NEW TANK PROJECT

GUIDED BY:

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SYNOPSIS

New tanks are constructed to provide water for multipurpose activities. Tanks and reservoirs requires very careful planning, design and operation for which certain observation relating to selection of site, merits of different types of tank storage capacity optimum yield, co-ordinate usage for storing for different purpose are studied in detail.

The irrigation tanks are primarily constructed to store the excess water during the period of the last supply in rainy season and release it gradually for irrigation purpose when required. As per the university regulations the extensive survey project work was taken up at **Shri Kshetra Kaiwara-Chikballapur District for** 12 days (05/02/2019 – 17/02/2019)

The proposed site for tanks across natural valley is situated around 2km from Shri Kshetra Kaiwara temple towards Kempadenahalli the latitude and longitude 13°21'5.7960``N and 77°59` 37.8636``E respectively.

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Salient features of the project

DETAILSOF THE SITE:	
Location of the Project	Kaiwara
Distance from Bangalore	58km
Distance from Development	3km
Nature of the Project	New tank project
Type of the Bund	Earthen bund with puddle core wall
DETAILS OF STORAGE RESERVOIR:	
Catchment Area of Tank	6.44sqkm
Area irrigated	812.89 Hectares
Proposed crop pattern	Wheat crop, Ragi, Jowar and vegetable
DETAILS OF BUND:	
Type of Bund	Earthen bund with puddle core wall
Length of Bund	289m
Top width of Bund	3.0m
Maximum Height of Bund	7.95m
Top level of Bund (TBL)	909.495m
Maximum Water Level (MWL)	908.495m
Full Tank level (FTL)	907.495m
Dead Storage Level (DSL)	902.555m
Lowest Bed Level (LBL)	901.555m
Upstream Slope	1.5:1
Downstream Slope	2:1
Rock Toe	Provided Rip-Rap
Upstream Revetment	50cm Thick Stone Revetment And15cm Gravel Backing
Sluice Level	902.555m
DETAILS OF THE WASTE WEIR:	
Type	Broadcrested surplus weir
FTL	907.495m
Depth Of Spillage	1.0m
Length Of The Weir	15m
Top Width of the Waste Weir	1.6m
Bottom Width Of The Waste weir	4.5m
DETAILS OF MAIN CANAL:	
Canal Takeoff RL	902.555m
Longitudinal Gradient of the Bed	1 in 2000
Bottom Width of the Canal	1.0m
Depth of the Water	1..0m
Side Slopes	1.5:1
Free Board	0.5
Type of Sluice	Tower Head Tank Sluice

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NEW TANK PROJECT

1.1 Introduction:

New tanks are constructed to provide water for multipurpose. Tanks and reservoirs requires careful planning, design, and operation for which certain observations relating to selection of site, relative merits of different types of tanks, storage capacity, coordinated use of storage for different purposes etc. are studied in detail

The formation of new tank near Kaiwara has taken up as mini project work as per university regulations.

1.2 Object of New tank project:

The main object of the new tank is to construct an earthen dam across the steam for the purpose of irrigation. Since the land to be irrigated is very small and population of the town is very less, it is not necessary to construct a major work but it is sufficient to provide minor tank project.

The new tank project (NTP) involves three major operations.

- The Selection of site for proposed dam
- The selection of site for waste weir

1.3 Dam:

A Dam is an impregnable and impervious barrier thrown across a natural drainage line to impound water up to a certain limiting height which is usually lower than the top of the dam on its upstream side. Its main function is to store water either for irrigation or water supply or produce power.

Choice of the type of the dam:-

Classification of dams: -

Dams are usually classified as

- *Rigid dams.*
  1. Gravity dam
  2. Arched dam
  3. Arched buttress dam
  4. Steel dam

5. Timber dam
6. Reinforced cement concrete panel and buttress dams.

- Non – rigid dams
  1. Earthen dams.
  2. Rock fill dams.

➢ **Earthen dams**: -

Earthen dams and earthen embankments are the most ancient type of embankments as they can be built with the natural materials with a minimum of processing and with primitive equipment.

Earthen dams are classified as follows:

Type A – Homogeneous embankment type

Type B – Zoned embankment type

Type C – Diaphragm type

Homogeneous embankment: The simplest type of earthen embankment consists of a single material and is homogeneous throughout sometimes a blanket of impervious material may be placed on the upstream face. A purely homogeneous section is used when only one type of material is economically or locally available such sections is used for low to moderately high dams and for large dams are designed as homogeneous embankment.

Zoned embankment: Zoned embankments are usually provided with a central previous core, covered by a comparatively previous transition zone which is finally surrounded by much more previous outer zone. The outer zone gives stability to the central impervious fill and also distributes the load over a layer area of foundation.

Diaphragm embankment: - Diaphragm type embankment have a thin impervious core, which is surrounded by earth or rock fill. The impervious core called diaphragm is made up of as an impervious soil, concrete, steel, timber or any other materials. Its acts as a water barrier to prevent escape through the dam. The diaphragm may be placed either at the central or at the upstream face as a blanket.

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1.4 **Irrigation**: -

Irrigation may be defined as the process of artificial supply of water to soil for raising crop. It is a science of planning and designed of effective low cost, economical irrigation system tailored to fit the natural condition s. It is the engineering of the controlling the various natural sources of the water by the constriction of dam and reservoir, canal and headwork and finally distributing the water to the agricultural field. Irrigation engineering involves the study and design of work in connection with river controlled drainage of water logged areas and generation of the hydro-electric power.

Methods of Irrigation:

Irrigation is classified as two methods;

1. Flow irrigation
2. Lift irrigation

Flow irrigation: flow irrigation is the method of taking water to the land to be irrigated by the by the flow of gravitation. The water is stored at such a level in reservoirs, tanks that it can be easily transmitted to the irrigable lands by gravitation through canals.

The classification of flow irrigation are:

1. Perennial irrigation
2. Inundation irrigation
3. Direct irrigation or River canal irrigation
4. Tank irrigation or Storage irrigation

Lift irrigation: When the water available for irrigation is at a lower level than the land, then it has to be lifted by pumps or other water lifting devices and this method is known as lift irrigation. This water is sometimes stored in the tanks and then distributed to the lands by gravity system.

- **Tank irrigation**:

Tank irrigation may be defined as the storage irrigation scheme which utilize the water stored on the upstream side as a smaller earthen dam called as "Bund"

These earthen bunds reservoirs are thus in fact called as "Tanks".

Especially in the south India, where such works are very common. This terminology is limited to India only. There is no technical relationship between the reservoir and tank except that a large sized tank will be termed as reservoirs. More over a reservoir will be generally formed by dam of any

materials such as masonry dam. Concrete dam, earthen dam whereas tank is generally said to be formed to earthen dam as earthen bund .Most of the existing tank. South India passes a maximum depth 4.5m while a few is as deep as 7.5m to 9.5m and only a few are exceptional one which exceeds 11m depth. When the depth of the tank exceeds 12m or so then the tank is generally to as a reservoir.

Like all earthen bunds, tank bunds are generally provided with sluice or outlets for discharging water from the tank for irrigation and other purposes. These tank sluice may be pipes or rectangular as arched opening passing near the base of the bund. For carrying the water to the dam downstream side channel below the bund transporting at distance where required through pipes or canals. Sometimes these supply sluices may not be carried adjacent to it through hill side one end of the bond.

Similarly tanks are provided with the arrangements for the spilling the excess, surplus water that may ne enter into the tank so as to avoid over lapping of the tank bund. These surplus escape arrangements may be in the form of the tank bund or some other arrangements like siphon spillway may be provided in the case of the earthen dam project. The surplus escape weir in a masonry weir with its top i.e. crest level equal to full tank level [F.T.L] when the tank is full of up to F.T.L and extra water come in, then it is discharged over the surplus escape weir, surplus escape weir will also be designed that water level in the tank never exceeds the maximum water level, the top of the tank bund will be kept at a level so as provided a suitable free board and the maximum water level [M.W.L].

Since the surplus escape weir is a masonry weir then it will have to be properly connected to the earthen bund by suitably designed tank connection.

Water requirement of Crops:-

For the full successful growth of the crops, every crops require a definite quantity of the water, suitable agricultural soil, good irrigation and the proper method of cultivation. The total quantity of water required by a crop from the instant of sowing till it comes to the harvesting is known as water requirement of crops. It depends upon the following.

- The season in which the crop is growing
- Its period of the growth i.e., its crop period
- The climate condition of the region
- The rainfall in the season
- The water requirement of a crop varies from the place to place from season to season

1.5Components of DAM :

1.5.1 Weir:-

Weir is a structure constructed at right angles to the direction of the flow. Its purpose is to raise the water level and then divert it into the canal. As the tanks are the small storage works constructed to meet the local requirements obvious by attempting is not made to contain full run off coming down from the catchment area. It is therefore necessary to make suitable arrangement to pass from the excess water beyond F.T.L. The structure constructed to provide passage to excess water is called as "escape weir". It is also called as a "Tank surplus weir".

The Water starts spilling over the weir as soon as tank is filled up to its crest. However temporarily due to rush of incoming water. The level in the tank raises above F.T.L., the new level is reached is called as "maximum water level" [M.W.L.]. It depends on the extent of the flood for the design purpose M.W.L is calculated taking into the account maximum flood discharge likely to carry and water may be available at the site for escape weir. The surplusing as spill way water is carried down through a channel which is generally a natural discharge and has an enough capacity. As weir may be constructed in the masonry, rock fill, cement concrete etc…

Types of weir:

Escape weir constructed in the tank irrigation system is similar to a diversion weir are constructed across the river channel.

It may be classified as following types;

1. Masonry weir.
   - Masonry with the horizontal floor.
   - Masonry weir with depressed floor.
   - Masonry weir with stepped floor.
2. Rock fill weir
3. Concrete weir

Selection of site for a weir:

Following are the point may be taken into consideration while selecting a site for a tank weir.

- Tank weir performs the function of the surplusing excess flow therefore it is preferable to locate the weir in a natural saddle away from the tank bund.

- To carry surplus flow existence of a well-defined escape channel is very necessary at a site selected for the construction of a weir.
- The saddle where natural surface level us approximately same as tank level [FTL] should be given first performance.
- Hard foundation if available at the site reduces the cost of the construction.
- When a site is away from the tank bund is not available as for as possible weir may be located on one end of the tank bund.
- Surplus weir may be hosed in the body of the tank bund only as a last resort.
- Care should be taken to see that escape channel surplusing water is not likely to damage cultivated land.

1.5.2 Canal:

Canal is passage for the flow of the water from reservoir or tank to an irrigational field or any other field necessary. Water in a canal flow under gravity and the upper most surface of the water is sometimes stored in the tanks and then distributed to the lands by gravity system.

Classification of the Canal:

1. Based on the canal alignment
   - Contour canal
   - Water shed canal
   - Side slope canal
2. Based on distribution system
   - Main canal
   - Branch canal
   - Major distributaries
   - Minor distributaries
   - Water courses.

Guidelines for aligning a canal:

- The alignment should follow a falling contour and shall be in cutting
- The depth of the cutting should be minimum
- Alignment should be straight
- Curve should be long, minimum radius should be twenty times the bed width of the canal.

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- Number of cross drainage works should be minimum
- Longitudinal slope of the canal bed should provide non – silting and non – scoring velocity of flow.
- Alignment shall progress as far away from natural drain to yield large command area.

Longitudinal slope for canal:

Longitudinal slope for can shall be as a possible and is guided by minimum permissible velocity in the channel should neither be silting non – scoring. The value generally varied from 1 in 2500. It depends on natural terrain and type of the canal.

Slide slope of the canal:

Slide slope of the canal is an important feature in canal generally steeper slope section, narrower, deeper, increased velocity and discharge permits width. It also decrease evaporation and percolation loses. Slide slope is filling 1.5:1 is generally used in the hard and rocky soils.

Type of canal cross – section:

1. Fully embankment
2. Partial cutting and partial filling
3. Fully cutting

1.6 Surveys conducted for the new tank project:

Reconnaissance :

A site for the new project will be fixed based on the following preliminary investigations.

