A Review Paper on the Determination of best suitable site for infiltration well on the basis of infiltration rate of soil at Ekana Stadium Lucknow

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Abstract— **Infiltration is the process of penetration of water into the ground surface and the intensity of this process is known as infiltration rate. The infiltration rate is expressed in term of volume of water poured per ground surface per unit of time. Soil erosion, surface runoff & ground water recharge are affected by this process. At a certain moment the maximum infiltration rate can be indicated by the infiltration capacity of soil. Infiltration of water into the soil can be determined by a simple instrument called Double ring infiltrometer. The cylindrical ring infiltrometer consist of single metal cylinder. These cylinders are partially inserted into the ground and water is filled up to a margin inside the cylinder and after that the speed of penetration of water is measured with respect to the time and depth of penetration of water inside the cylinder. Four types of cylinders are taken for this experiment of diameter 15cm, 30cm, 45cm&60cm and they are experimented as 15-45cm& 30-60cm double ring infiltrometer. To spread the water vertically after infiltration we use double ring infiltrometer. Double ring infiltrometer is better than single ring infiltrometer. In single ring infiltrometer the water will spread horizontally & vertically both, from which water will not move only towards the ground water but using double ring infiltrometer the water will penetrate in one direction that is towards the ground water without much wastage of water.**

Index Terms: **Find best suitable Site for infiltration well on the infiltration rate at Low land area of Ekana Stadium, in 3km in radius Lucknow.**

I.INTRODUCTION

Infiltration is the process where the water enter surface strata of the soil and move down towards water table. Maximum rate (LT^{-1}).at which a soil in any given Condition is capable for absorbing water is totally soil characteristic. Prevailing rate at which the water entered given soil at any given time is known as Infiltration rate measured by depth (in mm).Hydraulic conductivity is ability of a fluid to flow through a porous medium. It is determined by the size and shape of the pore spaces in the medium & viscosity of fluid. OR It is expressed as the volume of fluid that will move in unit time under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow. The steeper the slope (gradient), the less the infiltration or seepage. The more saturated the loose Earth materials are, the less the infiltration. Porosity is the percentage of open space (pores and cracks) in a earth surface. The greater the porosity, the greater the amount of infiltration. sponge clay brick. The clay surfaced soils are compacted even by the impact of rain drops which reduce infiltration. This effect is negligible in sandy soils. Vegetation:- Grasses, trees and other plant types capture falling precipitation on leaves and branches, keeping that water from being absorbed into the Earth & take more time to reach in to the ground. more the vegetation Slower the Infiltration. Roads, parking lots, and buildings create surfaces that are not longer permeable. Thus infiltration is less. At high temperature viscosity decreases and infiltration increases Summer–Infiltration increases Winter–Infiltration decreases furrow irrigation. Entrapped air in pores- Entrapped air can greatly affect the hydraulic conductivity at or near saturation b) Quality of water-Turbidity by colloidal water c) Freezing-

Freezing in winter may lock pores. d) Annual & seasonal changes –According to change in land use pattern. Except for Massive deforestation & agriculture

II- LITERATURE REVIEW

Denis Fox R.B.Bryan[1] Infiltration rate decreased with increasing slope angle; image analysis of pore characteristics in the affected layer and subseal pressure head measurements indicated there were no differences in seal characteristics between slope angles. The results showed that sealing intensity did not vary with slope angle, and the dominant influence of slope angle on infiltration rate resulted from changes in overland flow depth and surface storage. The results also suggest that small changes in seal hydraulic conductivity with microrelief play an important role in the infiltration process.

Li chenMicheal H young[2]Green ampt Infiltration model for sloping surface:The model's applicability for non-uniform slopes was discussed, and it was found that the model is generally applicable for isotropic and mildly anisotropic soils except for some small-scale topographic elements. Finally, the occurrence of non-vertical rainfall could increase runoff with increasing slope angle when rainfall deflects a large angle to upslope.

