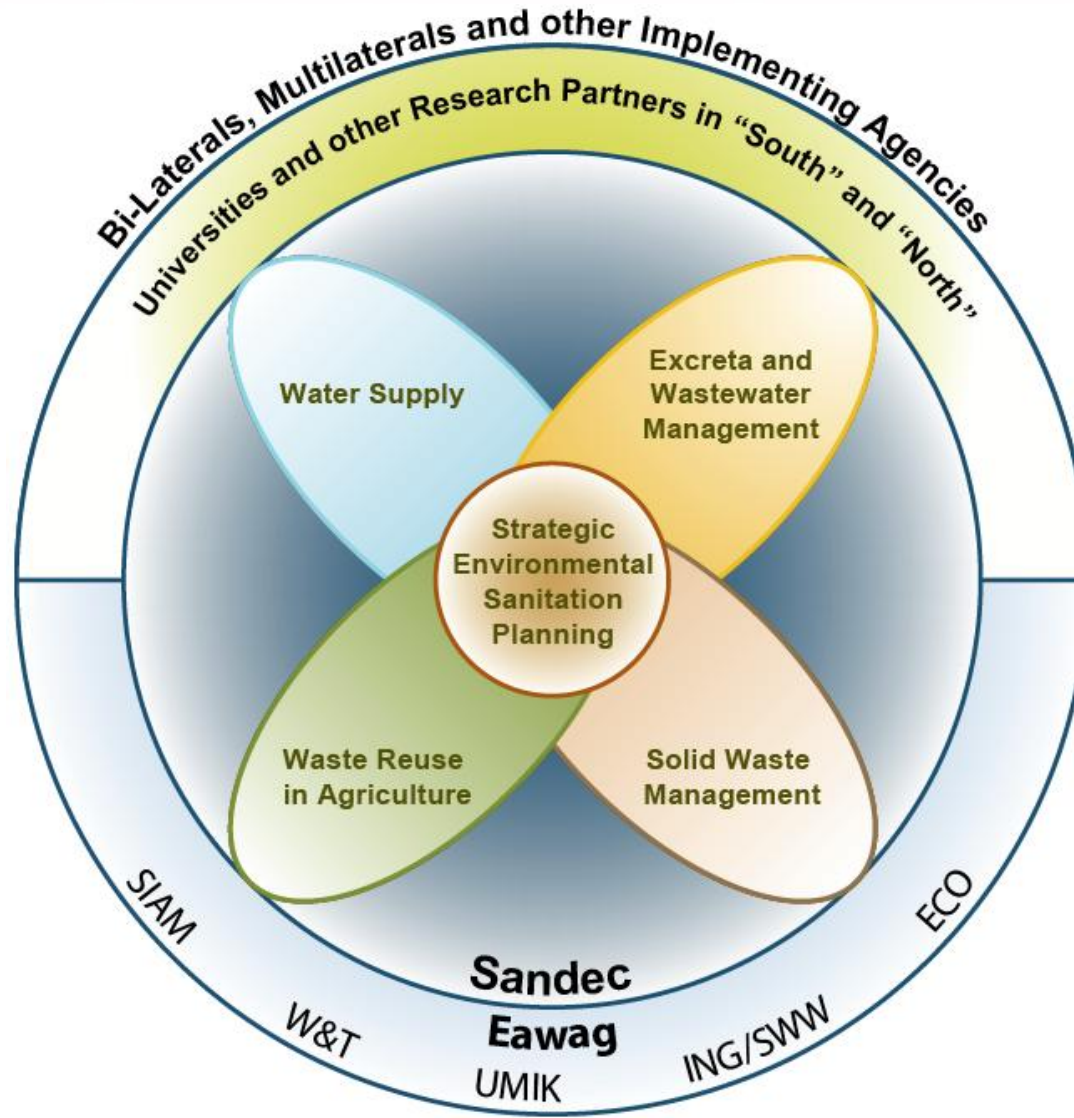


# Faecal Sludge Management: Overview of Common Treatment and Disposal Options and Applicability in Post-Emergency Situations

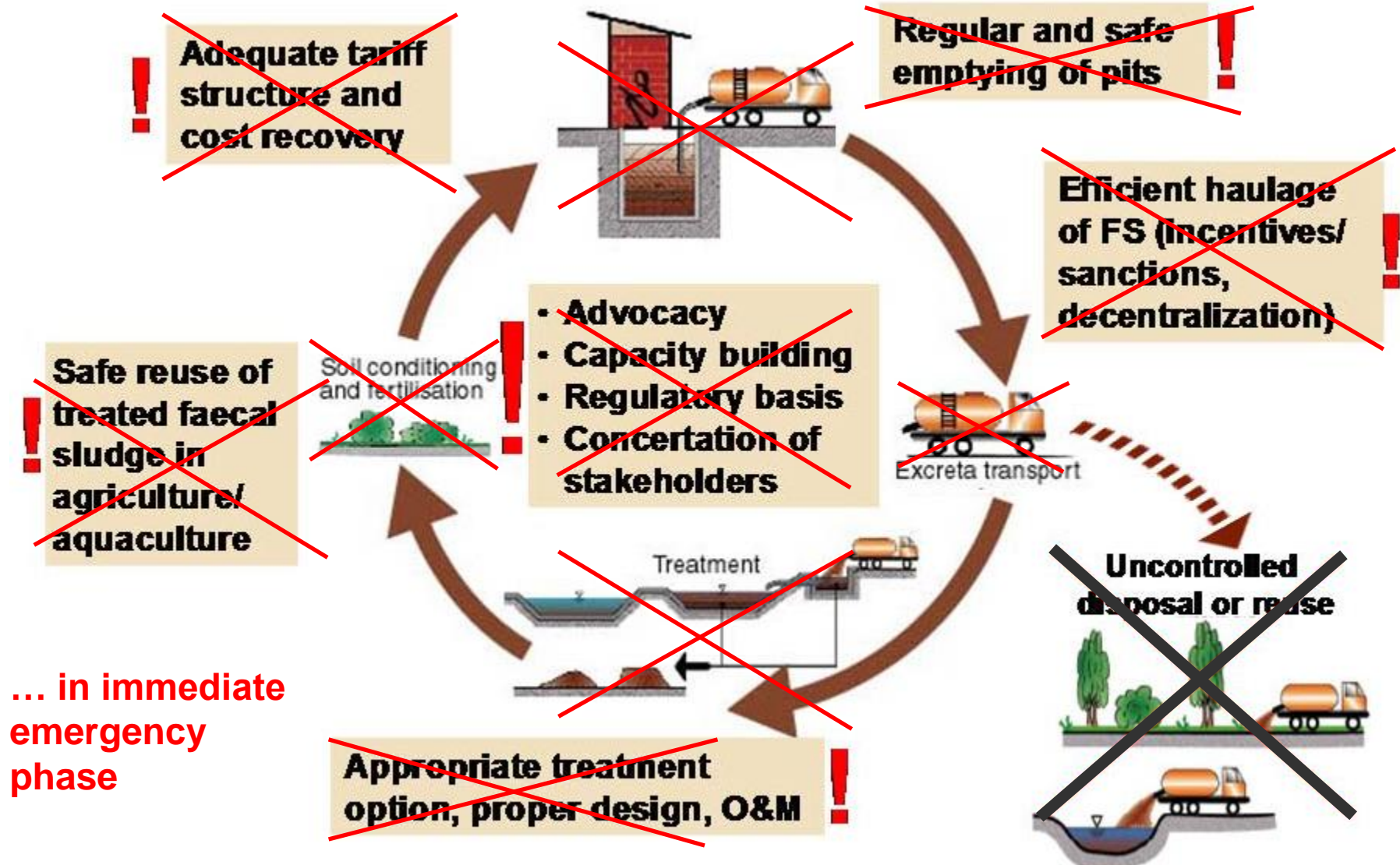
Emergency Sanitation Workshop Delft, 15 June 2012