- Catchment area of a place
- Average rainfall of a place
- Suitable site for the bunds, weirs and sluice
- Extent land to be irrigation with nature of the crop.
- Available of the construction materials.
- Financial feasibility of the project

Longitudinal and cross section along the centre line of the bund:

- From the permanent benchmark fly levels are carried out to establish a benchmark on the left bank or right bank wherever the work is to be started.
- The end points of the bund are fixed and the wooden pegs are driven at regular intervals.
- The center line bearing is noted using prismatic compass
- From the both the ends of bund bearing to the permanent object such as transformer, electric pole, building etc...
- Above the centerline of the bund already fixed longitudinal section at every 5m interval on centerline and cross section at15m interval up to or beyond the embankment cases on either side taken 5m interval.

Height of the bund = tank bund level -ground level base.

Width of the bund = [U/S slope X Height + Top width + D/S slope X height].

The day's work is constructed at temporary benchmark established.

Block leveling at waste weir :

- The top of the weir should be at FTL. Fix the centerline and mark left and right points.
- Construct a block of 50m length on U/S side and 50m length D/S side.
- Carry out block leveling at every 5m level.
- Work is started and closed at established bench mark.

Block leveling at tank sluice :

- RL of the canal at tank, take a point on the centre line of the bund.
- Construct a block of 40m along the centre line and 40m on side of the centerline.
- Divide this entire area into smaller block of 5m X 5m
- Carryout the block leveling along with the point.
- Start and close down the work with respect to the permanent benchmark.

CONTOUR TRACING :(TOTAL STATION)

- Measure the bearing of the bund line.
- Locate two flag point along the centerline of the bund
- Set up the Total station at a commanding position.
- RL's of ground points in the catchment area are measured by bisecting the target.
- The salient points such as electric poles, telephone poles are also recorded

- Contours are drawn by interpolating the ground RLs.
- Area of Contours is calculated.
- Volume of capacity contours computed

1.7 DESIGN DETAILS

1.7.1 DESIGN OF EARTHEN DAM SECTION

1. FREE BOARD

As per VSBR recommendation, for uncontrolled spillway, the minimum free board over the maximum water level should 2m

2 TOP WIDTH OF THE DAM SECTION

The top width of the dam should be sufficient to keep the seepage line well above the body of the dam when the Reservoir is small.

For small dam no vehicular traffic movement on the top of the dam the top width is calculate as H/5. In our case, the maximum height of bund is 8.0m. Therefore, top width =8/5=1.6~ 3m.

3 SIDE SLOPE FOR EARTHEN DAM:

For low to moderately high dams, homogenous section is used. In our case, the maximum height of the dam is 8m, which is a low height dam. Using homogeneous well graded material for the dam section as per Terzaghi's recommendation the upstream slope is taken as 1.5H: 1V, and the downstream slope is taken as 2H: 1V

4 TO ESTIMATE THE FLOOD DISCHARGE OF THE RIVER:

Flood discharge of a river is estimate by Dicken' formula as shown below:-

C= constant of the catchment, which is 13 for the site with small hilly terrain as 1.0 km^2.

Therefore, flood discharge in the river, $Q=13*16^{(3/4)}$

Q =13cumes

1.7.2 CAPACITY (By contours)

	RL OF BUND	AREA (M^2)	HEIGHT (M)
TBL	909.495	A_4=92322.039	h_4=7.94
MWL	908.495	A_3=64213.049	h_3=6.94
FTL	907.495	A_2=49686.322	h_2=5.94
DSL	902.555	A_1=4611.905	h_1=1.0

To estimate the volume of the reservoir from trapezoidal rule:

$V= (A_1x\ H_1) + (A_2x\ H_2) + (A_3x\ H_3) + (A_4x\ H_4)$

Where, $H_1=(h_0+h_1)/2$

$H_2=(h_1+h_2)/2$

$H_3=(h_2+h_3)/2$

$H_4=(h_3+h_4)/2$

Therefore;

$H_1 = (0+1)/2=0.5m$

$H_2= (1+5.94)/2=3.47m$

$H_3= (5.94+6.94)/2=6.44m$

$H_4=(6.94+7.94)/2=7.44m$

$V = (92322.04*7.44)+(64213.05*6.44)+(49686.32*3.47)+(4611.90*0.5)$

$V = 1275125.50m^3$

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1.7.3 DESIGN OF CANAL:

Capacity of reservoir =1275125.50m^3.

Assume that the reservoir gets filled 3 times during the monsoon period.

Total water available in the reservoir = 3*1275125.5m^3

=3825376.5m^3.

Let us assume the losses due to evaporation & percolation as 15% of the total capacity.

The net water available for the reservoir is = 0.85*3825376.5

=3251570.025 m^3

Let us select wheat crop for the canal design.

Therefore, delta (Δ) for wheat crop = 0.4 m.

[Taken from irrigation text, by S.K Garg]

Therefore;

Area of the land that can be irrigated = 3251570.025 /0.4

=8128925.063 m^2

= 4781720.06/10^4

= 812.89hectares.

Since the area under irrigation is small,

Therefore, the project is not economically feasible for minor tank irrigation.

Hence for our survey project purpose, we are assuming the area under irrigation as 1500 hectare

Duty for wheat crop is 1800 hectare/cumecs.

Therefore,

Discharge required in the canal = Q = 1500/1800

= 0..833cumecs.

Design of canal section by Kennedy's theory,

Data:-

Slope of the canal bed = 1:250

$= 4*10^{-3}$.

Depth of flow in the canal = 1.5-0.5

= 1.0 m.

Side slopes for trapezoidal section is 1H:1V.

Critical velocity ratio = m = 1.1

Use Kutters rugosity coefficient = N = 0.023

$V_0 = 0.55my^{0.64}$

$= 0.55x1.1x1.0^{0.64}$.

= 0.605 m/sec.

Area = A = Q/V_0

= 0.833/0.605

= 1.376 m^2.

A= y (b+y/2)

1.376 = 1.0x(b+1.0/2)

b = 0.876 m.

Assume the breadth of the canal is 1m

Wetted perimeter = P = b+[2*√(1 + 1/4)]*y.

= 1+[2*√(1 + 1/4)]*1.0.

= 3.236 m.

Hydraulic mean depth = R = A/P. = 0.98/3.236 = 0.425 m

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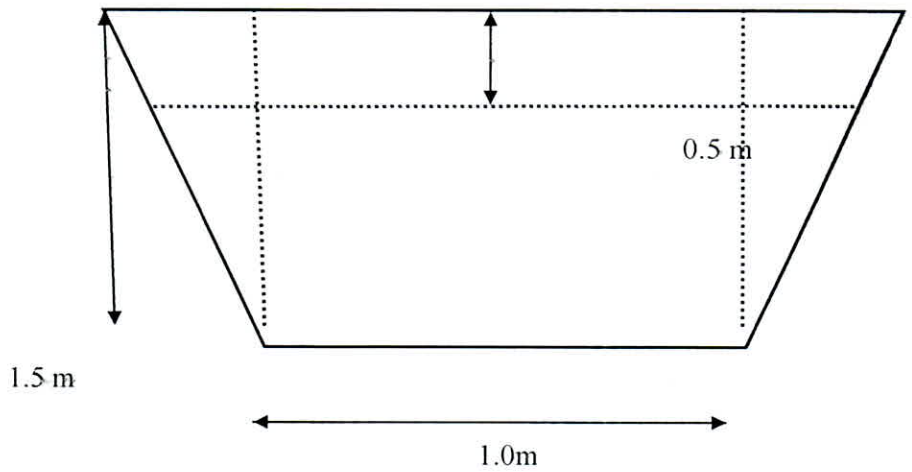
.Canal Dimensions:

Width = b = 1.0 m.

Depth of flow = y = 1.0 m.



1.7.4 DESIGN OF WASTE WEIR:

The weir includes the following components and the designs of these are as below: Estimation of flood discharge entering the tank Design of clear length of crest

1. Estimation of flood discharge entering the tank:

Catchment area of the tank, A = 6.44sq.km

Ryve`s coefficient C = 6.42 (for limited area near hills)

Flood discharge entering the tank is given by

$Q = C \times A\ (2/3)$

$= 6.5*6.44^{(2/3)}$

$= 22.49\ m^3/sec$

1.7.5 Design of Rectangular Weir

Length of the weir is calculated by considering rectangular shape

$Q = 2/3\ Cd\sqrt{2g}\ L\ (h^{3/2})$

$22.49 = 2/3*.62(\sqrt{2}*9.81)*L*0.5^{(3/2)}$

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L = 34.74m ≈ 40m

Provide the clear length of the waste weir to discharge surplus water=40m

Since, temporary arrangements are to be made on top of waste weir to store water in times of necessity the dam stones of size 0.15 x 0 .15m will be fixed in the center of crest weir at 1m c/c with its top at MWL.

Weir details:-

Height of the weir above the foundation concrete,

H= FTL - HARD STRATA

=907.495-903.500 = 3.995 ~ 4m

a. Top width of the weir:

The weir is considered as broad crested weir and discharge is given by, h = 1m

a = 0.55 [√H+√h]

= 0.55 [√4+√0.5]

=1.5m

b. Bottom width or Base width of weir:

b =(H+h)/(√s−1)

= (4+0.5)/(√(2.4-1)) = 4.2m ~ 4.5m

Where, S = Specific gravity of masonry (2.3 to 2.6)

c. Abutment:

Top width = 1.0

Bottom width = 0.4 x H = 0.4 x 4 = 1.6

d. Upstream side wing wall:-

Section at is same as that of abutment wing wall starts sloping from A with a slope of 1:5.1 in flush with the slope of tank bund till it reaches 0.3m above MWL. The length of return provided 3m. Let us provide 4m length of apron of 0.9m thick of concrete and 5m length of apron 0.5m thick concrete and 5m length of apron 0.5m thick talus is provided on the D/s side

1.7.6 DESIGN OF DIRECT SLUICE:

Let us provide a plug sluice pipe arrangement for feeding water from the reservoir to the canal.

Discharge required in the canal = 0.833cumecs.

We have the formulae;

$Q = C_d * A * \sqrt{2gh}$.

Where; Q = discharge.m^3/sec

A = area of the outlet sluices.m^2

H = difference in of the head causing flow. It is the difference of upstream and downstream water level.

C_d = co-efficient of discharge.

Let us take h = 1m for shallow depth of head available for the flow.

Let us consider (C_d) co-efficient of discharge as 0.60.

Therefore;

$0.833 = 0.6 * A * \sqrt{2} * 9.81 * 1$

A = 0.169 m^2.

Providing circular pipe, we have

$$\text{Area (A)} = \frac{\pi}{4} * d^2 0..169 = \frac{\pi}{4} * d^2$$

d = 0.465 ~ 0.50m

Hence let us provide sluice pipe of diameter 500 mm or 0.50m

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EARTHWORK CALCULATION

1.8 BUND CALCULATIONS

Chainage	Depth	Mean Depth (d)	Central Area Bxd	Side Area 1 $(S_1xd^2)/2$	Side Area 2 $(S_2Xd2)/2$	Total Area	Distance	Filling
0	0						0	
15	1.235	0.6175	1.8525	0.286	0.381	2.520	15	37.797
30	3.795	2.515	7.545	4.744	6.325	18.614	15	279.212
45	5.075	4.435	13.305	14.752	19.669	47.726	15	715.892
60	5.395	5.235	15.705	20.554	27.405	63.664	15	954.962
75	5.815	5.605	16.815	23.562	31.416	71.793	15	1076.896
90	6.335	6.075	18.225	27.679	36.906	82.810	15	1242.148
105	6.705	6.52	19.56	31.883	42.510	93.953	15	1409.298
120	7.015	6.86	20.58	35.295	47.060	102.934	15	1544.015
135	7.245	7.13	21.39	38.128	50.837	110.355	15	1655.319
150	7.605	7.425	22.275	41.348	55.131	118.754	15	1781.304
165	7.705	7.655	22.965	43.949	58.599	125.513	15	1882.699
180	7.91	7.8075	23.4225	45.718	60.957	130.097	15	1951.460
195	7.94	7.925	23.775	47.104	62.806	133.685	15	2005.273
210	7.76	7.85	23.55	46.217	61.623	131.389	15	1970.841
225	7.835	7.7975	23.3925	45.601	60.801	129.794	15	1946.914
240	6.67	7.2525	21.7575	39.449	52.599	113.805	15	1707.080
255	1.715	4.1925	12.5775	13.183	17.577	43.337	15	650.060
270	1.805	1.76	5.28	2.323	3.098	10.701	15	160.512
285	0.045	0.925	2.775	1.283	0.856	4.914	15	73.711
							Total	**23,045.391**

