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Natural capping of the Volgermeerpolder

- from landfill to nature -

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Copenhagen, November 9-10, 2009
GreenRemediation, Incorporating Sustainable Approaches in Site Remediation

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Outline of the presentation

- introduction ACV
- background Volgermeerpolder (VMP)
- remedial planning, design and remediation (1998-2010)
- management phase: natural capping (>2010)
- lessons learned
- conclusions

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Introduction ACV

- 1 + 1 > 2
- 2000: Advising Combination Volgermeer
  - TAUW BV
  - Witteveen+Bos
- development “Natural Cap” approach
  - Volgermeerpolder
  - Ilperveld (landfill in nature area)
  - Kanaalpolder (interception ditch)
- Kyrgyzstan, Tajikistan, Uzbekistan

Tauw

Witteveen+Bos

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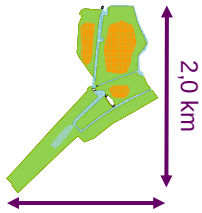
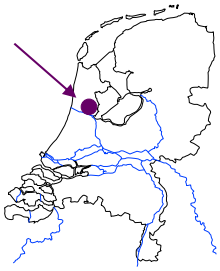
Background VMP – location

- 105 ha / 5 km north of Amsterdam
- marshy polder





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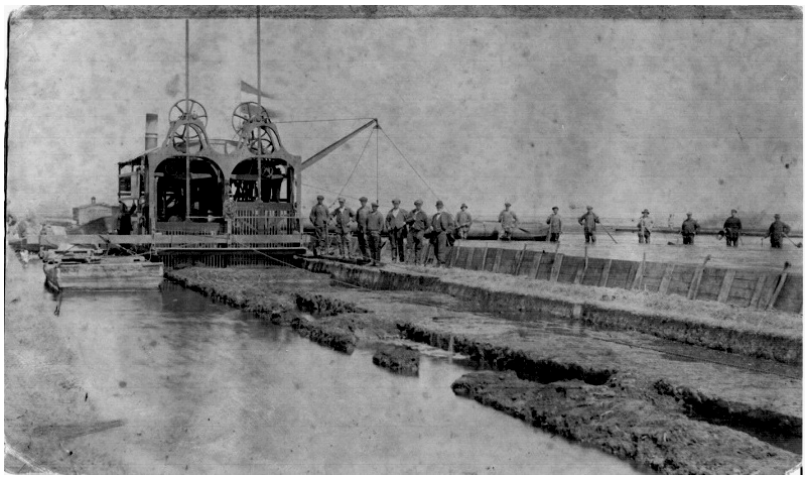
Background VMP – history

- former peat reclamation (~1900)



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Background VMP – history

- VMP used as landfill (1960-1970)

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Background VMP – the landfill

- landfill: 100 ha, ~8 m deep
- domestic and chemical waste
- mixture of contaminants:
  ~30,000 barrels with:
  – benzene
  – monochlorbenzene
  – Agent Orange
  – dioxines
  – …

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Background VMP – history

- closing landfill (1981)

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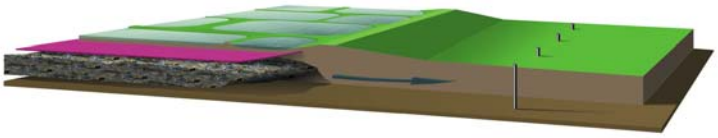
Remediation plan – Eco variant (1998)

Specific aims

- preventing contact risks
- prevention and control of waste spread
- creating conditions for developing a natural wetland

Remedial approach

- classic standard cover (soil / HDPE-foil)
- buffer zone with groundwater monitoring
- interception or isolation of the landfill



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Remedial planning and design (2001)

Create a new and natural wetland

- remediation of the VMP and adjacent areas
- structural design of the landscape, including a system of shallow ponds with dikes on top
- 60 ha wetland / 40 ha dry area

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Remediation – the standard cover (2005)

Remove contact risk / stop infiltration

- start 2005 / finished 2010
- collect material outside VMP (155.000 m^3)
- cover landfill with several surface sealing layers
  - HDPE-foil (renew after 50 years)
  - development nature (pond-system)

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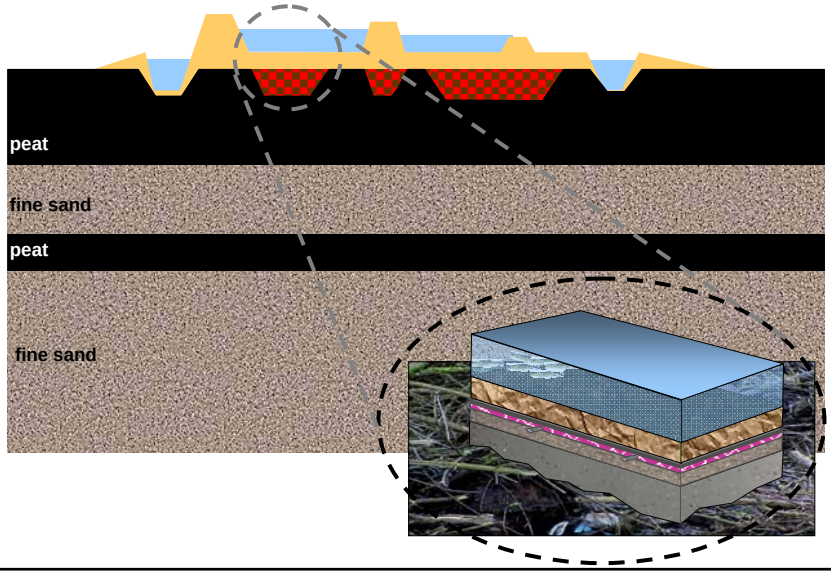
Remediation: cross-section pond system



