Blue Polder Model,
Towards Sustainable Water Management in Rietmolen

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ABSTRACT

In the village of Rietmolen a big part of a traditional combined sewer system has to be renewed. In addition, extra storage capacity is needed to reduce the emission of the overflow. A project is defined to investigate alternative solutions towards a more sustainable water management. The goal is a far-reaching separation of rain and wastewater. Communication with the villagers is an important part in the process of realising measures like infiltration facilities on private grounds. The blue polder model is used to start a unique collaboration of authorities like the Province of Gelderland, the Waterboard Rijn en IJssel, and the Municipality of Neede, villagers and consultant. In this paper the backgrounds and the set-up of the project are presented.

KEYWORDS

Infiltration, (improved) combined and separated sewer system, storage detention tanks, water quality, groundwater, make use of rainwater, sustainable water system.

INTRODUCTION

Rietmolen is a very small village (800 inhabitants) in the Province of Gelderland in the eastern part of the Netherlands, shown in figure 1. The main part of the village is connected to a combined sewer system. The only CSO (Combined Sewer Overflow) of the system is discharging very frequently on water with a special ecological function.
According to sharpened regulations of the water-authority a traditional approach was applied to design improvements to the sewer system: an additional storage of 2 mm in a storage settling tank and 13 mm in extra 'green' storage.
The municipality of Neede asked Tauw consulting engineers to present a second

Figure 1 Municipality of Neede (Netherlands)

opinion in improving the system. This project is supported (with Dutch guilders and enthusiasm) by the provincial authority of Gelderland and the water-authority of the Rijn en IJssel area.

In the project the following party's are involved:

- The Province is a strong stimulator of alternative and environmental friendly solutions to the traditional extra storage approach.
- The Water-authority is interested in reducing the load of relatively clean rainwater on the treatment plant.
- The Water Company is interested in making use of rainwater to reduce the consumption of first class drinking water.
- The Municipality of Neede is interested in more durable, sustainable and especially cost-friendly improvements of the sewer system.
- The inhabitants of Rietmolen are interested in the effect of the system on their environment.
- The consultant Tauw is a pioneer in consulting source control solutions and a promoter of sustainable water management.

The movement to leave traditional approach to a more sustainable water management is called the Blue Transformation. The collaboration of the mentioned party's in this project can be called the Blue Polder Model. The project is divided into 3 phases. First, an investigation is carried out to determine possible solutions to improve the water system of Rietmolen. Then communication meetings are organised with the project team and the inhabitants of the village to discus the best solution. Finally the system is designed and checked.

RIETMOLEN VILLAGE

The village of Rietmolen is part of the Municipality of Neede, which is situated in the Province of Gelderland, in the eastern part of the Netherlands. The name Rietmolen in English means Reed-mill.

The village is divided by the Schipbeek (Ship-brook) in a northern and southern part. The centre of the village on the north bank of the Schipbeek is equipped with a combined sewer system. The combined system has one overflow location, which is situated north east of the village. The actual overflow-frequency of the system is larger than expected theoretically. The combined sewer system has a storage capacity of nearly 8 mm and a (rain) pumping-capacity of 0,7 mm/h.

The deteriorating quality of the sewer in the main road implies that this part of the system has to be renewed. The environment of the main road is to be restyled within the coming years.

After a hydraulic check of the system became clear that the capacity of the sewer from the main road to the overflow is insufficient to prevent occasional flooding (water on the street).
In addition to the renewal of a part of the sewer system, extra storage capacity is planned behind the overflow of the combined system.
In recent years, new houses are built in Rietmolen. The new Olland housing estate is provided with an improved separate drainage system. In the next years, two more estates have been planned, northwest of the village.

Figure 2 Rietmolen seen from the air.

TRADITIONAL APPROACH EMISSION REDUCTION

In the Netherlands an average combined sewer system has a storage capacity of 7 mm rainfall and a pumping capacity of 0,7 $mm.h^{-1}$. After a national research program NWRW, the conclusion is drawn that the emission of nearly 80% of 12000 overflow locations has to be reduced substantially. The government has formulated a 2-track policy to achieve acceptable water quality. First a general 50% emission reduction has to be realised before 2005 and secondly additional measures have to be tuned to an acceptable water quality.

