

Technical information – Koukkujärvi wastewater treatment plant

Nokian Vesi Oy (Nokian Vesi Ltd) is building a new wastewater treatment plant (WWTP) that will be situated in Koukkujärvi, Nokia, Finland. The treatment plant will treat the wastewaters from Nokia City and Siuro village. Presently, wastewaters of Nokia City are treated in Kullaanvuori WWTP and wastewaters of Siuro village in Siuro WWTP. The new WWTP will be entirely located indoors.

Nokian Vesi Oy has decided to implement carrier based biological treatment (such as moving bed biofilm reactor, MBBR) as the secondary treatment step in the new WWTP. Primary treatment and tertiary treatment methods will be decided during the development phase of the project.

Possible primary treatment methods to separate solids are at least primary sedimentation and belt filtration (microsieving). Nokian Vesi Oy has tested microsieving as a primary treatment method in pilot scale in Kullaanvuori WWTP. Master's Thesis has been published about the results and can be found in Finnish here: <http://dspace.cc.tut.fi/dpub/handle/123456789/25258>

Possible tertiary treatment methods are at least disc filtration, membrane filtration and disinfection with chemicals or UV. There is also a possibility that tertiary treatment methods are not applied.

In this document, information is given about the technical specification of the WWTP and the influent water.

1. Influent quality

Influent temperature in Kullaanvuori WWTP in the year 2016 is presented in Figure 1. Daily wastewater temperature and influent flow variation at the Kullaanvuori WWTP in the year 2016 are presented in Figure 2. Predictions in the year 2040 are presented in Figure 3.



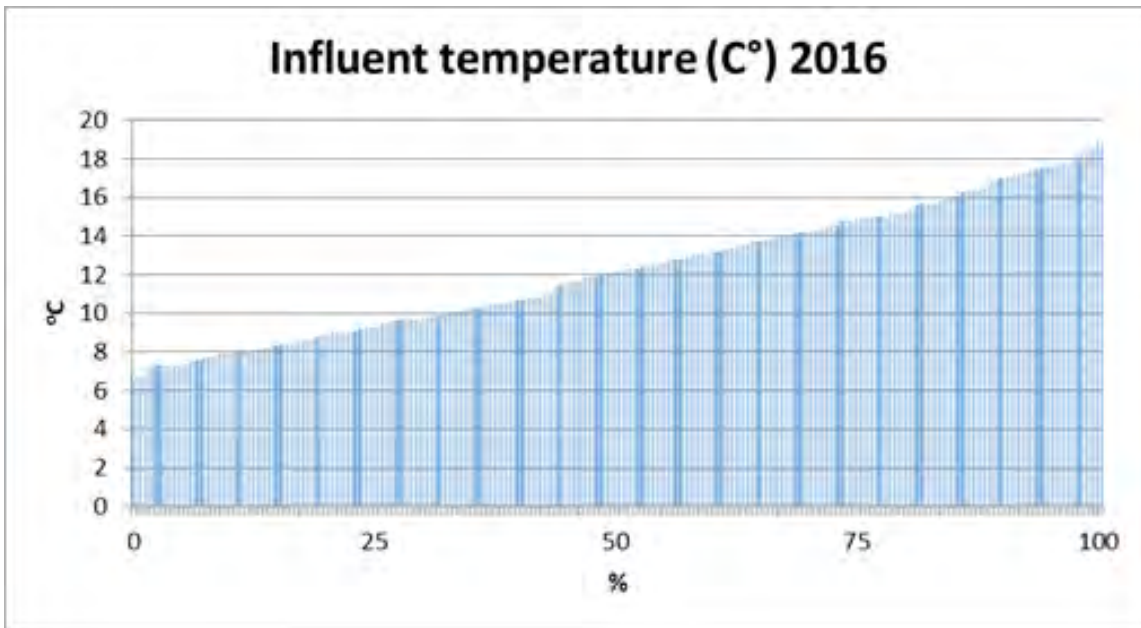


Figure 1. Influent temperature in Kullaanvuori WWTP.

