do not adequately address synergistic impacts.

Chapter Four

Results and Discussion

Chapter Four

Results and Discussion

4.1 Introduction

The results of the pollution effect assessment in the Shatt al-Hilla will be studied and discussed in this chapter. The results of the Leopold method will be shown in the first section, the results of the checklist method will be presented in the second section, and a comparison of the two methods will be presented in the third section**.**

4.2 Operational Performance Treated Wastewater Assessment of Al-Muamirah WWTP

The effluent wastewater sampling was examined to determine the performance efficiency of this plant in treating the pollutant parameters of the wastewater in order to assess the WWTP's performance. BOD_5, COD, TSS, PO_4, NH_3, and pH were all tested on a monthly basis during the year 2021.

The stage of assessment the environmental impacts of the project on the elements of the surrounding environment is considered one of the most important stages of the environmental impact assessment process depending on its results, the project is rejected or accepted. Therefore, the accuracy of the results of this stage is a very important, and the accuracy of the results depends on two main factors:

1- the accuracy and validity of the information and measurements adopted in the assessment process.

2- The method used in conducting the process and its credibility.

There are several methods for assessing the environmental impacts of any project.

Each method has a special way of presenting data. Given the complexity of ecosystems and the large number of their components, it is difficult to choose a single method to treat a particular environmental problem. Often the researcher needs to apply several methods to treat one case so as to balance its results before adopting it.

Therefore, two methods will be taken from the methods mentioned previously in third chapter (Leopold matrix-checklist method), and we'll compare their results.

4.3 The monthly average in the parameter's concentration in the effluent wastewater during the year 2021 by Excel program.

Figures below shows the monthly average in the parameter's concentration in the effluent wastewater during the year 2021 by Excel program.

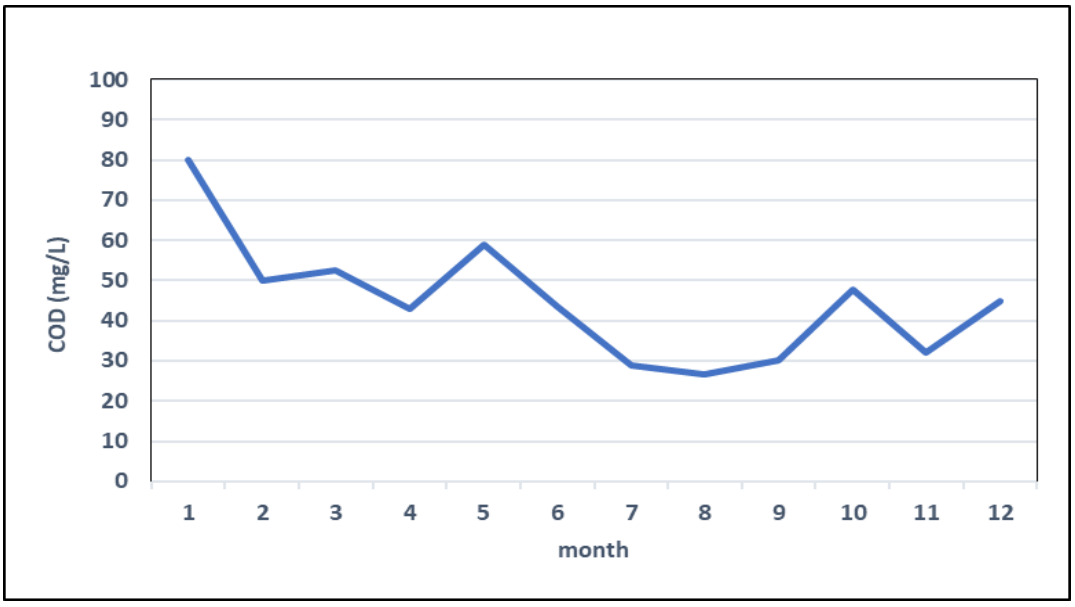


Fig 4-1 The monthly average in the parameter COD content in the effluent wastewater during the year 2021.

