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## River Kleine Nete : Creating ecological flooding zones at recreation areas

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Interreg North Sea Region  
Project: Building with Nature  
WP4: Natural Catchment Laboratories  
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### 1 Kleine Nete river restoration

The Kleine Nete is a rain river which winds across the sandy north-east of Flanders as a blue-green ribbon. It is one of the most natural rivers in the dense populated Flanders. On the one hand, the agriculture sector, which is the principal land user along the Kleine Nete, bears the water in case of high floods. Buildings are rare and so the valley is hydrological seen mainly unspoilt. On the other hand, the valley of the Kleine Nete is ecologically very valuable, protected by Flemish and European legislation. Significant populations of rare fish species can still be found here.



Figure 1: Location of Kleine Nete river in Flanders, the northern region of Belgium

However, the river itself has endured some changes in the seventies. In order to make the wet valley grounds more suitable for large-scale agriculture, the river has been straightened, broadened and deepened. This has several consequences. The water is evacuated more efficiently, which increases the flood risk in downstream areas. The groundwater levels went down by the enhanced drainage, causing a loss of groundwater dependent habitat species. It also meant a loss of natural habitat and migration facilities of biotic communities within the water system and by so a decline of the ecological value of the Kleine Nete valley. As the embankments are located very close to the river, they are vulnerable to erosion. By so, they need continuous

maintenance. Also there is loss of water storage capacity caused by for example the building of dikes, cutting off meanders and elevation of grounds by landfills owing to several sectors (agriculture, recreation, ...).

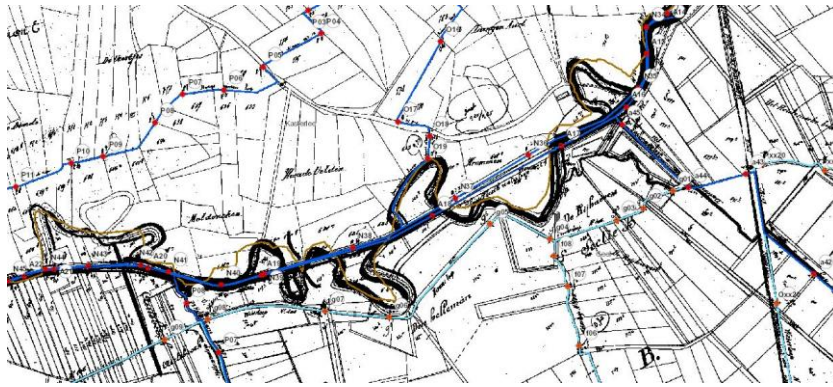


Figure 2: Course of the Kleine Nete in the past

To mitigate the major disturbance of the river system, a river restoration program was set up. Goals are:

- Creation of more water storage capacity
- Realisation of ecological added value
- Restoration of the structure of the water course

The following projects are fitted within the river restoration program:

- Fish passages at the weirs of Grobbendonk, Herentals, Kasterlee and Retie (established)
- Dike replacement near the city of Grobbendonk (established)
- Excavation of a former sand deposal area of 15 ha, known as “Hellekens” near the city of Herentals (works in progress)
- Remeandering in the nature reserve ‘Olens Broek’ near the city of Olen (design finished)
- Creating ecological flooding zones at recreation areas near the city of Kasterlee (pre design phase)
- Dike replacement and construction of a winter bed near the cities of Geel and Kasterlee (building permit delivered)
- Remeandering and construction of a swamp area near the city of Geel (works will start summer 2018)



## 2 Recreation areas

Three recreation areas are situated along the Kleine Nete at the municipality of Kasterlee. These recreation areas have an economic function. It is not evident making alterations to the water course here. The economic sector is on the one hand vulnerable to the consequences of climate change, e.g. increased flood risk, and on the other hand not willingly to cede space with an economic function to river adaptation works, e.g. water storage areas. A challenge is present to find innovative solutions for multifunctional use of space.

