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Water Source and Plumbing Systems for Development at Remote Area

Introduction

“Have you considered that how to provide the water supply for a deluxe Resort at a Remote Location?”

Would like to share some experiences and design considerations on starting from looking for available water source and then consider different possible supply system for area without proper utilities as like as us in HK where we can take a safe and reliable water main easily.

Design Consideration

Safe and **Reliable** water source is a crucial and fundamental element for a development at remote site area. It should be with sufficient quantities and quality to cater for daily demand for different operation needs of development.

Different types of water supply source are listed for consideration.

We should depend on the site condition/nature of each each development to select proper water supply source. Following are the major considerations for different water supply sources:



A. City Water Main

- Availability of Supply Flow Rate and Pressure
- Duration and Stability of Water Supply
- Water Quality (e.g. depend on the water quality to design and select the proper treatment process)

B. Recycled Water

- Source of Recycled Water (e.g. stormwater harvesting, grey water collected from showers / baths & AC condensate, or even sewage treatment from sanitary wares)
- Amount / balancing of Collected Water for Recycle Use against demand

C. Ground Water

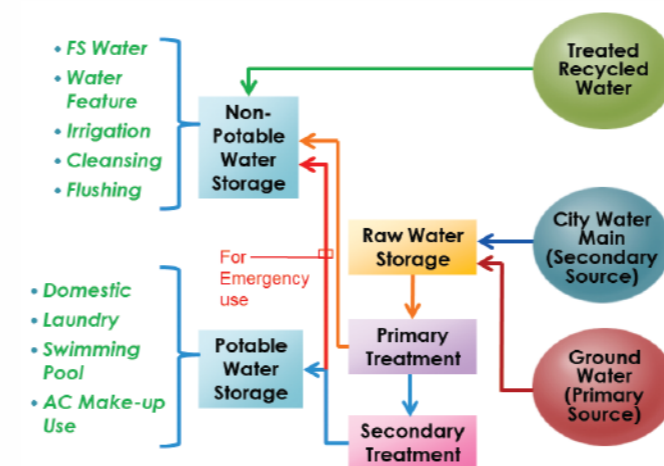
- Availability of Underground Water Sources within the Site Area
- Suitable Location for Installation of Deep Bore Well to Collect the Ground Water
- Water Quality (e.g. depend on the water quality to design and select the proper treatment process)

D. Alternative Water Sources

- River Stream / Pond / Lake
- Sea water desalinization
- Swimming Pool Water as Emergency Use for FS Water Supply System

In view of our case in large scale, the existing city water supply main to our remote site is limited in flow & not reliable for all-day operation and hence **“Ground Water”** was considered which is available within the site. **Dual water supply sources** was then considered to provide sufficient and continue water supply for the development use. Water tank storage volume was designed with larger (~ 3 days usage) for backup purpose and maintain the operation for the development in case of any problem / maintenance works at the water supply sources. Self-circulation and sanitization system will be provided to eliminate any risk of **“Dead Water”** inside the tank for such large storage volume to maintain water quality.

The more reliable water source was considered as **“Primary Water Supply Source”** and the other supply source – **“Secondary Water Supply Sources”** acted as support / backup purpose.



We should develop the “Water Flow Diagram” for the design of different water supply systems use.

In the Project, **“Ground Water”** was the Primary Water Supply Source for the development. The raw water should be pumped out from the underground to a raw water tank for onward water treatment process. The underground water collected in our case was in the range of salinity **10,000 to 35,000 mg/l**, it was considered high and not suitable for domestic potable water usage. Desalination for these water must be required to reduce the salinity to the acceptable level, and in according to the WHO Guideline, the recommended salinity level for the drinking purpose water should be **< 250 mg/l**.

Treatment Process for the Collected Ground Water

Followings are the required treatment process:

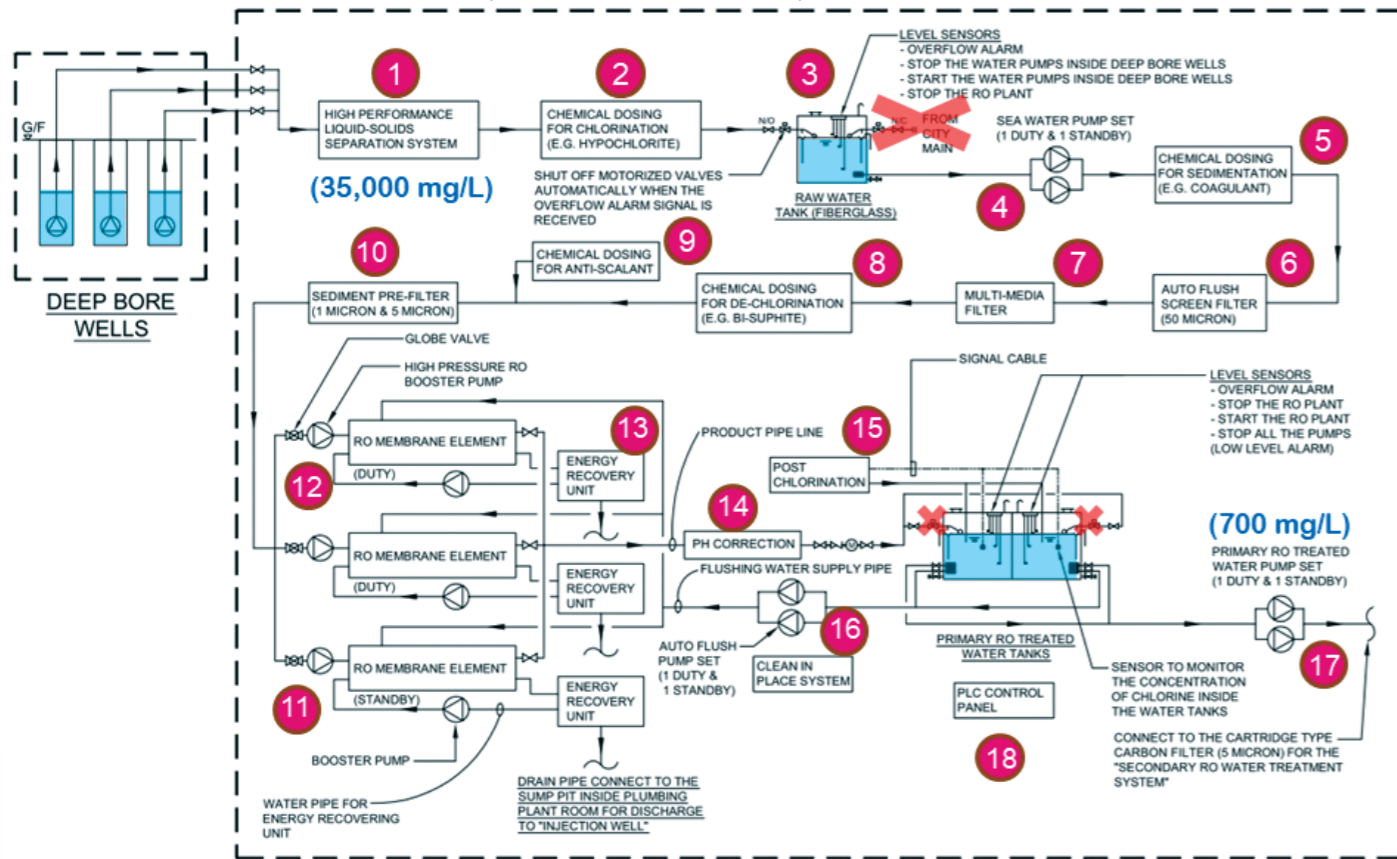
- Filtration
- Disinfection
- Desalination
- Chemical Dosing

Key treatment components:

- High Performance Liquid-Solids Separation System
- Chemical Dosing
- RO Member Element
- Energy Recovery Unit



RO PLANT ROOM (PRIMARY TREATMENT)



For the “**High Performance Liquid-Solids Separation System**”, it is a preliminary filtration system to remove 98% of coarse and larger particles.

For the “**Chemical Dosing**”, it is including the below chemical:

- Sodium Hypochlorite (to kill bacteria)
- Coagulant (to stick the small suspended particles together for sedimentation)
- Sodium Bi-Sulphite (to neutralize the residual chlorine to protect the RO membrane)
- Anti-Scalant (to avoid scale formation on the RO membrane)

For “**RO Member Element**”, it is a pore structure of film membrane only allow the water molecules to pass through. By applying a high pressure to the concentration stream to “push” the water to the dilute stream. Typically, **around 98% of “salts” content are rejected** (e.g. 35,000 mg/l x 2% = **700 mg/l** salinity level of treated water).

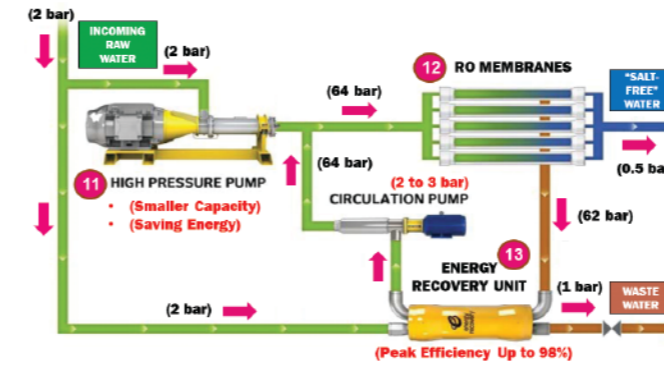
For the “**Energy Recovery Unit**”, it can recover the energy of the high-pressure waste water before rejecting it and collect the waste water kinetic energy to boost up the incoming raw water pressure. It is an energy saving device for the desalination process of high salinity incoming water.