Before the year 2005, the water authority demands an emission reduction to achieve an emission equal to the level of a so-called reference system. This phase is called the basic afford or the emission track. Before the year 20XX additional measures should be taken if necessary to achieve an acceptable water-quality, called the water quality track. The reference sewer system has a theoretical storage capacity of 7 mm with an additional storage of 2 mm in a storage detention tank, as shown in figure 3.

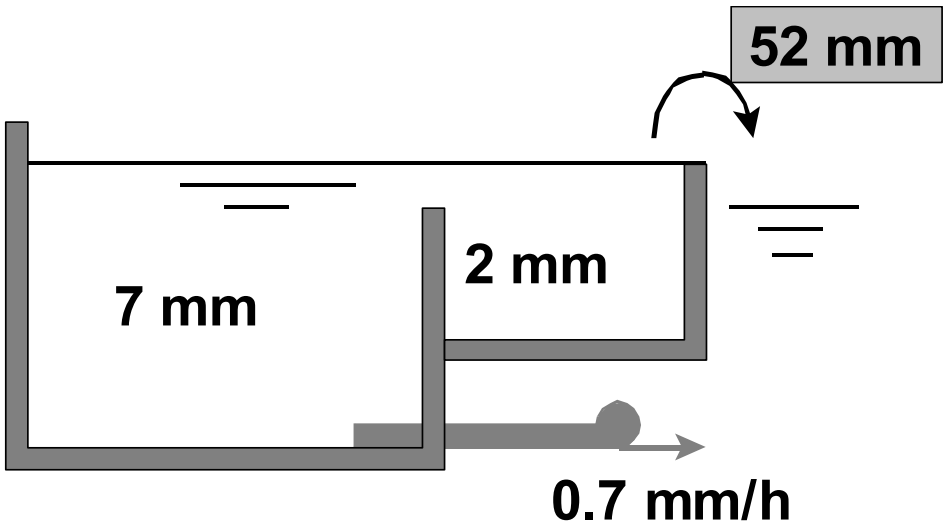

Figure 3 Reference of a (improved) combined sewer system.

This emission of the (combined) reference system is based on an average degree of water pollution and assumed settlement efficiency of the storage detention tank. The first phase of emission reducing measures, mean that the total runoff discharged to the treatment plant will increase from 90 to 95% of the total rainfall on the contributing catchment area. The overflow frequency will reduce from 12 to nearly 7 times per year. Additional measures can be found in extra storage capacity in green storage basins between the overflow and the surface water.

For new housing estates, the improved separate system is prescribed with a storage capacity of 4 mm and a pumping capacity of 0,3 $mm.h^{-1}$. This system is applied to direct the first flush of "foul" rainwater to the treatment plant. The effect of such a system is that nearly 75% of the rainfall is discharged to the treatment plant. The average overflow frequency of a separate system measures more than 30 times per year.

The traditional way of handling our rainwater is to get rid of it as soon as possible. In combined sewer systems, "clean" rainfall is mixed with our domestic and industrial wastewater. In a flat country like the Netherlands, large quantities of (formerly clean) water are pumped to central treatment plants. Pressurised pipe systems with a transport distance of more than 20 km (13 miles) are not exceptional. A lot of energy is used to pump relatively clean rainwater to a treatment plant.
Traditional measures (additional storage capacity) to achieve emission reduction of combined and separate sewer systems can lead to an increasing discharge of rainwater.

ROAD TO SUSTAINABLE WATERMANAGEMENT

Sustainable water management has become very popular in the last few years. The way to define and apply sustainable water management can be very creative. Sustainable water management has something to do with a responsible way of treating our resources like clean rain-, surface- and groundwater. In addition, unnecessary use of energy can be avoided, by not pumping clean water to a treatment plant.