Satyawanjagdale[3] The parameters considered for best fitting of model were correlation coefficient and standard error. The results shown that, The Horton's model, and Green-Ampt model were best fitting to observed field data to estimate infiltration rates at any given time with high degree of correlation coefficient and minimum degree of standard error.

Nitin P. Sonaje,MilindWaikar[4] Indian journal of applied researchModellingof Infiltration process: 1.7. Conclusion: The paper has reviewed various frameworks for measurement of infiltration in use for analytical and experimental comparison. With extensive coverage an analyst may go for a suitable and economical method and further tailor the same for obtaining numerical solutions for scientific estimations. Such infiltration studies are helpful for rainfall – runoff simulation. The paper has revealed that current infiltration models are comprehensive, and formed their basis on many physical parameters. In general, usage of numerical computing software tools is growing by leafs and bounds. With extensive survey these tools are found to be capable of simulating not only water quantity but also quality. The review empowers the researchers to choose appropriate model for water infiltration investigation.

AvinashKadam[5] This paper presents a spatial model that evaluates the roles of water infiltration capacities and flood risks in watershed where cities are established. Understanding these characteristics is essential for managing water in urban areas, since water infiltration is related to the rainwater that may arrive to the aquifer, and floods are among the biggest concerns in risk management. We used spatial categorical data for land use, slope, soil texture, elevation, and precipitation to create a model that yields graded areas with different potential infiltration capacities, indicating susceptibility to flooding. The model can generate scenarios considering changes in land use and climate change up to the year 2050. We tested this model in Mexico City, Sao Paulo and Buenos Aires, three of the largest Latin American cities with different type of watersheds but similarities in population and policymaking. We found that climate change will decrease the infiltration capacities in Sao Paulo, but in the other two cities it will increase. Change in land use is the key factor, however, in reducing infiltration capacities and increasing the risk of flooding in all three cities. The model is applicable to urban areas in other parts of the world. These types of spatial models should be used in cities to emphasize the importance of watershed dynamics in managing water for the future.

NileswariYewaleandMadhuriGajabe[6]Measurement of Infiltration on different land cover: Different properties of soil on cultivated land cover and bared land covers. Based on the results obtained from the study, the following conclusions are drawn. 1. The average infiltration rate for cultivated land cover was 6.06 cm/hr and 4.34 cm/hr for bared land cover. 2. Measured and predicted values were nearly same and curved were nearly fitted with each other. 3. The average moisture content, bulk density and field capacity was found out to be 16.49%, 1.71 gm/cc, 26.23 % respectively, for cultivated land cover. The average moisture content, bulk density, and field capacity was found out to be 11.7%, 1.59 gm/cc, 29.55% respectively, for bared land.

JahagirPoreman and H.Nazari[7] March 2016An investigation and evaluation Of Infiltration model: The results showed that Philip model was the most

accurate for estimating of the infiltration and Kostiakov model is also the second one. Regression coefficients of Philip model were between 0.975 to one, mean error -0.017 to +0.017 and the maximum root mean square error was 0.22.

Shaid Abdul, HammidSajjani[8]Effect of soil physical properties on Infiltration rate:The purpose of this research was to investigate the relations between infiltration rate and soil texture, moisture and compaction. To achieve this purpose an experimental study was performed to show the effect of soil properties and their relations on infiltration rate by using non-linear regression.

M.A.Kalan, M.Ramesh [9]Determination of Infiltration rate and soil indices using double infiltrometer: The infiltration process is affected by surface runoff, ground water recharge and erosion of soil. At a certain moment the infiltration capacity of soil is indicated by maximum infiltration rate. By adopting Φ index, which gives average rate throughout the rainfall, it is well suited for calculating maximum run off from a major storm on wet soils. In this study constant infiltration rates of the soils under different soil conditions were studied, compared with the infiltration rates and were verified with IS code 15792-2008. Because of highest infiltration rate in Malchalma village surface water is available even in summer. It has been proved that maximum infiltration results in excess of ground water. Application/Improvements: It is a strenuous task to measure infiltration in the field. The infiltration rates can be estimated from the proposed model by using ArcGIS.

