

DEVELOPMENT OF MODULAR TECHNOLOGY FOR STORMWATER MANAGEMENT AND TREATMENT IN AALBORG

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Motivation

- The ongoing upgrade of the sewer systems in Aalborg from combined systems to separated systems reduces the risk of flooding and environmental impacts from combined sewerage overflow.
- However, the separation of rainwater results in a distributed release of stormwater to the environment through suds solutions.
- Although separated stormwater contains far fewer pollutants than stormwater from combined sewers, it still has the potential to contain a wide variety of xenobiotics originating from depositions on the urban surfaces.
- In Denmark, wet detention ponds are the most used technology, because of their simplicity, cost-efficiency and recreational value.
- Particulate bounded pollutants are deposited onto the bottom. However, as particles settle out, the volume of the pond is reduced over time.
- If the pond is not maintained by clean-up, the hydraulic detention and substance removal will be significantly hampered, thereby reducing the environmental value of the pond
- Removing the sediment from wet ponds is time-consuming, complicated and costly.



Concept

- The concept is to separate the stormwater detention and the stormwater treatment into two separate modules.
- One module is optimized for sedimentation of substance from the normal everyday rainfall as well as first-flushes of heavy rainfall.
- It is designed to retain most of the particulate contamination under highly variable hydraulic loads and is drained between rainfall events.
- Drainage of the sediment makes it less costly to discard and dry periods further promote natural bacterial degradation of hazardous organic substances.
- The other module is the detention volume.
- Allows heavy rainfall to bypass the sedimentation basin and flow directly into the detention volume.
- 'Normal' daily rainfall events will be handled in the sedimentation module, while extreme rainfall events completely or partially will be passed on to the detention system.

Separated stormwater

Sedimentation section:

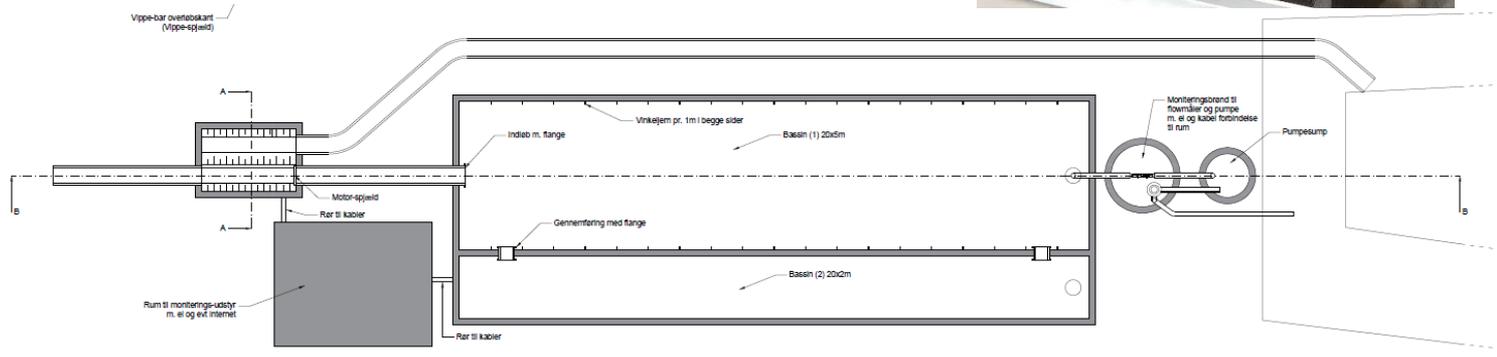
Highly efficient sedimentation of stormwater particulates.

Sediment is drained between rain events allowing aerobic degradation and easy maintenance.

Detention section:

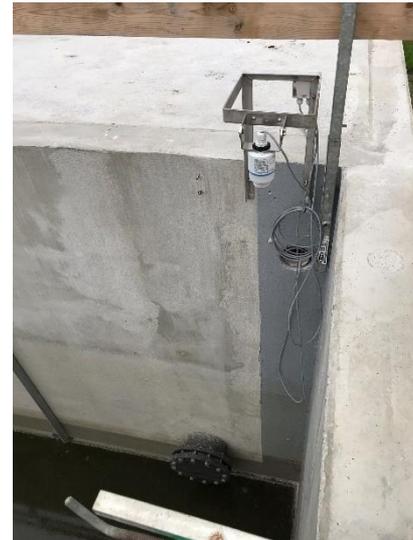
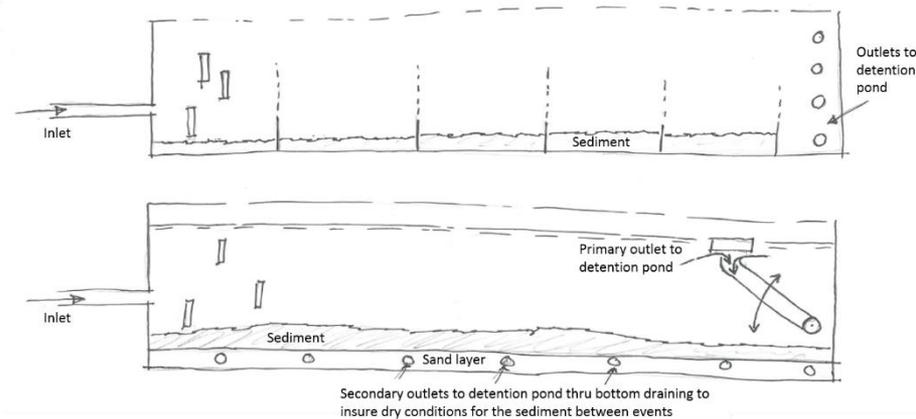
Delays the release of the stormwater reducing the risk of flooding and hydraulic erosion of the streambed.

