Noise Acoustic Pollution In Tikrit University Buildings

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Abstract

The present era is representing a noise era with excellence because of the spreading of communications media, music and visuals on a large scale, causing a state of negative disturbing and annoying, especially in buildings that need a large amount of relative calm, such as hospitals, libraries, schools and universities. In our research paper that has been selected (University of Tikrit) campus to make the measurements realistic and true to some vital buildings which are representing of selected classrooms to see how much the amount of acoustic noise affecting the functioning of the teaching process in those buildings, and also in the building reading halls of central library and several cafeterias inside university campus .It was observed that most of the buildings at the university suffers from an unacceptably high level of noise emitted from many sources .The results showed that the noise levels need for more attention to this phenomenon where it was found that the noise from the surrounding buildings exceeded all acceptable standards, as well as the ambient noise on the campus of colleges emitted from different sources continuously .

In this paper several criteria are studied to identify those specifications. These criteria are represented by the outdoor and indoor noise sources of classrooms and also the manner of measurement of direct mathematical calculations, as well as properties that affect the receipt of the concept of lecturer diction , including the Signal to noise ratio (SNR) and the distance between the Lecturer and students . It has been recommended, that it can be obtained a quiet classrooms using modern technology (construction materials, proper equipment, and design appropriate), as well as to give more attention to treat the noise sources with appropriate recommendations to reduce it like the noise emitted from diesel electrical generators , traffic nose and loudspeaker of cafeterias.

Key words: Noise, internal sources, external sources, voices.

1. Introduction

Noise enters all our facilities and become a problem for the comfortable of humans. Factories, streets, outer roads, and stations or airports, noise has crept into our life and without feeling in spite of the human tendency to adapt [1].

Continuous exposure to noise leads to loss of hearing with age and the estimated number of people from the age group (50-60 years) who have lost their hearing partially or totally are tens of millions of people and expected to increase the proportion of these people for the present generation of young people when they reach that age because of the increased exposure to noise compared to generations before them [2].

Noise pollution effects the understanding of lectures in the classrooms also effects on workers and students (customers) in restaurants and cafeterias. Hence the need to conduct a survey of noise pollution in the Tikrit University.

In this research, the field work included noise measurements and other field measurements for a number of buildings at the University of Tikrit included cafeterias, classrooms, and the central library. The following is a description of the equipment and tools used in this study as well as field work:

a. Digital Sound Level meter: In this study, sound level meter model 407 730 from the production of Extech Instrument Company as shown in Figure (1) is used to measure the noise.

Figure (1) sound level meter

b. Measuring tape: used to measure the distances between sound sources and recipients.

2. Fieldwork

Included measurements of noise pollution for a number of halls, restaurants (cafeterias) and number of classrooms in the University of Tikrit, as shown below:

1. Reading halls in the Central Library:
   A. Hall No.(1) with dimensions: (25 × 25 × 3) m.
   B. Hall No. (2) with dimensions: (25 × 25 × 3) m.
2. Faculty of Agriculture:
   A. Cafeteria (boys) with dimensions (15.7 × 11.5 × 2.5) m.
   B Cafeteria (girls) with dimensions (13.2 × 6.5 × 2.5) m.
3. Cafeteria of the Faculty of Pharmacy with dimensions: (18 × 17.5 × 2.9) m.
4. Student Center Cafeteria at the university with dimensions :(31 × 24 × 4.5) m.
5. Classroom at the Faculty of Law Department No. (2) with dimensions of: (14.5 × 8 × 4) m.
6. Classroom at the Faculty of Political Sciences No.(1) with dimensions of: (14.5 × 8 × 4) m .

2.1. Mathematical equations:

2.1. Sound pressure level (SPL) is a logarithmic value of the ratio between the instantaneous sound pressures effective to the acoustic pressure quadrate. The equations are listed below [3], [4].

$$SPL = 20 \text{ Log } \frac{P}{P_o} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$SPL = 20 \text{ Log } \frac{P}{2*10^{-5}}$$

SPL: sound pressure level dB (A).

P: acoustic pressure effective.

Po: acoustic pressure quadrate, hearing threshold ($2 * 10^{-5}$ Pa).

2. 2. Equivalent Continuous Noise Level (Leq):

$$Leq = 10 \text{ Log } [(t_1 * 10^{L_1/10} + t_2 * 10^{L_2/10} + t_3 * 10^{L_3/10} + t_4 * 10^{L_4/10} \ldots..) / T] \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Leq: the alleged equivalent continuous sound dB (A).

t1, t2, t3 ...: the time required for each particular sound pressure level (h).