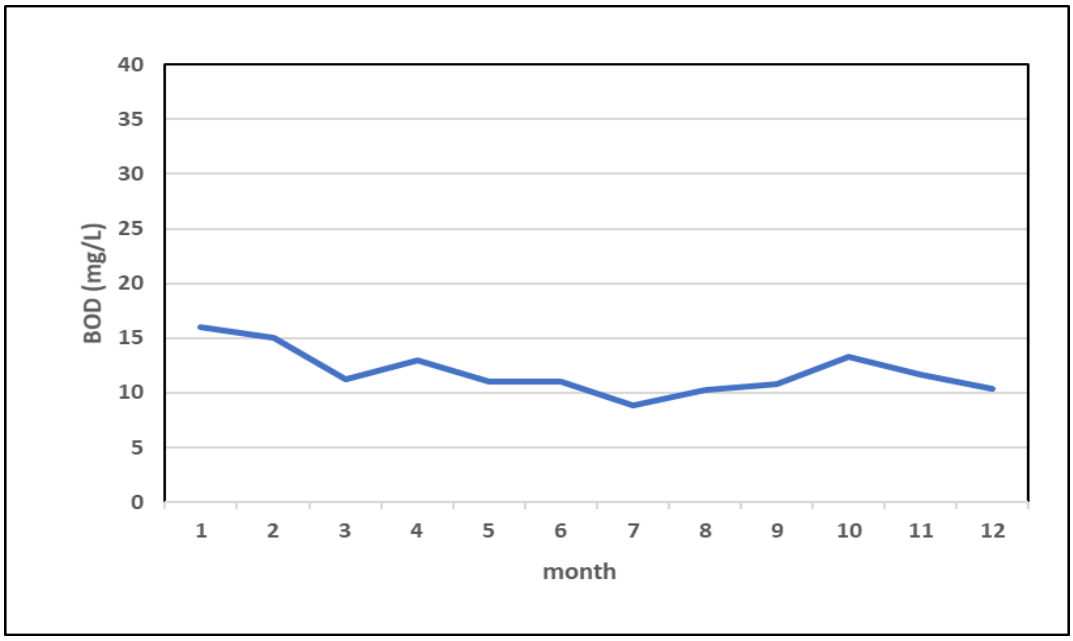


Fig 4-2 The monthly average in the parameter BOD content in the effluent wastewater during the year 2021.

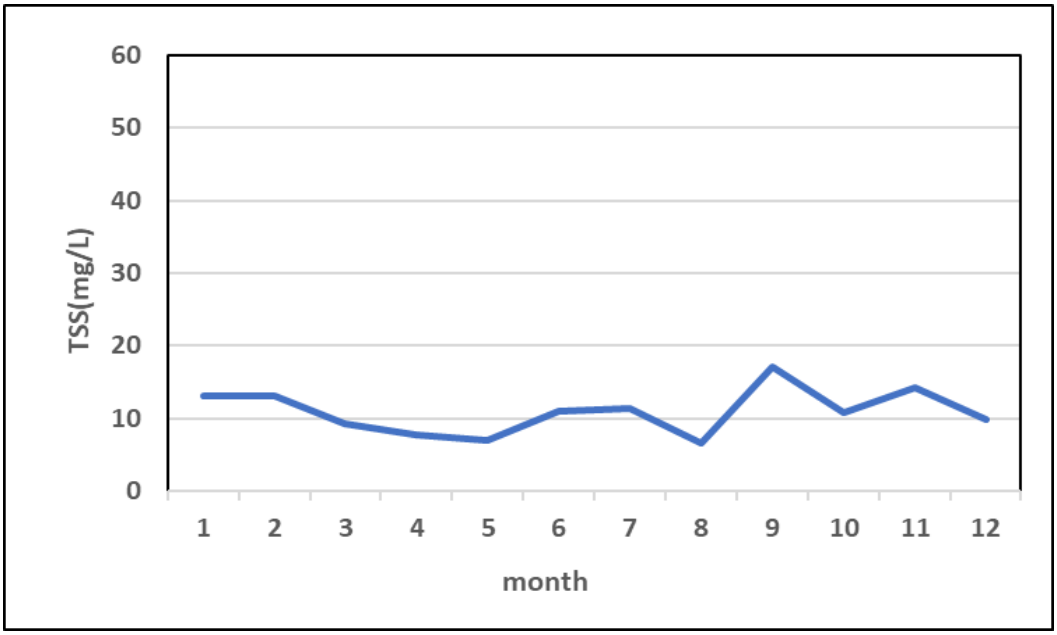


Fig 4-3 The monthly average in the parameter TSS content in the effluent wastewater during the year 2021.