Where S1 = 1.5 S2 = 2 B = 3

TOTAL VOLUME OF THE BUND:

VOLUME (V) = 23045.391m^3

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1.9 CANAL EARTHWORK CALCULATIONS:

Chainage	Depth	Mean Depth (d)	Central Area B*d	Side Area 1 S1*d^2	Total Area	Distance	VOLUME	
							CUTTING	FILLING
0	-1.5					0		
15	-1.63	-1.565	-1.565	3.674	-5.239	15	-78.583	
30	-0.455	-1.0425	-1.0425	1.630	-2.673	15	-40.091	
45	-0.29	-0.3725	-0.3725	0.208	-0.581	15	-8.710	
60	-0.195	-0.2425	-0.2425	0.088	-0.331	15	-4.961	
75	-0.135	-0.165	-0.165	0.041	-0.206	15	-3.088	
90	-0.045	-0.09	-0.09	0.012	-0.102	15	-1.532	
105	-0.02	-0.0325	-0.0325	0.002	-0.034	15	-0.511	
120	-0.455	-0.2375	-0.2375	0.085	-0.322	15	-4.832	
135	1.635	0.59	0.59	0.522	1.112	15		16.682
150	2.68	2.1575	2.1575	6.982	9.140	15		137.096
165	3.495	3.0875	3.0875	14.299	17.386	15		260.797
180	3.94	3.7175	3.7175	20.730	24.447	15		366.708
195	4.255	4.0975	4.0975	25.184	29.282	15		439.226
210	4.46	4.3575	4.3575	28.482	32.839	15		492.588
225	4.87	4.665	4.665	32.643	37.308	15		559.625
240	5.095	4.9825	4.9825	37.238	42.220	15		633.307
255	4.055	4.575	4.575	31.396	35.971	15		539.564
						TOTAL	**-142.306**	**3445.594**

Where S1 = 1.5 B = 1m

Total volume of embankment:

$$V_E = h\,[(A_1+A_n)/2+A_2+A_3+\ldots\ldots\ldots A_{n-1}]$$

$$=3445.594m^3.$$

Total volume of cutting:

$$V_C = h\,[(A_1+A_n)/2+A_2+A_3+\ldots\ldots\ldots A_{n-1}]$$

$$= -142.306m^3$$

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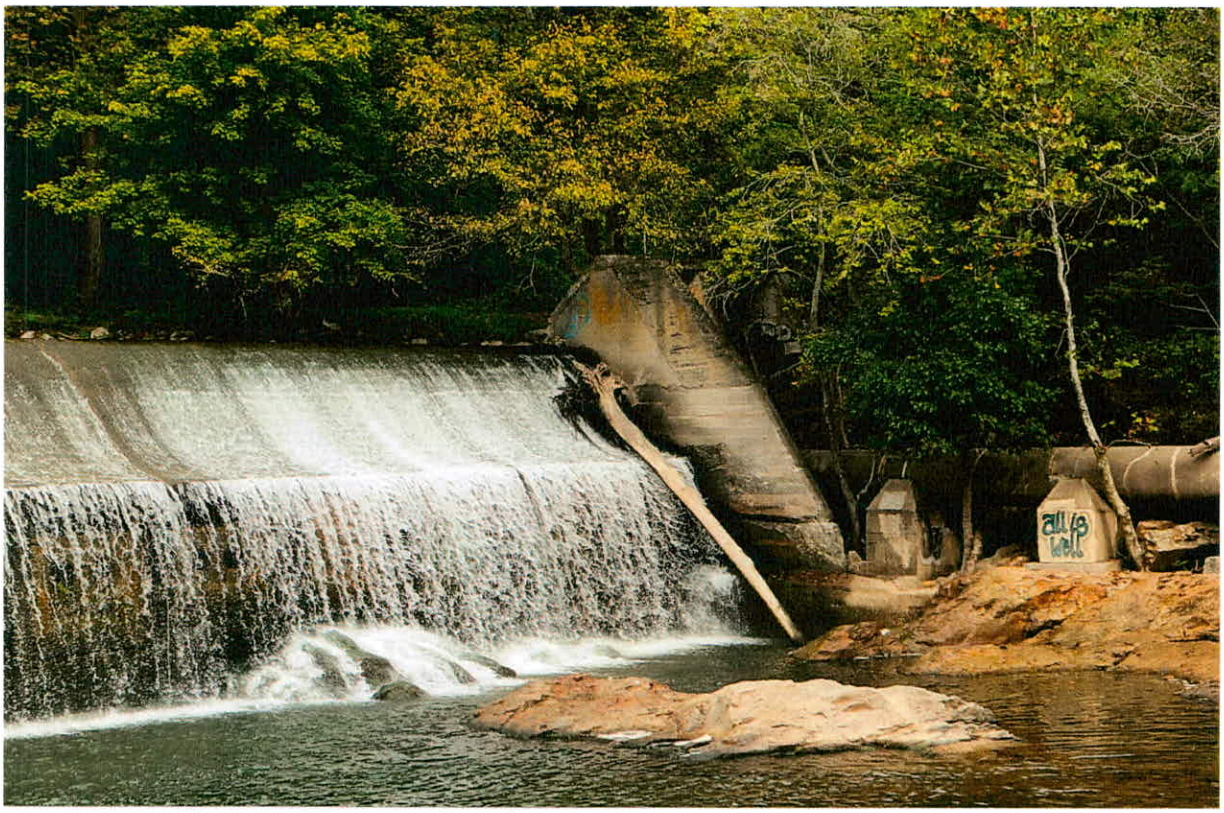
OLD TANK PROJECT



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OLD TANK PROJECT

OBJECTIVE: TO PROPOSE REPAIRS OF EXISTING OLD TANK AND INCREASE THE STORAGE CAPACITY OF TANK.

2.1 INTRODUCTION:

A minor irrigation tank is defined as the one, which has irrigable area less than or equal to 2000 hectares.

Every rainy season, surface runoff carries large amounts of silt into the reservoir. The silt deposits reduce the storage capacity of the reservoir over the years. The reduced storage capacity of the tank can be increased by raising the sill level of the waste weir. Sometimes due to bad maintenance, the profile width of the earthen dam may also get altered due to erosion of the downstream slope. The deteriorated section of the bund is given the required slope, free board, top width in order to restore the earthen dam. Sometimes it may also be necessary to increase the height of the bund.

2.2 SURVEYS TO BE CONDUCTED:

1. Longitudinal and cross sections along the center line of the existing bund.
2. Capacity contours at the existing maximum water level,dead storage level,top bund level and full tank levels.

2.3 LONGITUDINAL & CROSS SECTIONS ALONG THE CENTER LINE OF THE EXISTING BUND

a) Equipment's:

1) Level with stand
2) Leveling staff
3) Compass with stand
4) Ranging rods
5) chain and tape

b) Procedure ;

1. Considering the sill of the waste weir as bench mark, leveling work is carried out to determine the RL of top of abutment of waste weir.
2. A point along the center line of the existing bund (beyond the existing portion of the bund) is located whose RL is one meter higher than RL of top of the abutment.

3. This point is taken as point of zero chainage. The location of this point should be fixed with respect to three permanent objects.
4. RLs along the center line are taken at every 30 m intervals and cross sections are taken at every 30 meter interval. Salient features such as sluice and waste weir positions are located while traversing along the center line.
5. While taking cross sections, RLs and chainages of the followings points should be also noted:-
    a. The two top edges of the bund.
    b. At least two point on the u/s side
    c. The junction point of d/s side of earthen bund and ground (Toe of the bund)
    d. At least one intermediate point between the top edge of the bund.
    e. Points beyond the top of bund are taken at approximate intervals of 5m. The number of such points to be taken depends upon the height of bund. The minimum number of such points shall be one and maximum of three.
6. The last point on the traverse shall have same RL as the Zero chainage point. The location of end point also should be fixed with respect to three permanent objects.

c) Drawings:

1) L.S. of the bund showing the position of sluice and waste weir showing the existing profile of the bund and proposed formation levels for the bund and waste weir.

2) Cross–section at every 30m intervals showing the profile of existing and proposed bunds.

Scale: a) Longitudinal section; 1cm 10m Horizontal 1:2000 and Vertical 1:50

b) Cross section 1:50

2.4 Contour tracing (Total station):

- Set up the Total station at a command in position and do the necessary arrangements
- Enter the global co-ordinates and height of the instrument.
- Enter the RL of first point and take the back sight point.
- RL's of ground points in the catchment areare-measured by bisecting the target.
- The salient points such as electric poles, telephone poles are also recorded.

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- Contours are drawn by interpolating the ground RLs.
- Area of Contours is calculated.
- Volume of capacity contours computATION

2.5 CAPACITY Contours

	RL OF BUND	AREA (M^2)	HEIGHT (M)
TBL	881.990	A_4=372730.95	h_4=5.25
MWL	880.990	A_3=244542.22	h_3=4.24
FTL	880.490	A_2=158871.13	h_2=3.75
DSL	877.745	A_1=61127.11	h_1=1.0

- To estimate the volume of the reservoir from trapezoidal rule:
- $V = (A_1 x\ H_1) + (A_2 x\ H_2) + (A_3 x\ H_3) + (A_4 x\ H_4)$

Where, $H_1 = (h_0+h_1)/2$

$H_2 = (h_1+h_2)/2$

$H_3 = (h_2+h_3)/2$

$H_4 = (h_3+h_4)/2$

Therefore: $H_1 = (0+1)/2=0.5m$

$H_2= (1+3.75)/2= 2.38m$

$H_3= (3.75+4.24)/2= 4.00m$

$H_4=(4.24+5.25)/2= 4.75m$

$V = (61127.11 \times 0.5) +(158871.13 \times 2.38) +(244542.22 \times 4.0) +(372730 \times 4.75)$

$= 3157313.224m^3$

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2.6 BLOCK LEVELS AT WASTE WEIR

OBJECTIVE: To design and determine the volume of earthwork excavation for the waste weir,sluice and other protective works required.

Usually the waste weir is situated within the bund so as not to alter the river course. Further the foundation and other details are also to be observed before fixing the location of waste weir. The length and height of the body wall should be minimum. The cost of protective works should be minimum.
In this project ,the waste weir is proposed at the centre .the canal alignment is made on both the sides

Equipments required:

- Level with stand
- Leveling staff
- Chain with arrow
- Tape
- Wooden pegs
- Ranging rods and
- Compass with stand

Procedure:

Chose the centre of the block as the centre point of the length of the weir (approximate) .Layout the blocks of 5m square 40m along the bund line on both sides of the centre point and 20m on upstream and 30m downstream of the weir .Levels are taken at each corner of sub blocks of 5m square .Similar exercise for sluice location shall be carried out for a block of 20m along the bund and 30m across the bund at 5m intervals.

HIGHWAY PROJECT

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HIGHWAY PROJECT

3.1 AIM:

Proposal for connecting two important stations through obligatory Points by NEW HIGHWAY ALIGNMENT. A comprehensive study for a detailed proposal involves extensive database fieldwork and designs. The study, however, aims at making a model proposal at best for a new highway alignment due to various limitations.

3.2 SURVEY FOR HIGHWAY ALIGNMENT :

This study involves various surveys like:

1. Transportation planning surveys: For traffic Highway inventory geometric and accident studies.

2. Map studies: For identifying possible routes using topo-sheet.

3. Reconnaissance survey for route locations of alternative alignment by using simple instruments and collecting essential information which affect geometric design construction traffic and economics.

4. Preliminary survey is carried out in order to assess the various alternatives and finalize the best alignment by collecting all necessary details either by conventional approach or using modern approach. These survey include open traversing, collection of topographical features, leveling work, hydrological data for Cross Drainage work, soil surveys etc. For pavement design.

5. Final location and detailed survey is conducted to establish center line alignment for the best route chosen and to collect detailed information for the preparation of plans and drawings and finalization of design and construction details for the highway project. Soil and drainage studies also form part of detailed surveys. based on soil analysis and testing pavement design is finalized.

3.3 INSTRUMENTS REQUIRED FOR SURVEY

1. Leveling instruments with stand and leveling staff for profile.

2. Compass (or) plane table with accessories.

3. Arrows Chains Taps, Cross staff, ranging rods, Pegs etc.

3.4 OFFICE WORK FROM FIELD DATA

Reduced levels are computed from field data by HEIGHT OF INSTRUMENTS Method or RISE AND FALL method for all the observed levels of longitudinal sections, cross sections and block leveling in the field book. Page checks for R.L's computed must be carried out to ensure correct entry and calculations. Details of physical features, computed R.L's, observed bearings for the center line etc. are to be transferred to drawings as required in a standard format.

