EFFICIENCY ANALYSIS OF HIMACHAL PRADESH WASTEWATER TREATMENT PLANTS

A Project Report Submitted in the partial fulfillment of the requirements for the award of degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision
of

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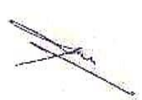
May 2021

CERTIFICATE

This is to certify that the work which is being presented in the project Report title "EFFICIENCY ANALYSIS OF HIMACHAL PRADESH WATEWATER TREATMENT PLANTS" in the partial fulfillment of the requirements for the award of degree of Bachelor of Technology in Civil Engineering submitted to the Department of Civil Engineering, **Jaypee University of Information Technology, Waknaghat** is an authentication record of work carried by **KANISHKA SHARMA (171607), ANJAN SOOD (171628), AYUSH RANA (171660)** during a period from August 2020 to December 2020 under the supervision of **Mr. Anirban Dhulia**, Assistant Professor, Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat.

The above statement is made correct to the best of my knowledge.

Date: May 6, 2021



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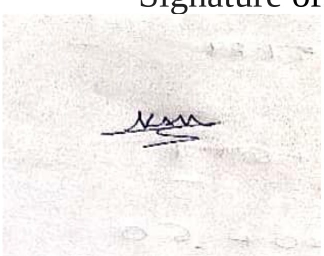
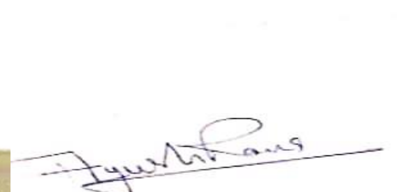
I hereby declare that the work presented in the Project report entitled "EFFICIENCY ANALYSIS OF HIMACHAL PRADESH WATEWATER TREATMENT PLANTS" submitted for partial fulfillment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of my work carried out under the supervision of **Mr**. **Anirban Dhulia**. This work has not been submitted elsewhere for the reward of any other degree/diploma. I am fully responsible for the contents of my project report.

Signature of Students





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ABSTRACT

Sewage includes a variety of natural and inorganic constituents that degrade the climate, making it one of the most significant contributors to ecological degradation. As a result, effective sewage treatment is important for a healthy lifestyle. The output of 11 existing domestic wastewater treatment plants in Himachal Pradesh was analyzed for this report. The traditional technology is extended aeration with mechanical aerators and a diffused aeration device. Only physico-chemical variables were checked and taken into account.Seasonal variation of STPs is also carried out in parallel, as temperature is one of the most important factors in the successful functioning of microorganisms. The Effluent Quality Index, as shown by the findings of this investigation, is quite probably the best technique for profluent reuse. The aim of this project is to measure the efficiencies of the STPs under consideration and rate them according to their performance. The study concludes that the treatment efficiency of various plants is insufficient and that urgent upgrades are needed to meet the CPCB's latest effluent quality standards.

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We wish to express my deep regards and gratitude to Dr. Anirban Dhulia, Assistant Professor, Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat, and Solan for his continuous support and invaluable guidance throughout the duration of the project. We also thank Prof. Ashok Kumar Gupta, HOD of Civil Engineering Department for giving us this opportunity.

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KANISHKA SHARMA ANJAN SOOD AYUSH RANA

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LIST OF ABBREVIATIONS

STP	Seewage Treatmant Plant
I&PH	Irrigationn & Public Health Departmant
HPPCB	Himachel Pradash Pollution Control Board
CPCB	Central Pollution Control Board
MLD	Milliion litars par day
LPCD	Liters per capita per day
DAF	Diffuesed Aeratian Siystem
ETP	Effleuent Treatmant Plent
DWT	Domastic Wastewaterr Treatmant
BOD	Biochemicel Oxygan Deemand
COD	Chemeical Oxygan Deemand
TSS	Totel Susspended Soleds
DO	Dissolvead Oxiygen
ASP	Activeted Sludje Proceess
MBBR	Moving Bied Biofilem Reactar
UASB	Upflaow Anaerobic Sludje Blenket
°C	degeree Celesius

CHAPTER 1
INTRODUCTION

1.1. Processing of sewage

Treatment is the process of removing foreign pollutants from wastewater or sewage and converting it into a contribute to people that can be added to the water supply with little ecological impact. In the leftover community, toilet facilities, cooking, shaving, sinks, and other household wastewater sources are comprised of plant based and inert materials.In order to safeguard habitats, Domestic wastewater treatment (DWT) is often used to exclude such natural and toxic substances from runoff.

1.1.1 Primary Treatment

Any element that can float or quickly settle out by gravity is discarded during clinical care. Screening, compaction, grit removal, and siltation are some of the physical procedures concerned. Coarse solids, heavy materials such as plastics, and slime such as oil and grease are removed from wastewater during primary treatment, as these substances can impede the efficiency of the treatment system and treated wastewater. These materials can interfere with the functioning and maintenance of subsequent biological treatment. The main therapies are screening, grit removal, and flow measuring devices (partial flume).

It also entails storing waste in a residual bowl such that heavy solids fall to the bottom and filth, grease, and other contaminants lighter than water may be skimmed off and discarded..

1.1.2 Secondary Treatment

Auxiliary therapy removes organic solvent substance that isn't absorbed during primary care. It also lowers the concentration of dissolved solids in the water.

Organic toxins are consumed afood by bacteria, which convert them to carbon dioxide, water, and energy for their own growth and reproduction, which is aided by natural cycles. As it interacts with the elimination of dissolved and broken up synthetic substances matter, this is the most important method in sewage treatment. Auxiliary treatment removes the vast majority of liquid microorganisms. Since it requires the use of bacteria to degrade organic agents, secondary therapy is considered as wastewater treatment. Biological processes may be handled using aerobic, anaerobic, or a combination of both methods. The tunable slop process is a well, yet anaerobic interference is gaining popularity in residential wastewater treatment due to its potential to extract high levels of organic matter

food by bacteria, which convert them to carbon dioxide, water, and energy for their own growth and reproduction, which is aided by natural cycles. As it interacts with the elimination of dissolved and broken up synthetic substances matter, this is the most important method in sewage treatment. Auxiliary treatment removes the vast majority of liquid microorganisms. Since it requires the use of bacteria to degrade organic agents, secondary therapy is considered as wastewater treatment. Biological processes may be handled using aerobic, anaerobic, or a combination of both methods. The tunable slop process is a well, yet anaerobic interference is gaining popularity in residential wastewater treatment due to its potential to extract high levels of organic matter food by bacteria, which convert them to carbon dioxide, water, and energy for their own growth and reproduction, which is aided by natural cycles. As it interacts with the elimination of dissolved and broken up synthetic substances matter, this is the most important method in sewage treatment. Auxiliary treatment removes the vast majority of liquid microorganisms. Since it requires the use of bacteria to degrade organic agents, secondary therapy is considered as wastewater treatment. Biological processes may be handled using aerobic, anaerobic, or a combination of both methods. The tunable slop process is a well, yet anaerobic interference is gaining popularity in residential wastewater treatment due to its potential to extract high levels of organic matter.

1.1.3 Tertiary Treatment

The final treatment phase before sewage is recycled, reused, or discharged into the atmosphere is tertiary treatment. Even during treatment, all remaining inorganic mixtures and contaminants, such as nitrogen and phosphorus, are eliminated. Since sewage system effluent is discharged into lakes or waterways where it could be reused, secondary treatment only removes 60 to 70% of BOD and 55 to 65 percent of COD, necessitating further treatment to render it appropriate for reuse. Disinfectants are added during secondary washing to make it ready for reuse. Nanofiltration, reverse osmosis, ultrafiltration, and other techniques must be used if liquid is to be ingested.

1.2 Need of the Study

- Since sewage is one of the most fundamental contributors to climate change, more focus is put on its treatment and proper disposal.
- STPs are being proposed with methods for increasing their productivity..
- The best technologies for processing high-quality effluent are being determined.
- The effluent can be reused for a number of purposes, depending on its supremacy.
- To meet the CPCB's latest effluent quality standards, existing STPs must be updated.
- Identifying the power generation capacity of STPs.
- Identifying the factors that have an impact on STP performance.

1.3 Objectives

- The study's initial objective is to demonstrate the effectiveness of Himachal Pradesh's water treatment systems and the following objectives:
- The indoor care technology used throughout Himachal Pradesh must be examined and compared with advanced technology.
- Evaluate the effectiveness of different strategies of current Himachal Pradesh household sewerage planning.
- Make suggestions for effective methods/technologies for increasing STP performance.

CHAPTER 2

LITERATURE REVIEW

2.1 Context of sewage disposal

There have been several books published on the history of water delivery schemes, but there has been no literature on pollution control. The absence of a sanitation scheme has a more significant effect on air quality. 20,000 years ago, the first human populations scattered through vast stretches of land, and the garbage they created was eventually returned to the soil and broken down by the organic digestive cycle. Domestic waste was composed of by drilling trenches in the earth and covering them after usage ten thousand years ago, soon after the advent of the very first modern humankind, as required by the Mosaic Law of Sanitation (Deuteronomy; chapter 23).

It was difficult to predict the wellbeing of ancient societies due to a lack of prior documents.

Thanks to a lack of understanding of the economic advantages of pollution management and practices, wastewater treatment has taken a precarious course toward sufficient regulation. Developed countries are water treatment specialists who have progressed past basic practices. Given potential water shortage, the aim is to produce high-quality effluent that can be reused right away. According to the survey, sewage treatment practices, economic conditions, and welfare have all changed dramatically.

