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Ground Water Recharge By Utilizing Waste Water From Residential Area.

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Abstract: The Artificial recharge of groundwater exploitation continues to rise, significantly in arid and semi-arid countries. Artificial recharge as a way to strengthen the natural provide of groundwater aquifers is popping into more and more necessary in groundwater management. the first aim of this study is to arising with and planning of artificial recharge structures for residential district . The study estimated the degree of generated waste water yet as rain runoff water and from the residential district . the speed of natural ground water recharge, rain runoff and total treated effluent out there for recharge is calculable as further or various method of recharge of spring water . From the world bank report it is found that a confined aquifer is goes decreasingly up to 4m to 8m from there natural level. The soil strata below the aquifer was impervious. So recharging below impervious layer is impossible in order that we've to recharge treated water in pervious layer. that's within aquifer in order that treating this water within rapid sand filter and sends it to the aquifer. the first objective of this technology is enhance groundwater resources in arid and semi arid area in country.

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***Index Terms* – Ground Water Recharge, Rapid Sand Filter.**

I.INTRODUCTION

Artificial Recharge Technique might be a way of replenishing spring water by Surface and Sub-Surface ways. it's necessary that groundwater need to be recharged naturally or artificially in proportion to the quantum of depletion. As artificial recharge has improved method, managers have begun to seem for extra sources of recharged water artificially. during this context recharge of groundwater table using waste water from residential district is one among the simplest method. Different sort of method are employed everywhere the word can briefly classified into two categories that's surface and sub surface spring water recharge. In surface method available water is spread on open area to allow them to percolate sub-surface reservoir. In sub-surface method artificially we bore hole or well and recharge the bottom water. Our project is predicated on sub-surface recharge of spring water by treating waste water from the residential district . groundwater is that the main source of both drinking and irrigation water. India is that the largest user of spring water table within the world. It use about 230 cubic kilometers of spring water per annum . it's adequate to the 1 quarter of the worldwide . India used 60% of their irrigated agriculture water and 80% of their beverage from the bottom water from A report of International Bank for Reconstruction and Development it said up to 2022 the bottom water level in 22 different places in India is goes to their critical ground condition. If the over exploitation of groundwater is continue then the entire country will affected by water scarcity. In India the entire number of bore wells and wells is around Twenty Seven million which consumed 50% of groundwater. to unravel this problem we create our model. during this model we use water from residential district to extend the bottom water level . We use waste water from residential district , this water transfer to cylinder during which sedimentation and floating of oil on surface of water is takes place. By giving some treatment we remove the oil then we transfer this water to the rapid sand filter during which water is purified upto some level then, this water is send to well and from well it transfer to the bottom water level . The applications of this project are land subsidence, preserve of spring water resource partially of India, reduction in wastage of waste water from residential district . Nagpur city, one among the main metropolitan cities in India, is situated at the centre of the India. Nagpur is inhabited by quite 2.5 million people in a neighborhood of 227 Sq.km. water system for this population is maintained by augmenting a com¬bination of surface storage reservoirs and aquifers. Nagpur municipal corporation (NMC) is liable for water system and sewerage services within the Nagpur Metropolitan Area. The preset study is initiated by considering reuse of waste water to recharge the aquifer for augmen¬tation of groundwater which may be a viable option instead of demanding the extra sources.

II.LITERATURE REVIEW

In this project following research papers have been studied for the conduction of this project.

Mr. Mohmed A. Dawoud(2012), study on "Ground water aquifer recharge with treated wastewater in egypt:Technical, environmental,economical and regulatory consider rations." the economic development in egypt and the rapid growth rate in various development sectors are dependent on the availability of water resources. surface water is used to supply approximately 82% of the egyptian water demand. while the groundwater is used to supply about 12%. the remaining about 6% comes from the reused of agriculture drainage water and treated water. he Conclude that increasing the basin hydraulic head resulted in significant increase in the infiltration rate.and evaluate the hydrogeological suitability of artificial recharge with pre treated wastewater in egypt for augmentation of ground water supply and mitigation the negative environmental impact of direct illegal reused of raw waste water.

