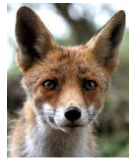
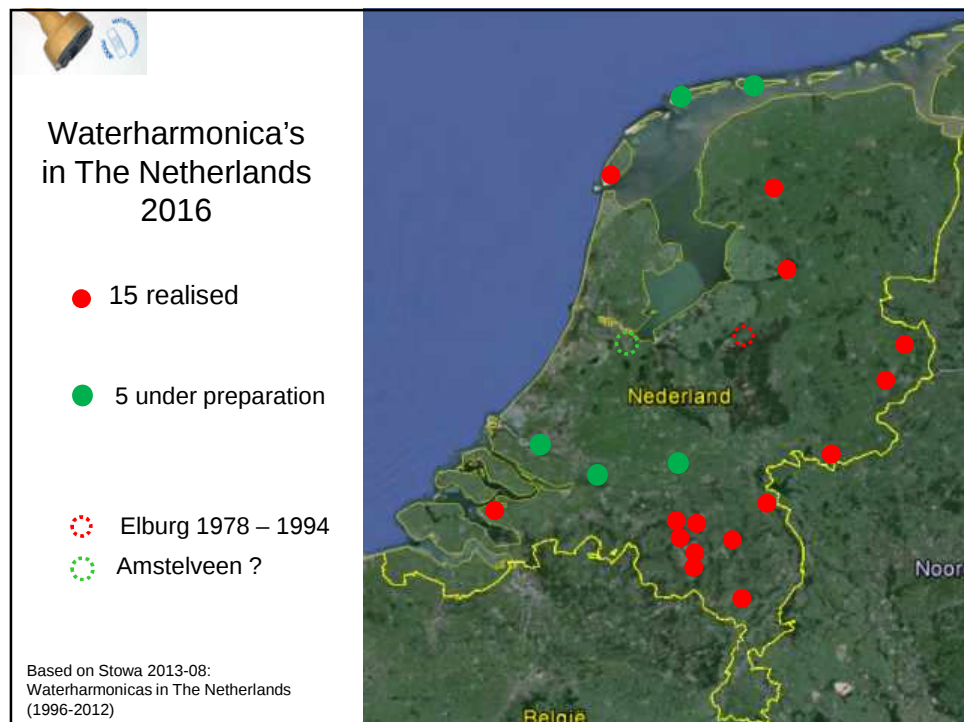


Overview Waterharmonica's in The Netherlands

Ruud Kampf
Rekel/Water
July 2016



Rekel/Water



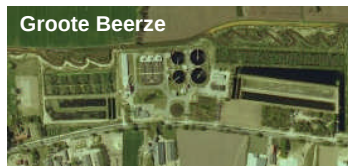
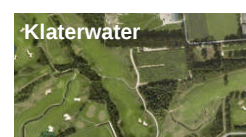
Waterharmonicas – till 2001

No.	Name	Primary reason/reasons for construction
0	Elburg	1978: to lower the nutrient level in STP effluent, taken out of operation. Has not been put back into operation because of the 'high natural values'
1	Eversteekoog, Texel	1994: as a source of fresh water for agriculture on the island, disinfection because it crosses a residential area. Has been expanded and renovated in 2012 – 2013
2	Empuriabrava, Spain	1995: to supply water for a nature reserve/to create local natural value
3	Klaterwater in Kaatsheuvel	1997: to produce water with a low level of nutrients and pathogens for the Efteling
4	Tilburg-Noord	1997: to buffer effluent during rainwater discharge so as not to exceed the maximum permissible effluent rate because of the limited capacity of the stream de Zandleij, ecologisation at basic discharge
5	Land van Cuijk	1999: to supply water to agriculture/nature and to reduce discharge to national waters
6	Sint Maartensdijk	2000: to reduce nutrients and obtain insight in the functioning of the helophyte filter, recreation
7	Waterpark Groote Beerze	2001: river restoration Groote Beerze, to promote wet habitats

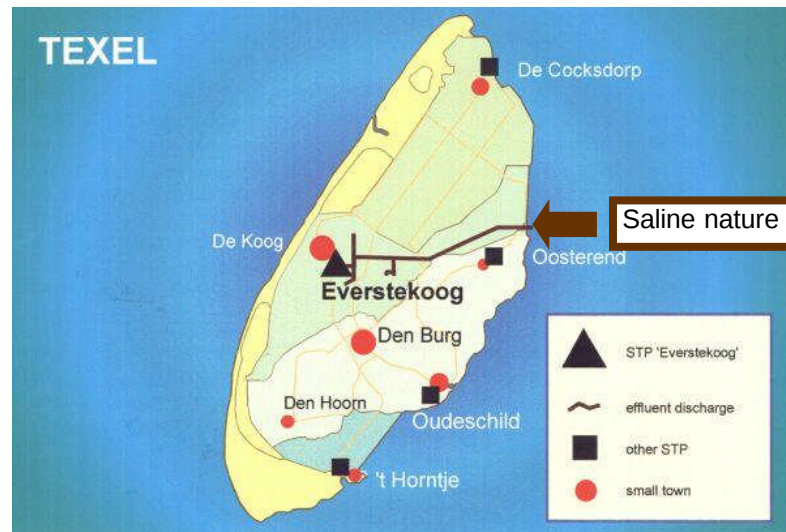
- Nutrient removal
- Buffering water
- Supply water for agriculture, nature