Lukas Ulrich  
Eawag  
Sandec  
Überlandstrasse 133  
P.O. Box 611  
8600 Dübendorf  
Phone: +41 (0)58 765 50 20  
lukas.ulrich@eawag.ch  
<http://www.eawag.ch>  
<http://www.sandec.ch>

# Department Water and Sanitation in Developing Countries



# About Faecal Sludge and its Management

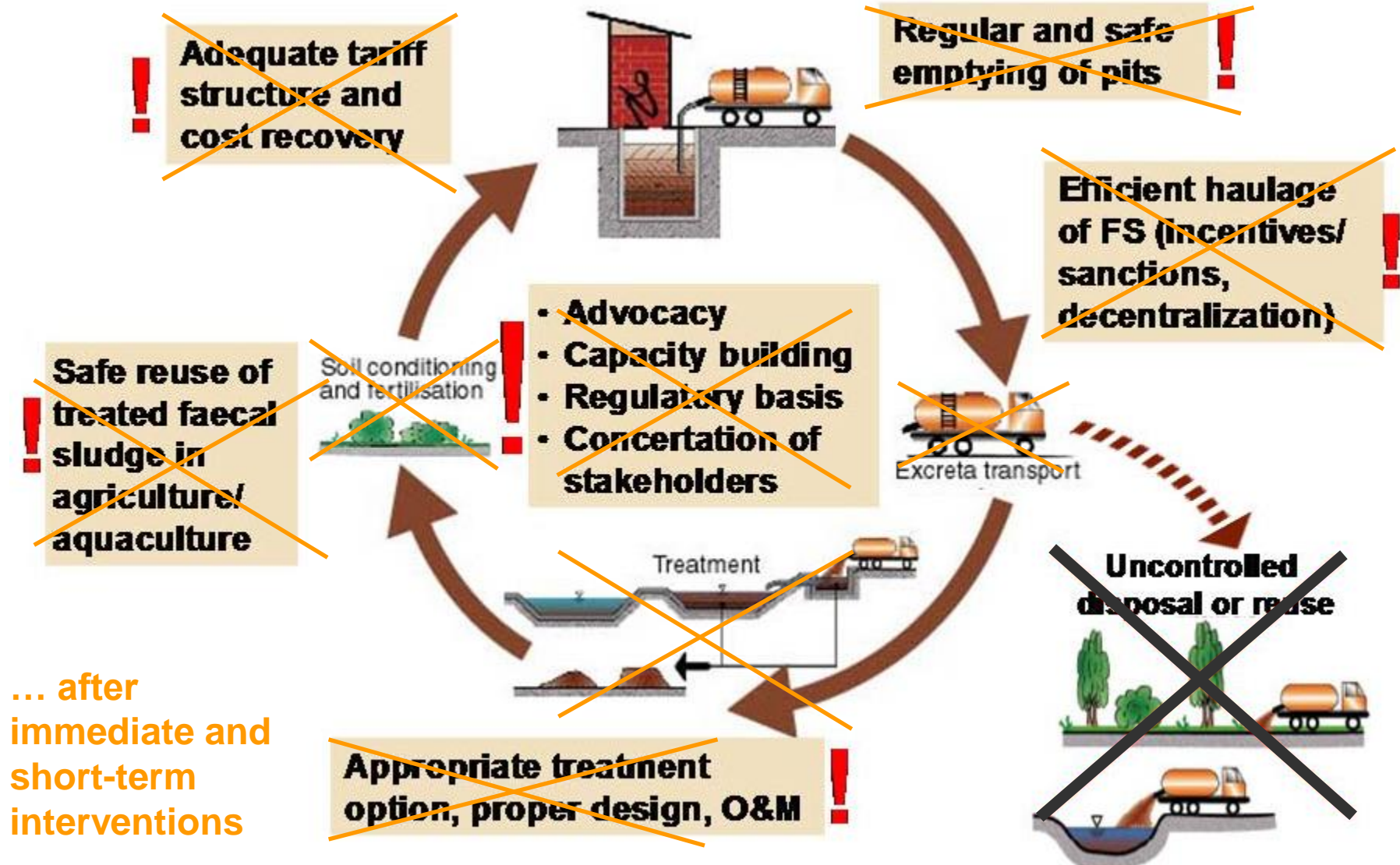


# FSM Options after Disasters and Emergencies

- **Immediate emergency phase (up to 3 months):**  
**short-term interventions**
  - On-site collection/infiltration and backfilling
  - Landfilling/burial of sludge
  - Adaptation and use of existing infrastructure  
(e.g. co-treatment with wastewater or co-composting)
- **Stabilisation and recovery phase:**  
**interventions for longer-term use**
  - Upgrade and stepwise development of infrastructure and services  
-> Introduction of treatment steps
  - From disposal to productive valorisation