To receiving waters

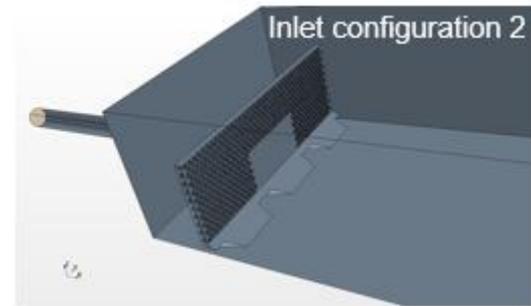
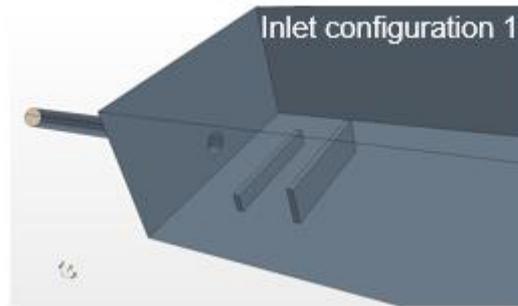
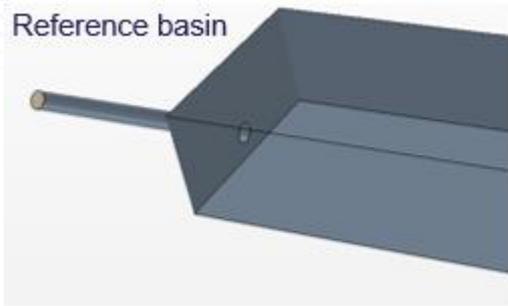


Design ideas

- The success of the concept is greatly dependent on the ability to trap the particulates from the stormwater and at the same time to avoid resuspension of the trapped material.
- In order to achieve this, it is important to understand and predict the hydrodynamics of the sedimentation module.
- Different flow regimes are dominating during and after stormwater runoff events. At the start of the event, the sedimentation section will experience a rising water table, while after the event the table will fall.
- Moreover, the flow through the sedimentation section will vary during the event due to variations in the hydraulic stormwater load.

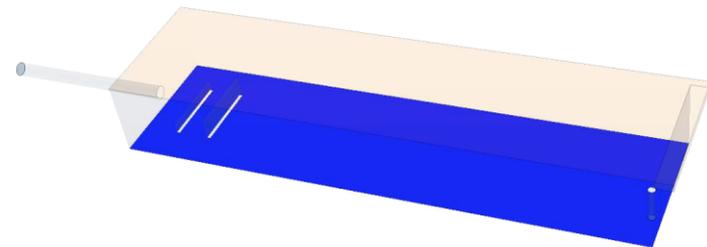
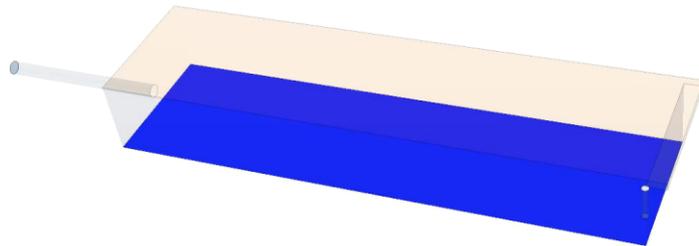


Evaluation of inlet structure



Solution Time 0.1 (s)

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Final remarks

- Currently, we have more conceptual ideas and questions, than answers 😊
- The aim is to use the facility to develop scalable treatment modules, that can pre-treat the stormwater before it reaches any SUDS solution and can facilitate cost-efficient maintenance.
- Hydrodynamic design optimizing the sedimentation.
- Design of filter materials.
- Real-time control of the outlet flow.

