







### PRODUCT OVERVIEW BWRO

#### water | wastewater | treatment | recycling



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### **Overview**

MAK Water's Brackish Water Reverse Osmosis (BWRO) plants are designed to treat ground/surface or industrial water with <5,000 mg/L of dissolved solids (TDS) and < 30 mg/L of suspended solids (TSS), to achieve potable water quality with TDS 10 to 500 mg/L, TSS < 0.1 mg/L, that is free of viruses and bacteria.

MAK BWRO plants are available as skid mounted or containerised systems.

#### 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 Containerised 650 m<sup>3</sup>/day BWRO Plant



MAK Containerised 130 m³/day BWRO Plant



### **Overview**





The standard treatment process involves pre filtration (auto backwashing multimedia filters and cartridge filters), anti-scalant dosing to prevent membrane scaling, RO desalination and a CIP system 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 BWRO systems can be configured as single-stage or multi-stage arrays, depending on feed water quality, to achieve maximum recovery rate.

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



### **Overview**



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

Parameter	Unit	Raw Water (typical)	Treated Water (typical)
Recovery Rate	%	-	60~85% (varies according to feed water quality and RO configuration)
Total Dissolved Solids	mg/L	< 5,000	10 ~ 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.







#### **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<sup>™</sup> 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.







#### **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<sup>™</sup> 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.







#### 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 to alert the operator of a low level condition; the level should be checked regularly and topped up as required.







#### **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 varies according to feedwater quality and system configuration.

On any given feedwater, factors affecting recovery rate include membrane and anti-scalant selection, system operating pressure, concentrate recirculation, membrane configuration (single stage, two stage, three stage etc) and path length.

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





#### **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 brine discharges at low pressure for disposal to drain.

Where ClearAccess<sup>™</sup> 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.







#### **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<sup>™</sup> 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.

### **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

#### 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).



Process Support via ClearAccess™



ClearAccess<sup>™</sup> from your Smart Phone or Tablet



# **Options – Containerised Plant**

MAK BWRO 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 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 (-40°C/-40°F)
- High spec/high build two-pack epoxy container painting





Standard 20' Container

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



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



# **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.

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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	<ul> <li>Broadest application</li> <li>Instantaneous reaction</li> <li>Also removes arsenic, aluminium, some other metals and hydrogen sulphide</li> </ul>	<ul> <li>Broad application</li> <li>Lower capital cost than DMI- 65 media</li> </ul>	<ul><li>Lowest capital cost</li><li>No chemical consumption</li></ul>
Disadvantages	<ul> <li>Chemical consumption</li> <li>Higher capital cost</li> <li>Does not tolerate clays, large organic molecules and very high hardness</li> </ul>	<ul><li>Slow reaction</li><li>Chemical consumption</li></ul>	<ul><li>Slowest reaction</li><li>Narrow pH range</li><li>Limited application</li></ul>
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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.





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: <u>http://www.dmi65.com/</u>





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<sup>™</sup> 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.





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 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.





**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.





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 de-chlorination (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<sup>™</sup> 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.

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### **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<sub>2</sub> 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 is 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, a mak water comoan



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# **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.



Project	Mineral Sands Processing Plant
Location	Kemerton, Western Australia
Date	2014
Scope	24 months hire contact, commissioning & operator training, remote monitoring, monthly service & maintenance
Capacity	1,800 m <sup>3</sup> /day (3 trains)
Raw Water	Bore water, TDS < 1,000 mg/L
Treated Water	Process water, TDS < 10 mg/L
Features	3 x 40' Containerised plant (3 x trains) High pressure SS316 pipework ClearAccess <sup>™</sup> Remote Monitoring & Control MAK Standard (Data Sheet Product)









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Project	Gorgon LNG Project (KJV/Chevron)
Location	Barrow Island, Western Australia
Date	2015~2016
Scope	15 months hire contract, commissioning & operator training, remote monitoring, monthly service & maintenance
Capacity	960 m³/day (2 x 50% trains)
Raw Water	Chlorinated potable water, TDS < 500 mg/L
Treated Water	Demineralised process water, EC < 1 $\mu$ S/cm @ 25°C, pH 6.5 ~ 7.5
Features	2 x (40' + 20') Containerised plants (2 x 480 m <sup>3</sup> /day) Feed and permeate tanks Transfer pump sets Interconnecting hoses with quick couplings Pre-RO SMBS and caustic dosing Post-RO polishing (ion exchange resin filters) High pressure SS316 pipework ClearAccess <sup>™</sup> Remote Monitoring & Control MAK Standard (Data Sheet Product)









