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Augmentation of Water Supply Scheme in Khammam Town

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Preamble- We express our sincere thanks to **VIJAYALAKSHMI, Head of Civil Engineering Departmentfor** her support and guidance for doing the RESEARCH.

We express our ineptness and gratitude to our guide **CH. RAVI,** Assistant professor, Department of Civil Engineering, **MOTHER TERESA INSTITUTE OF SCIENCE AND TECHNOLOGY,** for his guidance and care taken by him in helping us to complete the Project work successfully.

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ABBREVATIONS:

1. LPCD: Liter Per Capita per Day
2.MLD: Million Liters per Day
3. KL: Kilo Liters
4. WTP: Water Treatment Plants
5. EIA: Environmental Impact Assessment
6. ELSR:Elevated Service Reservoir
7. GLSR: Ground Level Service Reservoir
8.CPHEEO: Central Public Health and Environmental Engineering Organization
9. OMC: Operation Maintenance Charges
10. RCC: Reinforced Cement Concrete
11. DI: Ductile Iron
12. PSC: Pre Stressed Concrete
13. CI: Cast Iron
14. AC: Asbestos Cement
15. HDPE: High Density Polyethylene
16. EIA: Environmental Impact Assessment

I. Introduction

Khammam is the head quarters of the Khammam district in A.P state. Its population is 2,565,412 of 19.81% were urban as from 2011 census. The present name of Khammam is derived a local hill, which is called "STAMBHADRI". It is located about 193 km (120mi) east state capital of Hyderabad.

On October 19th A.P government has announced Khammam city as municipal corporation adding 14 villagesaround it, which developed in business with the town.

The Godavari River enters into Khammam at Warangal district and flows nearly 250 km across the district.

Khammam district is one of the "coal mining districts has singareni collieries head town.

II. BACKGROUND

Khammam is located at17°.25'N80°.15'E.It has an average elevation of 107 meters (351 feet). The district is bounded by Chhattisgarh state to the north, Odessa state to the northeast, Eastland westGodavari districts to the east, Krishna District to thesouth, Nalgonda District to the southwest.

People of khammam city are well coordinated with East & West Godavari & Krishna.

It has an area of 16,029 km².Khammam city has many educational Institutions .There are 18engineeringcolleges,5 pharmacy colleges nearly 20 MBA&MC colleges around the city.

Khammam town connected capital city of TELANGANA through south central railway.

III. EXISTING SYSTEMS

The existing water treatment plant (WTP) at Munnaru near Nagarjunasagar and its water supplyCapacity is18.18MLD.

There are about 5 existing reservoirs, those are
1. Guttalabazaar (GLSR) 1.28 lakhs gallons
2. Jammibanda (GLSR) 4.50 lakhs gallons
3. Templehillock (GLSR) 4.00 lakhs gallons
4. Burahpurum(ELSR) 2.20 lakhs gallons
5. Srinivasanagar (ELSR) 2.20 lakes gallon

- Number of house service connections 12,290.
- Public tanks posts 893.
- Length of distribution pipe is 130.20 km.

IV. NEED OF RESERACH

POPULATION PROJECTION:

Based on 2011 censes by incremental increase method % of population trend is as follows

YEAR	POPULATION	POPULATION TREND	%OF POPULATION TREND
2001-11	236030	83716	8.371%
2011-21	366175	130145	13.014%
2021-31	54274	917657	17.65%
2031-41	765752	223003	22.300%

WATER DEMAND:

YEAR	POPULATION(lakhs)	LPCD (MLD)	WATERDEMAND (MLD)
2011	2.36	135	31.56
2021	3.66	135	49.409
2031	5.42	135	73.17
2041	7.65	135	103.36

The LPCD 135MLD based on CPHEEO manual.
Considering for the population the demand is 75MLD.
Available quantity of water is 18.18%.
Difference of demand is 73.17-18.18=54.89MLD.
Intermediate water demand required for 2031 is 55 MLD.
The ultimate demand for 2041 is 103.36-55 =48.56MLD.
Additional of 48.56MLDis to be required.

V. RESERACH PROPSALS DETAILS:

TO meet the 2021 demand of 55MLD the project component proposals are

- Intake wells with REINFORCED CONCRETE CEMENT(RCC) with 55MLD
- Raw water main
- Summer Storage tank
- Water treatment plant

WATER TREATMENT PROCESS:

The main object of the treatment process is to remove the impurities of raw water and bring the quality of water to the required standards.