LuesezambanoRadrigo[10] International journal of scienceA spatial model for evaluating the vulnerability of water management in Mexico City:The process of water infiltration into the soil consists of two stages, which are infiltration and percolation stages. The infiltration stage is the movement of water from the earth's surface into the soil body, and the placement stage is the movement of water in the soil body (unsaturated zone) from the topsoil layer to the lower soil layer (water-saturated zone) (Sonaje, 2013). The infiltration and percolation processes play an important role in replenishing soil moisture and groundwater.

Mohammad Raja Sadikhani[11]Effect of land use on the performance of sallected soil water Infiltration model: The infiltration models examined, Model Kostiakov-Lewis is the best model for quantifying the process of infiltration. One reason for the excellence of Kostiakov-Louis model was great number of parameters than SCS, Kostiakov, Green-Ampt and Philip models and the fitting method is to determine the parameters mentioned models. This feature makes more flexible of this model than other model.

Renato Morbide Carla saltalippi[12] Infiltration rate decreased with increasing slope angle; image analysis of pore characteristics in the affected layer and sub sealpressure head measurements indicated there were no differences in seal characteristics between slope angles. The results showed that sealing intensity did not vary with slope angle, and the dominant influence of slope angle on infiltration rate resulted from changes in overland flow depth and surface storage. The results also suggest that small changes in seal hydraulic conductivity with microrelief play an important role in the infiltration process.

Kishan Singh Rawat,Tatung Taka Silkar[13]Infiltration rate plays very important role in concerning the efficiency of irrigation and drainage, optimizing the availability of water for plants, improving the yield of crops, minimizing erosion, and wastage of water. The soil physical properties, land use, vegetation coverage, and seasons also play a very important role in rate of infiltration. Infiltration models can be developed through PTFs using different soil properties and will be useful for the prediction of infiltration rate in the hilly region of Sikkim where the direct/field measurement of soil infiltration rate is very difficult due to one or more reasons.

MehandiRahmati[14]Increase in water infiltration will automatically reduce surface runoff and further stabilize river water discharges. Reducing water discharges through upstream water regulation can be a solution for downstream flooding.

Abdul khaider Aziz mutshar[15] The infiltration indicate to irrigation or rainfall water that penetrating the soil surface. This process represents the first phase of the movement of water in the soil. In the present study a double ring in- filtrometer was used to determine the field infiltration rate in three locations of soil of the Karbala Technical Institute. From the present study there are many result have been recorded:-

From the field measurements the initial infiltration rate (F 0) were found (64, 38, 32 cm/hr) while the steady stateinfiltration values; (F C) were found (6, 4.2 and 2.1 cm/hr) in the locations (1, 2 and 3) respectively in the study area.

The values of the infiltrations rate that calculated from the Horton equation gave a good match with the field-measured values, and the correlation coefficients values (R 2) were; (0.8001, 0.9167.0, 9253) in the locations (1, 2 and 3) respectively. That indicate to a good fittings of the Horton model with the filed result.

The soil for the three locations have a high permeability depending on the (Fo / Fc) ratio which is calculated from the field results.

The results showed that the soil infiltration rate was closely related to the granular gradient of the soil and since there was a positive relationship between the infiltration rate and the effective diameter (d 10). The results recorded a highest value of the constant infiltration; (F C) was (6 cm / hr) in the location (1) when effective diameter was (0.132 mm), while the lowest value was (2.1 cm / hr) in the location (3) when the effective diameter of (0.05mm). There is a significant correlation between the measured field steady state infiltration values; (F C(filed)) and their values were calculated according to the Horton equation (Fc (Horton)) and those calculated according to (ASTM D422) ; (FC (ASTM D422)) depending on the effective diameter (d10).

