PRODUCT OVERVIEW SWRO

water | wastewater | treatment | recycling

Clearmake
a mak water company

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Overview

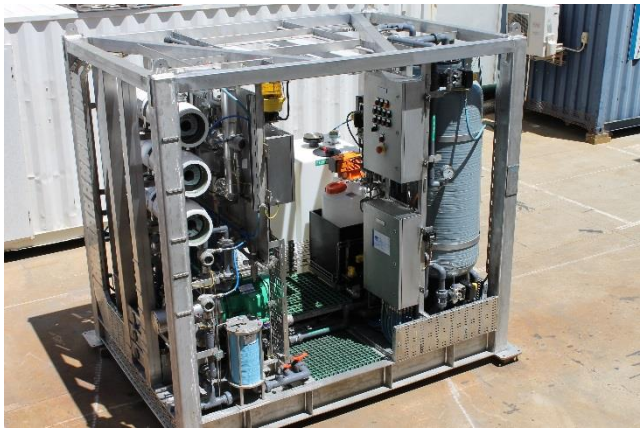
MAK Water's Sea Water Reverse Osmosis (SWRO) plants are designed to treat sea water, or high salinity ground/surface water with <40,000 mg/L of dissolved solids (TDS) and <30 mg/L of suspended solids (TSS), to achieve potable water quality with TDS 100 to 500 mg/L, TSS < 0.1 mg/L, that is free of viruses and bacteria.

The MAK SWRO plants are available as skid mounted or containerised systems.

MAK Containerised 500 m^3/day SWRO Plant

The MAK Advantage:

- High quality Australian designed and built systems
- Experienced team with >100 RO plants operating nationally
- Nationwide service & maintenance capabilities
- Remote monitoring for expert process support
- Fully automated systems minimise operator attendance
- MAK standard designs for fast lead times
- Optimised designs to suit client's objectives
- Fully customisable to accommodate client specific engineering standards, vendor data requirements and site preferred electrical equipment
- Extensive hire fleet available for rapid deployment



MAK Skid Mounted 40 m^3/day SWRO Plant for Offshore Oil Platform (Zone 2 Hazardous Area)

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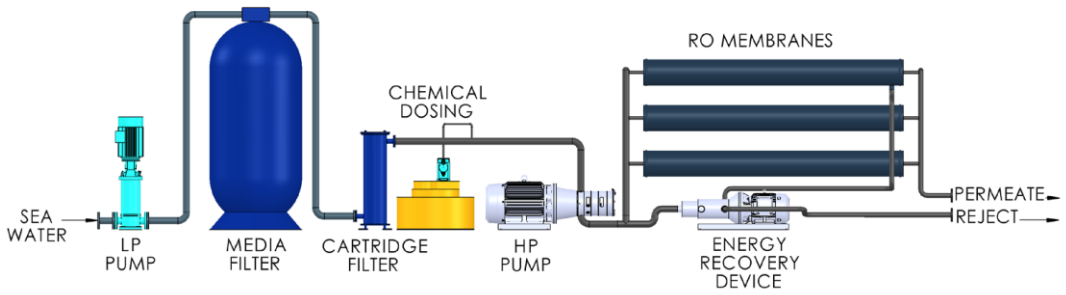
Overview



The standard treatment process involves pre filtration (auto backwashing multimedia filters and cartridge filters), anti-scalant dosing to prevent membrane scaling, RO desalination, auto membrane flushing and CIP systems for membrane cleaning.

Additional pre-RO and post-RO treatment steps (such as chemical dosing, iron & manganese removal, pH & hardness correction, sterilisation etc) may be added as required to suit feed water conditions and/or treated water quality requirements.

MAK SWRO systems can be provided with standard efficiency or premium efficiency high pressure pumping and energy recovery systems, to minimise power consumption.

The MAK SWRO plants are available as skid mounted or containerised systems for easy deployment to remote locations.

NOTE: For larger plants (≥500 m^3/day), UF pre-treatment is recommended.

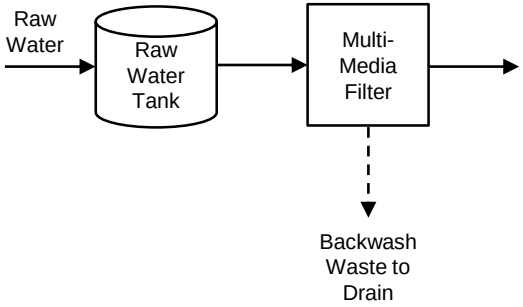
Overview

The following table summarises typical raw water and treated water values.

Parameter	Unit	Raw Water (typical)	Treated Water (typical)
Recovery Rate	%	-	35~45% (varies according to feed water quality and RO configuration)
Total Dissolved Solids	mg/L	≤40,000	100~500
Total Suspended Solids	mg/L	<30	<0.1
Particle Size	-	95% > 10 µm, 5% > 1 µm	-
Total Recoverable Hydrocarbons	mg/L	0	-
Temperature	°C	15 to 45	-

NOTE: MAK Water recommends a water analysis be carried out prior to detailed design.

Process Steps

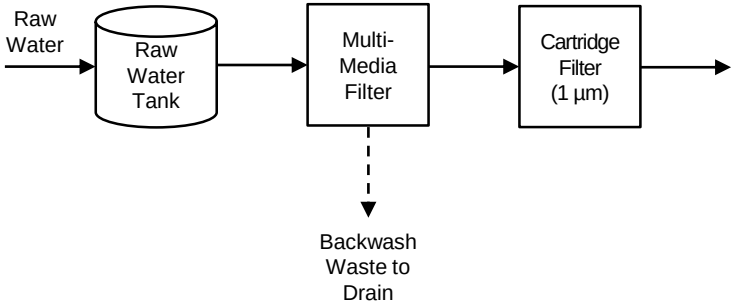


Pre Treatment – Media Filtration

The low pressure pump takes flooded suction from the raw water tank and supplies raw water to the multimedia filter(s), which remove suspended solids (20 micron or greater) from the water. The filter is periodically backwashed with raw water, based on operator adjustable time clock setting, via an electrically actuated multi-port control head.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the media filter; the filter is automatically backwashed when the differential pressure set point is triggered.

Process Steps

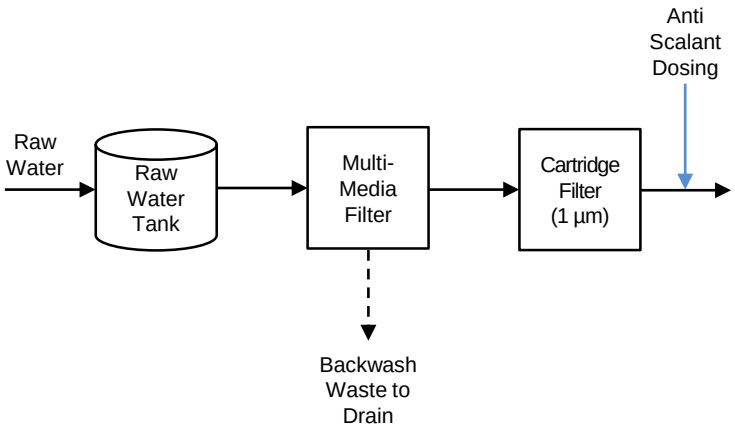


Pre Treatment – Cartridge Filtration

The water then passes though a 5 and/or 1 micron cartridge filters, which trap any remaining sediment/suspended solids. The cartridge filter elements are typically replaced on a monthly basis as part of routine planned maintenance procedure.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the cartridge filter; an alarm is generated on high differential pressure, to alert the operator that the filter elements require replacement.

