Design of Rectangular Weir (Sivakasi Lake)

S. Rajesh, B. Saritha, Maria Subashini L

Abstract: ***The study was undertaken to design a weir in sivakasi lake of Tamil nadu. The present details of the lake such as combined catchment, intercepted catchment of the lake, full tank level, maximum water level of the tank, bund level, ground level and details of the weir such as size of the weir, materials used for the construction of the weir were analysed. And we have collected the population in that area, rain fall data, flood ratio of that particular lake and total number of houses in that area, number of houses in upstream and number of houses in down stream of the lake. The cause of designing a weir is due to the damage in the existing weir and bunds of the lake so it cannot with stand the pressure of the water in heavy rain fall. To avoid the flood water entering in the residential areas near by the lake we have designed a weir. So that the water can be saved in the lake and there will be no flood occurs in due to the heavy rain fall.***

Keywords – Collection of data, design of the weir.

I. INTRODUCTION

A weir is the water powered structures that have been utilized for quite a long time by pressure driven designing for guideline of stream profundity, stream estimations, vitality scattering, stream, and stream redirection. It also refers to a wall or obstacle used to manage the flow from settling tanks and clarifiers to make certain a consistent flow rate and avoid short-circuiting. Weirs are some oldest structures used in canals, river, and reservoir application for water flow measurement[1]-[5]. They may be defined as overflow structures built across channels or rivers to divert or split water. Weirs are usually used to observe rivers flow keeping in mind the end goal to shield from flooding and bolster navigation Weirs are flood structures for estimating release and controlling stream in open channel. Doors and funnels are additionally considered as estimating and controlling stream gadgets. Entryways and weirs have been utilised widely for stream control and release estimation in open channel. Regarding the significance of increment the release, this examination was done to do the trick the expected water requests[6]-[10]. The examination objective is to expand the weir release without expanding the water head above it. This could be accomplished by opening the two channels to expand the release. As started earlier, the excess surplus water is spilled from a tank, into the downstream channel, so as to avoid the rise of water in the tank above the M.W.L. In fact, the water will generally start spilling over the crest of the escape weir, as and when it rises above

F.T.L. ; and the discharging capacity of this weir will be designed so as to pass the full maximum flood discharge with a depth over the weir equal to the difference between F.T.L and M.W.L. Weirs are likewise used to gauge release in open channels by utilizing the standard of quickly shifted stream. They are broadly utilized in open diverts in water system channels, labs, ventures, and furthermore utilized as dam instrumentation gadget. Weirs are most normally utilized because of their effortlessness and simplicity in development, sturdiness and precision in estimation[11]-[15].

II.OBJECTIVES

The main objective of the study is to:

1. To identify the most suitable outlet of the weir construction.
2. To determine the water demand including crop water requirements and domestic uses.
3. To prepare a detail design drawing of weir.

A. Need For the Study

Now a days the demand of water increases day by day. Due to increase of industries, residencies, etc. So the water capacity in the lake is decreasing. But by the construction process of weir we can increase the height of storage of water in the lake. So that the storage capacity of the lake can be increased and can be used for several purpose(domestic and agriculture).

III. EXPERIMENTAL STUDY

Sivakasi lake, locally known as meemampatti, is a lake in the sivakasi Next to Madurai, tamilnadu, India. The lake is near to sivkasi road Junction. Government is planned to construct a park and maintain the meemampatti lake. The lake, which was once a drinking water source for the neighbourhood, now has water for most part of the year and is a haven for birds. The coordinates of this area Latitude:12.922744’6,Longatude :80.151744’E. The Water Resources Department (WRD) has decided to improve meemampatti lake.The improvement works include removing vegetation, desilting, introducing boating, and developing a park along the 3-km bund. Other works include planting various species of medicinal and flowering saplings to attract butterflies and birds, creating a walkers' path and a mud flat in the middle of the lake.