Mr. Mohammad matoug(2018), study on "the reused of treated waste water via ground water recharge for the development of sustainable water resources."due to the reduction of ground water resources,the artificial recharge of these resources through the reuse of treated waste water is an efficient way to tackle the problems. they Conclude that long term effects of this pollution necessitates a conservative view about the implementation of policies concerning the ground water recharge system and increasing the quality standard of water.

Mr. Rajni ,Rajesh kumar paswan, Sandeep dubey, sanjay sharma, jyoti NITTTR, Chandigarh (2015), They study on "evaluation of ground water artificial recharge well in Chandigarh(U.T.)" Chandigarh is a rapidly growing city with a population growth rate of 40% in the last decade. The demand for water is estimated to grow steeply. It is estimated that by 2025, the water demand will be 800mld. There by indicating an increase of 58% over the present requirements. They conclude that recharge well should be properly constructed and provide with appropriate well head protection measures. Maintenance of these well should also be carried out a regular intervals. Silt of upper layer should be removed in pre-monsoon and post-monsoon season and gravel should be change in every four years

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R. J. Patel, H.D. Rank ,B. H.Ajudiya, N. V. Dhanani they study on "An Assessment of ground water recharge potential through tube well". Water is limited vital natural resource wich is indispensable for existence of all living of all matter plant, animal and man. Farmer of the saurastra region are tempted to use more irrigation water from the tu e well due to erratic and uneven rainfall to meet the requirements if intensive cropping, this has been resulted in very heavy withdrawal of ground water therefore, it is a need to recharge the runoff water on their field. They conclude that the aquifer properties like transbility, storage coefficient and specific capacity of the well was found as 26.45metre cube per hour,0.27 and 18.89 metre cube per hour per metre respectively through pumping test. or 27.57metre cube per hour ,0.28 and 19.69 metre cube per hour per metre respectively through recovery test. The potential rate of ground water recharge for aquifer of this region through 0.20m diametre tube well would be 0.03lps. 1.56lps, and 12.50lps for the depth 6m, 26.90m, and 55.98m respectively. The benifit cost ratio for wheat,cumin and green gram grown by utilising recharged water was found as 2.26, 10.83 and 2.41 respectively.

III. RESEARCH METHODOLOGY

1. Collection of wastewater

1.1. collection of wastewater is the Initial process of this project.
1.2. In this process wastewater is collected from kitchen and bathroom.
1.3. The waste water is collected by means of pipe which are connected to sedimentation tank.
1.4.

1.1 Primary Treatment on waste water

1.1.1 Screening

Floating matter such as packets, plastic sheet bits, rags, fibres, hairs etc. needs to be removed by the process of screening. If we do not provide screening while collecting waste water choked condition can be occur in collecting pipe.the screen is a device with uniform opening, which may consist of parallel bars, rods, grating or wire mesh.

1.1.1.2 Coarse Screens

Coarse screen fills in as defensive gadget, ordinarily bar screens. A bar screen is level and vertical bars set at equivalent spans through which the sewage streams, for the most part with an enormous opening of 25mm.

1.1.1.3 Fine Screens

Fine screens are used remove very fine material which are present in wastewater. The distance between spaced bars is less with openings of 5mm.

1.1.2 Grit Removal

1.1.2.1 Composition of Grit

Coarseness comprises of sand, ash, clinkers, egg shells, bone chips and numerous dormant materials inorganic in nature which are available in waste water gathered from washroom. The particular gravity of coarseness shifts from 2.4 to 2.65. It is non-putrescible and has a higher pressure driven subsidence esteem than natural solids. Consequently, abrasive material can be isolated from natural solids by differential sedimentation in a coarseness chamber.

2. Sedimentation and Removing of oil

The suspended particle which can not removed by screening for this sedimentation process is carried out.

2.1 Settling

2.1.1 General

Settling tanks, sedimentation tanks are commonly utilized in water treatment. They are utilized to isolate the suspended solids, which can settle by gravity when the waste water is held in a tank. The essential sedimentation is situated after screens and coarseness chamber lessens the natural burden on optional treatment units and are utilized to eliminate inorganic suspended solids, Organic and remaining inorganic solids, free oil and oil and Chemical flocs delivered during concoction coagulation and flocculation.