Process Steps

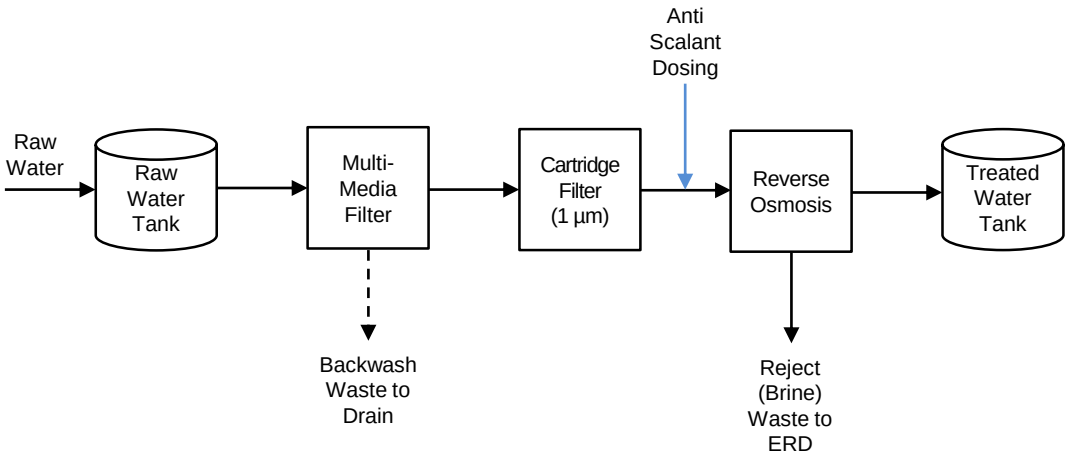


Pre Treatment – Anti-scalant Dosing

Anti scalant is dosed into the filtered feed water to inhibit the formation of scales on the RO membranes. The dose rate is pre-set and should not be varied.

The anti scalant storage tank is fitted with a low level switch for auto-shutdown, and to alert the operator of a low level condition; the level should be checked regularly and topped up as required.

Process Steps



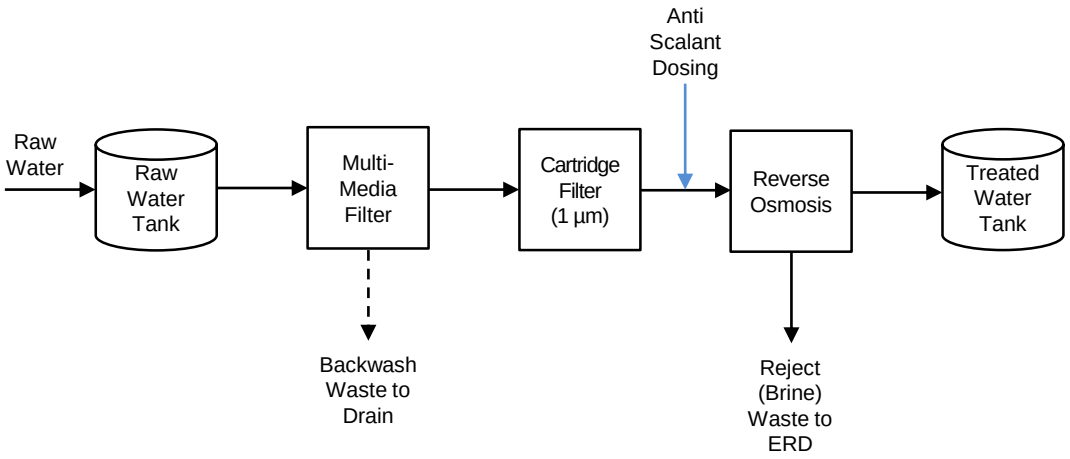
Desalination – Reverse Osmosis

The high pressure RO pump pushes the pre-treated feedwater through the RO membrane system. The process produces permeate (high quality water, low in TDS) and reject (low quality water, that is high in TDS, to be disposed of). The ratio of permeate to reject is typically 40:60 (i.e. 40% recovery).

Energy consumption is proportional to operating pressure. On any given feedwater, factors affecting operating pressure include recovery rate, membrane selection, membrane flux and feed water temperature.

MAK Water's process engineers can customise each RO design to suit the client's objectives and priorities.

Process Steps



Desalination – Reverse Osmosis

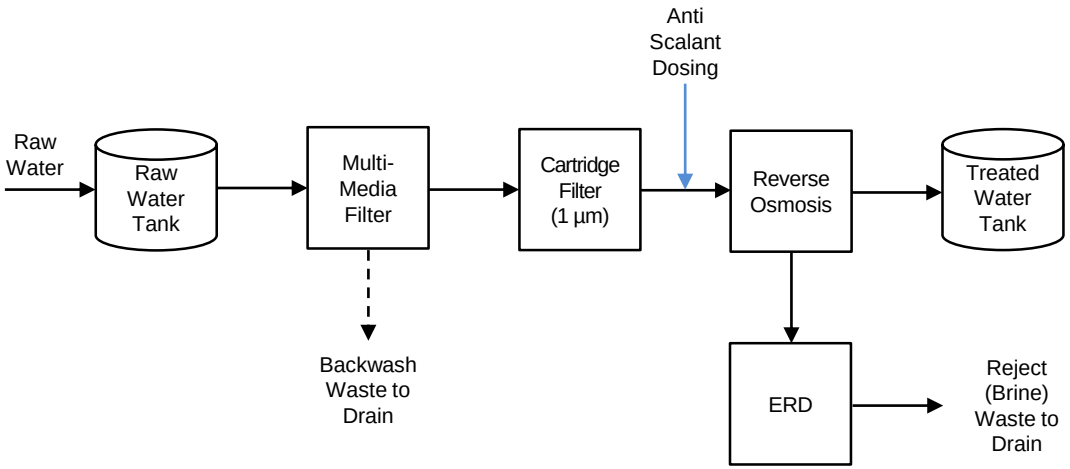
The inlet pressure to the high pressure RO pump is continuously monitored; a shutdown alarm is generated on low feed pressure, to prevent damage to the pump.

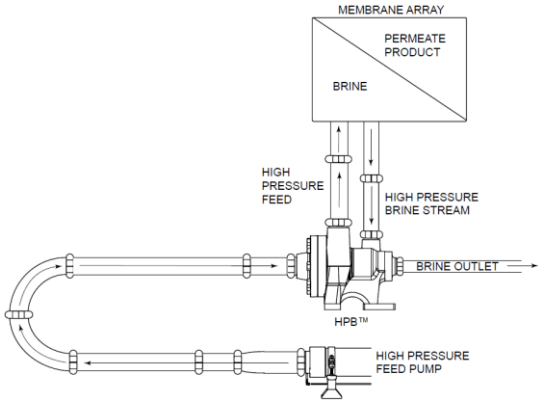
The permeate conductivity is continuously monitored; an alarm is generated by any abnormal readings.

The high pressure brine diverts to the energy recovery device (ERD).

Where ClearAccess™ remote monitoring is installed, the RO membrane feed pressure, brine discharge pressure, brine flow and permeate flow are continuously monitored; alarms are generated by any abnormal readings.