Examples of Waterharmonica's: till 2001



Effluent discharge to the sea



Effluent use on the island



Aerial view STP Eversteekoog

- sewage treatment plant
- presettling basin
- 9 ditches with reed/cattail and aquatic plants
- discharge ditch



Research project
1995 - 1999



Eversteekoog



Land van Cuijk

Water for agriculture



Rekel/Water

Waterharmonica's – 2006 - 2016

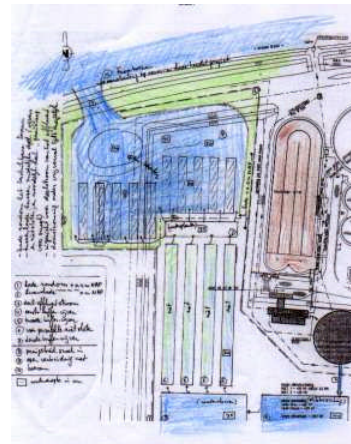
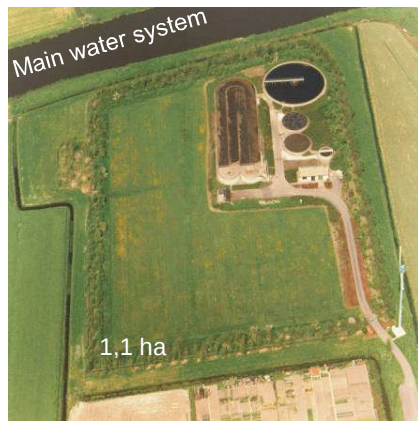


No.	Name	Primary reason/reasons for construction
8	Aqualân Grou	2006 to develop nature and a spawning pond, demonstration project and Urban Water Cycle Project
9	Ootmarsum	2010 'ecologisation' of the effluent for discharge into a small stream and Urban Water Cycle Project
10	Sint-Oedenrode	2011 ecological corridor, 'natural water', incorporated in a trail, bird sanctuary with watchtower
11	Kristalbad	2012 regional buffering water, recreational green buffer zone, ecologisation, improvement of water quality and Dutch WFD subsidy
12	Soerendonk	2012 water buffer, recreation, to develop natural habitats, spawning pond/fish migration and Dutch WFD subsidy
13	Tilburg Moerenburg	2012 to buffer 'influent', Stormwater overflow, improving natural values, recreation, to prevent overflow
14	Vollenhove	2012 'purifying riverbank'
1b	Eversteekoog, Texel	2013 extension existing Waterharmonica, more capacity and lower loading
15	Biest-Houtakker	2013 'ecologisation' of the effluent for discharge into a small stream, landscaping
16	Dinxperlo	2014 Water garden and green zone. First Waterharmonica after a Nereda plant

- Buffering water
- River restoration
- Surface water quality
- Fish spawning
- Making "natural habitats"
- Recreation
- Customers relations:
"making friends"

Dinxperlo: First Waterharmonica after a Nereda plant

Waterharmonica Aqualân Grou - first design -



Rekel/Water



Texelse kennis toegepast bij zuiveringsmoeras en paaibiotop bij rwzi Grou

H₂O, 2007 (24): 41-43



Rekel/Water

Aqualân Grou



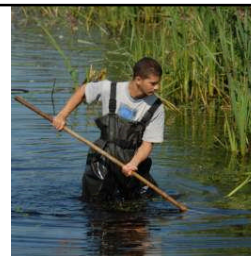
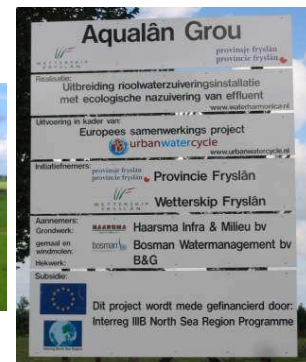
Three Daphnia ponds