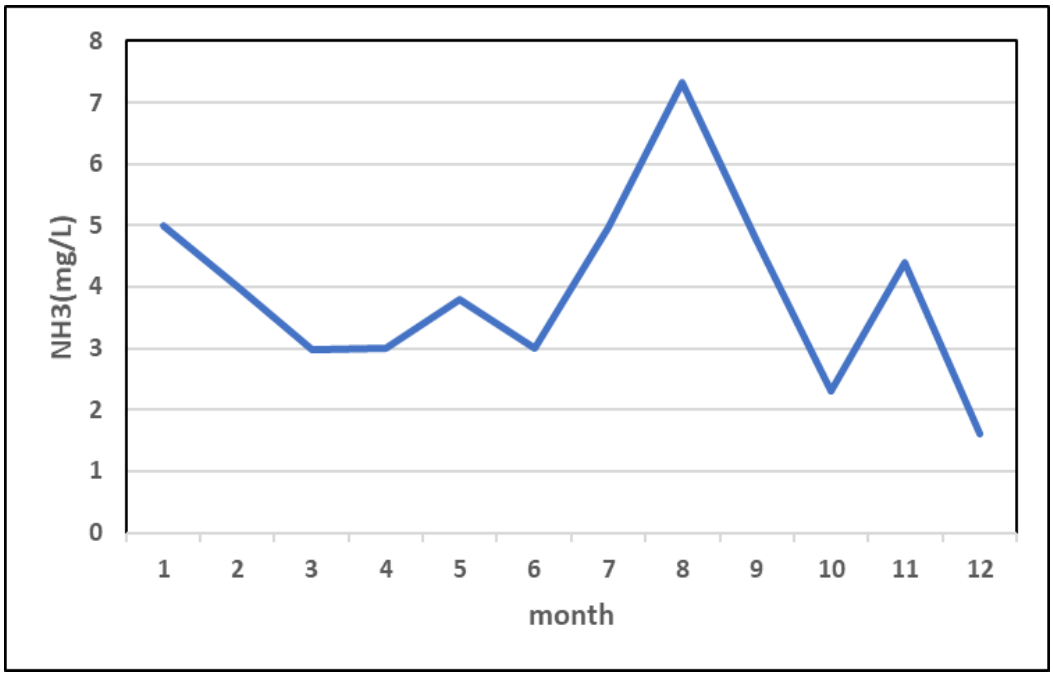


Fig 4-4 The monthly average in the parameter NH3 content in the effluent wastewater during the year 2021.