L1, L2, L3, sound pressure level each time dB (A).

T: total time (hours) [5].

2. 3. Sound Pressure Level at Distance:

$$SPL = Lw - 20 \text{ Log } r - 11 \quad \text{(For absorbent Ground)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$SPL = Lw - 20 \text{ Log } r - 8 \quad \text{(For Non - absorbent Ground)} \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

SPL: sound pressure level at a certain distance dB (A).

Lw: sound pressure level ((measurement device)) dB (A).

r: distance (radius) m[6].

Constant depends on the type of land Are absorbent or non-absorbent of sound.

$$Drop = 20 \text{ Log } \frac{Far}{Near} \ldots\ldots\ldots\ldots\ldots (5)$$

Drop: reduction in the intensity of sound pressure level dB (A).

Near: the distance from the noise source to the point where the subject noise measuring device (m).

Far: The distance away from the noise source (m)[7].

Professor voice at a certain distance = voice professor at the measurement - the reduction site..... (6)

2.4. To measure verbal conceptual, we are using the speaker-to-noise ratio (SNR):

SNR = voice Professor at a certain distance - the existing noise level in the classroom [8] …. (7)

2.5. Find the outcome of the two source of noise:

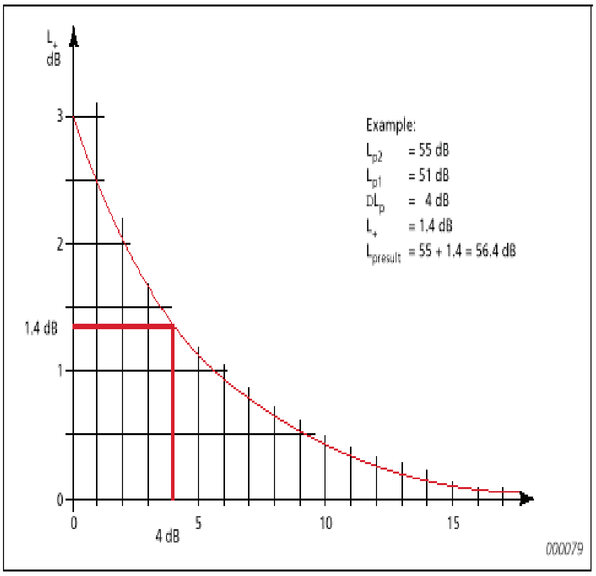

Fig. (2) Curve to create the effect of more than one source of noise on the final outcome.

The outcome of the noise (SPL) for two or more sources are not worth the simple combination of forced exporters to noise levels, but it is taking the difference between the noise level b dB (A) then extracted the increment from the curved shown in Fig. (3)[9][10].

3. Measurements tables.

Table (1) the noise level in the reading hall number (1) - Central Library.

The time From ---To	The number of the readers students	The case of diesel generator near the library	Noise inside the hall dB (A)	Noise equivalent dB (A)	Acceptable limit Leq dB (A)
9:00-11:00	39	Operated	60.6	57.99	30-45
11:00-12:30	35	Operated	55.4		
12:30-2:30	28	Operated	52.2		

Table (2) the noise level in the reading hall number (2) - Central Library.

The time From ---To	The number of the readers students	The case of diesel generator near the library	Noise inside the hall dB (A)	Noise equivalent dB (A)	Acceptable limit Leq dB (A)
8:45-11:00	19	Operated	48.3	49.03	30-45
11:00-12:30	20	Operated	51.0		
12:30-2:30	11	Operated	47.9		

Table (3) the noise level in the cafeteria (No.1) of the College of Agriculture.

The time From --To	Number of workers exposed Noise	Acoustic pollution sources	No.	Case Operating	Internal Noise level dB (A)	Exposure time Hour	Leq dB(A)	Notes
8:30-10:30	4	People (customers)	12		62.8	2	77.32	
		Loud speaker	1	x				
		Air Conditioner	1	x				
		TV	1	x				
		Fan	3	x				
		External noise level rate dB (A)	55.9	x				
10:30-12:30	2	People (customers)	14		77.8	2		
		Loud speaker	1	x				
		Air Conditioner	1	x				
		TV	1	x				
		Fan	3	x				
		External noise level rate dB (A)	67.2	x				
12:30-2:30	2	People (customers)	22		80.0	2		
		Loud speaker	1	x				
		Air Conditioner	1	x				
		TV	1	x				
		Fan	3	x				

		External noise level rate dB (A)	77.6	x				

Table (4) the noise level in the cafeteria (No.2) of the College of Agriculture.