Yuije, Xinliang Wu, Jinwen Xia, Rubing Zeng [16] June 2019This study, the effects of erosion induced land degradation and rainfall intensity on infiltration process in the Ultisols was investigated by the field plot rainfall simulation experiments. Soil infiltration processes, including time to incipient runoff, the decay coefficient and the steady state infiltration rate, and their variability were generally larger at the high than at the low rainfall intensity, and showed an increasi

RobertaZambitoMarsala [17] 2019/2020 The effectiveness of engagement initiatives may depend more on how the initiative is implemented, rather than the choice of method used (Dean et al., 2016). It is generally assumed that face-to-face methods increase awareness and knowledge in attendees, facilitate the gathering of community opinion and preferences and also provide input for researchers. In our study, different consultation mechanism and strategies throughout the overall project, such as face to face meeting, direct survey, participatory monitoring and the planning of several training activities, were adopted. The low level of trust of the farmers, was the highest barrier at the beginning of the project.

SmaranikaMahaPatraMadam K. Jha [18] 30 January 2020EvaluatedAssessing Variability of Infiltration Characteristics and Reliability of Infiltration Models in a Tropical Sub-humid Region of India: The results of the detailed field investigation indicated that the average ‘quasi-steady infiltration rate’ of the study area is 22.23 ± 28.27 mm/h, which varies appreciably (CV = 127%) over the area. About 96% of the study area falls under ‘low’ and ‘medium’.

Rama Krishna VeldalanPalli[19] 2020His present study revealed the following: (i) groundwater depth and quality is affected due to dry and wet periods of the season (ii) the hydrological movement of rainwater depends upon the infiltration and soil properties and the obtained values are consistent irrespective of approaches used for the purpose.

Ajobin Thomas, A L Achu [20] 2020The approach enables us to locate the areas suitable for different groundwater recharge structures using remote sensing, geospatial data, and multi-influencing factor technique in the GIS environment. The geo-environmental variables used in the study are lithology, geomorphology, available space for recharge, slope angle, lineament density, soil texture, rainfall, percentage of sand fraction in soil, land use/land cover, and drainage density.

DurgaBahadurTiruwa, Babu Ram Khanal, SushilLamichhane and Bharat Sharma Acharya [21] 25 July 2020;In summary, the use of the RUSLE model and GIS provides a promising tool to map the spatial distribution of soil erosion risks, and results serve a valuable reference guide to other studies and policy makers for effective soil and water resource planning and management. However, RUSLE excludes the effect of mega-rill, gully, bank and channel erosion, and landslides, and deposition of eroded soil, and as such, priority should be given to field measurements of rainfall, soil properties, slopes, and NDVI for inclusion in erosion factors to improve model prediction and accuracy

G.Thabile1, D.M.Das1, S.K.Raul1, C.R.Subudhi1, B.Panigrahi[22] 09.10.2020/ SpringerThe present study was undertaken to identify potential

groundwater zones in the Kalahandi district of Odisha using the remote sensing, GIS and AHP, a multi criteria decision-making (MCDM) technique. Thematic layers of seven hydrogeological parameters were prepared using existing maps, satellite images and attribute data. Different parameters such as geomorphology, lineament density, dynamic groundwater, LULC, soil type, land slope and drainage density that affect the groundwater flow and availability were considered in the study.

Mohammed Saleh, AbdolmajidLiaghat[23] -2020In this study, we attempted to estimate infiltration values in saline soils using only early available soil parameters. For this reason, we selected nine soil surfaces with loam texture and different salinity. Double ring infiltration was measured with three replications at each point. Coefficients a and c were obtained using the Solver tool of Excel software and fitting the Kostiakov-Lewis equation with real infiltration values.

ElineApeneudujustino and other [24] - Jan 2021In general, infiltration can be determine by empirical and physical equations, laboratory and on site methods. However, the methods have as assumption that only vertical water movement occurs during infiltration at great depths, thus, horizontal movement is not represented (King, 1992); the application is expensive for large areas and does not describe all infiltration conditions (Sonaje, 2013); the work scale affects directly the infiltration response; and soil heterogeneity it has a strong effect on the predictions and scaling space-time relationships (Morel-Seytoux, 1988).