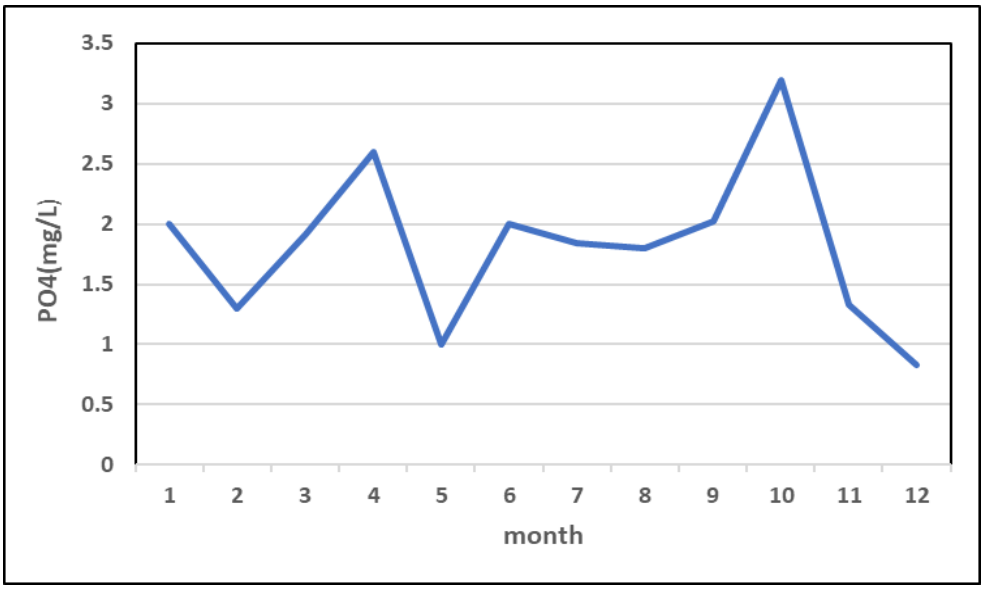


Fig 4-5 The monthly average in the parameter PO4 content in the effluent wastewater during the year 2021.

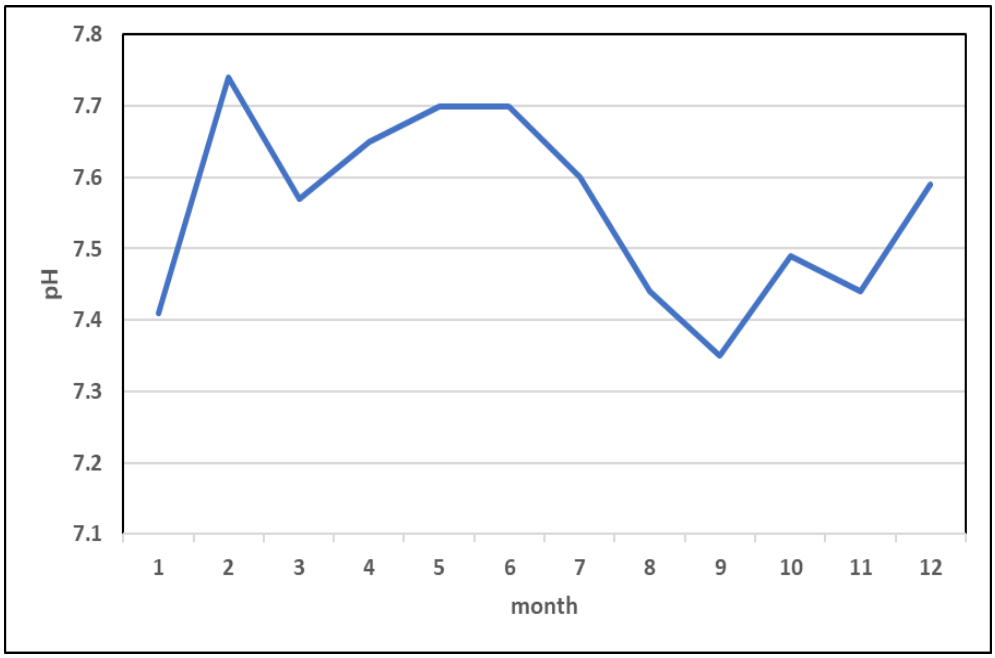


Fig 4-6 The monthly average in the parameter PH content in the effluent wastewater during the year 2021.

4.4 Environmental Impact Assessment by Using Leopold Matrix

To reach a qualified result, environmental impact assessment methods rely mostly on human experience, with the assistance of select professionals and specialists. Using the Leopold matrix to estimate the environmental impact of pollution in the Shatt Al-Hilla.

Table 4-1 Calculations of total effect for all pollutants by using Leopold matrix.

Contaminants / Environ-mental Media	BOD	COD	TSS	NH3	PO4	PH	Total
	0.3 / -6	0.45 / -7	0.18 / -5	0.4 / -10	0.67 / -4	0.79 / -6	
Water Quality	-1.8	-3.15	-0.9	-4	-2.68	-4.74	-17.27

The total effect of all contaminants will be calculated and compared to a pre-determined weight. We'll use the classification of the five worldwide water classes provided in the table below for this example.