Two main ways in achieving a more responsible use of water are:
- infiltration of clean rainwater in the soil to replenish the groundwater supplies and to reduce the transport of water to the treatment plant;
- make use of clean rainwater for flushing the toilet, washing clothes and cars or watering the garden, as shown in figure 4.

In the eastern Netherlands, mainly ground water is used to produce first class drinking water. Cars are washed, gardens are watered with the same first class water. The water is delivered with one distribution network.
Drinking water costs about $ 1,25 per m^3, which is not an economical reason to use high quality groundwater supplies sparingly.
The other sources to prepare drinking water are the rivers. Because of the lower quality of the river water the cost to prepare drinking water are higher.
To spare the groundwater supplies in the soil the government and the water companies stimulate the use of locally collected rainwater.

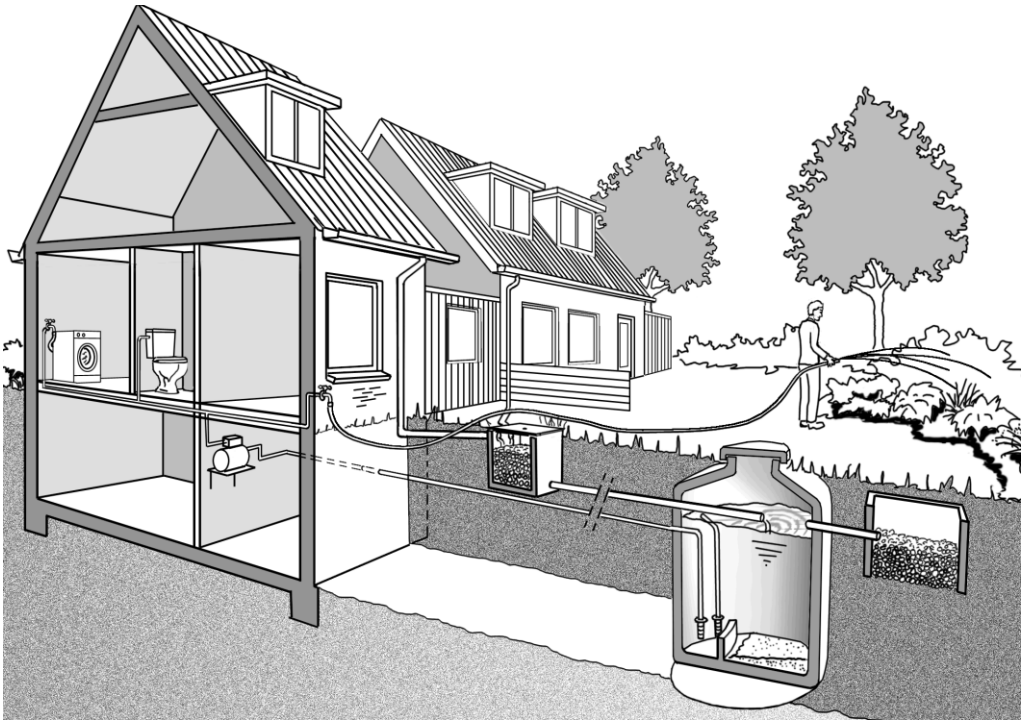

Figure 4 Make use of rainwater.

In this paper, the attention is focused on the infiltration of clean rainwater in the soil in stead of discharging it to a sewer system. The road to a more sustainable water management is chosen in many new housing projects in the Netherlands.

In existing housing areas with a combined sewer system, there are practical and financial barriers in switching to a new approach. The switch from a traditional to a more sustainable system cannot be made overnight. In an existing area, the traditional system has to be changed gradually. In addition, measures on private property have to be taken into account. If a house is provided with a combined drainage system than it may be difficult to separate the rain flow from the wastewater flow.

The costs of a gradually replacement of a sewer (discharge) systems may go far ahead of the benefits. It may be difficult to estimate future measures following the traditional extra storage approach.
An overflow frequency of once per 2 years is better than 5 times per year, but can be very disturbing in valuable ecosystems. A far-reaching separation of wastewater and rainfall may make the discussion about CSO emission simulations and effects on the surface water quality unnecessary.

