Waughter

AKTION CONSULTANCY

Volume 2 : Edition 10 – Drinking Water Treatment – Small Community to big Municipality *Oct 31, 2022*

Dear Water Warriors,

Safe Drinking Water has no substitute. While State Governments tried to reach populations, the entrepreneurs provided safe drinking water to citizens and we see bottled water plant all along India and people are happy to pay for quality and safety.

Even in Big Cities, where the Government is able to give water e.g. Mumbai, Kolkata etc. the public doubts quality and prefers installing a Domestic RO Plant.

From small Community to Big Cities – education rather than lake of it towards water purification has resulted in this fear for safe drinking water.

Judiciary may give a verdict against use of RO where low TDS water is available, Public needs trust and surety.

This issue of 'Waughter', focus on safe Drinking Water.

Nidhi Jain – Civil Engineer

What's Safe to Drink?

Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumption.

IS:10500-2012 provides for quality standards to be maintained for drinking water. These are in consideration of WHO, USEPA and EU Directives.

Few Important parameters for acceptable and permissible water quality are as hereunder:

Parameter	Unit	Acceptable	Permissible
TDS	mg/l	500	2000
Al	mg/l	0.03	0.2
F	mg/l	1	1.5
Fe	mg/l	0.3	0.3
NO3	mg/l	45	45

Microbiology as Concern?

E. coli or thermotolerant coliform bacteria shall not be detected in any 100 ml sample either after treatment, during distribution or point of use.

Additionally, Virus, Cryptosporidium, Giardia, certain parasites, including amoebic cysts have concern and their limits are defined in IS: 105000.

Chlorination for 1 hour maintaining 0.5 mg/l FRC is generally considered as good enough protection from microbiological contaminants.

Pesticides, Toxic substances shall be absent. However it's difficult to specify them as Zero and the manual gives limits for various substances.

Readers can download the IS:10500 from IS 10500 (2012): Drinking water (resource.org) and check the limits of any other parameter of interest. WHO guidelines are available at Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum (who.int)

Interestingly, Silica (SiO2) does not find any mention in the Drinking water guidelines.

History of Water Treatment for Drinking

A lot is available on internet, boiling, Exposure to sunlight and early fill from Ponds at Sun Rise when Sun Raise are nearly parallel to earth and we have longer UV contact time at Surface of Ponds.

Some also suggests use of (Moringa Seeds (Drumstick – सहजन).

It is believed that crushed seeds of *Sahjan* can disinfect water by killing bacteria by penetrating the cell wall?

The ancient Indian custom of storing drinking water in brass vessels for good health has now been proved scientifically by researchers. Microbiologists affirm that water stored in brass containers is scientific.

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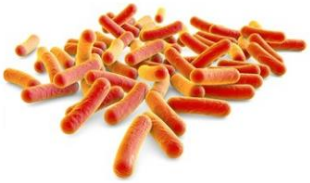

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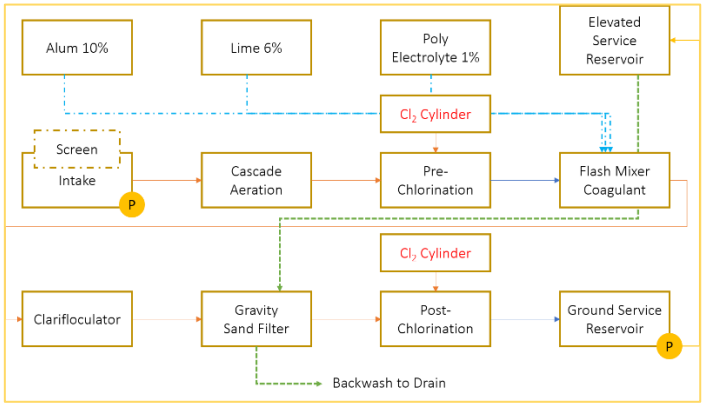
Municipal Drinking Water Treatment