The time From --To	Number of workers exposed Noise	Acoustic pollution sources	No.	Case Operating	Internal Noise level dB (A)	Exposure time Hour	Leq dB(A)	Notes
8:30-11:30	2	People (customers)	17		61.4	3	78.43	
		Loud speaker	1	x				
		Air Conditioner	2	x				
		TV	1	x				
		Fan	3	x				
		Cloning device	1	x				
		External noise level rate dB (A)	53.0	x				
11:30-1:30	2	People (customers)	28		81.8	2		
		Loud speaker	1	x				
		Air Conditioner	2	x				
		TV	1	x				
		Fan	3	x				
		Cloning device	1	x				
		External noise level rate dB (A)	76.6	x				
1:30-3:00	2	People (customers)	25		79.9	1.5		
		Loud speaker	1	x				
		Air Conditioner	2	x				
		TV	1	x				
		Fan	3	x				
		Cloning device	1	x				
		External noise level rate dB (A)	78.1	x				

Table (5) the noise level in the cafeteria of the College of Pharmacy.

The time From --To	Number of workers exposed Noise	Acoustic pollution sources	No.	Case Operating	Internal Noise level dB (A)	Exposure time Hour	Leq dB(A)	Notes
8:30-10:30	11	People (customers)	10		70.7	2	78.16	Cafeteria close to street traffic for vehicles
		Loud speaker	1	x				
		Air Conditioner	5	x				
		TV	1	x				
		Fan	5	x				
		External noise level rate dB (A)	67.8	x				
10:30-12:30	11	People (customers)	70		80.8	2		
		Loud speaker	1	x				
		Air Conditioner	5	x				
		TV	1	x				
		Fan	5	x				
		External noise level rate dB (A)	79.5	x				
12:30-2:30	11	People (customers)	25		78.1	2		
		Loud speaker	1	x				
		Air Conditioner	5	x				
		TV	1	x				
		Fan	5	x				
		External noise level rate dB (A)	80.3	x				

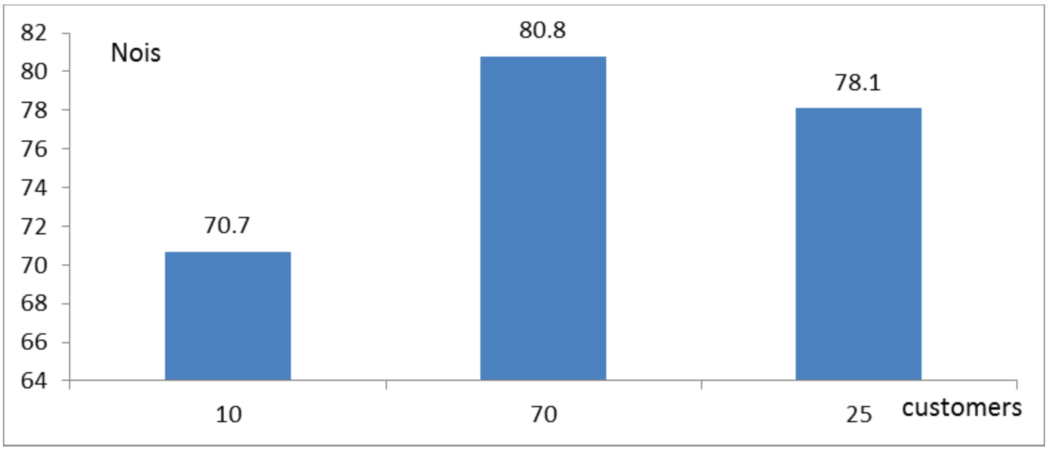

Fig.3. The relationship between the customers and the noise in the cafeteria of the College of Pharmacy.

Table (6) the noise level in the cafeteria of the Student Center.

The time From --To	Number of workers exposed Noise	Acoustic pollution sources	No.	Case Operating	Internal Noise level dB (A)	Exposure time Hour	Leq dB(A)	Notes
8:30-10:30	5	People (customers)	31		63.3	2	79.22	
		Loud speaker	2	x				
		Air Conditioner	5	x				
		TV	2	x				
		Fan	18	x				
		Billiards	4	x				
		External noise level rate dB (A)	71.6	x				
10:30-12:30	5	People (customers)	95		82.89	2		
		Loud speaker	2	x				
		Air Conditioner	5	x				
		TV	2	x				
		Fan	18	x				
		Billiards	4	x				
		External noise level rate dB (A)	77.6	x				
12:30-2:30	5	People (customers)	70		77.5	2		
		Loud speaker	2	x				
		Air Conditioner	5	x				
		TV	2	x				

		Fan	18	x				
		Billiards	4	x				
		External noise level rate dB (A)	81.3	x				

Table (7) the noise level at the Faculty of Law classroom No.(2).

