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Development of sustainable water provision and wastewater disposal concepts for the 35-hectare new development in New Town Hashtgerd

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p2mberlin **inter 3**	Development of Water Management Strategies for Arid and Semi-arid Regions – a case study from Tehran (2003-2006).
p2mberlin **inter 3**	Consulting services for the DBO of a wastewater treatment plant in Ahwaz, (2007-2010).
inter 3 p2mberlin	Integrated Water Resources Management in Esfahan. Case Study (2005-2006).
p2mberlin **inter 3**	Training Program for Employees and Managers from the Tehran Province Water and Wastewater Company
p2mberlin **inter 3**	WTP No. 7 in Tehran – Consultancy Services (2006-2008).
inter 3 p2mberlin	National Wastewater Financing and Investment Strategy in Iran (2008).
inter 3 p2mberlin	Optimization of Water and Wastewater Sector in Iran (2008-2009).
p2mberlin **inter 3**	Consulting services for the DBO of a wastewater Pumping Station in Ahwaz, (2008-2009).
p2mberlin **inter 3**	Consulting services of rehabilitation of wastewater treatment plant West Ahwaz, (2008).

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Conditions

- Existing drinking water connections
- Insufficient wastewater disposal system
- 35-hectare new development: 1800 living units and 8 public buildings

Approach

- Catch-up strategy
- Modern strategy
- Overtaking strategy

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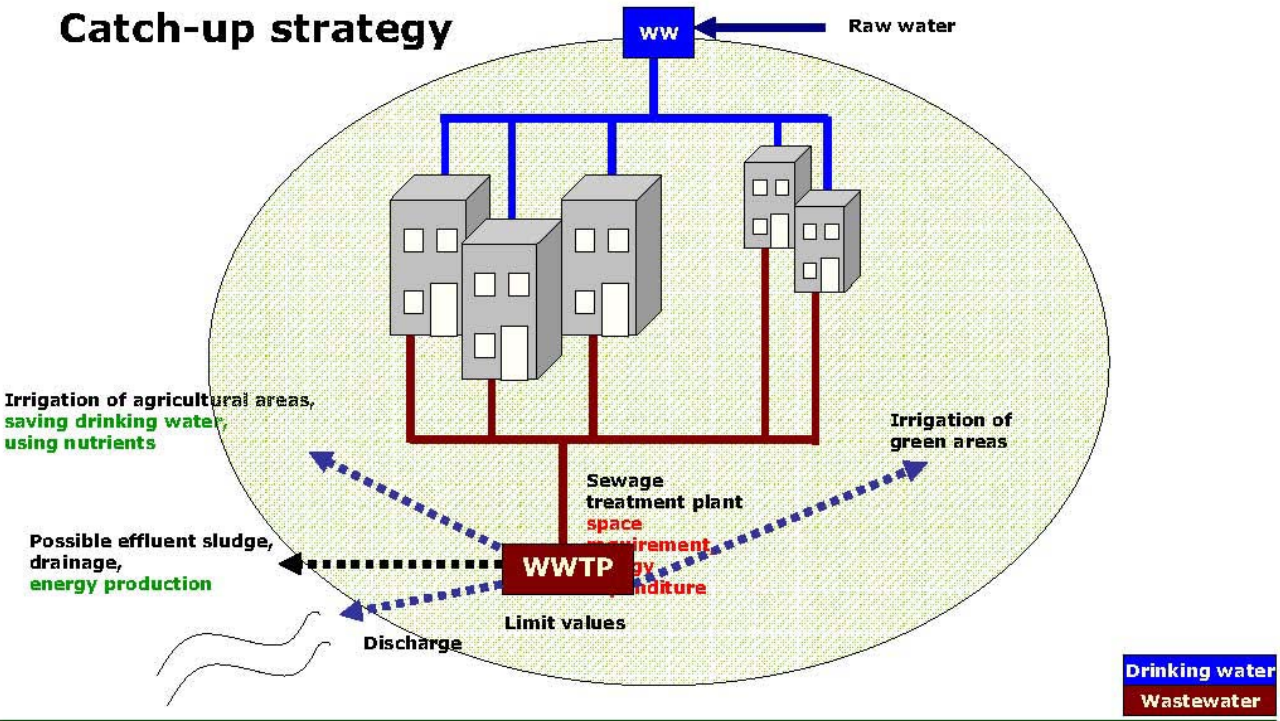
Catch-up strategy