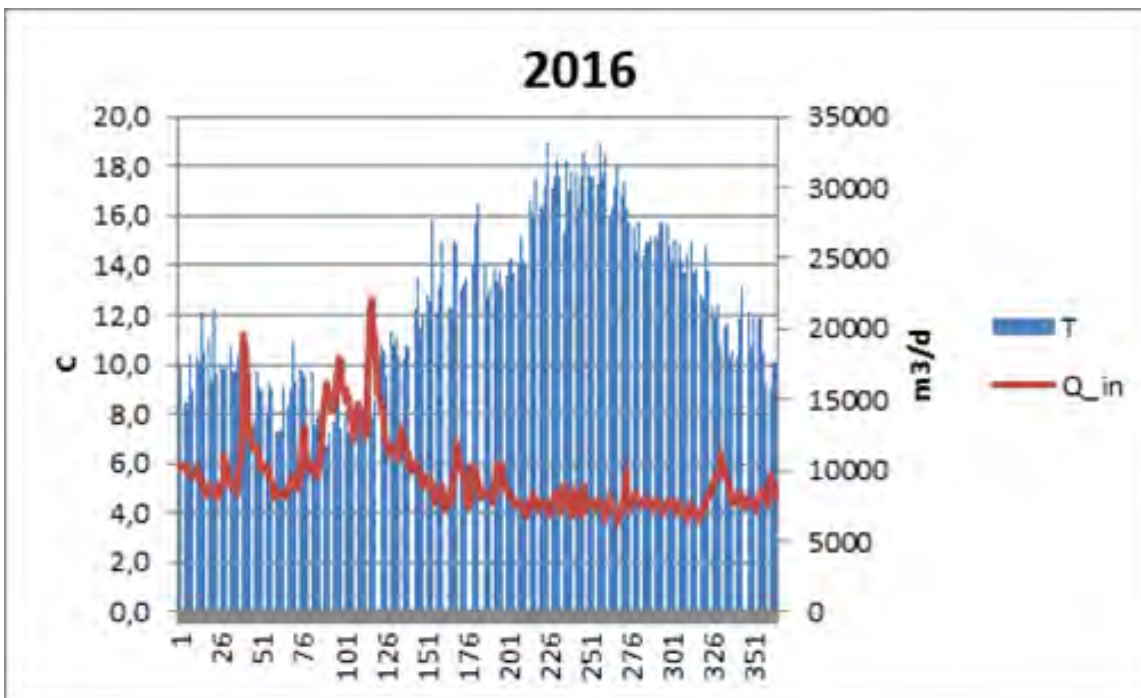


Figure 2. Daily wastewater temperature and influent flow variation in Kullaanvuori WWTP.