The time From - -To	Number of students	Acoustic pollution sources (All works)	No.	Professor Voice dB (A)	Internal noise level busy by students dB (A)	Leq dB(A)	External noise level dB (A)	Internal noise level Unoccupied and without work devices dB (A)	Damping Noise walls, windows and door dB (A) (All are Not matching)	SNR dB(A) Distance from the Professor (3 meters)
8:30-10:30	96	Air Conditioner	1	**65.3**	**58.6**		**75.4**	**58.6**	**16.8**	**-8.86**
		Fan	2							
11:00-1:00	96	Air Conditioner	1	**69.0**	**60.9**	**59.4**	**77.6**	**60.9**	**16.7**	**-7.46**
		Fan	2							
1:00-2:00	65	Air Conditioner	1	**62.8**	**56.4**		**73.9**	**56.4**	**17.5**	**-9.16**
		Fan	2							

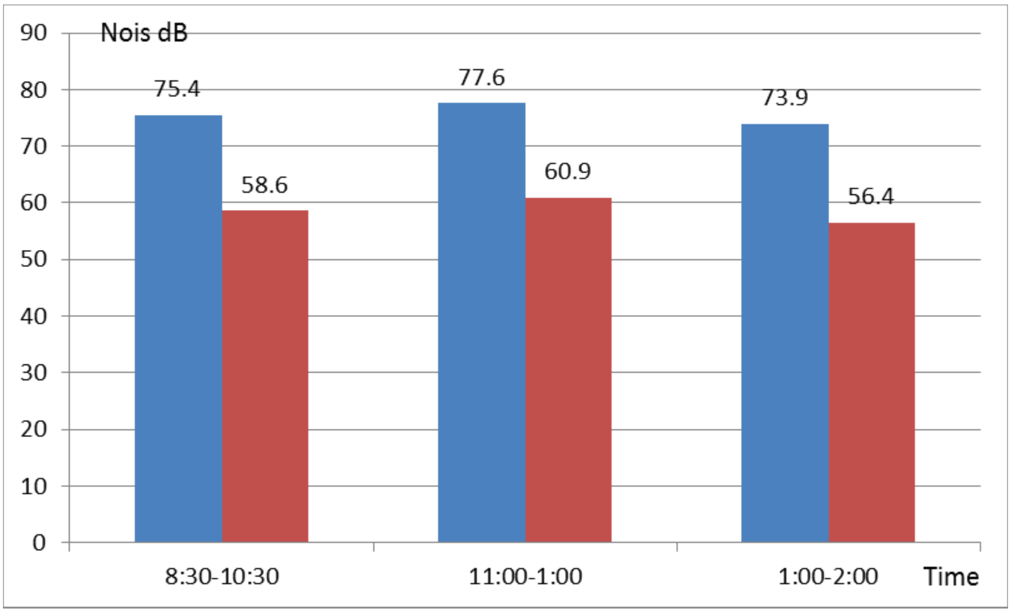

Fig.4. The relationship between time and noise at the Faculty of Law classroom No.(2).

Table (8) the noise level at the Faculty of Political Sciences classroom No.(1).

The time From - -To	Number of students	Acoustic pollution sources (All works)	No.	Professor Voice dB (A)	Internal noise level busy by students dB (A)	Leq dB(A)	External noise level dB (A)	Internal noise level Unoccupied and without work devices dB (A)	Damping Noise walls, windows and door dB (A) (All are Not matching)	SNR dB(A) Distance from the Professor (4 meters)
8:30-10:30	25	Air Conditioner	1	**79.9**	**73.4**		**79.9**	**73.4**	**6.5**	**-5.54**
		Fan	2							
10:30-12:30	20	Air Conditioner	1	**78.4**	**71.9**	**72.11**	**78.5**	**71.9**	**6.6**	**-5.54**
		Fan	2							
12:30-2:30	18	Air Conditioner	1	**71.8**	**70.6**		**77.5**	**70.6**	**6.9**	**-10.84**