3.5 DRAWINGS TO BE PREPARED

1. INDEX MAP

Details are to be presented by a neat and proportionate free hand sketch, showing various alignments considered for connection station points, obligatory points, physical features like land, valleys, ponds, streams, buildings etc. using appropriate symbols on a sheet of size 30x20cms

2. INITIAL ALIGNMENT PLAN

This is drawn to a scale of 1cm=20m generally or as specified .The plan shows center line alignment with bearings R.L's along L/S. and C/S. chainages stream crossings and all the physical features surveyed .The details are symbolically represented on a standard size drawing sheet suing Indian ink in BLACK, North line is represented for reference.

3. FINAL ALIGNMENT PLAN

Finalized alignment details after the designs are shown in RED ink on the initial alignment plan sheet only. Horizontal curves, transition curves designed are presented in RED ink with radius, length etc. and are numbered. Final centre line alignment with designed curves is marked clearly from station points connecting obligatory points.

4. ROAD PLAN

Road plan is drawn on a separate sheet to a scale of 1cm=20m by transferring the final alignment (drawn in Red) preferably showing existing features and formation widths and right of way along the alignment finalized.

3.6 LONGITUDINAL PROFILE

This is drawn to vertical scale of 1 in 100and a horizontal scale of 1 in 100. The details presented include changes, ground levels, and formation levels, height of bank, depth of cutting, datum nature of

ground, gradients and vertical curves along the center line of alignment. Height of banking and depth of cutting can be shown after finalizing the proposal of formation levels for the alignment. Vertical curves are designed and incorporated based on formation gradients (to be shown in red ink). Existing ground profile is shown in Black ink.

3.7 CROSS SECTIONAL DETAILS

These may be drawn to a scale of 1cm=2m, on a drawing sheet (std size). At least three cross sections each for sections in full cutting, complete filling, level stretch, partial cutting and filling must be shown. The cross sections are shown either on the drawing sheet or on the graph sheet for computing earth work quantities .Each cross section must contain details of the ground profile, chainages, formation level and standard cross sectional elements adopted for a village road like width of pavement (3.8m), shoulders, formation width (8m), side slopes (1:1 to 1:2) and right of way (20m).The road level must be shown in Red ink and embankment slopes to be indicated.

3.8 SURVEY OBJECTIVES

1. To trace the initial and final alignment of highway in the field. 2. To obtain the longitudinal and cross sectional profile of existing ground for the alignment. 3. To obtain details of drawings works, soil types, terrain and other essential features important for highway alignment and design.

3.9 DETAILS OF FIELD WORK

GENERAL

Survey work is started with carrying Fly levels from a specified reference B.M. to the starting point from a local B.M. (as specified). Starting point is fixed with reference to three permanent objects by Taking bearings and measurements.

CENTER LINE ALIGNMENT

This is carried out by stretching one chain length (30m) fully in the direction of survey as guided by gentle and flowing gradients of the terrain. Ceylon ghat tracer may initially be used to fix or check gradient (for one chain length) .Generally ruling gradient of 1 in 30 or a limiting gradient of1 in 20 is provided for plain and rolling terrains. After ensuring the direction and gradient, bearings (FB) are taken for the center line thus fixed by using compass, frequent zig- zags; sharp and reverse turns are avoided for center line alignment.

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➢ DETAILS OF PHYSICAL FEATURES:

Physical features surrounding the center line (up to 15m on either side) like buildings, land (agriculture), ponds, wells, telephone lines etc. are surveyed by cross staff and compass. Objects surveyed are noted down in the field books with chainages and measurements using proper symbols

➢ GRADIENT MESUREMENTS

This is important especially for mountainous and sleep terrains. Instrument is used to fix the ruling gradients for center line. Preferably ruling gradients are provided for any terrain if unavoidable, limiting gradients for a shot stretch (not exceeding 60m/km) may be allowed. However exceptional gradients for short stretches are provided if there is no other possibility (but usually it is avoided). IRC suggests a maximum gradient of 1 in 15 for plain/rolling terrain and slightly steeper gradients not exceeding 1 in 12.5 for steep terrains. Generally gradients of the terrains indicate the direction of center line.

➢ LEVELLING WORK

To start with, fly levels are carried from a permanent B.M. to the starting point of survey. At the beginning of day's work similarly fly levels can be carried back from the terminal point of survey at the end of day's work (to check errors in field work). Leveling work for highway alignment includes.

1. Longitudinal sections (L.S.) are taken at every 15m intervals along the center line as the survey proceeds.

2. Cross sections are taken at 30m intervals and the cross levels taken at 2m intervals extending up to 10m on either side of center line.

3. Block leveling: At stream or specified crossings a block of 30x30m is constructed for leveling work and the levels are observed at 3m intervals on either side of and along the center line with reference to crossing point. Leveling work extends up to 15m on either side of center line.

3.10 SOIL SAMPLING

Representative samples of soil are collected from different stretches of the alignment for analysis and testing in the laboratory. Sampling procedure and quantities to be obtained as specified at site.

3.11 DESIGN DATA AND SPECIFICATIONS (As per IRC)

Type of road = Major District Road

Width of carriage way = 3.75m (single lane) Two ways

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Road way width (Right of way) = 45m (Rural areas) and 30m(Urban areas)

Land width (R.O.W) = 18m (open areas)

Terrain type = Plain terrain (10-25% cross slope)

Rainfall = Light intensity

Pavement = Thin bituminous surface

Design speeds for village road (v), kmph = 80(Ruling) & 65 (Minimum) for rolling terrain

Minimum radii for village = 60m (ruling) & 45m (abs min)

Roads(R) = for plain terrain

Gradients (Rolling country) = 1 in 30 (ruling),

1in 20 (limiting)

1 in 15 (Exceptional)

Coefficient of lateral friction f = 0.15 for 40 kmph (max)

Coefficient of longitudinal friction f = 0.35

Super elevation (e) = 0.07 (max)

Camber = 1 in 50 or 2% (depends on rainfall)

Safe stopping sight distance = 120m for design speed of 40 kmph

No super elevation is required for radius beyond 350m for design speed of 40kmph and 2% camber

Extra width of pavement (We)-0.60m for single lane for a radius unto 60m(from 21m) as per IRC in the absence of calculation.

Minimum length of vertical (summit and valley) curve for grade change values higher than 1.2% for design speed of 40 kmph is 20m. For grade change lower than 1.2% no vertical curve is required. Minimum length is 15m for grade change exceeding 1.5% for design speed of 35kmph.

Reaction time of the driver (t) =2.5 seconds for speed 40 – 60 kmph

Side slopes in ordinary soil = 1:1, soft rock (1/4:1)

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From the results obtained pavement thickness is designed adopting Standard Procedure.

3.12 SETTING OF FINAL ALIGNMENT

After the design of the alignment (vertical and horizontal), the same will have to be set in the field and shown to the concerned in charge. Earth work quantities are computed with the help of details presented from LS & CS data of final alignment. Batch teachers will give the details as how to obtain earth work quantities.

ALIGNMENT JUSTIFICATION

The final alignment selected by the batch must be justified in terms of technical and economic feasibility.

3.13 DESIGN PROCEDURE FOR CURVE HORIZONTAL ALIGNMENT

DESIGN OF SIMPLE CURVE:

Simple circular curve by offset from long chord is linear measurement of setting curve. The method involves calculating perpendicular offset from the long chord. The mid ordinate or the center offset is given by

O_o =R-√(R^2-(L/2)^2)

Applying method of ordinates from long chord

Let R = radius of curve

O_o = midordinate

O_x = ordinate at distance x from the mid point of the chord

L= length of long chord

For Curve 1:-

A simple curve having a long chord 'L' of m with an interval of 5m and mid ordinate 'O_o' of 7.92m.

Hence radius of the curve can be found by the equation

$O_o = R-\sqrt{(R^2-(L/2)^2)}$

$7.92 = R-\sqrt{(R^2-(32.97/2)^2)}$

Therefore, R = 21.06m

The equation for ordinate at a distance 'x' from the mid point of a long chord is

$O_x=\sqrt{(R^2-(L/2)^2)}-(R-O_o)$

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Distance	-15	-10	5	0	5	10	15
Ordinate(m)	1.64	5.39	7.31	7.92	7.31	5.39	1.64

For Curve 2:-

A simple curve having a long chord 'L' of 36.4m with an interval of 6m and mid ordinate 'O_o' of 8.34m

Hence radius of the curve can be found by the equation

$O_o = R - \sqrt{(R^2-(L/2)^2)}$

$8.34 = R - \sqrt{(R^2-(36.4/2)^2)}$

Therefore, R = 24m

The equation for ordinate at a distance 'x' from the mid point of a long chord is

$O_x = \sqrt{(R^2-(L/2)^2)} - (R-O_o)$

Distance	-18	-12	-6	0	6	12	18
Ordinate(m)	0.214	5.12	7.57	8.34	7.57	5.12	0.214

Hence the required curve is provided by ordinate from long chord method.

3.14 TO FIND THE SUPER ELEVATION

Super elevation can be found out by taking speed at 75% of design speed

$e=(0.75V)^2/127R$

For Curve 1:

$e_1 = 0.336$ (>0.07)

Hence provide super elevation of e= 0.07 check the value of coefficient of friction developed

$f_1 = (V^2/127R) - 0.07$

$f_1 = (40^2/127x21.06) - 0.07$

$f_1 = 0.528$ (>0.15)

Hence calculate allowable speed at the curve

$V_a = \sqrt{(27.94R)} = \sqrt{(27.94x40)} = 33.41$kmph

For Curve 2:

$e_2 = 0.295$ (>0.07)

Hence provide super elevation of e= 0.07 check the value of coefficient of friction developed

$f_l = (V^2/127R)-0.07$

$f_l = (40^2/127x24) -0.07$

$f_l = 0.45$ (>0.15)

Hence calculate allowable speed at the curve

$V_a = \sqrt{(27.94R)} = \sqrt{(27.94x24)} = 25.88$kmph

3.15 EXTRA WIDENING OF CURVE

Total width required on horizontal curve is given by

$W_e = (ne^2/2R)+(V/(9.5\sqrt{R}))$

n=number of lane =1

v=design speed = 40kmph

R=radius of curve (R_1=21.06m and R_2 =24m)

e= wheel base of vehicle = 6m

For Curve 1:

Therefore $W_e = (1x6^2/2x21.06)+(40/(9.5\sqrt{21.06}))$

=1.77m

Hence provide external widening of 0.5m on one side

For Curve 2:

Therefore $W_e = (1x6^2/2x24)+(40/(9.5\sqrt{24}))$

=106m

Hence provide external widening of 0.45m on one side

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3.16 EARTH WORK CALCULATIONS

SL NO.	Chainage	Depth	Mean Depth (d)	Central Area B*d	Side Area 1 S*d^2	Total Area	Distance	VOLUME	
								CUTTING	FILLING
1	0	-1.000					0		
2	30	-0.175	-0.588	-4.318	0.345	-4.66	30	-139.898	
3	60	-1.185	-0.680	-4.998	0.462	-5.46	30	-163.812	
4	90	-1.065	-1.125	-8.269	1.266	-9.53	30	-286.031	
5	120	-0.970	-1.018	-7.479	1.035	-8.51	30	-255.418	
6	150	1.155	0.093	0.680	0.009	0.671	30		20.140
7	180	2.140	1.648	12.109	2.714	9.395	30		281.846
8	210	1.925	2.033	14.939	4.131	10.80	30		324.235
9	240	1.870	1.898	13.947	3.601	10.34	30		310.384
10	270	1.515	1.693	12.440	2.865	9.575	30		287.260
11	300	1.125	1.320	9.702	1.742	7.960	30		238.788
12	330	1.030	1.078	7.920	1.161	6.759	30		202.759
13	360	0.870	0.950	6.983	0.903	6.080	30		182.400
14	390	1.050	0.960	7.056	0.922	6.134	30		184.032
15	420	1.015	1.033	7.589	1.066	6.523	30		195.685
16	450	0.885	0.950	6.983	0.903	6.080	30		182.400
17	480	0.760	0.823	6.045	0.677	5.369	30		161.066
18	510	0.560	0.660	4.851	0.436	4.415	30		132.462
19	540	0.420	0.490	3.602	0.240	3.361	30		100.842
20	570	0.310	0.365	2.683	0.133	2.550	30		76.486
21	600	0.305	0.308	2.260	0.095	2.166	30		64.967
22	630	0.205	0.255	1.874	0.065	1.809	30		54.277
23	660	-0.075	0.065	0.478	0.004	0.474	30		14.206
24	690	-0.135	-0.105	-0.772	0.011	-0.78	30	-23.483	
25	720	-0.065	-0.100	-0.735	0.010	-0.74	30	-22.350	
26	750	-0.030	-0.048	-0.349	0.002	-0.35	30	-10.541	
27	780	-0.055	-0.043	-0.312	0.002	-0.31	30	-9.425	
28	810	-0.140	-0.098	-0.717	0.010	-0.72	30	-21.784	
29	840	-0.125	-0.133	-0.974	0.018	-0.99	30	-29.743	
30	870	-0.210	-0.168	-1.231	0.028	-1.25	30	-37.775	
31	900	-0.125	-0.168	-1.231	0.028	-1.25	30	-37.775	
32	930	-0.440	-0.283	-2.076	0.080	-2.15	30	-64.685	

33	960	-0.580	-0.510	-3.749	0.260	-4.00	30	-120.258	
34	990	-0.540	-0.560	-4.116	0.314	-4.43	30		
							TOTAL	**-1222.981**	**3014.23**

DISTANCE	**GRADIENT**
0-1000	1 IN 400

Area of cutting or filling = area of the trapezoid = (b + n*d)*d

Where,

b = pavement width with shoulder i.e., 7.35m

s = side slope for pavement = 1in 1

d = mean depth of cutting or filling.

