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Design of the Pipe Line System for The Replacement Of Existing Detoriorated Pipe Line Network

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Abstract : *This study has been undertaken to investigate the determinants of Design of pipeline system in Santhi Nagar near Narasaraopeta using IS 8329:2000 the design code for the manufacturing of DI K7 pipes which are to be used for the design of the Proposed new pipeline system. To test the new pipe line design, the design requirements to be considered from the existing site conditions and the parameters that are required to be followed for the design flow and to meet the future requirements for the people of Narasaraopeta municipality water distribution cum treatment plant .the design was undergone with manual calculations by using standard design practices and this was under the AMRUT scheme prestigiously carried out by the Government of INDIA.*

IndexTerms: *Full supply level, Filtration losses, Transmission losses, water demand*

I. INTRODUCTION

A. Pipes for Water Supply System

Pipes which are commonly used in water supply system are given below.

- 1) Cast Iron (CI) Pipes
- 2) Steel Pipes
- 3) Galvanized Iron (GI) Pipes
- 4) Copper Pipes
- 5) Plastic or Polythene or PVC pipes
- 6) Asbestos Cement (AC) Pipes
- 7) Concrete Pipes
- 8) Polypropylene pipes
- 9) C.I. pipes are manufactured by following 4 methods.
 - a) Horizontally cast (MC ware pipes)
 - b) Vertical cast (pit cast in sand moulds)
 - c) Centrifugally cast in sand lines moulds spun type
 - d) Centrifugally cast in water cooled metal moulds

Presently a day on a level plane cast C.I. funnels are never again utilized. Diffusively cast funnels have fine grained thick structure and uniform thickness and in this way they are broadly utilized and along these lines they are generally utilized. Exceptional care must be taken amid transportation and making association of these funnels, to anticipate harm.

B. Major and minor canal

Canals are human-made channels for water conveyance, or to service water transport vehicles. In most cases, the engineered works will have a series of dams and locks that create areas of low speed current flow. These areas are referred to as slack water levels, often just called levels. Major canal are those, which we are taken from the water to the canal for the purpose of water supply

C. Diversion head Works

A diversion head works is a structure constructed across a river for the purpose of raising water level in the river so that it can be diverted into the off-taking canals. It is also known as canal head works

D. Canal Regulators

A structure which is constructed at the bed of the canal to regulate flow of water in the off taking canal is known as head regulator.



Fig 1:-deteriorated pipes removed from the existing system



Fig 2:- New DI K7 Proposed pipes for construction

II.OBJECTIVES

- A. To survey the existing pipe line system and to analyse the obstructions present in the survey line.
- B. To prepare a design of a new water pipe line system by using design standards.

III. RESEARCH METHODOLOGY

A. SS Tank at Santhi Nagar

Bund Top Level	:	+ 103.6700m
Max Water Level	:	+ 103.170m
Lowest Water Level	:	+ 98.300m
Bed Level	:	+ 98.1501 m

B. Chilakaluripeta 10R Major Canal @ ch.1-7-0 of NS right canal

Full supply level	:	+ 106.200m
Canal Bed level	:	+102.950m
Bund Top level	:	+106.650m
Sill level of gravity main near of take chamber	:	+103.050m
Depth of water in canal	:	3.25m

C. Raw water Demand to fill SS Tank near Santhi Nagar

1) Proposed period of filling SS Tank	:	30 days
2) Existing SS Tanks capacity	:	568 ML
3) Raw water Requirements for filling SS Tank in 30 days (568/30):	:	18.93 MLD
Total requirement of raw water to fill SS Tank	:	19.00 MLD
Filtration losses at 5% of water demand	:	0.95 MLD
Transmission losses at 15% of water demand	:	2.85 MLD
	:	22.80 MLD
	:	Or say 23.00 MLD

From off take raw water is being collected into SS Tank through 600 mm dia DI K7 gravity main of length 900m. The design of raw water gravity main from off take to raw water SS Tank is given below.

600 DI.k7 Proposed Raw water gravity main from off take chamber to Jn at SS Tank

Total Requirements or Raw Water to fill SS Tank	:	23.00 MLD
Hours of drawls	:	23.00 Hours
Considering 23 hrs of filling, Discharge Q =	:	$23 \times 10^6 / 23 \times 60$