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NO	DETAILS OF THE WEIR	SIZE
1	FULL TANK LEVEL OF THE TANK	2m
2	CREST LEVEL OF THE TANK	2.8m
3	MAXIMUM WATER LEVEL OF THE TANK	3m
4	GROUND LEVEL	2

Figure -1 Details of the weir

IV. CONCLUSION

No	Materials used in construction of weir
1	Rock.
2	tailing from mining or milling.
3	concrete.
4	masonry.
5	steel.
6	timber.
7	miscellaneous materials. (plastic or rubber)

Figure -2 Materials used in Construction weir

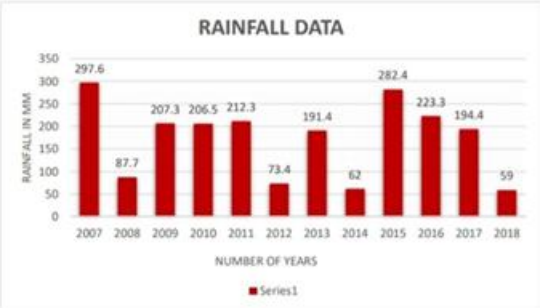
Depth of the lake	12.192m	40ft
Height of bunds	4.572m	15ft
1	COMBINED CATCHMENT	10 Sq.Km
2	INTERCEPTED CATCHMENT	8 Sq.Km
3	NO OF HOUSES	8069
4	HOUSES IN UPSTREAM	5043
5	HOUSES IN DOWNSTREAM	3026

Figure -3 Details of the lake

V. RESULTS

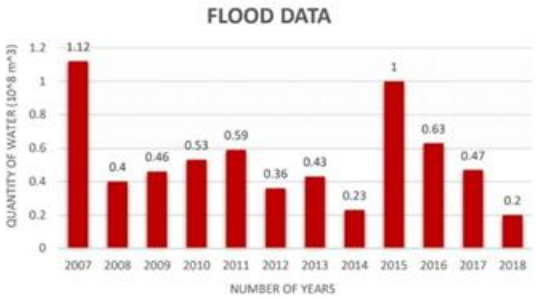
A. Rain Fall Data

The average rainfall in sivakasi area for past 12 years. By seeing the flow chat we can clearly know the increase of the rainfall in past years. In this the amount of rainfall has been shown in mm scale. The average rainfall has been shown from 2009-2019[16]-[22].



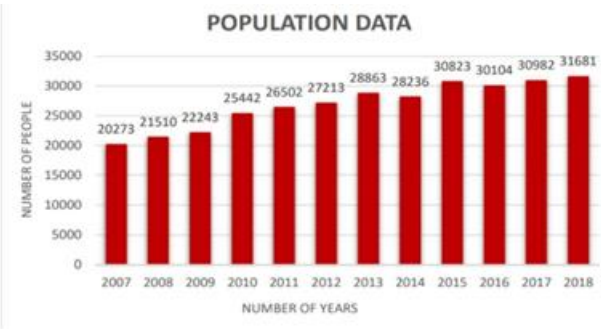
B. Flood Data

Flood data for last 12 years. Encroachers damaged the bunds of sivakasi area lakes — at three points and one, respectively — which led to the flooding of surrounding areas. Though the municipality had placed over 300 sandbags at these points at the sivakasi lake, water gushed out, causing panic in the area. Many areas around the lake were flooded[31]-[36]. Miscreants similarly damaged the bund at the sivakasi lake, which caused flooding of vacant plots and residential localities in sivakasi and the neighbouring sivakasi. As water drained throughout Sunday night and for most part of Monday, the lake became dry in the evening[23]-[26]. Around 3,000 houses in meemampatti, and a little over 2,000 houses in meenampatti, have come up on the bed of these lakes in the past few years. sivakasi Eri, known for its high pollution levels and encroachments, developed a breach near the meemampatti lake 200 Feet Radial Road, and the rain water gushing from it paralysed traffic for most part of the day. Flood waters entered commercial establishments on radha Road and marooned over 500 residents of Krishna Nagar, Royappa Nagar in Varadharajapuram and Adambakkam, who were evacuated by Fire and Rescue Service personnel and experts from National Disaster Response Force (NDRF) from Arakkonam[27]-[30].



C. Population Data:

The population data for last 12 years. The population have been increased in the following year 2007-2018.