1.INTAKE PIPE:

Intake pipe is the arrangement to take the raw water from lake or reservoir to supply the water treatment plant. Generally the intake pipes are in circular shape to collect the raw water .Generally the intake pipe with diameter of 4 to 7 meters to collect water from rivers. The intake pipes are with diameter of mm. The raw water is supplied to the intake pipes with the help of electric motor or gravity mains.

PRELIMINARY TREATMENT:

In this preliminary treatment the solid and liquid wastages are removed by screening process .

2.PROTECTIVE BAR SCREEN:

The first step in the treatment of waste water is the removal of larger particles of floating and suspended matters by coarse screenings. In most of the plants this is accomplished by a set of inclined parallel bars, fixed at certain distance apart in a channel. These could have been properly called as ”RACKS”, instead these are referred to as “BAR SCREENS”.

The cross-sectional area of this chamber is always greater than that of inflowing sewer. The length of this channel should be sufficiently long to prevent eddies around the screen. The suggested velocity in the screening channel is 60cm/sec to 70 cm/sec. Clear spacing of bars may be from 25 to 50 mm for hand cleaned bar screens, this may range from 15mm to 75 mm for mechanically cleaned bar screens. Generally the sizes of bar screens are 15mm width and 50 mm depth.

3.GRIT CHAMBER:

Grit chambers are designed to remove grit, consisting of sand, gravel, cinders, or other heavy solid materials. In this the solid materials are settled down and clear water is pumped to the next process. The detention time in the grit chamber is 30 to 60 seconds. In grit chamber 0.20 mm size suspended settle able solids of specific gravity 2.60 are removed.

4.LOW LIFT PUMP WELL:

In this chamber the water is pumped to the next operation with the help of motor arrangement by pumping arrangement.

5.CHLORINATION:

The History of Chlorination

Chlorine was first discovered in Sweden in 1744. At that time, people believed that odours from the water were responsible for transmitting diseases. In 1835, chlorine was used to remove odours from the water, but it wasn't until 1890 that chlorine was found to be an effective tool for disinfecting; a way to reduce the amount of disease transmitted through water. Today, chlorination is the most popular method of disinfection and is used for water treatment all over the world

Pre-chlorination:

The addition of chlorine in the collection system serving the plant or at the head works of the plant prior to other treatment processes mainly for odor and corrosion control. Also applied to aid disinfection, to reduce plant BOD load, to aid in settling, to control foaming in Imhoff units, and to help remove oil. In water treatment, pre-chlorination can be used to control tastes and aquatic growth and to aid in coagulation and settled. The dosage of chlorine in this process is 0.10 to 0.50 ppm to the filter plant.

6.Coagulation:

Coagulant Chemicals

Coagulant chemicals come in two main types - primary coagulants and coagulant aids. Primary coagulants neutralize the electrical charges of particles in the water which causes the particles to clump together. Coagulant aids add density to slow-settling flocs and add toughness to the flocs so that they will not break up during the mixing and settling processes.

Primary coagulants are always used in the coagulation/flocculation process. Coagulant aids, in contrast, are not always required and are generally used to reduce flocculation time.

Chemically, coagulant chemicals are either metallic salts (such as alum) or polymers. **Polymers** are man-made organic compounds made up of a long chain of smaller molecules. Polymers can be either **cationic** (positively charged), **anionic** (negatively charged), or **nonionic** (neutrally charged.) The table below shows many of the common coagulant chemicals and lists whether they are used as primary coagulants or as coagulant aids.

Generally the dosage of alum varies from 5 mg/litre for relatively clear water and 25 mg/litre for very turbid water.

Chemical Name	Chemical Formula
Aluminum sulfate (Alum)	$Al_2(SO_4)_3 \cdot 18\ H_2O$
Ferrous sulfate	$FeSO_4 \cdot 7\ H_2O$
Ferric sulfate	$Fe_2(SO_4)_3 \cdot 9\ H_2O$
Ferric chloride	$FeCl_3 \cdot 6\ H_2O$
Cationic polymer	Various
Calcium hydroxide (Lime)	$Ca(OH)_2$
Calcium oxide (Quicklime)	CaO
Sodium aluminate	$Na_2Al_2O_4$
Bentonite	Clay
Calcium carbonate	$CaCO_3$

7.FLOCCULATION:

After thoroughly mixing of coagulants in the water next operation is flocculation. Flocculates are slow stirring mechanisms, which forms FLOC. Flocculates mostly consists of paddles which are revolving at very slow speed about 2-3r.p.m . The detention time for best results should be 30-60 minutes.

