SUDS retrofitting as a lever for urban renewal and resilient stormwater systems

La mise en place de techniques alternatives comme levier pour des systèmes de gestion des eaux pluviales plus résilients et pour le renouvellement urbain

Martin W. Soerensen

VCS-Denmark, Vandværksvej 7, DK-5000, Denmark (mws@vcsdenmark.com)

RÉSUMÉ

Les techniques alternatives de gestion des eaux pluviales semblent proposer une certaine flexibilité, notamment en termes d'expansion et d'ajustement. Toutefois, la mise en place optimale de telles techniques peut se révéler compliquée lorsqu'il s'agit de remplacer un système classique préexistant.

Ce cas d'étude présente les résultats d'un projet collaboratif entre la municipalité et le service des eaux de Odense, Danemark. Ce projet pilote sert de laboratoire in-situ pour le test de techniques alternatives, notamment dans le cadre du renouvellement des systèmes classiques existants. L'objectif final est de créer un catalogue de « recettes » afin d'inciter un renouvellement urbain orienté vers des systèmes plus résilients. Au-delà de l'utilisation de techniques alternatives et innovantes, l'importance de la communication ainsi que l'implication des acteurs locaux sont également mis à l'épreuve.

Des techniques alternatives ont été mises en place dans une rue présélectionnée de la zone d'étude et la prochaine étape pourra déjà bénéficier des premiers retours d'expérience, dont notamment le potentiel d'ajustement des différents éléments ainsi que l'optimisation des techniques de construction.

ABSTRACT

This case-presentation describes selected findings in a collaboration project between a Danish municipality and utility for adapting an urban catchment to climate change. where the objective is to create a robust strategy for the use of SUDS retrofitting as a lever for urban renewal and resilient stormwater systems.

Besides creating innovative engineering solutions, the project aimed to redefine the roles of citizens, urban water planners and the municipality by developing a cooperation model to be applied in future projects

Throughout the planning and first implementation phase of the project, opportunities and challenges have been identified in this trans-disciplinary project.

Unlike traditional pipe-solutions, SUDS-solutions often holds the possibility for easy future expansion and adjustments. By focusing on exploiting this new flexibility that many SUDS-solutions holds, more resilient stomwater solutions can be found.

The project has also shown oppotunities for finetuning and rethinking of construction methods that are yet to be fully utilized.

KEYWORDS

IOT-connected measurements, Public involvement and communication, Resilience in SUDS-solutions, SUDS construction methods, SUDS dimensioning practice

1 INTRODUCTION

The 15-hectare project area is an urban area in Odense, Denmark that has experienced frequent flooding and overload of the existing combined sewer system.

In this area, the Municipality of Odense and the water and wastewater utility VCS Denmark work in close collaboration with the local property owners to create a watertight recipe for climate adaptation of private and public areas that can eventually be rolled out to cover the entire city. The project has been named “Klimaklar” (“ClimateReady”) and are currently under construction.

Through this pilot-project we seek to generate knowledge and experience by testing new methods for design and cooperation from project kick-off to construction.

The project is aiming to retrofit the area utilizing SUDS (Sustainable Urban Drainage Systems) to secure the area against flooding that is expected to become more severe due to climate change, while at the same time providing additional benefits like increased road safety, green areas and urban-biodiversity

The ultimate objective is to completely decouple roads and private properties from the existing sewer system and handle all stormwater in a separate system. We see rainwater as a resource that will help us create greener, more luxuriant neighborhoods that are prepared for the climate of the future.

However, we have learned that it is one thing to decide to convert public roads with paved surfaces into green avenues aligned with rain gardens serving to slow down traffic – it is an entirely different matter to arouse sufficient goodwill in the property owners for them to actively contribute to the overall solution. We have actively tried to overcome this challenge by broad community participation and regular communication.

The second stage of a total of 4 stages in the project is currently under construction.

2 METHODS

The system consists of permeable green pavements and roadside soakaways for pollutant removal, and detention boxes and gravelfillings with high voidfactor for detention. All elements are connected with drains, as a line of “communication vessels” and with a flow-controlled discharge.

Figure 1.

