International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249 – 8958, Volume-8, Issue-6S3, September 2019

Flood Control and Water Management at Basin Level -at Orathur of Kanchipuram District

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ABSTRACT---The water resources management affords many solutions to manage water more holistically and optimally. In essence, they are a call to stop fragmentary approaches to water management and high-handed development decisions made for the benefit of a single user group of action.The Integrated Water Basin Management and its components are used to find a suitable flood mititgation measure. The study area is Orathur of Kancheepuram district. The data that are used in this work is been taken for the consecutive 20 years and it has been analysed. With the overall data the GIS mapping is done using ArcGIS software to locate the area precisely. Its tributaries and origin from Manimangalam tributary is located clearly to estimate the inflow and outflow of the water and the demand for water at the particular region is found and then analysed for the planning of water management and flood control..

Keywords: integrated water management, flood control, water conservation

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I. INTRODUCTION

A basin-level analysis also helps in distinguishing between two important aspects of management: resource management at the macro level, and the service delivery management at the system level. They need to be compatible with each other for efficiency and productivity and optimum level of water use.

II. WATER CONSERVATION COMPONENTS:

- Major users allocation
- Priorities in River basin planning
- Participation of Stake holders in decision making
- Managing pollution and appropriate incentives to minimize environmental impacts
- Implementing effective monitoring system
- Sustainable benefits of financial management

Information management.

a. ELEMENTS OF THE WATER-BASIN PERSPECTIVE

There are key elements of the river basin approach that are commonly applicable to all basin locations. Appropriate Institutional Arrangements

- Reliable Information Base
- Integrated Natural Resources Management in the Basin
- Strong Community Participation

Local people are enabled for long-term association with the basin environment to gain a very intimate knowledge about the constraints on resources use. Effective community participation leads to an adjustment in the existing power relationships both within and outside the community.

B. NEED FOR STUDY

- To suggest improved flood controlling methods.
- To collect and review the data and information of flood control and their relevant case studies.
- To derive the water balance for the river, and to suggest sustainable management strategies for the river basin.

C. OBJECTIVES

- To establish a balance between the existing natural functions of the river system and the developed aspects of the system.
- To promote the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner.
- To control the flood and to manage the water maintenance.

II. METHODOLOGY

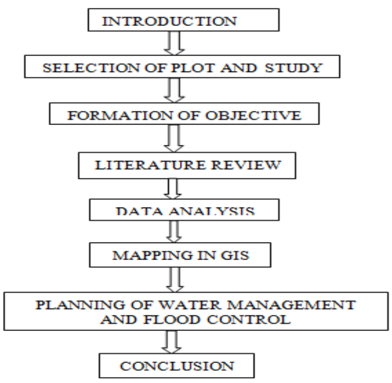

fig 3.1 flow chart for the process of flood control and water management

Revised Manuscript Received on 14 August, 2019.
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D. LOCATION – ORATHUR

It is one of the most affected area during flood periods.It is a small village/hamlet located in Thiruporur block of Kanchipuram district near which is connected from Manimangalmlake and it is near Bay of Bengal.It is surrounded by Kattankolathur block towards west, Tirukkalukunram block towards south, Chengalpattu block towards west, St. Thomas mount block towards north.

The location is specialized in ArcGIS to locate the tributaries and the origin of the basin precisely. It is shown in the Fig 3.2

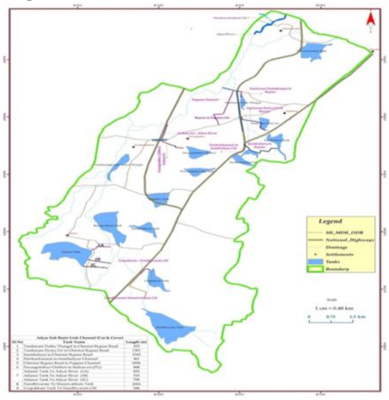


Fig:3.2 Location – map

D. SELECTION OF ORATHUR FOR CHECK DAM

Selection of plot is very important for building a Check Dam. The factor to be considered while selecting the construction site are availability of utility services,the drainage area should be ten acres or less,the water way should be on a slope of no more than 50% and should have a minimum depth to bedrock of two feet.

E. DESIGNING ELEMENTS

In this chapter the design of check dam and the data are been tabulated, analyzed and then calculated.

4.1 DESIGN OF CHECK DAM

4.1.1 DISCHARGE CALCULATION

STEP:1 Top of bank = 20.40 m

Bed level = 17.650 m

Observed MFL = 18.85 m

Available free board = 1.552 m

Bed width of river = 36.40 m

Bed slope orathur=0.00077 (1 in 1300)

Assume water depth = 1.20 m

Wetted perimeter, P = 40.718 m

Area, A = 45.7446371 m^2

$R = \frac{A}{P}$

n = 0.025 (forearthern channel)

s = 1 in 1300

$V_d = \frac{1}{N} x R^{2/3} x S^{1/2}$

Q = AV

= 54.894 m^2/sec =1938.57 cumecs

STEP: 2 Rear water level calculation (RWL) - 1

C/S at L.S = 100 m downstream

Rear water level (assume) = 30.490 m

Required discharge = 7455.70 cumecs

= 0.02832 x 7455.70

= 211.12 cumecs

Discharge passing = 213 cumecs

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

The different chainage levels are observed and tabulated for the calculation of wetted perimeter. The tabulation of wetted perimeter is shown in the Table 4.1

