

#### Ultra Compact Wastewater Treatment Plant with High Phosphorous Recovery Yield

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### The Oslo region

Norway

OSLO

Denmark

Sweden

#### Finland

### **VEAS – A Cleaner Oslofjord**



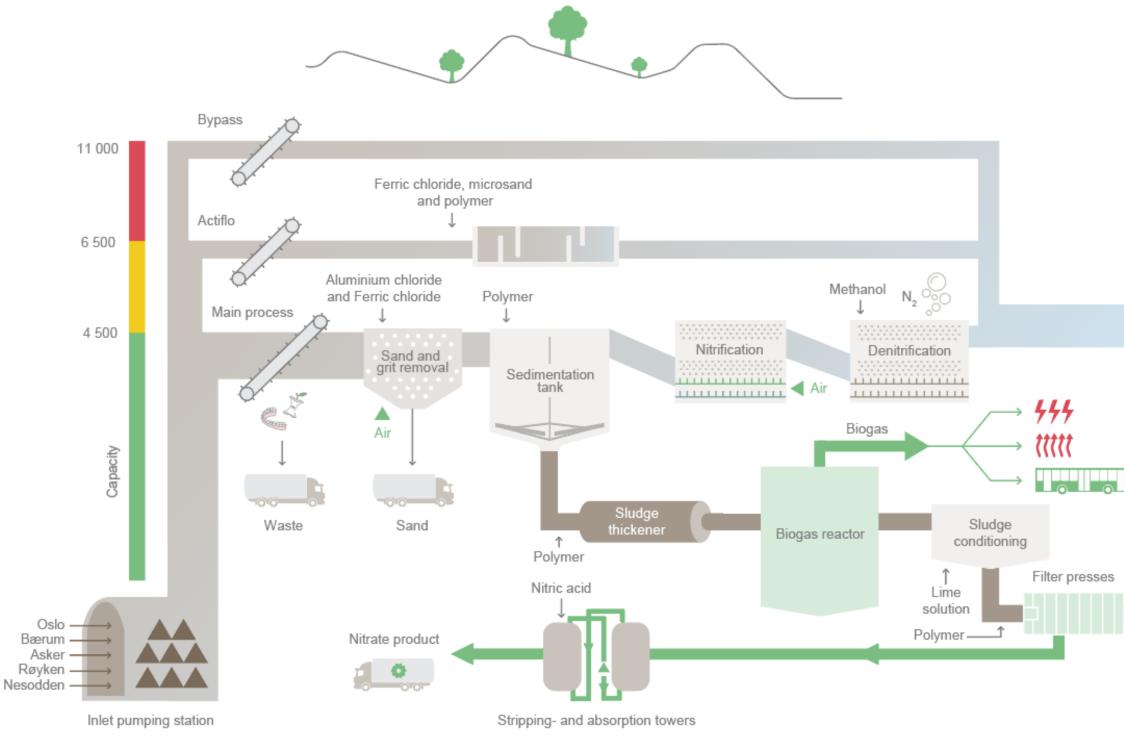
#### **VEAS' strategy and vision**



- Norway's largest WWTP
- 625 000 persons connected, approx 750 000 pe
- Established in 1982 chemical precipitation
- **Biological treatment from 1996**
- 100-110 mill. m<sup>3</sup> wastewater treated annually
- Short retention time, ~ 3 hours
- Plant situated in rock caverns
- Demands:
  - 90 % P removal
  - 70 % N removal
  - 75 % COD and 70 % BOD5 removal