Volume of cutting b/w 2 sections = (A1+A2)2*D

Where, A1 = area of cutting @ section 1.

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WATER SUPPLY AND SANITARY PROJECT

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INTRODUCTION

HISTORICAL DEVELOPMENTLEADING TO THE DEMAND OF PROJECT:

Kaiwara is a small holy place located about 78km from Bangalore city. As a pilgrimage center, since many pilgrims visiting this place have been increasing day by day, an acute shortage of water is silt. The existing and future population is taken into account and project is designed for a period of 30 years expanded in stages at 10 years intervals.

4.1 GENERAL FEATURES

The present area served is the only the main Kaiwara village located around the temple. Water is not available to individual houses and rural areas located to southwest of the temple. The Kaiwara village is located on a rolling terrain, sloping towards the south, on the northern side. The topography is very hilly, rainfall is not very certain in its duration.

4.2 Objectives:

- Examining the sources of water supply and calculation of required quantity of water based on existing & projected population.
- Preparing village map and locating sites for ground level overhead tanks.
- To formulate and design water supply scheme to Kaiwara village, considering water available from old tank which is the main source of supply.
- To ensure treated water availability at all times of year at adequate pressure.

4.3SURVEYS CONDUCTED FOR THE PROJECT

a) Map study
b) Reconnaissance
c) Preliminary survey

Following are the survey work to be conducted

a. Longitudinal section and cross section of transmission main
b. Village traverse

Equipments required:

(a) Chain
(b) Tape
(c) Arrows
(d) Ranging rod
(e) Plane table
(f) Plumbing fork & plumb bob
(g) Level and staff
(h) Alidade
(i) Compass
(j) Spirit level
(k) Drawing papers with a rain proof cover.

4.4 POPULATION FORECAST

Present population of the village will be obtained by counting the number of dwelling unit in the topographical map and assuming 5 to 6 persons/dwelling unit. For this purpose a large scale topographical map of the village was prepared using field traverse method at 1:1000 scale and 0.5m contour interval. This topographical map was utilized to compute the existing population. The topographical map was also used to plan the layout of water supply pipe distribution system for the village.

Kaiwara village is an old village developed in an unorganized manner so the dead end system pattern of water supply distribution has been considered for layout planning. The details of pipe distribution is marked and indicated on the topographical map assuming that the water in the pipe lines will flow under gravity at the specified head needed for locations having one to two storied dwelling units as specified in manual of water supply engineering. For water supply components design periods.

Pump House	**30years**
Electric motors/pumps	**15years**
Water treatment units	**15years**
Pipe connection and conveyance	**30years**
Service reservoir	**15years**
Distribution pipe system	**30years**

Present population (P) = Number of dwelling units × (5to 6) persons

=1221×5

P =6106persons

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Incremental Increase Method:

SL No.	Year	Population	Increase in population	Incremental increase in population
1	1991	4927	-	-
2	2001	5488	561	-
3	2011	6106	618	57
Total			**X = 589**	**Y = 57**

Average per decade= $\frac{1134}{2} = 567$

%Increase in population= $618 - 561 = 57$

Average of % increase in population =57

Population forecast for 2021 = $P_{2015} + (X + Y) \times n$

Population at end of 2021 - $6106 + (589 + 57) \times 1 = 6752$

Population at end of 2031 - $6106 + (589 + 57) \times 2 = 7398$

Population at end of 2041 - $6106 + (589 + 57) \times 3 = 8044$

The population of Kaiwara can be taken as8044 in the year 2041

Floating Population:

Daily pilgrims	200
Marriage party	100
Education camp	200
Total	**500**

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4.5 DESIGN OF RISING MAIN

Per capita rate of supply	
Human and Cattle	**135 liters/day/person**
Quantity required per day	
Human and Cattle	[8044+500]×135 = **1153440 liters/day**
Total quantity of water	**1153440 liters/day(1153.44 m^3/day)**
Assuming maximum daily water demand to be 1.8 times average demand	1.8 × 1153.44= **2076.19 m^3/d** Say **2077 m^3/day** $\frac{2077}{(24\times 60\times 60)} = 0.02403\ m^3/s$
Assuming that the pump is operated only for 8 hours a day	
Therefore maximum daily demand	$0.02403\times\left(\frac{24}{8}\right) = 0.07209\ m^3/s$
Economical Diameter of pipe is given by, D = 0.97 to 1.22 $\sqrt{Q}$, (Taking 1.1)	**0.327 m say 350 mm**
Actual velocity of flow	**0.842 m/s**

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4.6 DESIGN OF PUMP

Distance from clear water reservoir to high level distribution reservoir	**L = 673 m**
Distance from clear water reservoir to proposed treatment plant	**L_1 =20 m**
Distance from proposed treatment plant to high level distribution reservoir	**L_2 = 653 m**
R L at clear water reservoir	**976.120 m**
R L at proposed treatment plant site	**974.010 m**
R L at high level distribution reservoir	**996.350 m**
Static head, H_{st}	976.120- 974.010=**2.110 m**
Delivery head from treatment plant to distribution reservoir (Elevated type)	996.350–974.010=**22.34 m**

From Source to Treatment Plant

Assuming coefficient of friction as 0.0067

Head loss due to friction in pipe given by Darcy-Weishbach

$$H_f = \frac{4fLV^2}{2gD}$$

$$H_f = \frac{4 \times 0.0067 \times 20 \times 0.842^2}{2 \times 9.81 \times 0.35}$$

$$H_f = 0.055\,m$$

Velocity head,

$$V_h = \frac{V^2}{2g}$$

$$V_h = \frac{0.842^2}{2 \times 9.81}$$

$$V_h = 0.036\,m$$

Total Head loss.

$$H = 2.110 + (0.055 + 0.036) = 2.20m$$

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Assuming pump efficiency as 70 % power required to run the pump

$$P = \frac{Q \varpi H}{75\eta}$$

$$BHP = \frac{0.07209 \times 1000 \times 2.203}{75 \times 0.70}$$

$$BHP = 3.02503\text{HP}$$

To Find Gradient (From Source to Treatment Plant)

Using Hazen's Williams formula

$$V = 0.85 C_H R^{0.63} S^{0.54}$$

$$\Rightarrow S^{0.54} = \frac{V}{0.85 C_H R^{0.63}}$$

Where, C_H = Coefficient of Hydraulic Capacity (For Concrete pipe C_H = 130)

R = Hydraulic mean depth $D/4$ for circular pipes i.e. $0.332/4 = 0.083\,m$

V = Velocity of flow (Assume 1.2 m/s)

S = Slope of energy line.

$$V = 0.85 C_H R^{0.63} S^{0.54}$$

$$\Rightarrow S^{0.54} = \frac{V}{0.85 C_H R^{0.63}}$$

$$S^{0.54} = \frac{1.20}{0.85 \times 130 \times 0.083^{0.63}}$$

$$S^{0.54} = 0.0520$$

$$S = 0.00419$$

Therefore provide a gradient of 1 in 240

- ***From Treatment Plant to storage tank (over head tank)***

Assuming coefficient of friction as 0.0067

Head loss due to friction in pipe given by Darcy-Weishbach

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$$H_f = \frac{4fLV^2}{2gD}$$

$$H_f = \frac{4 \times 0.0067 \times 653 \times 0.842^2}{2 \times 9.81 \times 0.35}$$

$$H_f = 1.9047m$$

$$V_h = \frac{V^2}{2g}$$

Velocity head, $V_h = \frac{1.02^2}{2 \times 9.81}$

$$V_h = 0.053\,m$$

Total Head loss, $H = 22.34 + (1.9047 + 0.053) = 24.23\,m$

Assuming pump efficiency as 70% power required to run the pump

$$P = \frac{Q\varpi H}{75\eta}$$

$$BHP = \frac{0.07209 \times 1000 \times 24.23}{75 \times 0.70}$$

$$BHP = 33.27 \text{ HP}$$

4.7 DESIGN OF TREATMENT UNITS

The layout of the treatment plant is shown in drawing. Care has been taken that gravity flow occurs from one unit to the other by observing the elevation difference at the outlet of each component of treatment plant and fixing the inlet of the next treatment plant accordingly.

4.7.1 Design of Screens

Intake is designed to work for 8 hours per day and screens are designed for maximum daily demand.

Flow through intake, $\frac{2077}{(8 \times 60 \times 60)} = 0.07211\,m^3/s$

Assuming V = 0.1 m/sec

Area of screens, $\frac{Q}{V} = \frac{0.07209}{0.1} = 0.7209m^2$

Provide 2 screens for each penstock entrance

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Area of each screen, $\frac{0.7209}{2} = 0.360\,m^2$

Diameter of each circular screen

$$\sqrt{(0.360\times 4)/\pi} = 0.677m \approx 0.70\,m$$

4.7.2 Design of sump

The sump can act as pre-sedimentation tank to remove 0.1mm and above particle size.

The side slope of sump is 10% towards the center so as to facilitate cleaning manually.

Assume Water depth as 5.5m and 0.5m as free board.

Total Depth of sump = 6m

$$\text{Surface area} = \frac{\text{capacity of sump (m3)}}{Depth(m)} = \frac{2077}{5.5} = 377.63m^2$$

L×B = surface area

L: B=3:1

L = 3×B

3B×B = 377.63

B = 11.219m = 12m

⇒L = 33.65m = 34m

$$\text{Actual over flow rate} = \frac{Q}{L\times B}$$

$$\text{Actual over flow rate} = \frac{2077}{12\times 34} = 5.09m^3/m^2/day$$

4.8 Design of sedimentation tank:

Max. Water to be treated in 24 hours = 2077x10^3 lit/d

Quantity of water to be treated during the detention period of 4 hours

$$= \frac{2077\times 10^3}{24}\times 4 = 346.16\times 10^3 litre = 346.16m^3$$

Assuming water depth in the tank to be 2 m

Cross sectional area of the required = (346.16 / 2) = 178.08 m^2

Diameter of sedimentation tank = $\sqrt{Area * 4/\pi} = \sqrt{178.08 * 4/\pi} = 15m$

Provide the tank size of dia = 15m

Dimension of the tank = 15*(2+0.5) = 37.5m^2

4.9 Disinfection:

Maximum demand of water = 2077m^3/day

Assuming chloride dosage of 0.5ppm

Quantity of chloride required = $\frac{2077 \times 1000 \times 0.5}{10^6} = 1.0385 kg/day$

Bleaching powder is used as a disinfection

Amount of bleaching powder required $= \frac{\text{Quantity of chloride x 100}}{30}$

$$= \frac{1.0385 \text{ x } 100}{30} = 3.46 kg/day$$

The bleaching powder is mixed with water and the solution is fed into disinfection unit for mixing with raw water to achieve disinfection and to maintain residual chlorine of 0.1mg/liter.