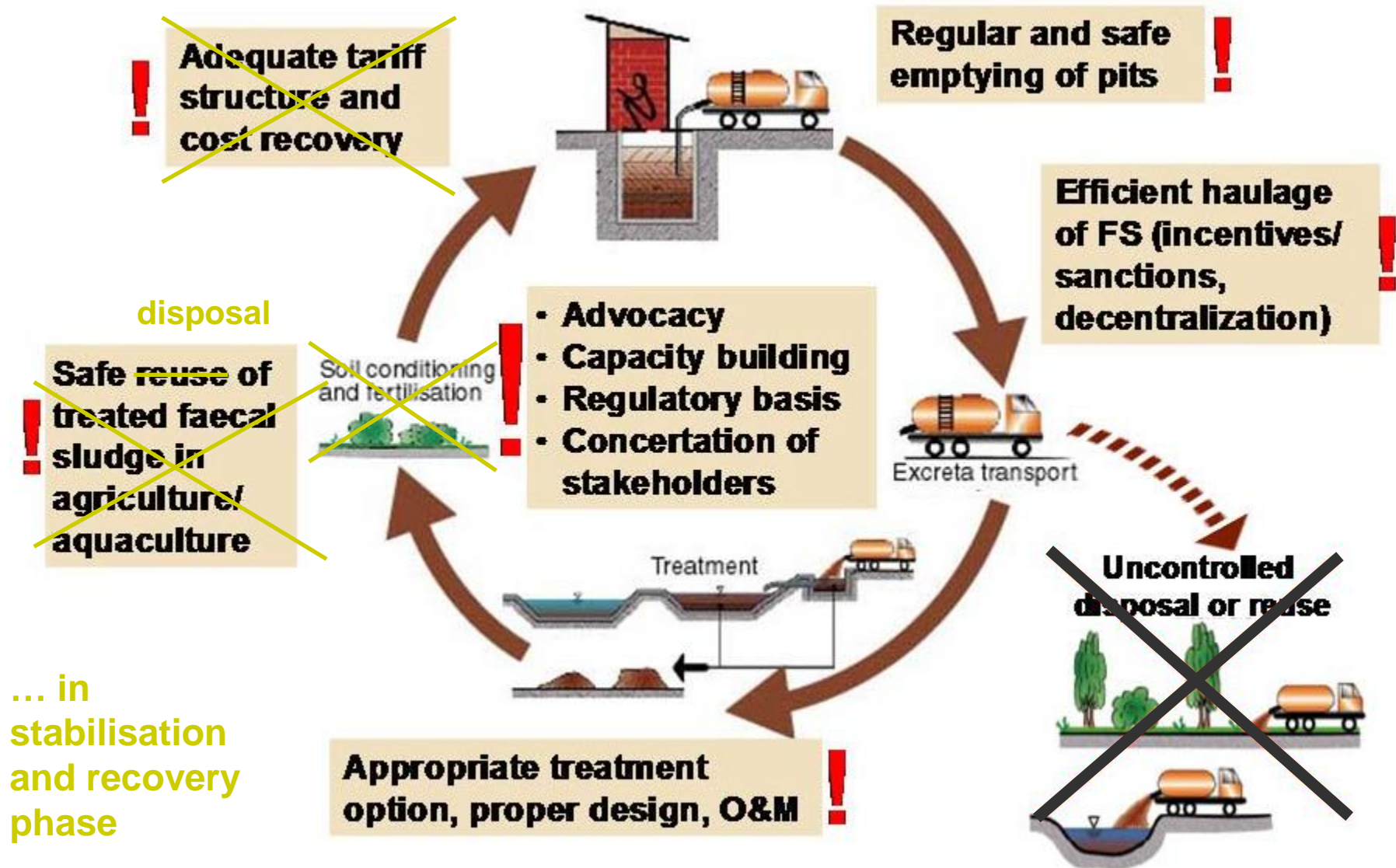
# About Faecal Sludge and its Management