By rearranging the bank zone of the Kleine Nete, we intent to create a win-win situation for both the river and the recreation areas. It means that we are looking for an innovative solution in which the functions of the water course and the recreation are combined. This is understood as multifunctional use of space. The project can be considered as a pilot project / laboratory on how hard, rather economic allocations can be conformed to water and ecological systems.

The recreation areas attract lots of people, which provides opportunities to install educational and sensitization facilities. For most people, enterprises and even local authorities, climate change and his consequences is something they have heard from, but they don't know how it affects them and which actions should be done concretely. It is not considered a priority. The challenge is not only to inform the different stakeholders (population, local authorities, enterprises, ...), but also to involve them actively in the elaboration of adaptation measures. In this manner we can create more awareness, responsibility and understanding for the needed public works.

The 3 recreation areas are camping site 'Korteheide', amusement park 'Bobbejaanland' and recreation site 'Ark van Noë'. Together, they represent 1,6 km of banks. The main reasons to integrate these areas into the river restoration program are:

- Comprehensiveness: if these areas are included, the Kleine Nete river will be adjusted for a continuous 10 km
- Public support: lots of owners in the neighbourhood had to cede land. It concerns mainly agriculture, forestry, pasture. It would be difficult to accept if the 'harder' economic sites would not be affected.

## 3 Characteristics of the Kleine Nete near the recreation areas

The section of the Kleine Nete near the recreation areas has a width at the bottom of 9 meter. The width between the banks is 17 meter. The bottom lies more or less 3,5 meter under the surface level.

The average discharge is 4 m<sup>3</sup>/s which can increase to 33 m<sup>3</sup>/s for a storm with return period 100 years. The catchment area of the Kleine Nete is 573 km<sup>2</sup> and belongs to the Scheldt basin.

| Return period | Discharge            | Water depth |
|---------------|----------------------|-------------|
| Average       | 4 m <sup>3</sup> /s  | 1,7 meter   |
| 2 years       | 23 m <sup>3</sup> /s | 3,6 meter   |
| 10 years      | 29 m <sup>3</sup> /s | 3,7 meter   |
| 100 years     | 33 m <sup>3</sup> /s | 3,8 meter   |

