Pond ecosystem services (CONFORTO project)
How to assess the potential for flood control

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Small urban ponds

- **Created** for ecological, landscape, recreational or ornamental purposes
- Storm water management is **rarely a goal**
- **Supplied** by incident rainfall, neighbouring field, stream, drainage system, drinking water network
- **Water balance** happens due to inflow – outflow, by evaporation and evapotranspiration

Retention ponds

- Created to be technical
- Goal is storm water management and flood control
- **Supplied** by incident rainfall, from natural and urban catchments, by a diffuse way and pipes
- Downstream from the pond, the **receiving environment has to be protected** due to a **limitation criteria** at **the outlet** of the pond

Flood control potential of small urban ponds

Conforto
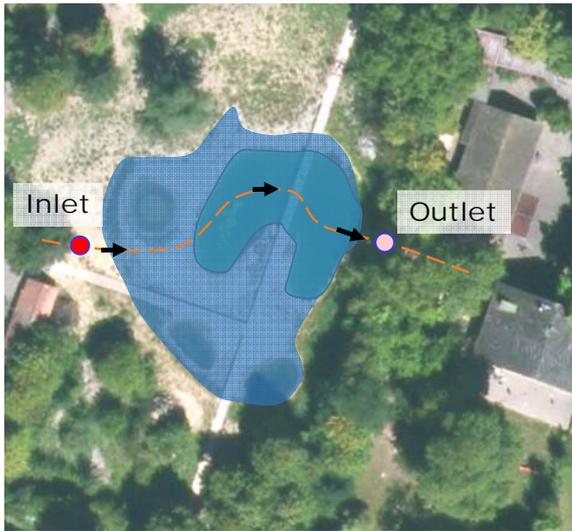
Cross-section

Retention : $V_R = 700$ m³ (1600 m²)

Permanent: $V_0 = 250$ m³ (500 m²)

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Expected spices in new urban ponds (Geneva)

Iris pseudacorus 49%

Lysimachia vulgaris 31%

Coenagrion puella 58%

Anax imperator 30%

Nymphea exotique/horticole 46%

Phragmites australis 31%

Libellula depressa 35%

Sympetrum sanguineum 25%

Typha latifolia 33%

Cloeon dipterum 53%

Sympetrum striolatum 30%

Bufo bufo (Crapaud commun) 13%

Pyrrhosoma nymphula 35%

Ischnura elegans 48%

Rana ridibunda (Grenouille rieuse) 13%

Mesotriton alpestris (Triton alpestre) 63%

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Assess flood control potential of small urban ponds

- Identify **catchment** and **contribution types** :
  natural, urban, diffusive **inlet** or pipe

  > Connect roofs too
  > Extend contributing area

- Determine **catchment variables** :
  areas (ha), slopes (%), runoff coefficients (-)

  > Improve runoff conditions
  > Guide surface water to the pond

- Chose the **design storm return period** (years)

  > Avoid overtopping

- Determine the **outflow limitation criteria** (l./s/ha)

  > Create an overflow pipe or spillway

- Design the **pond**
  location, surface (ha),
  permanent V_0 (m³) and retention volume V_R (m³)

  > Increase the room for V_R

- Design the **outlet**
  location, materials, weirs, orifice, overflow spillway

  > Be simple
  > Maintenance requirements should be low

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Retention ponds protect the receiving environment

Design storm, T(year)