Table 4.1 Calculation Of Wetted Perimeter

CHAINAGE	LEVEL	ORDINATE	AREA	WETTED PERIMETER
0	30.990	-0.500	0.000	0.000
10	30.150	0.340	6.650	10.021
20	29.500	0.990	15.250	10.057
30	28.430	2.060	24.725	10.034
40	27.605	2.885	28.70	10.0
50	27.635	2.855	16.650	10.279
60	30.015	0.475	5.650	10.002
70	29.835	0.655	1.675	10.047
80	30.810	-0.320	0.00	0.00
		TOTAL	99.3	70.441

Wetted perimeter, P = 70.44056109 m

Area, A = 99.3 m^2

$R = \frac{A}{P} = 1.409699$

n = 0.025

S = 1 in 550 = 0.001818 (adopt)

$V = \frac{1}{n} x R^{2/3} x S^{1/2} = \frac{1}{0.025} x 91.409699)^{2/3} x (0.001818)^{1/2}$

= 2.144 m/sec

Q = A x V

= 212.9236 cumecs

Or 75192848 cusecs

Discharge passing = 213 cumecs

Hence, adopt a rear water level (RWL) = +30.490 m

STEP: 3 REAR WATER LEVEL CALCULATION (RWL) – 2

Cross section at L.S = 300m Downstream

RWL (Assume = 30.445m

Required Discharge = 7455.70 cusecs

Discharge passing = 11583.32 cusecs

Since the RWL is not verified, the different chainage levels are observed again and tabulated for the calculation of wetted perimeter. The tabulation of wetted perimeter is shown in the Table 4.2

Table 4.2 Calculation of Wetted Perimeter

CHAINAGE	LEVEL	ORDINATE	AREA	WETTED PERIMETER
0	30.610	-0.120	0.000	0.000
2.1	29.965	0.525	12.475	10.104
12.1	28.520	1.970	27.225	10.113
22.1	27.015	3.475	31.850	10.017
32.1	27.595	2.895	26.575	10.011
42.1	28.070	2.420	18.050	10.075
52.1	29.300	1.190	4.725	10.102
62.1	30.735	-0.245	0.000	0.000
72.1	30.735	-0.245	0.000	0.000
74.2	30.735	-0.245	0.000	0.000
		TOTAL	120.900	60.422

Wetted Perimeter (P) = 60.4223574m
Area (A) = 120.9 m^2
R = A/P = 2.000915
n = 0.025
S = 1 in 550 may be adopted
= 0.001818
V = $\frac{1}{N} \times R^{2/3} \times S^{1/2}$
= $\frac{1}{0.025} \times (2.000915)^{2/3} \times 0.001818^{1/2}$
= 2.7082 m/sec
Q = A* V
= 327.4178 cumecs
Discharge passing = 328 cumecs
Hence, adopt a Rear Water Level of, **RWL = +30.445m**

4.2 DETERMINATION OF FRONT MAXIMUM WATER LEVEL

Design discharge = 54.878 m^3/s or 1938 cusecs
Crest level = +18.400 m
Upstream bed level = +17.650 m
Downstream bed level = +17.650 m
Assume FMFL = 19.280 m
Height of weir, P = 0.6 m
Head over crest, $H_{o.}$= 0.880 m
$\frac{P}{H_0}$ = 0.68 < 1.33
Velocity of approach should be taken
$V_a = \frac{Q}{A}$ = 0.019 m/sec
N_r = head due to velocity, $\frac{V_a^2}{2g}$ = 0.053 m
Effective head, $H_e = H_o + \frac{V_a^2}{2g}$ = 0.933 m
Total length of struct between abutments = 36.4 m
Length of ancient portion, L = 36.4 m

4.2.1 DISCHARGE OVER WEIR PORTION

Top width of crest (assume) = 2.0 m. (1.5m from stability)
1.5 x crest width = 3 m
1.5 x crest width > head over crest
3 > 0.88
The weir function as a broad crested weir

Discharge over weir, $Q = Q_f + Q_d$
where, $Q_f = \frac{2}{3} \times C_{d1} \times (2g)^{0.5} \times B \times (h)^{3/2}$ free weir equation
$Q_d = C_{d2} \times (2gh)^{0.5} \times B \times h_1$ drowned weir equation
Co-efficient of discharge, C_{d1} = 0.577, C_{d2} = 0.8
h = FMFL – RWL = 0.430 m
B = waterway = 0.430 m
H_1 = depth of discharge water level above crest = 0.45 m
$Q_f = \frac{2}{3} \times 0.577 \times (2\times9.81)^{0.5} \times 36.4 \times (0.43)^{3/4}$
= 17.49 m^3/sec
$Q_d = 0.8 \times (2\times9.81\times(0.43))^{0.5} \times 36.4 \times 0.45000000000003$
= 38.06 m^3/sec
Total discharge of weir = 55.55 m^3/sec/1961.74 cusecs
Percentage of discharge passing = 101.23%

RESULT

Total discharge through scour vents & over weir portion = 1961.748 cusecs
Design discharge for the anicut = 1938 cusecs
Hence safe.

