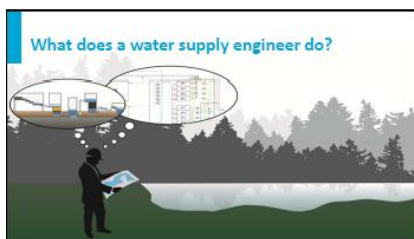


D2 – Design aspect of drinking water treatment plants



Luuk Rietveld

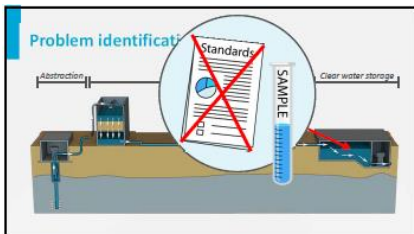


What does a water supply engineer do?

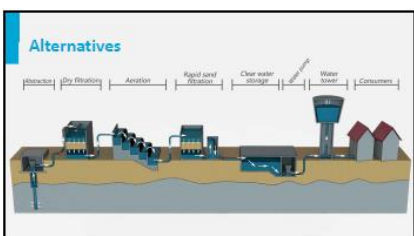
Welcome to the lecture about the design aspects of drinking water treatment plants.

One of the activities of a drinking water supply engineer is designing treatment plants.

In this lecture I will show you the process of designing.

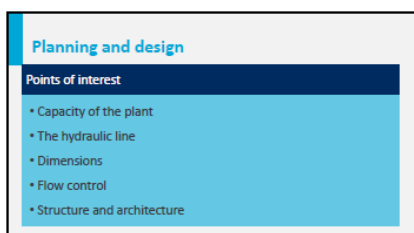


The design phase starts with the identification of a problem, the water quality does not meet the drinking water standards and an extension of the existing treatment plant is needed.



Then alternative solutions have to be identified.

After choosing the most promising alternative, the treatment process has to be further designed,

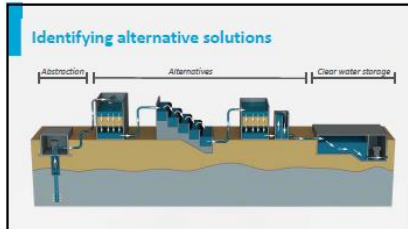


looking into the capacity of the plant, the hydraulic line, dimensions, flow control, and structure and architecture. The different aspects of the design are represented in, so-called, design schemes.

The approach is multidisciplinary involving process, civil, and mechanical engineers and architects.



Alternative solutions for the treatment plant are identified based on the raw water composition and the drinking water standards and requirements.



Mostly, there are different possible processes and positions of the processes in the treatment train.

Based on objective criteria,



such as costs, environmental impact, energy consumption, operational complexity, additional water quality effects, reliability, and robustness, an alternative is chosen.

Input for this analysis comes from experience at comparable treatment plants or, in case of new technologies, extensive pilot plant research.

The chosen alternative is represented in the Process scheme.

Here the position of the process in the treatment train is shown, sometimes already with an indication of the number of units and the dimensions.



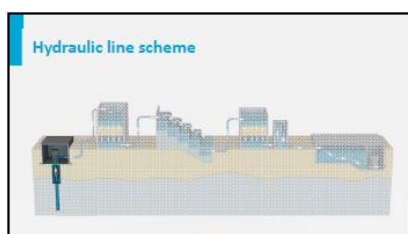
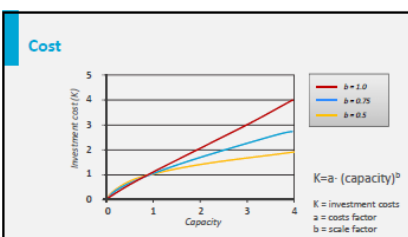
Costs is one of the most important aspects for decision makers to decide on investing in a new technology.

Therefore, it is necessary to have an indication of the investment and exploitation costs already in an early stage.

Exploitation costs, expressed as costs per m3 produced water, give an indication for the drinking water price.