Urban catchment

Pond

Outlet

Natural catchment

Flood control
by discharge limitation
at the outlet

Receiving environment protected

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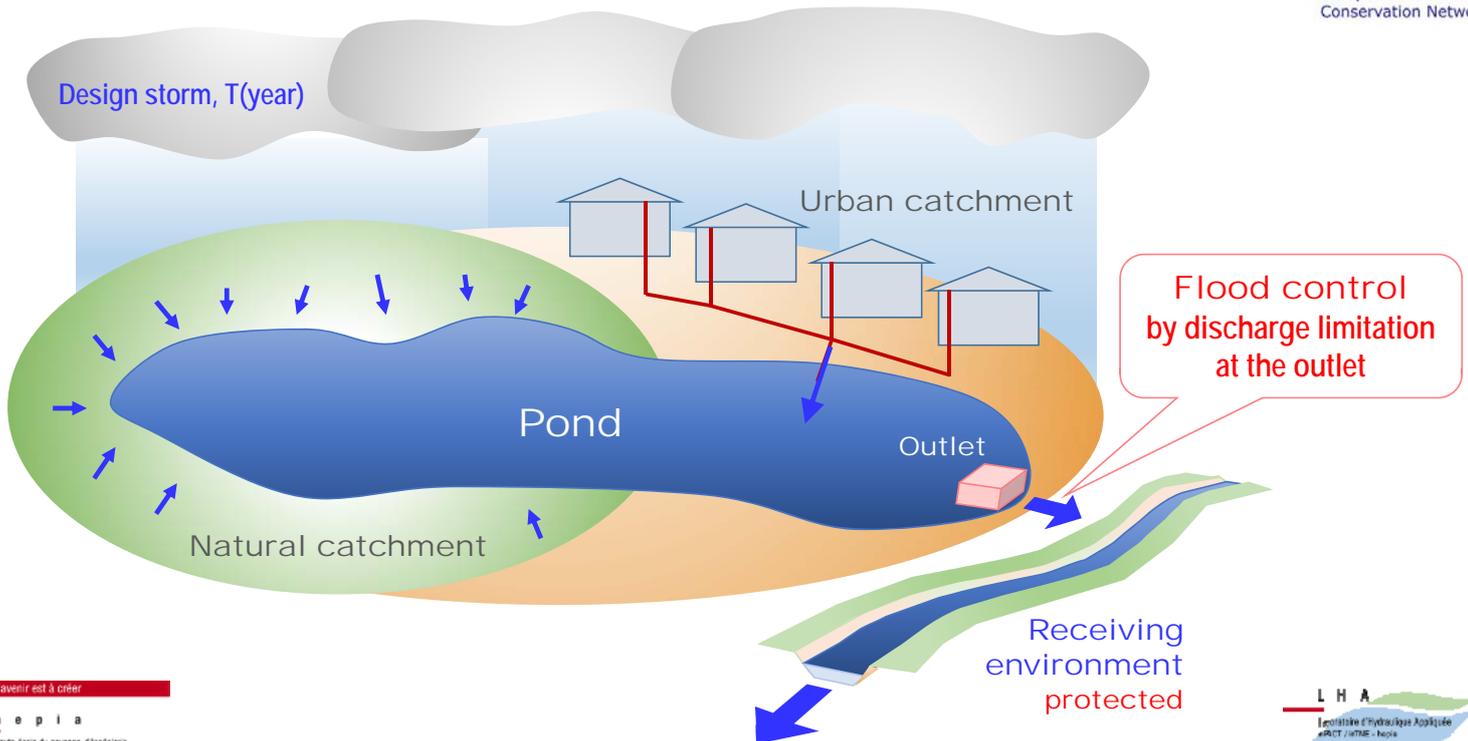
Flood control at the outlet