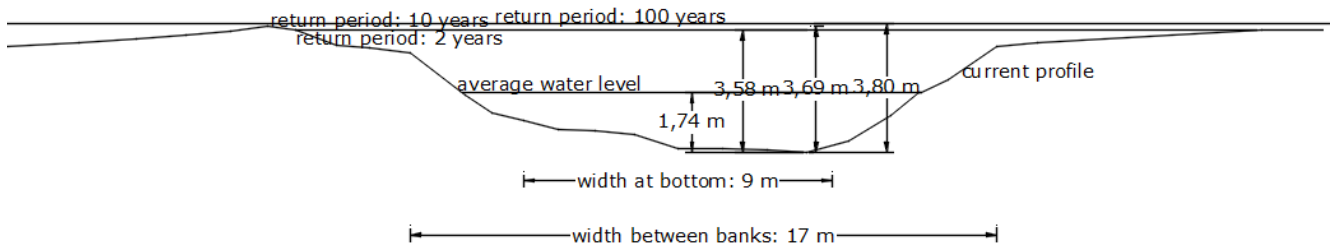


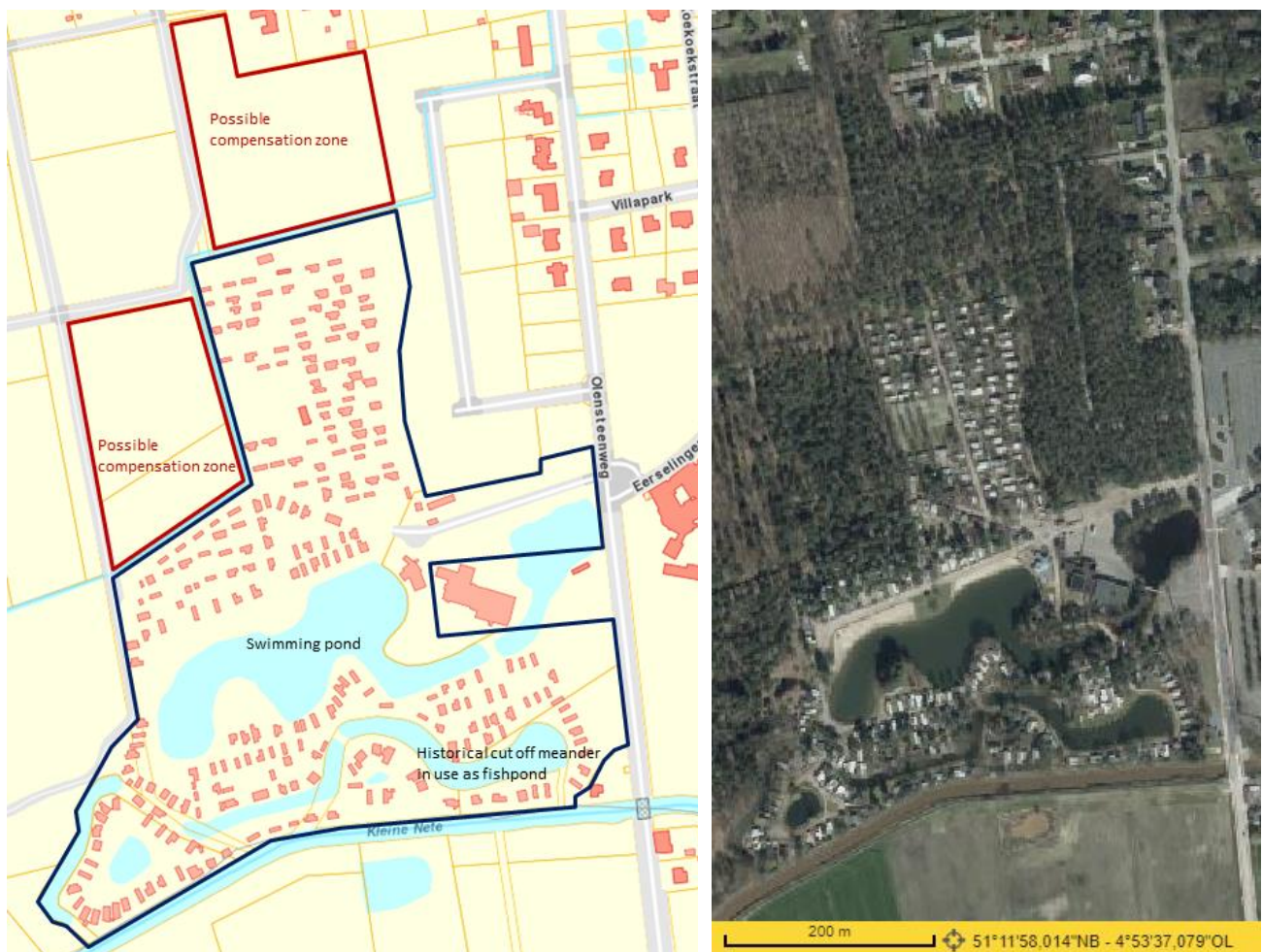
Figure 3: Section Kleine Nete

## 4 Camping site Korteheide

### 4.1 Description

Camping site Korteheide is adjacent to the Kleine Nete for a distance of 400 meter. Roughly 40 meter inland, an historical cut off meander is still present in the landscape. It is in use as fishpond. More northly a pond is located (seepage water), used as swimming pool.

A limiting condition for the rearrangement of the bank zone is the preservation of the camping facilities, i.e. number and quality of the standings for caravans. North of the camping site two areas are present on which new standings for caravans can be allocated as compensation for a possible loss in the bank zone. These two compensation zones can only be brought into use for a surface area equal to the camping site surface area given to nature or water. In other words: a compensation is allowed, a bare extension of the camping site is not allowed.





## 4.2 Design proposal

The design consists of:

- Reconnection of a part of the old, cut-off meander to the river. The other part will be kept in use as fishing pond as it is more difficult to create a new fish pond further from the river where the ground level is higher
- The area between the meander and the river will be turned into an ecological, inundatable place. Summer camping is still allowed, but there will be no infrastructure. It is needed to remove 58 campers to the compensation areas.
- Two compensation zones will be used to relocate the 58 campers. At the moment, these zones are covered with conifers, which will be cut down (28.000 m<sup>2</sup>)
- A small stream around the camping site will be upgraded and connected to the Kleine Nete river system.