A. River as a Source

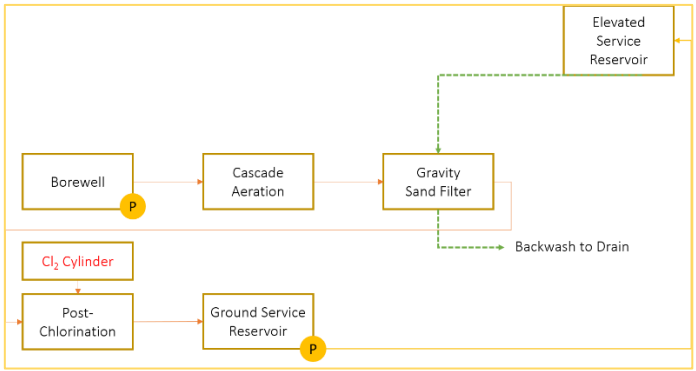
River, flowing or from Dam provides large quantity of Water for Urban Populations. Designer may follow the scheme given below.



The above scheme shall provide IS:10500 quality subject to source water TDS < 500 mg/l provided the source is not contaminated with Industrial effluent.

B. Underground Water as Source

In some small municipality, underground water; well or deep well may provide low TDS water that is largely very clean and fit for human consumption. It is however recommended to follow the minimum treatment steps given below:

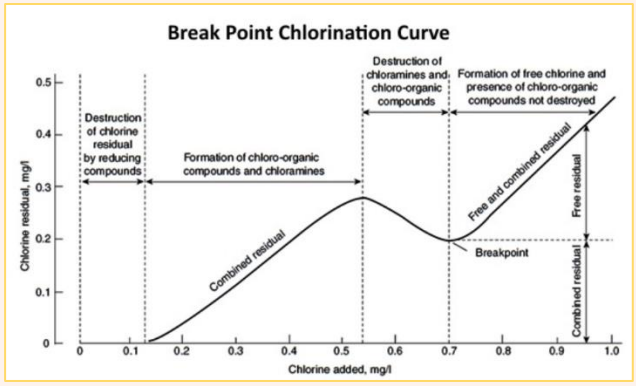


The chlorination is to ensure that water is free from pathogens and FRC (Free Residual Chlorine) > 0.3 mg/l need to be maintained to ensure its residual effect available in distribution network and avoid contamination during transmission.

The Role of chlorine

Chlorine is by far the most commonly used water disinfectant worldwide. Today, 100% of Indian municipalities use some chlorine-related process to treat their drinking water, thanks to the chemical's wide-scale availability, low cost, ease of use, and proficiency at destroying germs.

When chlorine is added to your water supply, it rapidly reduces the spread of all kinds of waterborne diseases, like cholera and typhoid fever, as well as other ailments. It also makes it easier for cities and towns to purify drinking water to keep residents safe.



Break-Point Chlorination

It may be defined as the chlorination of water to such an extent that not only living organism but also other organic impurities in water are destroyed.

When chlorine is added to water, it is used for different reactions like oxidation of oxidizable substance, chlorination of organic substance, destructive oxidation of organic substances and disinfection of pathogens.

Initially all the chlorine added is consumed and there is no free chlorine. This is due to complete oxidation of oxidizable substances. As the applied chlorine increases, there is steady increase in amount of residual chlorine. This stage corresponds to formation of chloro-organic compounds and chloramines when the dose of chlorine increase, destruction of chloro-organic and chloramines take place.

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Community Drinking Water Treatment

A. Pond or Lake as Source

Certain communities may have geographical location that is not covered by Municipal supplies. Water here is often < 500 mg/l TDS but science the Surface water body is exposed to Human and cattle, usually contaminated with:

1. Plastic
2. Dust and Debris
3. Eutrophication
4. Odour due to septic bottom or weeds on surface
5. Surfactants and Soap
6. Runoff Water during rain – add pollutant and E. Coli
7. Etc.

First and foremost, thing is to do fencing of pond to avoid unregulated cattle entry.

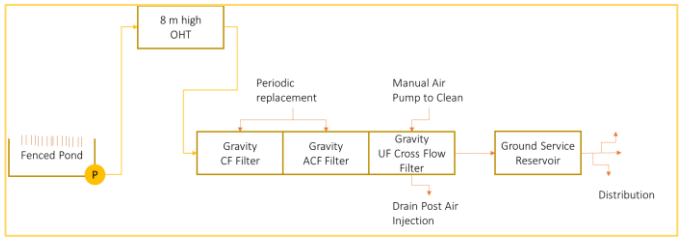
The next best thing is to grow plants around prefer to avoid ingress of impurities due to wind blowing across mainly plastic and pouches. It is very import that the garbage dump yards of villages are located far away from ponds and "Do not Litter" need to be followed in letter and sprit to key pond free from debris.