8.SEDIMENTATION:

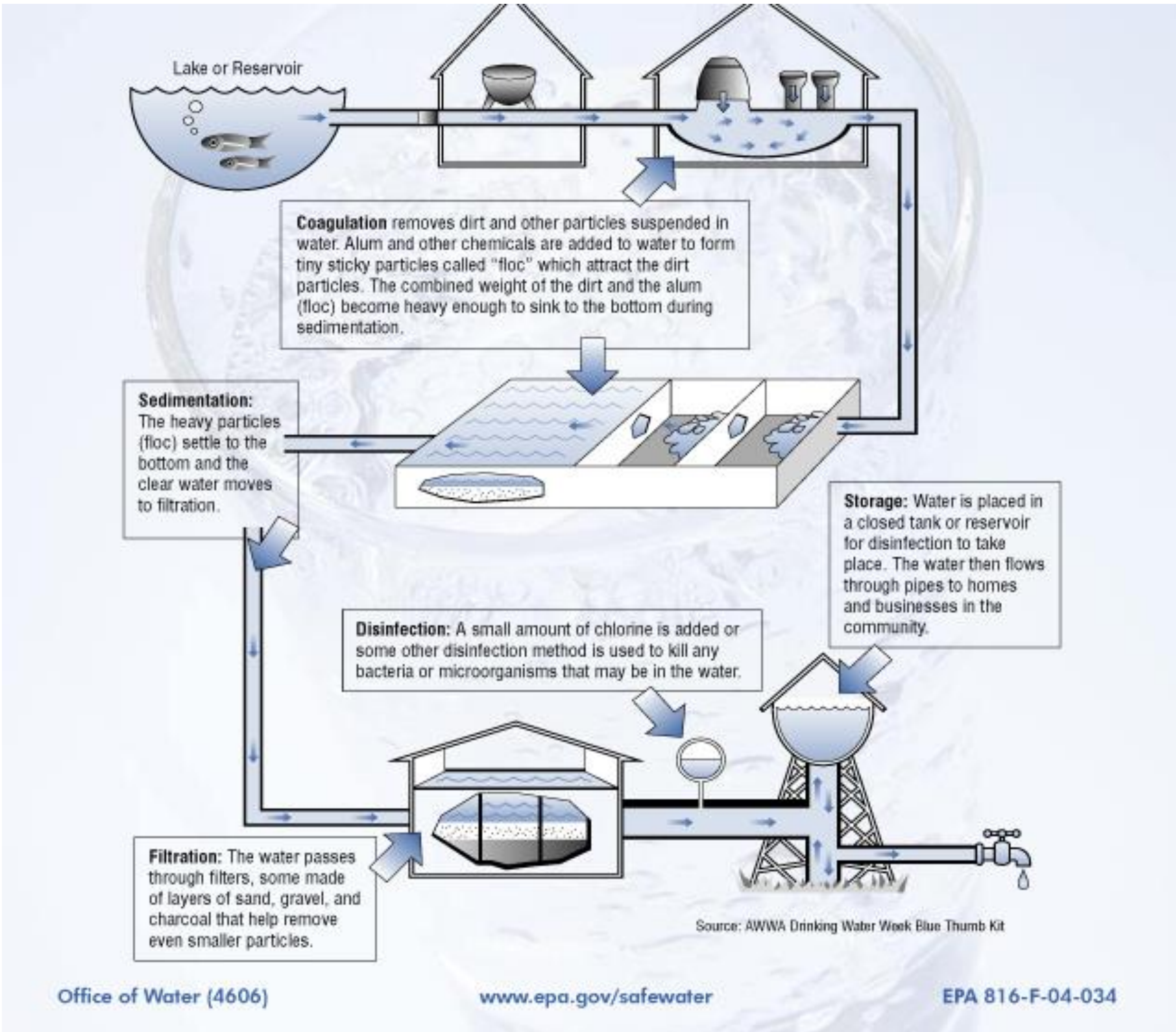
Solids are removed by sedimentation (settling) followed by filtration. Small particles are not removed efficiently by sedimentation because they settle too slowly; they may also pass through filters. They would be easier to remove if they clumped together (coagulated) to form larger particles, but they don't because they have a negative charge and repel each other (like two north poles of a magnet).