Discharge Q	:	16667 lpm
Or say	:	278.00 lpm
Length	:	900 m
Internal Dia	:	600 DI. K7
Area of pipe 'A'	:	0.28274 sqm
Velocity 'v'	:	0.9832 m/s
V	:	$4.567 \times 10^{-3} \times c \times d^{0.63}$
$S^{0.54}$:	$V / 4.567 \times 10^{-3} \times c \times d^{0.63}$
C = Hazen Williams co-efficient	:	140
d	:	600mm
$s^{0.54}$:	0.983224/35.97
	:	0.027331161
S	:	0.0012733
OR 1/S	:	785.00
Head loss in friction	:	900/785
	:	1.15 m
Other losses @ 10%	:	0.11
Total losses	:	1.27
Full supply level	:	+ 106.200 m
HL at jn near SS tank tapping point	:	+ 104.930 m
GL at jn near SS tank tapping point	:	+ 97.550 m
Residual head available	:	7.38 M
Check for class of main		
Full supply level	:	+106.20m
Lowest ground level along the alignment	:	+97.55m
Lowest invert level	:	+95.95m
97.55-1-0.6		
Total head (Static and frictional losses)	:	10.25m
Maximum pressure on gravity main column	:	15.00m
Pressure as per IS8329: 2000(ANNEX 'E' Table-I)		
MOP: Max operating pressure	:	80.00m>15 [SAFE]
Hence 600DI.K7 Clear water gravity main in sufficient		
2) 600DI.K7 proposed raw water gravity main from off take chamber to Jn at SS tank		
Total requirement of raw water to fill SS tank	:	<u>23.00 MLD</u>
Hours of drawls	:	23.00 HOURS
Considering 23 hrs of filling, Discharge Q	:	<u>23×10^6</u>
Discharge Q	:	16667 lpm
Or say	:	278.00 lps
Length	:	65 m
Dia of gravity main	:	600 DI.K7
Area of pipe 'A'	:	0.28274 sqm
Velocity 'V'	:	0.9832 M/S
S	:	0.0012733
Or 1/S	:	785.00
a) Head loss in friction	:	65/785
	:	0.08 m
b) Other losses @ 10%	:	0.01
Total losses	:	0.10

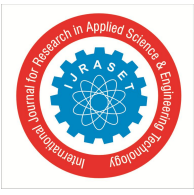
HL at in near SS tank tapping point	:	+ 104.930 m
HL at SS tank to fill	:	+ 104.830 m
SS tank at Santhi Nagar:-		
Bund Top level	:	+ 103.670 m
Max Water Level	:	+ 103.170 m
Lowest Water Level	:	+ 98.300 m
Residual Head available above bund top	:	1.16 m
Residual Head available above MWL	:	1.66 m
Check for class of main:-		
HL at jn near SS tank tapping point	:	+ 104.93 m
Lowest Ground Level along the alignment	:	+ 97.55 m
Lowest invert level	:	+ 95.95 m
Total head (static & Frictional losses)	:	8.98 m
Max pressure on gravity main	:	8.98 m
Pressures as per IS 8329: 2000 (ANNEX "E" Table -I)		
MOP: Max operating pressure	:	80.00 m > 8.98

SAFE

600 DI.K7 proposed raw water gravity main from Jn near SS tank to existing filters.

Total requirements of raw water to fill SS tank	:	23.00 MLD
Hours of drawls	:	23.00 hrs.
Considering 23 hrs of filling, Discharge Q=	:	$\frac{23 \times 10^6}{23 \times 60}$
Discharge Q	:	16667 lpm
Or say	:	278.00 lps
Length of main	:	760 m
Dia of gravity Main	:	600 DI.K7
Area of pipe 'A'	:	0.28274 sq. m
Velocity 'V'	:	0.9832 m/s
V	:	$4.567 \times (10 - 3) \times C \times d^{0.63} \times S^{0.54}$
Or 1/S	:	0.0012733
	:	785.00 Head loss in friction
	:	$\frac{760}{785}$

	:	0.97m
Other losses @ 10%	:	0.10
Total Losses	:	1.07
HL at jn near SS tank tapping point	:	+ 104.930 m
HL at Existing Filters	:	+ 103.860 m
Existing Filters at santhi nagar		
GL at Filters	:	+95.050 m
Top of Aerator in filters	:	+97.150 m
Residual Head Available above BUND TOP	:	8.81 m
Residual Head Available above Aerator	:	6.71 m
Check for class of main:-		
HL at jn near SS tank tapping point	:	+ 104.93 m
Lowest Ground Level along the alignment	:	+ 95.55 m
Lowest invert level	:	+93.95 m
Total Head (static & Frictional losses)	:	10.98 m
Max Pressure on gravity main	:	11.00 m
Pressures as per IS 8329: 2000 (ANNEX "E" Table -I)		
MOP: Max operating pressure	:	80.00 m > 11



IV. RESULTS AND DISCUSSION

As we had encountered obstructions while laying the pipeline system, so we had divided the total pipeline system into 3 parts of 900m, 65m, 750m. for each individual pipeline force of gravity and no external pressure is required to transfer the water through the pipes from the major canal near Chilakaluripeta town. The pressure in the pipeline is less than the maximum operating pressure under IS 8329: 2000 (ANNEX "E" Table -I) for DI K7 pipe with a internal Dia of 600mm.

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