Project	Roy Hill Iron Ore Project – Port
Location	Pilbara, Western Australia
Date	2014
Scope	Design & construct, loading and transport to site, commissioning & operator training
Capacity	228 m <sup>3</sup> /day
Raw Water	Bore Water, TDS 1,660 mg/L, pH 8.5
Treated Water	Potable to ADWG
Features	40' Containerised plant, with floor coatings Two (2) stage RO configuration Post-RO flow paced hypochlorite dosing Potable water delivery (booster) pump set Safety shower & eyewash station High spec engineering and vendor data requirements Project specific preferred electrical equipment









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Project	Plant Nursery
Location	Forrestfield, Western Australia
Date	2011
Scope	Design & construct, commissioning & operator training
Capacity	150 m <sup>3</sup> /day
Raw Water	Bore water, TDS 1,200 mg/L, pH 7.1
Treated Water	Irrigation for plant nursery, TDS 250 mg/L
Features	Skid mounted plant Permeate blending with manual FCV MAK Standard (Data Sheet Product)









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Project	Roy Hill Iron Ore Project – Rail Yard
Location	Pilbara, Western Australia
Date	2014
Scope	Design & construct, loading and transport to site, commissioning & operator training
Capacity	144 m <sup>3</sup> /day
Raw Water	Bore water, TDS 1,660 mg/L, pH 8.5
Treated Water	Potable to ADWG
Features	40' Containerised plant, with floor coatings Post-RO flow paced hypochlorite dosing Potable water delivery (booster) pump set Safety shower & eyewash station High spec engineering and vendor data requirements Project specific preferred electrical equipment









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Project	Exxon Mobil – Longford Gas Plant
Location	Longford, Victoria
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	140 m <sup>3</sup> /day
Raw Water	Bore water, TDS 130 mg/L, pH 8.3
Treated Water	Demin process water (chlorides < 2 mg/L, hydrogen sulphide 0 mg/L)
Features	40' Containerised plant, with floor coatings Pre-RO iron removal and pH correction systems Post-RO degassing tower Duty/standby inlet strainers Duty/standby RO & chemical dosing pumps High spec engineering and vendor data requirements Project specific preferred electrical equipment Hazardous area approved instrumentation ClearAccess <sup>™</sup> Remote Monitoring & Control







Project	Remote Aboriginal Community
Location	Eastern Goldfields, Western Australia
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	128 m <sup>3</sup> /day + Blend line
Raw Water	Bore water, TDS 1,150 mg/L, nitrate 110 mg/L
Treated Water	Potable to ADWG, nitrate < 50 mg/L
Features	20' Containerised plant, with premium container fit out (wall & ceiling insulation + steel flooring) Vandal proof installation Duty/standby feed & dosing pumps Two (2) stage RO configuration / 80% recovery Permeate blending with remote control FCV Auto plant restart on power outages Feed and permeate nitrate analysers Safety shower & eye wash station ClearAccess <sup>™</sup> Remote Monitoring & Control Telemetry link to client SCADA system MAK Standard (Data Sheet Product)









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Project	Roy Hill Iron Ore Project – Mine Site
Location	Pilbara, Western Australia
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	100 m <sup>3</sup> /day
Raw Water	Bore water, TDS 7,570 mg/L, pH 7.4
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 PLC controlled hypochlorite dosing, with recirculation and free chlorine monitoring Safety shower & eyewash station Duty/standby air conditioners High spec engineering and vendor data requirements Project specific preferred electrical equipment









Project	Gold Mine
Location	North West Mongolia
Date	2012
Scope	Design & construct, commissioning & operator training
Capacity	96 m <sup>3</sup> /day
Raw Water	Bore water, TDS 2,150 mg/L, pH 7.9
Treated Water	Potable to ADWG
Features	40' Containerised plant, with premium container fit out (wall & ceiling insulation + floor coatings) -40° ambient design operating temperature Post-RO flow paced hypochlorite dosing MAK Standard (Data Sheet Product)









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Project	Hospital
Location	Broome, Western Australia
Date	2013
Scope	Design & construct, commissioning & operator training, remote monitoring + service & maintenance, monthly lab testing and reporting
Capacity	85 m³/day
Raw Water	Chlorinated tap water, TDS 350 mg/L, SiO <sub>2</sub> 95 mg/L, pH 6.6
Treated Water	Cooling tower feed, SiO <sub>2</sub> < 10 mg/L, hardness 60~100 mg/L, pH 7.5 +/-0.5
Features	40' Containerised plant, with premium container fit out (wall & ceiling insulation + floor coatings) Duty/standby power supply switch board Duty/standby feed, RO and transfer pumps Feed tank and treated water transfer tank Pre-RO carbon filter and caustic dosing Post-RO calcite filter and acid dosing RO bypass line with manual valves ClearAccess <sup>™</sup> Remote Monitoring & Control MAK Standard (Data Sheet Product)