TOWARDS SUSTAINABLE WATERMANAGEMENT IN RIETMOLEN

In the village of Rietmolen a big part of the combined sewer system has to be renewed within the next years. In addition, the storage and discharge capacity has to be enlarged to reduce the risk of flooding and to reduce the emission by the combined sewer overflow.
A pilot project is defined to investigate alternative measures towards a more responsible way of handling clean rainwater. The road towards a more sustainable water system in Rietmolen is supported by the Province of Gelderland, the Waterboard Rijn en IJssel and the municipality of Neede. The ambitious target is a total separation of waste- and rainwater. The main preference is to infiltrate rainwater in the soil or to make use of it, in stead of discharging directly or by a treatment plant to the surface water.

The pilot project consists of the following 3 phases:

1 **Initial research** is carried out to determine possible solutions to improve the water system of Rietmolen. Examples of alternative measures are:
- to reduce runoff to the combined sewer system by infiltration of rainwater into the soil;
- to make use of rainwater to spare first class drinking water;
- to use rainwater for washing and toilet-flushing;
- to apply vegetation roofs to reduce peak-flows and runoff;
- to transport more water visually to stimulate pollution control;
- to use central infiltration filters to treat more polluted rainwater of roads with high traffic-intensities;
- to restructure improved systems with smart drain separators, to reduce discharge to the treatment plant;
- etc.

A reduced runoff into the system can be translated into less emission by the overflow. A major issue is a gradual replacement of the existing combined system by a wastewater system and an alternative way of handling rainwater.
Planned investments reserved for traditional measures can be applied to finance an alternative approach. Cost-effectiveness is estimated to face the reality of using alternative measures.

2 **Communication** is planned to involve the inhabitants of Rietmolen intensively with sustainable management. A communication phase is inevitable because of the fact that measures on private property are necessary.
In 3 sessions the citizens are informed about the local situation, the traditional approach and possible roads to a more sustainable water management, a result of the initial research. The citizens (villagers) are asked to think along with the choice of alternative measures, not only on private property but also in their public room.
In an existing housing situation, individual measures can be found in storage systems to make use of rainwater and infiltration facilities to supply the groundwater reserves. Especially rain on pavements and roofs at the rear side of the housing is difficult to catch

in municipal (public) facility. Therefore, this part of the project is necessary in motivating the people to take measures on their own property. The municipality may stimulate measures on private property by subsidising the purchase of facilities.

3 **Design** and check of the chosen alternative water system. In the final phase of the project the alternative system will be detailed and checked. Arrangements with the villagers will be established to stimulate the realisation of private facilities.

STATE OF AFFAIRS PROJECT RIETMOLEN

In February ’99 the pilot project Rietmolen was started after the approval of the local authority. The first steps in the project are the collection of data of the sewer system, the catchment area, and the local situation. Next weeks experiments are carried out to determine the infiltration capacity and structure of the soil. A field inspection is planned to get detailed information about the local situation. On detailed maps, a classification of the potential possibilities for alternative measures will be reported. Alternative solutions will be compared and judged at cost-effectiveness and sustainability. The communication with the inhabitants is planned around the summer. Results of the project will be presented at the conference in august of this year.

CONCLUSIONS

In Rietmolen, part of a small village in the Netherlands a pilot project is set up to investigate the possibilities to transform the traditional urban water-system into a more sustainable water-system. This project is carried out as a collaboration of the Provincial authority of Gelderland, the Waterboard Rijn en IJssel, the Municipality of Neede (principal), the inhabitants of Rietmolen and Tauw consultants. The collaboration of the mentioned party’s in this project can be called the Blue Polder Model. The project is divided into 3 phases. The ambitious target is a total separation of waste- and rainwater. First, an investigation is carried out to determine possible solutions to improve the water system of Rietmolen. Then communication meetings are organised with the project team and the inhabitants of the village to discus the best solution. Finally the system is designed and checked. Results of the project will be presented at the conference.

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