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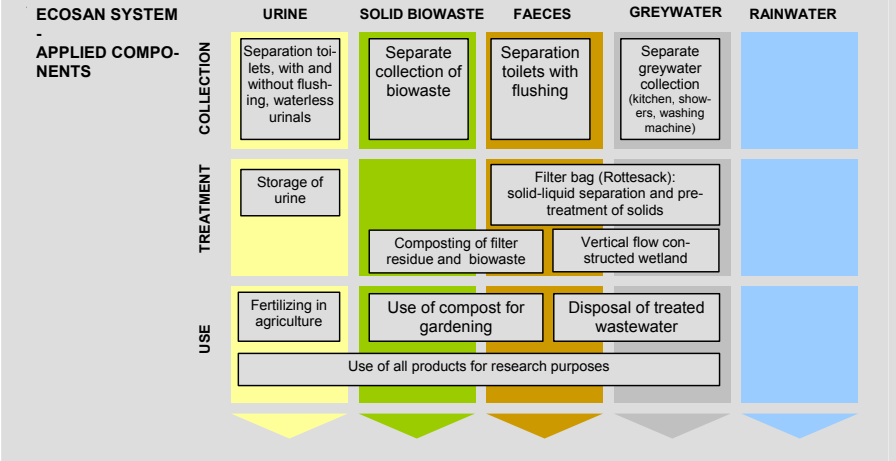
Innovative wastewater management project "Lambertsmuehle"

Burscheid, Germany



1 General Data

Type of Project:
Rural upgrading, research and demonstration project

Project Period:
Start of construction: mid-2000
Start of operation: mid-2001
Final Research Report: 2005

Project Scale:
8 population equivalents

Address:
Lambertsmühle zu Burscheid
51399 Burscheid, Germany

Planning Institutions:
- Otterwasser GmbH, Wupperverband

Research Partners:
- Bauhaus-Universität Weimar, Professur Siedlungswasserwirtschaft
- Hygiene-Institut des Ruhrgebietes
- OtterWasser GmbH
- Rheinisch-Bergischer Kreis
- Rheinisch-Westfälisches Institut für Wasserforschung an der Gerhard-Mercator-Universität Duisburg
- Technische Universität Hamburg-Harburg, Arbeitsbereich Abwasserwirtschaft,
- Universität Bonn, Institut für Pflanzenernährung
- Universität Bonn, Institut für Hygiene und öffentliche Gesundheit
- Verein zur Förderung der Lambertsmühle zu Burscheid e.V.
- Wupperverband
- Wupperverbandgesellschaft für integrale Wasserwirtschaft mbH

Project owner:
Verein zur Förderung der Lambertsmühle zu Burscheid e.V.

Supporting Agency:
Ministerium für Umwelt und Naturschutz, Landwirschaft und Verbraucherschutz des Landes Nordrhein-Westfalen

Figure 1: The historical watermill Lambertsmühle *(photo: GTZ)*

2 Objective of the project

1. Implementation of an innovative independent wastewater management system taking the natural hydrological and nutrient cycle into consideration. Local conditions required a self-sustaining system, as connection to the public sewer system would have been too expensive due to the long distance.

2. Demonstration of innovative closed-loop systems for wastewater management.

3. Research and development: gaining practical experience with source separating techniques and split stream treatment technologies. Objectives of the research project have been:

- to obtain experience with source separating technologies and the treatment of the separate flow streams.
- to analyse separation efficiency and hygienic quality.
- To investigate the concentration and type of pharmaceutical residues in recovered material.

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ecosan sector project

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commissioned by:

Federal Ministry for Economic Cooperation and Development

- To investigate possible degradation and decomposition of micro-pollutants in the urine and their transfer to soil and plants.

The "Lambertsmühle Project" is one of the first projects in Germany considering source separation. Research results are therefore important for the further development of this technique.

3 Location and general conditions

The "Lambertsmühle" is an old water mill that today serves as a museum, located between Wuppertal and Cologne in Germany. As part of the renovation of the building a progressive sanitation concept has been developed for the museum and the apartment in the millhouse.

4 Technologies applied

For the separation of urine and faeces 3 different separation toilets and waterless urinals have been installed:

Figure 2: Waterless urinal *(photo: Otterwasser)*

(1) BB-Innovation, Sweden
(2) WostMan, Sweden
(3) Roediger, Germany
(4) Waterless urinals, Ernst, Germany

The urine is collected in a special storage tank (volume: 4 m³, storage capacity: approximately 1 year).

Faeces and greywater are flushed separately into the wastewater system, where liquids and solids are separated by centrifugal force. Solids enter a filterbag, where a filtering and dewatering occurs. After half a year of storage they are then composted. This composting process is supported by adding further organic material such as wood chips.

Figure 4: Liquid / solid-separator *(photo: Otterwasser)*

Figure 5: Constructed wetland *(photo: Otterwasser)*

The liquid phase is treated in a constructed wetland together with greywater from the mill.

