

## **Rainwater management**

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## Abstract:

There is a growing environmental problem in Denmark. The sewer systems in most areas have to take in both the waste water and the surface water from the heavy rainfalls that we are experiencing. The sewer system floods when there is too much rain in a short period of time, like we have experienced several times over the past few years. We want to address this issue by finding out what is already being done nationally and locally and map out what the individual household can do to manage the surface water and prevent flooding. How much will it take to implement some of the newly invented technologies and methods to avoid that the enormous amounts of excess surface during heavy rainfalls flood the sewer system. How much can be done by the individual household as well as in local communities? Will awareness raising campaigns have any effect?

## Keywords

Sewage-separation, rainwater-management, economy, education, behaviour-influence.

## Introduction:

In these days when the weather is getting hotter and hotter, the evaporation is also increasing and, that leads to very high humidity. When the humidity is very high it rains a lot, and that leads to the sewage system flooding. When we did not have a sewage system, we dug a ran in the dirt, and had both dirt and excrements running down the side of the road. People still do that in the third world, and they are getting really ill because of that, because they have excrements in the streets. When our sewage system is filled by rainwater, the system's wastewater floods up to the streets and to basements, which makes a health risk for people[1].

## Findings:

In Denmark it is possible to separate the sewages pipes into a two-pipe-system: one pipe for wastewater and one pipe for "clean" water, e.g. rainwater. As of now all the water from the Danish houses flows to the sewer, together with the rainwater, and from there to the waste refinery plant, where all the water gets cleaned and released back into nature. With separation of the rain- and wastewater, you will be able to move the clean rain water directly back into nature, which would decrease the amount of water the water refinery plant would have to clean. Furthermore, by increasing the amount of pipes, the water capacity of our sewages would increase and help prevent flooding.

If a Danish municipality has decided to separate sewage pipes, has stated that it is the individual owner that has to pay for the digging and installing of the pipes. The final price ranges between 700 DKK and 2,500 DKK per. meter running pipe[2], and can cost between 10,000 DKK and 105,000 DKK (with a mean price at 47,000 DKK)[3]. The price may vary by the following points:

- If you choose a bed to collect rain or a fascine on your property for seepage or is the water moved with separate pipes to the main rainwater pipes
- Are you going to do some of the digging yourself?
- Where are the new conduction to be buried - is there underlining or flooring?
- How many drainpipes does your house contain and where are they located?

- How is the ground, location, arrangement and plant growth on your property?
- How is the base of your house, and how close to the base can the new pipes be placed?
- Do you have drainage around your basement, does the drained water need to be pumped to rainwater conduction?[4]

To separate the sewage pipes you need to separate wastewater and rainwater in your household first though. Separating your wastewater and rainwater can be done by, as said before, installing new pipes, which leads rain water into the new rainwater pipe. You could also manage your rainwater with for example a fascine or a bed of flowers to collect rain and letting the water flow through the ground by itself. This solution requires a low amount of pollution in the ground which makes it less helpful in urban areas[5]. Another solution is perma roads. We interviewed a water engineer, Martin Sørensen, from Odense, who showed us these roads. A perma, or permeable, road is a street where the asphalt is special made so that water can flow through. The idea is that the rain which falls onto the road flows through the asphalt and further on into the ground down to the groundwater. The reason for building perma roads is to reduce flooding in case of cloudbursts and other environmental issues related to water. Perma roads can be built on public roads, but also private roads, paths and driveways. This is a way house owners can make a further difference[6]. If a household wants to disconnect their rain water connection, they can get a connection fee up to 23.795 DKK included VAT[7].

We, the five members of our group, are all members from Eisbjerg International School in Denmark. We have talked with the school's janitor, Ronni Haugaard, who has the responsibility for the water system. We found out, that our school, Eisbjerg International School, and the nearby area have already built a separating system, that divides the rainwater from the wastewater, but it is not used to its full potential. We have a nearby stream, where rainwater could be led into, and therefore avoid floods. But the rainwater is instead lead into a bigger pipe, which is also connected to the wastewater pipe, and then it gets mixed, and led to a cleaning station, just outside the city of Nørre Aaby, where our school is placed. At our school we have 3,000 square meters of roofing. This roofing collects around 2,550,000 litres of rainwater, which could be "reused" as water in for example toilet flushes. One toilet flush is around 4 litres, and if we used the rainwater for flushing, we would get 637,500 flushes; that way the school could save money and prevent floods.

Today, most new sewages are build separated; but not much is done to separate the existing sewage system. It is very expensive, and can cost up to 150,000 DKK for the average Danish house-owner, if their municipality choose to separate the sewage system[2]. Besides, not many Danes know about this issue. If the communal politicians therefore chose to separate the sewage system and thus charge Danes a high fee, the population would probably become very upset and angry at the politicians. Therefore, it would affect their carrier poorly. If a sewage system had to be separated, it would also be very inconvenient for the population, since roads would be blocked. All in all, it is not something the Danish population would be pleased about at the moment.