Process Steps





ERD - Hydraulic Turbo Charger

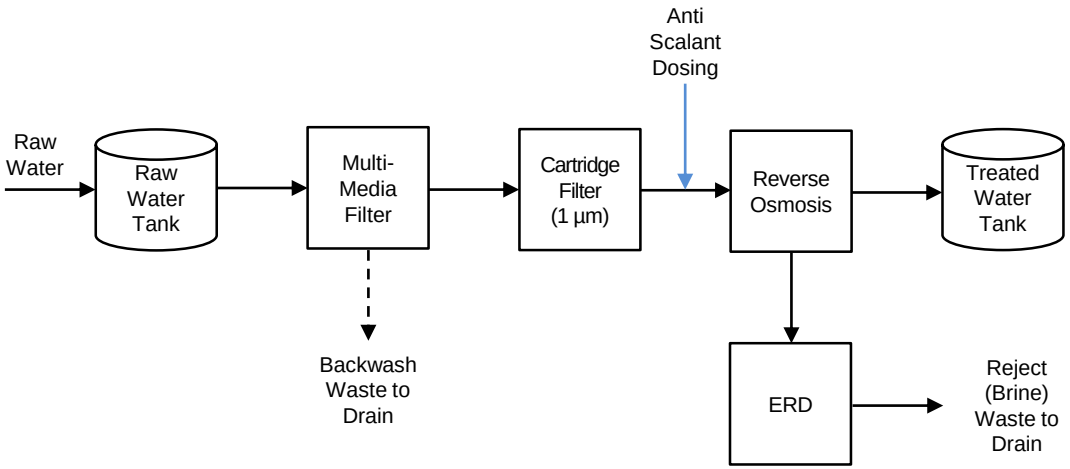
Desalination – Energy Recovery (Standard Efficiency)

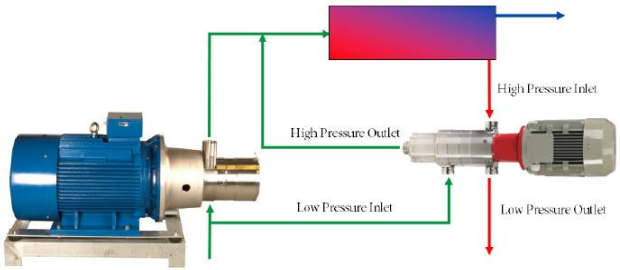
Energy consumption is typically the single largest cost driver of sea water desalination, thereby making energy recovery equipment economically critical to SWRO processes.

All MAK SWRO plants, with capacity of ≥150 m^3/day, are provided with an energy recovery device (ERD), in the form of a hydraulic turbo charger. Currently, ERD's are not available for plants with capacity <150 m^3/day.

The high pressure brine passes through the energy recovery turbo, which recovers ~80% of the brine pressure energy, resulting in a large pressure boost in the feed stream independent of the high pressure RO feed pump. Net energy consumption can be reduced up to 40%.

Process Steps





ERD - Isobaric

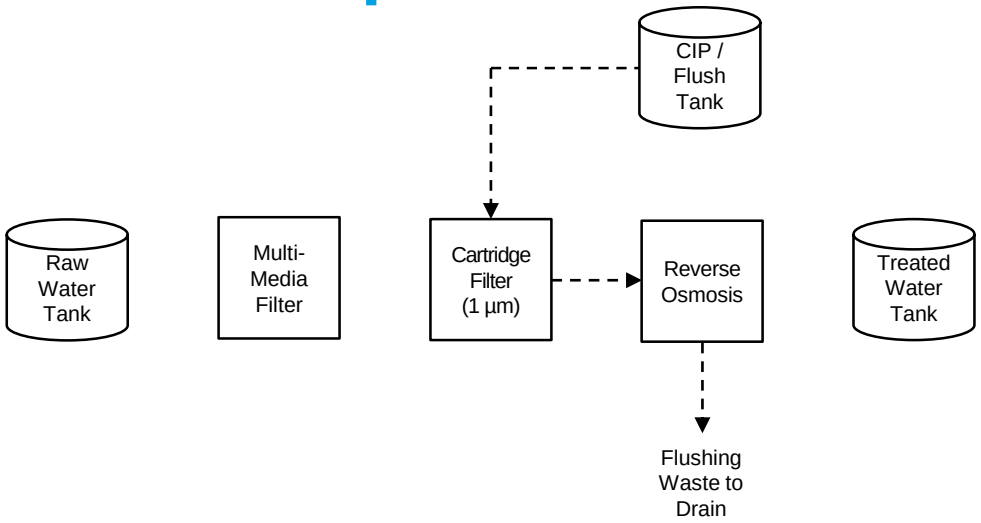
Desalination – Energy Recovery (Premium Efficiency)

The isobaric energy recovery device captures wasted pressure from membrane reject flow and transfers it directly to the membrane feed flow.

It has a built in HP Positive displacement pump and electric motor, which allows it to automatically control the HP flow, without separate flow meters, to ensure a constant high pressure feed to the RO membranes.

Due to near perfect energy transfer, which in many cases reaches up to 98% efficiency, net energy consumption can be reduced up to 60%.

Process Steps

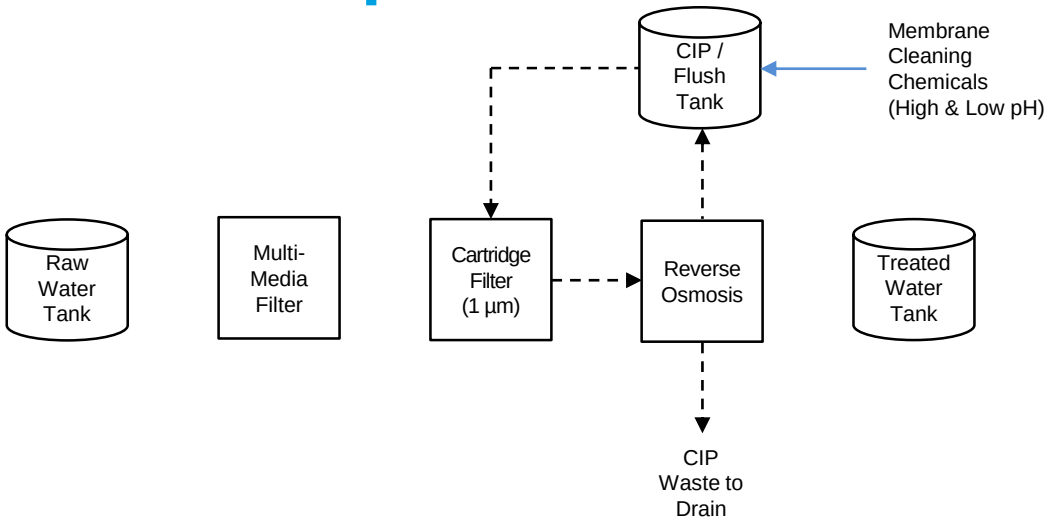


Desalination – Auto Membrane Flushing

The low pressure pump takes suction from the CIP tank, which contains RO permeate. In case of RO shutdown, the pump automatically flushes the RO membranes with RO permeate to prolong membrane life.

The CIP tank is fitted with a low level switch for auto-shutdown low level condition.

Process Steps



Desalination – Membrane Chemical Cleaning

A Clean in Place (CIP) system is provided for routine membrane chemical cleaning; the chemical clean is a semi-automated function requiring an operator, whereby acid/alkaline chemicals (in solid form) are manually added to the CIP tank; the low pressure pump takes suction form the CIP tank and circulates the CIP solution throughout the membranes.

The CIP solution is circulated though the cartridge filters to trap any particles or contaminants removed from the membranes by the cleaning process.

A CIP membrane clean is typically performed on a monthly basis as part of routine planned maintenance procedure.

Options – ClearAccess™

Optional ClearAccess™ Remote Monitoring enables personnel to view and operate the plant remotely. This saves time in response to emergencies and assists local operators to diagnose problems. It prevents unnecessary service call-outs and improves reliability and plant uptime.

Process Support via ClearAccess™

Key Functionality:

- Remotely view and operate the plant on your PC, smart phone or tablet
- Automatic alerts (email or SMS) on alarm conditions
- Automatic report generated daily and emailed to your inbox
- Real time monitoring of process data, such as flow rates, pressure and alarm conditions/status messages
- Password protected system with two login security levels

ClearAccess™ from your Smart Phone or Tablet

Inclusions:

- Additional electrical instrumentation (premium package)
- Additional PLC hardware and programming
- Programming of email alert system

NOTE: Remote monitoring requires an internet connection or mobile network coverage (client to provide SIM card).