4.2.2 DISCHARGE THROUGH SCOUR VENT PORTION:

(partially submerged orifice flow)
Discharge through scour vents, $Q = C_d \times b \times \sqrt{2g} \times \{[(H_2 – H) \times \sqrt{H}] + (2/3 (H^{3/2} - H_1^{3/2}))\}$
No of vents = 0
Size of vents = 2.4 x 1.5 m
Area of opening , A = 0 m^2
Co-efficient of discharge , C_d = 0.62
Clear waterway, b = 0 m
Head causing flow, H = FMFL – RWL = 0.430 m
H_1 = FMFL – top of vent opening = 0.130 m
H_2 = FMFL –bottom of vent opening = 1.630 m
Discharge , $Q = 0.62 \times 0 \times \sqrt{2} \times \sqrt{9.81} \times \{[(1.63 – 0.43) \times \sqrt{0.43}] + 2/3(0.43)^{3/2} – (0.13)^{3/2}]\}$
= 0.0 m^3/s or cusecs

RESULT:

Percentage passing through scour vents = 0.0%
Total discharge through scour vents & over weir portion = 1961.748 cusecs
Design discharge for the anicut = 1938 cusecs
Hence safe.

F. OTHER FLOOD MITIGATION MEASURE:

FLOOD REGULATOR

Flood regulator is referred as the pressure regulator which is a control valve that reduces the input pressure of a fluid to a desired value at its output. It provides an equitization of hydrostatic pressure on either side of the wall. It is defined as the orifice in an enclosed structure intended to allow the free passage of water between the interior and exterior.

As the climatic change and the subsequent sporadic variation in the rainfall is driving the need for climate adoptive infrastructural interventions are imperative.

In this front, the river Adyar and its tributaries are widened for full width and flood banks are formed. The width of the tributaries and part of main river has almost doubled now. This scenario has given scope for formation of riverine reservoir.

In the Adyar basin, the Chembarambakkam tributary alone having flood control regulators at the tail end of Chembarambakkam tank. All other Adyartributaries via Bomangalam, Manimangalam, Orathur and Adamur do not have the flood control shutters or regulation arrangements. Now the present proposal of construction of formulation of Riverine reservoir and construction of flood regulators is muted out with multifaceted objectives and benefits.

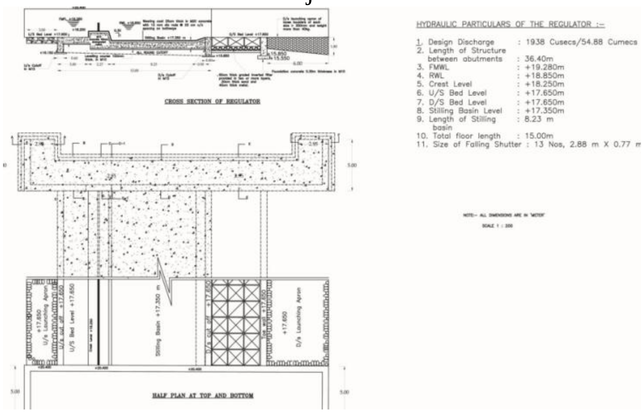
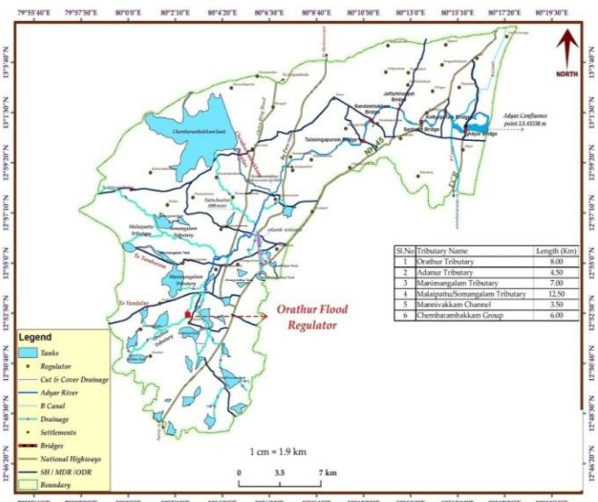


Fig.4.1 Construction of Regulator at Orathur, Kanchipuram district

G. GIS MAPPING



IV.CONCLUSION

The project involves the flood control and water management at Orathur locality. A check dam is designed to control the flood and water management and the data from the TamilNadu Water Department has been analyzed for design purpose. This project is designed with GIS mapping of the Orathur locality to study the area. The design of Check Dam is made clearly which is considered to achieve more than fifty percent of flood mitigation. As a flood regulator, it will give crucial breathing time by regulating the flood by buffering the flood and truncate the flood peck to a sizable extent.Ground water recharge will lead to rising of water level and supplement the irrigation as well as local body water supply.

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