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Remediation – groundwater monitoring

Buffer with groundwater monitoring
- control area
  - zone of 50 m around VMP
  - monitoring wells (350)
  - different depths

Results
- 30 years of results (>5 years)
- no spreading of contamination
- limited by surrounding peat soil
- peat works as a natural barrier

Conclusion: the waste was unintentionally dumped at a very favorable location

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Remediation → Management (>2010)

Aftercare
- standard cover → limited lifespan (50-100 years)
- replacement necessary after 30 years (according to remediation plan)
- considerable effort, resources and cost
- nuisance for those living nearby
- negative for redeveloped Flora & Fauna

To avoid replacement of the standard cover in 30 years, using the principles of nature, ACV developed the NATURAL CAP

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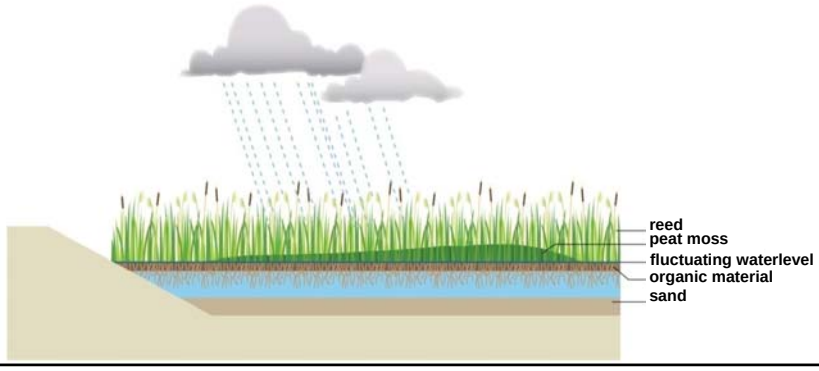
Management: introduction to natural capping

- Natural capping = gradual and functional replacement of the standard cover by a natural layer of living, organic material
- Use the time after remediation – the management phase – to create the natural cap



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Natural capping - VMP

- <u>natural cap</u>
  - recovery of peat in pond-system
  - peat as natural isolation
  - reduction of the risk of contact/spread
  - no renewal of foil necessary

- <u>advantages of peat as 'natural cap'</u>
  - grows naturally
  - added value for nature development
  - low permeability for water
  - a natural carbon filter for organic contaminants

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Management: developing the natural cap

Manage the area in such a way that:

- peat can grow in the shallow ponds
- in time create a sufficient layer of organic material
- take over the environmental, physical and hydraulic qualifications of the standard cover (foil)
- the spread of contamination is buffered by the peat soil

For this validation is necessary

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Validation of the natural cap

<u>knowledge development</u>

Research to understand the processes that are involved:

- with universities and research institutes
- recovery of peat (Centre for Wetland Ecology)
  - study optimal circumstances
  - practical experiment
- functioning of 'natural cap'
  - geohydrology
  - mass transport
    - adsorption
    - diffusion
    - microbiological decay
    - processes at surfacewater/groundwater interface
  - ecological risks
  - monitoring system

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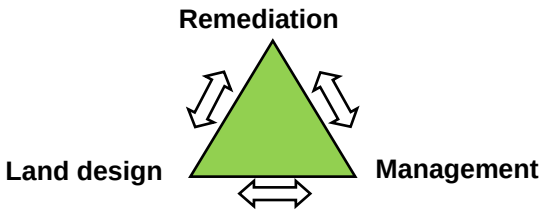
Lessons learned
- integration of design, remediation and management -

- the project is not finished after remediation
- look for opportunities in design and management
- use measurements and visual information from the remediation and – in time – adjust your original design
- to prevent risks, use natural occurring processes
- fit the landfill in the surrounding landscape



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The design, including the natural cap

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VMP – summer 2008

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Conclusions
The natural cap an example of green remediation

<u>green remediation</u>

- simple and effective concept, based on natural principals
- great potential for landfill remediation
- prevents replacement of the standard cover
- a solution for landfill remediation (worldwide)

<u>sustainable</u>

- peat captures significant amounts of CO2
- peat as isolation
- interception of contaminants by peat as a carbon filter

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And it will look great!