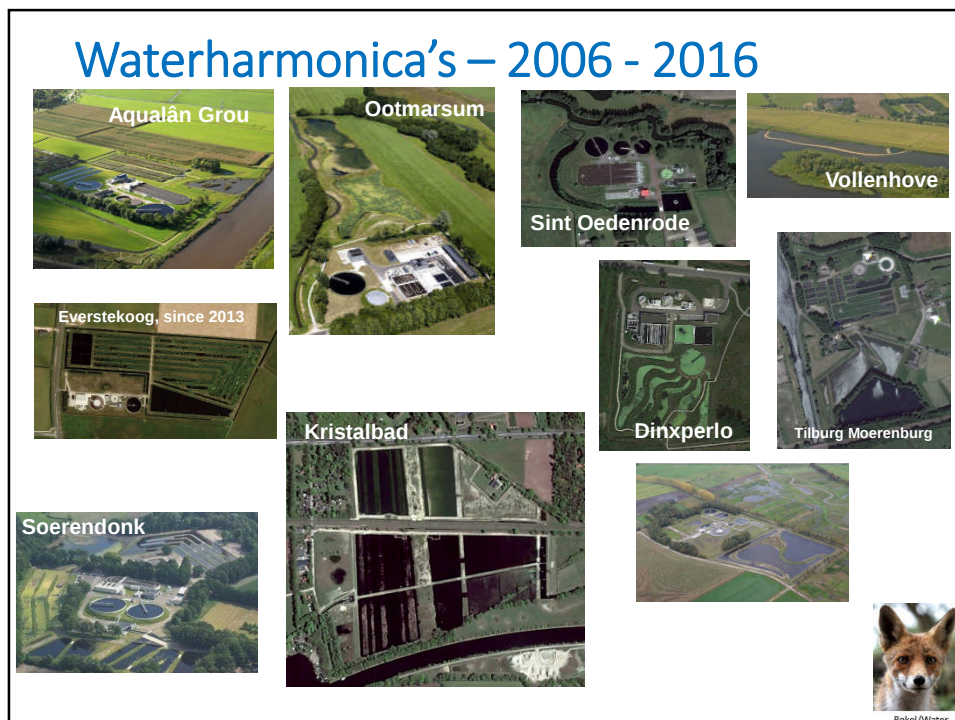


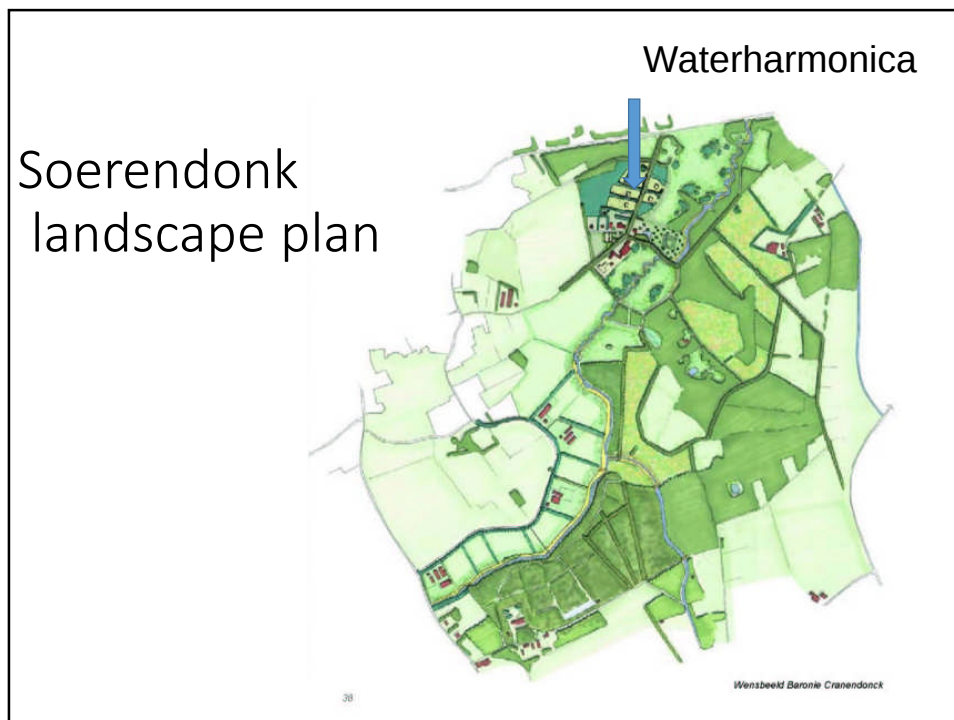
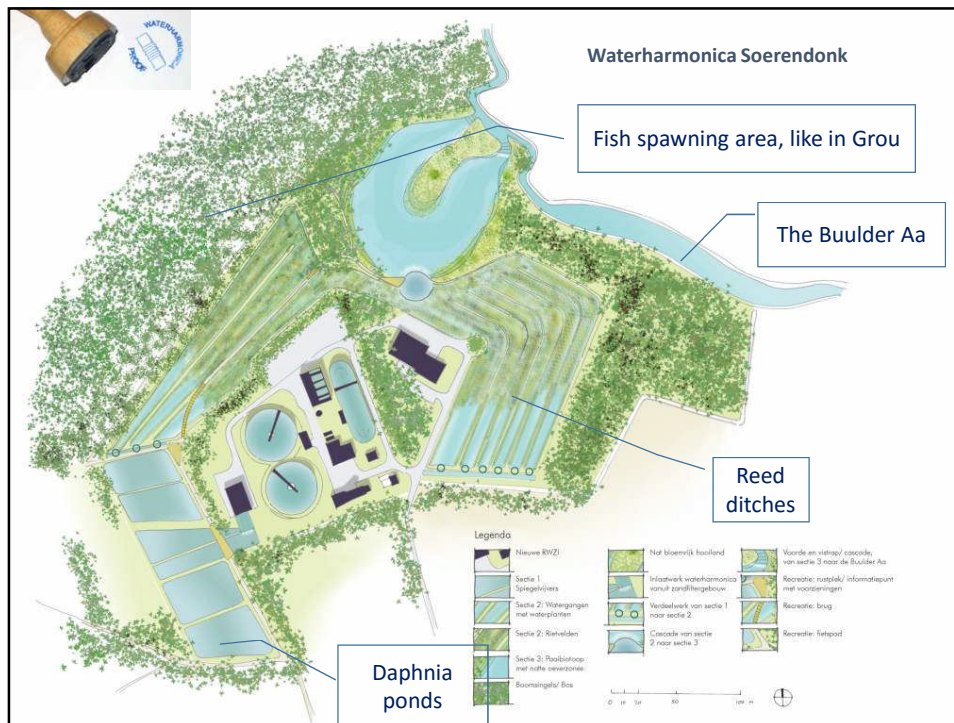
Four reed ditches