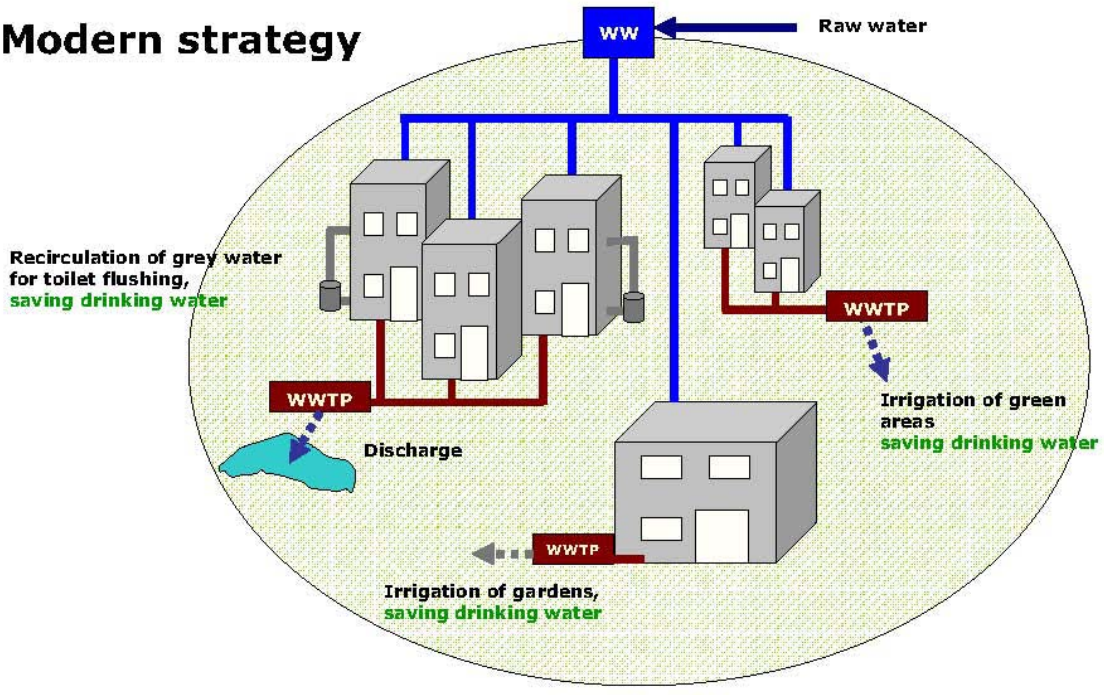
Wastewater treatment plants (WWTP)

- Activated sludge process
- Biological filter system
- Wastewater ponds (aerated/ non-aerated)

Wastewater treatment plant, Ruhleben, Berlin

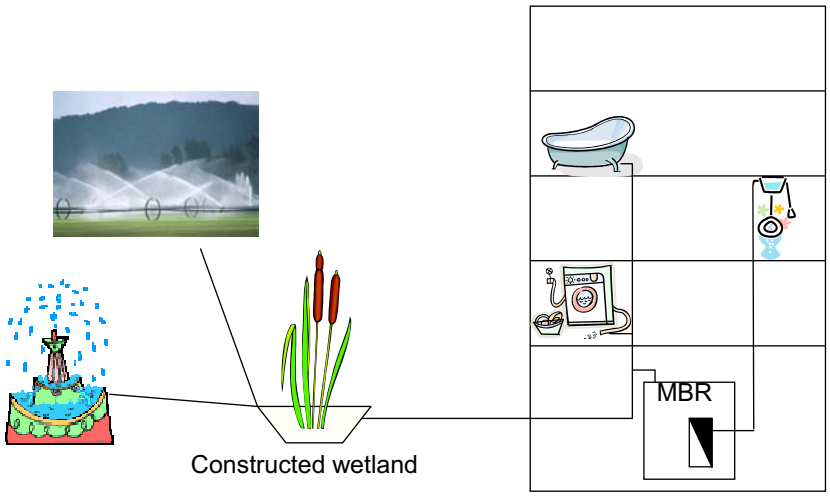
Non-aerated wastewater pond, Colombia

Modern strategy



Grey water

- Grey water is only slightly polluted and thus purification requires little effort