Options – Containerised Plant

MAK SWRO plants can be installed in ISO sea container(s) for safe, fast deployment by sea, road and rail. Installing the plant inside sea container(s) is an ideal way to protect the plant and equipment from harsh operating conditions in remote sites. The durable construction assures the plant is able to be transported through rough terrain and perform to the design requirements on arrival at remote sites (plug and play operation).

Standard 20' Container

Premium Fit Out (insulation, floor coating and access door)

Standard Inclusions:

- As new, freshly painted inside and out (high gloss enamel)
- Distribution board with separate circuits for lights & aircon
- Overhead internal lighting & reverse cycle air conditioning
- GPO's for maintenance work

Premium Container Fit Out Options:

- Chemically resistant, non-slip floor coverings
- Wall and ceiling insulation
- Personal access doors & windows
- Smoke detectors and alarming
- Safety shower & eyewash station with flow switch & lighting
- Winterisation for extreme climates (-40ºC/-40ºF)
- High spec/high build two-pack epoxy container painting

Containerised WTP with access door, window and safety shower & eyewash station

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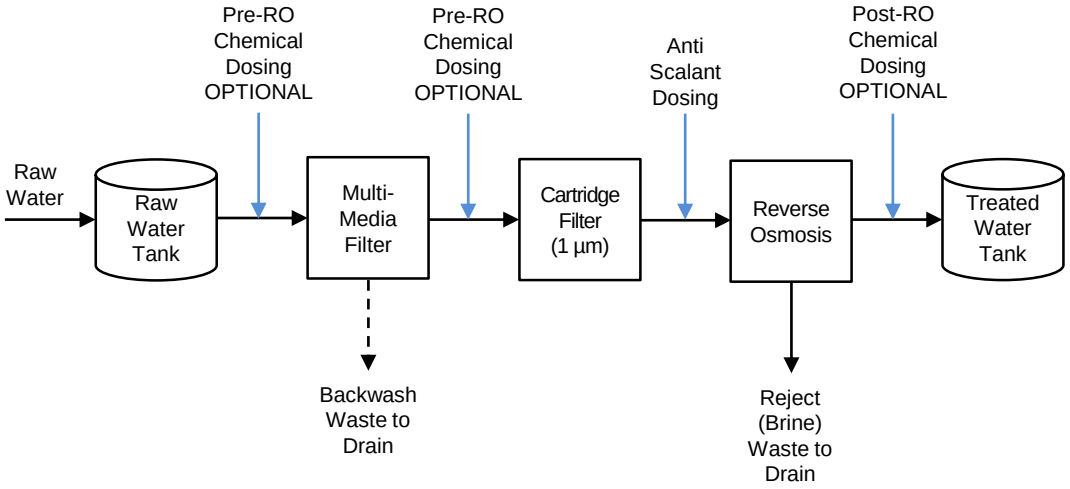
Options – Chemical Dosing



Acid, caustic and sodium hypochlorite dosing systems

Pre/Post-RO Chemical Dosing

Pre and post RO chemical dosing systems may be added as required to suit feed water conditions and/or treated water quality requirements. Typical chemicals include acid and/or caustic for pH correction, sodium hypochlorite for sterilisation or iron/manganese oxidation, sodium meta-bisulphate for chlorine neutralisation, and calcium chloride for hardness correction.

Depending on the application, chemical dosing rates are pre-set based on flow rate (flow paced), or automatically controlled by the PLC, based on online instrumentation (such as pH, ORP or chlorine analysers) downstream of the dose point.

All chemical storage tanks are fitted with a low level switch for auto-shutdown & to alert the operator of a low level condition; the tank levels should be checked regularly and topped up as required.

Options – Iron & Manganese Removal

Iron and/or manganese has the potential to cause fouling of RO membranes; depending on feedwater chemistry, it may need to be oxidised and removed prior to desalination.

There are a number of ways to achieve this, each method has its own advantages and disadvantages:

	Chemical Oxidation + DMI-65 Media Filtration	Chemical Oxidation + Multimedia Filtration	Venturi (Air) Oxidation + Multimedia Filtration
Feed Water pH	5.8 to 8.6	5.8 to 8.6	7.2 to 8.0 for $Fe2^+$ ≥ 9.5 for $Mn2^+$
Feed Water $Fe2^+$	> 5 mg/L is tolerated	Maximum 5 mg/L	Maximum 3 mg/L
Feed Water $Mn2^+$	> 5 mg/L is tolerated	Maximum 5 mg/L	Maximum 3 mg/L
Reaction Time (Feed Tank Size)	Nil	15 to 30 minutes	45 to 60 minutes
Advantages	• Broadest application • Instantaneous reaction • Also removes arsenic, aluminium, some other metals and hydrogen sulphide	• Broad application • Lower capital cost than DMI-65 media	• Lowest capital cost • No chemical consumption
Disadvantages	• Chemical consumption • Higher capital cost • Does not tolerate clays, large organic molecules and very high hardness	• Slow reaction • Chemical consumption	• Slowest reaction • Narrow pH range • Limited application

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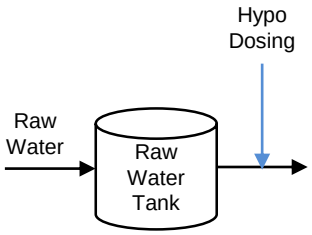
Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



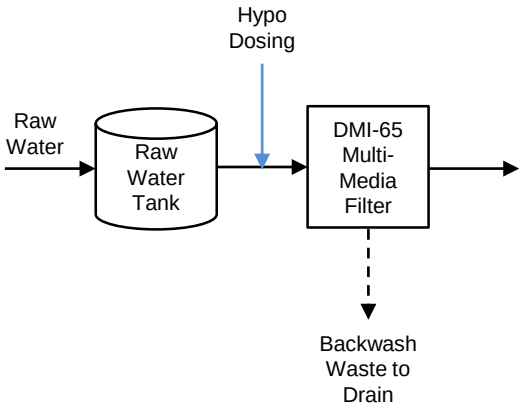
Chlorine Dosing (Oxidation)

Firstly, the raw water is dosed with chorine to promote oxidation of dissolved iron & manganese, aiding in removal via a DMI-65 media filter. The dose rate is automatically controlled via ORP sensor installed downstream of the DMI-65 media filter. Alarms are generated by any abnormal readings.

The chlorine storage tank is fitted with a low level switch for auto-shutdown and to alert the operator of a low level condition; the level should be checked regularly and topped up as required.

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



DMI-65 Granular Catalytic Media Filtration

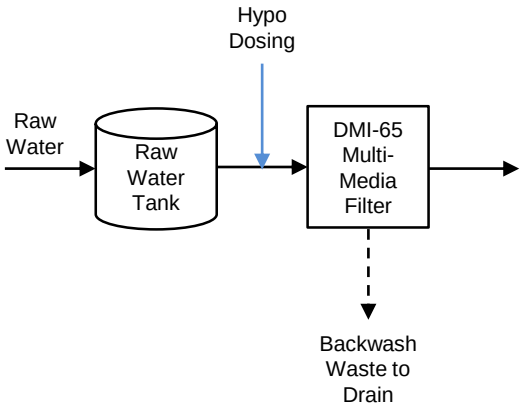
DMI-65 is an extremely powerful catalytic water filtration media that is designed for the removal of iron and manganese in aqueous solutions (water) without the need for potassium permanganate or chemical regeneration. The unique microporous structure of DMI-65 efficiently removes dissolved iron to almost undetectable levels as low as 0.001 ppm and manganese to 0.001 ppm.

