

Water Recycling & Reuse

*From Waste to Worth:
Reuse Water for a
Sustainable Future.*



Water Reclamation Systems
from WABAG – a water reuse pioneer



sustainable solutions. for a better life.

Water Recycling & Reuse: The key to sustainable water management

Why water recycling is not a luxury, but the order of the day.

There is only a fixed amount of fresh water available and while the earth's natural resources continue to dwindle, the global population is increasing by 80 million people annually.

However, population growth and urbanisation are by no means the sole causes of ever-greater water shortages, as climate change, agriculture and industry, infrastructure deficiencies, pollution, the overexploitation of groundwater reserves, water wastage and the building of dams also constitute contributory factors.

A practical and sustainable solution: Water recycling and reuse

In view of the urgent need to conserve existing resources, the implementation of water recycling concepts is of enormous importance.

Intelligent reclamation systems can make a significant contribution to the increased water availability needed to meet private, commercial, agricultural and industrial demands, and improve supply reliability. Furthermore, reclamation systems consume less energy than alternatives such as seawater desalination.

SDG - Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing RECYCLING and safe REUSE globally.

Water Facts

Worldwide, 2.2 billion people – 27% of world's population - lack access to safely managed drinking water.

2.4 billion people live in water-stressed countries.

3.5 billion people - 46% of world's population - lack safely managed sanitation services.

(Source: UN World Water Development Report 2025)

GOAL 6:
ENSURE ACCESS TO WATER AND
SANITATION FOR ALL.



WABAG – a water reclamation pioneer

WABAG is an expert in the field of water reuse and recycling and in some areas represents a pioneer. We were one of the first companies to develop modern water reuse and recycling concepts and during the past three decades have implemented over 70 schemes involving a wide range of applications.

What makes WABAG a preferred partner?

- An extensive technology portfolio
- Proven process know-how and experience
- The provision of complete solutions: EPC, DBO, BOOT
- Experience as a reclamation plant operator
- Multinational experience, which ensures an understanding of different local needs
- In-house R&D centres in Austria and India
- The completion of 1,500 water and used water treatment plants during the past three decades.
- Having built the worldwide first Direct Potable Reuse (DPR) Plant in Windhoek, Namibia.

Today, the recycling of water using modern technologies is both viable and safe.

Our technologies fulfil all the requirements for re-cycled water. The main pollutants to be removed include:

- Organic and inorganic pollutants
- Turbidity
- Toxic substances
- Bacteria and viruses
- Protozoa
- Helminth eggs

Depending on requirements, appropriate technologies are combined to create individual solutions in the form of multi-barrier treatment systems for different applications.

Direct potable reuse - DPR

- Advanced Multi-Barrier Systems
- Non treatment & Operational barriers
- No environmental buffer

Typically for indirect potable reuse - IPR

- Advanced Multi-Barrier Systems
- Non treatment & Operational barriers
- Groundwater/reservoir augmentation (environmental buffer)

Industrial water recycling & reuse

Depending on the application:

- Typically: Coagulation/Flocculation, Clarification, Filtration, Ozonation, Ultrafiltration, Reverse Osmosis, Ion Exchange.
- to achieve MLD/ZLD: Multi Effect Evaporator, Crystallization.