2.1 A Resilient Modular System

Compared to traditional pipe systems, the ”communicating vessels” incorporated in this solution can be easily retrofitted with extra volume over time at a relatively low cost – and thereby adjust to changing climate or urban development.

2.2 Shallow excavation

A dogma in the project has been to build close to the surface. 90% of the excavations in this project are only 0,9 meters deep, eliminating the cost of trench boxes and large machinery normally needed for traditional pipe solutions (Figure 2). This also adds to a better working environment during construction, and less inconvenience for the local residents.

Figure 2. Excavation deepth and IOT-measurement equipment

2.3 SUDS dimensioning practice

The dynamics of waterflow through these systems are difficult to predict and calculate precisely compared to traditional pipe systems. Traditional modelling and calculation techniques are found not to be useable, forcing us to consider new approaches.
However, the flexibility of these systems offsets the uncertainty of not knowing the exact capacity of these more nature-like solutions.

This flexibility, which is simple and cheap to achieve, supports a new dimensioning practice with less safety factors in order to avoid over-dimensioning and consequent waste of resources.

It might be relevant to combine a more simple dimensioning practice, with a subsequent lead-in period after construction, where the solution is finetuned to its desired performance.
This requires data, and with the test of cheap IOT-connected measurements, this has been found doable. These simple IOT measurement-installation will also be able to guide the future maintenance (Figure 2).

2.4 Communication

From the very start, property owners have contributed with ideas and input presented at informal workshops and during neighbourhood inspections and road meetings - as well as via the project's Facebook page, website and newsletter (www.facebook.com/vandcentersyd , www.klimaklar.nu).

Involvement of property owners was a key factor in this project, because 2/3 of the stormwater stems from private properties. In other words: They hold 2/3 of the solution. Without the citizens – no solution!

Figure 3. Documentation of citizen information measures : neighbourhood walks; project camper, disabled

3 RESULTS AND DISCUSSION

3.1 Resilience, dimensioning and construction

The flexibility and modularity of the SUDS solutions can be exploited as conditions change in the future (e.g. increasing rain levels or urban development). Building for present needs while embedding the possibility to adjust for future needs makes these solutions more adaptable and resilient compared to traditional pipe solutions (built for future needs and with no flexibility embedded).

The shallow installation deepth, means that it is also easy to get to make changes or repairs. One mann and a small excavator can easily add detension-capacity to the system or change the configuration.

The full potential of this flexibility and modularity are still to be exploited, structured and utilized in our infrastructure configuration.

These acknowledgements calls for at rethinking of or traditional dimensioning practice, our use of safety factors and our accet management of SUDS.

Green solutions like these absorb and evaporate the small rain events, which in Denmark make up the majority of the rain volume. In these systems, small rain events are handled without a droplet ever reaching the connected pipe system. This drastically reduces the overall rain volume that ends up in the combined sewer system - making huge water volumes distributed in small rain events practically “disappear”. The value of this additional gain when implmenting green solutions, are still to be concretized.

3.2 Communication

The project builds on measures implemented on private properties to handle all stormwater.
Inspiration from nudging theory has been used to innovate the way we engage property owners.

Ongoing and varied communication has generated awareness and understanding for new SUDS solutions in the area. Whether this is sufficient to reach the necessary amount of private rainwater detachment remains to be seen.

This level of communication requires a substantial workload and demands new competences from the planners involved.

4 CONCLUSION

SUDS-solutions can represent a more resilient stomwater solution. The full potential of this flexibility and modularity are still to be exploited, structured and utilized in our infrastructure configuration.

The project has shown oppotunities for finetuning and rethinking of construction methods that are yet to be fully utilized.

Active involvement of local citizens has been achieved, and new ways of interact with the public have been tested in this project.

Despite an active involvement of local citizens, opinions may still wary over time – we still need to find acceptable ways of making “contracts” with the citizens regarding their input.

Trans-disciplinary collaboration between utility, municipality and authority has been “trained”, and valuable lessons have been learned, and the partnership has been strengthened.

LIST OF REFERENCES

1. VCS-Denmark, project web-page: http://klimaklar.nu/skibhus/

2. VCS-Denmark, project Facebook profile: https://www.facebook.com/klimaklariskibhus/