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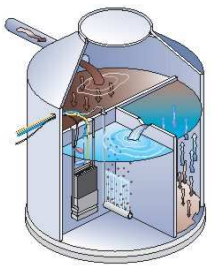
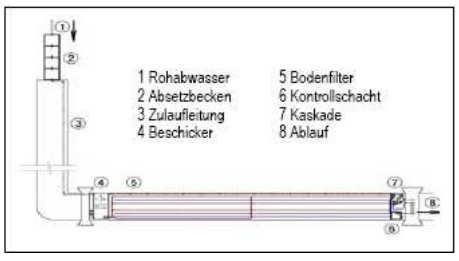
Grey water purification

HUBER Membrane Clear Box plant

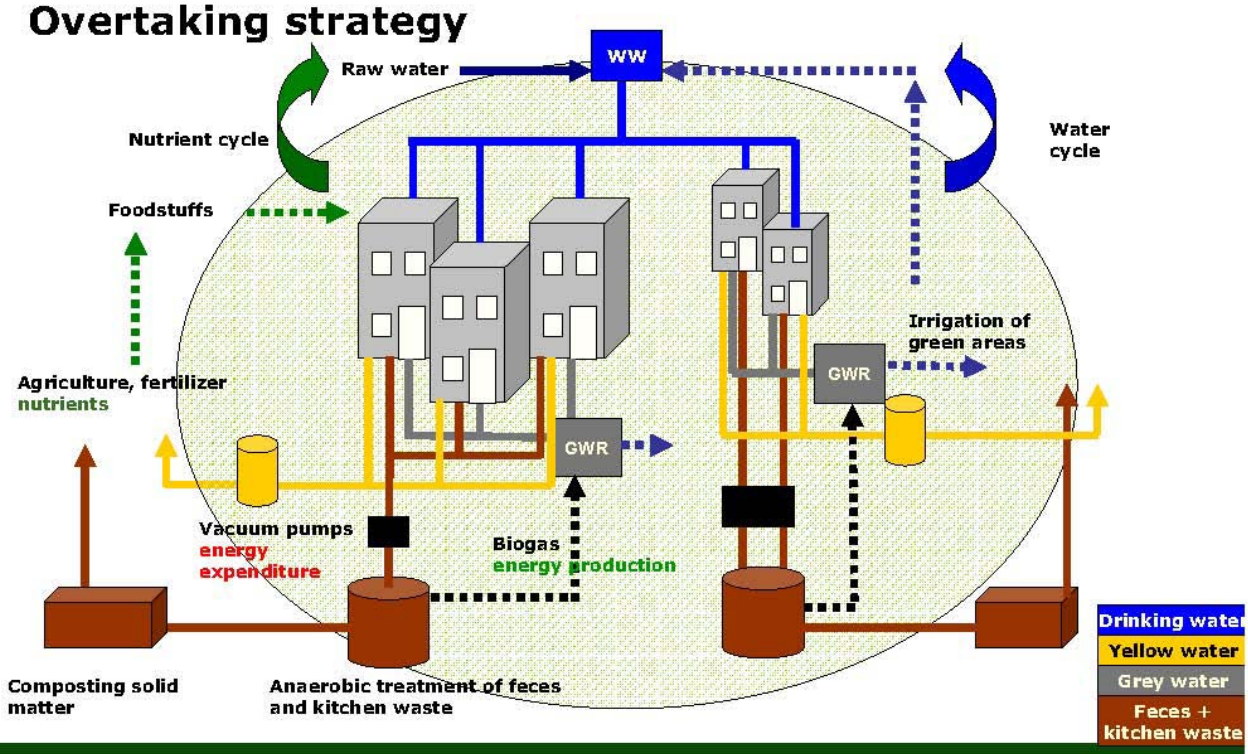


Urban constructed wetland



Constructed wetland HuaXin / Shanghai
Engineering Company Janisch & Schulz mbH

Overtaking strategy



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Yellow and black water

- Separation of urine and feces enables a specific usage
- The less water the better for use (vacuum toilets)
- Collection with separation toilets
- Urine: fertilizer, feces: biogas

Wastewater management for the 35 ha area
- Sketch of implementation ideas -

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General Approach 1

- The 35 ha area is viewed as a test field for innovative water and waste water technologies
- Estimated population: 8000 persons
- Current water consumption: 275 l/P d (Tehran)
- Aimed water consumption: 180-200 l/P d