Typically for urban reuse

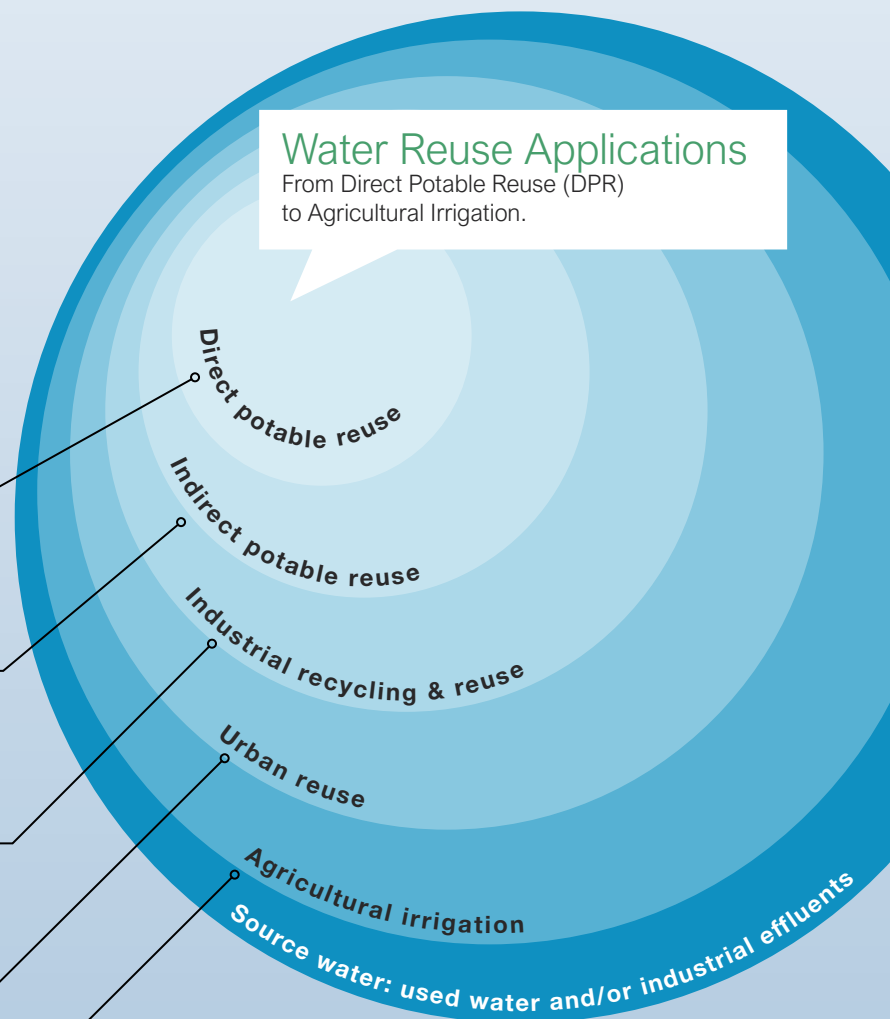
- Tertiary Sand/Dual Media or Disc filtration & Disinfection
- Biofiltration & Disinfection
- MBR & Disinfection

Typically for agricultural irrigation

- Tertiary Sand/Dual Media or Disc filtration & Disinfection
- MBR & Disinfection

Water Reuse Applications

From Direct Potable Reuse (DPR) to Agricultural Irrigation.



Agricultural reuse

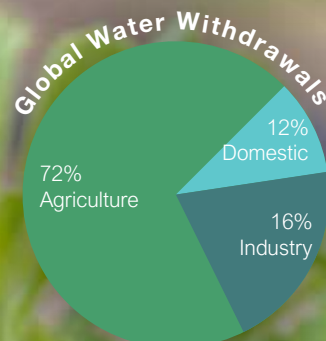


Recycled water for irrigation.

72% and rising: Agriculture is the world's largest water consumer.

As global populations grow, so does the demand for food—and with it, the water needed for agriculture. By 2050, farming water use is projected to rise by 20%, further straining freshwater supplies needed for drinking and ecosystems.

A practical and sustainable solution lies in water reuse. Treated wastewater, enhanced with proven tertiary processes such as filtration and disinfection, or advanced methods like MBR, MBBR, or BAF, offers a reliable and safe source for irrigation. Reuse turns a readily available resource into a vital asset for sustainable farming.



Meeting future food demand with reclaimed water.

SAUDI ARABIA: LARGE-SCALE WATER REUSE FOR SUSTAINABLE AGRICULTURE

In Saudi Arabia, WABAG realised a large-scale municipal wastewater treatment plant - **Al Kharj Road WWTP, Stage III** - reclaiming **200,000 m³/day** of treated water for agricultural irrigation. The facility combines advanced water treatment technology with anaerobic sludge treatment and energy recovery, ensuring environmental sustainability.

Technology: Screening, grit removal, pre-clarification, activated sludge with secondary clarification. Tertiary treatment: Disc filtration & Disinfection.