The media is designed to operate in the presence of chlorine or other oxidant; it acts as an oxidation catalyst with immediate oxidation and filtration of the insoluble precipitates derived from this oxidation reaction.

Further reading on DMI-65 Media Filtration: http://www.dmi65.com/

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



DMI-65 Granular Catalytic Media Filtration

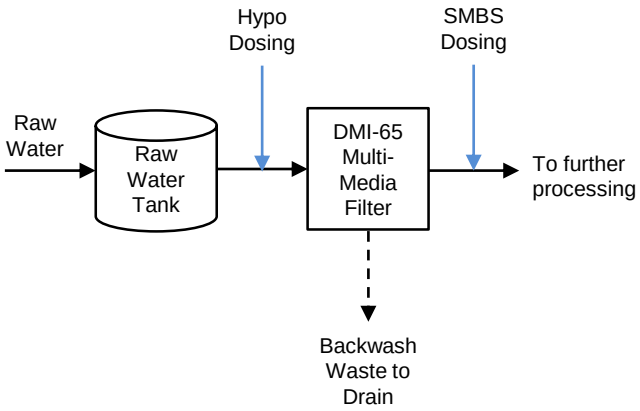
The low pressure pump takes flooded suction from the raw water tank and supplies the chlorinated raw water to the media filter containing DMI-65 media, which removes oxidised iron & manganese, as well as suspended solids (20 micron or greater) from the water.

The filter is periodically backwashed with raw water, based on operator adjustable time clock setting, via an electrically actuated multi-port control head.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the media filter; the filter is automatically backwashed when the differential pressure set point is triggered.

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



SMBS Dosing (Chlorine Neutralisation)

The filtered water is dosed with SMBS to neutralise residual free chlorine, thus protecting the RO membranes from damage via oxidation. The dose rate is pre-set and need not be varied.

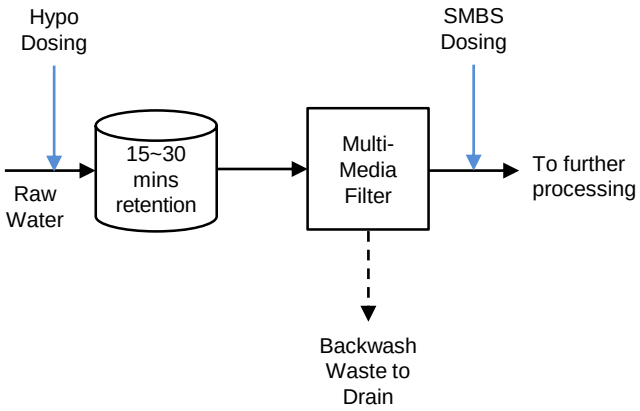
An ORP sensor continuously monitors the de-chlorinated water for the presence of chlorine; a shutdown alarm is generated on detection of chlorine to prevent damage to the RO membranes.

The SMBS storage tank is fitted with a low level switch for auto-shutdown, and to alert the operator of a low level condition; the level should be checked regularly and topped up as required.

The pre-treated water is now available for further processing downstream.

Options – Iron & Manganese Removal

Chemical Oxidation + Conventional Multimedia Filtration

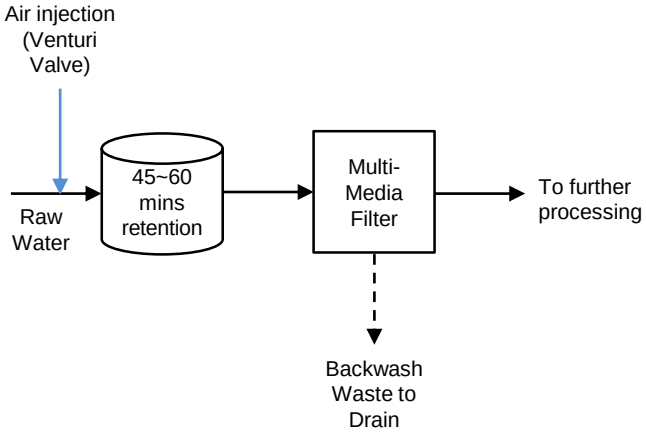


This process is the same as the DMI-65 process, except that the hypochlorite is dosed into the raw water tank upstream of the conventional multimedia filter, with a minimum 15 minutes of reaction time before filtration.

Steps should be taken to prevent “short circuiting” of the feedwater, though the use of appropriate baffles in the raw water tank, ensuring the minimum required contact time is maintained.

Options – Iron & Manganese Removal

Venturi (Air) Oxidation + Conventional Multimedia Filtration



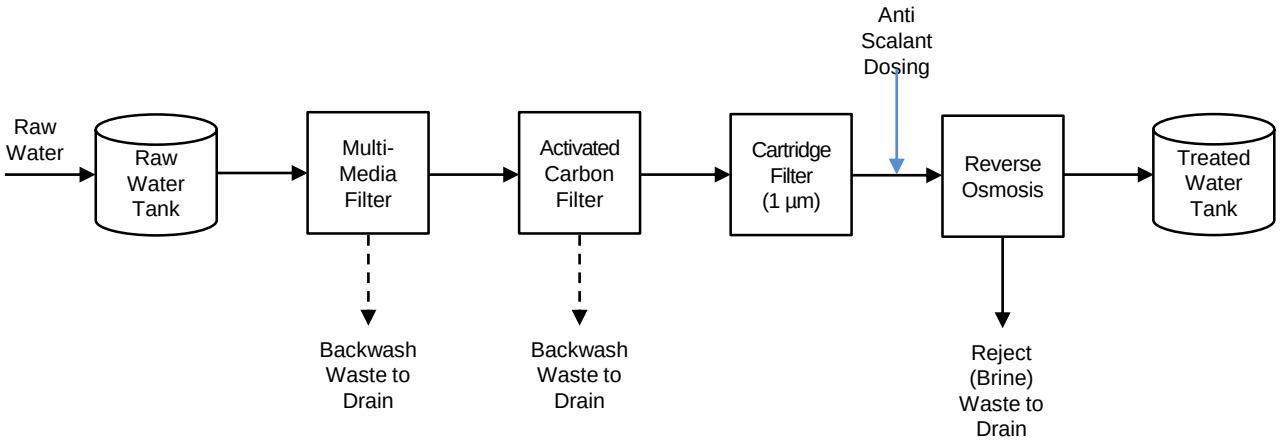
In this process, rather than dosing hypochlorite into the feedwater, a venturi valve is used to inject air into the water pipe supplying the raw water tank.

As no chlorine is used, the dechlorination (SMBS dosing) step is not required.

A minimum of 45 minutes of retention time is required.

Steps should be taken to prevent “short circuiting” of the feedwater, though the use of appropriate baffles in the raw water tank, ensuring the minimum required contact time is maintained.

Options – Activated Carbon Filtration



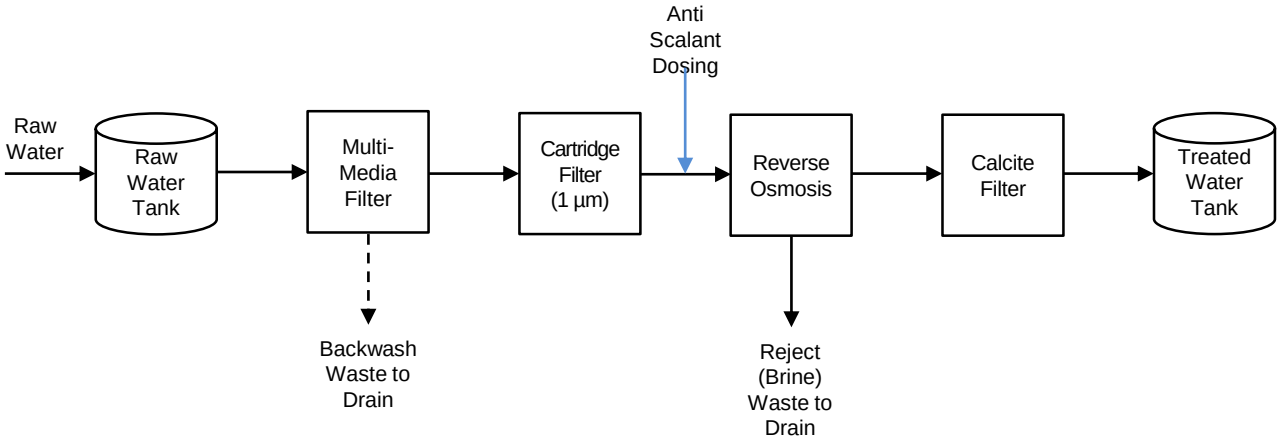
Activated Carbon Filtration

Activated carbon filters can be used to remove free chlorine and/or to remove trace amounts of hydrocarbons prior to desalination.