3. Rapid Sand Filter

After sedimentation process treated water is transfer in ground ,where various layer of sand are placed for removing remaining particles. Rapid sand filter consist five layer of sand.

3.1Layer of rapid sand filter

From the bottom first layer is off gravel

1.3

Tertiary Treatment

This step involves the removal of constituents beyond removal in secondary treatment. These are Chemical Precipitation and Membrane Technologies.

1.3.1. Chemical Precipitation

This method is required to remove the phosphorous for control of eutrophication in receiving waters, salts if the treated sewage is to be used for industrial purposes and heavy metals.

The chemical precipitation of phosphorous is by the use of Ferric or Aluminium salts using a two-step process. For each Kg of phosphorous 0.8 kg of Aluminium or 1.7 kg of Iron is needed, showing that the sludge production is less by half by using Aluminium. The chemical equations are as under:

$Al_2(SO_4)_3{\cdot}18H_2O + 2H_3PO_4 \rightarrow 2AlPO_4{+}3H_2SO_4 + 18H_2O$

$FeCl_3{\cdot}6H_2O + H_2PO_4^- + 2HCO_3^- \rightarrow FePO_4 + 3Cl^- + 2CO_2 + 8\ H2O$

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1.3.2. Disinfection

1.3.2.1. Need for disinfection

Disinfection of treated sewage may be needed when the receiving water quality may be affected by the Coliforms after the discharge. The following methods are used for disinfection.

Chlorination

This is the most widely used technology in both water supply and sewage treatment. As the treated sewage is fresh from secondary aerobic biological treatment, the chlorination of such effluents does not result in hazards.

De-chlorination

Excess of residual chlorine if any is nullified by de-chlorination chemicals like sulphur dioxide (SO_2) gas or salts as sodium Thiosulfate ($Na_2S_2O_3$), Sodium Sulphate (Na_2SO_3), Sodium Bisulfite ($NaHSO_3$), Sodium Metabisulfite ($Na_2S_2O_5$), Calcium Thiosulfate (CaS_2O_3), Ascorbic acid (Vitamin C) and Sodium Ascorbate. Sodium Bisulfite is used by some utilities due to its lower cost and higher rate of de-chlorination.

IV. DESIGN & PLANNING

1. Selection of Site and Location

For the designing of the Rapid Sand Filter we have taken the statistics and location of village Dahegaon, Near Guru Nanak Institute of Technology, Nagpur in the state of Maharashtra, India. If the model is taken into consideration for design, please note that the model can be a central sludge-biogas plant with the cluster of approximately 3-4 villages.

2. Design of STP Units

2.1 Population Forecasting of the Site

The population of Dahegaon for the year 2011, was 1410. The design period for the plant is 30 years. We are taking an annual growth in population of 50 people. By using Arithmetic Increase Method, the population for the year 2020 is:

$P_n = P_o + nx$

$P_{2020} = P_{2011} + nx = 1411 + 9 \times 50$

$P_{2020} = 18622$ people

After 30 years,

$P_{2050} = P_{2020} + nx = 1410 + 9 \times 50$
$= 3350$ people

Hence, the forecasted population for the design period of 30 years is 3312 people.

2.2 Calculation of Sewage Generation

The water supplied per capita = 100 lpcd
Average water supplied per day = 3360 × 100
= 336022 l
= 0.336 MLD
= 336KLD or m^3/day

Average sewage generation per day = 85% of water supplied = 0.85 × 0.336
= 0.2856 MLD
= 285.6 m^3/day
= 11.0 m^3/hectare

Maximum sewage generation per day = 285.6 × 3
= 854.8m^3/day
$= \frac{856.8}{24 \times 60 \times 60}$
= 9.9×10^{-3}
= 35.7 m^3/hectare

UNIT 1: Receiving Chamber

The detention time for the sewage is taken as 3 hours
Hence, volume required=max. sewage generation × detention time =35.7×3
=142.8 m^3