- Capacity of the distribution tank:

  The capacity of the distribution tank for construction is decided depending upon the daily requirement of water in liter.

  The water is drawn from the distribution reservoir as below:

4.10 DAILY WATER SCHEDULE:

TIME	DAILY DEMAND
7AM – 8AM	30%
8AM – 5PM	35%
5PM – 6:30PM	30%
6:30PM – 7PM	5%

The pumping is done into the tank for 8hrs. From 8AM to 4PM.

TABLE:

water draw from the distribution reservoir		**Water quantity**	**cumulative water quantity**
Time	**quantity of water in %**		
7:00AM	**30**	**623100**	**623100**
8:00AM			
8:00AM	**35**	**726950**	**1350050**
17:00PM			
17:00PM	**30**	**623100**	**1973150**
18:30PM			
18:30PM	**5**	**103850**	**2077000**
19:00PM			

- The pipe distribution system for a have older layout developed in an organized manner requires dead end system. (Tree system).
- Pipes taken along main roads and branch road wherever required.
- The pattern of pipe distribution system consisting of main, sub-main, branches or laterals and service pipes will be planned by looking into the topographical map.

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NECESSITY FOR SANITATION:

Every community produces both liquid and solid wastes .The liquid portion –waste water– is essentially the water supply of the community after it has been fouled by a variety of uses such as spent water from bathroom kitchen, lavatory basins, house and street washings, from various industrial processes semi solid wastes of human and animal excreta, dry refuse of house and street sweepings, broken furniture, wastes from industries etc. are produced daily.

If proper arrangements for the collection, treatment and disposal are not made, they will go on accumulating and create foul condition. If untreated water is accumulating, the decomposition of the organic materials it contains can lead to the production of large quantity of mal odorous gases. It also contains nutrients, which can stimulate the growth of aquatic plants and it may contain toxic compounds. Therefore in the interest of community of the city or town, it is most essential to collect, treat and dispose of all the waste products of the city in such a way that it may not cause any hazardous effects on people residing in town and environment.

4.11 IMPORTANCE OF SEWERAGE SYSTEM:

One of the fundamental principles of sanitation of the community is to remove all decomposable matter, solid waste, liquid or gaseous away from the premises of dwellings as fast as possible after it is produced, to a safe place, without causing any nuisance and dispose it in a suitable manner so as to make it permanently harmless.

Sanitation though motivated primarily for meeting the ends of preventive health has come to be recognized as a way of life. In this context, development of the sanitation infrastructure of any country could possibly serve as a sensitive index of its level of prosperity. It is needless to emphasize that for attaining the goals of good sanitation, sewerage system is very essential. While provision of potable drinking water takes precedence in the order of provision of

Environmental Engineering Services, the importance of sewerage system cannot be last sight and cannot be allowed to lag behind, as all the water used by the community has to flow back as the sewage loaded with the wastes of community living, unless properly collected, treated and disposed of, this would create a serious water pollution problems.

4.12 SYSTEMS OF SANITATION:

Different methods of domestic waste water disposal include

- **CONSERVENCY SYSTEM:**

Sometimes the system is also called as dry system. This is out of date system but is prevailing in small towns and villages. Various types of refuse and storm water are collected conveyed and disposed of separately. Garbage is collected in dustbins placed along the roads from where it is conveyed by trucks ones or twice a day to the point of disposal. all the noncombustible portion of garbage such as sand dust clay etc. are used for filling the low level areas to reclaim land for the future development of the town. The combustible portion of the garbage is burnt. The decaying matters are dried and disposed of by burning or the manufacture of manure.

Human excreta are collected separately in conservancy latrines. The liquid and semi liquid wastes are collected separately after removal of night soil it is taken outside the town in trucks and buried in trenches. After 2-3 years the buried night soil is converted into excellent manure. In conservancy system silage and storm water are carried separately in closed drains to the point of disposal where they are allowed to mix with river water without treatment.

□ WATER CARRIAGE SYSTEM:

With development and advancement of the cities urgent need was felt to replace conservancy system with some more improved type of system in which human agency should not be used for the collection and conveyance of sewage .After large number of experiments it was found that the water is the only cheapest substance which can be easily used for the collection and conveyance of sewage. As in this system water is the main substance therefore it is called as WATER CARRIAGE SYSTEM.

4.13 DESIGN PERIOD:

The future period for which the provision is made in designing the capacities of the various components of the sewerage scheme is known as the design period. The design period depends upon the following:

- Ease and difficulty in expansion,
- Amount and availability of investment,
- Anticipated rate of population growth,
- Including shifts in communities,
- Industries and commercial investments,
- Hydraulic constraints of the systems designed, and

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- Life of the material and equipment.

Following design period can be considered for different components of sewerage scheme.

1. Laterals less than 15 cm diameter: Full development
2. Trunk or main sewers: 40 to 50 years
3. Treatment Units: 15 to 20 years
4. Pumping plant: 5 to 10 years

4.2 DESIGN OF SEWER SYSTEM:

Dry weather flow = discharge x 80% of water supply

= (2077x80)/100

= 1661.6 m3/day

= 0.01923 m3/sec

Maximum dry weather flow= 3 x 0.01923

= 0.05769 m3

Wet weather flow = (A x I x R) /360

Where, A=Approximate area = 2.6 hec

I=0.7(assumed)

R=intensity of rainfall=15m/sec

Wet weather flow= (2.6 x 0.7 x 15)÷360

= 0.0758m3/sec

Total discharge = Dry Weather Flow + Wet Weather Flow

= 0.05769+0.0758

= 0.1335m3/sec

4.3 DESIGN OF SEWER PIPES:

Diameter of Pipes (stone ware)

Assuming that the pipe is running half full.

Longitudinal slope, S = 1in 300.

Hydraulic mean radius, R = (wetted area / wetted perimeter).

Using Manning's Formula:

$$V = \frac{1}{n}(R^{2/3} \times S^{1/2})$$

No of dwellings under pipe =62

Total no of dwellings =160

Total discharge =0.1335m3/sec

For 62 dwellings discharge = (0.1335x62/160)

= 0.517m3/sec

WKT discharge

$$Q = AV$$

$$Q = \frac{\pi d^2}{8} \times \frac{1}{n} (R^{2/3} \times S^{1/2})$$

$$0.517 = \frac{\pi d^2}{8} \times \frac{1}{0.017} ((\frac{d}{4})^{2/3} \times (\frac{1}{300})^{1/2})$$ (Substituting for d)

d = 0.99 m(Say d = 1m)

Check For The Velocity:

$$V = (\frac{1}{0.017}) \times (\frac{1}{4})^{2/3} \times (\frac{1}{300})^{1/2}$$

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V = 1.348 m/sec >0.75 m/sec

Hence provide 1.348 m/sec

The above value is in between 0.75 m/sec and 3 m/sec.

In both the pipes the velocity is within the range.

Hence, design is safe.

4.4 OXIDATION POND

Oxidation pond is one of the biological systems which are used for the treatment of wastewater. It is considered as the secondary treatment method by which natural purification and stabilization of wastewaters like domestic sewage, trade waste and industrial effluents is accelerated. The biological treatment process in oxidation pond mainly involves an interaction between bacteria, algae and other organisms. It efficiently removes bacteria, biodegradable organics, phosphorous and nitrogen present in the wastewater which is going to be discharged to the receiving streams. In this method, 98% to 99% of BOD reduction in wastewater is often possible.

4.4.1 DESIGN OF OXIDATION POND:

$Q_{sewer} = 0.8 \times Q_{water\ supply}$ [$2077 m^3/d = 2.077 \times 10^7$ L/d]

$= 0.8 \times 2.077 \times 10^7$

$= 1.67 \times 10^7$ L/D

The BOD content per day

$= (1.67 \times 10^7) \times 300$

= 5010 kg/day

Assuming a BOD loading of 500 kg/hec/day for an area located in hot climate.

The surface area required

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$$= \frac{5010\ kg/day}{500 kg/ha}$$

=10.02 ha

= 1, 00,200 m^2

Assuming the length of the tank (L), as twice of its width (B)

$2B^2$ = 1, 00, 200

B =223.83≈250 m

L = 250 x 2

= 500 m

Using a tank with effective depth as 1.2m; we have

The provide capacity = 500*250*1.2 = 150000 m^3

Now, capacity = sewage flow per day x Detention time in days.

∴Detention time in days = capacity in cum. Sewage flow per day in cum/day

=150000/10000

= 15days

Hence, use an oxidation pond with length = 500m

Width = 250 m

Overall depth = (1.2+1) =2.2 m; and detention period of 15 days.

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TOWN PLANNING PROJECT

GUIDED BY:

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5.1 INTRODUCTION:

AIM: To Plan the township by conducting different surveys and by using zoning bye-laws

THEORY:

Following theory aspects are included for the town planning:

1. Reconnaissance Survey
2. Layout Planning Surveys
3. Collection of Data
4. Preparation of Maps and Drawings
5. Layout bye-laws
6. Site Area Index
7. Bye-laws for Residential layouts
8. Zoning

5.2 RECONNAISSANCE SURVEY:

It is the preliminary survey. It is used at of any project work through suggesting possible alternative paths and routes. It needs to be done with greater efficiency and cost accuracy for identifying these alternative paths and routes.

It is the process of identifying variable possible routes and evaluating possibility of these routes in a highway between the specific points. This is done especially for new routes between the rural areas, for which the aerial photographs are primarily used.

commencement

It has four phase study processes as follows, 1) Research, 2) Draft report outline, 3) Draft sensitivity map and 4) Final report.

Purpose of reconnaissance survey is discussed below.

• The main purpose is for taking survey in a particular area about its weather conditions, map and terrain etc..

• It is used for assessing the flexibility of alternative corridor paths or routes for the highway between specific points and it can take into account the subsequent points as below.

1) Topography, geology and traffic volume, 2) Environmental use and 3) Social and economic land use (construction unit cost, agricultural trends and commercial activities in industries)

• It is used to estimate quantity of earthwork.

• It is used to evaluate flood records, metrological statistics, topography and other existing services or communications.

Significance of reconnaissance survey are as given below.

- The results of reconnaissance survey is used to develop the plan. which is helpful to identify or protect the cultural resources.
- It has to identify any archaeological sites nearby the alignment of routes.
- To explore the site conditions with infrastructure availability.

5.3 LAYOUT PLANNING SURVEYS:

The surveys establish ultimately the present state of the town and indicate the measures for its improvements. It may be mentioned that the surveys do not necessarily mean the work carried out usually by a land surveyor.

TYPES OF SURVEYS:

The various surveys conducted for town planning schemes can broadly be divided into the following four types:

1. **Preliminary survey**: The data collected in the preliminary survey are of fairly general nature and it is the usual practice to conduct preliminary survey before conducting national, regional or civic surveys. The main objective of the preliminary survey is to decide approximate boundary of area to be planned. The topics which are usually covered in the preliminary survey are as follows,

- Electric power: Source and distribution of power and location of supply units.
- Water supply and sewerage: The existing facilities as well as the future requirements.
- General amenities: Study of civic arts, parks and playgrounds, etc.
- Highways: Conditions of existing roads with respect to their construction and maintenance problem.
- Railway: The existing routes and volume of goods traffic.
- Waterways: Highest water level, yearly, seasonal variations, etc.
- Housing: Study of existing housing conditions with respect to lighting, ventilation, sanitation, etc.
- Industries: Arrangement and classification of various industries, location and distribution of the manufacturing units, etc.
- Land use: The density and character of structures, divisions and uses of land, etc. are studied.

2. **National survey:** The study of national resource gives a broad vision for the requirements of town planning schemes. The policy and procedure adopted by nation as a whole affect considerably the proposals of town planning schemes. The topics that are usually covered are as follows:

- Administration: The aspects of land ownership and general administration of the country are considered.
- Agriculture: It includes the study of types of agricultural soil, crops, and number of crops per year.

- Communication facilities: The existing modes of transport such as roads, railways, waterways and air routes are studied.
- Economic development: The overall situation of economic conditions of the nation including availability, etc. are considered.
- Geography: The geological conditions, the extent of sea coast, etc. are considered.
- Natural resources: The availability of natural resources in the form of oil, minerals, gas, water, etc. are studied.
- Urban settlement: It includes the study of distribution and density of population.