In coagulation, we add a chemical such as alum which produces positive charges to neutralize the negative charges on the particles. Then the particles can stick together, forming larger particles which are more easily removed.

The coagulation process involves the addition of the chemical (e.g. alum) and then a rapid mixing to dissolve the chemical and distribute it evenly throughout the water.

Sedimentation Process

In Water Treatment Process Sedimentation is the process of removal of suspended particles that are heavier than water by gravitational settling. Most raw water will contain mineral and organic particles. The density of mineral particles is usually between 2000 to 3000 kg/m3 and can easily settle out by gravity. Organic particles, on the other hand, have densities ranging from 1010 to 1100 kg/m3and take a long time to settle by gravity. In conventional water treatment, coagulants are used to destabilize particle to form larger and settable solids



9.FILTERATION:

During the normal filtration operation he water enters through the top part of the filter to the supertant layer.

The inlet pipe has two holes to release the possible accumulation of air at the top of the inlet pipe. The water will remain in the supermen ant layer for several hours, during which time the suspended particles will settle. The obstruction of the filter will cause the supernatant layer to rise to the brim, at which time it will be necessary to clean the sand bed. There must be 20cm of free space above the brim. The greatest biological activity takes place on the surface layer of sand, where the majority of pathogenic organisms in the water are removed. The bed must be between 30 and 40cmhigh, depending on the quality of the gross volume of water. The inner walls of the filter box in the section containing the filtration bed must have a rough finish to prevent the formation of short-circuits.

The sand must go through a sifting process to eliminate grains that are too thick or too fine .Both the gravel and the sand must then be washed before being placed in the filter, in order to eliminate organic matter and clay (see Operation and Maintenance chapter).The water goes through the filtration sand bed to the drainage system underneath, which is comprised of porous pipes leading to the next unit. Layers of gravel are placed on top of the porous pipes at the bottom to support the sand .Outside the filter, the outlet pipe has a 10-20cm tee pipe above the sand bed to prevent any accidental discharge from the filter which could affect the layer of micro organisms and avoid the formation of negative pressures during the operation. This pipe serves the same purpose as the device that controls the minimum level in conventional..

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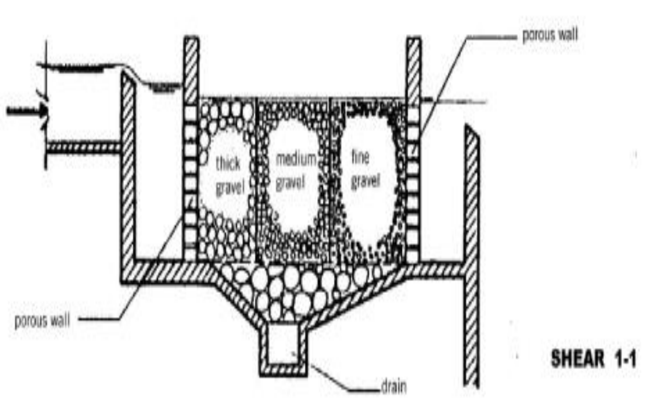
PARAMETER	VALUES
Number of pre-filters	(n) ≤ 2
VF Filtration rate (flow/area) (m/h)	
FL	0.1 – 0.2
Sedimentation or pre-filter + FL	0.15 – 0.3
Sedimentation + pre-filter + FL	0.3 – 0.5
Area of a filter (A)	A = Q / (n x VF)
Minimum cost coefficient (K)	K = 2n / (n+1)
Length of filter (m)	L = √(area x K)
Total height of the gravel bed (m)	0.1 – 0.3
Layers thickness (m) size (mm)	
First layer (gravel)	≤ 0.05 1.5 – 4.0
Second layer (gravel)	≤ 0.05 4 - 15
Third layer (gravel)	≤ 0.15 10 – 40
Height of the sand bed (m)	0.3 – 0.4
Effective diameter of the sand (D10)	0.15 – 0.4
Uniformity coefficient (D60/D10)	1.8 – 3
Height of free border (m)	0.2
Height of supernatant layer (m)	1 – 1.5



Horizontal flow of water in WTP

10.CLEAR WELL:

After post chlorination the treated water is collected into the clear well.