Capacity: 200,000 m³/d (max. 320,000 m³/d)

Start-up: 2024

Type: EP

Water quality standards depend on crop use.

Water quality requirements for reuse vary by crop type—whether for raw-consumed foods, processed foods, or non-food crops. **Key parameters** include E. coli, BOD₅, TSS, turbidity, and, in some cases, Legionella spp. or intestinal nematodes (helminth eggs).

TUNISIA: 3 SUSTAINABLE WWTPS FOR WATER REUSE

Supporting agriculture and environmental protection in Tunisia, WABAG has built three small-scale municipal wastewater treatment plants —Sidi Bou Ali, El Jem, and Querdanine— for national ONAS. Each features a three-stage treatment process to enable safe reuse of treated water for agricultural irrigation.

Technology: Screening, grit removal, aeration tanks, physico-chemical treatment of phosphorus, secondary settling. Tertiary treatment: Sand filtration & UV Disinfection.

Capacities: 1,595 m³/d / 3,300 m³/d / 2,900 m³/d

Start-up: 2022 - 2023

Type: EPC

Urban water reuse



The key to sustainable, socio-economic development.



Recycled water is transforming cities—making them greener, more resilient, and better places to live.

Intelligent water reclamation systems are becoming essential for the sustainable, socio-economic development of urban areas worldwide. As pressure on freshwater resources grows, treated used water is increasingly being recognized as a valuable resource. Today, modern WWTPs are not just for disposal—they are a source of high-quality reclaimed water, suitable for:

- Urban green space and landscape irrigation.
- Public services such as street cleaning, firefighting, and toilet flushing, etc.).
- Sustainable water supply

Water reuse benefits communities through:

*Increased water availability - Independence from rainfall and droughts - Keeping cities clean and green
Sustainable socio-economic development - Enhanced quality of life*

EGYPT: MADINATY WATER RECLAMATION PLANT, CAIRO (PHASE I & II)

80,000 m³/d for a new and eco-friendly city in Egypt

A new and exclusive satellite city was built east of Cairo on the road to Suez and its inhabitants will be offered a high quality of life with plenty of green spaces and recreation areas. In addition, great value was attached to environmental protection. Accordingly, the new used water treatment plants were designed for sustainable water reclamation. The purified water is used for the watering of green areas and golf courses.

Technology: Mechanical pre-treatment, primary clarification, activated sludge treatment and secondary clarification, sand filtration and final disinfection. Sludge treatment.

Capacity: 2 x 40,000 m³/d

Start-up: Stage I: 2018, Stage II: 2022

Type: Stage I: DBO, O&M since 2018, Stage II: O&M since 2022



A multi-stage-treatment system for the water reclamation plant Madinaty, located near Cairo.



Pumping Station: the reclaimed water is directly pumped into a special service water network for irrigation purposes.



A fully equipped laboratory for continuous water quality monitoring.

Water reclamation for urban reuse



Proven and innovative technologies for tailor-made solutions.



SAUDI ARABIA: Jubail Industrial City WWTP – Water Reuse for Urban Irrigation

120,000 m³ water per day for a new industrial city

WABAG has built a turnkey municipal used water treatment plant in Jubail Industrial City, the world's largest single industrial development. Designed for 120,000 m³/day, the plant includes three-stage treatment, a 20,000 m³/d tanker pumping station, and sludge treatment. The high-quality effluent meets the Royal Commission of Jubail's standards and is reused for urban irrigation and the preservation of nearby Sabkha wetlands.

Technology: Biological treatment, Wastewater (sand) filtration and Disinfection using Chlorine, Sludge treatment.

Capacity: 120,000 m³/d

Start-up: 2023

Treating municipal and industrial effluents to the benefit of the urban population and the environment.

NAMIBIA: Ujams - Industrial Water Reclamation

Industrial park in Windhoek – urban reuse of industrial effluents

5,175 m³ water per day for Namibia's capital

Located in the northern industrial area of Windhoek—the capital of Africa's driest sub-Saharan country — the new Water Reclamation Plant supports sustainable water reuse at Ujams. As the third water reuse facility in the city, it treats industrial effluents from different production companies using advanced technologies. The reclaimed water is reused for augmenting the Klein-Windhoek River and for applications such as dust control during road construction—helping preserve scarce water resources in a severely arid region.