$$Q_{in} > Q_{out} \rightarrow V_R$$

$Q_{in,\,max}$

time

Q_{in}

V_R retention volume

Outlet

Q_{out}

Hydrology

Ecology

V_0 permanent volume

Aquatic habitat

$Q_{out,\,max}$

time
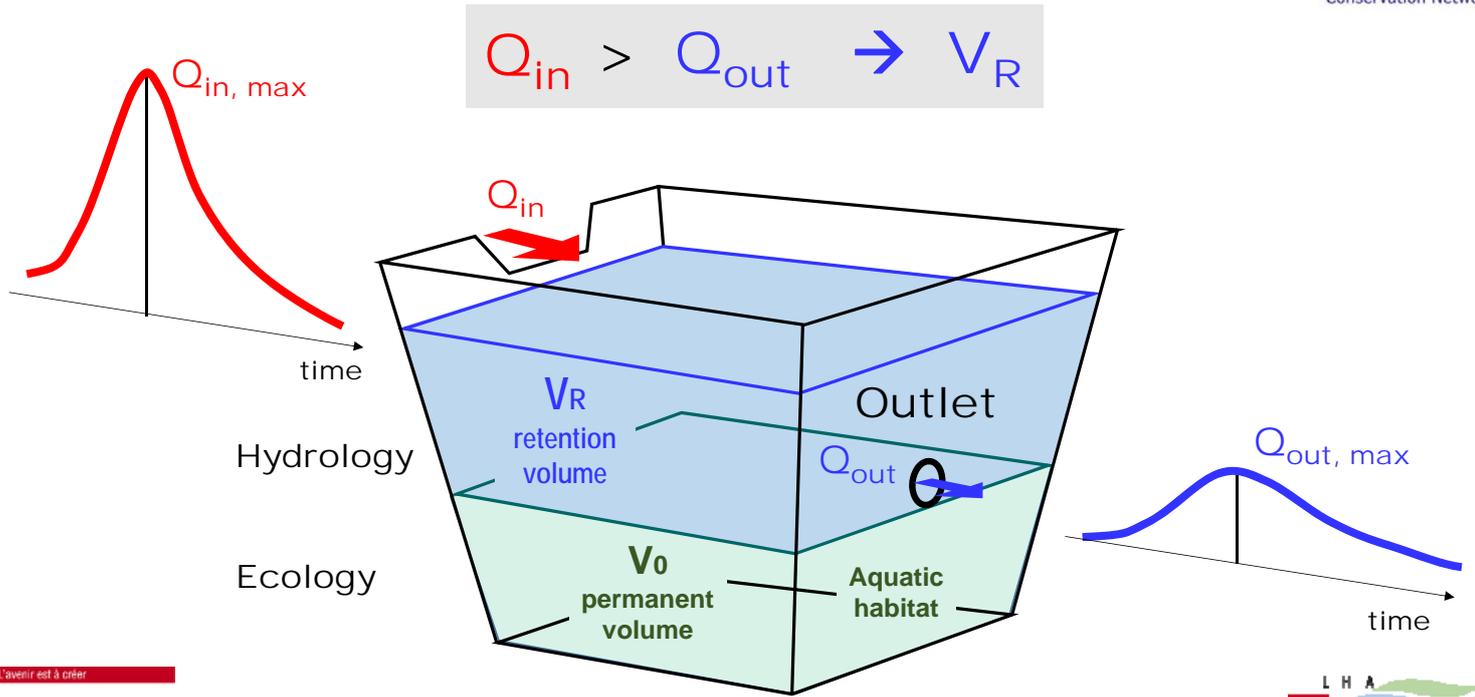
Highway retention ponds (polluted storm water)

Case study of Courfaivre – Jura CH
**Highway retention pond:** combines technical goal with ecology

