# External sludge management
## Challanges & Opportunities

Mittskåne Vatten

EUROPEAN UNION Interreg South Baltic
mittskåne vatten

# Mittskåne Vatten

- Supply municipal wastewater and drinking services in Höör and Hörby, Sweden
- Two main WWTP – Ormanäs (Höör) and Lyby (Hörby) – treating wastewater from approximately 22 000 people
- Approximately 7000 households with local/private facilities for wastewater treatment such as septic tanks and installations for infiltration.
  - Residues in the private facilities are collected and brought to the WWTP:s once a year.

# Composition of sludge

- Höör and Hörby WWTPs have been experiencing high levels of heavy metals in the treated sludge.

| Heavy metals (mg/kg TS) | Existing regulation | New proposal for legislation | Hörby WWTP | | Höör WWTP | | |
|---|---|---|---|---|---|---|---|
| | | | Average sludge | Average external sludge | Average sludge (no lime) | Average sludge (lime) | Average external sludge |
| Pb | 100 | 25 | 8,8 | 13 | 33 | 16 | 68 (750) |
| Cd | 2 | 0,8 | 0,9 | 0,9 (1,8) | 2,2 | 1 | 1,3 (16) |
| Cu | 600 | 475 | 400 | 340 | 913 | 485 | 417 (1200) |
| Cr | 100 | 35 | 19 | 16 | 15 | 10 | 24 |
| Hg | 2,5 | 0,6 | 0,4 | 0,56 (1,4) | 0,9 | 0,3 | 0,32 |
| Ni | 50 | 30 | 11 | 15 | 13 | 8 | 28 (150) |
| Zn | 800 | 700 | 480 | 770 (1300) | 760 | 420 | 670 (2400) |
| Cd/P | | | 45 | 94 (186) | 85 | 69 | 128 (1600) |

*Average sludqe quality of outgoing fraction from the WWTP:s compared to the external sludge for Höör and Hörby. Values within parentheses are measured peak levels.*

# Origin of heavy metals

- Large fractions origin from the external sludge.

| Year | Lead (Pb) % | Cadmium (Cd) % | Copper (Cu) % | Nickel (Ni) % | Zinc (Zn) % |
|---|---|---|---|---|---|
| 2013 | 52,9 | 36,5 | 9,0 | 81,0 | 25,6 |
| 2014 | 33,3 | 11,1 | 15,6 | 40,6 | 23,0 |
| 2015 | 70,0 | 15,0 | 17,1 | 45,4 | 27,2 |

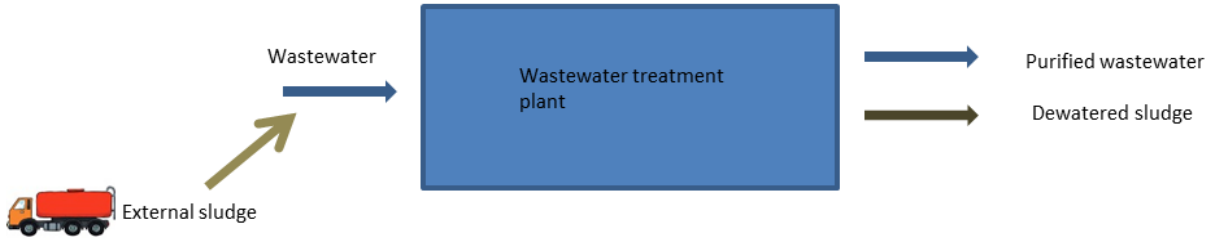
*Percentage of metals which the external sludge is contributing with at the Höör treatment plant.*