#### **The Treatment Process: Main Plant and Stormwater Plant**





Outlet to Oslofjord

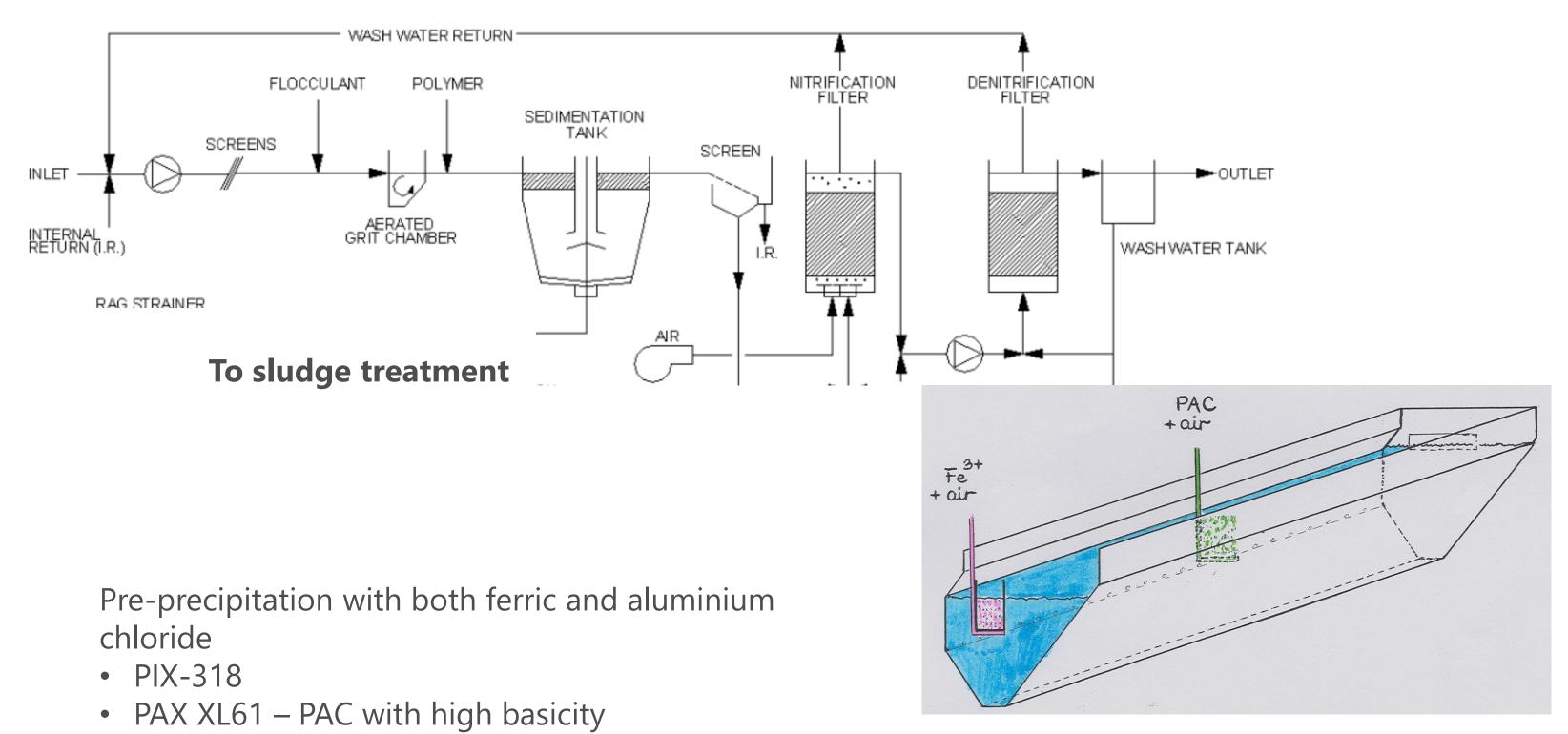




Soil enrichment product



### Water Treatment in the Main Plant





### **Purpose of Pre-precipitation at VEAS**

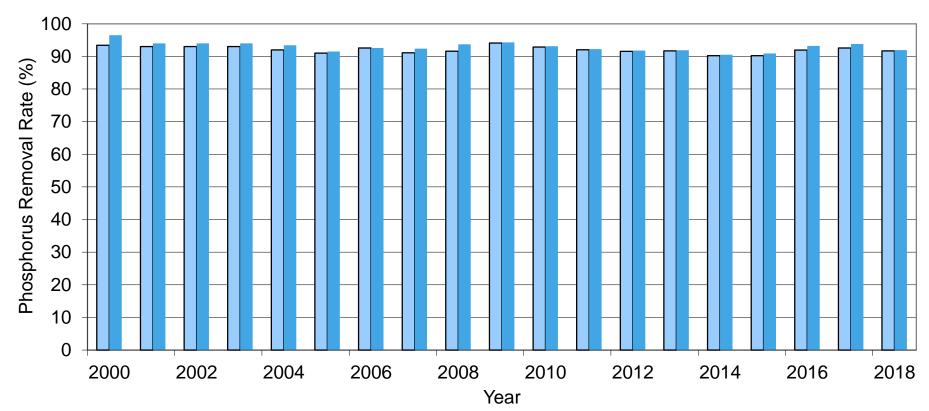
- Reduce the load on the biological aerated filter for nitrogen removal
  - Orto-phosphorus ~ 0,5 mg P/l
  - Low alkalinity consumption
  - High reduction of particles and organic matter

 Separate as much organic material as possible for biogas energy production. Digestion of primary, chemical and biological sludge.



#### **Results**

- < 90 % P removal including stormwater plant and bypass
- mole Al + Fe / mole P = 2,0
- Coagulants: 4,5 g Fe/m<sup>3</sup> + 4,0 g Al/m<sup>3</sup>



Year 2018	P (mg P/l)	N (mg N/I)	COD (mg/l)	BOD5 (mg/l)
Outlet Main Plant	0,25	10,1	42	11
Outlet Main + Stormwater Plant	0,31	10,5	47	15

## Phosphorus Removal Rate (%) with and without bypass water



#### **Energy and Products**

	2014 Mill kWh	2015 Mill kWh	2016 Mill kWh	2017 Mill kWh	2018 Mill kWh
Energy consumption					
Water and sludge treatment, ventilation of plant	26,2	25,8	26,5	26,3	25,8
Transport (pumping, tunnel)	14,0	13,7	11,8	11,6	9,8
Sum	40,2	39,5	38,2	37,9	35,6
Energy production					
Biogas	69,5	66,9	68,2	69,7	70,7
Biogas -> electricity Biogas -> heat	15,4 17,6	16,3 18,2	13,8 21,9	17,4 18,0	16,9 20,5
Energy from inlet water (heat pump)	116	107	125	126	111

- Year 2020: upgrading to liquid biogas (LBG)
- 4 500 tonnes ammonia product sold to Yara (fertilizer)
- 12 200 tonnes DS sludge to farmlands (fertilizer and soil conditioner)



# Thank you for your attention