EWA – European Water Association

AN ECONOMIC PERSPECTIVE OF STORMWATER MEASURES

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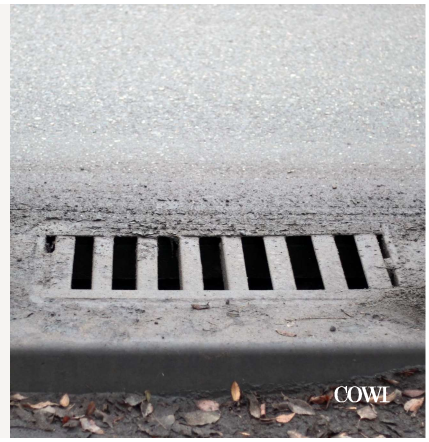
Agenda

- Stormwater issues
- Consequences of urban flood
- Problems to be addressed
- Case study
- Method
- Results
- Discussion and conclusion



Consequences of urban flood

	DIRECT LOSS	INDIRECT LOSS
MATERIAL DAMAGES	Physical damages: › Structure › Infrastructure › Vehicles › Agricultural land Expenses: › Evacuation and rescue operations › Clean up	Disruptions: › Transport › Business › Production Expenses: › Temporary rehousing
IMMATERIAL DAMAGES	› Death and injuries › Disease › Loss of object with sentimental value › Loss of heritage › Damage to the ecosystem and environment	› Psychological stress for affected people › Disturbance of everyday life and social function › Less trust in the public system › Reducing values of houses

Problems to be addressed

Profitable to include climate factor in dimensioning?

- Prevent damages caused by current climate
- Adaptation for future climate

How profitable are the studied measures compared to each other?

- Conventional measures
- LID–Low Impact Development

CASE STUDY

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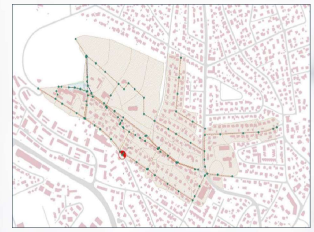
Case study

AK45 – GREFSEN, OSLO

- Area: 345 018 m2
- Population: 1014
- Number of buildings: 196
- Impervious areas (roof/road): 12 % / 6 %
- Pervious areas: 82 %

NETWORK

- Combined sewage: 94 %
- Stormwater: 4 %
- Separate: 2 %



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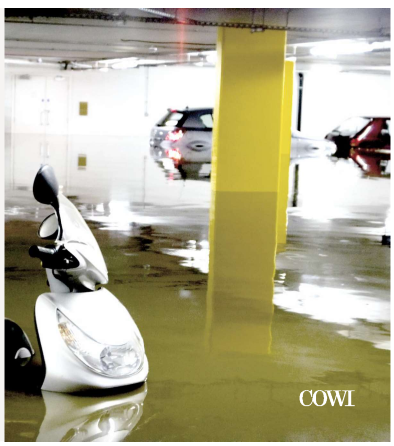
Case study

Damage cost driver:

- Basement flooding caused by exceeding capacity of sewage network

Dimensioning criteria from «Hovedplan avløp og vannmiljø»:

- DM07: VAV, Oslo municipality must take into account climate change in it's dimensioning guidelines and choice of solutions
- DM20: No one should have basement flooding due to the sewage network's capacity with return period of 30 years



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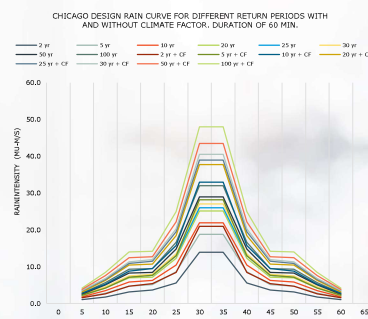
Case study

- ROSIE sewage network model
- Measures studied:
  - Upgrading capacity by separating the stormwater network
  - Disconnection of roofwater draining to raingarden
  - Open detention basin
  - Non-return valve



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METHOD

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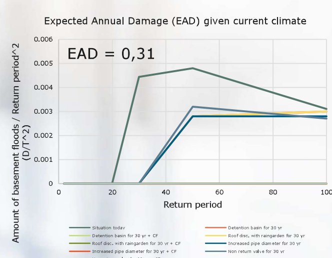
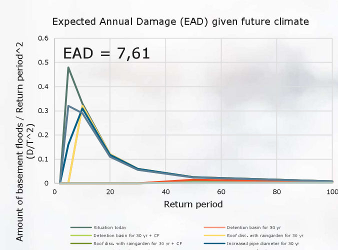
Method

EAD (Expected Annual Damage) $= \int_0^\infty \frac{D(T)}{T^2} dT$





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Method

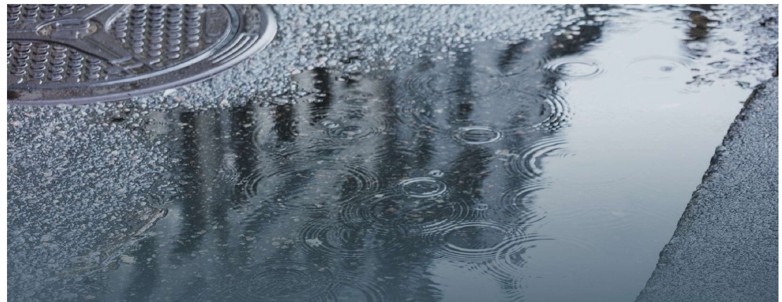
Three cost elements of interest for the profitability analysis:

1. Net present value of damage cost related to not implement measures during a period of 100 years with respect to increasing climate factor.
2. Net present value of damage cost during a period of 100 years even though implementation of measures is carried out.
3. Net present value of life cycle cost of measures during a period of 100 year.