Technology: MICROPUR® fine sieving, Membrane Bioreactor, UV Disinfection.

Capacity: 5,175 m³/d

Start-up: 2014

Type: Build-Own-Operate-Transfer (BOOT), 21 years O&M

FURTHER REFERENCE EXAMPLES

New Jeddah Airport 2 ISTP, Saudi Arabia
300,000 m³/d, NEREDA®, Disc filtration & Disinfection; Reuse for irrigation.

Madinat Salman WWTP, Bahrain
40,000 m³/d, Activated sludge, Disc filtration, Disinfection; Reuse for irrigation.

Jazan Economic City, Saudi Arabia
10,000 m³/d, Rapid gravity sand filtration, Dual media filtration, Disinfection, Reuse for irrigation and service water (TSE network).

Beni Messous, Algeria: 100,800 m³/d, Tertiary treatment plant with Sand filtration and UV disinfection for urban irrigation.



Industrial water recycling & reuse



Transforming effluents into a valuable production factor.

Industry accounts for around 16% of global freshwater use, rising to up to 60% in industrialized countries. In regions facing water scarcity, industrial supply is often the first to be restricted. A sustainable alternative lies in reclaiming water from industrial and municipal used water treatment plants.

Tailor-made treatment systems enable the reuse of the cleaned used water for industrial production in various forms:

- Cooling tower make-up water
- Boiler feed water
- Process water (e.g. for PTA production)
- Service water (e.g. for cleaning, fire fighting)

Using our comprehensive process portfolio, WABAG designs efficient, custom-built systems for every operation—from basic tertiary treatment up to Zero Liquid Discharge (ZLD).

Minimizing dependency on fresh water resources

Closed, integrated water management systems with internal used water treatment significantly reduces freshwater intake and wastewater discharge, helping industries cut costs, enhance sustainability, and secure their water supply—all while contributing to long-term resource conservation.

*Wherever
potable water supply
is endangered, the public
authorities first reduce the
supply to industry.*

*Water is too precious
to be used only once!*

Benefits for industry and the environment:

- Secure and reliable water supply
- Reduced dependency on fresh water resources
- Consistent water quality
- Lower fresh water consumption and resource preservation.
- Cut in used water volume and charges
- Lower production and operating costs
- Fast Return on Investment
- Support for regional and socio-economic development



Photo: Water Recycling System for PARADIP Refinery, India

Industrial water recycling and reuse



Providing high-quality water for industry from used water.



PRODUCT
Industrial water
for various
industries

INDIA: Ghaziabad TTRO

Reclamation of municipal effluents to secure water supply for industrial hub

The new recycling plant in Ghaziabad utilizes treated wastewater from the upstream municipal 56 MLD STP as the raw water source for producing industrial water. The tertiary treatment plant employs Ultrafiltration and Reverse Osmosis as main technologies. The reclaimed water is supplied to industries located in the Sahibabad Industrial Estate, Ghaziabad, which are directed to use TTRO-treated water instead of the rapidly depleting groundwater currently in use.

Location: Ghaziabad, India

Capacity: 40,000 m³/d

Start-up: 2024

Type: DBO, 15 years O&M



PRODUCT
Industrial Water
for various
Industries

INDIA: Koyambedu TTRO, Chennai

Creating alternate water sources to ensure industrial water supply

A landmark project in municipal used water recycling, the Koyambedu WWTP creates an alternative water source to ensure reliable supply for Chennai's industrial zones. Treated water is further processed at a tertiary treatment facility using Ultrafiltration and Reverse Osmosis to produce high-quality industrial water, which is conveyed through a 60 km pipeline to key industrial hubs, mainly serving the automotive sector. The plant ensures consistent water quality and supply security, reducing dependence on freshwater sources.