The estimated costs are:

- Construction of new camping terrain and relocation of the caravans: 750.000 euro
- Construction of green area, including side works on bank Kleine Nete: 250.000 euro
- Construction of meander: 150.000 euro
- Upgrading small stream: 50.000 euro
- TOTAL: 1.200.000 euro



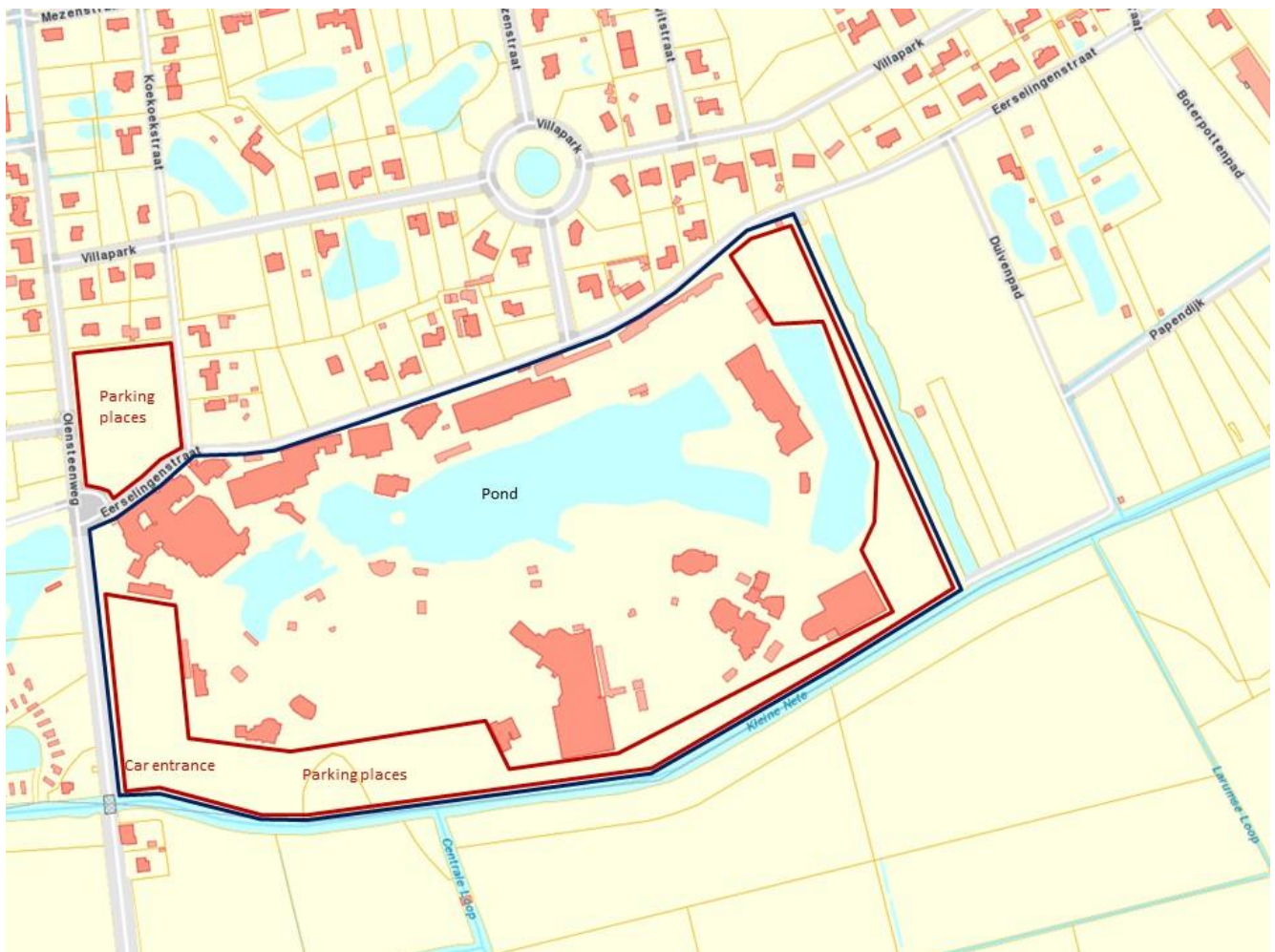
## 5 Amusement park Bobbejaanland

### 5.1 Description

Amusement park Bobbejaanland is adjacent to the Kleine Nete for a distance of 850 meter. The area between the amusement park and the Kleine Nete is in use as parking places for visitors.

Offering sufficient parking places to visitors is already a problem for Bobbejaanland at the moment. A limiting condition for the rearrangement of the bank zone is a preservation of the number of parking places.

The rearrangement should imply an improvement of the landscape experiencing. The rather bare car park can be transformed into a nice place by which the visit starts with a pleasant walk from car to amusement park. The strong separation between Kleine Nete and recreation area should be abandoned.







## 5.2 Design proposal

The design consists of:

- Lay a 10m buffer strip between parking and river (loss of 50 parking places)
- Digging of a new meander: 4,50m bottom width (loss of 164 parking places)
- Reconversion of inundatable parking island between meander and Kleine Nete
- Construction of new two storey parking garage to compensate loss of parking places. The garage will implicate a loss of 96 parking places on the ground level. One level of the garage can store 307 cars. By so, the loss in parking places is compensated by one level. If the amusement park wishes to increase the parking capacity, it is possible to make a two storey parking garage.

The estimated costs are:

- One level garage of 307 parking places: 2.700.000 euro
- Construction of meander: 150.000 euro
- Construction of parking island including 4 bridges and green area: 850.000 euro
- TOTAL: 3.700.000 euro



## 6 Recreation site Ark van Noë

### 6.1 Description

Recreation site Ark van Noë is adjacent to the Kleine Nete for a distance of 300 meter. Roughly 60 meter inland, an historical cut off meander is still present in the landscape. It is in use as fishpond. Between the Kleine Nete river and the meander there is an artificial pond which was used for swimming in the past.