The Treatment Scheme

Simple village level treatment plants shall completed avoid the followings:

1. Chemical Dosing
2. Frequent backwashes
3. Instrumentations
4. Frequent Operation intervention

Thus, it is highly recommended to follow the scheme as shown below:



We came across an organization that has a product based on the above scheme and it's highly successful. PiYO is a brand of Technorbital and the organization has already served masses:

- ❑ Reached over 6,00,000 people
- ❑ Gravity Purification
- ❑ Free from Bacteria Virus and Cyst
- ❑ No odor or color
- ❑ No waste water as in case of RO
- ❑ Simple operational skills and operators can be trained in 1 day
- ❑ No Chemicals
- ❑ Supported by Tata CSR

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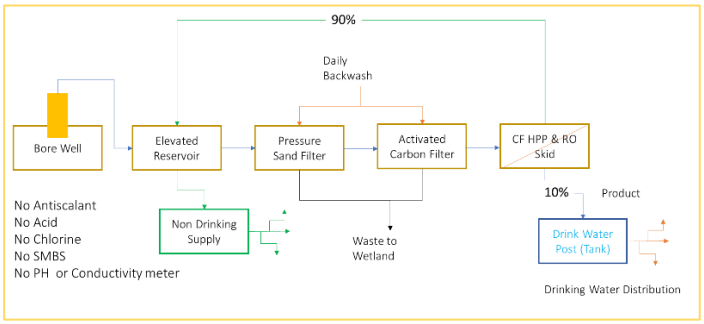
Community Drinking Water Treatment

B. Borewell with High TDS Water

In many geographies in India Lake and Ponds are just not available and the population need to depend upon brackish high salt underground water. Here our recommendation is slightly against many existing myths that insists for high Recovery, Higher Recovery and highest Recovery.

The below treatment scheme is preferred option that will get 100% recovery.



A good chemical engineer if understand mass balance would find above scientific rest will wonder how? TDS rejected goes back to elevated reservoir that not only Feeds RO (at slightly higher TDS then borewell) also supplies water for other non-drinking uses.

The % of drinking water need (even if we add cooking water in kitchen) is < 5% of overall water need and hence the impurities (TDS) do not accumulate in overhead reservoir and are flushed out through other daily uses. In practical terms people wont even notice 3-5% increase in TDS in non-drinking water applications.

This system however may need a point of use disinfection. The best would be use of Cl_2 tablets at house hold level or may be once nan use a UF at tap at point of use.

C. Borewell with Low TDS but other contaminants

1. Fe (Iron)

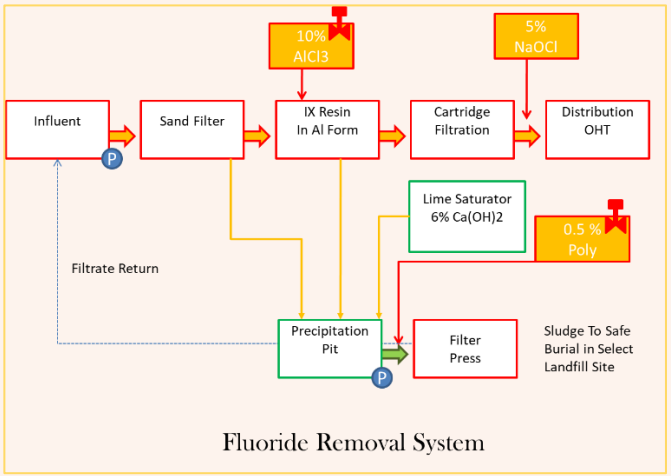
Some parts of India, especially North East & Orissa we have high Fe in borewell water. The best way to remove Fe is Oxidation and sand Filtration. O_2 paces a important role in oxidation and therefore it's presence is must.