		Fan	2							

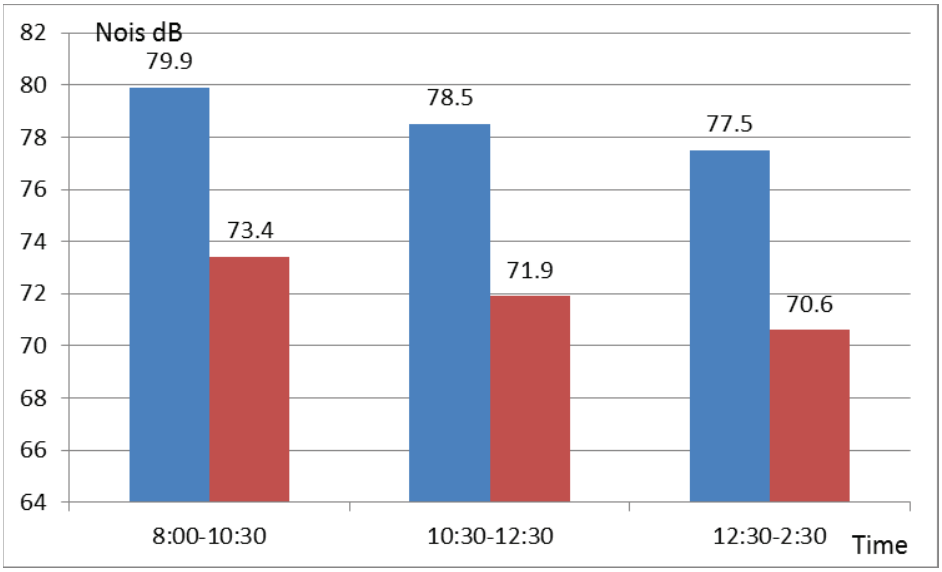

Fig.5. The relationship between time and noise at the Faculty of Political Sciences classroom No. (1)

4. Results and discussion.

Noise in the cafeterias results from internal and external sources. The internal noise includes: talking while eating, and noises from operating electrical devices such as sound speakers which launches loud music, TVs, fans, and air-conditioners. While external sources is represented in all the sources that surround the restaurant besides electrical diesel generators. Noise level in the cafeteria is directly proportional to the number of diners and the time of the day. It was noticed that (12:30 - 2:30PM) recorded the highest level of noise where this period represents the peak of the noise. There is also a direct correlation between the numbers of customers with the internal noise level of the cafeteria.From Table 5 and figure (3), It can be noticed that high level of noise was monitored in the period (10: 30- 12:30PM) with noise level of 80.8 dB (A), which approves the presence of the largest number of customers (70 customers). Besides that, 5 electrical fans were operated which contributed to maximize the noise in a substantial increase in the internal noise pollution. As for the external noise to the cafeteria of Faculty of Pharmacy, the resultant of the noise comes from two main sources: first customers gathered in front of the entrance of the cafeteria and second the traffic noise where the cafeteria is located close to the street. To compare the results with the determinants described in the table (4) and (5) and (6) – we noted that the equivalent noise level in the cafeteria was 78.16 (dB A) which is higher than the allowable limits, while it be noted that (11) workers exposed to equivalent noise level of (78.16 dB (A)) which is within the acceptable limits.Tables (7) and (8) shows results obtained for classroom of Law Department No. (2) and classroom No.(1) of the of Political Science Department. Results (A) showed that the noise level of the two classrooms were 59.4 and 72.11 dB respectively and at least 18 students were exposed to this level of noise and when comparing with specifications, it is clear that the noise level of the classrooms are off limits and the exposure of students in the two classrooms is within acceptable limits. The external noise of classrooms of Law Department classroom No.(2) and (1) of the of

Political Science Department of the periods set out in tables above are 75.4, 77.6 , 73.9 dB (A), and 79.9, 78.5,77.5 dB (A). And internal noise level 58.6, 60.9, 56.4 dB (A), and 73.4, 71.9, 70.6 dB (A). Thus, the noise damping of the two classrooms of 16.8 , 16.7 , 17.5 dB(A) and 6.5, 6.6 , 6.9 dB (A) respectively, as shown in figures (4) and (5).

5. Conclusions and recommendations.

5.1. Conclusions

1. Noise level recorded in reading halls in the Central Library and cafeterias was higher than the allowable limits and that there is direct proportion between the number of readers and the level of noise in the halls.
2. Internal noise level in classrooms is higher than the permissible limits, and the sound damping ratio of the walls, doors and windows is less than the engineering specifications.
3. The speaker-to-noise ratio SNR in classrooms is low except for students sitting the front rows. This affects hearing and understanding the lecture by recipient students.
4. Diesel generators effected directly to the infiltration of noise to reading halls in Central Library and , cafeterias and classrooms.