General Approach 2

- Water saving installations in all living units and public buildings
- Education of the inhabitants for development of water saving habits
- Separate collection and reuse of low polluted greywater (showers, bath tubes, sinks)
- Installation of special technologies in well suited objects
- Combined fermentation of waste water compounds/sludge and bio-waste for bio-gas production

Wastewater

- A max daily amount of 2200 m³/d waste water can be calculated
- The greywater content is about 70% (max 1500 m³/d)

	Production (g/Pd)	C total WW, 273 l/Pd (mg/l)	C total WW, 180 l/Pd (mg/l)	C grey-water, 273l/Pd (mg/l)	C grey-water, 180l/Pd (mg/l)
COD	120	440	660	200	300
BOD	60	220	330	100	150
TKN	11	40	60	6.6	10
TP	2	7	11	1.6	2.5

Grey water

- Grey water from showers, bath tubes, sinks and washing machines is collected separately
- water from kitchen is collected together with the black water
- Treatment in semi-centralized constructed wetlands
- Reuse for irrigation, artificial water bodies and as service water

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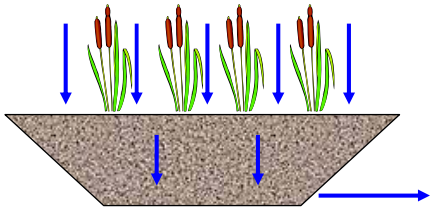
Grey water Reuse

- Construction of a central green space
- Artificial water body and fountains
- • Service water points in each court

Constructed Wetlands for Greywater Treatment

- Low polluted waste water, low content of solids (no kitchen), no odour annoyance
- Waste water is treated by the plants and micro organisms in the soil filter
- Design basis: 1 m²/PE, vertical flow
- Semi-centralized treatment:~500 m² per CW
- Harvested plants can be used for energy production



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Constructed Wetlands 1

- 1 to 2 blocks are served by one CW
- Vertical flow reduces the needed surface
- Vertical flow enables freedom in design of geometries

Possible areas for the CWs

Constructed Wetlands 2

- High germ reduction, effluent has bathing water quality
- Surfactants (mainly transported in grey water) are removed up to 99% in CW
- Besides reed also more attractive plants such as e.g. special types of Iris or Canna are possible

Iris hexagonae

Canna Lily

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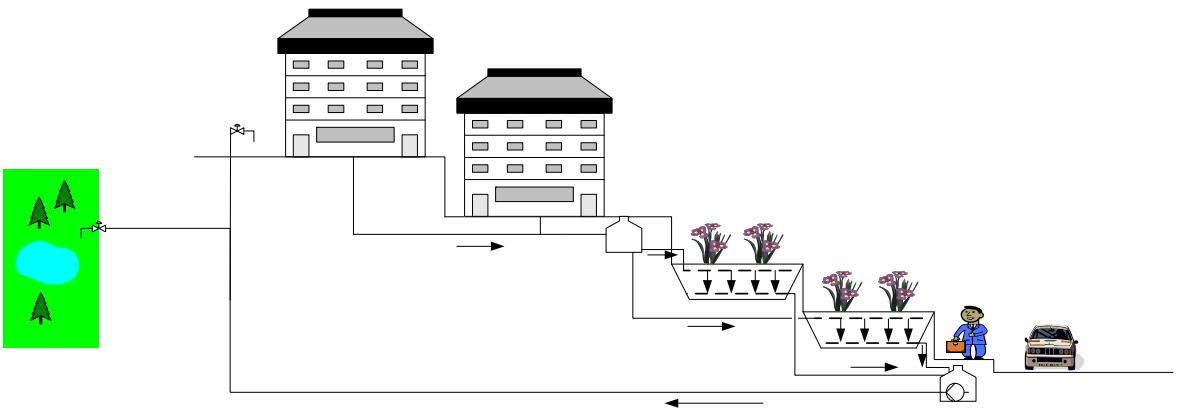
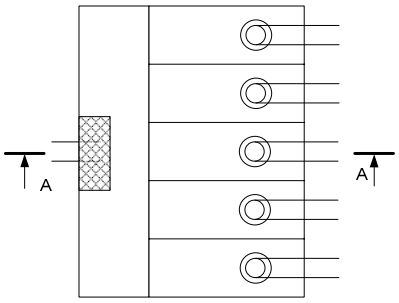
Schematic of the grey water treatment