# Aim

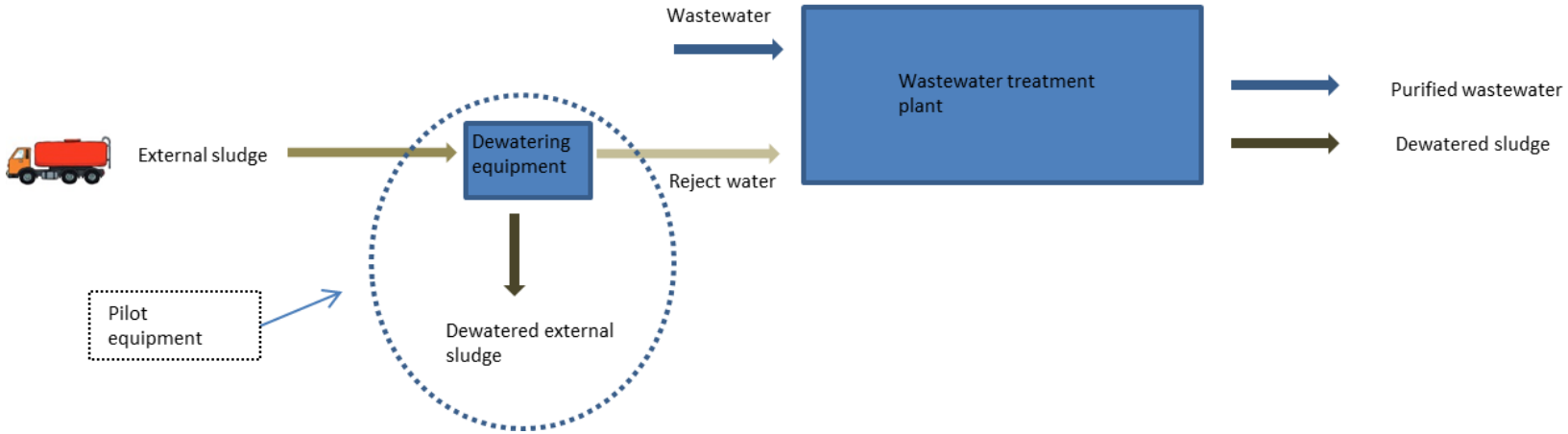
- The main aim was to investigate to what extent the heavy metal inflow to the treatment plant could be reduced by a separate handling of the external sludge.
- For the organisation to receive valuable experiences from running a new type treatment design.
- Potentially form basis for future investments.