2.2 Management of sewage

Wastewater treatment is the process of removing poisons from wastewater or sewage and converting it to a form that can be recycled into the water cycle with minimal environmental effects. Toilets, bathing, washing, drains, and other domestic wastewater sources in the residual population It's made up of macrobiotic and inert ingredients. To protect human and environmental health, the extraction of certain biochemical and inerte components from either the drainage, domestic wastewater treatment (DWT) is used.

2.2.1 Primary Treatment

During critical care, material that can skim or effectively settle out by gravity is removed. The actual cycles include screening, comminution, coarseness expulsion, and sedimentation, to name a few. Primary treatment is often used to extract gritty solutes, big substances like plastics, including drainage slime like tar, as these substances can affect the efficiency of the drainage process and storage tanks. This components should be used in issues with the subsequent treatment units' operation and maintenance. Screening, grit removal, and flow measurement instruments are the key treatments (partial flume).

This also means storing refuse for a duration of time in an unused area so that dense particulates can rise to and remove from the substrate and the residue, grass and other compounds lights up to water.

2.2.2 Secondary Treatment

Optional therapy removes all remaining liquid natural matter after the primary treatment. Additionally, it reduces a greater proportion of suspended solids. Microbes eat natural dynamic management as food, turning them to carbon dioxide, water, and energy for their own development and production in natural cycles. This activity is the most significant cycle of wastewater treatment because it is related to the removal of suspended and decomposed natural and inorganic matter. Optional treatment gets rid of a lot of the bacteria in the water.Auxiliary therapy differs from organic medicine in that it requires use of such microorganisms to degrade natural content. Periods of organic therapy may be vigorous, anaerobic, or a mixture of both. Regularly implemented ooze measures are normal, but anaerobic interference is gaining traction in indigenous sewage treatment due to its ability to remove a large amount of natural substance.

2.2.3 Tertiary Treatment

Tertiary treatment is the final cleaning step before wastewater is reused, reused, or released into the environment. The treatment removes remaining inorganic mixtures and contaminants such as nitrogen and phosphorus.As the wastewater is discharged into watercourses so it can be used, only 60 to 70percent of Biochemical oxygen demand and 55 to 65percent of its total of chemical oxygen demand is removed by the treatment processes. This means more treatment is needed to create it suitable for usage. After secondary cleaning, desinsecticides are applied to make it safe for reuse. If water is to be consumed, microfiltration, reverse osmosis, ultrafiltration, and other methods must be used.

2.3 Treating aerobics

Among the most important wastewater disposal techniques is the breakdown of organic with aid of microbes in the presence of air. Oxygen, which helps in the termination of organic matter, is one of the most essential components of large therapy. In the atmospheric oxygen, these small cells, bacteria, and microorganisms prey on natural materials to minimize biochemical oxygen interest (BOD), synthetic oxygen interest (COD), and complete suspended solids (TSS) and part ways solids (TDS). This reactors have been painstakingly designed. Water-powered maintenance time (HRT) helps to reduce natural matter by giving microorganisms enough chances to profit from it. Physical aerators and a dispersed air ventilation framework should be used to supply broken down oxygen (DO) where it is found to be unavailable (DAS). These processes help to keep the vessel's oxygen content high enough for the microorganisms to function as drainage work horses.

2.3.1 Aeration extended

The expanded air circulation measure is a step up from the standard slime measure, which is based on natural matter weakening in the midst of a hot environment. In this step, the water-driven maintenance time (HRT) is held longer than in a traditional initiated ooze framework so that miniature organic organisms have enough time to benefit from the natural matter. Aeration is done mechanically or with compressed air to ensure that the microbes have enough dissolved oxygen. pH is one of the most critical factors in biological processes, so it must be preserved to ensure that the microorganisms will function in an aerobic environment in the reactor..

The subsequent compartments are part of the extended aeration process:

1) Compartment for Inlet
2) Screen Chamber

3) Compartment of Grit Extraction

4) Air circulation System

5) Sediment deposition supplementary reservoir

6) System for recycling lots

7) Distillation of Sludge

8) Evaporation fields of sludge

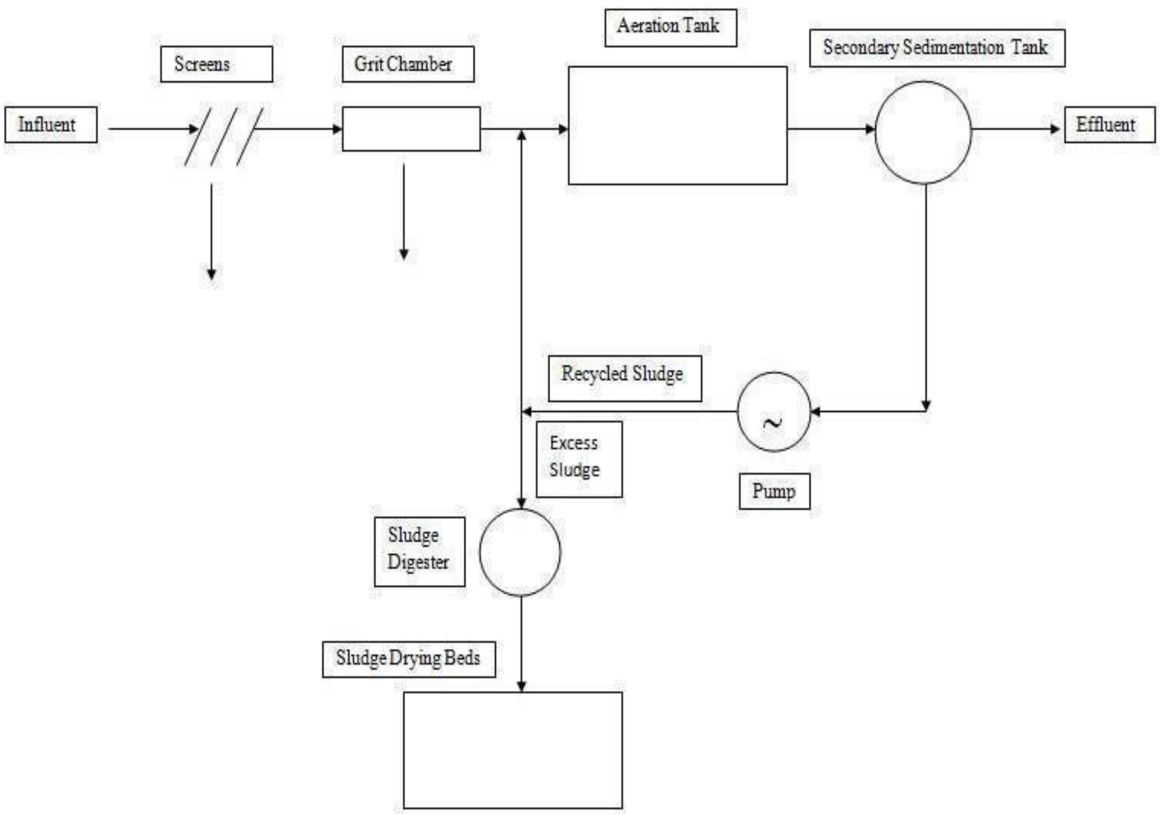

Figure 2.1 Flow Sheet of Extended Aeration Process

2.3.2 Diffused Aeration System

Method of freeing compressed wind in sedimentation tanks is known as diffuse aeration.

Diffused aeration system serves two purposes:

1) Shift of oxygen from the gaseous to the liquid phase, resulting in sufficient oxygen in the water.

2) Holding the microbes suspended to avoid them from resting

The network of pipes is the most popular diffused aeration device. There are two types of openings: coarse and fine. While fine bubble aeration is more efficient than coarse bubble aeration, fine bubble aeration has the downside of clogging pores, which necessarily involves frequent maintenance.

2.4 Method of aerobic metabolism

Anaerobic interaction is described as the expulsion of organic material without the presence of oxygen. Since the 1980s, anaerobic digestion (AD) has been used to treat a variety of wastes, including solid, fluid, and gas wastes.Amongst the most significant aspects of anaerobic digestion is sanitary sewers. However, anaerobic digestion singularly is ineffective. Another technology, often aerobic, is used in conjunction to help it perform properly.

2.4.1 Upflow Anaerobic Sludge Blanket (UASB)

For wastewater treatment, anareobic systems such as anareobic touch reactors, UASBs, and others are used. UASB, on the other hand, it was majored and used to treat sludge in the food, paper production, chocolate, pharmaceutical and syrup factories.

Influent wastewater is allowed to circumvent the bottom of the storage tu 10 pt be and drain upward, flowing through a bacterial suspended sludge blanket that serves as a barrier to handle influent sewage in the granular form with diameters ranging from 1 to 3 mm after passing through standard treatment such as screening and grit deletion.

As organic matter degrades in anaerobic environments, biogas (primarily methane and carbon dioxide) is formed. These gas are responsible for the quality of microbial granules.

At the reactor vessel crown is a gas-fluid heavy divider that separates vaporous, fluid, and heavy sections of sewage.

The solids are retained in the reactor tank while the biogas is deposited in the inverted- cone. The unpolluted effluent is drained from the reactor's crown and, if possible, sent to aerobic therapy for more treatment. To hold bacteria alive in the plant, some of the secondary wastewater is recycled.

When effluent grows, larger sludge particles serve as filters for smaller particles after several weeks of use. Due to the upward surge, granule-forming microorganisms accumulate, while the remainder is swept out. The serviceable and ecological environments of the reactor have an effect on granule formation. The granules disintegrate because of a lack of optimal temperature conditions.