As mentioned above, the recommended salinity level for the drinking purpose water is < 250 mg/l. Therefore, second stage of desalination treatment by RO Member Element shall be required to further reduce the salinity level of treated water (e.g. from 700 to 250 mg/l). After

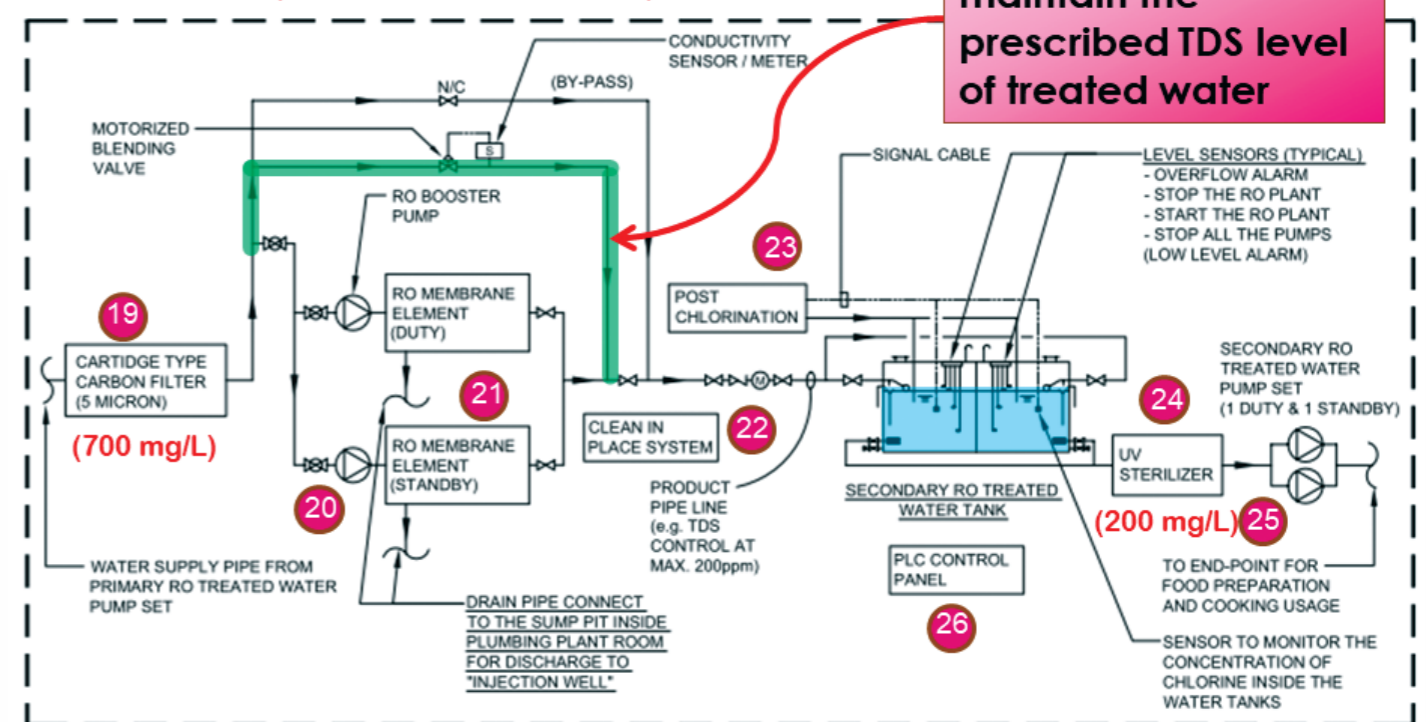


the treatment, the 2nd treated water can be stored inside the water storage tank for the Potable Water Usage.

source. The water supply source should be clean & reliable and suit for the development operation needs. Furthermore, dual supply sources and large storage capacity were considered critical to enhance reliability of water source for a deluxe resort operation. Also, the design arrangement should be complied with local Codes and requirements from the utilities company and WHO guidelines.



RO PLANT ROOM (SECONDARY TREATMENT)



Discussion

From the above of design sharing, different from our general design & planning practice, we, plumbing engineers need to considered the water sources together with our Project professional to handle water supply source and design corresponding water supply systems for the development at the remote site area. The civil and water professional should have detailed site survey and collect the related information on the site conditions before selection of proper water supply

After selection of the available water supply source for the development use, continuous testing of the water quality for the raw incoming water is crucial for the design of required water treatment system. Of course, plant space shall be larger than typical developed city building but it is required for secure suitable treatment of incoming water with higher salinity level and contaminated water sources, and it should be incorporated to the layout planning in the initial building / development planning.