# Project setup

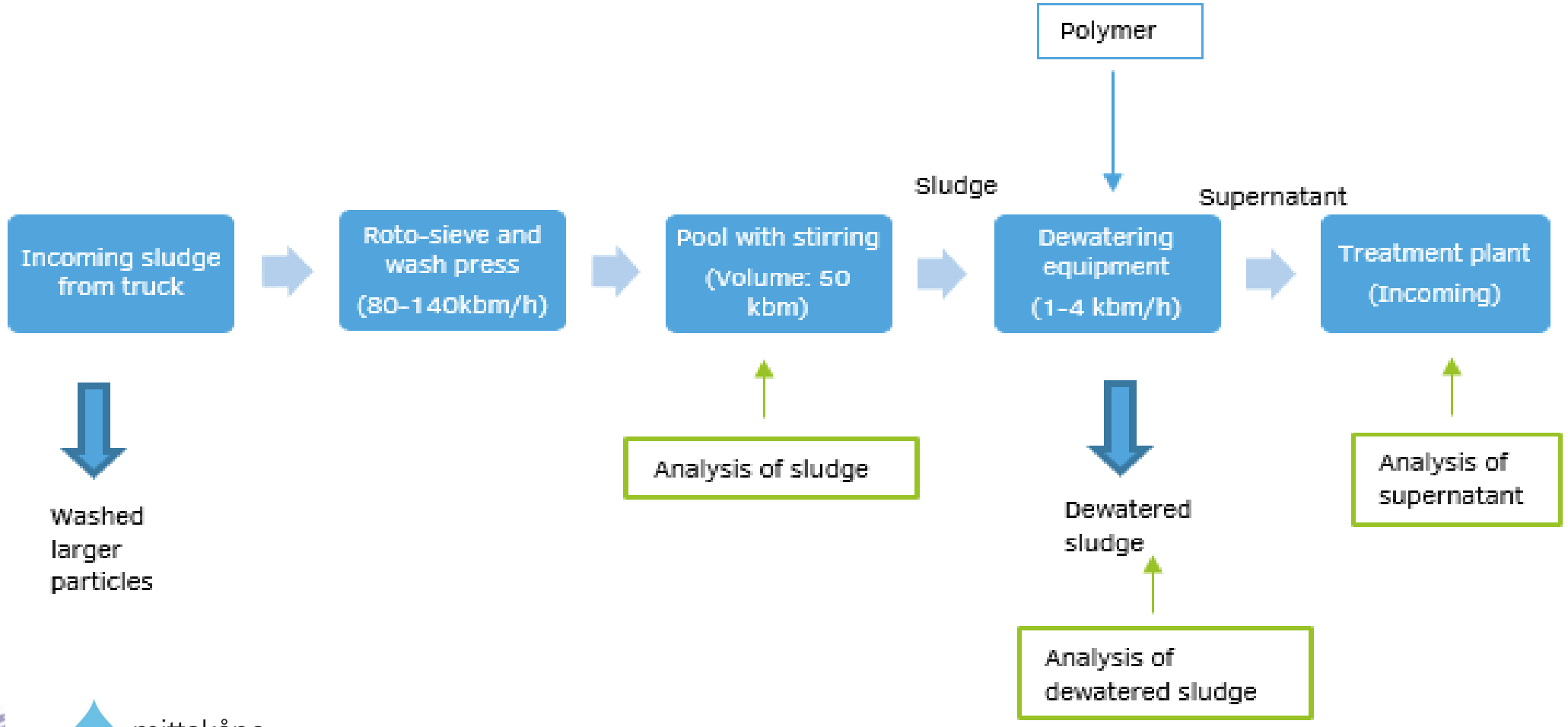
**Current state**




**Pilot plant**



# Dewatering steps



# Dewatering steps

# Analysis of sludge and supernatant

- Four weekly composite samples and ten daily samples were sent to a certified laboratory for metal analysis.
- 60 trace elements were analysed according to Swedish sludge quality standards.
- COD and BOD was analysed for the supernatant in order to determine the treatment capacity of this fraction.

*Sampling of the supernatant.*

# Results

- The pilot plant operated without major malfunctions
- 23 trucks of external sludge were emptied and treated in the pilot plant resulting in 1,72 tonnes of dewatered sludge and 242$m^3$ supernatant

# Results

- The largest share of metals ends up in the dewatered sludge, not the supernatant.
- Separate treatment of external sludge is indeed one way to decrease the level of metals to WWTP:s
- Supernatant possible to treat together with ordinary waste stream

| Metal | Amount in pre-treated sludge (g) | Amount in supernatant (g) | Amount in dewatered sludge (g) | % supernatant/ dewatered sludge |
|---|---|---|---|---|
| Pb | 8,55 | 0,47 | 6,29 | 7/93 |
| Cd | 0,66 | 0,059 | 0,40 | 13/87 |
| Cu | 525 | 17,39 | 358 | 5/95 |
| Cr | 6,40 | 0,38 | 5,70 | 6/94 |
| Hg | 0,25 | * | 0,18 | - |
| Ni | 8,3 | 1,30 | 5,59 | 19/81 |
| Zn | 789 | 54,51 | 501 | 10/90 |

*Amount of metals in the pre-treated sludge, the supernatant and the dewatered sludge, calculated based on concentrations and volume in the various fractions. The share of heavy metals in the supernatant compared to the dewatered sludge can also be seen. * Below detection limit.*

# Further treatment of the external sludge

- Sludge sorts under domestic waste according to Swedish regulations.
- Dewatered external sludge will not be permitted for recirculation on arable land.

| | Metal levels in dewatered external sludge (mg/kg dry matter) | Metal levels in outgoing sludge from Hörby WWTP (2018-2019) (mg/kg TS) | Threshold limit for sludge recirculation (mg/kg TS) |
|---|---|---|---|
| Pb | 10,97 | 8 | 100 |
| Cd | 0,70 | 0,71 | 2 |
| Cu | 624 | 400 | 600 |
| Cr | 9,94 | 20 | 100 |
| Hg | 0,32 | 0,22 | 2,5 |
| Ni | 9,75 | 10,6 | 50 |
| Zn | 873 | 467 | 800 |
| Cd/P | 103 | 36 | |

*Comparison of dewatered external sludge and outgoing sludge from WWTP as well as the threshold limits for the recirculation of sludge.*

# Effect on sludge in ordinary treatment process

- Seen was that about 80-90% of the metals in the external sludge ended up in the dewatered external sludge.

- Based on this a reduction in metal content of about 5-15% can be achieved by separate handling of external sludge.

# Conclusions

- Inflow of metals to the WWTP can be reduced by a separate handling of the external sludge.
- The quality of the supernatant was sufficient for direct treatment at the WWTP.
- The operation and maintenance were relatively straight forward and the sludge easy to dewater.
- The dewatered external sludge was found to have elevated levels of copper and zinc.

# Thank you!