Vikram Kumar, BarkhaChaplot, PadamJee Omar, Shaktibala S. and H.Md.Azamathulla[25] 8 March 2021;Investigation of soil infiltration characteristics plays a crucial role in the field of water resource management and environmental protection. Infiltration measurement in the field will contribute meaningfully in predicting the runoff from the forest and other land use after the precipitation and how the soil and water can be conserved.

Nguyen DucLuong1,*, Nguyen Hoang Hiep 2 and ThiHieuBui1 [26]- 09 March 2021In this study, the VIC macroscale hydrological model was applied for simulation of the daily soil moisture at a grid resolution of 0.1 0.1 during the 10-year period of 2005–2014 for the northeast, northwest, and RRD regions of the RRB part belongs to the territory of Vietnam.

TabasumRasool 1, AbdulQayoomDar1,Mushtaq Ahmad Wani [27] - 2021In the current study, an effort has been made to determine the parameters of Horton, Kostiakov, Modified Kostiakovand Philip infiltration models in the urban sub-basin of lesser Himalayas from the easily measured soil properties. To collect infiltration data field experimentation using double-ring infiltrometerwas conducted. Parameters of selected infiltration models were initially determined by applying non linear.

Vikram Kumar, BarkhaChaaplot; and other [28]04 May, 2021Results showed that the average cumulative infiltration rate for the study area varies between 0.38-2.20 cm/min with an average rate of 1.16 cm/min.

Mirko Castellini1*, Simone Di Prima, David Moret-Fernández, Laurent Lassabatere [29] 3-10 August 2021This review paper has described some of the most promising methods for saturated soil hydraulic conductivity estimation (SFH and SBI) and a procedure for a complete soil hydraulic characterization, i.e., hydraulic conductivity function and water retention curve (BEST method). For these methods, some free tools were shared in order to both simplify their application to the agro-environmental applications and spread the techniques towards non-specialized users in soil science.

VSeongyunKim1,

GülayKarahanMananSharma1YakovPachepsky [30]-2021In the author evaluated which infiltration equation is more suitable using RF classification and investigate how soil properties, land use, and infiltration methods control infiltration equations. We used 4,830 cumulative infiltration data from the SWIG database. The Horton equation was found as the most suitable equation and Mezencev and Collis-George equations were ranked second and third, respectively.

III- CONCLUSION

Analyze & study of above journal research paper we found that occurrence of non-vertical rainfall could increase runoff with increasing slope angle when rainfall deflects a large angle to upslope it showed that sealing intensity did not vary with slope angle, and the dominant influence of slope angle on infiltration rate resulted from changes in overland

flow depth and surface storage, the small changes in seal hydraulic conductivity with micro relief play an important role in the infiltration process.Such infiltration studies are helpful for rainfall-runoff simulation. It revealed that current infiltration models are comprehensive, and formed their basis on many physical parameters.In general, usage of numerical computing software tools is growing by leafs and bounds. With extensive survey these tools are found to be capable of simulating not only water quantity but also quality.

The review empowers the researchers to choose appropriate model for water infiltration investigation. The average infiltration rate for cultivated land cover was 6.06 cm/hr and 4.34 cm/hr for bared land cover. Measured and predicted values were nearly same and curved were nearly fitted with each other. The average moisture content, bulk density and field capacity was found out to be 16.49%, 1.71 gm/cc, 26.23 % respectively, for cultivated land covers. The average moisture content, bulk density, and field capacity was found out to be 11.7%, 1.59 gm/cc, 29.55% respectively, for bared land.Philip model was the most accurate for estimating of the infiltration and Kostiakov model is also the second one.The infiltration process is affected by surface runoff, ground water recharge and erosion of soil. At a certain moment the infiltration capacity of soil is indicated by maximum infiltration rate. By adopting Φ index, which gives average rate throughout the rainfall, it is well suited for calculating maximum run off from a major storm on wet soils. In this study constant infiltration rates of the soils under different soil conditions were studied, compared with the infiltration rates and were verified with IS code 15792-2008. Because of highest infiltration rate in Malchalma village surface water is available even in summer. It has been proved that maximum infiltration results in excess of ground

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