Location: Koyambedu, Chennai, India

Capacity: 45,000 m³/d

Start-up: 2019

Type: DBO, 15 years O&M



PRODUCT
Process water
for Petrochemical
Complex

NIGERIA: DANGOTE Petrochemical Complex

Complete water management including recycling and reuse

WABAG has designed a multi-stage treatment employing state-of-the-art technologies like MARAPUR®-MBR, Ultrafiltration, Reverse Osmosis, Biofiltration and SBR as well as spent caustic treatment. Treated effluents together with cooling tower and boiler blow down streams are further processed in a RO-based demineralization plant for a sustainable and cost-efficient water recycling.

Location: Lekki Zone, Lagos, Nigeria

Capacity: 26,400 m³/d

Completion: 2023

Type: EPC



**Reclaiming
Municipal
secondary
effluent**

FURTHER REFERENCE EXAMPLES

Chennai Petroleum Corp.Ltd., India:

11,400 m³/d, treatment of secondary municipal effluent by SBR, Filtration, Ultrafiltration and Reverse Osmosis for the production of boiler and cooling make-up water.

Vizag Steel, Andhra Pradesh, India:

8,400 m³/d, treatment of secondary municipal effluent by Ultrafiltration and Reverse Osmosis; Re-use as cooling water in steelworks.

Closing the water cycle - working towards Zero Liquid Discharge (ZLD).



PRODUCT
Utility Water for a Refinery

INDIA: Indian Oil Corporation, Paradip Refinery

Largest industrial water recycling plant in India

For an environmental-friendly and cost-efficient water management, WABAG has completed an effluent treatment and water reclamation plant which ensure a sustainable water recycling and reuse. Effluents from various streams emanating from the new 15 MMTPA grassroots refinery facilities are treated exclusively along with landfill leachates, spent caustics, and also treat the reject water through Hard COD management. Key ETP technologies include removal of free oil (API, TPI, DAF, Wet Air Oxidation) and biological treatment. The reclamation plant employs Rapid Gravity Sand Filters, Basket Strainers, Ultrafiltration and Reverse Osmosis, achieving up to 85% water recovery.

Location: Paradip, Odisha, India

Capacity: 54,000 m³/d

Start-up: 2016

Type: EPC (turnkey execution)



PRODUCT
Cooling water for steel works

INDIA: Integrated Steel Plant of NMDC Ltd.

Zero Liquid Discharge (ZLD) for 3 MTPA Steel Plant

Design, construction, commissioning, and operation of a ZLD plant with a capacity of 180 m³/h, incorporating advanced technologies such as Ultrafiltration and Reverse Osmosis to treat various effluents generated during steel production. It efficiently reclaims and reuses purified water as make-up cooling water. The plant achieves Zero Liquid Discharge (ZLD) through a multi-stage process, which includes a Reject Reverse Osmosis unit followed by a Multiple Effect Evaporator, (MEE) operating with an overall efficiency of 90%.

Location: Jagdalpur, Nagarnar, Chhattisgarh, India

Capacity: 4,320 m³/d

Start-up: 2023

Type: DBO, 5 years O&M



PRODUCT
Utility Water for a Refinery

INDIA: Reliance Industries, Dahej Refinery

PTA effluent recycling

Effluent from PTA and PET plants are purified and reused as utility water thus minimizing the dependence on external water sources.

A tailor made advanced process design was employed: DAF, UASB (Paques), MARAPUR®-MBR, Dual Media Filtration, Ultrafiltration and Reverse Osmosis. In addition, the biogas generated during anaerobic treatment is used as fuel for plant utility purposes. 80 per cent water recovery.

Location: Dahej, Gujarat, India

Capacity: 36,000 m³/d

Start-up: 2014

Type: DBO, 3 years O&M

Reclaiming
Treated
industrial
effluent

FURTHER REFERENCE EXAMPLES

Amur Gas Chemical Complex, Russia: 24,180 m³/d. Process water for refinery; UF, RO. **ZLD:** Evaporator & Crystallizer. Start-up: 2026

Ras Tanura Refinery, Saudi Arabia: 20,000 m³/d. Process water; SBR, Dual media filter, Activated carbon filters, RO, Wet air oxidation. Start-up: 2026

Common ETP for Jajmau Leather Cluster, Kanpur: 20,000 m³/d. incl. Chrome recovery and ZLD pilot plant.