Profitability = point 1. – point 2. – point 3.

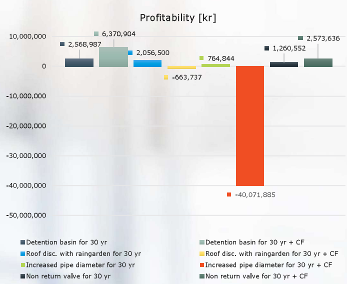
$$\text{Profitability \%} = \frac{\text{point 1.– point 2.– point 3.}}{\text{point 3.}}$$

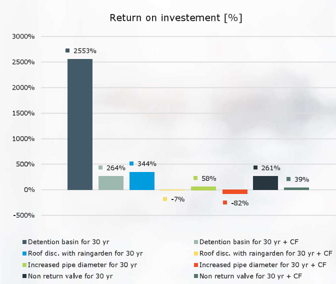
$$\underset{\text{Net Present Value}}{\text{NPV}} = -I_0 + \sum_{t=1}^{n} \frac{U_t}{(1+r)^t}$$

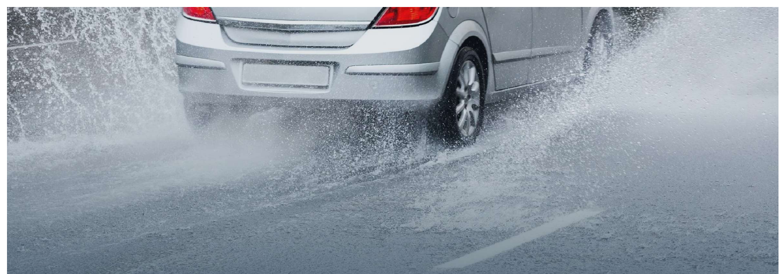


RESULTS

Results



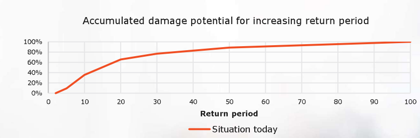


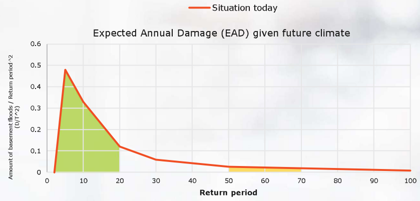


DISCUSSION AND CONCLUSION

Discussion

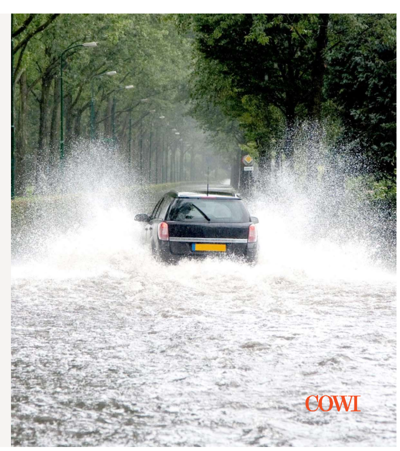
- Absolute profitability vs. return on investment
  - Eliminating the size of the investment projects
  - Benefit compared to cost
  - How much can you save per kronor invested in a measure
- Rain events with low return period vs. high return period
  - Risk method - EAD
  - Rain events with low return period contributes more to the total damage





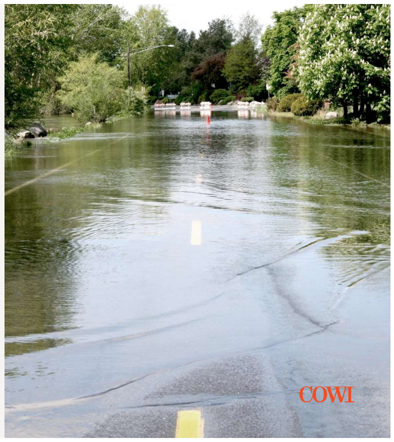
Discussion

- Dimensioning for a smaller return period gives opportunity to allocate capital to small projects with high ROI
- The future climate is unpredictable → Why implement installation with a long life cycle?
- Technology and methods are constantly developing and improving.
- Decision based on risk is harder to accomplish. Real damages gets more attention than prevented damages.



Discussion

- Basement flood damage – only cost driver
  - More cost drivers should be accounted for.
- Other catchment characteristic
  - Catchment with high amount of "green areas".
  - Different outcome of city areas, high density of valuable assets, downstream a catchment.
  - Other stormwater measures more preferable for other types of catchments.



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Conclusion

1. LID measures gives the highest return on investment.
2. Dimensioning to prevent damages given todays climate gives the highest return on investment compared to climate change adaption.

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Profitability analysis for stormwater management measures

– A case study of the wastewater network in Grefsen, Oslo municipality

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THANK YOU!

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