(-) sign refers to negative effect of environmental impact.

Table 4-2 Qualitative criteria for consequence (Bindu N. Lohani et al, 1997)

Descriptor	limits	Descriptions and uses
Negligible	(0-20)	Effects are impossible. Environmental effects that is changeable for a limited period of time, a limited activity, or an area with low environmental significance.
Minor	(21-40)	Some slight effects, but no long-term effects, might be easily solved.
Moderate	(41-60)	significant environmental differences that could be hard to reverse. Beyond physical location, there are direct and indirect environmental effects (onsite or offsite).
Major	(61-80)	Real or possible environmental contamination, whether immediate or long-term, needs urgent action.
Severe	(81-100)	Changes in the environment that are significant and continuous. Serious environmental harm occurs when there are actual or possible irreversible, high-impact, or widespread environmental effects.

Since the value of (d) falls within the class (0-20) so the water is described as Negligible quality because the Al-Muammirah WWTP is not operating at full capacity, as the main transportation lines have not been connected to the plant yet.

4.5 Environmental impact assessment by using Checklist method.

Using the checklist method to estimate the environmental impact of pollution in the new Al-muamirah WWTP.

Table 4-3 Checklist method for environmental impact assessment for Al-muamirah WWTP

Project activities / Environ-Mental components	Solid waste	Effluent discharge	emission	Plant location	Plant construction	Electric power generators	Unpleasant odors	Raw material storage
Water quality	..	.	*	*	*	/	*	/
Surface water	.	..	*	*	*	/	*	*
Ground water	..	..	*	*	*	/	*	/
Soil	+++	+++	*	*	*	..	*	...
Agriculture	+++	+++	*	+++	*	*	*	/
Highways	*	*	*	...	..	...	*	/
temperature	*	+	*	*	*	..	*	*
winds	*	*	/	*	*	*	.	*
Rains water	..	..	*	*	*	.	*	..
noise	*	*	..	...	..	..	...	*
Health	..	..	..	...	..	..	…	..

Severe negative effects	…
Medium negative effects	..
Weak negative effects	.
Severe positive effects	+++
Medium positive effects	++
Weak positive effects	+
No effect	*
Undefined	/

4.6 *The difference between Leopold matrix and checklist method*

1- The Leopold matrix method worked only on water quality, while the Checklist method worked on all environmental elements and discussed the impact of the plant on them, so it was considered complementary to the Leopold matrix method.

2- The Leopold matrix method showed that the impact of the water quality in the plant on the water quality in the river as negligible. As mentioned, the reason may be that the station is not operating at its full capacity, as the main transmission lines have not been connected to the station yet. While the method of Checklist depends on the opinion of experts and their previous studies in other stations, where they put some negative or negligible impact of the water leaving the plant, given that the plant treats the water well.

Chapter Five

Recommendation and Conclusion

Chapter Five

Recommendation and Conclusion

5.1. Conclusions

It was concluded from the present study the following points:

1- The use of impact assessment methods plays an important and effective role in the process of evaluation and management of projects, particularly water and sewage projects.

2- The results of the first method (Leopold matrix) were based on real data, while the second method (checklist method) was based on the opinion of the experts.

3- the first method (Leopold matrix) was to find Total impact d = -17.27 these value showed that the quality of water has negligible (not harm) effect on the river water and the reason for this finding that the plant is not working at full capacity as the transmission lines was not link to the station yet. The second method (checklist method) was also used to find the environmental impacts of the plant on the river water. As this method works on all environmental elements and discussed the impact of the plant on them. The checklist depends on the opinion of the experts, so they put some negative, positive or neglected impacts from the effluent water quality of the plant on the water quality in the shat Al-Hilla river, so it is considered a complement to the (Leopold) matrix method.