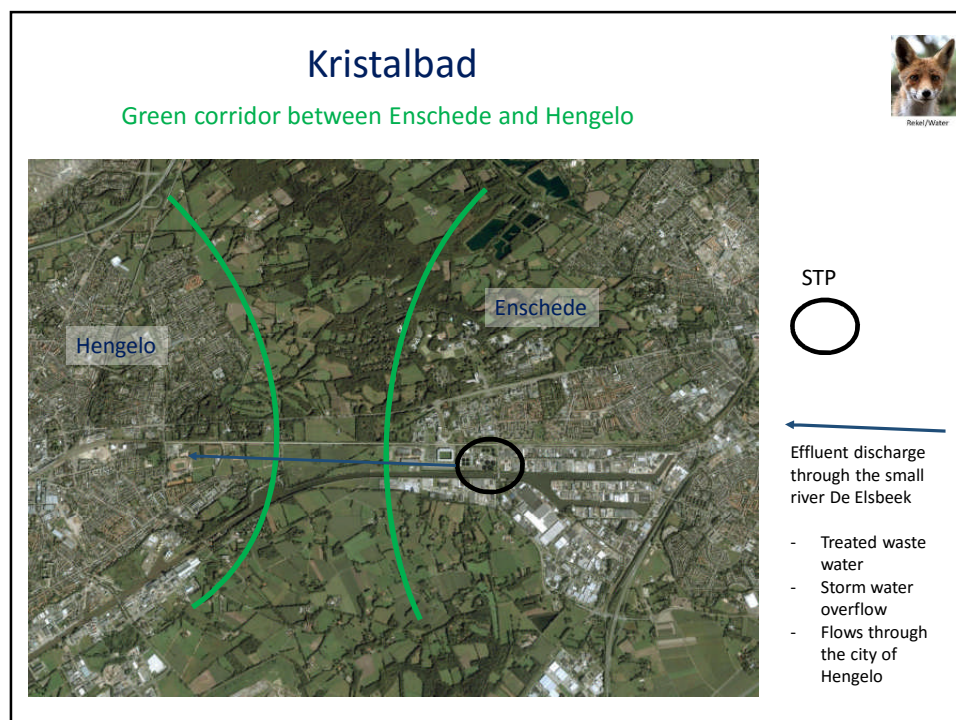
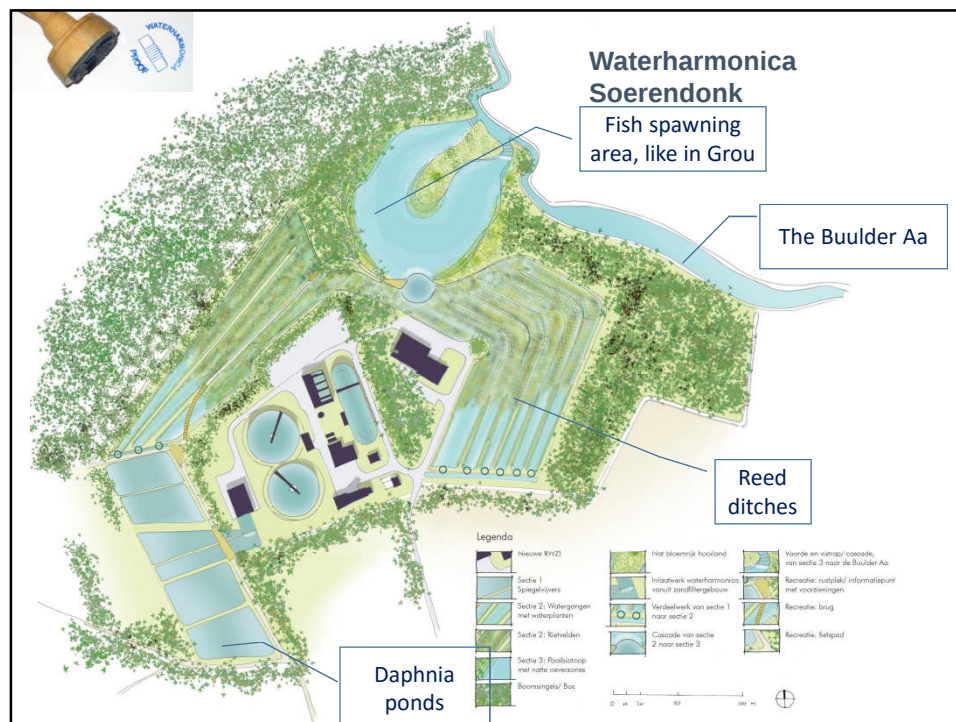