3. **Civic survey:** The civic or town survey is conducted with special reference to the conditions prevailing in and around the town to be planned the topics covered in civic survey are as follows:

- Communication amenities: The means of communication such as roads, railways, airways, and waterways are studied together with their inter-relationship.
- Contour: The study of contour of the area helps in deciding the gradients of roads, location of waterworks and sewage plants, etc.
- Land uses and land values: It includes the study of agricultural lands, residential and commercial areas, parks, open spaces, location of airports, etc. The study of land values is useful to get an idea of the compensation required to be paid to private owners for the acquisition of land for public purposes.
- Historical background: It includes the study of general historical development of town, present policy of administration, physical and social aspects of the area, etc.
- Housing: The characteristics of houses, distribution and relation of people to houses, etc. are studied.
- Industries: The character, distribution, types, and special requirement of the local industries are studied.
- Population: It includes the study of present and future population to be served by the town planning scheme, family structure, density of population, migration tendencies, etc.
- Natural features: The building, open spaces and spots of natural beauty, which are to be preserved, are considered.
- Public health: A study is made of general health of inhabitants, death rates, causes of special diseases, etc.
- Topography: The topography of the area is studied with reference to climatic conditions, locations of rivers and streams, etc.

4. **Regional survey:** It is conducted on a slightly bigger scale as compared to the civic survey. The purpose of regional survey and civic survey is the same, namely, to investigate the economical, physical, and social conditions of the area to be covered under the town planning schemes. The investigations made under regional survey are of general nature and as same as those of civic survey.

5.4 COLLECTION OF DATA:

Following four surveys are carried out to collect data and other relevant information, required in the process of town planning:

1. **Functional survey:** The functional aspects of a town life are studied under this survey. The type of information collected in the functional survey can be enlisted as follows:

- Roads including history of roads, traffic survey, details of width of roads and tree planting,
- Railways with positions of level-crossings, passenger stations and goods sheds,
- Airports and seaports,
- Waterways and canals,
- Routes of bus, tram, ferry, suburban railways,
- Local industries, their classification and location,
- Availability of raw materials and type of labor employed,
- Mines and their location,
- Conditions of commercial activity,
- Probable cost of planning scheme and sources of raising funds.

2. **Social survey:** The social aspects of a town life are studied under this survey. This type of information collected in the social survey can be enlisted as given below:

- Ancient ruins,
- Architectural character of the locality,
- History of growth from the study of old maps,
- Conditions favorable for preservation of wild life,
- Preservation of natural beauty,
- Birth rates, death rates and charts of diseases,
- Residential areas, types of buildings, slums and suburban development,
- Historical buildings and public buildings, their location and classification,
- Parks and playgrounds, their size,
- Public services comprising of water supply, sewerage, drainage, electricity, telephone, street lighting, cemeteries and fire protection.

3. **Territorial survey:** The physical aspects of territory are studied under this survey. The type of information collected in the territorial survey can be enlisted as follows:

- Geological features showing rocks and method responsible for formation of topography,
- Contours of the land surface showing actual heights and variations of surface,
- Rivers, oceans, streams and lakes,

- Climatic conditions including temperature range, rainfall and direction and intensity of winds,
- Types of soil including areas of first class agricultural soil,
- Forests and other natural vegetation.

4. **Vital survey:** The population aspects of the town under consideration are studied under this survey. This type of information collected in the vital survey can be enlisted as follows:

- History of past growth of population,
- Characteristics of present population,
- Density of population,
- Factors which may influence the future rate of growth of the town such as migration, development of local industries, etc.

METHODS ADOPTED TO COLLECT DATA

The methods adopted to collect data for the surveys can be summarized as follows:

1. A questionnaire form may be prepared and information may be collected by house to house investigation.
2. The interview may be arranged with individuals or organizations having special knowledge in specific fields.
3. The specialist maybe employed in some cases to supply the information on topics related to their work.
4. The records and reports maintained by the government offices, police department, municipal offices, revenue department, etc. can be studied and analysed.
5. The town planner himself carries out the surveys and collect the necessary information on spot examination with the help of the staff.

5.5 PREPARATION OF MAPS AND DRAWINGS

After the collection of data, maps and drawings are prepared in standard scales and represented in different colours and symbols. The following drawings are generally prepared:

- Contours map
- Land use map showing broad features of the town such as open space and built-up areas, etc.
- Population density map
- Town map showing proposals of different zones
- Programme map of town showing development in first five years.

Based on the maps and drawings, a detailed report is prepared, sometimes models are also prepared to convey the ideas. The representation of drawing helps in following two ways:

1. The task of town planner becomes easy.
2. The representation of town planning proposals on drawings assists in easy understanding of the ideas by general public and authorities in particular.

5.6 LAYOUT BYE-LAWS:

- All building sites have to be of regular size and shape, except the sites abutting the existing outer boundary of the layout. Exemption shall be provided in hilly areas due to the undulating terrain of the layout, if any.

Minimum size of a residential building site shall be of 54.00Sq.m, except for EWS housing.

a. The frontage of a residential building site shall be 6.0m, except for EWS housing.
b. Minimum size of a non-residential building site shall be 108.0Sq.m
c. The frontage of a non-residential site shall be 9.0m
d. Minimum size of a commercial building site shall be of 216.0Sq.m
e. The frontage of a commercial building site shall be of 12.0m
f. 3% to 5% of the total extent of plot proposed for layout approval shall be permitted to be allotted as building sites for commercial use.

- A layout plan submitted for approval shall be prepared in a legible scale, preferably in 1:200 to 1:500 but not less than 1:1000 scale. The layout plan shall contain the following details, namely

a. Approach road to the plot with its existing and proposed width and hierarchy
b. Laying of roads within the layout, including the roads of the master plan, if any, with road numbering, length of the road, width of the road and hierarchy.
c. Area reserved for park and open spaces.
d. Sites earmarked for civic amenities.
e. Building sites earmarked for residential use, commercial use, other non-residential use and industrial use, as the case may be
f. On-street or off-street parking details, if any
g. Location of public utilities provided.
h. Layout plan superimposed on existing contour map of the plot proposed to be developed as a layout. Formed found levels of the roads and that of all sites including the area reserved for park and open spaces, civic amenities and public utilities.
i. Required number of the cross sections of the layout (not more than 25m intervals, if the natural ground level difference of the total plot is more than 20m, not more than 50m intervals. if the natural ground level

difference of the total plot is more than 10m, not more than 100m intervals, if the natural ground level difference of the total is more than 5m and not more than 250m intervals, if the natural ground level difference of the total plot is less than 5m) showing the details of earth cut and fill and details of retaining wall proposed to be constructed.

j. Longitudinal sections of roads showing the levels of abutting sites on both sides, showing the existing ground level and the formed road level, if the vertical slope of the road is steeper than 1:15 .

5.7 ZONING

Zoning is the application of common sense and fairness to public regulation governing the use of private land. Zoning can be defined as the creation by law of the zones such as residential, commercial, industrial, civic, institutional and recreational in which regulations prevent misuse of lands and buildings and limit their height and densities of population differing in different zones. While planning a city the area of town can be divided into following zones:

1. Industrial zone
2. Administrative zone
3. Business zone
4. Open space
5. Residential zone

a) Different zone for different height

b) Zone for single family

c) Zone for two family

d) Zone for apartment houses

6. Recreational zone
7. Local administrative zone
8. Agricultural zone.

Under the Use zoning the town is divided into the following:

a) Residential zone: This is very important zone of the town, where the people of the town live together in large number. This zone covers an area of 40% - 50% of total land. The buildings coming under this zone are single

family houses, semi-detached houses, group housing, chawl, flats, sky-scrappers, etc. The following are the points considered while locating residential zones:

- Near to the market, free from noise and smoke, parks and playgrounds should be close by.
- It should have certain amount of privacy and separated from other zones by wide strip of green belt which may consists of parks and parkways, etc.
- Speedy travel and communication facilities.
- Peaceful surroundings, as far as possible from industries and business zones.
- Healthy environment with respect to hygienic and sanitary requirements.

b) Industrial zone: This zone covers an area of 5% - 20%. This is next to the residential zone in terms of importance. Hence great care should be exercised in locating the industries. The following are the points considered while locating industrial zones:

- Minor industries like bakeries, dairies, laundries may be grouped and located close to the residential zone for the benefit of inhabitants.
- Light industries and factories like manufacture of glass, porcelain, and ice, etc. which use only electric power can be located anywhere on the periphery of the town.
- Heavy industries giving out obnoxious (or harmful) gases and the industries causing noise such as manufacture of cement, steel, and other such material should be located on the outskirts of the town.
- The special industries producing undesirable trade wastes and by-products may be located far away from town in spacious grounds.

c) Commercial zone: This zone covers an area of 2% - 5%. This zone consists of markets, banks, ware-houses (gowdons), business offices. These should be located near centers of traffic and as far as along the road-sides.

d) Civic zone: This zone covers an area of 2% - 3%. This contains all public buildings like town hall, court, public libraries, post office, museum, auditorium, bank, show-rooms, stores and houses for the employed under the government.

e) Institutional zone: This zone covers an area of 1% - 2%. This zone contains schools, colleges, institutions, etc.

f) Recreational zone: This is planned in the remaining area of the town, usually 15% - 20%. This is an important zone since it provides healthy environment for the people. It mainly includes parks, playgrounds.

stadiums, cinemas, community centres. Generally, the various units of recreational zone are scattered throughout the town.

Densities of a Town

1. Overall town density = Total population / Total town area
2. Developed area density = Total population / Total developed area
3. Gross residential area density = Total population / Total residential area
4. Net residential area density = Total population / Net residential area
5. Accommodation density = Number of habitable rooms / Area
6. Occupancy rate = Number of persons / Number of habitable rooms
7. Floor Space Index = Total built up area / Plot area

5.8 PROCEDURE:

1. Reconnaissance Survey has to be done for certain area of land.
2. Due to some undulations, dumpy level is used for leveling purpose.
3. Mark certain points using radiation method and join those points to form a boundary for the layout.
4. Calculate the area within the boundary in hectares. Let the area be minimum of 1Hectares.
5. Later determine the type of zoning for the land selected for layout planning.
6. Note that the proposed land for developing from existing public road shall not be less than 12m width.
7. Now divide the entire area into plots of size not lesser than 59sq.m.
8. Bearings has to be taken for each site in order to determine its direction.
9. Division should be as follows:
   - The area of Residential sites shall be maximum of 55% of total area.
   - Remaining area shall be divided for roads, parks, playgrounds and civic amenities.
   - Area under Playground not less than 10% of total area.

- Area under civic amenities not less than 5% of total area.
- 3% of land for commercial uses.
- When the plots are of size 9m*12m minimum road width should be equal to 9m
- When the plots are greater than 9m*12m road width will be greater than 9m.
- For every 3m manhole is made

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PHOTOS OF FIELD WORK

NEW TANK PROJECT

New tanks are constructed to provide water for multipurpose. Tanks and reservoirs requires careful planning, design, and operation for which certain observations relating to selection of site, relative merits of different types of tanks, storage capacity, coordinated use of storage for different purposes etc. are studied in detail

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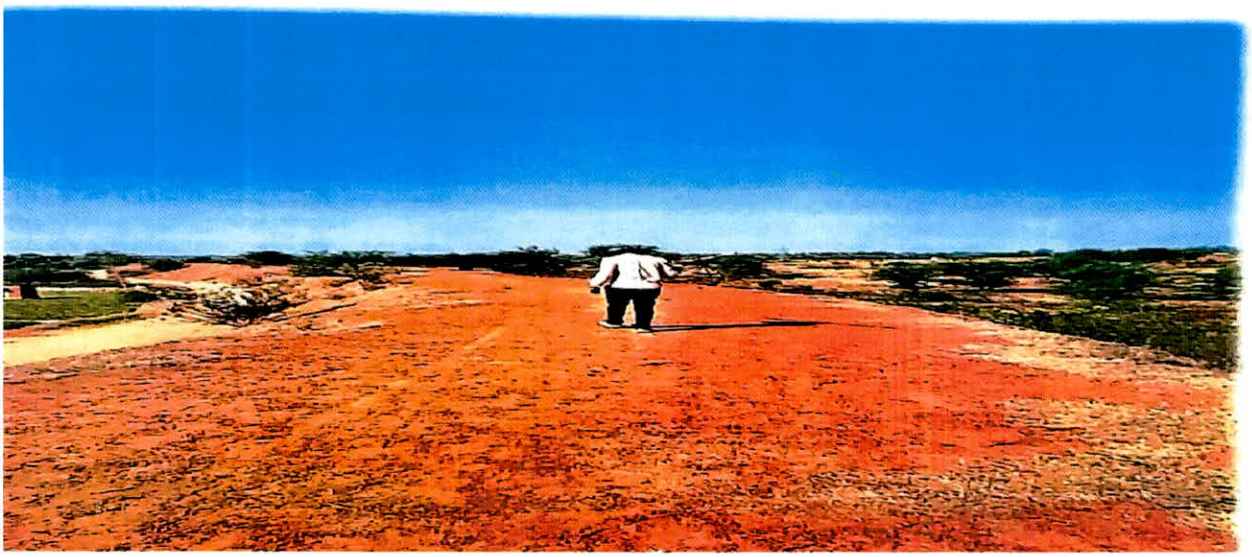
The main object of the new tank is to construct an earthen dam across the steam for the purpose of irrigation. Since the land to be irrigated is very small and population of the town is very less, it is not necessary to construct a major work but it is sufficient to provide minor tank project.