The best method is Cascade aeration or sprinkler aeration. An innovative way is to use Degasser (Surprized !!,) the DG used in DM plant can easily be used as oxidation tower without any further engineering. If sufficient DO is present one can use MnO_2 lump on top of Sand Filter or can use Sand Impregnated with $KMnO_4$ and baked.

Most above methods will bring Fe < 0.1 ppm.

2. F (Fluoride)

Fluoride is easily isolate by IX Resin as well as RO (it is rejected). The challenge is in isolating that as sludge to avoid any open discharge. Designer's can follow below scheme a go for Sludge Disposal as per hazardous sludge handling norms.



3. As (Arsenic)

Needs a full Edition of Waugher. Wait and we will come back on this.

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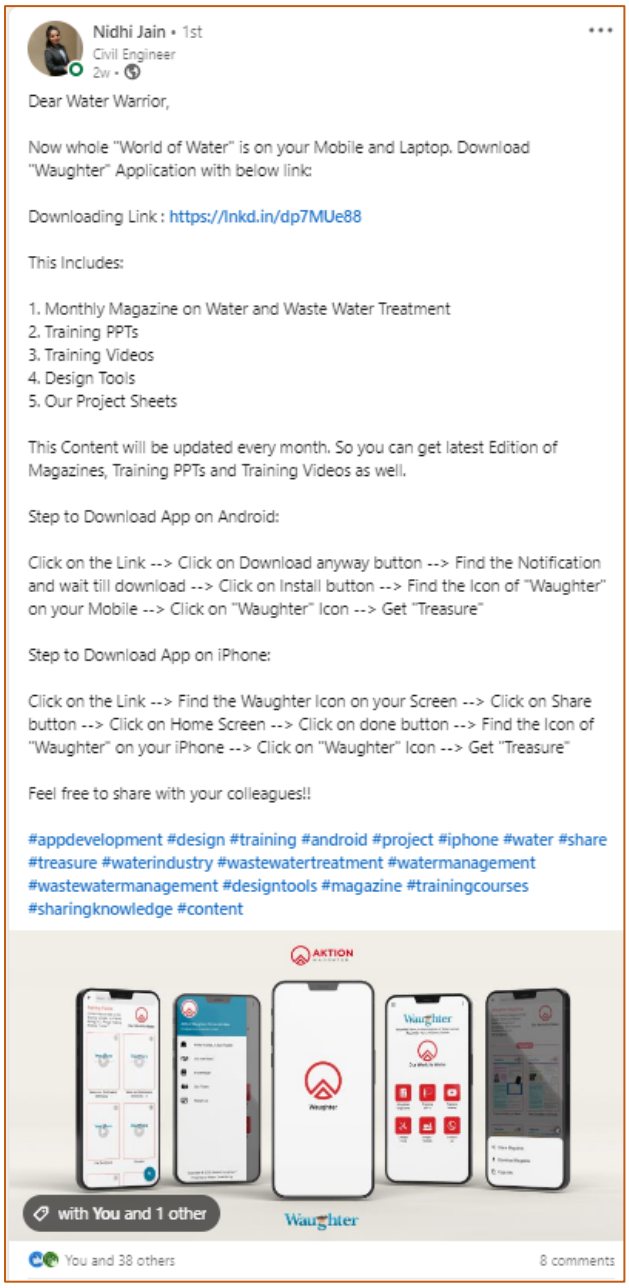
जल जीवन जननी !!

Our Sanjeev Srivastava, Nidhi Jain and Larity Nongsiej covered the subject of "Operation & Maintenance strategy for RO and WWTP". With 152 Registrations, 72 Participants and 38 participants answering the quiz, the program was a great success with announcement of prize for



Aktion around the World !!

WATER EXPO AN INTERNATIONAL EXHIBITION

BANGLADESH WATER EXPO

28th, 29th, & 30th November 2022

Aktion Waughter would be at booth B9 with all it's deliveries integrated with "Water link" a growing Water EPC from Bangladesh.

Additionally, our S. Srivastava shall be the trainer at the event on 29th on "Wastewater Management in Textile Sector including ZLD Chemistry".

For Training information and Registration, Click on the below link:

https://www.bangladeshwaterexpo.biz/training-program

Our world is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead.

Our next edition focuses on: "Sludge Management – Storage, Dewatering and drying"

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