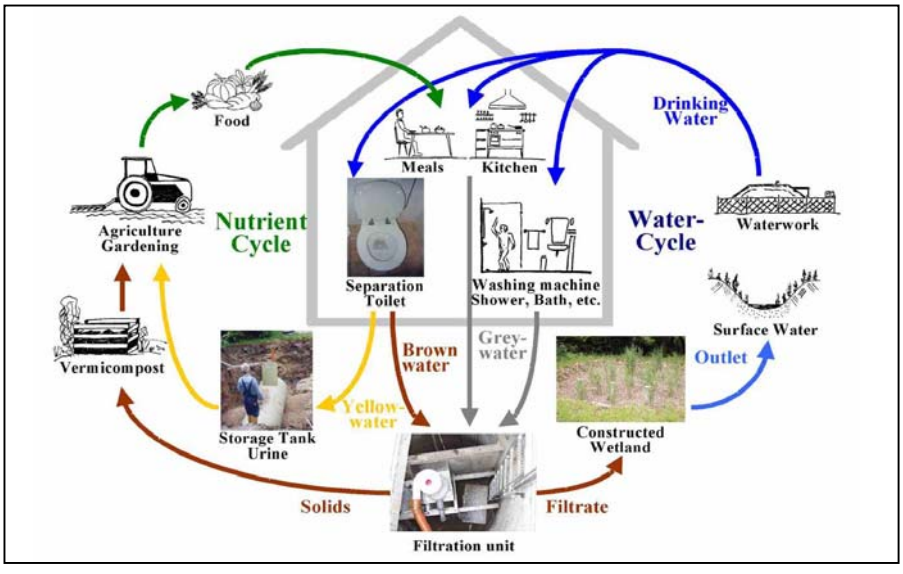

Figure 3: Water and nutrient cycle (graphic: Otterwasser)

5 Type of reuse

The urine collected is used as a biological fertiliser in agriculture.

The urine has the same fertilising capacity as a mineral fertiliser, but due to the salt-concentration and possible negative effects on the plants a dilution (e.g. with manure) is recommended.

Most of the micro-pollutants (pharmaceutical residuals) are found in the urine. Investigations concerning their concentration, transfer to the soil and plants, and decomposition were finished at the end of 2004. The results will be published in spring 2005 (source, see end of this paper).

The quality of the compost as a soil conditioner and biological fertiliser has been investigated and meets general compost standards.

The greywater treated by the constructed wetland is discharged to a small creek.

The nitrogen concentration in the effluent of the constructed wetland is very low (< 12 mg/l) as a result of the urine separation. The source of the remaining nitrogen is mainly one non-separating toilet in the house, which was not converted to a separating model.

6 Further project components

A questionnaire was distributed to the users. However results have not yet been obtained due to the low number of visitors.

A risk assessment is one of the main results of the second investigation phase.

7 Costs

The complete investment costs for the installation were approx. 47.000 €. The particular demands of the protection of historical monuments and the research project resulted in elevated costs.

The Ministry for Environment and Nature Conservation of the Federal State Nordrhein-Westfalen has supported this pilot project .

8 Operation and Maintenance

The operation and maintenance consists of:

- Emptying the urine tank.
- Controlling the collection of the solid material.
- Emptying the filtration unit (once a year).

- Control of the constructed wetland.

This is carried out by the Wupperverband on behalf of the Lambertsmühle society.

9 Design information and technical specifications

The urine tank is designed for a storage of more than 6 months.

The solids collection in the filter-bags is calculated for a storage time of one year.

The design parameters for the wastewater treatment plant are as follows:

	COD mg/l	BOD_5 mg/l
Input	300 - 500	200 - 300
Output	30 - 40	5 - 8

10 Practical experience and lessons learned, comments

Not all separation toilets proved suitable. Children in particular need special seats and shapes.

Nitrogen loss during urine collection and storage is negligible and the urine can be used as liquid fertiliser. Under both external and greenhouse conditions, investigations showed the growth rate of plants fertilised with urine to be similar to those treated with mineral fertiliser or manure.

Standards for wastewater treatment given by the authorities can be achieved without any problems.

The phosphorous elimination capacity of the constructed wetland decreases after three years of operation.

Since the faecal compost was too humid a composting by worms (vermiculture) was implemented. This improved the process and the solid materials can be handled like conventional compost.

The separation of solid and liquid fractions before the filter-bag unit was an amelioration during operation. It has improved the dewatering capacity compared to the first trials, when both fractions were flushed into the filter bag.

Micro-pollutants are mainly concentrated in the urine. These substances may limit the utilisation of the urine.

Through urine separation the emission of persistent organic pollutants to the natural environment can be avoided. Additionally the emission of nutrients in the receiving waters can be reduced and artificial fertilisers can be replaced.

Further investigations have to be focussed on the behaviour of the micropollutants in urine and technical treatment for the destruction of these substances may need to be developed in the future.

11 Available documents and references

- The report of the investigation phase I (2001-2002) can be downloaded from the project homepage: http://www.lambertsmuehle-burscheid.de
- The report of phase II (2003–2004) will available soon on the same site.

Both reports are only available in German.

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