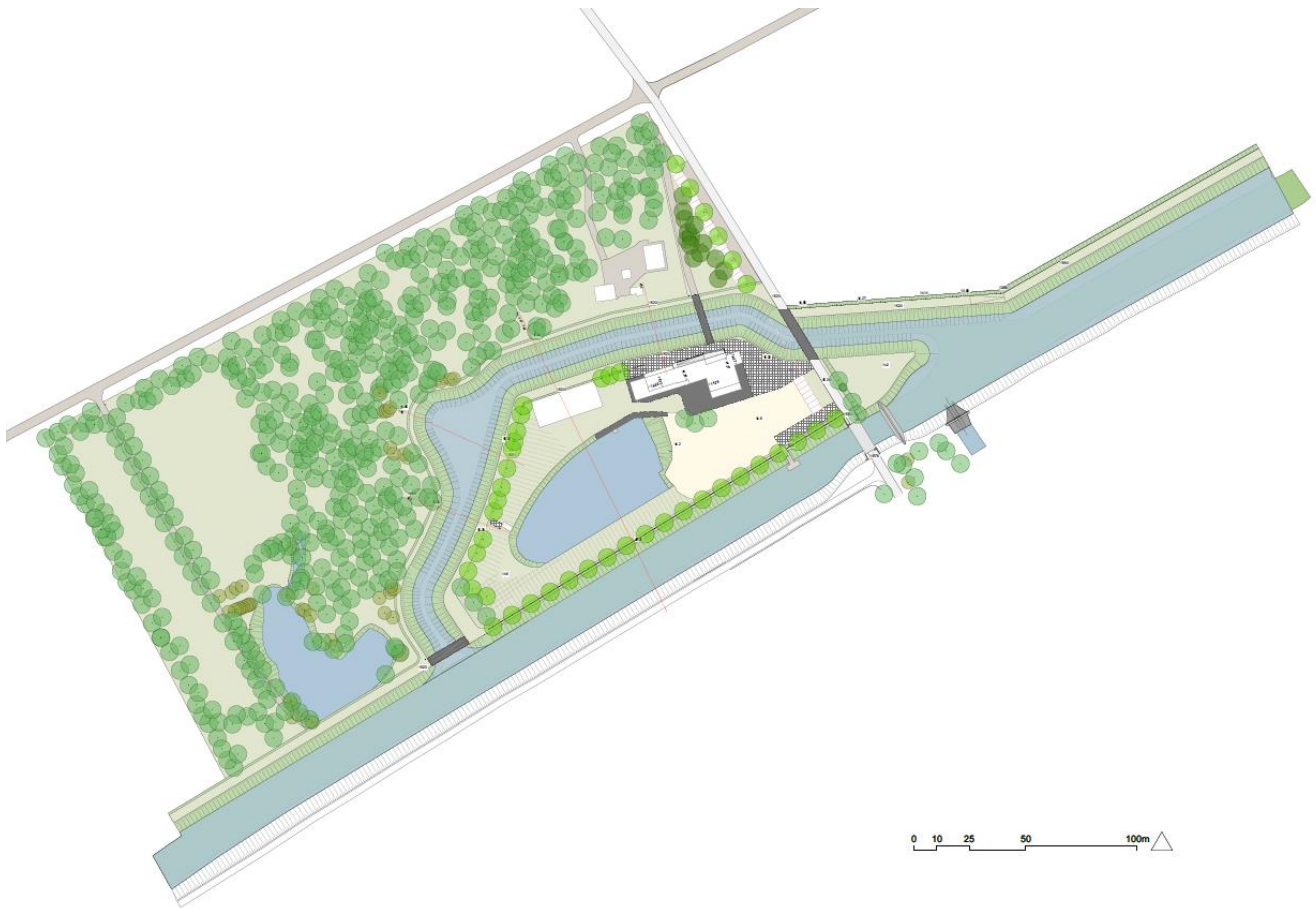
## 6.2 Design proposal

The design consists of:

- Dike improvement works along the Kleine Nete using natural materials
- Reconnection to the river of the old, cut-off meander
- Re-organisation of the entrance to the site to increase the water experience. Parking places will be relocated to the north of the meander. Visitors will enter the site by a new footbridge.

The estimated costs are:

- Construction of meander, bank works on meander and Kleine Nete, including land purchase: 200.000 euro
- 3 new bridges: 300.000 euro
- TOTAL: 500.000 euro



## 7 Questions

We would like to know your opinion about this project. Here are some guiding questions:

### General

- Do you have any experience with similar cases? Which points of attention do you see?
- The realisation of the project is accelerated by pressure from neighbouring farmers who had to cede land and had a hard time accepting that more popular areas would not be affected. Do you think the water manager as a public service has to take this into account?
- The recreation areas are surrounded by farmland. Here, the water manager has expropriated a 15m strip along the Kleine Nete to create a two stage channel and new dikes. Designing concepts with meanders or compensatory parking places and caravans in agriculture areas would be cheaper, but affects again the agricultural sector. Would you consider such solutions?

### Design concept

- What do you find positive / negative about the design proposals? Which other solutions do you propose?
- Do you think too much importance is set to the interests of the private companies who own the recreation sites? The recreation areas have to adapt themselves more to a new natural river system.
- The meanders are not considered as free meandering water courses. Which bank protection do you propose? How would you conceive the embankments?

## **Financial**

- The redevelopment of both sites will have little impact in reducing the flood risk, but there will be positive effects on other goals of river restoration. Which are the main benefits you think of and how can they financial be valued? Do you think comparing costs and benefits, the investments are worth it?
- Who has to pay for the realisation of the project? Do you think the government has to bear all the costs? Do you propose a certain distribution key?  
For the case of the amusement park: should they increase the price of a parking ticket in order to finance the project? What is an acceptable price?

## **Educational**

- Which educational / sensitization possibilities do you see to promote the Kleine Nete river and water management? Which concrete measures do you propose and on which themes?