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Oslo, June 17th 2019

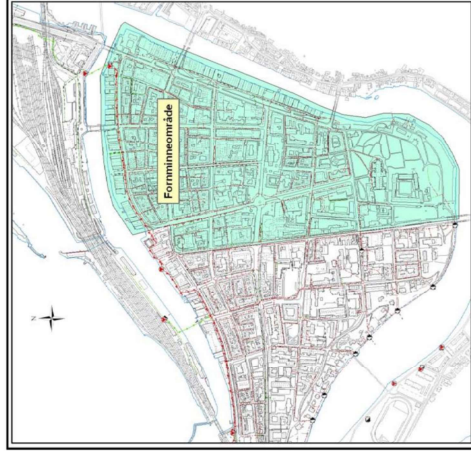
“Potential for integrating SUDS in Trondheim, with special emphasis on extensive green roofs”

Potential for integrating SUDS in Trondheim

Outline

- Trondheim city center, limitations and possibilities
- Relevant SUDS measures
- Potential for implementation
- Green roofs, field studies in 4 Norwegian locations

Middle age settlement - Prehistoric site



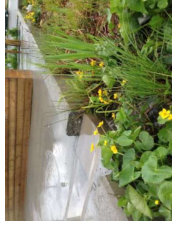
Green roofs



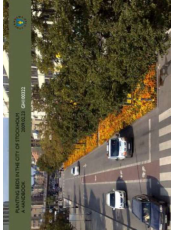
Perivious pavements



Detention ponds



Bioretention/Rain gardens



Trees capturing rainwater



Swales/open trenches

SUDS examples

Stormwater quality

A screenshot of a news article from 'Aftenposten' with the headline 'Trærne takler ikke saltskader' (Trees can't handle salt damage). The article discusses how salt on roads affects trees and the environment. It includes a photograph of a road with orange salt trucks and a small inset image of a tree. The article is dated 14.02.2019 and is from the 'MILJØ' section.

Bioretention cells/ Street trees



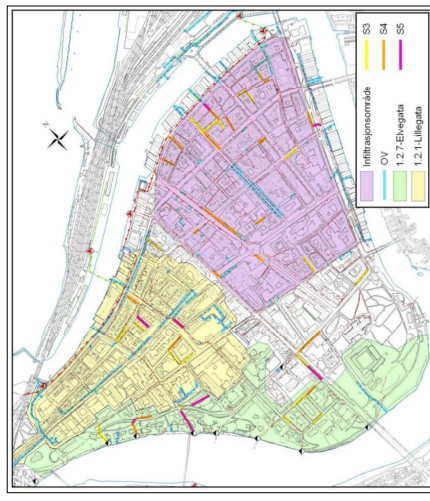
Flat roofs



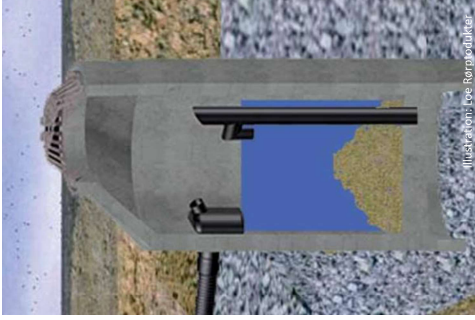
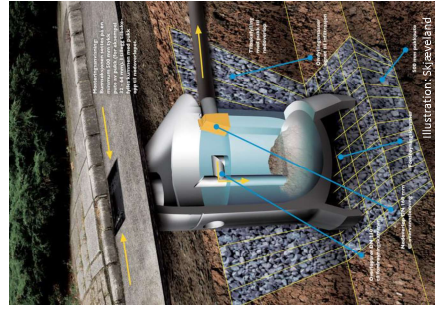
Sloped roofs