➢ **POST CHLORINATION:**

When the water is added in the water after all treatment is called as POSTCHLORINATION. Chlorine added in the clear well .The minimum contact period is 30 minutes ,before use of water.

11.FIOURIDATION:

The fluoridation of drinking water is an important part of the overall strategy to improve the dental health of the population. Fluoride helps to strengthen the structure of the tooth and to repair damage to the enamel from acids in the mouth. Having healthy teeth is critical for healthy nutrition and self-esteem as well as reducing pain and tooth loss that can come from cavities.

The major advantage of water fluoridation is that it benefits allmembers of the community. While some children and adults use fluoridated tooth paste on a regular basis and visit adentist every year for cleaning and other preventive care, others do not have access to these services for financial or other reasons. Without fluoridated water, these children and adults would be at an added disadvantage.

If the fluoride concentration in the treated water is less than 1.0 mg/litre it will be harmful to the health.

12. HIGH LIFT PUMP WELL:

From clear well the water is pumped to the supply reservoir with high efficiency of motors.

13.ELEVATED SERVICE RESERVIOR:

The treated water is stored in the ELSR to supply the distribution system.

14.DISTRIBUTION SYSTEM:

WATER DISTRIBUTION SYSTEMS

Distribution system is a network of pipelines that distribute water to the consumers.

They are designed to adequately satisfy the water requirement for a combination of

- ➢ Domestic
- ➢ Commercial
- ➢ Industrial
- ➢ Fire fighting purposes.

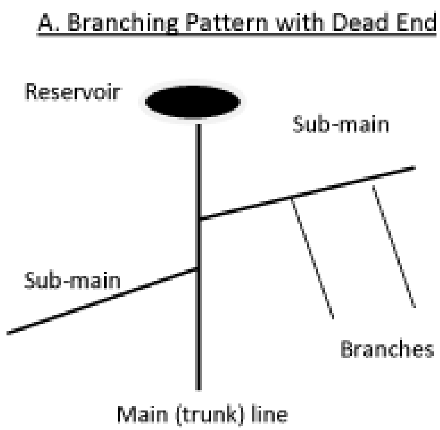
A good distribution system should satisfy the followings:

- ➢ Adequate water pressure at the consumer's taps for a specific rate of flow (i.e, pressures should be great enough to adequately meet consumer needs).
- ➢ Pressures should be great enough to adequately meet fire fighting needs.
- ➢ At the same time, pressures should not be excessive because development of the pressure head brings important cost consideration and as pressure increases leakages increases too.

Note: In tower buildings, it is often necessary to provide booster pumps to elevate the water to upper floors.

- ➢ Purity of distributed water should be maintained. This requires distribution system to be completely water-tight.

- Maintenance of the distribution system should be easy and economical.
- Water should remain available during breakdown periods of pipeline. System of distribution should not such that if one pipe bursts, it puts a large area without water. If a particular pipe length is under repair and has been shut down, the water to the population living in the down-stream side of this pipeline should be available from other pipeline.
- During repairs, it should not cause any obstruction to traffic.



A. Branching pattern with dead end.

- Reservoir
- Sub-main
- Sub-main
- Branches
- Main (trunk) line
- Similar to the branching of a tree.

It consists of

- Main (trunk) line
- Sub-mains
- Branches
- Main line is the main source of water supply. There is no water distribution to consumers from trunk line.
- Sub-mains are connected to the main line and they are along the main roads.
- Branches are connected to the sub-mains and they are along the streets. Lastly service connections are given to the consumers from branches.

8. EXTENT OF LAND REQUORED:
- To construct SUMMER Storage Tanks in 5 ACRES
- To construct WTP in 2ACRES
- To construct Reservoirs in 1.5ACRES

9.PROJECTCOST:
1. Construction of intake well (RCC) - 200 lakhs
2. Construction of pump house - 20 lakhs
3. Pumps& motor with electrical equipments- 750lakhs
4. Construction of summer storage tanks - 950lakhs
5construction of 60MLD WTP - 1800 lakhs
. Construction 3ELSR - 90 lakhs
7. Construction of 2GLSR - 40 lakhs
8. Construction of sump- 25 lakhs

Pumping system:
A. pump main DI pipes - 240 lakhs
B .Ground main PSC pumps - 150 lakhs
C. feeder main reservoir to reservoir (DI pipes) - 180 lakhs
D. Distribution main (AC pipes) - 250 lakhs

Land required for schemes is 8.5 ACRES.CONSIDERING COST FOR 1 ACRE is 60 lakhs.
Overall cost for land is 8.5*60= 52.5 CRS
TIME of project 3 years.