Where an activated carbon filter is used to remove free chlorine, an OPR sensor is installed downstream of the carbon filter to automatically shut down the RO on detection of free chorine in the feed water. The filter is periodically backwashed with raw water, based on operator adjustable time clock setting, via an electrically actuated multi-port control head.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the carbon filter; the filter is automatically backwashed when the differential pressure set point is triggered.

Options – Calcite Filtration



Calcite Filtration

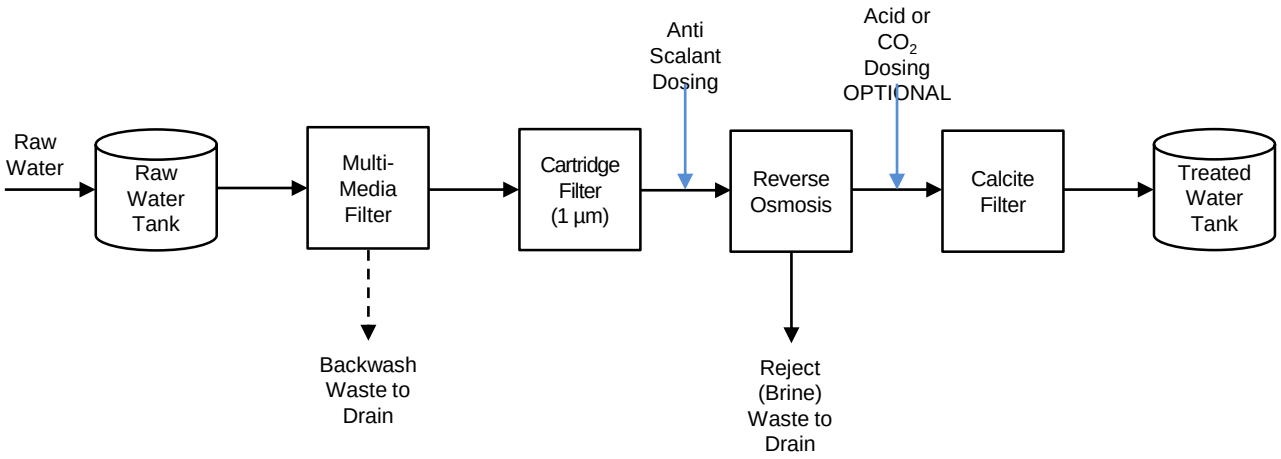
RO permeate can sometimes be corrosive (pH < 6.5) and lacking in hardness. This can cause corrosion problems for pipes and equipment downstream.

One effective way to neutralise the pH and increase hardness is to pass the RO permeate through a calcite filter, which provides remineralisation and neutralises the pH.

The down-to-up flow configuration of the filter prevents compaction of the calcite bed without the need for backwashing.

The pH of the neutralised RO permeate is continuously monitored; an alarm is generated by any abnormal readings.

Options – Calcite Filtration

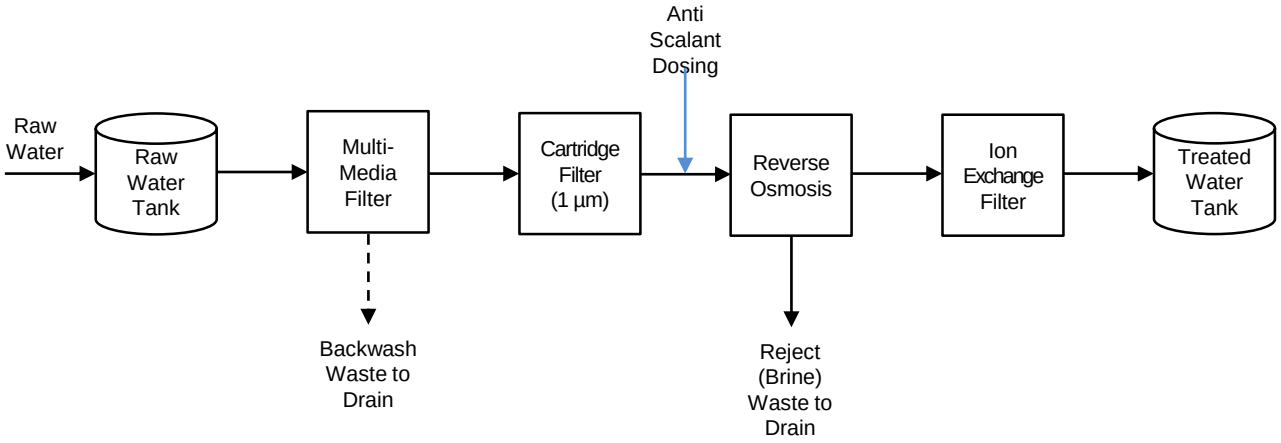


Calcite Filtration + Acid or CO_2 Dosing

The lower the pH of the permeate, the more hardness is absorbed by the calcite filter.

One way to guarantee a minimum level of hardness in the RO permeate is via acid or carbon dioxide dosing into the permeate stream, to reduce pH and promote sufficient calcite dissolution; the dose rate is automatically controlled by a pH transmitter installed downstream of the dose point.

Options – Ion Exchange Filtration



Permeate Polishing with Mixed bed Ion Exchange Resin Filter

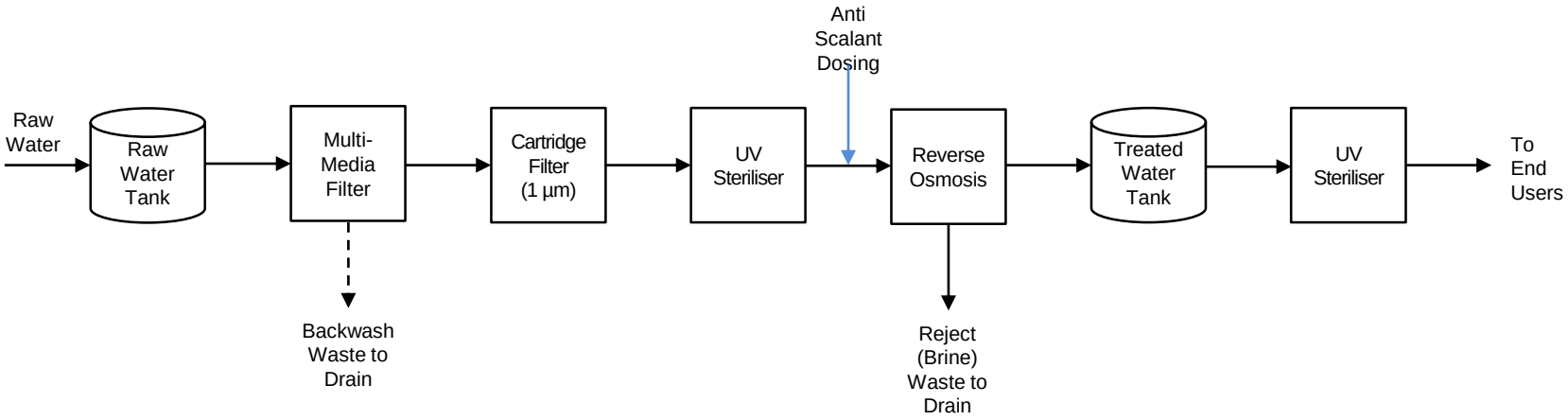
Where further reduction in permeate TDS is desirable, a Mixed Bed Ion Exchange Resin Filter can be provided.