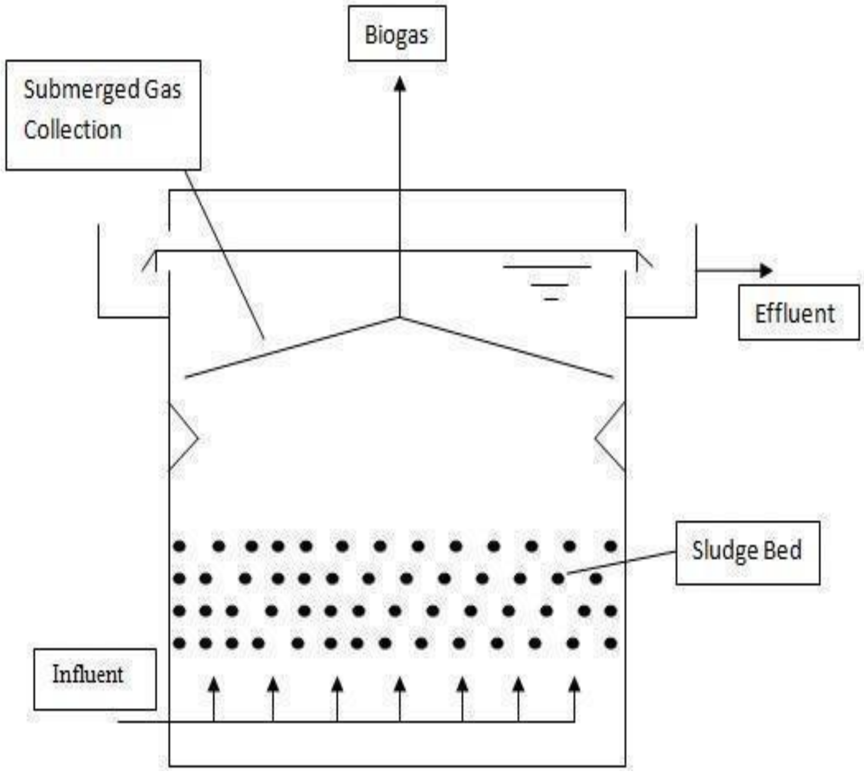

Figure 2.2 Flow scheme of UASB

2.5 Efficiency evaluation

In order to improve treatment structures and raise the prejudice against watering in compliance with profluent efficiency requirements, it is aimed at determining how to use new wastewater treatment stations. The research is conducted. Various tests have been carried out to assess the disposal capacity of wastewater treatment plants.

Almudaena Hospiedo 1, M" Teresa Moreirai, Mercedes Fernifindez-Couto 2 and Gumersiendo Feeijoo 1. Almuadena Hoispido 1, M'' Tereesa Moreirai, Merecedes Fernfinidez-Couto 2 and Gumarsindo Feijoo 1. (2004) A WWTP was evaluated in this review by extensive hands-on work. The discharge of water and the applying of ooze to land have been the most important backers of a WWTP's ecological presentation. This inquiry will serve as a springboard for potential inquiries into a wide range of drainage offices, taking into account factors such as treatment frameworks and limitations.

Laurentiue Luaca, Mariean Barbeu, Sergieu Caraman (2014) For this study, two types of indicators were used: “limit” indicators established in line with Romanian water quality legislation and “calculated” indicators. Complete nitrogen concentrations were shown to be significantly higher in sunny, rainy, and stormy simulations. These could be minimized by increasing aeration and recycling flows, but this would result in a substantial cost increase.

Renean Moraeno, Manuela Correiea, Florinda Marteins (2017) The Kruskal-Wallis test was used to measure the effect of the elements in the pointers considered, and it resulted in two major outcomes. The key point is that for the three outright pointers, vital contrasts were discovered for population same and scale. There were no important comparisons observed for the proportion markers. This last conclusion demonstrates that when efficiency indicators are broken down into a value for each cubic meter of sewage treated, the components analyzed do not produce measurable differences.

Dario Toregrosaa,b,⁎ , Joaachim Hansenb , Francsesc Hernándeez-Sanchoc , Alex Cornelisend , Georges Schultzd , Ulrich Leopoold (2017) Energy efficiency is a major test in the WWTP room, and energy savings in divert frameworks will offer significant budgetary and environmental benefits. In this article, an innovative and highly effective data-driven approach for creating an itemized sump framework assessment and assisting plant managers in energy conservation is proposed. This method is extremely replicable in situations where the only data available is the environmental impact and inflow.

P. vann Dal-Rombauts a, L. Beneadeti c , J. dea Jonge d , S. Weiiejers d , J. Langaeveld , e (2017) At WWTP Eindhoven, two synchronized, sway-based sensors were portrayed and evaluated. Both want to make more use of the WWTP's available tanks and increase storage in the subscribing catchments. According to estimates, the Storm Bubble Control significantly increases SST operation as compared to the normal control. The Primary Quantifier Control aims to reduce slop tank top piling, which causes NH4 tops in Wastewater treatment plant profluent and welcoming waters.

Vahid Noureni, Gozan Elkiran and S.Aba (2018) Various AI designs of FFNN, ANFIS, SVM, and traditional MLR were used to show the exhibition of NWWTP in this article. To boost the projected execution of single models, simple averaging, clustered, and neural system troupe approaches were used. ANFIS outperformed other single modules in both the alignment and validation periods, according to a study of single models. As a result of the findings, SVM was found to be more reliable than the Arima model. Furthermore, the models demonstrated more precise execution up to 10%, 15%, and 16% in the check phase of BODeff showing, respectively, for FFNN, SVM, and MLR prototypes.

Kathrin Newhert a , Ryan Holoway b , Amanda Hering c, * , Tzahi Coth a, (2019) The aim of information-driven and large-scale data analysis in WWTPs is to improve cycle management in order to reduce energy consumption, ensure water quality, and avoid system failure. PCA may be used with composite examples to test a variety of reasons for shortcoming position and detection. Knowledge experts, PC analysts, and designers can continue to collaborate to extend information's latent capability in order to develop high-quality and accurate broad information apparatuses also for treating wastewater industry.

Zhongichen Yeng, Haimong Sun, Qi Zhuo, Lui Zhoa, Weizhang Wu* (2020) In PHBV-Rice bodies and PHBV-Sawdust structures, a complex people collective with diverse denitrifying and delegitimizing microscopic species are discovered. In the PHBV-Sawdust system, the combination of denitrification and anaerobic can help to regulate nitrogen more easily and break up natural carbon. In a nutshell, eco-friendly PHBV-Sawdust can be used profluently in cutting-edge superfund sites.

Joshua Bunce, Aidan Robsan, Daviid W. Greham * (2020) The aim of this study was to see whether inherited fecal markers could be used to better understand the differences between the treatment exhibits of small WWTPs. Clearly genetic fecal markers may provide wastewater distributors with useful information about the treatment activity and differentiation of small WWTPs, particularly when there is a real or potentially emerging need to understand the health risks associated with small releases.

Fayez Abdula*and Saiif Farhat (2020) The role of environmental change on WWTP exhibition was assessed in this study using project success boundaries: BOD, TSS, and COD. Of these boundaries, BOD is the most significant affected boundary, according to the findings. Because of the drop in penetrated moisture to the sewer frameworks, the drop in precipitation would result in a high heap of BOD and COD. Organic corruption can be improved simply by increasing the temperature.

2.6 Summary

After reviewing all of the writing on sewer systems execution inquiries, it is reasonable to conclude that the standard wastewater invention, i.e., actuated slime measure, is the most evergreen and safest water treatment innovation. Elective advances, such as moving pad biofilm systems, sequential bunch reactors, and upflow anaerobic ooze covers, can also be used for homemade drainage treatment to achieve superior quality gushing. The execution independent inquiry of sewage treatment plants aids us in determining the treatment effectiveness of the plants and identifying the areas where they need to be upgraded. Similarly, one of the most pressing issues in today's world is water scarcity. There is a need to reuse stormwater in this way. To make wastewater suitable for reuse, it must first pass through treatment plants and be of good standard. Several complex models are also perhaps the best procedures for identifying the effluent consistency list from treated wastewater and understanding the areas where the effluents can be reused. Functional and cosmetic methodologies can assist us in choosing the optimum innovation for profluent treatment prior to the construction of a processing facility, thereby saving money with schedule.

CHAPTER 3

MATERIAL AND METHODS

3.1 Introduction

The techniques used for analysis are discussed in this chapter. The thesis work was structured in the following way to achieve the goals:

1. STPs are chosen based on their ability.
2. Analysis the information obtained from the sites on effluent.
3. Assess the effectiveness of STPs using physicochemical criteria.Consider its STPs regular shift.
4. Evaluation of the influential and sewage statistical quality rating.

3.2 Site Information

3.2.1 Himachal Pradesh's outline

The designation Himachal had been engraved on Sanskrit by the preponderance of magnificent scientists from area, Acherya Diwekar Dattt , implying "land" as well as the mix of snow-covered soil. Himachal Pradesh is famous for its unique natural surroundings, snow-fed ranges, mountain resorts and the most important temples, the Himalaya means Abode of Gods, for which it was called "Devbhoomi.'

Roughly 90 percent of the population live in rural, and 10 percent stay in the urban areas. As more people live in rural areas, sanitation also exceeds 98 percent since many dwellers has restrooms.

Himachal Pradesh has been divided into 12 regions from which Kangra is the main region with a population of 22percent of entire of a population of 24,84percentage points of the overall population.