Guru Gobindh Singh Refinery, Bathinda, Punjab: 13,680 m³/d. Process water for refinery; UF and RO.

Jindal Steel, India, TTP for Coal Gasification Project: 8,640 m³/d. Cooling tower make-up water, RO brine for dust suppression in ash handling. DMF, Fine sieving, UF, RO.

Direct potable reuse (DPR)



Turning secondary effluent into drinking water.

The New Goreangab WTP in Windhoek, Namibia



Gammans WWTP



PRODUCT
Drinking
Water

In many regions of the world, access to clean drinking water is not a matter of course. A secure supply is frequently only possible through the use of alternative resources. Therefore, reclaimed used water represents a viable option for potable water augmentation. Naturally there must be absolute certainty that the utilisation and consumption of this water do not involve any risks to humans.

WABAG has the know-how and the technologies required to provide drinking water from domestic used water, as demonstrated by the world's first direct potable reclamation plant in Windhoek:

The city of Windhoek receives water from three sources, one of which is the globally renowned Goreangab water reclamation facility. This unique reclamation plant transforms domestic secondary effluent into high-quality drinking water by means of the latest water technologies.

Multiple Barriers – before, during and after the water treatment.

A system of multiple safety barriers is installed, not only during, but also before and after the water treatment process. The first fundamental barrier is provided by the fact that industrial and domestic effluents are strictly separated followed by an extensive pretreatment prior to reaching the reclamation plant. The domestic used water from the city is conditioned using the Gammans used water treatment plant (nutrient elimination by the UCT process) and polished in maturation ponds before cleaning in the advanced multi-barrier system comprised of nine treatment steps. This employs a series of safety barriers for all crucial contaminants and thus guarantees the reliable fulfilment of strict standards.

The New Goreangab plant was completed in 2002 and represents the first direct potable water reclamation plant worldwide. It produces 21,000 m³ of high-quality potable water per day, which constitute 25% of the total volume of water consumed in Windhoek.