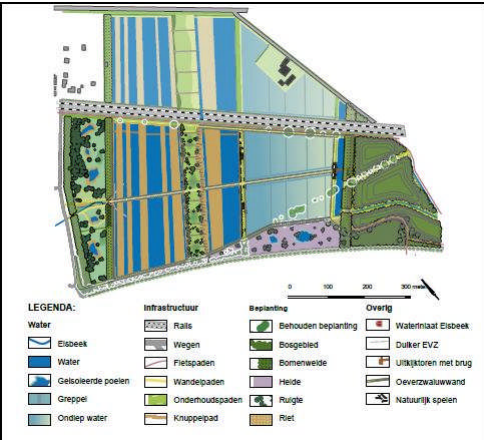
Spawning area for fish













Kristalbad

Land reformation plan ca. 40 ha

Project cost € 5.055.772

Innovation subsidy € 2.527.886

In operation 2013

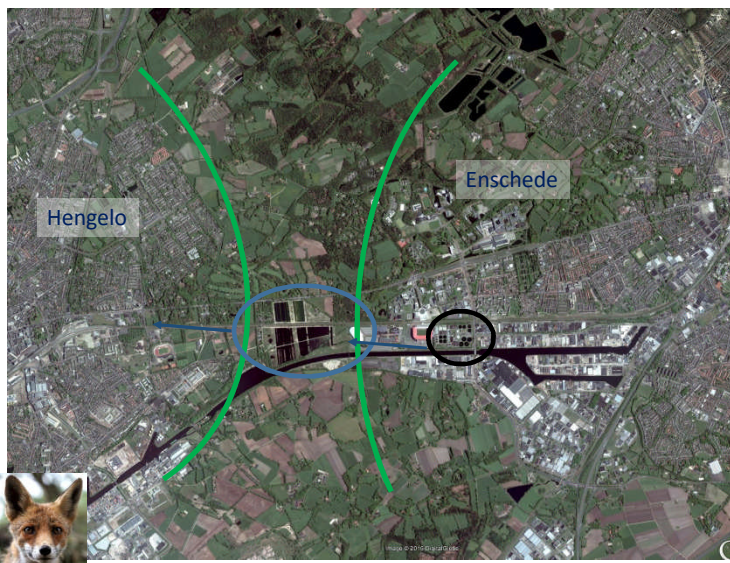
bronnen:
Senter-Novem KRW-innovatie programma
<http://www.berltribune.nl/images/stories/kristalbad-flyer.pdf>

5 functions integrated in one area

1. Water buffer: 187.000 m3
2. Ecological zone between cities of Enschede and Hengelo
3. Convert effluent into an "ecological sound water"
4. Spatial planning
5. Recreation and nature close to the two cities

Kristalbad

Green corridor between Enschede and Hengelo



the small river De Elsbeek

STP



Effluent STP



Waterharmonica Kristalbad



Outflow Kristalbad through the small river De Elsbeek





Rekel/Water

Kristalbad



Rekel/Water

De Elsbeek effluent to the Waterharmonica (Kristalbad)