Highway
250'000 m²

T = 30 years
V = 8'000 m³ runoff

Pond

$Q_{in} = 3.5 \text{ m}^3/\text{s}$

$V_R = 7'500 \text{ m}^3$
$V_0 = 3'500 \text{ m}^3$

$Q_{out} = 0.5 \text{ m}^3/\text{s}$

River

Stream

Transjurane

Hydraulic works

Embankment

Courfaivre – Jura CH

Inlet

Jetty

Sealant mat

Jetty

Outlet

Spillway

Tailrace

River
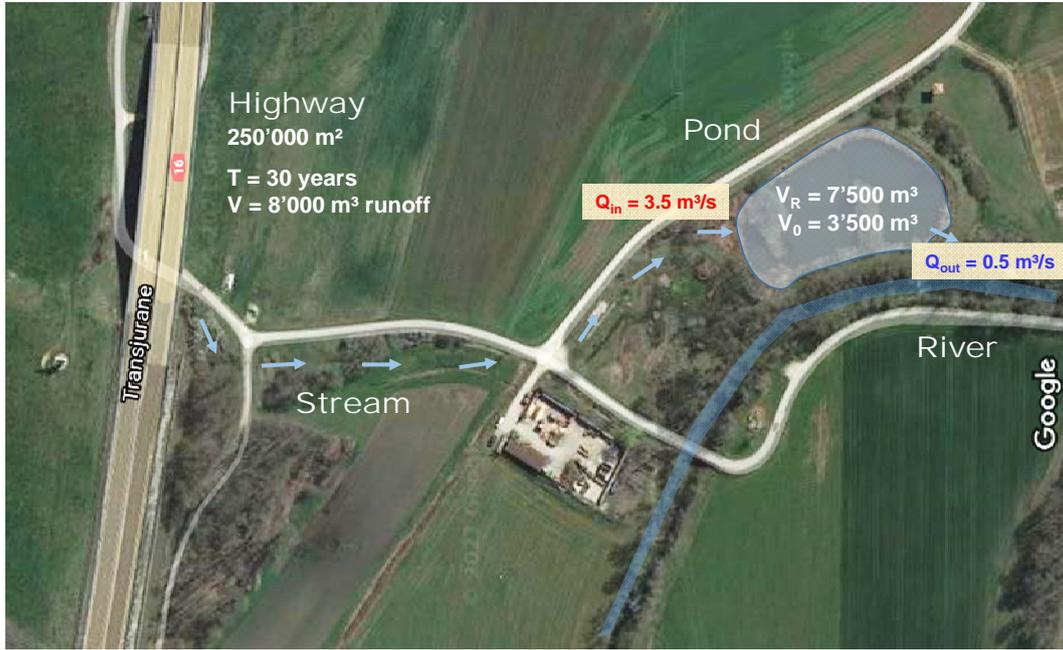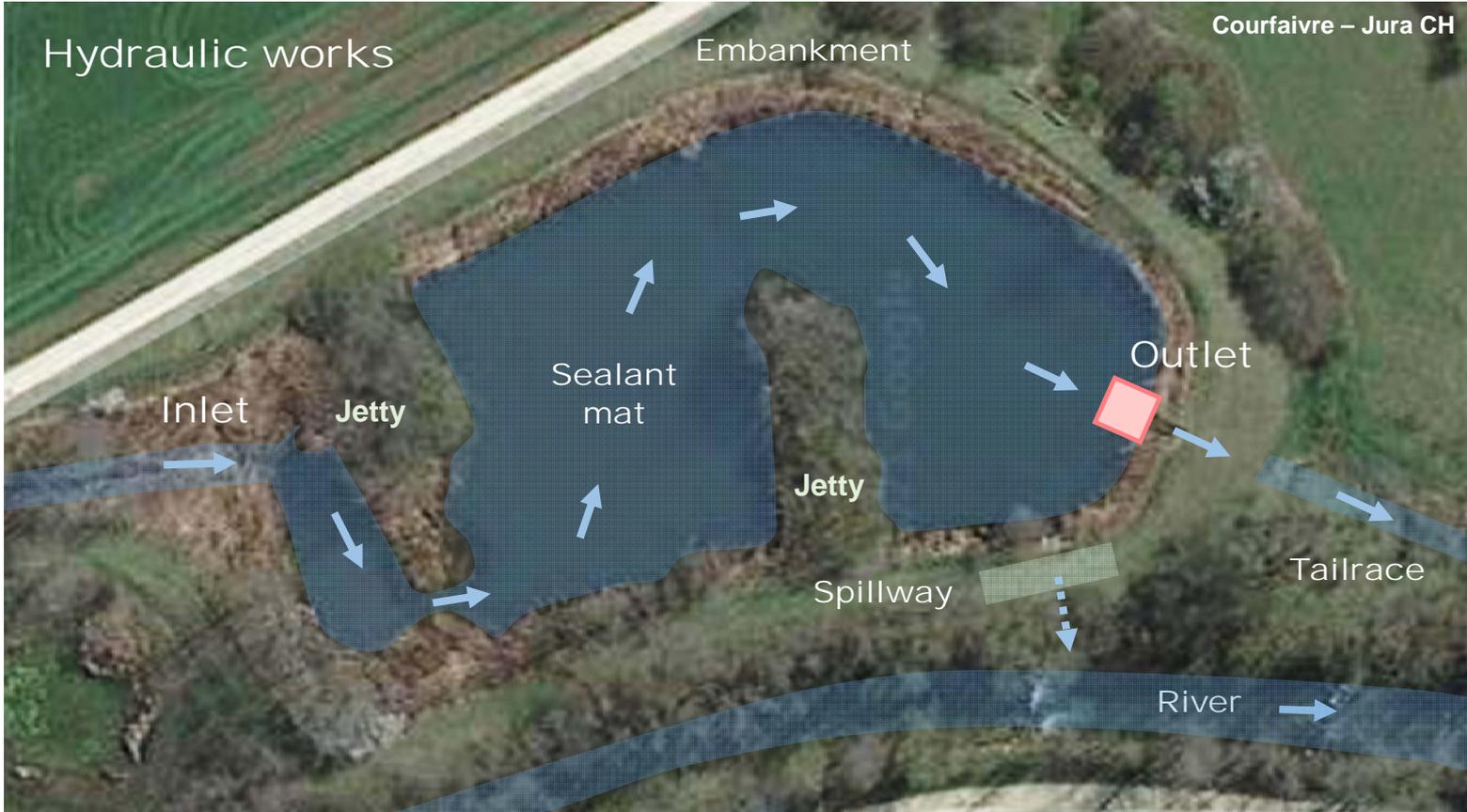
Outlet – Polluted storm water

