SECTION 01 / 07

Drinking Water Production Process PDF: Well Water & Tap Water Purification

Raw-water assessment & process map

A drinking water production line using well water or municipal tap water should be designed from measured feed quality and a defined finished-water specification. Filtration is a useful part of many systems, but a filter train chosen without water analysis may leave important contaminants uncontrolled. This PDF explains how source testing, pretreatment, optional membrane purification, microbial control and hygienic bottling fit together.

Keep this route separate from a natural-mineral-water project. Here, treatment can intentionally alter dissolved constituents to meet the selected packaged-water specification and applicable requirements. A naturally occurring well supply does not automatically justify a mineral-water label. Likewise, a compliant municipal supply does not remove the need to control storage, processing and contamination risks inside the bottling plant.

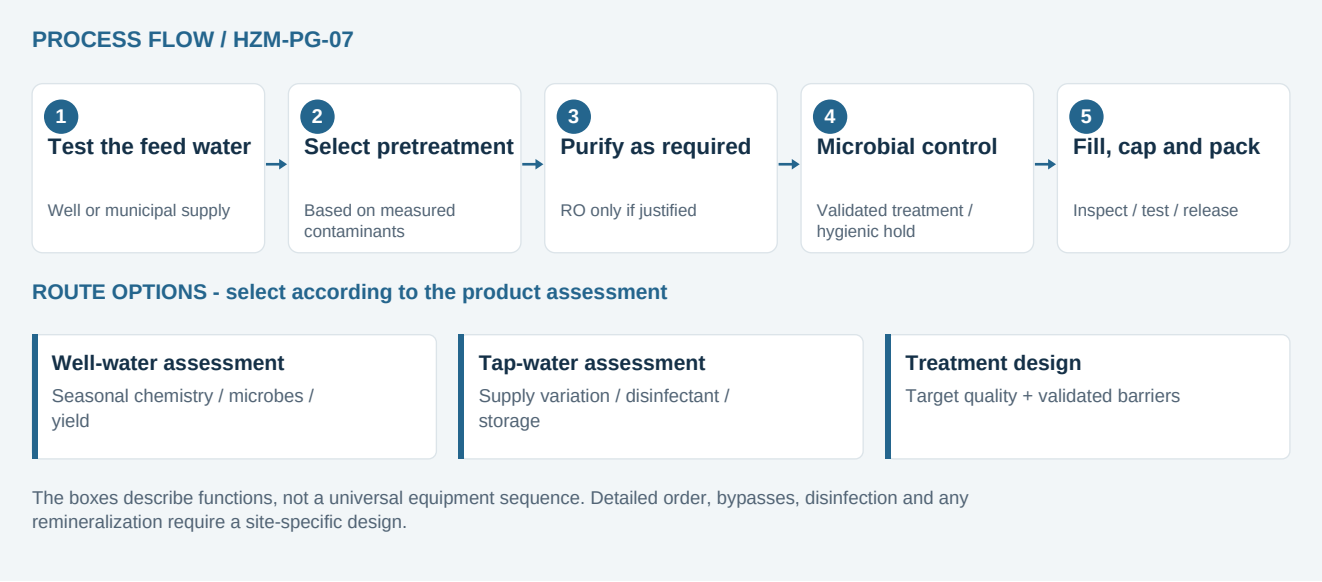

Figure 1. Original process schematic. Alternative routes require product-specific assessment.

Specify a result, not just a machine list

Define the feed envelope, contaminants to be controlled, target quality, monitoring method and action on failure for each barrier. RO, UV and ozone have different purposes and limitations; none is a complete bottling quality system by itself.

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From well or tap to treated product water

01 / Test representative feed conditions

For a well, investigate seasonal chemistry, microbiology, turbidity and dependable yield. Review locally relevant contaminants such as iron, manganese, hardness, nitrate, arsenic or salinity as appropriate. For tap water, obtain utility information but also sample at the plant; internal tanks and pipework can change the quality received by the treatment skid.

02 / Protect the raw-water system

Provide suitable storage, vents, drains and sampling access. Prevent cross-connections with process waste, cleaning chemicals and nonpotable services. Define the operating response to supply interruption or a change in water source. A backup supply must be assessed before it is substituted into a validated treatment train.

03 / Select pretreatment for the measured problem

Solids removal, iron or manganese treatment, activated carbon, hardness control or other steps may be needed. EPA describes different technologies for different contaminants [1]; their functions are not interchangeable. For membrane systems, specify acceptable feed conditions and pretreatment performance with the membrane supplier.

04 / Use RO or other purification where justified

RO can reduce many dissolved constituents, but its performance depends on feed chemistry, membrane selection and operating conditions. Confirm the target, rejection basis, recovery and concentrate handling. Protect chlorine-sensitive membranes through an appropriate dechlorination strategy where required, while also managing the microbiological consequences of removing residual disinfectant.

05 / Establish finished-water microbial control

Select and validate the required treatment barriers and hygienic storage arrangement. UV does not provide a persistent disinfectant residual, and ozone requires its own contact, residual, materials and byproduct assessment. Do not infer treatment adequacy simply because a lamp is lit or an ozone generator is running.

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Water treatment equipment & bottle filling

Figure 2. Water-treatment installation from the HZM library, showing vessels and membrane housings. The required treatment stages must be selected from the actual feed-water analysis.

Function	Possible equipment	Selection basis
Pretreatment	Media filters, activated carbon, softening or specific removal	Measured contaminants and downstream feed limits
Membrane purification	RO or other selected membrane system	Target quality; recovery; fouling and scaling assessment
Microbial control	Validated UV, ozone or other appropriate barriers	Organism target; water characteristics; operating envelope
Product storage	Hygienic tank, venting and controlled circulation	Turnover; sanitation; protection from recontamination
Bottling	Container preparation, filler, capper, inspection and packing	Bottle format; hygiene; closure; traceability

Specify the exact treatment function rather than calling every vessel a sterilizer. A particulate filter may reduce suspended matter without removing dissolved salts; a membrane or disinfection system must be assessed against its own performance targets. There is no fixed number of stages that makes every well or tap supply acceptable.