5.2. Recommendations

1. Noise pollution must be taken into consideration when designing any building from architectural point by choosing the function of that room (reading room, cafeteria. Sports hall, classrooms), which provides the lowest level of reverberation time .
2. Acoustic insulation of walls, ceilings and floors must be taken into consideration in the design and implementation of any building in, and using doors and windows that provide better damping of external noise .
3. The landscaping work around the buildings is suitable environmental solution which prevents the transmission and reduction of the noise.
4. Develop a soundproof barriers for diesel generators at the University to prevent the transmission of noise to the halls and buildings .
5. Not using amplifiers and recorders with high votes in the cafeterias.
6. Studying the traffic noise pollution within the campus and its impact on the buildings at the University.

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Modeling Water Harvesting System Using Soil Water Assessment Tool (SWAT) (Case Study in Iraq)

Imzahim Abdulkareem Alwan [1], Ibtisam R.Kareem [2], and Mahmood J. Mohamed[3]

Abstract— Estimation of runoff volume and analyzing quantity of water is needed to aid the engineers and researchers for knowing the quantity of water harvesting and determined the potential of utilization the collection water for irrigation or drinking and other uses.

The main objective of this study is to estimate the runoff volume for Wadi-Al Naft watershed with an area of (8820km^2), which is located inter the geographic coordinates ($45^\circ\,00'\,00''$to $46^\circ\,00'\,00''$) E, ($33^\circ\,00'\,00''$ to $34^\circ\,00'\,00''$) N at the North-East of Diyala city in Iraq republic , by using Soil Water Assessment Tool (SWAT).

SWAT requires three basic data for delineating the basin into sub basins, a digital elevation model (DEM), soil map and land use/land cover (LULC) map.

Soil Conversation System (SCS) was used with Geographic Information System (GIS) to develop the land use, soil type and soil texture maps from Landsat-8 (ETM+) satellite image. Also, Digital Elevation Model (DEM) is used to delineate the watershed and for computing watershed properties.

Index Terms— **Runoff, Water harvesting, Land sat 8, SWAT , case study-Iraq**

I. INTRODUCTION

Rainwater harvesting (RWH) refers to collection of rain falling on earth surfaces for beneficial uses before it drains away as Runoff. The concept of RWH has a long history. Evidences indicate domestic RWH having been used in the Middle East for about 3000 years and in other parts of Asia for at least 2000 years. Collection and storage of rainwater in earthen tanks for domestic and agricultural uses is very common in the world, since historical times. The main purpose of hydrologic model is to estimate the amount of surface runoff, sub surface runoff, water stored in the soil, and the changing of them through the seasons.

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(II) SCS CURVE NUMBER METHOD

SCS Curve Number (CN) is method for estimating direct runoff volume response from rainstorms was developed to fill technological niche in the 1950. Since then, use of the CN method has extended to other applications, and user experience and analysis have redefined numerous features of the original technology (Hawkins, et al, 2008). Its popularity is rooted in its convenience, its simplicity, is authoritative origins, and its responsiveness to four readily grasped catchment properties: soil type, land use/treatment, surface condition, and antecedent condition (Ponce and Hawkins, 1996). SCS Curve number method is an infiltration loss model, although it may else account for interception surface storage losses through its initial abstraction feature. As originally developed, the method is not intended to account for evaporation and evapotranspiration (long-term loses) (Ponce and Hawkins, 1996).

Watersheds have a certain group of soil and fair pasture cover can be classified by various curve numbers. These curves are the relationship obtained between rainfall and runoff, such that, (Chow, 1964):

$$F/S = Q/P \tag{1}$$

Where:

F=P-Q: is actual retention (mm).

S: is potential retention (mm).

Q: is actual runoff (mm)

P: is potential runoff that is total rainfall (mm).

Initial abstraction, I_a, is all losses before runoff begins. It included water retention in surface depression and intercepted by vegetation, infiltration, and evaporation as shown in figure (1).

I_a : is subtracted from rainfall P in equation(1) yields:

$$(P - Ia - Q) / S = Q / (P - Ia) \tag{2}$$

Solving for Q yields

$$Q = \frac{P-0.25s}{P-Ia+s} \tag{3}$$