D. Formula used for design a wiers:

Height (H) = MWL - FTL

Depth of fall (D) = F.T.L – G.L

Total length of horizontal floor = 3(D + H) Length of d/s talus = 4(D + H)

Length of crest = LC = $5\sqrt{(H.H)L}$

Length of weir = Qp = C1A2/3 -c1a2/3

QP = CLH3/2

Bottom width of weir b = (H+d)/√ρ

Top width to be fixed a =0.552(√H + √d)

MWL = maximum water level FTL
= full tank level

G.L = ground level D = depth of weir H = height of weir

LC = Length of crest

QP = peak floor discharge

C1 = coefficient in ryve's formula

c1 = coefficient from 1/5th to 1/3rd of C1 A = area of the combined catchment

a = area in sq.km of the catchment in upper tank

b = bottom width of body wall a = top width to be fixed

H = height of weir above the floor level d = depth of water above the weir crest

ρ = specific gravity of masonry of body wall.

E. Calculation

Design of rectangular weir : Combined catchment = 10 sq.km
Intercepted catchment = 8 sq.km

F.T.L of tank = + 3.065 m
Crest level of the tank = + 3.048 m

M.W.L of the tank = + 4.267 m

G.L = 2.00

Solution:
Depth of water over weir crest (H) :

H = M.W.L – F.T.L
= 4.267 – 3.065
=1.202 m

The depth of fall (D)

D = F.T.L – G.L
= 3.065 – 2.00
= 1.065 m

Total length of horizontal floor

= 3(D+H)
= 3(1.065 + 1.202)
= 3(2.284)
= 6.852 m

Length of d/s slope

= 4(D+H)
= 4(1.065 + 1.202)
= 4(2.267)
= 9.068 m

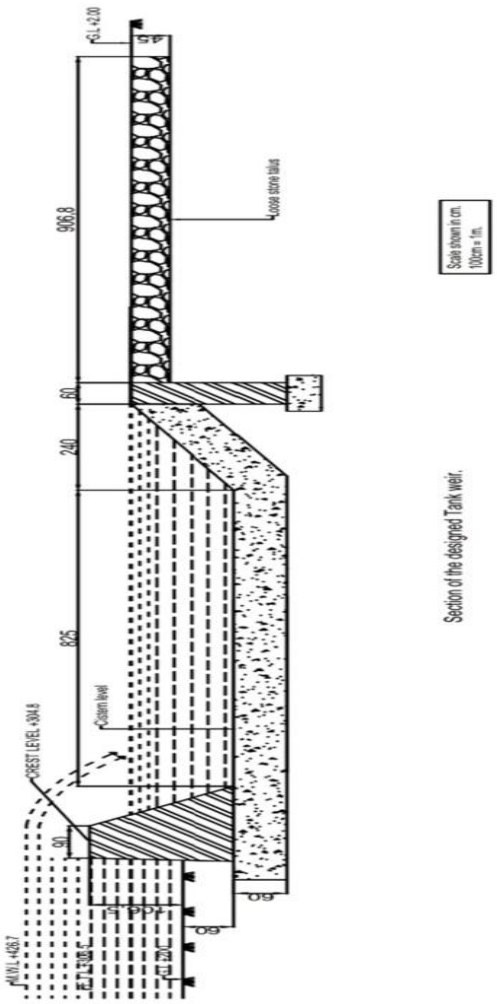
The depth to which horizontal floor is depressed

X = 1/4 (H – HL) 2/3
= 1/4 (1.202 – 2.267)2/3
= 1/4 (2.72)2/3
= 0.49 m

Length of glacis

Lc = 5 × √(H – HL)
= 5 × √(1.202–2.267)

F. Design of Wier



VI. CONCLUSION

The main goal of this project was to increase the size of the weir in sivakasi lake,Tamil Nadu. By collecting the dates of the lake and the surrounding areas and analyzing the conditions of the weir. We have made few changes in the sizes of the weir. So that in future the storage and the discharge of the sivakasi lake have been increased. And can avoid the discharge of the excess water from the lake. And it is safe for the bunds in the flood season when there is excess of water in the sivakasi lake in heavy rain fall.

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