Prepare bottles and caps through the selected hygienic route, then fill and close in a protected environment. Purchased bottles and on-site PET blowing need different infeed arrangements. Keep the product-water circuit segregated from cleaning and reject-water circuits, and verify package integrity after filling.

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Monitoring, sanitation & release checks

Control location	Examples of records	Response to define
Feed water	Analysis, pressure, source identity and supply events	Hold or reassess changed feed
Pretreatment	Pressure loss, relevant contaminant breakthrough	Service, regenerate or replace as specified
RO, if used	Flow, pressure, conductivity, recovery, normalized trends	Investigate performance outside the approved envelope
Disinfection	Validated operating indicators and applicable checks	Stop/divert or hold affected water
Finished product	Microbiology, chemistry, sensory, closure and lot identity	Release, hold or reject with traceability

Conductivity and TDS are not microbiological tests and do not demonstrate that every contaminant has been removed. Combine online operating records with representative sampling and laboratory analysis. Define both routine monitoring and verification after maintenance, extended shutdown, source changes or an abnormal process event.

Address treatment byproducts

Where ozone is selected, assess bromide-related bromate risk and the relevant finished-water requirements. Chlorinated or chloraminated feeds may require attention to residual disinfectants and associated byproducts [3]. The solution is a validated treatment and monitoring plan, not a universal ozone dose copied from another plant.

Control hygienic storage and restarts

Treated water can be recontaminated in tanks, vents, hoses and filler circuits. Define sanitation, turnover, hold-time limits and restart verification. Follow approved cleaning instructions for membranes and other components, including material compatibility. FDA guidance emphasizes sanitary processing, bottling, holding and transport [2].

Keep suspect stock identifiable. Link a bottle code to the source, treatment run, line and release results so that an investigation can isolate the affected interval without guessing which pallets were produced.

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Water balance, recovery & line capacity

Worked example - RO planning assumptions

At 12,000 bottles/h and 500 mL, net bottled-water demand is 6,000 L/h. If 2% of product feed is lost during bottling, required product supply is 6,000 / 0.98 = about 6,122 L/h. At an assumed 75% RO recovery, membrane feed is about 8,163 L/h and concentrate is about 2,041 L/h.

The 75% value is an arithmetic assumption, not a recommended recovery for every source. Feed chemistry, scaling risk, temperature and membrane design determine the feasible setting. Add pretreatment backwash, cleaning, bottle preparation and other uses separately. A plant drawing 8,163 L/h for RO may need substantially more raw-water capacity during simultaneous service operations.

Plan reject water and utilities

Characterize concentrate and cleaning waste before deciding how to handle them. Any reuse needs a separately assessed purpose and protection from product-water cross-connections. Ask the supplier for electrical loads, compressed-air demand, drain flows and peak water use, including startup and cleaning rather than only steady production.

- Obtain representative well or plant-inlet tap-water analyses.
- Define finished-water quality and the intended product description.
- Approve the treatment diagram, barrier targets and monitoring plan.
- Confirm membrane pretreatment, recovery and concentrate handling where used.
- Verify microbial control, hygienic tank design and cleaning procedures.
- Test bottling speed, closure integrity, code reading and restart handling.
- Train operators on out-of-limit actions and batch release.

A useful RFQ includes feed results, source variability, bottle sizes, good-output target, operating hours, product specification, plant layout and available utilities. Require a guaranteed duty tied to those inputs, not merely an advertised liters-per-hour rating.

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Frequently asked questions & references

Does every tap-water bottling plant need RO?

No. Select treatment according to measured feed quality, the intended product and applicable requirements. RO may be useful where dissolved constituents need reduction; it is not mandatory solely because the source is municipal.

Can a sediment filter make well water safe?

A sediment filter alone is not a complete solution for dissolved chemicals or all microbiological hazards. Characterize the well and design the required barriers for the identified risks.

Can filtered water be sold as natural mineral water?

Do not infer the name from a filtration step or natural origin. Product categories depend on source and processing requirements. This guide describes treated drinking water, not source qualification for natural mineral water.

Should UV and ozone both be installed?

Not automatically. Select a validated barrier strategy based on the product, water properties, process hygiene and operating conditions. Additional equipment is useful only when its purpose, performance and monitoring are established.

Can minerals be added after RO?

A defined remineralization step may be part of a suitable drinking-water formulation, subject to the relevant requirements. Assess dosing accuracy, hygienic addition, stability and labeling; it does not create a natural-mineral-water source.

Technical references

General technology references accessed September 21, 2026. Diagrams and worksheets are original planning material; examples are not equipment guarantees or process settings.

1. US EPA: Overview of drinking water treatment technologies

2. FDA: Safety of bottled water beverages

3. FDA: Bottled water residual disinfectants and disinfection byproducts

Find equipment and further planning articles at www.hzmmachine.com. For a project review, provide your recipe characteristics, package specification, required output and site utilities.

SECTION 07 / 07

Water-treatment and packaging photographs

Selected media-library photographs show equipment categories used when designing a treated drinking-water line. The pictures are illustrative; the approved process diagram determines which equipment belongs in the project.

Figure 3. Industrial water-treatment equipment with vessels, membrane modules and sanitary pipework. Exact membrane function must be confirmed from the equipment specification.

Figure 4. PET-bottle water filling equipment downstream of product-water release and hygienic container preparation.

Figure 5. Automatic shrink packaging after fill, closure and code checks.