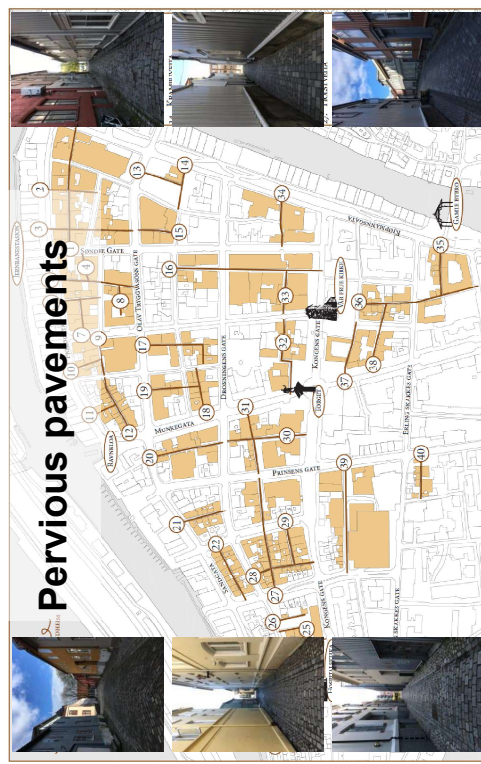
Infiltration capacities

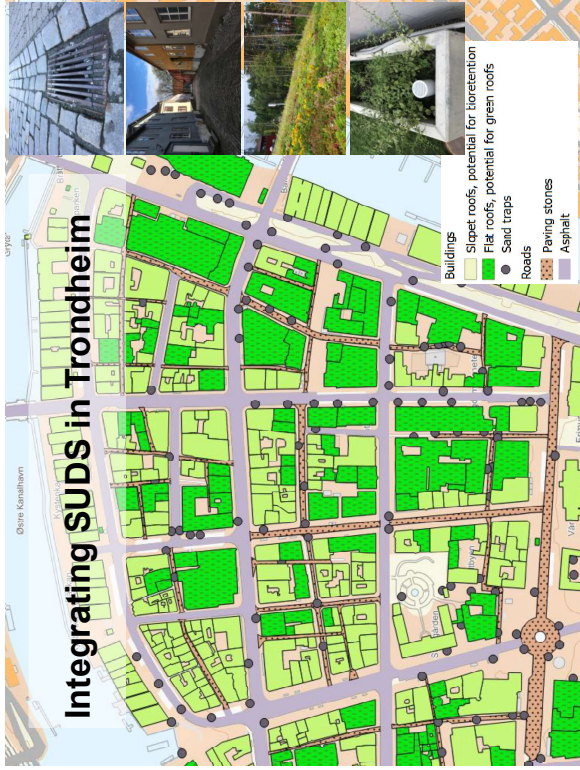


Infiltrating sandtraps



Pervious pavements





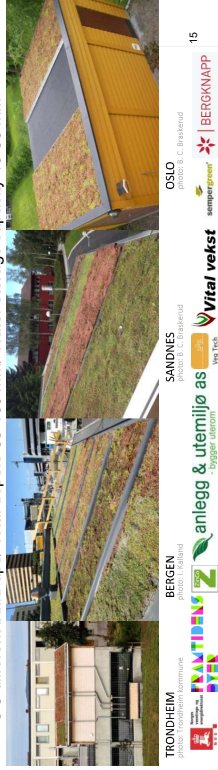
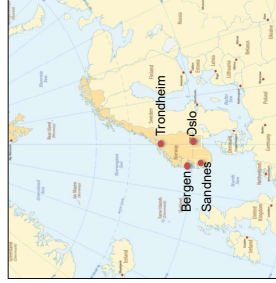
“Investigating the use of extensive green roofs for reduction of stormwater runoff in cold and wet climates”

PhD
NTNU
2015-2018

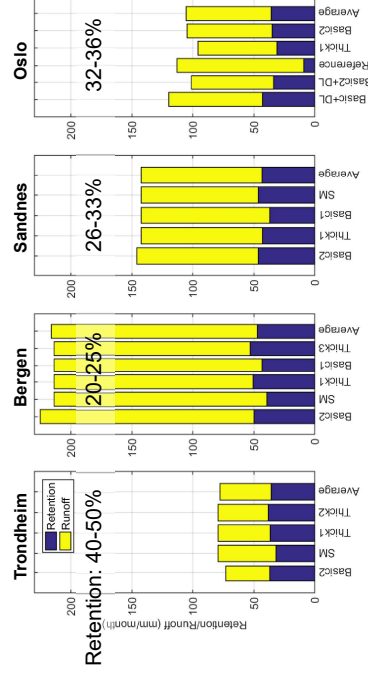
Norwegian field studies

	Bergen	Sandnes	Trondheim	Oslo
Annual Precipitation (mm)	2 710	1 950	1 190	860
Average Temperature (°C)	8.0	7.2	5.3	6.6
Length Growing Season (days)	258	235	182	196
No of summer days	6	3	3	12
No of winter days	28	35	77	79

3-5 different build-ups/ Total depths 35-160 mm/ Water storage capacity 10-35 mm

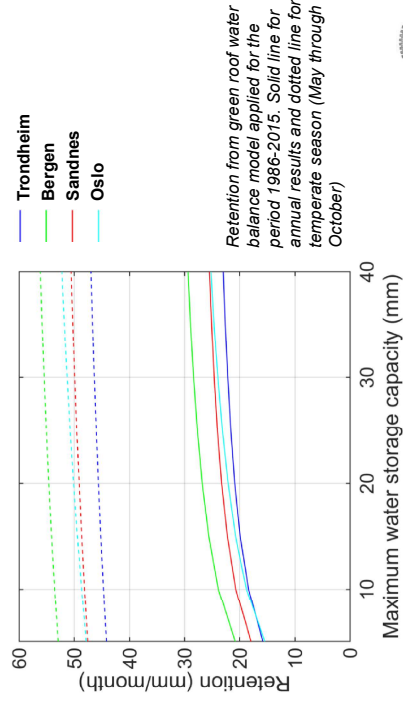


Results – Observed retention



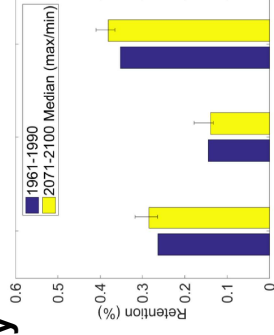
Monthly average retention from field studies, 2015-2017 temperate season (May through October).

Results – Modelled retention



Extensive green roof design Water storage capacity

- 10-15 mm water storage capacity sufficient for stormwater retention in present climate
- 20-30 mm recommended to promote plant welfare and reduce risk of drought
- Green roofs found to be suited for a future climate



Green roof annual retention performance for present and future climate (RCP 8.5). Based on green roof water balance model with a storage capacity set to 25 mm.