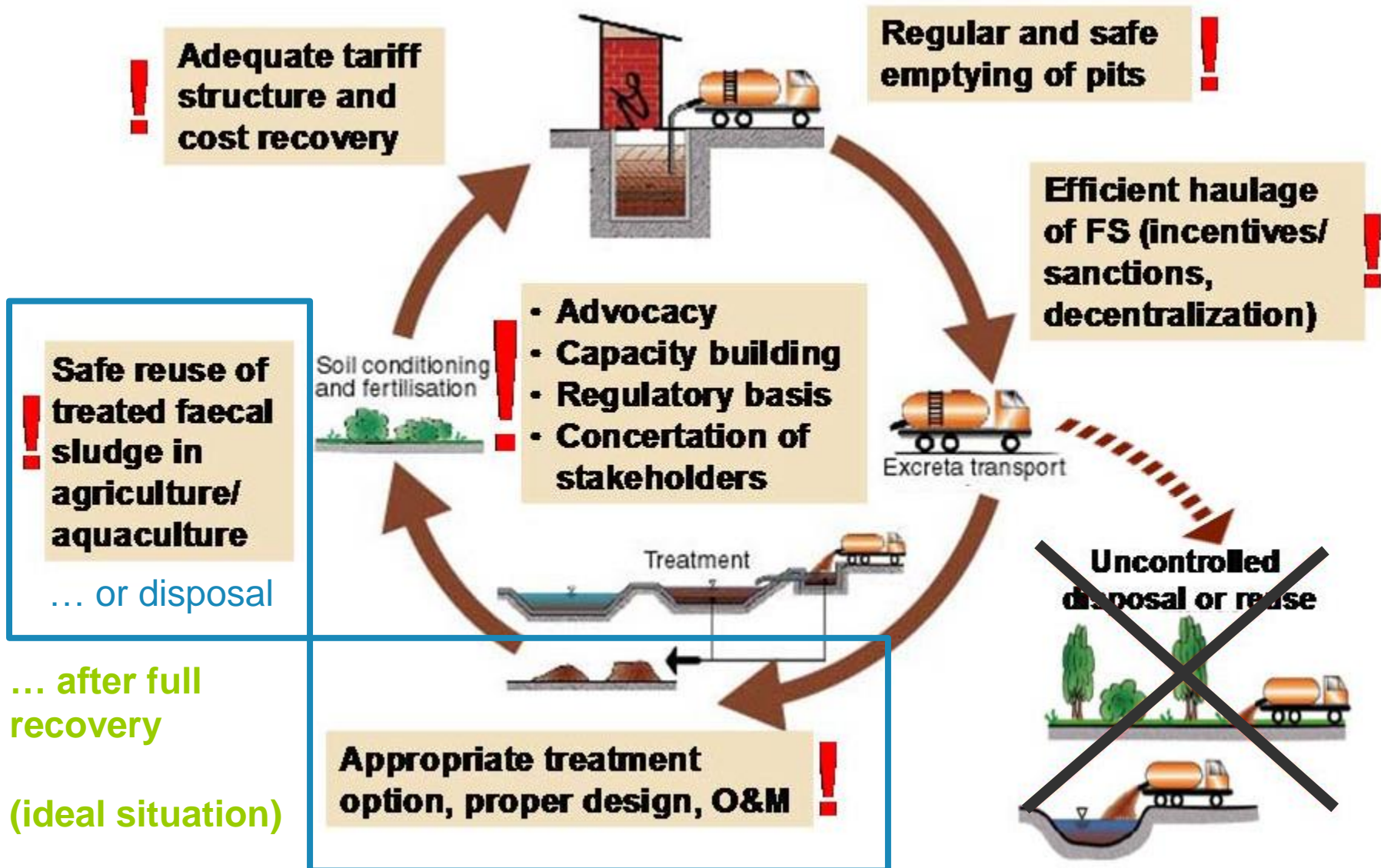




# About Faecal Sludge and its Management

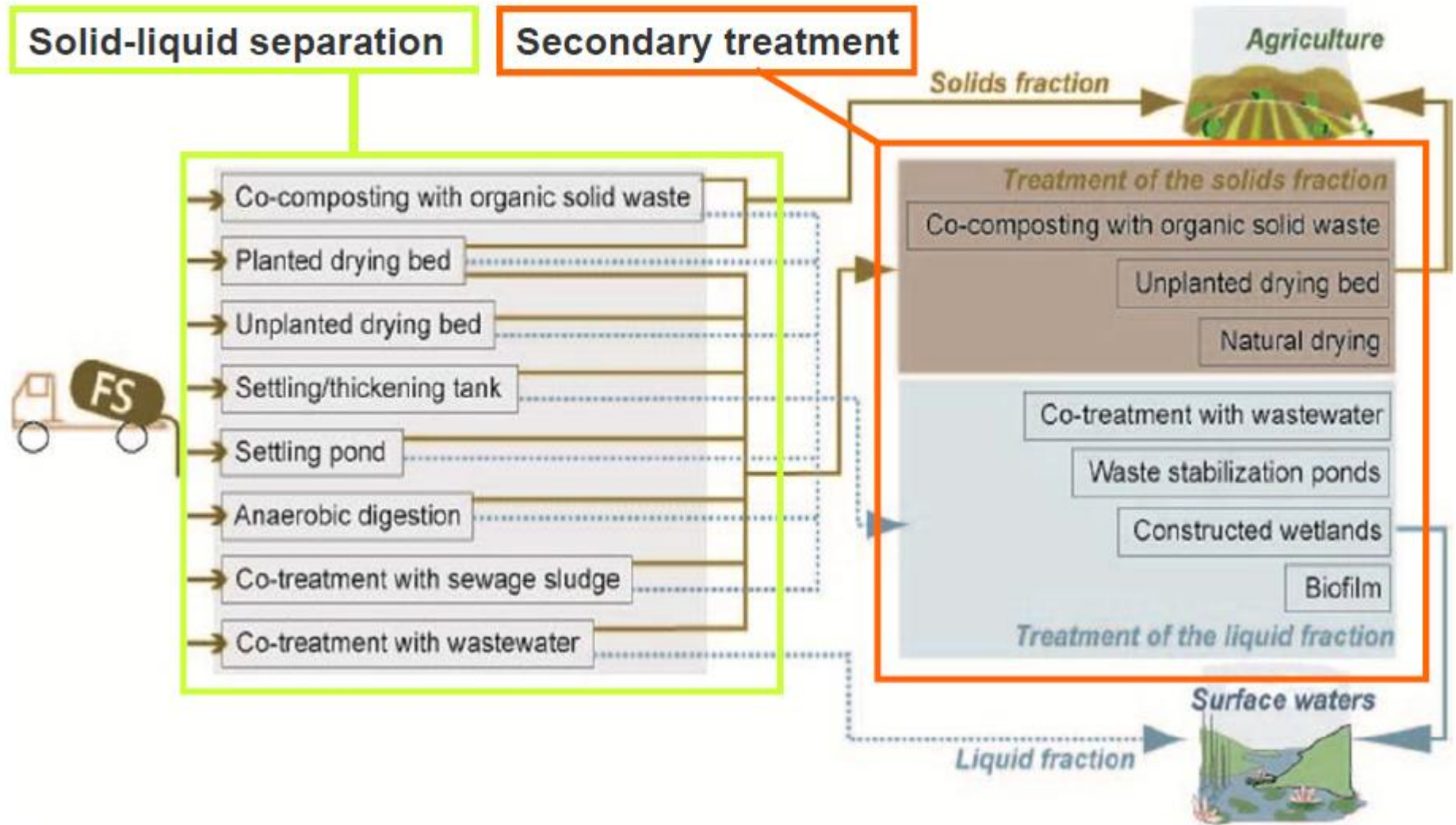


# About Faecal Sludge and its Management





# Overview of Common FS Treatment Options



➔ What can work as longer-term solution after emergencies?

# FSM Options after Disasters and Emergencies

Best solution will depend on factors like...