4- The checklist table can be summarized in the following points:

a-The activities that have severe negative effect (…) are:

Plant location effect on (Highways, noise, Health)

Plant construction effect on Highways

Unpleasant odors effect on (noise, Health)

Raw material storage effect on (soil)

Electric power generators effect on (highways)

b-The activities that have medium negative effect (..) are:

Solid waste effect on (water quality, ground water, rains water, Health)

Effluent discharge effect on (surface water, ground water, rains water, Health)

Plant construction effect on (highways, noise, Health)

Electric power generators effect on (soil, temperature, noise, health)

Raw material storage effect on (Rains water, Health)

c- The activities that have weak negative effect (.) are:

Solid waste effect on (surface water)

Effluent discharge effect on (water quality)

Electric power generators effect on (rains water)

Unpleasant odors effect on (winds)

d- The activities that have severe positive effect are:

Solid waste, effluent discharge & plant location effect on (soil, agriculture)

e- Other activities either have no significant effect or have undefined effect

5.2. Recommendations

The recommendations needed to improve the plant's environmental performance are:

1- Using other methods for the purpose of conducting the environmental evaluation of the processing station, especially after conducting the process of linking the transmission lines to the station.

1- Using environmental impact assessment methods for the purpose of evaluation water treatment plants before construction.

2- Using modern programming (SIMBA, Hydromantis GPSX 8, AQUASIM, Bio-Win, and EFOR) for the purpose of programming the environmental impact assessment methods to facilitate the process of entering data and obtaining results faster.

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الملخص

محطات معالجه مياه الصرف الصحي WWTPs هي انظمه تشغيليه تتضمن عمليات معالجه مختلفه تعمل على تجنب او تقليل اضرار مياه الصرف الصحي ، الهدف من البحث هو تقييم الاداء البيئي لمحطة معالجة المعيميره الجديده الواقعه في محافظه بابل(العراق) ، تم تقييم عمليات المعالجه فيها حيث جمعت البيانات والتي تتضمن بعض العوامل الفيزيائيه والكيميائيه المؤثره على المياه للعام 2021 ،حيث شملت 6 عوامل هي (BOD_5 الطلب على الاوكسجين الحيوي ، COD الطلب على الاوكسجين الكيميائي ، TSS اجمالي المواد العالقه ،NH_3 الامونيا ، PO_4 الفسفور ، والقياس الكمي للحموضه اوالقاعديه pH) . أظهرت نتائج تقييم الاثر البيئي للمحطه ان تراكيز جميع الملوثات في مياه الصرف الصحي تتوافق مع المعايير العراقيه . ولغرض تقييم الاثر البيئي لمحطة معالجة مياه الصرف الصحي اعلاه, تم استخدام طريقتين من طرق تقييم الاثر البيئي وبيان الفرق بينهما , حيث تم استخدام مصفوفة ليبولد وقد تبين ان مجموع الاثر للملوثات $d= -17.27$ وهذا يدل على ان نوعيه المياه الخارجه من المحطه ليس لها تاثير على جوده مياه النهر اي ان تأثيرها غير مؤذي لمياه نهر شط الحله والسبب ان المحطه اعلاه لاتعمل بكامل طاقتها الاستيعابيه حيث ان خطوط النقل الرئيسيه لم تربط بالمحطه حتى الان , وتم استخدام طريقة اخرى هي طريقه checklist لمعرفة التاثيرات البيئية للمحطة على جودة مياه نهر شط الحله .تعمل هذه الطريقه على جميع العناصر البيئيه وتناقش تاثير المحطه عليها . حيث انها تعتمد على رأي الخبراء لذا وضع الخبراء بعض الاثار السلبيه او المهمله لنوعيه المياه في المحطه على جوده المياه في النهر , لذلك فهي تعتبر مكمله لطريقه Leopold .

جمهورية العراق
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جامعة بابل /كلية الهندسة
قسم الهندسة المدنيه

تقييم الأثر البيئي لمحطات معالجة مياه الصرف الصحي في مدينة الحله

بحث

مقدمه الى كلية الهندسة في جامعة بابل كجزء من متطلبات نيل درجة الدبلوم العالي في الهندسة / الهندسة المدنية / الصحية

من قبل

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(بكالوريوس هندسة مدنية ـ ٢٠١٨)

اشراف

الاستاذ الدكتور سيف صلاح القزويني

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