3.2.2 Whereabouts

The Region of Himachal Pradesh occupies around 55675 cubic meters as in northern-west region of the Himalayas. Jammu and Kashmiir are north encircling; Punjab is south-west surrounded by Punjab; Haryana is south-west; Uttar Pradesh is south-east encircled. The scale is from 32 to 44 minutes and 33 to 12 to 40 seconds north and 75 to 79 to 44 minutes and 20 to the east. to 79 to 20 secondes east.

3.2.3 Geomorphology

Himachal Pradesh, located on the northwest side of the Himalayan range, is separated into 4 regional climate. The first being Shivalik Hills, the second being Lesser Himalayas and the other being the Greater Himalayas.

As a highland province, Dhauladhar Range is the largest part of the state. Shilla, 7025 m high, is the highest point in the mountains.

3.2.4 Atmospheric patterns

Due to its elevation and extreme state geography, the province's temperature changes are rare. As the altitude from either the west into the north and east, the high temperature latitude begins to change from its great cost to the low temperature region, meaning the colder the climate. Both districts at low altitudes and those in Bilaspur have more than one yearly temperature

Twenty-five °C. It rises above 32°C even in summer. If the altitude increases, in colder conditions decreases below – 4°C.

It comes from south-west mountains as far as rainfall is concerned, from the beginning of June until the end of September. Over winter, heavy plummet and snowfall occurs in the country as west disruptions increase from the plain to the hills. In both the districts of Lahaul-Spiti and Kinnaur, Dharamshala is by far the most heavily rained area in the region to the bottom.

3.2.5 Present wastewater and recycling infrastructure

Becaution is also vital for an efficient transportation of the waste to treatment plants prior to discharge to bodies of water and the water delivery infrastructure is important for the hygienic potable water system. Himachal Pradesh's wastewater treatment plants have so far increased their aeration by the activated sludge and the oxidation ditches. The Irrigation & Public Health System (I&PH) maintains the sewage grid. 1 works on anaerobic technology, that is, UASB technique, out of functional STPs and the rest operate on the oxidative new tech, i.e. prolonged ventilation procedure.There is a hybrid drainage facility that transports both residential and stormwater sewage. The government places increasing importance on connecting the numbers of households with the drainage system as 90% of the population live in rural areas. The Beas, Satluj, Ravi, Beas and Ganges rivers are all treatment plants, which are now potable sources of state drinking water. In order to ensure hygiene, it is also essential to handle domestic waste water until disposal..

3.2.6 Organizational Structure, Legislation, Enforcement

The Himachal Pradesh Division of Irrigation and Public Health (I&PH) is critical to the provision and preparation of drainage schemes, treatment facilities, storage facilities and for de-escalating water contamination from home waste water by (CPCB), and the Himachal Pradesh Pollution Control Board (HPPCB). The division for the handling of domestic wastewater and the manufacturing of effluents according to release requirements is properly engaged in its operation.

3.2.7 Info with STPs territory

Central Himachal Pradesh area of Dharamshala, Mandi, Hamirpur and Shimla are connected to four regions in the I & PH Division.

3.2.7.1 Dharamshala Zone

The total population of the Dharamshala area is 20,29,345 people (Census of India, 2011). This area encompasses the entire district of Kangra and Chamba with a total of 12.267 square metres. Kilometers. The net production of waste water from this area is

MLD 218.49 (considering per capita water demand of 135 lpcd, CPCB, 2013). 10 STPs with such a therapy design capability of 15,539 MLD are considered. More treatment systems should be installed to satisfy the desired generation and increasing numbers of households should be connected to the wastewater network.

3.2.7.2 Mandi Zone

The total population of Mandi area is 14,36,992 (Census of India, 2011). This area includes Mandi County and Kullu County with a combined surface area of 9453 sq. Kilometers. This region generates gross domestic contaminated water at 155,195 MLD . Of these, 9 STPs with treatment design capability of 16.885 MLD are being considered for assessment. In order to achieve the current domestic wastewater production, the government emphasizes the upgrading of STPs.

3.2.7.3 Hamirpur Zone

In Hamirpur a number of 13,57,406 people (Census of India, 2011). The district of Bilaspur, Hamirpur and una is 3825 square kilometers. The overall sewage generated in household is 146.56 MLD (considering per capita water demand of 135 lpcd, CPCB, 2013). There still are 9 STPs, six of which are STPs with an initial volume of 8.13 MLD for 12.66MLDs.

Increasing measures must be taken to meet the current need for this kind of processing of sewage. Far more families are needed to link the sewage infrastructure.

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3.2.7.4 Shimla Zone

The population of Shimla Zone is 20,54,044. (Census of India, 2011). This area includes the districts of Kinnaur, Lahaul, Spiti, Shimla, Sirmaur, and Solan and covers 30,128 sq. Kilometers. The total waste produced in the house is MLD 211.84. There are 18 STPs, of that which 5 are STPs, with just a deciding capability of 48.58 MLD.
For assessment, 9.70 MLD is considered. This landform is such that smaller treatment plants have to be constructed at various sites to satisfy the present demand for sewage generation, as it is impossible to link the h because of the realizing the potential in altitude.

3.2.8 Formation of wastewater

There are 68,64,602 people in the province (Census of India, 2011). Water is 135 lpcd per capita (CPCB, 2013). The state water demand is MLD 926.72. 80 percent of water is required for the complete wastewater production. So the state generates 741,38 MLD of gross sewage. The quality of wastewater processing is 60 to 70%. It's 40 to 50% in some areas. Take an average of around 55 percent. 410.76 MLDs of sewage shall be brought into the waste management planning.

Table 3.1 Himachal Pradesh input according to water demand and water supply

FACTOR	INDIA	HIMACHAL PRADESH
1. Population (Census 2012)	1,310,864,997	6,867,602 (0.59%)
2. Population (2017)	1,354,181,394	7,126,194 (0.57%)
3. Area (km^2)	3,297,273	55,683 (1.68%)
4. Water Demand (MLD) (2012)	173,495	926.72 (0.57%)

5. Water Demand (MLD) (2017)	179,783	961.63 (0.58%)
6. Sewage Production (MLD) (2017)	147,080.90	769.304 (0.56%)
7. Sewage Treatment Dimensions (MLD) (2017)	21,120.36	95.00 (0.47%)

Sources : SERIES: CUPS/2015 Inventories of Sewage Treatment Plants

3.3 STPs availability

The location of the Shimla area was selected. When assessing these physical and chemical properties. Conventional extension aeration using manual aerators and a diffusing aeration device are the systems used in waste water sewer systems.

Table 3.2 Waste Disposal Facilities Identification

S. No	**STP**	**Capacity (< 1 MLD)**
1	STP KHALIYAR	0.4
2	STP ARKI	0.7

3	STP DHALLI	0.76
4	STP KUNIHAR	0.9
		1 to 5 MLD
5	STP SOLAN	2.90
6	STP HAMIRPUR ZONE I	3.13
7	STP SUNDERNAGAR	3.55
8	STP SUMMERHILL	3.93
9	STP MALYANA	4.44
		>5 MLD

10	STP NORTH DISPOSAL	5.80
11	STP LALPANI	19.35

3.4 Tools For evaluation

By visiting and examining each STP, the survey findings from the 11 sites are retrieved. For 12 months, sampling measurements were collected from every site to examine each STP's success. There is also an analysis of the temporal fluctuations of STPs. The sample venue is determined to take the specimen on site for processing. The sample forms are:

1. Tombing: Tombing is determined to take the samples at a certain time from the influential and effluent areas.
2. Composite sample: The combination of grapes taken regularly in influential and industrial waste at a specific time is known as the combination of composite samples.

As selected by the agency, values are given. The list of testing criteria is further clarified. The sample preparation locations are as follows:

1. The STP's influential region.
2. STP's effluent region.

3.5 Dimensions for selection

The parameters selected to check the performance of STPs are:

1. pH
2. Dissolved Oxygen (DO)

3. Biochemical Oxygen Demand (BOD)

4. Chemical Oxygen Demand (COD)

5. Total Suspended Solids (TSS)

3.6 Measurement of Parameters

The following analytical techniques are used to calculate the chosen physical and chemical parameters of wastewater:

Table 3.3 Parameter-measurement techniques

S. No.	Parameters	Methods
1	pH	Digital pH meter
2	Dissolved Oxygen	Winkler test/Digital DO meter
3	Biochemical Oxygen Demand	3 Day BOD tests
4	Chemical Oxygen Demand	Open Reflux
5	Total Suspended Solids	Filtration

3.6.1 pH

3.6.1.1 Procedure

1. Influences/effluent sample in the bottle is filled.
2. Modern pH meter filler systems with pH 4.0, 7.0 and 9.2 measurements can be calibrated.
3. Put a pH meter throughout the specimen to scan.

3.6.1.2 Significance

PH plays a crucial part in wastewater treatment and research, and it is one of the most important criteria. The drainage has a number of issues, including a rise in pH, the prevalence of toxic contaminants, and the presence of other toxic matter, as well as a spike in alkalinity. This causes serious problems with its disposal, so all kinds of wastewater must be treated before being discharged. The microorganisms can only currently reside in an aeration tank with an ideal pH. Before the aeration tank, an equalization tank is given to control the pH level. The pH range in the aeration process that is most preferred is 6.5 to 9. (CPCB, 2005).