Location: Windhoek, Namibia

Raw water: Domestic secondary effluent

Process: Advanced multi-barrier system

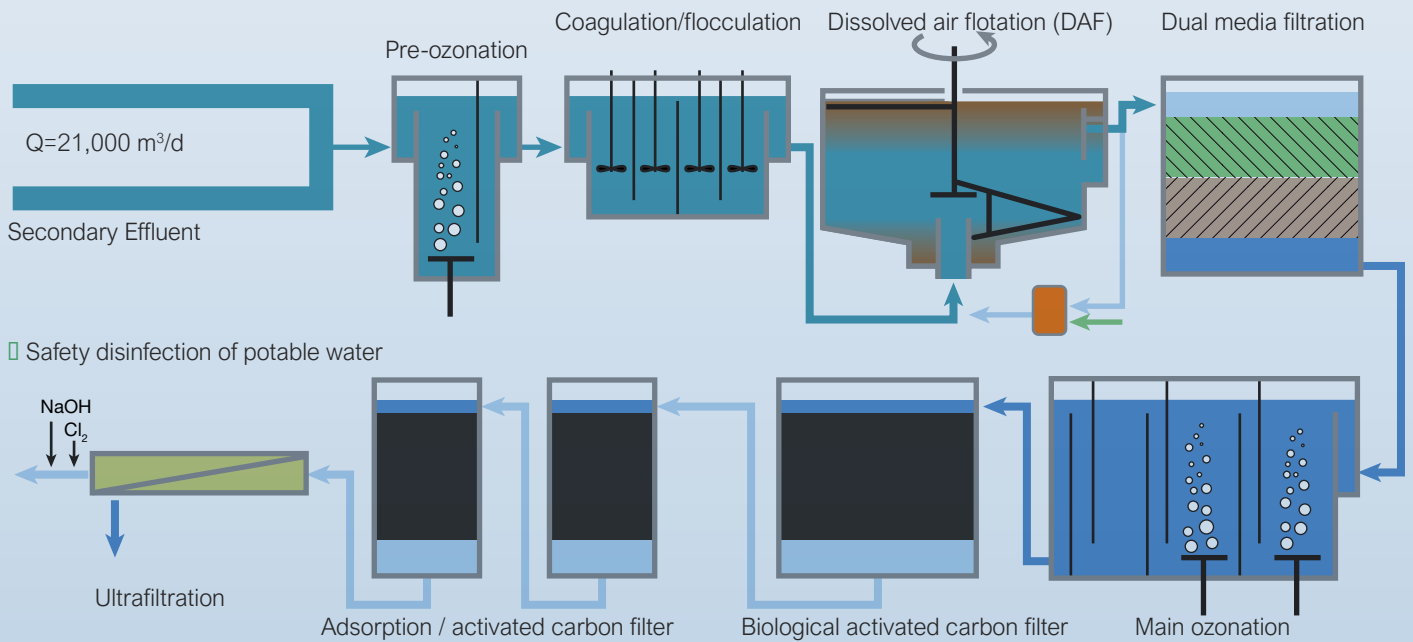
Production capacity: 21,000 m³/d

Start-up: 2002

Windhoek, Namibia

Source water
Secondary
effluent

Nine treatment steps, which provide multiple, full and partial safety barriers.



The final potable water conforms to the highest quality standards and guidelines. Since start-up, all the relevant standards have been fulfilled without difficulty. The reclaimed high quality drinking water is pumped to the New Western pump station where it is mixed with other potable water sources and further fed into the general water supply system.

WABAG not only designed and built this unique plant, but is also a member of the operating consortium WINGOC and has been managing the Goreangab water reclamation plant since its start-up in 2002. WABAG has thus contributed to a sustainable improvement in the population's quality of life.



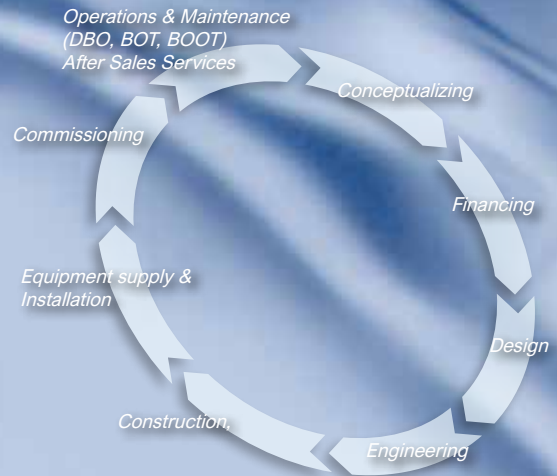
WABAG offers sustainable solutions for:

- Drinking water treatment
- Industrial water treatment
- Sea and brackish water desalination
- Water reclamation
- Municipal wastewater treatment
- Industrial wastewater treatment
- Sludge treatment

WABAG is one of the world's most innovative water treatment companies with know-how in specific technologies and in-house developed processes such as:

- | | |
|--|--|
| • Fine sieving | MICROPUR® |
| • Biofiltration | BIOPUR® |
| • Moving bed biofilm reactor | FLUOPUR® |
| • Activated sludge processes | Hybrid™, MICROPUR-CAS® |
| • Sequencing Batch Reactor (SBR) | CYCLOPUR® |
| • Membrane bioreactor | MARAPUR®, MICROPUR-MBR® |
| • Membrane filtration | RO, MF, UF, NF CERAMOPUR®, CERAMOZONE® |
| • Denitrification | BIODEN®, ENR® |
| • Oxidation processes | ADOX®, BIOZONE® |
| • Adsorption processes | CARBOPUR®, PACOPUR® |
| • Anammox | DAMOPUR® |
| • Thermal desalination | MED, TVC, MVC |
| • Membrane Crystallization, MEE | ZEROPUR® |
| • Deep bed filtration in various designs | |
| • Energy-optimised sludge treatment | ENOPUR® |

The WABAG Group represents a leading multinational player with companies and offices in over 25 countries and a focus on emerging markets in Europe, Africa, Near/Middle East, South East Asia and India.



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