There has been made several campaigns and initiatives to change the population's opinion though. E.g. a Danish campaign called "Rainwater is a gift from heaven" from DitRegnvand (YourRainwater):

<http://bit.ly/1ZIWKGc>

Throughout the whole video, a child's voice is speaking, while there is being drawn and shown what the problem is. Afterwards the video shows you, how you can solve the problem. In the end, the child's voice says: "When I get big, I also want to reuse my rainwater" and it links to a website (<http://www.haveselskabet.dk/ditregnvand>).

It is a really good at reaching its viewers, and it is very similar to our own. It is family-orientated campaign, because the companies whom are working within this industry, know that it is the common family they have to reach. Our campaign is quite similar to this one, since they are both simple and targeting families. The campaign is in a video format, which makes it easier and more attractive to understand. They tell you about the problem and shows you different solutions you can carry out.

In Denmark we considered it is really important educating children about all the issues our society suffers. It is important knowing that the new generations grow up knowing what is going on so they also know what to do about it. Schools, companies and industries work together to provide information about these problems to the children. For example, we have been working with a water company, VandCenterSyd, who offer visits and activities for schools. It is important both for them and for the kids getting the necessary knowledge. Maybe in the future, people will be educated and our whole sewage system will be separated?

### The purpose of the investigation

Our product is an informative video, that is targeting children under the age of 13. This we chose, because they are going to face this problem on a larger scale in the future, if there is not done anything about it today. We are hoping to impact them, so they will act in favour of the sewage system, and therefore themselves, in the future. Children can also have a huge impact on their parents, and we hope, that they will talk with the parents about the topic, which would make them research this topic. Since we are targeting children, we wanted to make something humorous and a bit light-hearted. We used cheery copyright free music to make this clear. The video shows a boy enjoying summer's sun, but then a rain, caused

### References

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- [2] HANSEN, ANNE KLEJSGÅRD (03/12-2012), [HTTPS://WWW.BOLIUS.DK/STOR-KLOAKREGNING-PAA-VEJ-TIL-BOLIGEJERE-9317/](https://WWW.BOLIUS.DK/STOR-KLOAKREGNING-PAA-VEJ-TIL-BOLIGEJERE-9317/)
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- [4] AARHUSVAND, [HTTP://WWW.AARHUSVAND.DK/PROJEKTER/SPILDEVAND/SEPARATKLOAKERING/PRISEKSEMPEL/](http://WWW.AARHUSVAND.DK/PROJEKTER/SPILDEVAND/SEPARATKLOAKERING/PRISEKSEMPEL/)
- [5] HERNINGVAND (01/21-2013), [HTTP://WWW.HERNINGVAND.DK/DA/HVAD-KOSTER-DET-SEPARERE-KLOAKKEN-PAA-EGEN-GRUND](http://WWW.HERNINGVAND.DK/DA/HVAD-KOSTER-DET-SEPARERE-KLOAKKEN-PAA-EGEN-GRUND)

by his father, appears. The boy then shows different ways to prevent flooding indoors. Since children cannot do a big difference directly, we wanted to show them, how they actually can make a change.

The video: <http://bit.ly/1qOYJgO>

### Method of the investigation

In the start of our process, we contacted a local wastewater treatment plant, VandCenter Syd (WaterCenter South). We got in contact with one of their water engineers, Martin Sørensen, whom we arranged an interview with. We were shown around at VandCenter Syd. Thereafter we had our meeting/interview with Martin, where he enlightened us about the details of the problem. Afterwards he drove us around in Odense and showed us a permeable road. We also interviewed our school janitor, Ronni Haugaard about the rainwater-management at our school.

Then we researched and made a mind map out from what we knew. Our initial idea was to sit down and talk about everything in the report; and then have a secretary who could write everything down. We reconsidered this, after we came to the knowledge of the close deadline, and decided to split up the workings tasks. Throughout the next days, we individually worked on our assignments. We had a great discussion with our supervisor. We worked over five hours the last day, so we could finish.

### Conclusion

Throughout our process of researching and investigating, we have found out, that the sewage system plays a crucial role in a developed country. It is directly linked with the health of the population. We have learned, that rainwater is a major threat to our sewage system, and therefore our health. It is also a problem in other European countries. We use an incredible amount of water every day, even though the world's water resources are spare. This consumption of perfectly clean drinking water could be exchanged by rainwater and through a separate sewage system, many would benefit this economically; our sewage would not be under so much pressure under a heavy rainfall and people would have a much lower water bill. There are many alternatives to relieve the sewage system for rain, e.g. fascines, permeable roads or flower beds. The government and the municipalities must enlighten the people about this growing problem, before people will help; and to secure the sewage system long term we must reverse the global warming.

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