OLD TANK PROJECT



A minor irrigation tank is defined as the one, which has irrigable area less than or equal to 2000 hectares. Every rainy season, surface runoff carries large amounts of silt into the reservoir. The silt deposits reduce the storage capacity of the reservoir over the years. The reduced storage capacity of the tank can be increased by raising the sill level of the waste weir. Sometimes due to

bad maintenance, the profile width of the earthen dam may also get altered due to erosion of the downstream slope. The deteriorated section of the bund is given the required slope, free board, top width in order to restore the earthen dam. Sometimes it may also be necessary to increase the height of the bund.

HIGH WAY PROJECT

This study involves various surveys like:

1. Transportation planning surveys: For traffic Highway inventory geometric and accident studies.
2. Map studies: For identifying possible routes using topo-sheet.

3. Reconnaissance survey for route locations of alternative alignment by using simple instruments and collecting essential information which affect geometric design construction traffic and economics.

4. Preliminary survey is carried out in order to assess the various alternatives and finalize the best alignment by collecting all necessary details either by conventional approach or using modern approach. These survey include open traversing, collection of topographical features, leveling work, hydrological data for Cross Drainage work, soil surveys etc. For pavement design.

5. Final location and detailed survey is conducted to establish center line alignment for the best route chosen and to collect detailed information for the preparation of plans and drawings and finalization of design and construction details for the highway project. Soil and drainage studies also form part of detailed surveys, based on soil analysis and testing pavement design is finalized.

TOWN PLANNING

It is the preliminary survey. It is used at of any project workthroughsuggestingpossible alternative paths and routes. It needs to be done with greater efficiency and cost accuracy for identifying these alternative paths and routes.

It is the process of identifying variable possible routes and evaluating possibility of these routes in a highway between the specific points. This is done especially for new routes between the rural areas, for which the aerial photographs are primarily used.

It has four phase study processes as follows, 1) Research, 2) Draft report outline, 3) Draft sensitivity map and 4) Final report.

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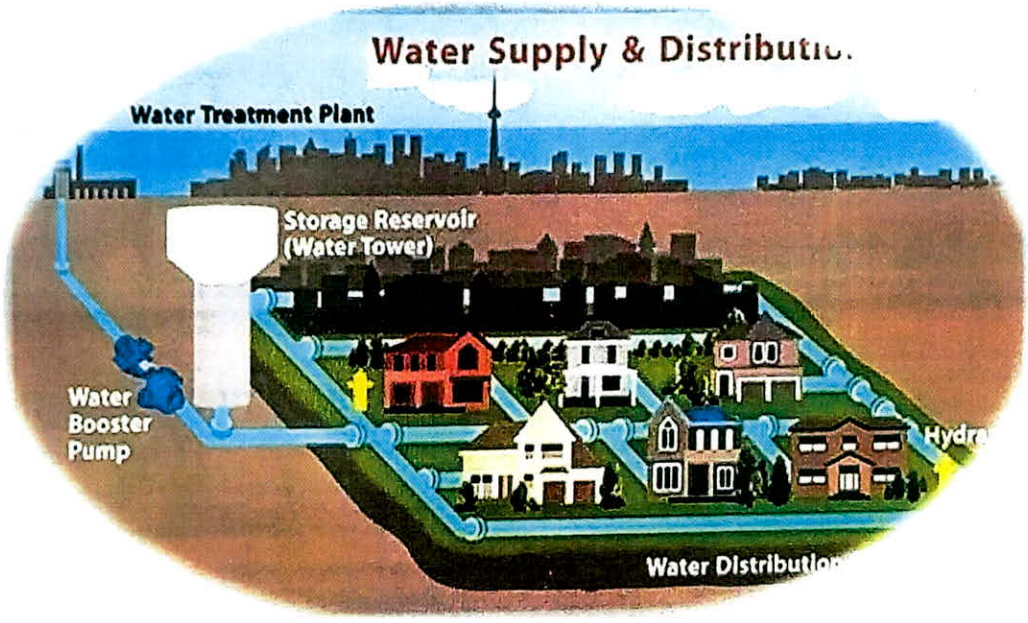
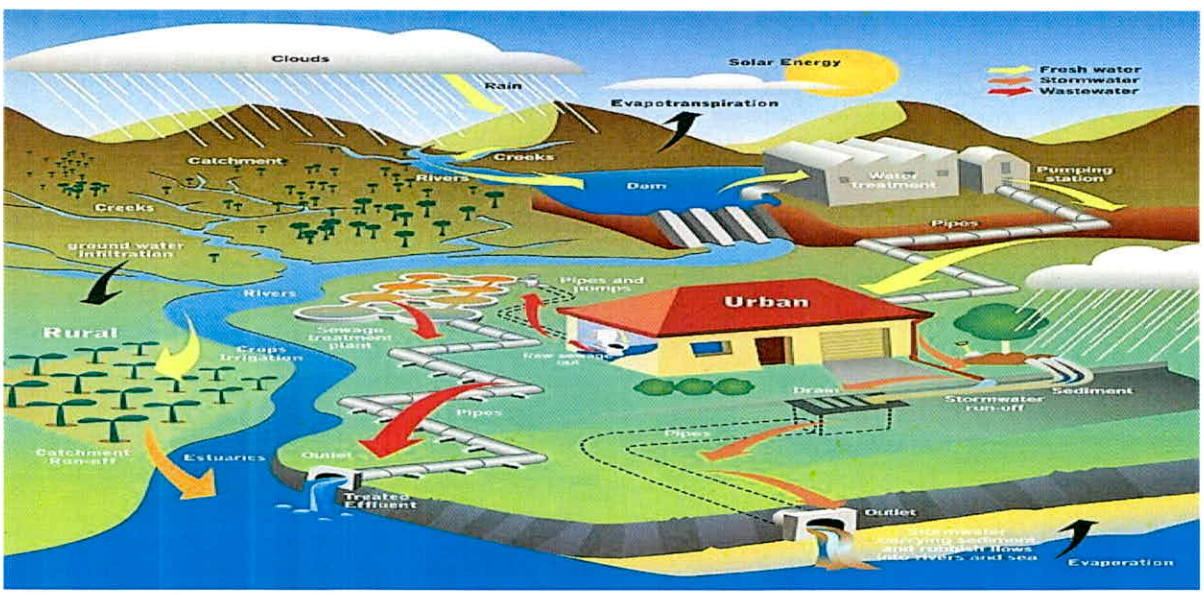
WATER SUPPLY AND SANITARY PROJECT





Every community produces both liquid and solid wastes .The liquid portion –waste water– is essentially the water supply of the community after it has been fouled by a variety of uses such as spent water from bathroom kitchen, lavatory basins, house and street washings, from various industrial processes semi solid wastes of human and animal excreta, dry refuse of house and street sweepings, broken furniture, wastes from industries etc. are produced daily.

If proper arrangements for the collection, treatment and disposal are not made, they will go on accumulating and create foul condition. If untreated water is accumulating, the decomposition of the organic materials it contains can lead to the production of large quantity of mal odorous gases. It also contains nutrients, which can stimulate the growth of aquatic plants and it may contain toxic compounds.Therefore in the interest of community of the city or town, it is most essential to collect, treat and dispose of all the waste products of the city in such a way that it may not cause any hazardous effects on people residing in town and environment.

PHOTOS OF STUDY OF WATER CHARACTERISATION OF CHIKKABANAVARA LAKE

PLASTIC WASTE DUMPED AT SHORELINE

A number of apartment complexes that have come up on the periphery of the vast chikkabanavara lake in northwest Bengaluru are discharging untreated sewage into the lake.The Karnataka State Pollution Control Board(KSPCB) that issues consent for establishment and consent for operation for sewage treatment plants of residential and commercial buildings, recently issued notices to nine apartments around the lake for violating the provisions of the water and air act.

There are many more such buildings, including apartment, hospitals and industries that are letting untreated sewage to Chikkabanavara lake. The authorities should take strict action against them before the lake becomes yet another Bellandur.

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CONSTRUCTION DEBRIES DEPOSITED NEAR SHORE LINE

WEED AND MACROPHYTE GROWTH

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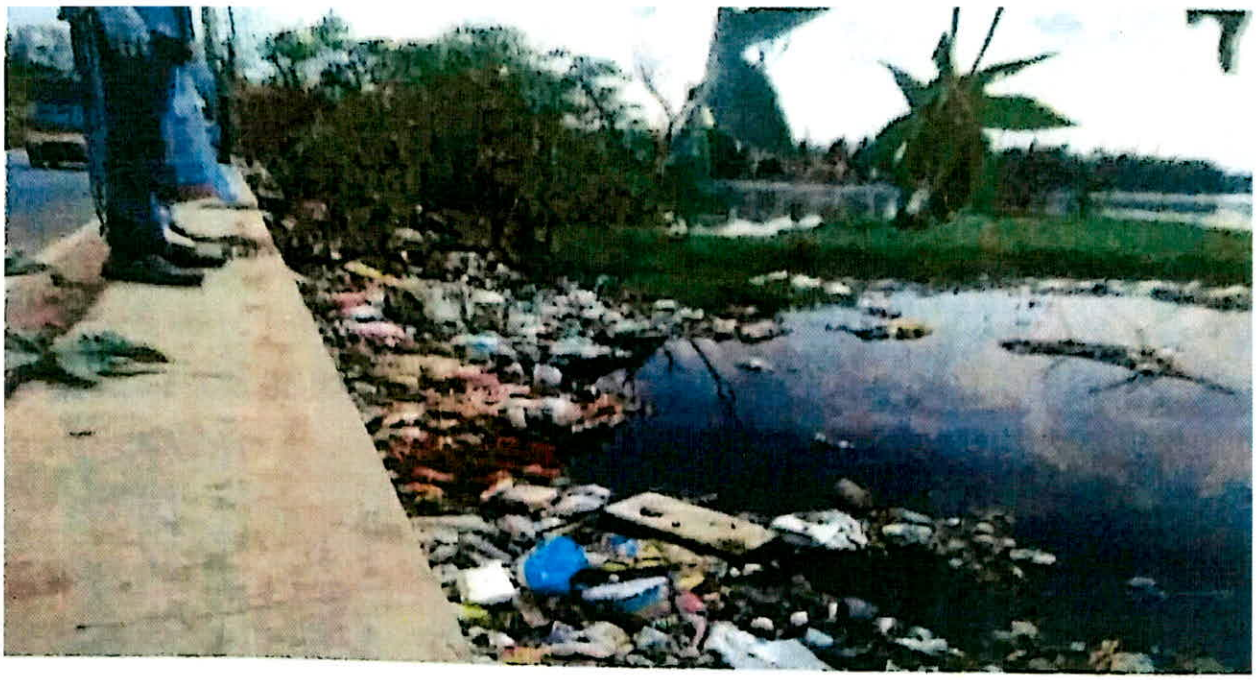

ABSENCE OF FENCING

DAMAGED FENCING

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OFFERINGS TO GOD

FACTS:

1. The lake now gives out a foul smell and fishing has been stopped.
2. People living near the lake are falling sick. Mosquitos breed in the water body.
3. A sewage water treatment plant has been set up at a cost of Rs 16 core. But there are no efforts to conserve the lake.
4. The revenue department has given a report on the encroachment. Fencing has to be completed and the sewage treatment plant (STP) is still under construction.