WATER CATCHMENT

The pump station
14 high-capacity rotatory pumps – the amount of water pumped can be regulated – feed the drinking water from the reservoirs into the water mains of the towns of Mülheim, Oberhausen and Bottrop. Because the towns are at different heights it is necessary to have three different pressure zones. Pumps with water-cooled electrical gears and protective caps ensure a maximum level of noise insulation in the pump house. Noise levels can thus be reduced from an original amount of 86 dBA to 72 dBA.

The water tower
The Bedingrade water tower in Essen-Frintrop is filled by the pumps of the waterworks Styrum/East and Styrum/West. The water tower can also be filled by the booster station "Aktienstraße" at the border between Mülheim and Essen. The tower has a capacity of about 1,000,000 liters and supplies the south of Bottrop with drinking water.

The central control room
All nine waterworks, the Kahlenberg power station in central Mülheim and the main RWW supply network are supervised and controlled from the computer-aided control room of the Styrum/East waterworks. Here RWW staff work round the clock in shifts to ensure that people can have continuous supplies of the most important nutritional element known to man directly from the pipeline.

FACTS AND FIGURES

The slow sand filtration and recovery of water
- Filter area: 50,000 m^2
- Filter speed: 1 – 3 m/d
- Soil passage: 50 – 150 m
- Water collection: 190 vertical wells (depth: 8 m) and 460 m of horizontal collecting galleries
- Siphon system using vacuum pumps
- 4 collecting wells (depth: 10 – 12 m)
- 5 pumps
  - Amount of water raised: 8,500m^3/h
  - Pressure head: 16 m
  - The pumps raise the water directly into the ozonisation plant

The ozonisation plant
- 3 ozone generators (capacity per generator: 6.3 kg/h = 18.9 kg O_3/h)
- Rated voltage: 8 – 9 KV controllable
- Frequency: 7 – 12 kHz, controllable
- Air preparation: Blower, refrigerating machine, air drier
- Ozone gassing: in 2 gassing routes (2 gassing chambers and 1 reaction chamber per route)
- Feed system: 28 gassing plates per gassing chamber
- Water throughput: max. 6,000 m^3/h
- Ozone feed: 1 – 3 g O_3/m^3
- Ozone remains are removed by catalytic converters

The filter plant
- 12 twin-chamber filters
- Diametre: 6.3 m
- Height: 13.5 m
- Weight: gross 500 t / net 80 t
- Filter construction top
  - 1.20 m VA coke
  - 0.80 m filter sand
  - 0.45 m gravel and support layers
- Filter construction bottom
  - 4 m activated carbon
- Filter throughput: max. 500 m^3/h each one
- Filter speed: max. 16.5 m/h
- Filter backwashing: automatic with water 26.5 m/h and air 55 m/h

The UV plant
- 4 reactors
- Water throughput: max. 2,000 m^3/h each one
- Power requirement: 6 – 17 kW each one
- Reactor length: 3,800 mm incl. in-flow and out-flow segments
- 8 rows of radiators: each one with 9 low pressure gas discharge lamps, dimmable

The drinking water reservoir
- 2 circular containers
- Diameter: 28 m
- Capacity: each, 3,500 m^3

The pumping
- 14 horizontal rotatory pumps, one of each zone speed regulated
- 3 pressure zones
- Mülheim zone
  - max. 6,750 m^3/h
  - max. 102 m = 10.2 bar
- Oberhausen zone
  - max. 5,250 m^3/h
  - max. 84 m = 8.4 bar
- Bottrop zone
  - max. 6.750 m^3/h
  - max. 120 m = 12.0 bar
- Speed regulation

RWW Rheinisch-Westfälische Wasserwerksgesellschaft mbH

Am Schloß Broich 1–3
45479 Mülheim an der Ruhr

T +49 208 4433-1
F +49 208 4433-233
E rww@rwe.com
I www.rww.de

RWW

THE RWW WATERWORKS IN MUELHEIM STYRUM/EAST

VORWEG GEHEN

HISTORY

As early as 1871 the "Aktiengesellschaft Oberhausener Wasserwerk" built up facilities beside the River Ruhr in Styrum in order to catch water and pump it to the industrial works and railways that belonged to the company's owners. Only 8 years later, in 1879, the company began to provide drinking water to parts of the Oberhausen population. In the years until 1903 the water supply mains was extended to include Mülheim, Osterfeld, Sterkrade and Holten.

In 1893 the industrialist August Thyssen set up his own waterworks directly next to the Oberhausen waterworks in order to supply water to his iron works in Mülheim and his collieries in Gladbeck. Later Thyssen & Co also took over responsibility for supplying water to the citizens of Bottrop, Gladbeck, Borbeck, Horst, Kirchhellen and Osterfeld.