3.6.2 Dissolved Oxygen (DO)

3.6.2.1 Procedure

1. Take the specimen in the tube and extract it..

2. While in the spillway specimen locate the mobile DO meter and ensure measurement is taken..

3.6.2.2 Significance

One of the most significant elements in the dissolution of biological material streaming through the aeration reactor is dissolved oxygen. Mechanical means are used to keep biological material retained, and microorganisms use the dissolved oxygen in the wastewater to disintegrate the hanging organic matter, allowing the existing matter to stabilize. Mechanical means are used to disperse air evenly in the aeration tank. The effluent should have a high degree of DO. DO ought to be greater than 4 mg/L in the effluent.

3.6.3 Biochemical Oxygen Demand (BOD)

3.6.3.1 Procedure

1. Tubes of 50 ml are obtained including 2.5 ml sampled tubing while 2.5 ml of pure water including one tube.
2. Consider instantly the DO of such two sets.

3. Maintain the specimen for 3 days at 27°C during fertilization in BOD

4. Mention the DO of its two sets.

5. BOD3 can be determined as:

* Solubility factor [38] BOD3 (mg/L) = (D.1-D.2) – (B.1-B.2) Where,

D1 is the blank sample original DO D2 is the blank study final DO (3 Day) B1 is the mixture sample's original DO

B2 is the last DO of the test solution (3 Day)

3.6.3.2 Significance

The need for biochemiical oxygen refers to the amount of disolved oxygenn (DO), which the microscopic agencies need for organic suspended elements in the aerobic biological method. The mechanical methods are used to keep these organic materials in suspension. Measuring BOD is very significant in influential and effluent sewage, as its indicator has a significant effect on climate and water supplies.

It is observed that much organic content in the wastewater is determined by the value of the BOD. It then needs much care, since these water supplies could be used for many home intentions, before releasing into any kind of water supply. The BOD level of waste water does not surpass 30 mg/L according to former effluent limits (CPCB, 2005).

3.6.4 Chemical Oxygen Demand (COD)

3.6.4.1 Procedure

1. Tubes of 50 ml are obtained including 2.5 ml sampled tubing while 2.5 ml of pure water including one tube.
2. Both measurement samples were coated with a 1.5 ml solution of potassium dichromate and mixed gently with 3,5 ml of sulphuric acid reactant.
3. Set all tubes for 2 h at 150°C into a free Reflux COD system.
4. Cool off the measurement pipes.
5. As an indication, place a single drop of ferron.
6. 0.1 N FAS mixture titrated before blue-green colors transition to wine red.

7. COD is measured as

COD (mg/l) = ((B--S) *N*8000) of Sample taken [38] Where, B = ml of FAS used for blank solution

S = milliliter of FAS is used for the sample N = Normality of FAS

3.6.4.2 Significance

Chemical compounds are not just found in wastewater, but deadly elements are also damaging to marine organisms when discharged into water bodies. As a consequence it is crucial to measure the need for chemical oxygen for removal. The volume of air designed to eliminate wastewater contaminants is known as the need for chemical oxygen (COD). The greater the COD level, the more organic materials are found in wastewater. It really should be remembered. DOC does not, under prior effluent standards of sewage, exceed 250 mg/L (CPCB, 2005).

3.6.5 Total Suspended Solids (TSS)

3.6.5.1 Procedures

1. Evaluate a crust of 50 million litres. In the jar, add 50 ml of water solution and prepare at 103°C.
2. Evaluate the 50 mL size of another cauldron. Fill in the bottle with another 50 mL sample.
3. Evaluate a filter paper from Whatmann No. 42. Take the specimen there in the oven at a temperature at 103°C after processing through filter paper.
4. Measurement of TSS willl take:

TDS (milligram/L) = millilitre of residue / millilitre of sample taken * 1000 [38]
TDS (milligram/L) = millilitre of residue / millilitre of sample taken * 1000 TSS
(milligram/L) = TS (milligram/L) – TDS (milligram/L) TSS (milligram/L) TSS
(milligram/L) TSS (milligram/L) TSS (milligram/L) TSS

3.6.5.2 Significance

Complete solids in the sewage that are covered by filtration are absolute suspended solids. Especially relevant is the measurement of total suspended solids, since they affect drainage and the ecosystem activities.If a massive extent of suspended particles is present in wastewater, they restrict the light part of the water and render it anaerobic. Light is essential to sustain life in the ocean. The breakdown of oxygen is also an important limit.The suspended solids increase the sewage water's viscosity and destroy its delicious appearance. The

TSS measurement in sewage does not exceed 250 mg/L as per former quinta limits (CPCB, 2005).

3.7 Methods for Performance Analysis

The effectiveness of sewage treatment plants is evaluated by performance evaluation. For the success assessment of STPs, the main objectives are used:

1. General overall efficiency method
2. Effluent Quality Index method

3.7.1 General overall efficiency method

The optimal performance of the system, as measured using influential and effluent feature vectors, is defined. Physicochemical criteria, including BOD, COD, TSS and NH4, are recognized.

$$E_E = \frac{1}{4} [E_{EEE3} + E_{EEE} + E_{EE4} + E_{EEE}]$$

Where E_E is the overall general efficiency (%)

EBOD3, after 3-day BOD inspection, is the mean efficiency exclusion (percent)

ECOD represents the average utility of COD removal (percent)

ETSS means the average TSS removal performance (percent)

ENH4 is the median extraction of NH4 performance (percent)

The new average efficiency is shown by the estimate of the output of the variable exclusion in relation to present influencing numerical values and true effluent numerical values. Only recorded are the individual departments criteria regulated. This is the interpretation:

$EE = ^1 [\quad + \quad E \quad + E \quad]$

$E \quad 3 \quad EEE3 \quad EEE \quad EEE$

Where EGa is the true total efficiency (percent)

After 3-day testing EBOD3 is the current average performance elimination

ECOD is the real average COD elimination performance (percent)

ETSS is the real average elimination of TSS performance (percent)

BODEFF / EBODIN * 100 percent = (BODIN – BODEFF)

Where BODIN = current influential BOD; BODEFF = current BOD effluent

ECOD = (CODIN - CODEFF) / CODIN *

Where CODIN = current influential COD; CODEFF = current COD effluent

* 100 p. 100 p. 100 percent (TSSIN) / TSSIN

Where TSSIN = current TSS influence; TSSEFF = current TSS effluent

3.7.1.1 Standard General overall efficiency method

The standard general overall efficiency (GE) is interpreted as a measure of criteria extraction efficiency for the specific influential summary statistics and indeed the default effluent statistical results in accordance only with CPCB, 2005.

$EE = ^{1}$ [+ E + E]

E 3 EEE3 EEE EEE

Where EGs are the general efficiency norm (percent)

After a 3-Day BOD Test, EBOD3 is the normal mean effective elimination.

ECOD is the normal average COD deletion performance (percent)

ETSS is the normal mean TSS deletion efficiency (percent)

BODIN = BODIN / BODIN * 100% BODIN 100%

Where, BODIN = current influential BOD; BODEFF = normal BOD effluent

ECOD = CODEFF / CODIN * 100% CODEF CODIN

Where, CODIN = present influential COD; CODEFF = regular COD effluent

ETSS = TSSIN / TSSIN * Centrifugal * 100%

where TSSIN = current TSS influential tss; TSSEFF

3.8 Effluent Quality Index

One of the first problems nowadays is water scarcity. Thus, the left single option either consumes less power or re-use the groundwater from the treatment centers. In order to reuse the emanating material, the blowing should be taken care of after treatment. In this regard, one of the flowing quality control methods recognized as the Effluent Quality Index is used; (EQI)

The profitable consistency list rests on the technique of Delphi and TOPSIS, by doling weight to the limits, in which any border influence and blowing qualities is converted into a record. Performance records emanate to help decide the value of the carry out the tasks and the area where the bubble can be reused. The profluent quality record of the premises is described and contrasting, and the output quality file derives from of the standard limits:

1. Effluent Quality Index (influent)
2. Effluent Quality Index (effluent)

The value of EQI is obtained from the expression:

$$EQI = \sum (0.767 * E_{EEE} + 0.0767 * E_{EEE} + 0.0885 * E_{EEE} + 0.1344 * E) / 0.3763$$

IBOD considered BOD subiindex from rankiing

curves

ICOD considered COD subiindex from rankiing

curves

ITSS considered TSS subiindex derived from ratiing

curves

IpH considered pH subiindex from rankiing curves

Table 3.4 Importance attributed to criteria

S.Nos.	Parameters	Weightages
1	B.O.D	7.67%
2	C.O.D	7.67%
3	T.S.S	8.85%
4	PH	13.44%
	Total	37.63%

3.9 Methods to improve the performance of STPs

The pressing force in regions to successfully handle water is more influential than ever in recent memory against the setting of a worldwide water emergency. Administrators of water treatment plants can dissect the plant water treatment system regularly and have the most efficient hardware and creativity in terms of the framework. It continues to be very costly at a time when water treatment plants do not work effectively. The combination of waste-pumping and cycling equipment combined with redundant water will lead to higher job costs and lower revenues, which could negatively impact the primary plant

3.8.1 Conduct a self-assessment

In order to develop, advance and implement goals, benchmarking has become a key market activity. The Water Resource Foundation (WRF) assessment is essential in order to ensure the performance standard of efficiently manageable water not only helps chiefs and supervisors to differentiate legitimate patterns, it also decides the current measurement execution and measure relative performance across utilities in order to prepare them for subsequent and future operations. The self-assessment is a helpful opportunity for utilities to detect gaps in implementation and to develop methods to decrease gaps.

3.8.2 Evaluate technology

In order to test innovations for water generation, the next stage will be equipped with an understanding of the adequacy of dynamic rehearsals. For example, most surface sewer systems has water purification measurements and can burn tremendous quantities of energy and water without a great deal of stretch. In order to ensure that the process works productively, it is also important to lead an innovation analysis.

