Designing Sustainable Wastewater Systems: Generating Design Alternatives

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BACKGROUND

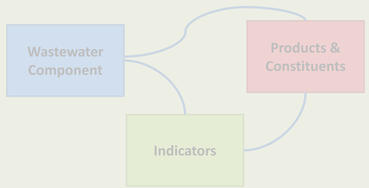
- Continual retrofitting of wastewater infrastructure in the industrialized world
- Growing need for new infrastructure in developing countries
- Growing environmental, energy and financial concerns continue to pressure conventional approaches to wastewater management

OBJECTIVES

- Help decision-makers 're-think' wastewater management and envision more sustainable alternatives
- Develop a decision-support system (DSS) to aid decision-makers, engineers and related constituents in selecting a system to balance environmental, economic and social needs

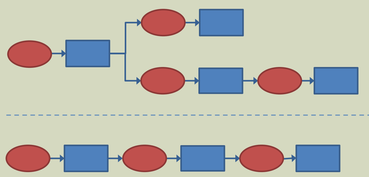
PROJECT MODULES

Database and Ontology of Wastewater



1

Generating Alternative WW Designs



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Visual, Interactive Preference Elicitation

3

STUDY OBJECTIVE

Create a decision support tool to facilitate the design of wastewater systems, in order to explore alternative – and possibly more sustainable – wastewater systems

HYPOTHESES

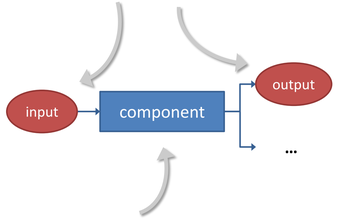
The design of wastewater systems can be automated through a constraint-based logic method, using quantitative properties of input/output products to create a functional system which meets output requirements

ALTERNATIVE GENERATION

- Uses wastewater ontology and dynamically constructs systems to meet a set of constraints
- Uses modular specifications of components, and design constraints; supervision not req.
- Intended to aid decision-makers and engineers in visioning alternative systems

Component and Product Model

Product: described by a set of quantitative properties (e.g. total solids, flow, biological oxygen demand, …)



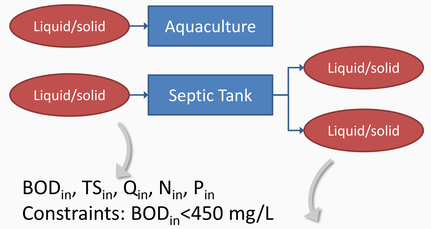
Component: a technology/method/process which consists of:

- Input: parameters
- Constraints: logical restrictions for input
- Component name
- Output(s): Zero to many output products as a function of the input parameters

Community Constraints

- Legal restrictions/codes (water quality, odour, …)
- Community needs (population, $$$, …)
- Environ. conditions (water supply, temp., …)

Component Examples

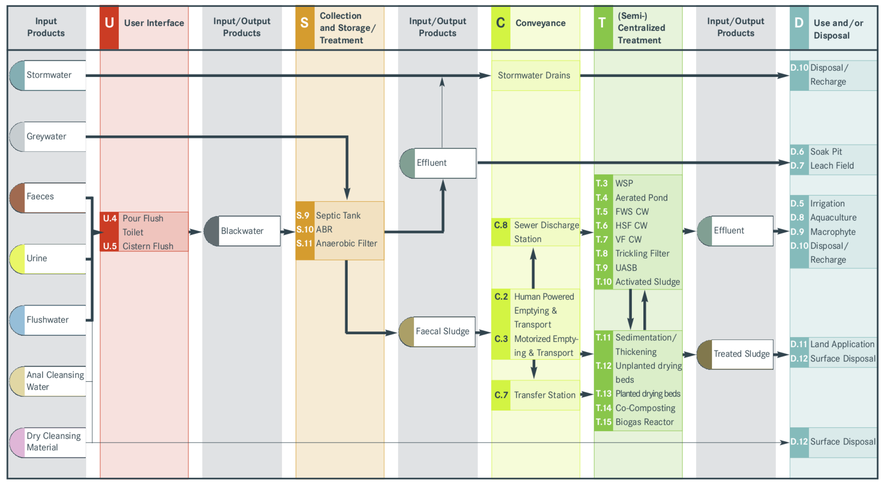


Generate Alternatives

Design Alternatives

PREVIOUS WORK

- Compendium of Sanitation Systems and Technologies [1] provides detailed information about rural wastewater components and systems (see figure on right)
- WISDOM [2] and other DSSs [3,4] design wastewater systems based on a component compatibility matrix
- Other software (e.g. WAWTTAR) allows user to simulate and tune existing systems [e.g. 5,6]



NEXT STEPS

- Include additional components and validate applicability of dynamically constructed systems to real-world scenarios
- Integrate with Module #3 (Preference Elicitation) to help user reduce number of alternatives using preferences

REFERENCES

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