Sludge  
Characteristics

Space  
Availability

Ground  
Conditions

Time  
Constraints

Design Life

Availability of  
Resources

O&M  
Requirements

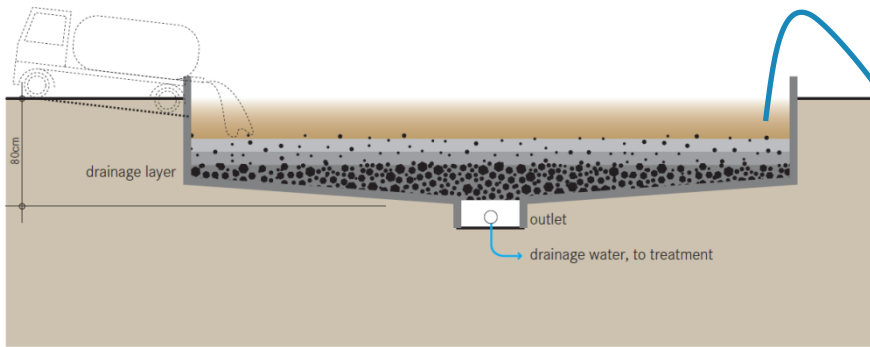
Logistical  
Requirements

Financial  
Constraints

# Longer-term FS treatment options

## Sample technology combinations

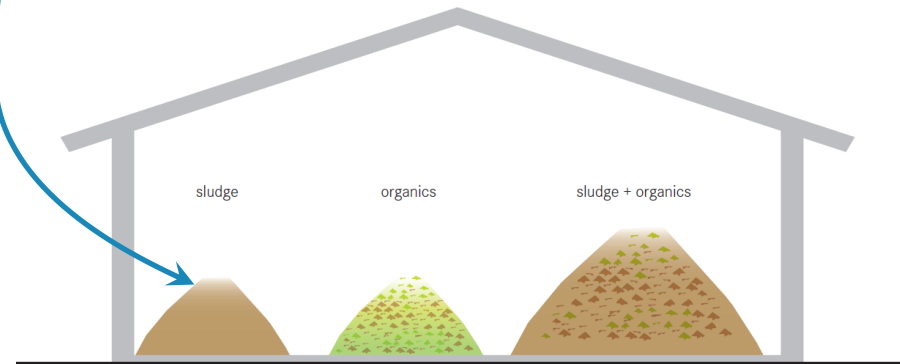
### Unplanted Drying Bed



- + Large volumes
- + Local materials
- + Moderate CAPEX, Low OPEX
- + No electrical energy
- Large land area
- Odours and flies
- Long storage time
- Leachate requires treatment
- Low efficiency in wet season

- + Resource for agriculture
- + High removal of Helminths possible
- + Local materials
- + Low CAPEX/OPEX
- + No electrical energy
- Large land area
- Long storage time
- Operation requires experience
- Labour intensive

### (Co-)Composting

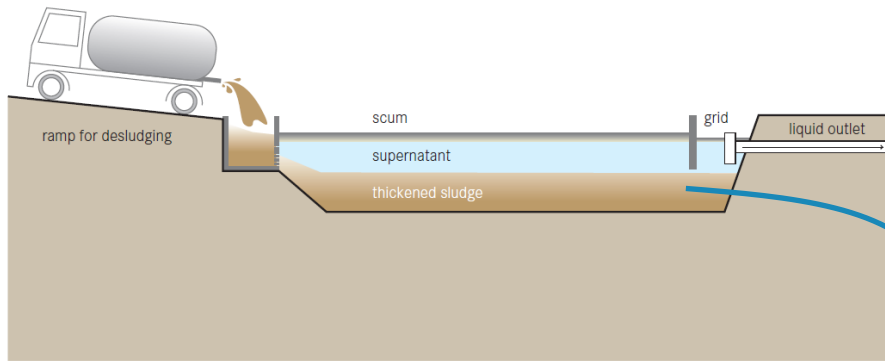




# Longer-term FS treatment options

## Sample technology combinations

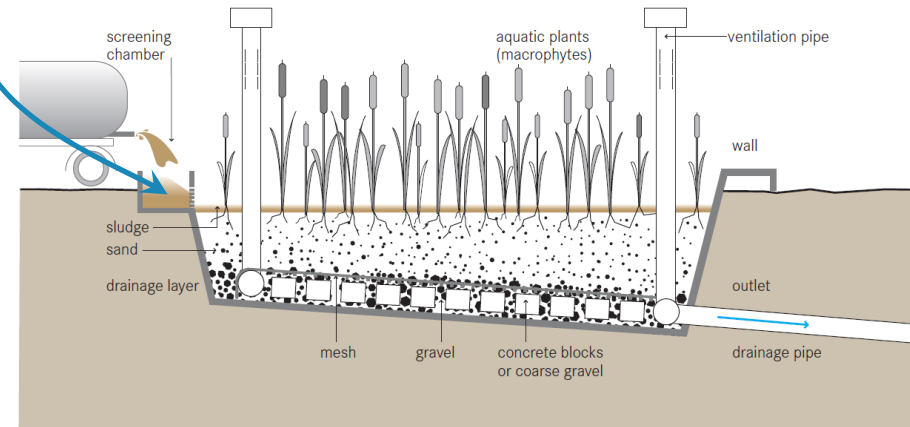
### Sedimentation / Thickening Pond



- + Low CAPEX/OPEX
- + Local materials
- + No electrical energy
- Large land area
- Odours and flies
- Long storage times
- Front-end loader for desludging
- Expert design
- Rain may hinder settling

- + Can handle high loading
- + Direct benefits from plantations
- + Local materials
- + No electrical energy
- + Low CAPEX/OPEX
- Large land area
- Odours and flies
- Long storage times
- Expert design and operation
- Leachate requires treatment