Innovations in channels requiring less water discharge have been popular in the current market, but the basis for water treatment facilities for five to ten years will employ higher than the necessary disposal water steps.

The waste water of the flow, sludge or clarification phase and canal discharge is supported by a muck plumping progress, which separates the solids from the fluid. Experts are likely to start going towards creativity making up to 6 percent of slime solids while the conventional period of muck thickening works about 0.5 to 3 percent. Moving to an elevated measurement of mucous membrane leads to reduced water waste, but water treatment plants often benefit from a smaller amount of mucous waste, which will reduce ooze detracting.

3.8.3 Perform a pump audit

Siphons include a significant number of developments in interaction used with water. Conventional procedure, especially with plants which have been known for two decades or more, is to set up siphons depending on the pinnacle flux, in view of the irregularity and the system value, when such siphons actually function in a dynamic flow. Many siphons are also bigger than normal.

Steady speed siphons working with on mode use more water than is necessary, which leads to waste of water and electricity. Plants should thus upgrade their constant speed siphons using variable incidence drives (VFDs) to reduce water loss and energy use, and avoid siphon efficiency from renewable on-off cycling. As www.energy.ca.gov indicates, VFDs will reduce a siphon's energy consumption by up to half, which often means less energy use.

3.8.4 Install smart technology

With respect to sewage, water treatment plants should consider implementing knowledgeable measurement innovation in order to examine their own organisation of appropriations. This will restrict wastewater from non-income sources.

Shrewd advancements such as Automated Meter Reading (AMR) arrangements and AMI help to test the implementation and improve the base by utilities.

Therefore, AMR assembles symptomatic, use-data and liquid sensor status data, thereby flattening outside and optimizing the accuracy of the amount of stretch without the need for a manual meter read. The data will help utilities and their customers properly track water usage in conjunction with research.

AMI enables utilities to make almost daily decisions based on performance and practice. This arrangement is more efficient than AMR, with strong meters, communications and board structure knowledge that enhances two-way connectivity through services and customers.

An effective way of improving implementation is the main arrangement of AMR and AMI creativity. Utilities may reflect each drop of water by collecting details from these structures.

3.8.5 Review the data

The last step is to obtain and examine the information to analyze the implementation of the base, and to determine what improvements can further increase the performance. Since several waste management offices have been established without many considered knowledge securement, it is important that the treatment plant managers ensure that they estimate and review the right skill limits.

Fundamental limits of competence recall that water emissions associated with the channels yield, sloping smoothing rates and skillful siphon operation using VFDs were observe for spills for the transportation company.The managers of treatment plants should reliably evaluate the board's procedures to ensure the plant functions efficiently, then reduce electricity costs and increase water responsibility involves.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In the jurisdiction of Himachal Pradesh, out of 66 STPs, 36 STPs are in operating process. Thirty STPs are concluded that the objectives out of a total of 36, based on various capacities. The efficiency of 11 STPs is evaluated using the source of two techniques, the effects of which are addressed.

4.2 Performance Evaluation

To ensure that septic recycling plants are working properly, they are subjected to performance monitoring. Wastewater contains large quantities of macrobiotic, inorganic, and radioactive matter, posing a danger to marine, human, and environmental life. As a result, before being pumped into lakes, waterways, and other shorelines, the pollutants must be treated. The treatment plant's effluent must be within the CPCB's acceptable boundaries. The aim of wastewater treatment plants is to create high-quality effluent that can be reused. In order to extract such effluent, a performance audit is carried out.

4.2.1 General overall efficiency approach (EG)

4.2.1.1 Results

Also as claimed by the overall performance strategy, of the 11 STPs tested, “STP NORTH DISPOSAL” with 5.80 MLD capability has the highest real general removal efficiency of 93.22 percent. “STP MALYANA” has the lowest real removal performance of 72.93 percent, with a power of 4.44 MLD. Both projects use the extended aeration technique, which is the same technology.

Table 4.1 Actual general overall efficiencies.

STP	**Actual general overall efficiency (EG_a)**
STP LALPANI	77.29
STP MALYANA	72.93
STP DHALLI	84.13
STP NORTH DISPOSAL	93.22
STP SUMMERHILL	76.08
STP KHALIYAR	84.13
STP ARKI	74.15
STP SOLAN	78.89
STP HAMIRPUR ZONE I	81.63
STP SUNDERNAGAR	82.31
STP KUNIHAR	91.93

During the hot and cold weather, the normal overall performance of the STPs was contrasted to the true general overall efficiency of the STPs.

4.2.1.4 Seasonal Variation

Following is the climate variability of the STP during summer:

Table 4.2 Comparative analysis between the Norm and the current Summer Efficiency

STP	Standard general overall efficiency (EG_s)	Actual general overall efficiency (EG_a)
STP LALPANI	92	79.62
STP MALYANA	92	71.30
STP DHALLI	92	84.02
STP NORTH DISPOSAL	92	92.69
STP SUMMERHILL	92	77.03
STP KHALIYAR	92	83.47
STP ARKI	92	73.12
STP SOLAN	92	77.89
STP HAMIRPUR ZONE I	92	83.97
STP SUNDERNAGAR	92	80.21
STP KUNIHAR	92	90.37

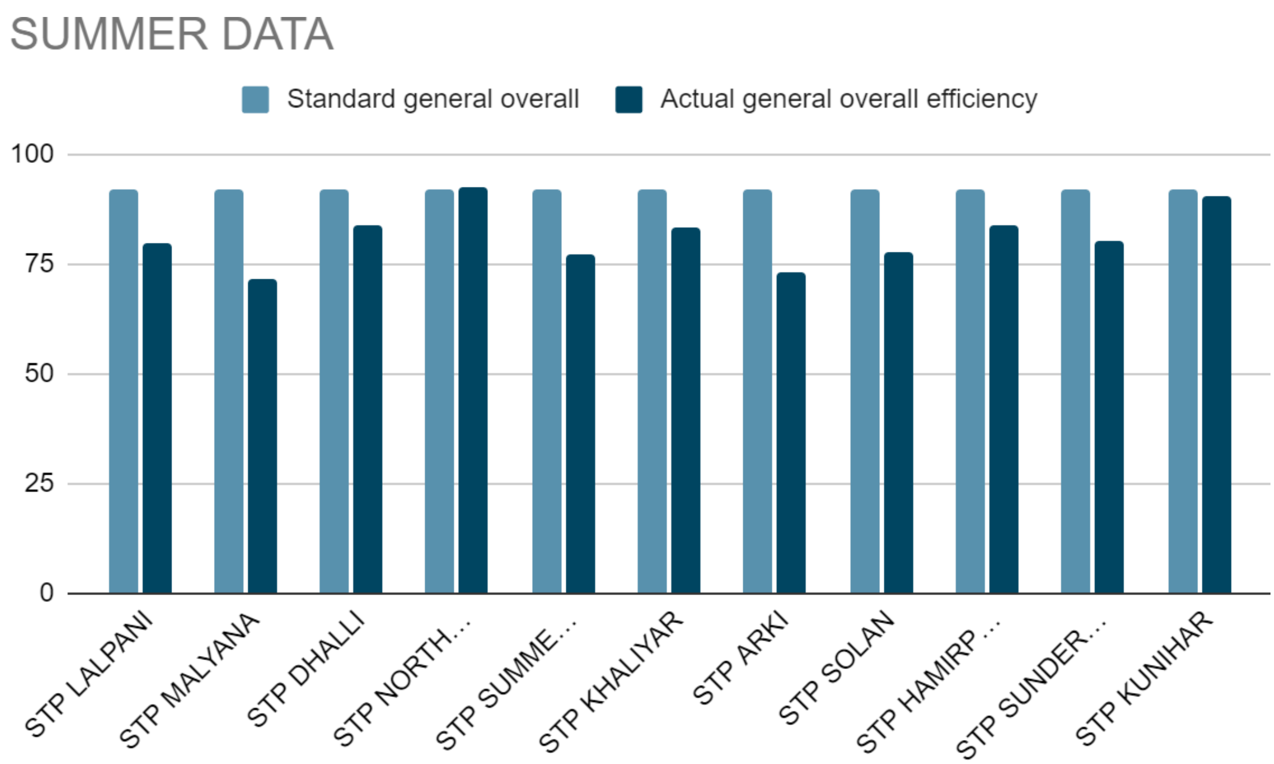

Figure 4.1 Comparative analysis between the Norm and the current Summer Efficiency

The seasonal variation in the cold is given below:

Table 4.3 Comparative analysis between the Norm and the current winter Efficiency

STP	Standard general overall efficiency (EG_s)	Actual general overall efficiency (EG_a)
STP LALPANI	80	74.56
STP MALYANA	80	77.38
STP DHALLI	80	77.57
STP NORTH DISPOSAL	80	93.76
STP SUMMERHILL	80	77.91
STP KHALIYAR	80	78.56
STP ARKI	80	72.78
STP SOLAN	80	78.19
STP HAMIRPUR ZONE I	80	86.47
STP SUNDERNAGAR	80	79.38
STP KUNIHAR	80	88.75