In 1912 both these waterworks merged with the local authority waterworks of the town of Mülheim (now known as the RWW-Wasserwerk Mülheim-Dohne) to become a single company, the RWW (or Rhineland-Westphalian-Waterworks company). From then on the RWW was responsible for supplying water to an area of 300 km², comprising half a million people and a huge number of factories and collieries in the western Ruhr area. At that time the annual water supplies amounted to 35 million m³.

Today's RWW waterworks Styrum/East in the Mülheim district of Styrum is the outcome of uniting the activities of the Oberhausen and the Thyssen waterworks.

The RWW waterworks Styrum/East today
The waterworks now provides drinking water to about 350,000 people in Mülheim, Oberhausen and Bottrop. In order to ensure enough water in 1954 the RWW constructed a new waterworks just a kilometre away, called Styrum/West.

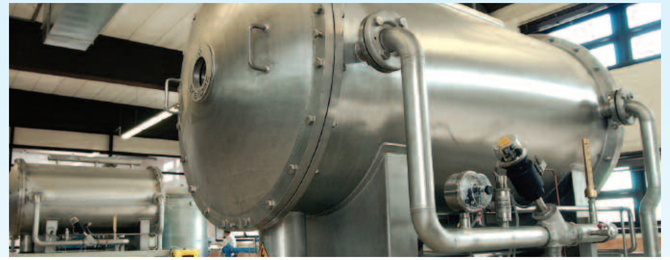
The water production site stretches over ca. 160 ha on both sides of the Ruhr River from the boundaries of Duisburg all the way to the inner city of Mülheim.

In 2002 Styrum/East waterworks was extended with the addition of a multifunctional congress centre, the Aquatorium.

WATER TREATMENT

The slow sand filtration
This waterworks, as with all the Ruhr waterworks belonging to RWW, operates according to the so called Mülheim process, but in a somewhat altered form. Instead of the first stage of flocculation and sedimentation, large slow sand filter basins are used to effect an artificial groundwater enrichment. Therefor water from the Ruhr River is led downwards in a natural incline in 1.5 metres thick pipes to basins filled with sand on a somewhat deeper level. Sliding valves regulate the amount of incoming water. The slow sand filter basins with an active adsorption area of around 50.000 square metres make up a natural barrier for any particles that have not been dissolved, like algae or particles of earth. Billions of microorganisms living in the sand feed off these particles, thereby considerably reducing a huge amount of unwanted materials in the later drinking water.

The water recovery
After a subsoil passage of two to four days the raw water is recovered by 190 vertical vacuum wells and 460 meters of collecting galleries which are situated in parallel lines between the filter basins. It is then passed into four collecting wells. Although the water is now optically clear it has not yet reached the quality necessary for drinking water.



The ozonation
After the water has undergone the first stage of mechanical and biological cleaning, it still contains a number of different harmful liquid materials like garden pesticides and other plant protection products that could be dangerous to people's health. In addition the water contains too much dissolved iron and manganese that are naturally present in ground and water. True, they are not harmful to people. Indeed, in certain amounts, they are vital to us all. In large amounts, however, they are not particularly good for the health, and in the long term they can also clog the supply pipelines.

Aggressive ozone, produced on-site out of natural oxygen by high tension electricity, is now added to the water via two gas routes. This has three effects which arise within a very short period of time. 1. Germs and bacteria are removed by disinfection. 2. Dissolved iron and manganese are oxidised and transformed into filterable granulates. 3. The chemical structure of organic substances is decomposed and transformed in smaller organic matter. In this way they are prepared for being biologically drawn off in the following stages of filtration.

The half finished product is now led into clear water chambers, before continuing its passage through the filter house.

The activated carbon filtration
Subsequently the water runs into 12 twin-storey filters, first over a multilayer filter. Here weakly activated carbon is used to eliminate any remaining ozone in order to allow a natural microbiology to develop in the layers of sand and gravel below. It particularly eliminates unwanted ammonium (nitrification) and filters off iron oxide and manganese oxide.

The activated carbon can be found in the bottom half of the filter. It is able to bind any organic substances whose structures have been changed by the ozone (pesticides, and where necessary also paints, varnishes, solvents, oil, petrol or the remains of medicines). Special microorganisms that flourish and reproduce in this atmosphere ensure that the great majority of harmful products are removed.

The UV disinfection
The waterworks Styrum/East is the first of its kind in the Ruhr area to use a secure disinfection process in a UV plant to guarantee the elimination of all pathogenic germs. Here water is treated with ultraviolet light (260 to 270 nanometres). This changes the DNA in the cell nuclei to such an extent that the bacteria lose their ability to divide, cannot multiply any more and die off. In this way it is possible to avoid any unpleasant tastes or smells caused by disinfection methods with chlorine, not to speak of the creation of any harmful by-products from chlorination.

The Drinking water reservoir
Both round water containers on the site have a diametre of 28 metres and a capacity of around the equivalent of 65,000 bathtubs (7,000,000 litres). They are used to ensure supplies during peak periods and to regulate the pressure on the mains.