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Project	Sheep Station
Location	Eucla Basin, WA/SA boarder
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	50 m³/day
Raw Water	Bore water, TDS 8,370 mg/L, pH 7.6
Treated Water	Watering of livestock, TDS < 500 mg/L
Features	20' Containerised plant Pre-RO chemical free iron oxidation system Auto-membrane flushing on plant shutdown Two (2) stage RO configuration High pressure SS316 pipework MAK Standard (Data Sheet Product)









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Project	Perth Mint
Location	Perth, Western Australia
Date	2014
Scope	Design & construct, site installation, commissioning & operator training, monthly service & maintenance
Capacity	30 m³/day
Raw Water	Chlorinated tap water, TDS 600 mg/L, pH 8.2
Treated Water	Process water, EC < 10 µS/cm @ 25°C
Features	Skid mounted plant Pre-RO chlorine removal (carbon filter) Post-RO polishing (ion exchange resin filter) MAK Standard (Data Sheet Product)









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Project	Copper Mine
Location	Cloncurry, Queensland
Date	2014
Scope	Design & construct, loading & transport, commissioning & operator training, service & maintenance
Capacity	20 m³/day
Raw Water	Bore water, TDS 1,220 mg/L, pH 8.2
Treated Water	Potable to ADWG
Features	10' Containerised plant, with premium container fit out (wall & ceiling insulation + steel flooring) Permeate blending line with manual FCV Post-RO flow paced hypochlorite dosing MAK Standard (Data Sheet Product)









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Project	Hospital, Surgical Theatres Upgrade
Location	Osborne Park, Western Australia
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	14 m <sup>3</sup> /day
Raw Water	Chlorinated tap water, TDS 700 mg/L, pH 8.0
Treated Water	Laboratory Grade 3, EC < 20 $\mu$ S/cm @ 25°C
Features	Skid mounted plant Two pass RO process Pre-RO carbon filter Duty/standby RO pumps (pass 1 & 2) Permeate tank Duty/standby delivery pump set Ethernet interface to Building Management System MAK Standard (Data Sheet Product)









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Project	Gold Mine
Location	Goldfields, Western Australia
Date	2014
Scope	Design & construct, commissioning & operator training
Capacity	10 m³/day
Raw Water	Bore water, TDS 5,630 mg/L, pH 7.2
Treated Water	Potable to ADWG
Features	10' Containerised plant Post-RO calcite filter for pH correction and re- mineralisation UV steriliser on potable water distribution pump discharge MAK Standard (Data Sheet Product)









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Project	Dampier to Bunbury Natural Gas Pipeline – Replacement RO plants for 5 x Compressor Stations (CS01, CS03, CS04, CS08, CS09)
Location	Various locations (5 off) between Dampier and Perth
Date	2012: CS03 & CS04 2015: CS01, CS08 & CS09
Scope	Design & construct of 5 x BWRO skids, commissioning & operator training
Capacity	5 x 10.5 m³/day
Raw Water	CS04: Bore water, TDS 10,570 mg/L, pH 8.3 CS01, CS03, CS08 & CS09: bore water, TDS <2,500, 6.4~8.45
Treated Water	Potable to ADWG
Features	Skid mounted plant SS316 skid and instrument tubing Post-RO calcite filter (CS01, CS08 & CS09) High pressure SS316 pipework (CS04 only) Auto-membrane flushing on plant shutdown (CS04 only) MAK Standard (Data Sheet Product)









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Project	Rio Tinto Iron Ore – Locomotive Service Facility
Location	Cape Lambert, Western Australia
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	10 m³/day
Raw Water	Chlorinated tap water, TDS <1,000 mg/L, pH 8.15
Treated Water	Industrial uses, TDS < 20 mg/L, pH 6.36
Features	10' Containerised plant Pre-RO carbon filter High spec engineering and vendor data requirements Project specific preferred electrical equipment









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Project	Port Hedland Power Station
Location	Port Hedland, Western Australia
Date	2016
Scope	Design & construct, commissioning & operator training
Capacity	480 m <sup>3</sup> /day (2 x 50% trains)
Raw Water	Potable water, TDS <600 mg/L, pH 7.96
Treated Water	Demineralised process water for CTG Evap cooler skids & steam section, chloride < 55 mg/L
Features	20' Containerised plant for required footprint Two (2) stage RO configuration / 83.3% recovery Permeate blend line Evap water supply pumps (3 x 50%) Fast delivery time 11-13 weeks Client specified engineering and documentation requirements







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