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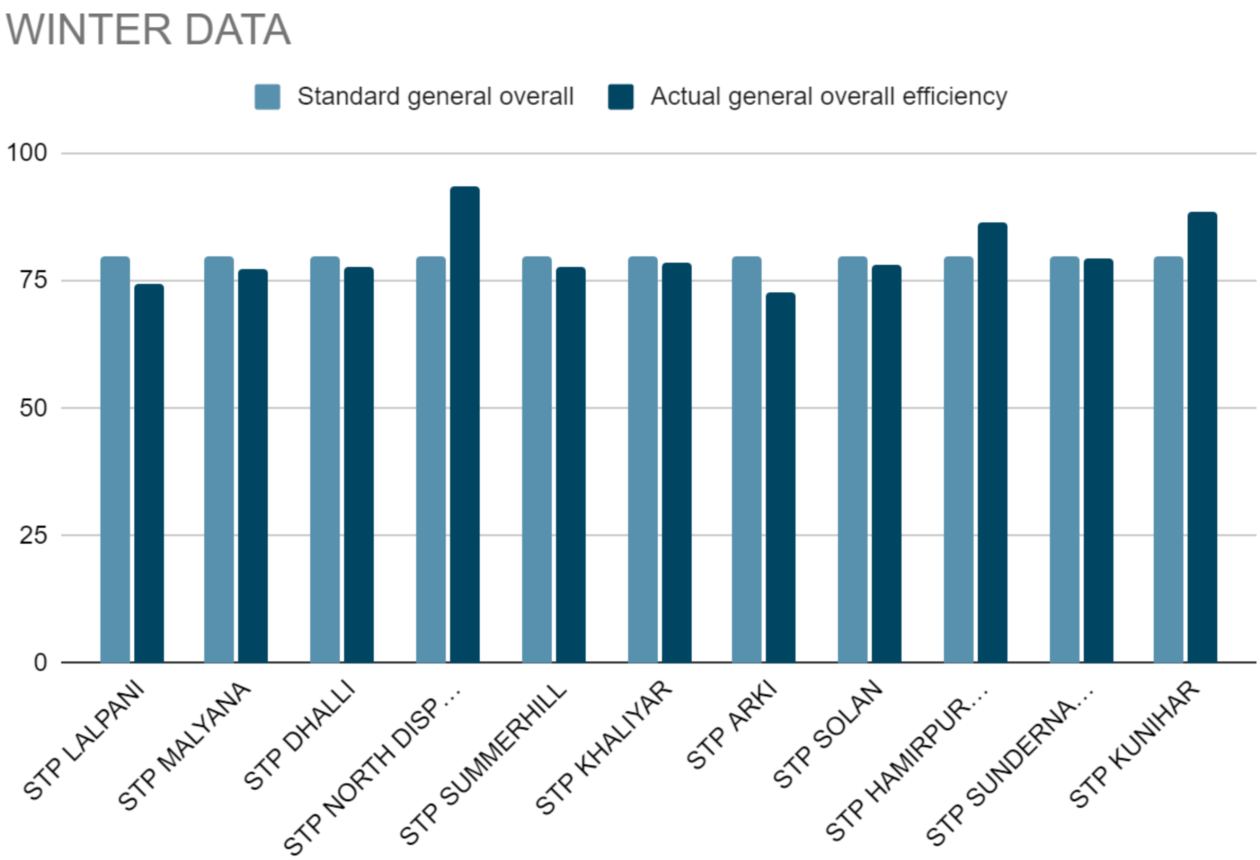

Figure 4.2 Comparative analysis between the Norm and the current winter Efficiency

4.2.2 Effluent Quality Index (EQI)

4.2.2.1 Results

The Effusive Quality Index is the most accurate method for determining the predominance of profluent discharged from a treatment plant. The appraisal aids in gaining a better understanding of the area in which wastewater from the treatment facility can be reused to save water. pH seems to be more essential than BOD, COD, and TSS. pH is regarded as the most important element since the value of pH reflects the wastewater's concept. Since wastewater contains both organic and inorganic components, it can be acidic or simple in nature. The proper pH must be maintained for the microbes to work properly. Out of the eleven STPs studied, "STP Kunihar" has the best results, indicating that its profluent water can be used for sporting purposes. "Malyana" receives the lowest EQI score. The STPs' prodigious consistency record ranges from 36.89 to 92.13. This demonstrates that the essence of the flowing is suitable and can be post for a variety of uses, including recreational, mechanical, soil, surface water, and agriculture - based reuse. Similarly, after tertiary care, the fangirling can be recovered for drinking.

Table 4.4 Effluent Quality Inndex

STP	Effluent Quality Index
STP LALPANI	71.04
STP MALYANA	92.13
STP DHALLI	63.72

STP NORTH DISPOSAL	39.72
STP SUMMERHILL	46.99
STP KHALIYAR	39.75
STP ARKI	43.38

STP SOLAN	40.89
STP HAMIRPUR ZONE I	51.77
STP SUNDERNAGAR	40.09
STP KUNIHAR	36.89

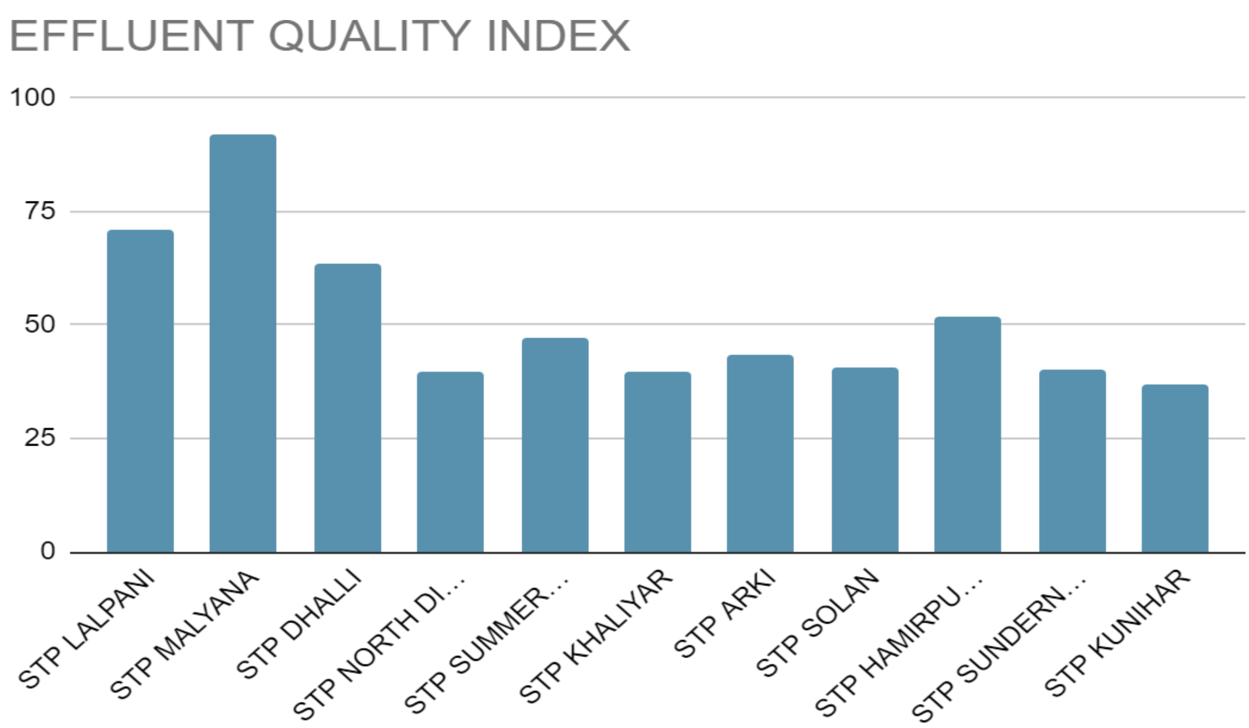

Figure 4.3 Effluent Quality Inndex

4.2.2.2 Seasonal Variation

Climate variability is important since it shows the effluent consistency at various times of the year. We will decide the best period for achieving a high effluent output based on the data. By analyzing them beside each other, we will figure out which plant plays best in which year.

Table 4.5 Effluent Qualety Inndex In the Summer Season

STP	Effluent Quality Index In Summer
STP LALPANI	73.57
STP MALYANA	100.97
STP DHALLI	62.51
STP NORTH DISPOSAL	41.53
STP SUMMERHILL	43.03
STP KHALIYAR	40.87
STP ARKI	43.76
STP SOLAN	41.69
STP HAMIRPUR ZONE I	48.34
STP SUNDERNAGAR	40.46
STP KUNIHAR	37.38