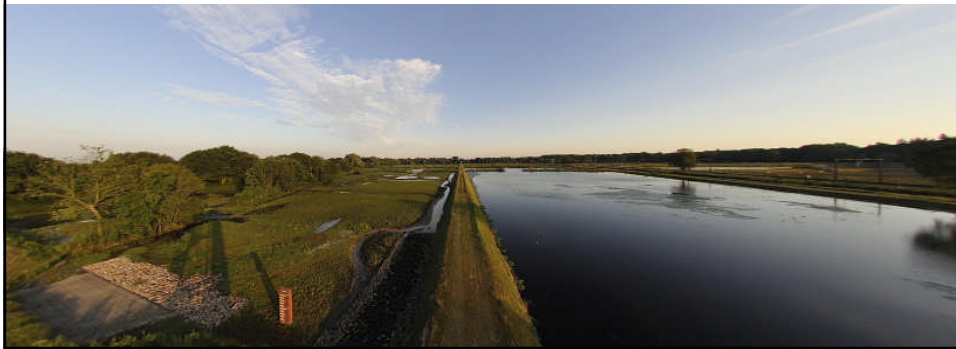
Rekel/Water

Praktijkbezoek Kristalbad

22 juli 2014

Foto's

*Ruud Kampf
Rekel/water*



Rekel/Water

Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014

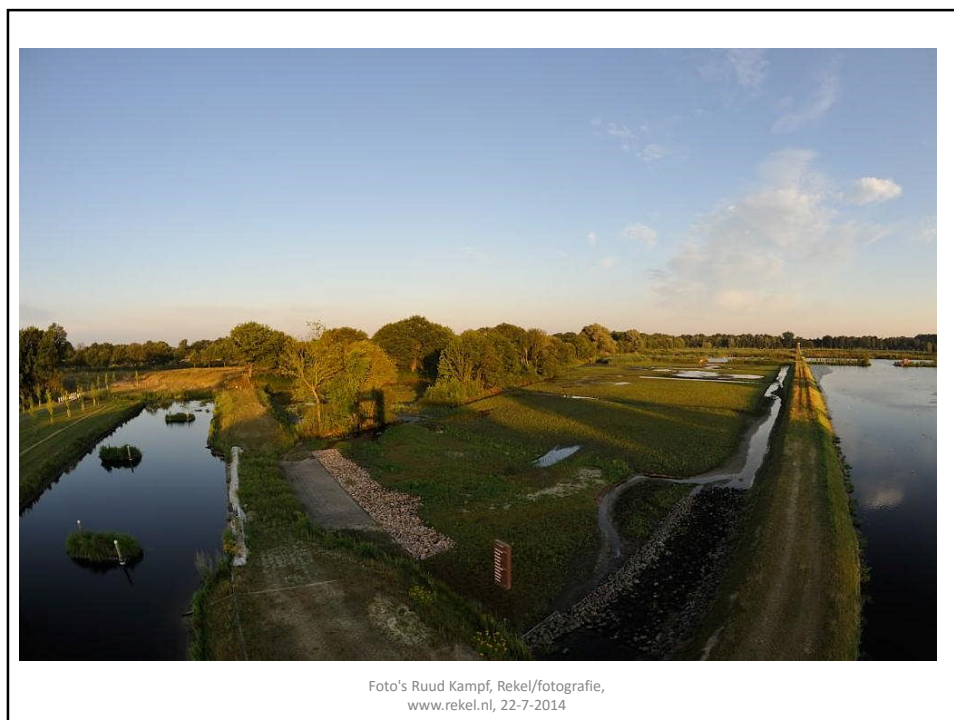
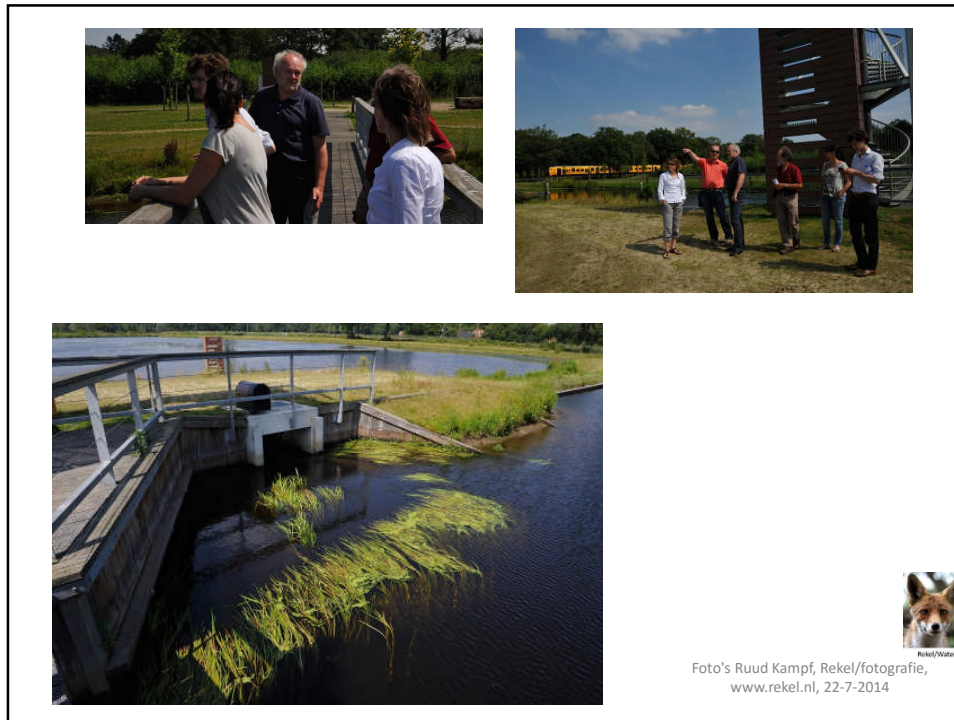