The RO permeate passes through the ion exchange filter which contains resin beads which replace all cations in the water with hydrogen ions (H+) and all anions with hydroxide ions (OH-), thereby demineralising the water via ion exchange.

The treated water conductivity is continuously monitored; an alarm is generated by any abnormal readings.

Note that this mixed bed resin is a consumable requiring periodic replacement.

Options – UV Sterilisation



UV Sterilisation

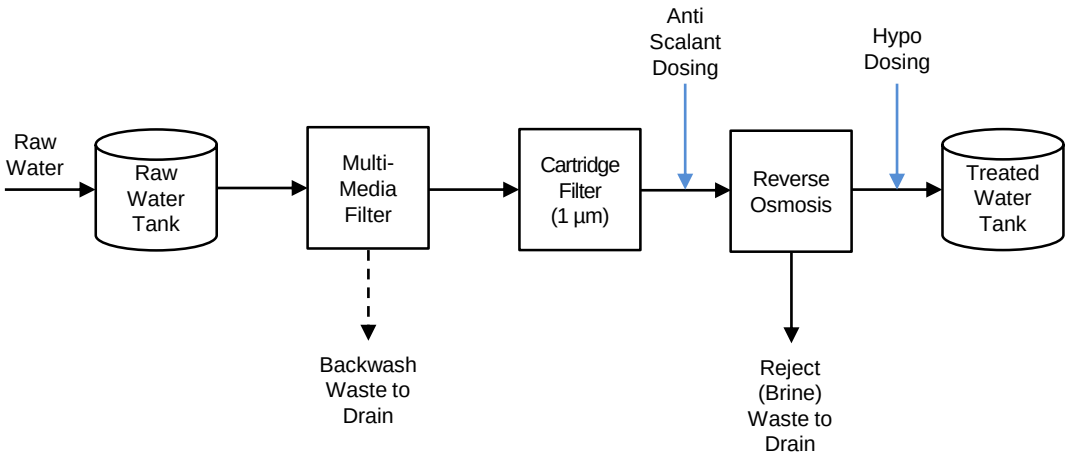
UV sterilisers deliver a massive dose of UV radiation (typically >40 mJ/cm2 @ 85% UVT), ensuring effective eradication of viruses and pathogens. They can be used to control biological fouling of RO membranes, or to sterilise the treated water prior to human consumption.

The on-board UV intensity monitor continuously monitors the UV intensity; an alarm is generated if the UV intensity drops below the minimum requited dose rate.

Pre-validated UV systems are available on request.

It is worth noting that UV systems are not typically installed immediately after the RO membranes, as at this point (thanks to the RO membranes), the water should already be free of microbiology,.

Options – Hypochlorite Sterilisation



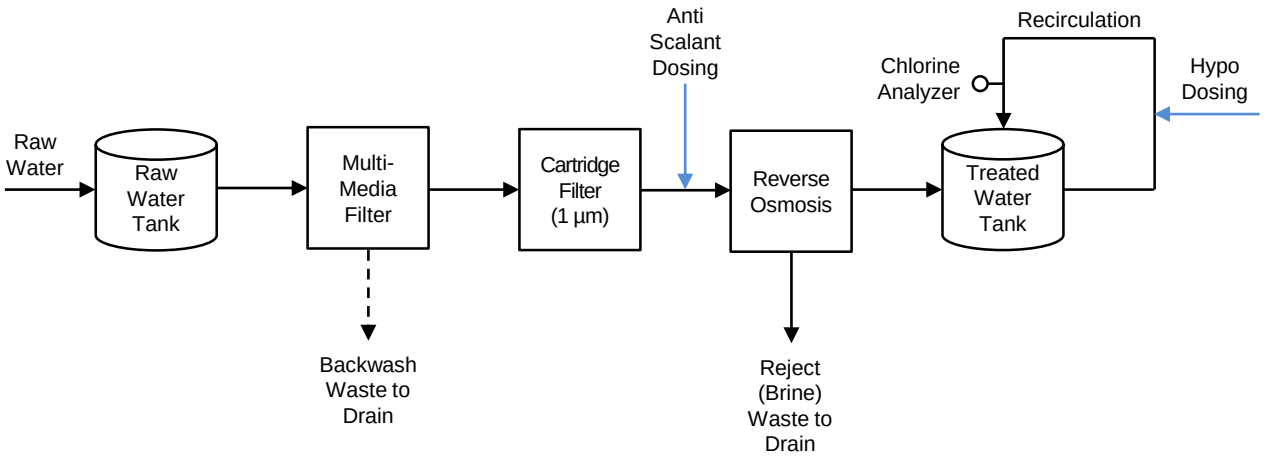
Flow Paced Hypochlorite Dosing

RO permeate can be dosed with sodium hypochlorite to maintain a sterile water supply. The operator adjustable dose rate is set based on the permeate flow rate to achieve the desired free chlorine concentration in the RO permeate.

The hypochlorite storage tank is fitted with a low level switch for auto-shutdown and to alert the operator of a low level condition; the tank level should be checked regularly and topped up as required.

An ORP transmitter can be fitted downstream of the chlorine dosing to monitor free chlorine in the permeate water.

Options – Hypochlorite Sterilisation

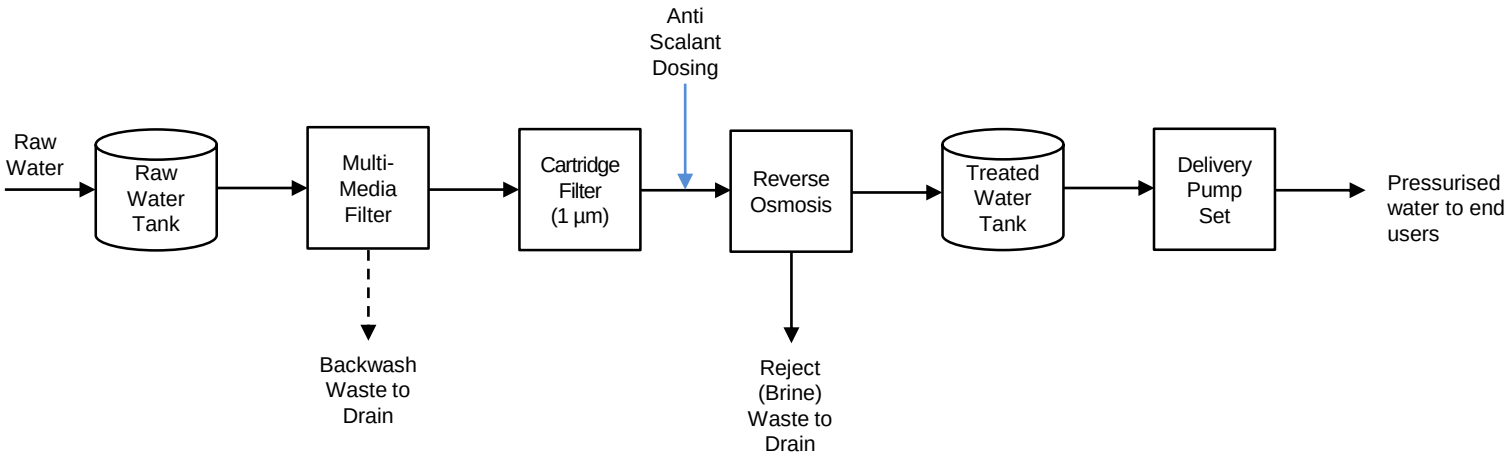


PLC Controlled (Residual Trim) Hypochlorite Dosing, with Recirculation & Monitoring

The recirculation pump circulates the contents of the storage water tank on a continuous basis; a chlorine analyser monitors the free residual chlorine, and the PLC controls dosing of sodium hypochlorite as required to ensure correct free chlorine levels are maintained in the tank at all times. Alarms are generated by any abnormal readings.