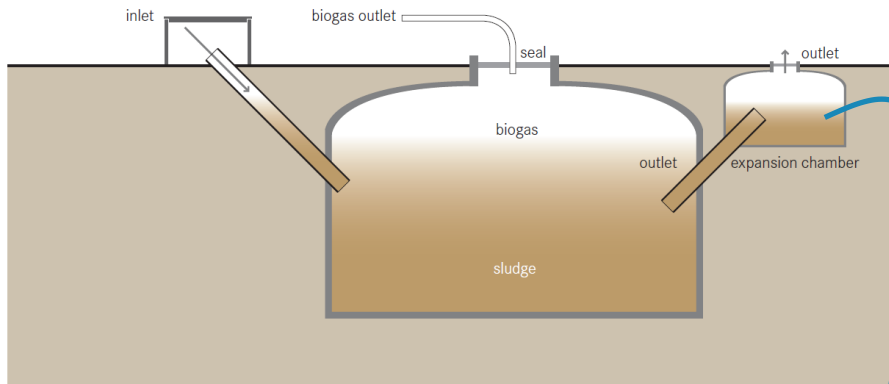
### Planted Drying Bed



# Longer-term sludge treatment options

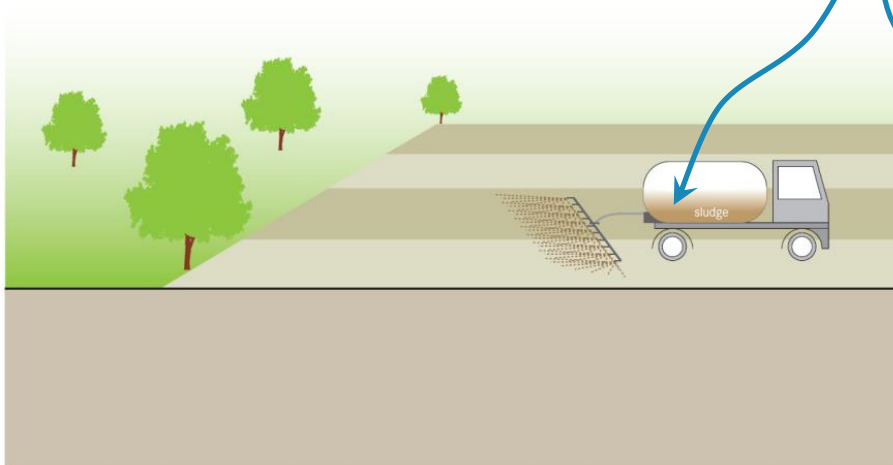
## Sample technology combinations

### Anaerobic Digestion

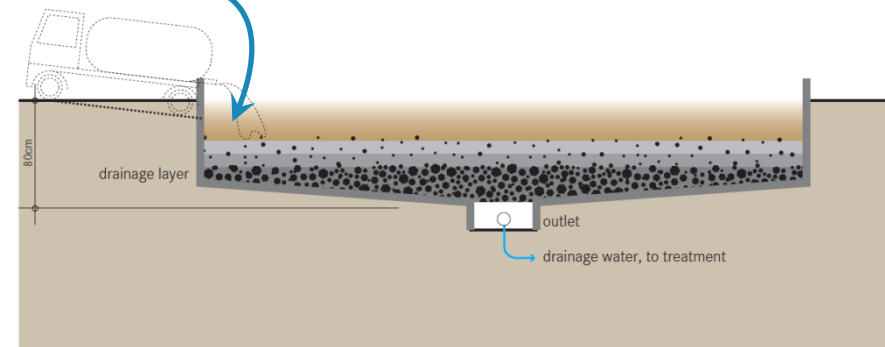


- + Renewable energy generation
- + Underground construction minimizes land use
- + Low operating costs
- + Local materials
- + No electrical energy required
- Expert design and construction
- Effluent requires further treatment

### Land Application

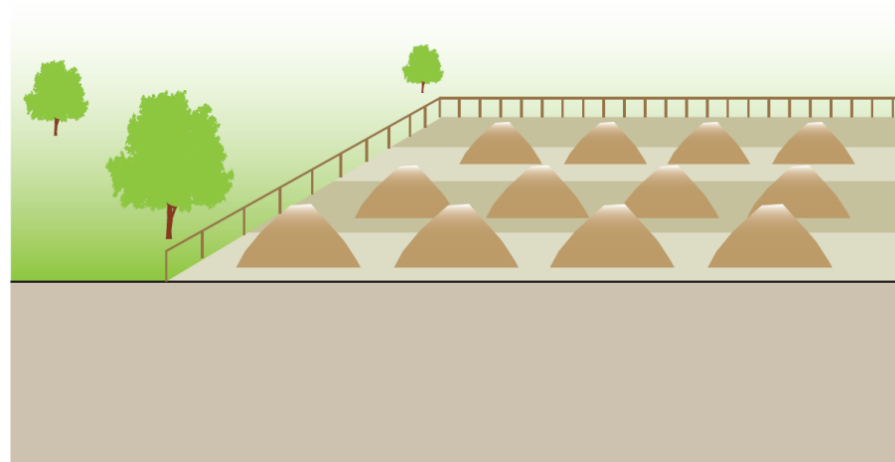


### Unplanted Drying Bed

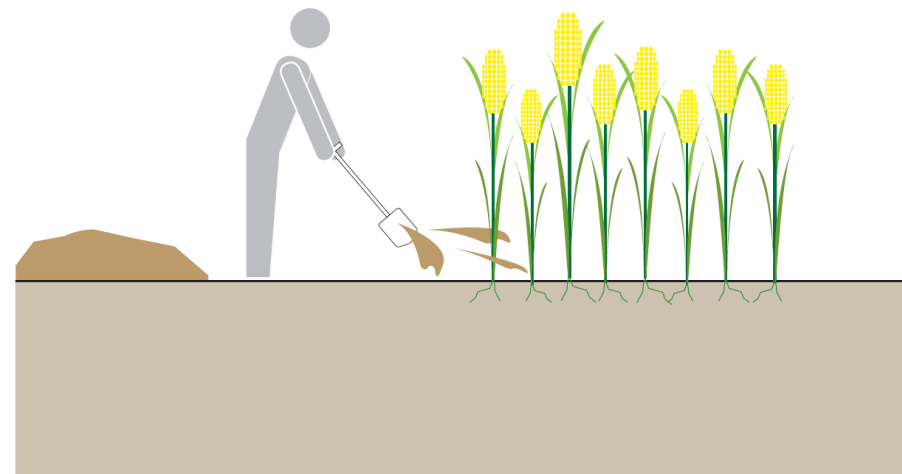
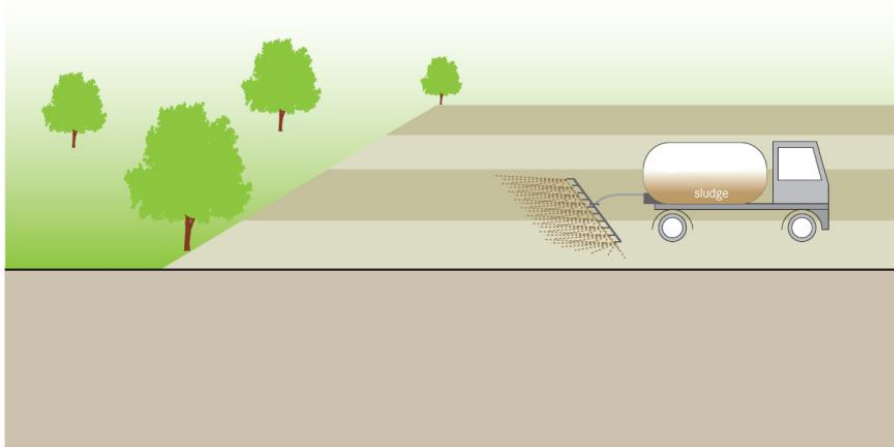