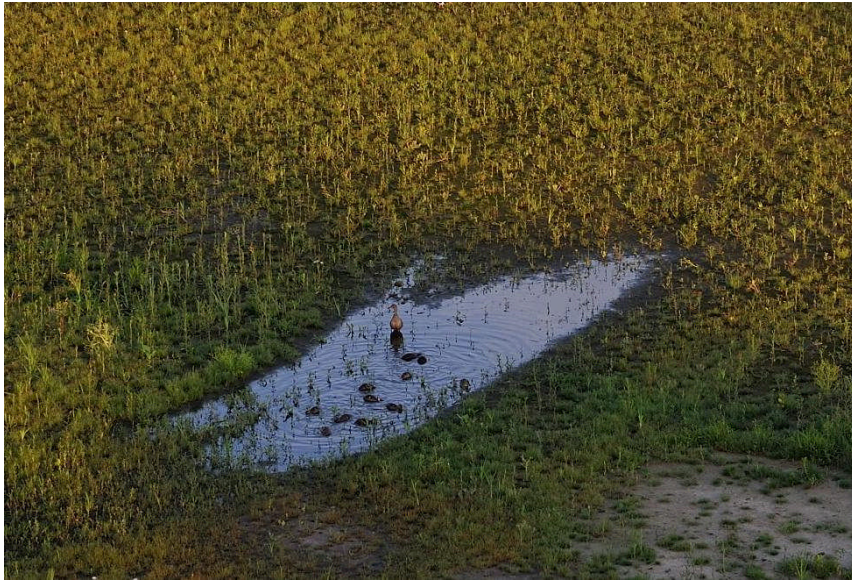


Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014

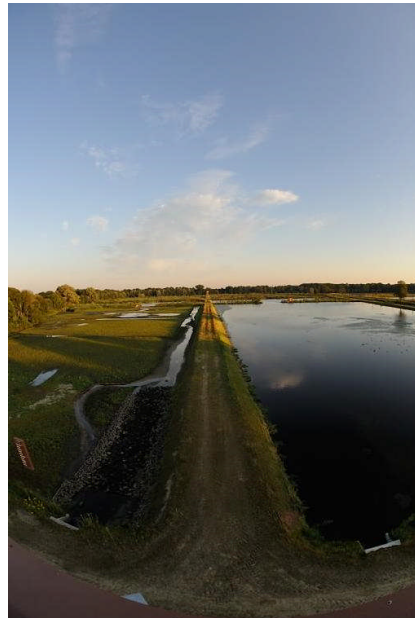
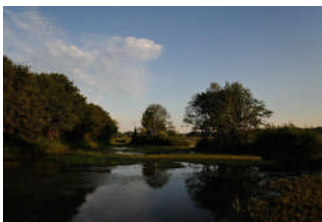


Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014





Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014



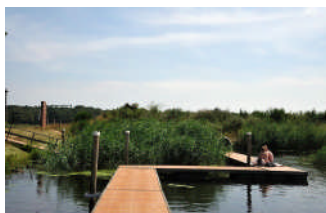
Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014



Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014



Foto's Ruud Kampf, Rekel/fotografie,
www.rekel.nl, 22-7-2014





Tilburg

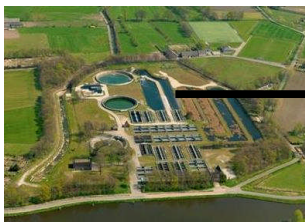
Waterharmonica Tilburg Noord

- max. Rise of water level 1.6 m
- water storage 240,000 m³



StormWaterharmonica Moerenburg:

- temporary storage and treatment of wastewater during stormwater events



STP Tilburg Noord

- Flow:
 - dry weather: 54,000 m³/day
 - storm water: 275,000 m³/day



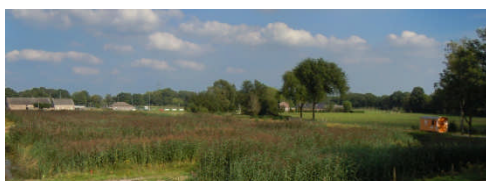
Waterharmonica Tilburg Noord



StormWaterharmonica Tilburg-Moerenburg



Tilburg-Moerenburg



Waterharmonica's – 2016 and beyond

No.	Name		Primary reason/reasons for construction
17	Berkenwoude	2016 – 2017	to remove nutrients, to make 'living' water, buffering
18	Ameland	2017	Making water for fish, combination with fish migration
19	Terschelling	2017	Making water for fish, combination with fish migration
20	Groote Lucht	2018 ?	Upgrading effluent to water for recreation

Trends:

- Sand filtration of effluent STP
 - Really needed when Waterharmonica?
 - Beneficial to make water for providing high-quality water for use in cities or nature