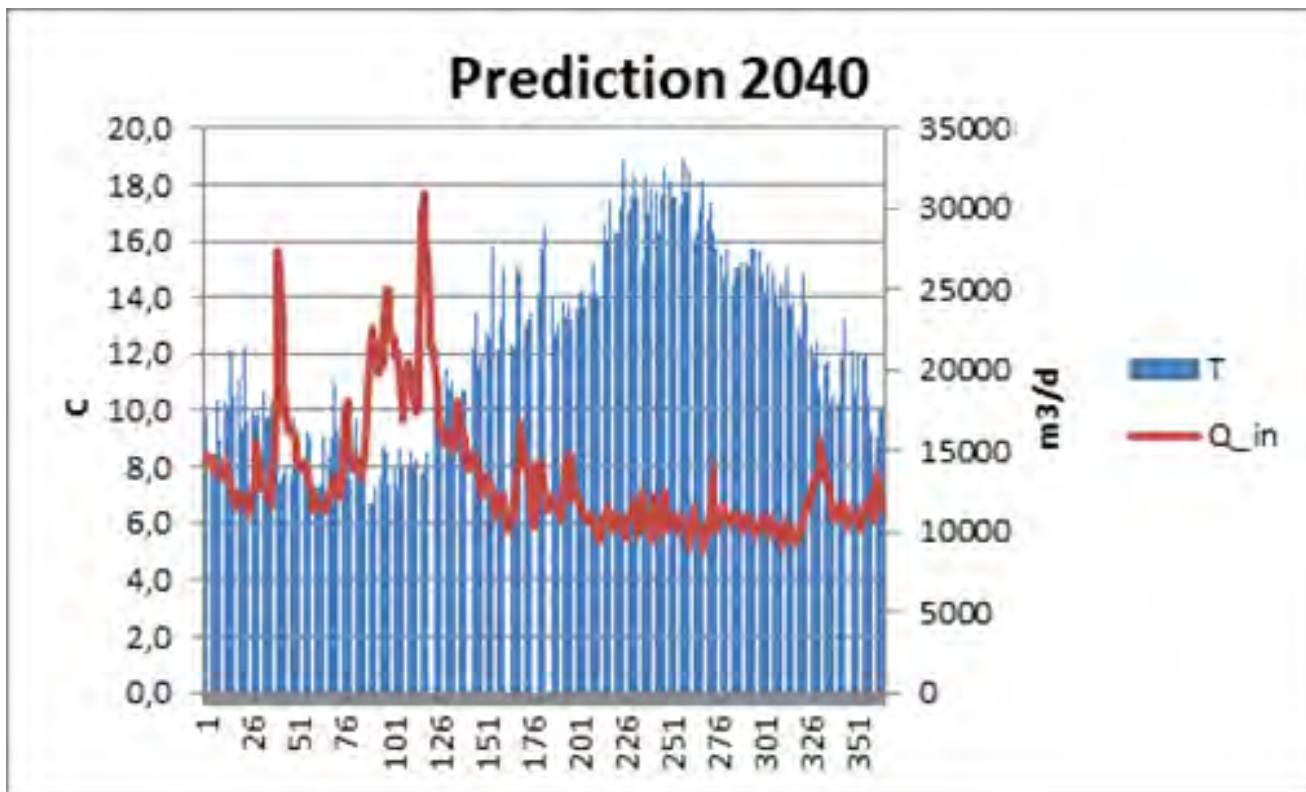


Figure 3. Predicted daily wastewater temperature and influent flow variation.



Data about the flow rates as well as loads of BOD, COD, TSS and nutrients in the years 2011–2014 in Kullaanvuori WWTP are presented in Table 1.

Table 1. Influent values for Koukkujärvi WWTP.

Parameter	Unit	Values in 2011–2014	Variation in 2011–2014
Annual flow	m ³ /a	4 065 000	-
Average daily flow, Q_{AV}	m ³ /d	11 137	7 000–24 000
Maximum daily flow, Q_{max}	m ³ /d	27 000	-
Average hourly flow, q_{av}	m ³ /h	460	-
BOD₇ load	kg/d	2 230	1 200–3 500
COD load	kg/d	5 345	2 200–7 200
TSS load	kg/d	2 815	1 000–5 000
Nitrogen load	kg/d	630	400–800
Phosphorous load	kg/d	83	50–100

2. Process description, dimensioning data and effluent quality

Pöyry Finland Oy has conducted basic engineering of the Koukkujärvi WWTP. According to the basic engineering:

- phosphorus will be removed primarily with chemical precipitation by ferric sulphate. Enhanced biological phosphorus removal (EBPR) is not considered a feasible option in the Nokia case;
- tertiary treatment is implemented as finishing treatment if needed;
- raw and excess sludge from the WWTP is taken to the new biogas plant situated in the neighbourhood site;
- based on the preliminary soil investigation, it is possible to use 6 to 8 meter water depth in the aeration basins. The soil in the area is mainly bedrock.



Koukkujärvi WWTP will include at least the following main equipment and process units:

- Influent pumping station
- Screening (3 mm step or perforated plate), screenings press and washer
- Grit removal and grit washer
- Reception of septic tank sludge, screening and storage
- Primary treatment
- Biological treatment
- Tertiary treatment if required
- Lime dosing and storage silo
- Ferric sulphate dosing and storage tank
- Storage and dosing facilities for additional carbon source for nitrogen removal if needed (methanol, by default)
- Return sludge pumping (if required)
- Primary and excess sludge pumping
- Reject water pumping station
- Surface sludge tanks and pumping (if required)
- Sludge thickener (covered)
- Polymer preparation and dosing to sludge dewatering
- Sludge dewatering
- Sludge containers
- Odor treatment
- Measuring probes (for example pH and oxygen)
- Sampling devices
- Blowers



2.1. Dimensioning data

The dimensioning values for incoming wastewater at WWTP inlet are presented in Table 2.

Table 2. Dimensioning values of the Koukkujärvi WWTP in 2040.

Parameter	Unit	Design value 2040
Population equivalent	-	40 000
Annual flow	m ³ /a	5 100 000
Average daily flow, Q_{AV}	m ³ /d	14 000
Minimum daily flow, Q_{max}	m ³ /d	6 000
Maximum daily flow, Q_{max}	m ³ /d	31 000
Average hourly flow, q_{av}	m ³ /h	580
Design flow, q_{dim}	m ³ /h	900
Maximum hourly flow, q_{max}	m ³ /h	2 000
BOD₇ load	kg/d	3 100
COD load	kg/d	7 000
TSS load	kg/d	3 800
Nitrogen load	kg/d	800
Phosphorous load	kg/d	110

2.2. Requirements for effluent quality

Effluent from WWTP shall fulfil at least the requirements given in Table 3. These requirements have to be fulfilled as quarterly averages except for total nitrogen, which is calculated as yearly average.

Table 3. Requirements for effluent quality in Koukkujärvi WWTP calculated as quarterly averages.

Parameter	Maximum concentration (mg/l)	Minimum reduction (%)
BOD₇	≤ 10	≥ 95 %
Total phosphorous	≤ 0,3	≥ 95 %
Total suspended solids	≤ 35	≥ 90 %
COD	≤ 60	≥ 85 %
Total nitrogen*	-	≥ 70 %

*annual average