Take depth of the receiving chamber as 5m and assume freeboard as 0.5m ∴
Depth of tank=5+0.5=5.5m

Area= $\frac{Volume}{Depth} = \frac{142.8}{5}$=28.56

L:B=2:1

Area=Length × Breadth

28.56=2 × B^2
B=3.9m
L=7.8mCheck:

Volume designed=L×B×D
$V_{designed}$=7.8×3.9×5
=152.1 m^3

$V_{designed} > V_{required}$ (safe)

∴ Dimensions of Receiving Chamber=7.7m×3.9m×5.5m

UNIT 2: Coarse Screen Bar

The following points need to be kept in mind while designing the unit:

- The screen chamber must have sufficient cross-sectional opening area to allow passage of sewage at peak flow rate should be 2.5 to 3 times the average hourly flow rate.
- The screen must extend from the floor of the chamber to a minimum of 0.3 m above the maximum design level of sewage in the chamber under peak flow conditions.

Peak discharge of sewage=34.7m^3/hr

The average velocity not exceed 0.8m/s
Take detention time=6 min
Volume=peak discharge of sewage (per min)×time
$= \frac{35.7}{60} \times 6 = 3.57 m^3$

Take depth=1m
Volume=Area × Depth
Area=3.57m^2
2B×B=3.57 (L: B=2:1)
∴B=1.35m & L=2.7m

Bar screen size=1×1.35×2.7

Bar dimensions=75mm×10mm (10mm in the direction of flow)
The clear spacing of bars is 30mm at 60° inclination
Q_{max}=9.9×$10^{-3}$$m^3$/s
At peak flow, the net incline area required=$\frac{9.9\times10-3}{0.8}$=0.0124$m^2$
Gross inclined area=0.0124×1.5
=0.0186m^2
Gross vertical area required=0.0186×sin60°
=0.161m^2
Submerge depth=0.7m, width=0.055≅0.10
Head loss for sewage water=h_L=0.1 to 0.4m
Clear opening between bars=300mm=0.3m
Clear Area=$\frac{0.0124}{1.6\times sin60°}$=0.00895 (1.6m/s is the max. velocity)
Provide 20 bars in chamber of size 1×1.35×2.7 @20mm clear opening with length of the chamber as 60cm

UNIT 3:
Avg vol demanded per person= 80 l/day

Avg vol demanded by students / staffs =80 l/ day = 100pple=8000 l/day

Avg vol supplied per day= 6000 l

Avg vol per day (m3) =5.55 m3

Approximately number of people in the college per day= 100 people

Avg volume per person per day = Avg vol litres per day/ Total number of people in hostel

=5550/100
= 55.5 l/day

UNIT 4:
Total amount of water supplied =Tank Capacity+ No.of times water is pumped to the per day to overhead tank

Vol of usable water produced per day

No.of students=100

Approximately number of times flushing the toilets =150

Capacity of cistern =15 litres

UNIT 5:
Amount of waste water produce per day =15×150=2250 l/day

Approximately vol of usable water produced=5500-2250=3250 l/day

Percentage of usable water produced =3250/6000 ×100
= 54.2%

V. RESULTS & DISCUSSION

This research is carried out for the better understanding of present condition and to improve the aspect technically for the betterment in future aspect. By conduction of this study & analysis of data following result has been made based on experimental investigation and research.

- By using this technique we treat 50 – 60 % of waste water from residencial area and transfer to ground by using well.
- Reduce scarcity of water in arid and semi aride areas.
- Increase amount of ground water and helpful for irrigation and environment.

The present techniques are simple, cost-efficient and property within the future.With several communities approaching the boundaries of their out there water provides, water reclamationand reprocess has become a beautiful possibility for protective and increasing out there water provides. Groundwater recharge exploitation rescued water is Associate in Nursing approach that helps to create the facility a lot of property. As technology continues toadvance and therefore the dependableness and safety of water reprocess systems is wide incontestible, it's believed that water reprocess via groundwater recharge can still expand as an important part in property water resources management.

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