# Disposal / use options for treated sludge

## Surface Disposal (or burial)



## Land Application

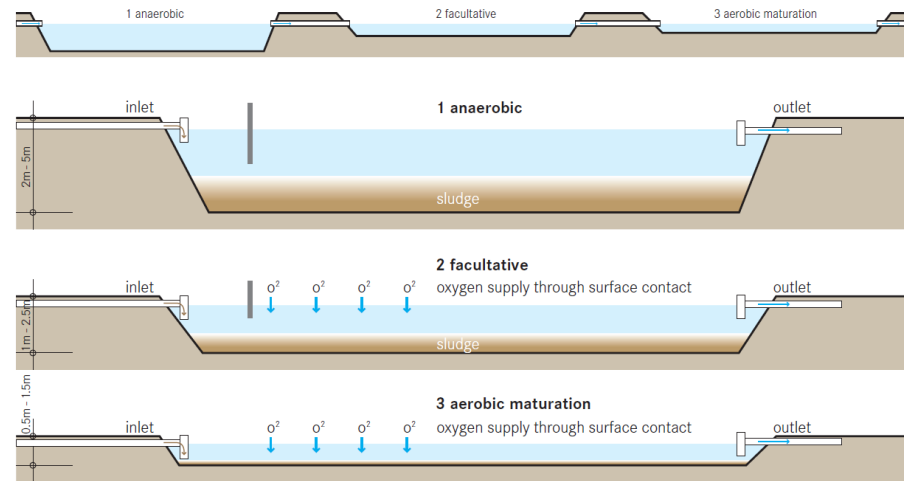




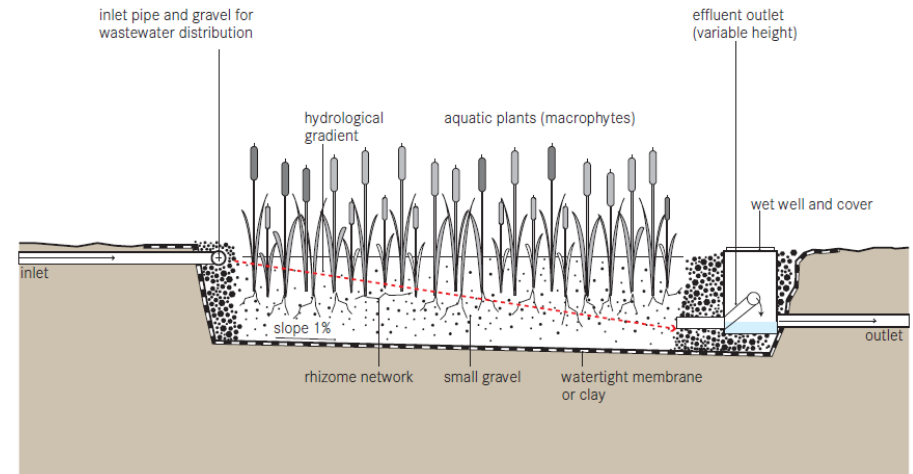
# Effluent / leachate treatment options

## Sample technologies

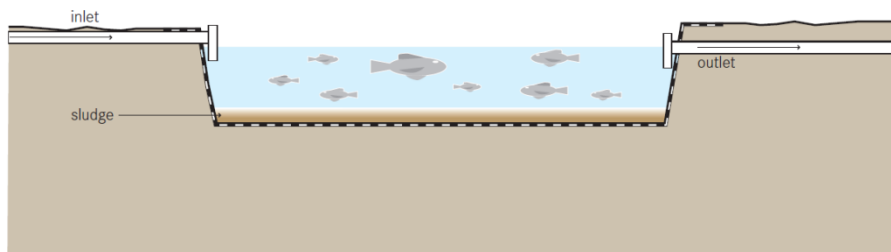
### Waste Stabilisation Ponds



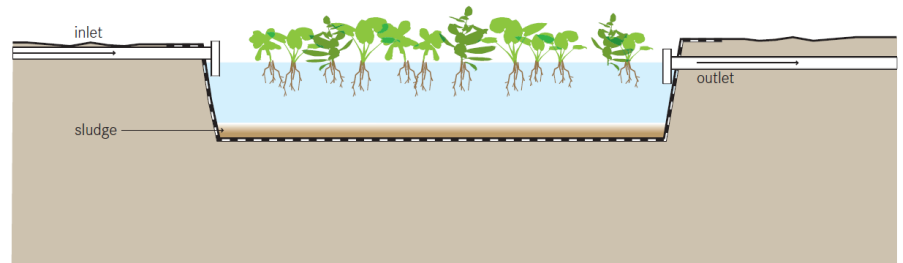
### Horizontal Flow Constructed Wetland



### Aquaculture Ponds

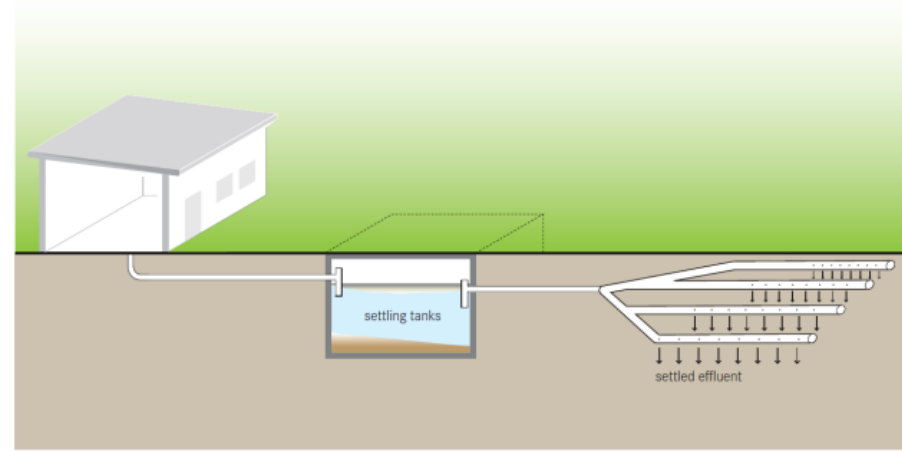
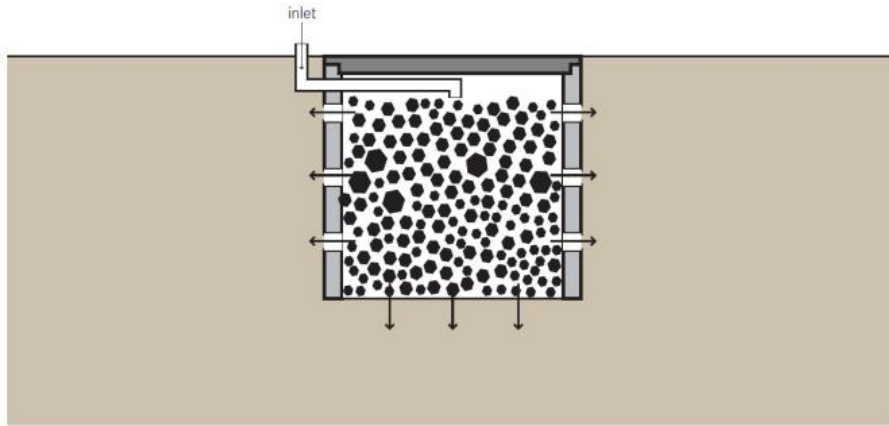


### Floating Plant (Macrophyte) Pond

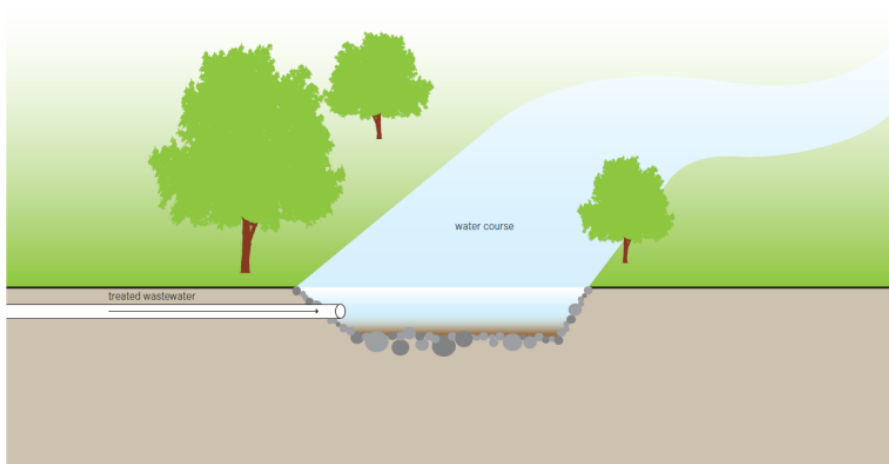


# Disposal / use options for effluent

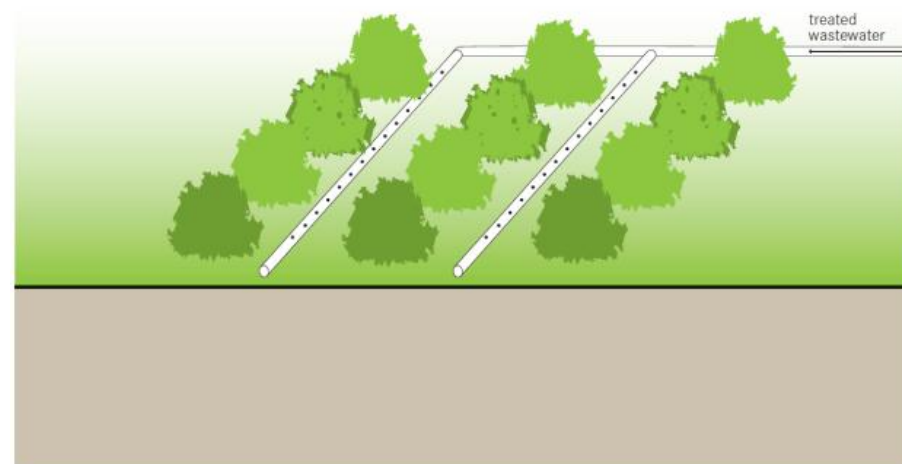
## Infiltration / Groundwater Recharge



## Disposal/Discharge



## Irrigation



## Key take-aways

- Sludge treatment facilities needed in stabilisation and recovery phase
- Stepwise development based on existing structures
- Design should consider collection and transport, and possible enduses
- Similar challenges and solutions as in normal urban infrastructure development, but
  - May come along with new development of other elements of the FSM chain
  - Different sludge characteristics and emptying frequency
  - Shorter planning time, uncertain design life
  - Uncertain funds, inability to plan for cost recovery
- Cost-effective solutions exist which fulfil many of the «top 10 requirements» except:
  - Deployment time
  - Modular configuration and scalability
  - Treatment time



Potential for innovation towards «next generation» solutions



## Further reading

- Sandec's Excreta and Wastewater Management Group: [www.sandec.ch/ewm](http://www.sandec.ch/ewm)
- Sandec FSM publications:  
[http://www.eawag.ch/forschung/sandec/publikationen/ewm/index\\_EN](http://www.eawag.ch/forschung/sandec/publikationen/ewm/index_EN)
- Forthcoming FSM book (co-edited UNESCO-IHE/Sandec, 2013)
- Sandec Compendium (revised 2nd edition coming soon)
- Publications by others (ACF, WEDC, ...)