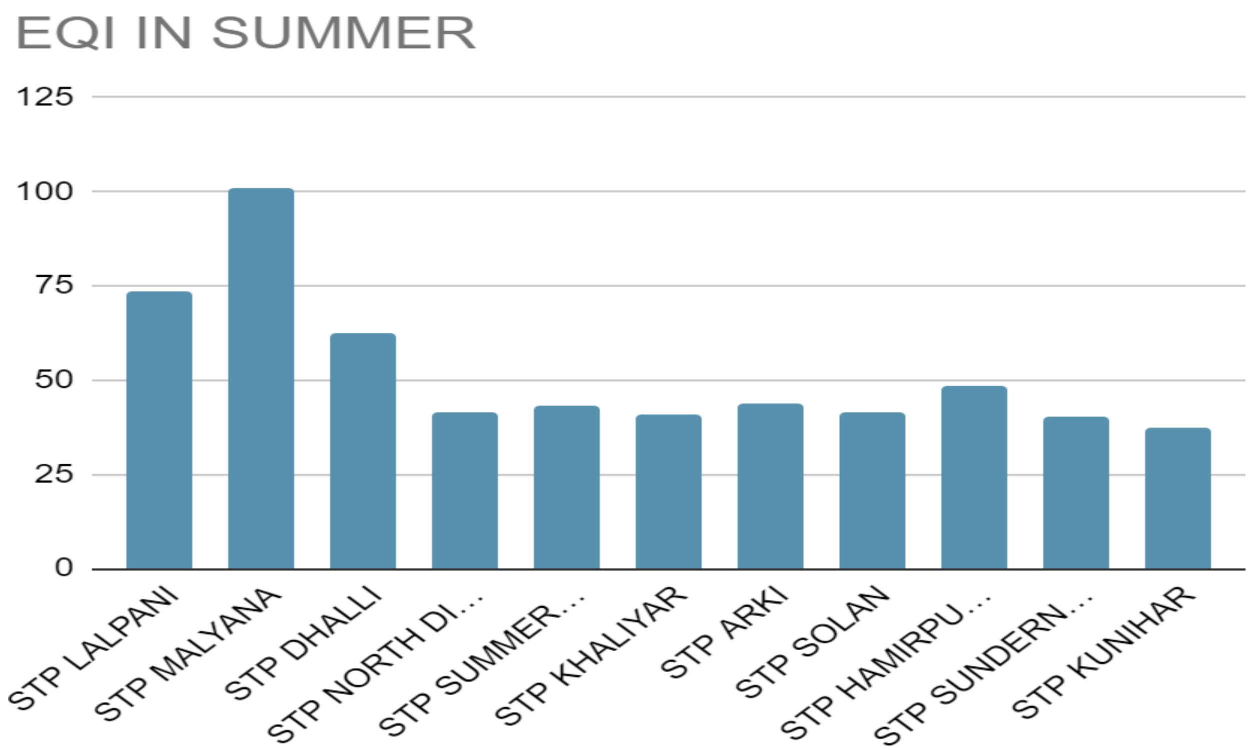

Figure 4.4 Efluent Qualety Index In the Summer Season

Table 4.6 Efluent Quality Index In the Winter Season

STP	Effluent Quality Index In Winter
STP LALPANI	68.52
STP MALYANA	84.03
STP DHALLI	64.93
STP NORTH DISPOSAL	37.92
STP SUMMERHILL	50.95
STP KHALIYAR	42.26
STP ARKI	43.78
STP SOLAN	40.36
STP HAMIRPUR ZONE I	39.78
STP SUNDERNAGAR	41.25
STP KUNIHAR	38.89

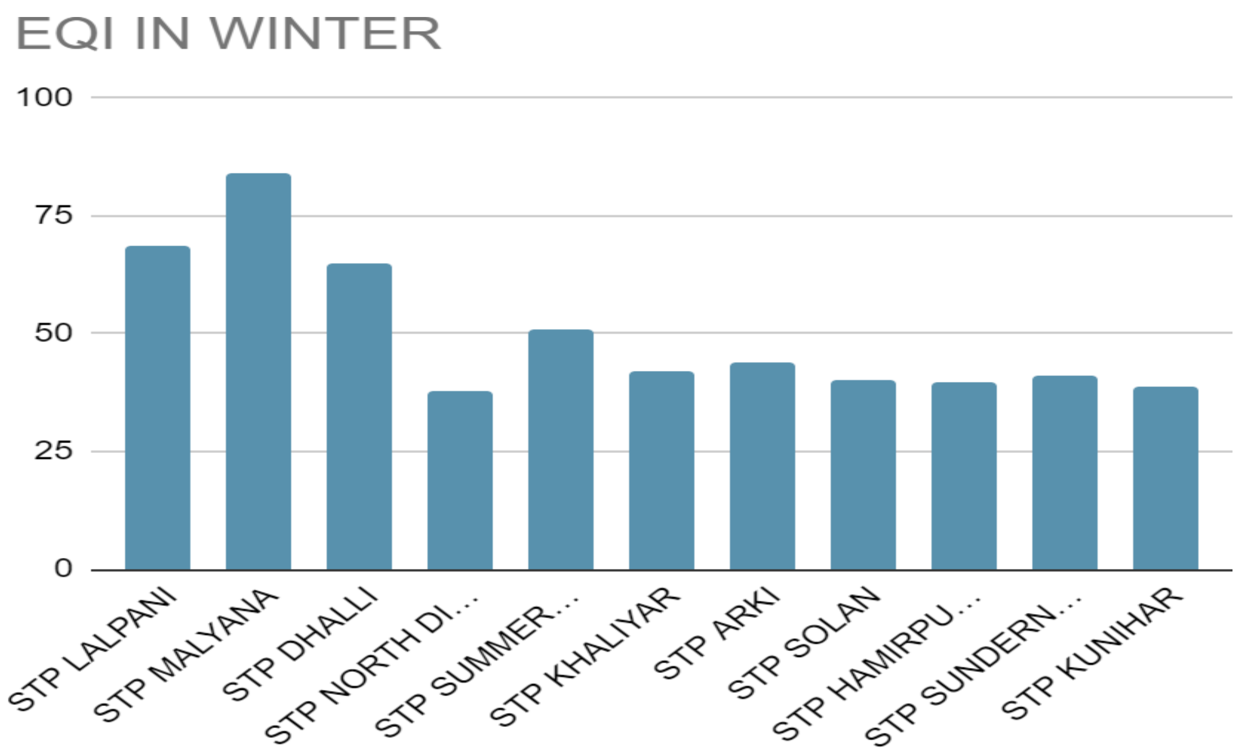

Figure 4.5 Efluent Quality Index In the Winter Season

The results obtained by each STP in different seasons are nearly identical, indicating that the occasional variety has no impact on the homegrown wastewater treatment plant. However, it is observed that the results obtained during heavy rain and winter seasons are higher as compared to summer and growing time seasons. This is due to the fact that during tornado and winter, the precipitation is higher, and the river in the sewer systems increases, resulting in the time required for each space of discharge to be treated being insufficient to provide high-quality effluent. More efforts are being taken in this direction to deal with certain situations.

CHAPTER 5
CONCLUSION

An inquiry into the efficacy of sewer systems (STPs) for handling sewage water was conducted on 5 existing STPs in Shimla, Himachal Pradesh. Most plantations' treated emissions did not meet the Center Pollution Control Board's (CPCB) and Himachal Pradesh Pollution Control Board's (HPPCB) recommended standards (HPPCB). According to the CPCB's latest requirements, all STPs under consideration must be upgraded to meet the new gushing rules. Since the results are not appropriate, a precise arrangement to verify the experiments conducted and mechanical assembly used is required. As most streaming standards are insufficient to satisfy the encompassing emanating standard, there is a need for testing further boundaries that allow us to disperse wastewater effluent into streams, waterways, and other water bodies, as these water bodies are house to undersea life and their water is used in a variety of fields.

Many proposed desalination plants do not reach their capacity because most households have septic tanks that are not linked to the contractor lines that transport water to treatment plants. As a result, the Irrigation and Public Health Department must be cautious about linking every small property to the sewer pipe.

Similarly, in the upper counties of Himachal Pradesh, where control plants are located, the temperatures in the winter falls below 0 degrees, allowing microorganisms to survive. As a result, warmers or heaters in the aeration tanks are needed to maintain the temperature, as air temp is a critical factor for microscopic organisms to degrade microbial matter and produce healthy profluent.

REFERENCES

- Hospido, A., Moreira, M. T., Fernández-Couto, M., & Feijoo, G. (2004). Environmental performance of a municipal wastewater treatment plant. *The International Journal of Life Cycle Assessment*, *9*(4), 261.
- • Luca, L., Barbu, M., and Caraman, S. Luca, L., Barbu, M., and Caraman, S. (2014, October). An urban wastewater treatment plant's performance was modelled and analysed. The 18th International Conference on System Theory, Control, and Computing (ICSTCC) was held in 2014, and it was a great success (pp. 285-290).
- Moreno, R., Correia, M., & Martins, F. (2017). Energy and environmental performance of wastewater treatment plants: A statistical approach. *Energy Procedia*, *136*, 296-301.
- Torregrossa, D., Hansen, J., Hernández-Sancho, F., Cornelissen, A., Schutz, G., & Leopold, U. (2017). A data-driven methodology to support pump performance analysis and energy efficiency optimization in WasteWater Treatment Plants. *Applied Energy*, *208*, 1430-1440.
- P. van Daal-Rombouts, L. Benedetti, J. De Jonge, S. Weijers, and J. Langeveld, P. van Daal- Rombouts, L. Benedetti, J. De Jonge, S. Weijers, J. Langeveld, J. Langeveld, J. Langeveld, J. Lange (2017). At a wastewater treatment facility, the performance of a smart buffer control was evaluated. Water Science, vol. 125, no. 1, pp. 180-190.
- V. Nourani, G. Elkiran, and S. I. Abba (2018). Artificial intelligence-based performance monitoring of wastewater treatment plants–an ensemble approach 2064-2076 in Water Science and Technology, vol. 78, no. 10.
- K. B. Newhart, R. W. Holloway, A. S. Hering, and T. Y. Cath (2019). An overview of data- driven efficiency analyses of wastewater treatment plants. 498-513 in Water Science.

- Yang, Z., Sun, H., Zhou, Q., Zhao, L., & Wu, W. (2020). Nitrogen removal performance in pilot- scale solid-phase denitrification systems using novel biodegradable blends for treatment of waste water treatment plants effluent. *Bioresource Technology*, *305*, 122994.
- J. T. Bunce, A. Robson, and D. W. Graham (2020). Seasonal factors affect the use of genetic markers as success metrics in small wastewater treatment plants. 139928, Science of the Total Environment.

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