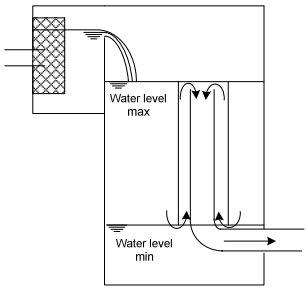


Operation of Constructed Wetlands

- Low maintenance:
  - Plants have to be harvested 1-2 times/year
  - Functions have to be checked regularly (hydraulics)
- Low energy demand:
  - Distribution by gravity flow, no pumping required
  - Even distribution due to hydraulic decoupling
  - Intermitted feeding by installations using the siphon effect or special valves
  - Pumping only required for distribution of the treated grey water



Top view possible distribution system



Section A-A

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Black water

- Combined collection of toilet water and kitchen water
- Use of gravity flow sewer or pressurized sewer
- Collection at one centralized pumping station or several semi-centralized pumping stations
- Before connecting to the central sewer the pumping stations can be used as storage and the water is trucked away
- Black water has a high solid content and is well suited for bio-gas production

Black water, Central Pumping Station

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Black water, Semi-Central Pumping Stations

Cost comparison to a conventional system

- Investment for in-house piping is higher due to two separate systems
- Constructed wetlands provide low investment costs (minimum 50% less per capita compared to an activated sludge plant)
- Transportation system for black water (sewer system, pumping stations) is significantly smaller, since only 30% has to be carried
- Semi-centralized grey water treatment in CW implies significant energy savings (no transport, no aeration, no stirring, etc.)

➡ No financial disadvantage expected
➡ Ecological benefits
➡ Semi-centralized structures: money is spend when the infrastructure is needed and not years before

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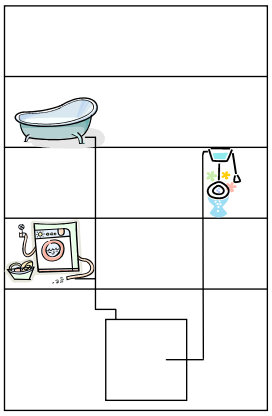
Special Technologies

- Investigations of "overtaking" technologies in small units
  - Grey water reuse for toilet flushing
  - Vacuum sanitation systems
  - Separation of urine and faeces
  - Decentralized black water treatment
- Gain information on:
  - Acceptance in the population
  - Technical aspect (maintenance, reliability, etc.)

Grey water Reuse for Toilet Flushing

- Internal reuse of grey water
- Disinfection of the treated grey water (e.g. Membrane)
- Installation in an apartment building or public building with sufficient amount of grey water



Treatment and disinfection

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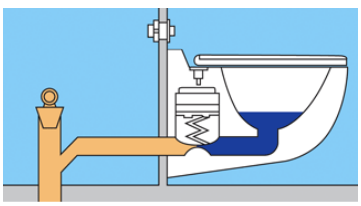
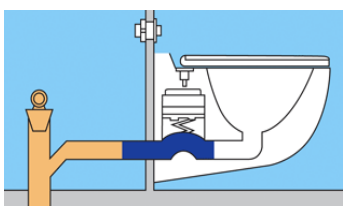
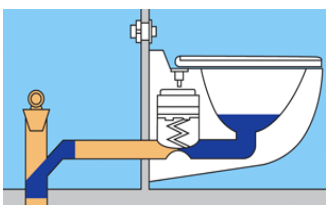
Vacuum sanitation

- Needs only 1L per flush
- 90% water saving
- Technology is well developed since it is implemented for years in plains, ships and trains







Pictures: RoeVac ®

Separation Toilets

- Sit-down and squat separation toilets are available
- Fermentation of faeces together with bio waste and harvested plants for the production of bio gas
- Urine as fertiliser
- Implementation in one building

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Water Saving

- The region of Hashtgerd is suffering from water scarcity
- The actual water consumption of 270 l/P d should be reduced
- Savings of 60% to 70% (80/110 l/P d) are possible by:
  - Change of habits (education)
  - Modern technologies (washing machines, faucets, vacuum sanitation)
  - Grey water reuse (irrigation, service water, toilet flushing)
- Saving water does not imply a loss of comfort or standard of living

Summary

- Modern technologies enable an efficient use of water
- Semi-centralized structures: infrastructure can grow together with the city
- Separate collection of grey water and black water
- Grey water reuse after treatment in constructed wetlands

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