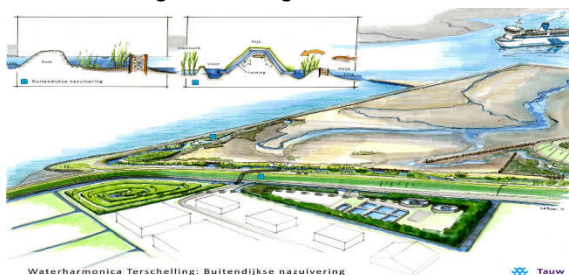


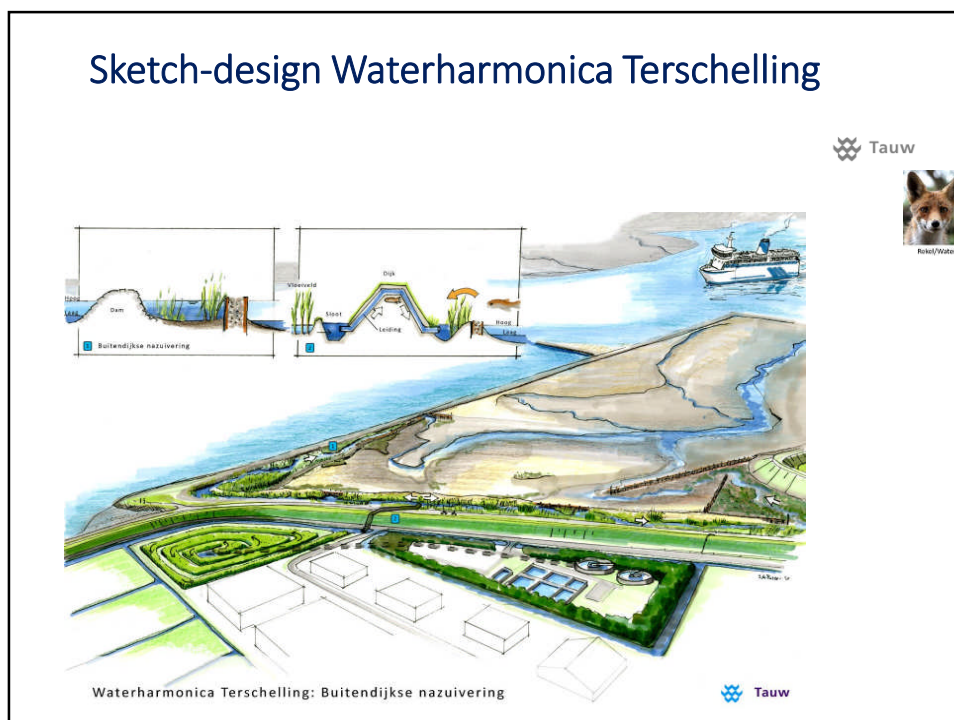
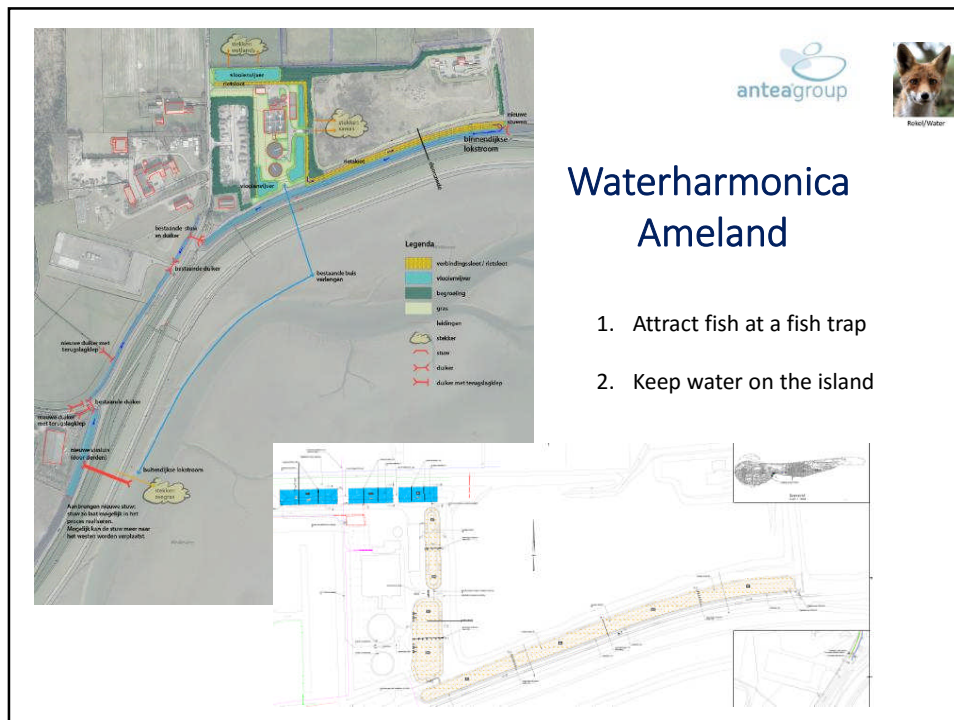
Waterharmonica's – 2016 and beyond

Berkenwoude - design



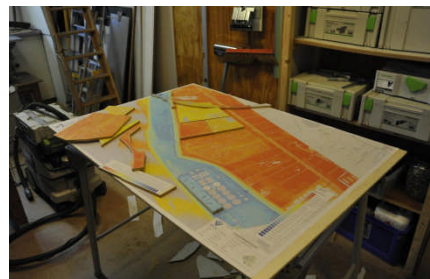
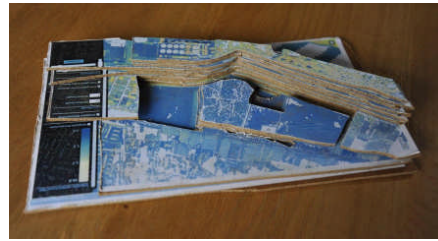
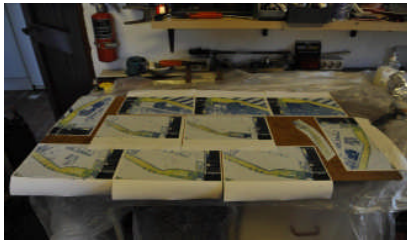
Terschelling Sketch design





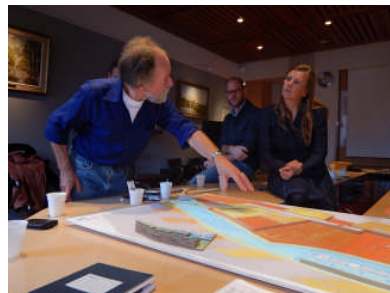
Waterharmonica De Groote Lucht

Preparing a design session 28 November 2014

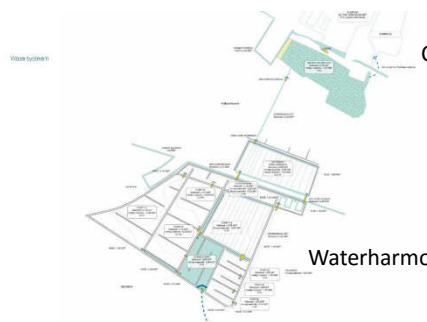


Waterharmonica De Groote Lucht

Design session 28 November 2014



Waterharmonica De Groote Lucht "De Rietputten": 2016



Clear and safe water for a recreational lake

Water Authority Delfland
Planning phase 2014 - ?

Waterharmonica

Effluent STP

Source: Toelichting Inrichtingsplan Waterharmonica De Rietputten, Willeveen+Bos, Fedes Othof, 2016