Accident on the highway !
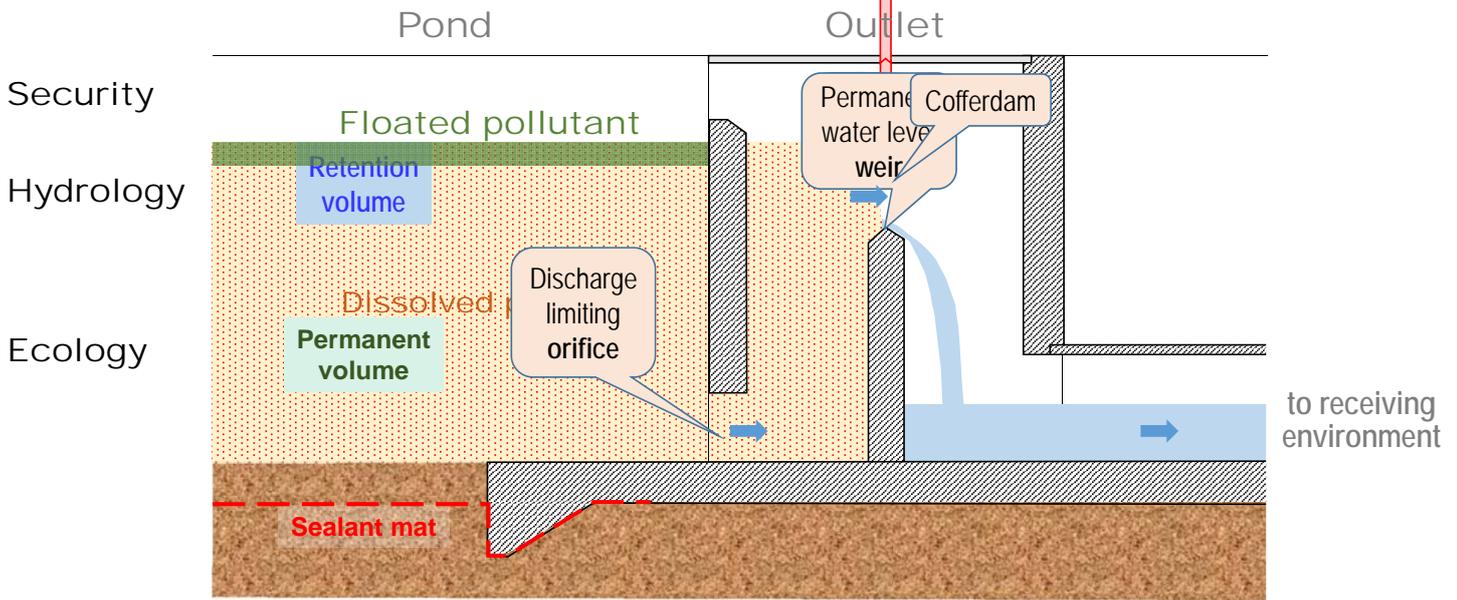
Inlet

Courfaivre – Jura CH

Three-pool retention / treatment pond

Courfaivre – Jura CH

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View from upstream
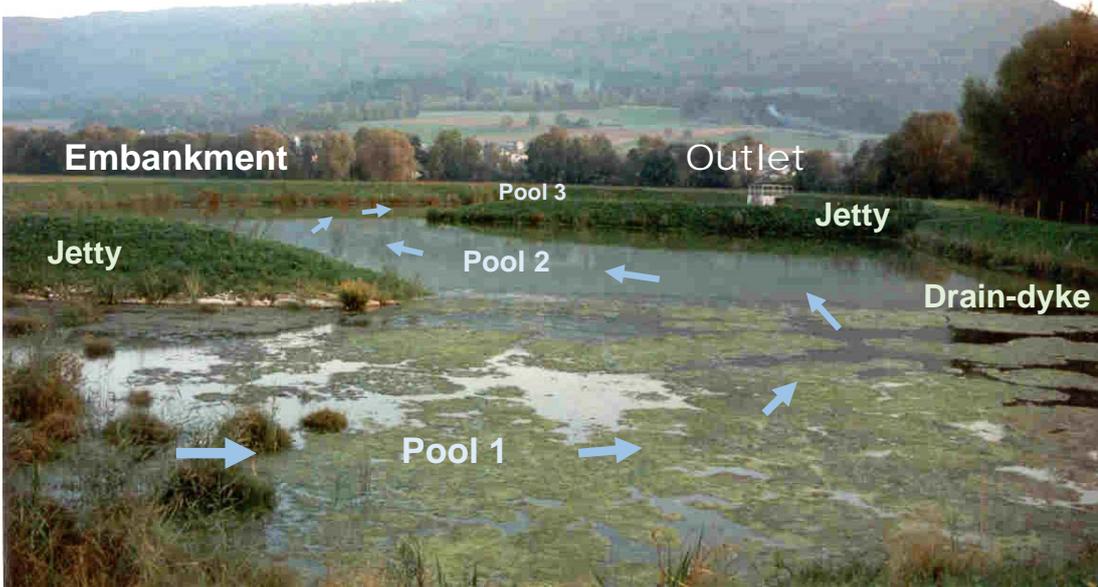
Anacaena lutescens
Haliplus lineatocollis
Lymnaea stagnalis
Crocothemis erythraea
Libellula quadrimaculata
Pyrrhosoma nymphula
Sympetrum striolatum

Embankment

Outlet

Pool 3

Jetty

Jetty

Pool 2

Drain-dyke

Pool 1

Nuphar lutea
Nymphaea alba
Ranunculus lingua
Iris pseudacorus
Caltha palustris
Carex elata

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Jetty – vegetated log caisson