10.PHASING OF PROJECT COMPONENT HORIZONEYEAR:
PHASE1: For 2031 the capacity 55MLD for all above proposed component
PHASE2: A 2031-2041ditional of 48.5MLD is required during the year 2031-2041

PIPE MATERIALS:
- Pumping mains DI pipes (300mm&350mm)
- Gravity main PSC/RCC pipes(500mm&600mm)
- Feeder Main DI pipes (400mm&450mm)
- Distribution mains AC pipes(100mm&125mm)

11. FUNDING CASH FLOW STATEMENT:
- Government of India -70%
- State Government ofIndia -20%
- Urban Local Bodies -10%

12. ISSUES &PERMISSIONS REQUIRED:
- Approval of the project from government
- acquisition land for units
- land Revenue permissions
- Funds for project

13. BENEFITS OF SCHEME:
- Peoples have potable water at the doors
- Improve the health conditions
- Minimize water born diseases &100% population coverage

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14. ENVIORNMENTAL IMPACT ASSESSMENT:

The water supply augmentation scheme is a non –polluting proposal to supply additional

Water for residing within the municipality limits of khammam .There are no significant

Environmental issues in the proposal project. Hence EIA is not envisaged in the present scenario .

15. COST RECOVERY:

- Connection charges to be implied.
- Existing system.
- Proposal Tariff.
- 100% Tariff collection (It is connection charges next monthly report).

CASH FLOW STATEMENTS:

SHARE AMOUNT YEAR2015
YEAR2016 YEAR2017
Government of India (70%) 10.50crs 14.00crs 12.25crs
State Government (20%) 3.00crs
4.00crs 3.50crs
Urban Local Bodies (10%) 1.50crs
2.00crs 1.75crs
TOTAL 15crs 20crs
17.5crs

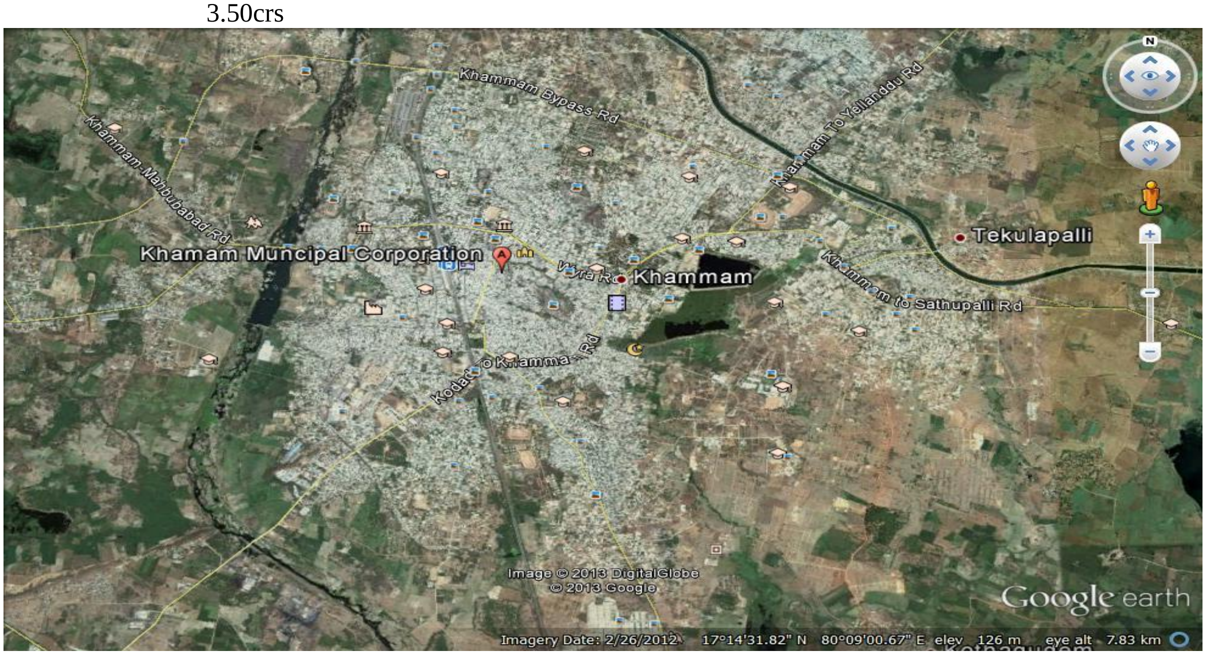
16. OPERATION AND MAINTANANCE:

The WTPS are operated with skilled labour to resist technical problems.

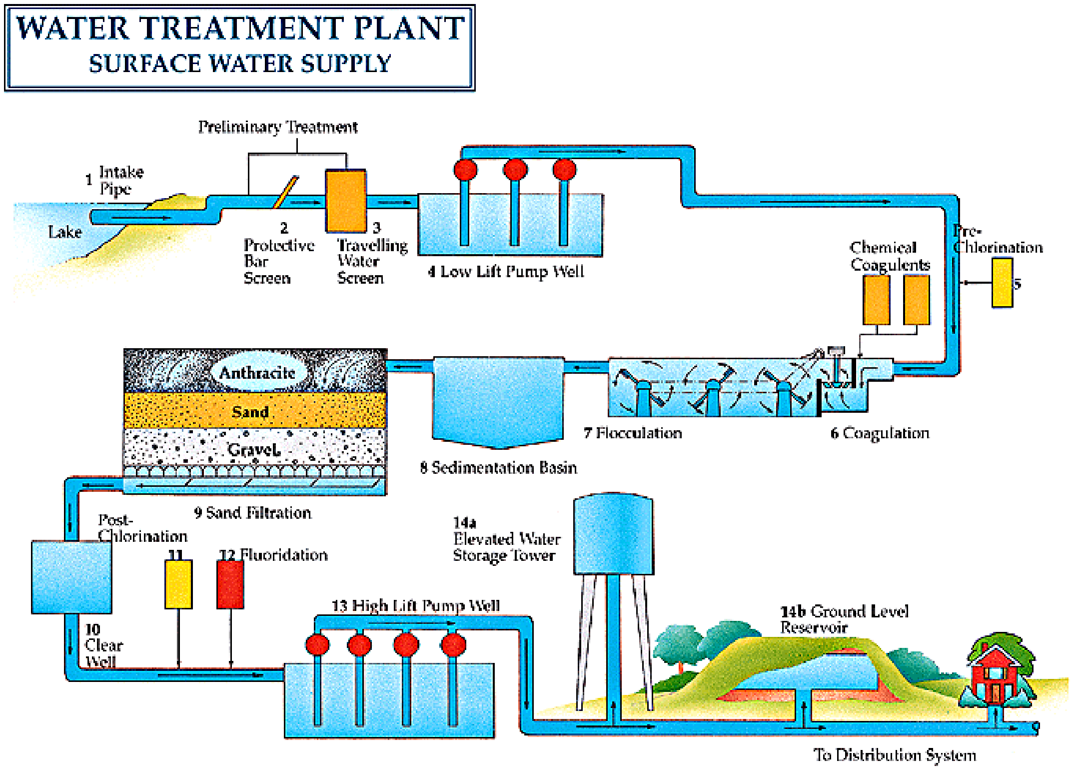
Maintenances of WTPS with proper manner to get pure quality of water to supply people.

The position of machine parts of WTP are checked periodically.

17.DRAWING&PLANS:



KHAMMAM TOWN PLAN



ELEVATED SERVICE RESERVIOR (ELSR)

ELEVATED SERVICE RESERVIOR

GROUND LEVEL SERVISE RESERCVIOR (GLSR

18. CONCLUSION:

- Aim to provide water to 100% population
- To provide portable and clear water to the households
- To minimize the water born diseases
- To increase the service level for providing daily water supply
- Attempt to made available water some for all but no all for some
- water is precious use efficiently save water efficiently

We can conclude that there is difference between the theoretical and practical work done.As the scope of understanding will be much more when practical work is done. As we get more knowledge in such a situation where we have great experience doing the practical work.

[1] blication)," *IEEE J. Quantum Electron.*, submitted for publication.