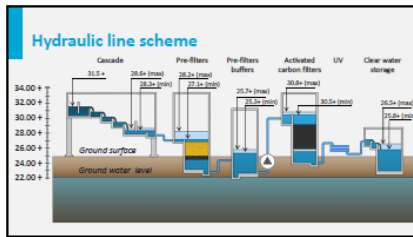
Most important part of the exploitation costs are the fixed costs, resulting from the investments in infrastructure, which can be estimated by evaluating previous projects.

For example, the investment in a treatment process can be estimated from the cost function that gives a relation between capacity and investment costs.

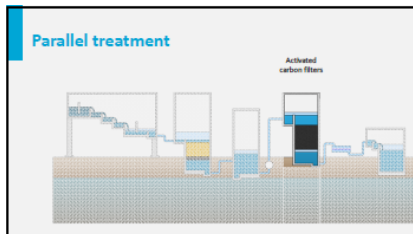


A treatment plant is normally fed by pumps, bringing the water to a level from where it is able to flow under gravity through the treatment plant to the clear water reservoirs.

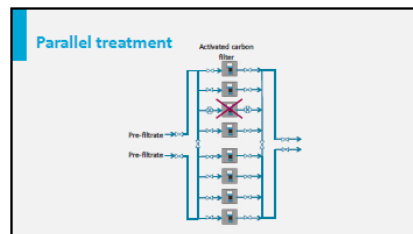
In some situations the boundary conditions, maximum building height or foundation depth, are such that an additional pumping phase is needed.



The Hydraulic line scheme indicates the heights of the treatment processes and the head losses. In addition it demonstrates the need for extra pumping phases, including the extra buffer to level off in- and outflow differences.



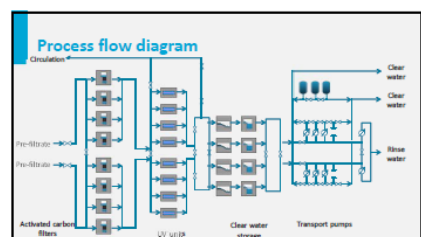
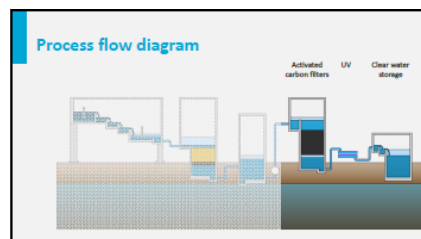
A treatment plant consists of different parallel treatment lanes or units to increase reliability.



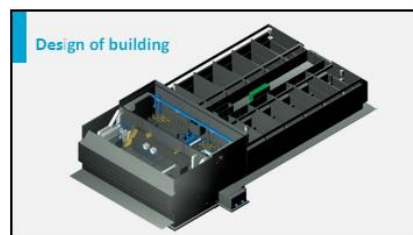
When for example a unit is out of operation because of maintenance or cleaning, the other parallel units can take over the flow, avoiding an interruption in drinking water production.

The parallel units and the treatment processes in series must be operated in such a way that always, so 24 hours per day, sufficient water can be produced to feed the clear water tank. Therefore sufficient valves and pumps must be available in the treatment plant.

However, the installation of too many control devices increases costs and complicates operation.



In the process flow diagram the optimal division of control devices is indicated.



Finally the treatment plant must be positioned in a building. The building must be compact to diminish investment costs, but the treatment processes pumps and valves must be accessible for maintenance and repair. For operation the layout of the building should be clear and logical. In the cross-sections it becomes clear what the functional design of the treatment building is, where storage chemicals is situated and how maintenance and repair can be performed.



The functional design can even be shown by 3D visualization techniques as demonstrated for cascade aeration.



The functional design of the treatment building should be made in good cooperation with the architect.



Normally, the treatment building is part of a protected natural area, where restrictions apply for buildings fitting in the environment.



After the final design of the treatment plant the entire cycle of construction can begin, which is a separate specialization, where not only technical but also political and managerial skills are needed.

Contractors will play an important role in this phase, where the water companies have the responsibility in supervision in order to secure that all anticipated functionalities are provided.

At the end, the proof of the pudding is the drinking.
Cheers!