Courfaivre – Jura CH

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Jetty

Pool 1

Pool 2

Salix purpurea
Salix viminalis
in log caissons

Carex elata, flava
Juncus effusus

Mixture of grasses and legumes – Jura CH

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Pool 3 and Outlet

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Outlet

Phragmites australis

Pool 3

Salix purpurea

Carex elata, flava
Juncus effusus

Typha latifolia

Jetty

Mixture of grasses and legumes – Jura CH
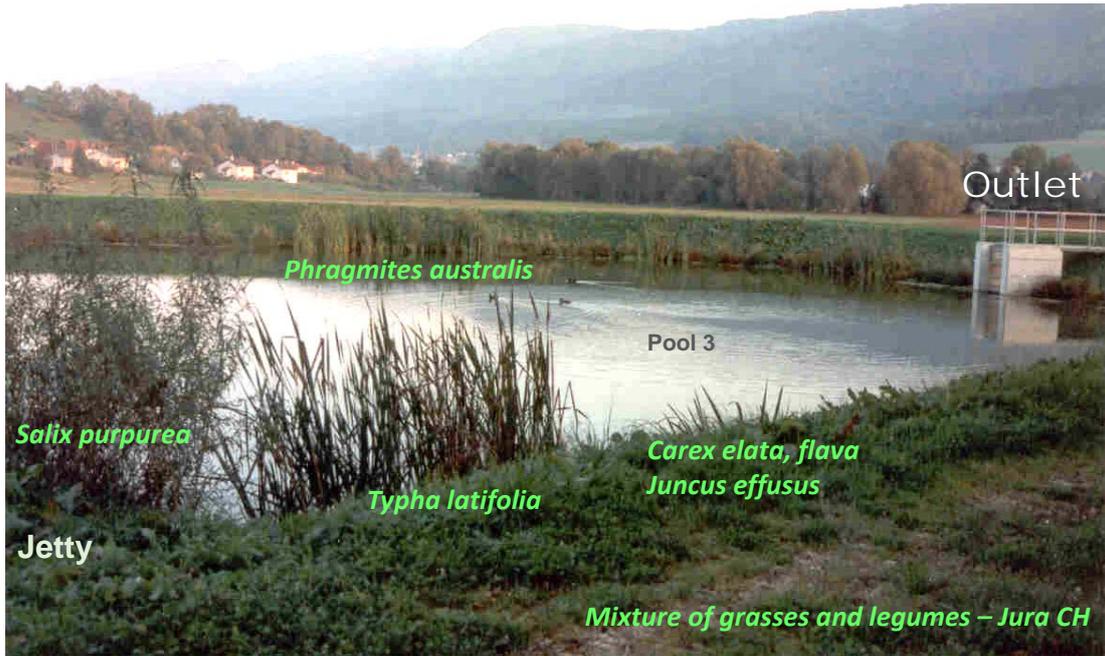
Outlet - Constructive aspects

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Embankment

Permanent water level

Outlet

Planting soil

Bentonite sealant mat

Gravel

Outlet pipe

Pool 3

Sand layer protecting the bentonite sealant mat

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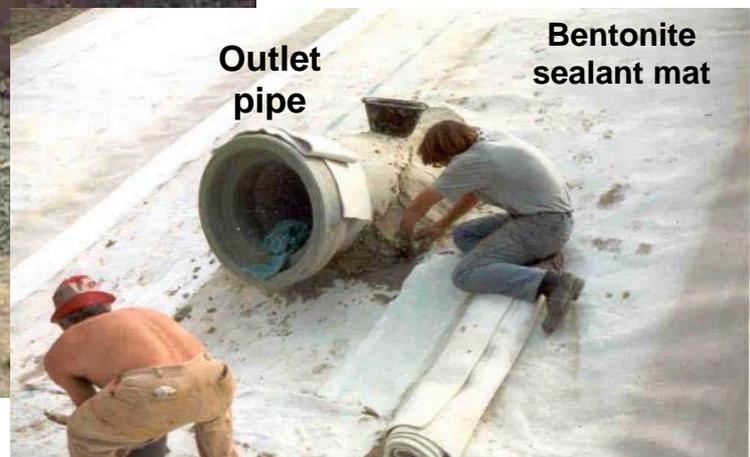
- Ponds should reach their hydrological goals
  by combining technical and ecological measures

- Civil engineers, biologists and landscape architects
  should work together

Thank you for your attention !

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