The hypochlorite storage tank is fitted with a low level switch to alert the operator of a low level condition; the tank level should be checked regularly and topped up as required.

Options – Delivery Pump Set



Potable Water Delivery Pump Set

A treated water delivery pump set can be provided to deliver treated water to end users.

The system typically is configured as a constant pressure system, with the capability to deliver variable flow rates in response to downstream demand.

A pressure sensor is installed on the discharge manifold to automatically control the operation of the pump.

Various options are available for pumping configurations (jacking pump, standby pumps etc), and electrical controls, to suit the client's requirements.

Projects Experience

Project	Pluto LNG Project – Construction Phase
Location	Karratha, Western Australia
Date	2009~2015
Scope	Design & construct, operate & maintain Client hired 3 trains and purchased 2 trains MAK Water provided full time site based operators, including periods of 24 hour coverage
Capacity	1,000 m^3/day (5 trains)
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Construction & potable water, TDS < 500 mg/L, pH 6.5~7
Features	5 x 40' Containerised plant (5 x trains) Delivered in 8 weeks MAK Standard (Data Sheet Product)

Projects Experience

Project	Marine Supply Base
Location	Karratha, Western Australia
Date	2013
Scope	Design & construct, remote monitoring + service & maintenance
Capacity	500 m^3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	2 x 40' Containerised plant with premium container fit out (wall & ceiling insulation + floor coatings) Raw water temp. EC and turbidity analysers N+1 media filters with air scouring backwash Post-RO calcite filter for pH correction and re-mineralisation PLC controlled hypochlorite dosing, with recirculation and free chlorine monitoring Treated water recirculation & transfer pumps ClearAccess™ Remote Monitoring & Control MAK Standard (Data Sheet Product)

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Projects Experience

Project	Macedon LNG Project – Construction & Operating Phase
Location	Onslow, Western Australia
Date	2011
Scope	Design & construct, site installation, commissioning & operating training, remote monitoring + service & maintenance Supply of ancillary equipment (tanks & generator) Supply of SWRO hire plants for construction
Capacity	1 x 150 m3/day SWRO plant (operations) 2 x 200 m3/day SWRO hire plants (construction)
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	40' Containerised plant, with premium container fit out (wall & ceiling insulation + floor coatings) Post-RO calcite filter for pH correction and re-mineralisation Post-RO flow paced hypochlorite dosing Potable water delivery (booster) pump set Smoke, heat and methane detectors & alarming ClearAccess™ Remote Monitoring & Control Project specific vendor data requirements

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Projects Experience

Project	Goldfields Australia – Granny Smith Gold Mine
Location	Laverton, Western Australia
Date	2014
Scope	Design & construct, service & maintenance Plant supplied under 3 year “lease-to-own” agreement
Capacity	240 m^3/day
Raw Water	Bore Water, TDS 2,500~38,500 mg/L, pH 7.5~8.4
Treated Water	Potable to ADWG
Features	40’ Containerised plant with floor coatings Designed to operate on raw water with wide TDS range (2,500 ~ 30,000 mg/L) Permeate throttling (variable) Premium efficiency high pressure pump + ERD MAK Standard (Data Sheet Product)

Projects Experience

Project	Wheatstone LNG Project
Location	Onslow, Western Australia
Date	2012
Scope	Design & construct
Capacity	200 m^3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	40’ Containerised plant with floor coatings Post-RO calcite filter for pH correction and re-mineralisation PLC controlled hypochlorite dosing, with recirculation and free chlorine monitoring ClearAccess™ Remote Monitoring & Control MAK Standard (Data Sheet Product)

Projects Experience

Project	Perth Wave Energy Project (Carnegie Wave Energy) – Wave Powered Desalination Plant
Location	Garden Island Naval Base, Western Australia
Date	2014
Scope	Design & construct, commissioning & operating training, remote monitoring + service & maintenance
Capacity	150 m3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	Worlds first wave energy powered SWRO plant Joint winner of AWA Program Innovation Award 40' Containerised plant, with premium container fit out (wall & ceiling insulation + floor coatings) Post-RO calcite filter for pH correction and re-mineralisation PLC controlled hypochlorite dosing, with recirculation and free chlorine monitoring Potable water delivery (booster) pump set Hydraulic motor/wave energy interface ClearAccess™ Remote Monitoring & Control

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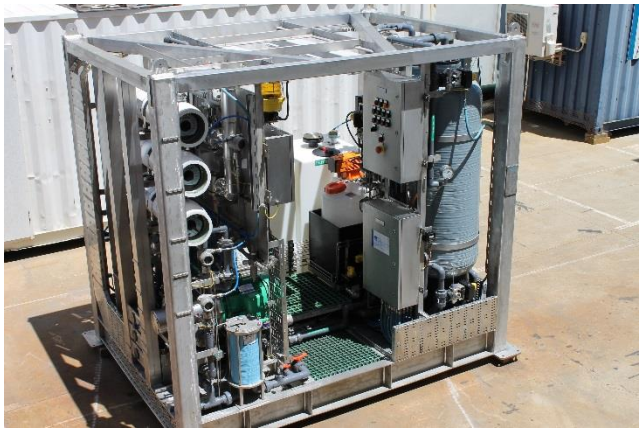
Projects Experience

Project	Iron Ore Mine
Location	Peculiar Knob, South Australia
Date	2011
Scope	Design & construct
Capacity	50 m^3/day
Raw Water	Bore water, TDS 60,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	20’ Containerised plant 1,200 PSI vessels for ultra-high operating pressure Post-RO calcite filter for pH correction and re-mineralisation Post-RO flow paced hypochlorite dosing MAK Standard (Data Sheet Product)

Projects Experience

Project	Offshore Oil Platform (Goodwyn A)
Location	North West Shelf, Western Australia
Date	2012
Scope	Design & construct, service & maintenance
Capacity	40 m^3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	Customised skid, for installation above deck in a Zone 2 Hazardous Area Compact design to fit inside available footprint Pre-RO carbon filter for chlorine neutralisation Post-RO calcite filter for pH correction and re-mineralisation Permeate buffer tank and transfer pump Ultra-high spec hazardous area offshore engineering and vendor data requirements Project specific preferred electrical equipment



Projects Experience

Project	Floating Production Storage and Offloading vessel (Northern Endeavour FPSO)
Location	North West Shelf, Western Australia
Date	2011 & 2013
Scope	Design & construct, service & maintenance
Capacity	2 x 30 m^3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	Customised skid, for installation below deck Compact design to fit inside available footprint Pre-RO carbon filter for chlorine neutralisation Post-RO calcite filter for pH correction and re-mineralisation Permeate buffer tank and transfer pump MAK Standard (Data Sheet Product)

Projects Experience

Project	Dampier Salt (Rio Tinto)
Location	Lake MacLeod, Western Australia
Date	2015
Scope	Design & construct, commissioning & operator training
Capacity	10 m^3/day
Raw Water	Sea water, TDS 38,500 mg/L, pH 8~8.5
Treated Water	Potable to ADWG
Features	10’ Containerised plant Post-RO flow paced hypochlorite dosing MAK Standard (Data Sheet Product)