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Rainwater use: Analysis of technical feasibility predicting water supply through rainwater harvesting

Ana Karolina Ronconi Matias[1] and Armando Ferreira[2]

ABSTRACT

The present ongoing case study will evaluate the technical feasibility of non-potable water consumption for activities that do not involve the need for potable water such as irrigation and in watersheds. Using information on the availability of rainwater, and the demand required by the evaluated region, data collected through the National Institute of Meteorology (INMET), we obtained the local rainfall indexes. In this way, the present work seeks to analyze the potential of rainwater supply to the Federal Institute of Education, Science and Technology of São Paulo – São Paulo Campus.

Keywords: Supply, Technique, Rainwater.

INTRODUCTION

The issue of the use of the lack of water has always been elucidated as one of the biggest current problems. A viable way to consciously reverse this situation is to rely on existing resources such as rainwater to supply regions that need or have greater demands, as is the case of the project in question.

The use of rainwater for non-potable purposes is a subject discussed in NBR 15527: 2019, which addresses the possible means for such use, as long as technical, economic, and environmental criteria are followed. This standard proposes some means to reach the final goal and guarantees the autonomy of the designer to choose the most viable path for the project, as long as it complies with the criteria.

The Rippl Method in Excel software presents a simple proposal, giving life to the project guided by NBR 15527, where initially the data of the land and the necessary demand for water must be added and configured appropriately according to the project to be analyzed. In this way, the software allows calculations to be carried out, presenting a result on the feasibility in a technical scope regarding the proposed project.

[1]Federal Institute of Education, Science and Technology – São Paulo
[2]Federal Institute of Education, Science and Technology – São Paulo

Figure 1 – Multi-sport gymnasium of the Federal Institute of Education, Science and Technology of São Paulo campus São Paulo, which will serve as a reference for the amount of rainwater collection

Source: Website of the Federal Institute of São Paulo, 2017

OBJECTIVES

The general objective of this work is to evaluate the technical feasibility of implementing a rainwater harvesting system, using the Ripple method, to supply the reservoir whose water is used to water the garden of the Federal Institute of Education, Science and Technology of São Paulo (IFSP) – Campus São Paulo, with rainwater captured from the gymnasium gutters.

For the development of the research, specific objectives are foreseen, such as presenting the technical potential of rainwater with the use of the system and developing simulations on the capture of rainwater to supply the institution in question.

METHODOLOGY

Initially, information for the year 2023 will be collected, through the website of the National Institute of Meteorology (INMET), such as precipitation data, presented in table 1 below, with the total rainfall per minute in the period of one year, catchment area of the studied site (Rua Pedro Vicente, 625 – Canindé, São Paulo - SP, 01109-010), of 432 m2, total rainwater demand of 250 L per capita/month, number of users equal to 200, percentage of total demand to be supplied by rainwater and surface runoff coefficient, considered equal to 1 (100% utilization). From the information obtained in the surveys, the system's service potential is calculated through a daily water balance.

Table 1 – Precipitation data for the year of the beginning of the year 2023 collected at INMET

Date	TOTAL RAINFALL, TIME (mm)
01/01/2023	0,2
02/01/2023	0,2
03/01/2023	0,4
04/01/2023	0,2
04/01/2023	0,2
04/01/2023	2,6
04/01/2023	0,2
04/01/2023	0
04/01/2023	1,6
04/01/2023	1,8
04/01/2023	4,0
04/01/2023	4,8
04/01/2023	6,0
04/01/2023	3,6
04/01/2023	0,6
05/01/2023	1,2
05/01/2023	1,0
05/01/2023	0,6
05/01/2023	0,2
05/01/2023	1,4
05/01/2023	3,2
05/01/2023	4,0
05/01/2023	0,4
05/01/2023	1,0
05/01/2023	0
05/01/2023	0
05/01/2023	0
05/01/2023	0,2
05/01/2023	0

RESULTS AND DISCUSSION

Through the Rippl Method to calculate the volume of water needed to meet the demand in question. You must add the data of the terrain and the required water demand and configure it appropriately according to the project to be analyzed. Excel will calculate the monthly rainfall volume (in m³) by multiplying the catchment area by the average monthly rainfall and applying a reduction factor of 20%, and the calculation of the volume of demand necessary to supply what is proposed, is made from the difference between the monthly demand, of 0.25 m³ per capita/day for 200 individuals, and the monthly rainfall volume. In this way, the project still under development intends to obtain the results presented in Table 2 below.

Table 2 – Rippl method for sizing the reservoir that meets the needs in question

Rippl Method			Catchment area = 432 m²	
Month	Average monthly rainfall (mm)	Monthly demand (m3)	Monthly rainfall volume (m3)	Demand volume and rainfall volume (m3)
January	132	50	45.6192	4.3808
February	132	50	45.6192	4.3808
March	132	50	45.6192	4.3808
April	132	50	45.6192	4.3808
May	132	50	45.6192	4.3808
June	132	50	45.6192	4.3808
July	132	50	45.6192	4.3808
August	132	50	45.6192	4.3808
September	132	50	45.6192	4.3808
October	132	50	45.6192	4.3808
November	132	50	45.6192	4.3808
December	132	50	45.6192	4.3808
Total:	1584	600		

FINAL CONSIDERATIONS/CONCLUSION

The project under development aims to reduce the consumption of drinking water that is in short supply, through the possibility of using rainwater through the capture and storage of such water, which can bring economically viable results that generate financial return in the long term, in addition to contributing to the conservation of drinking water.

Therefore, with Rippl's method and the results presented above, the possible feasibility of the project in the first instance is elucidated.

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