A learning and decision methodology for drainage and sanitation improvement in unplanned areas in developing cities

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Sanitation Challenge
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WAGENINGEN UNIVERSITY
ENVIRONMENTAL TECHNOLOGY

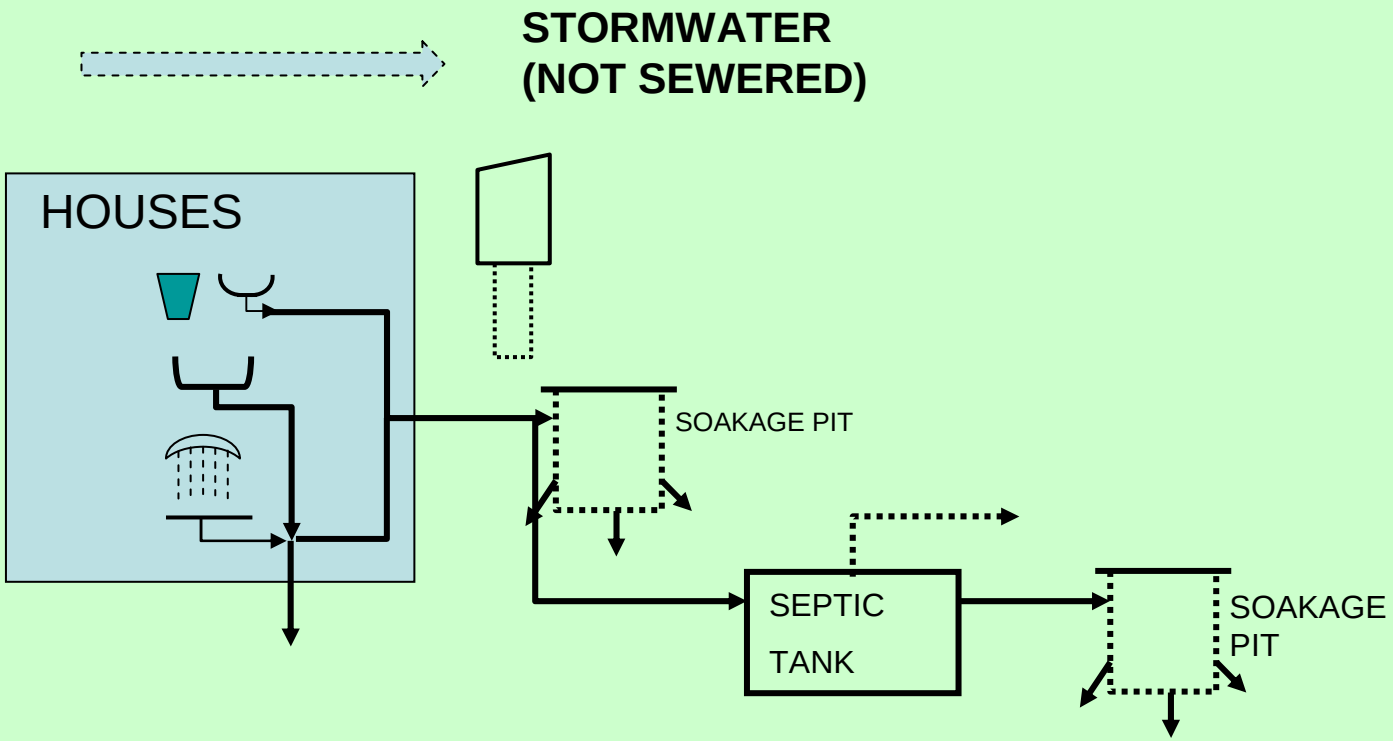
CONTENTS

- DRAINAGE AND SANITATION DEVELOPMENT
- PARTICIPATORY LEARNING & DECISION METHOD
  - STAKEHOLDER ROLES
  - DECISION SUPPORT
- WORKSHOP EXPERIENCE
- CONCLUSIONS

OUTLINE OF DRAINAGE AND SANITATION DEVELOPMENT DURING URBANIZATION

A NEIGHBORHOOD IS BUILT……

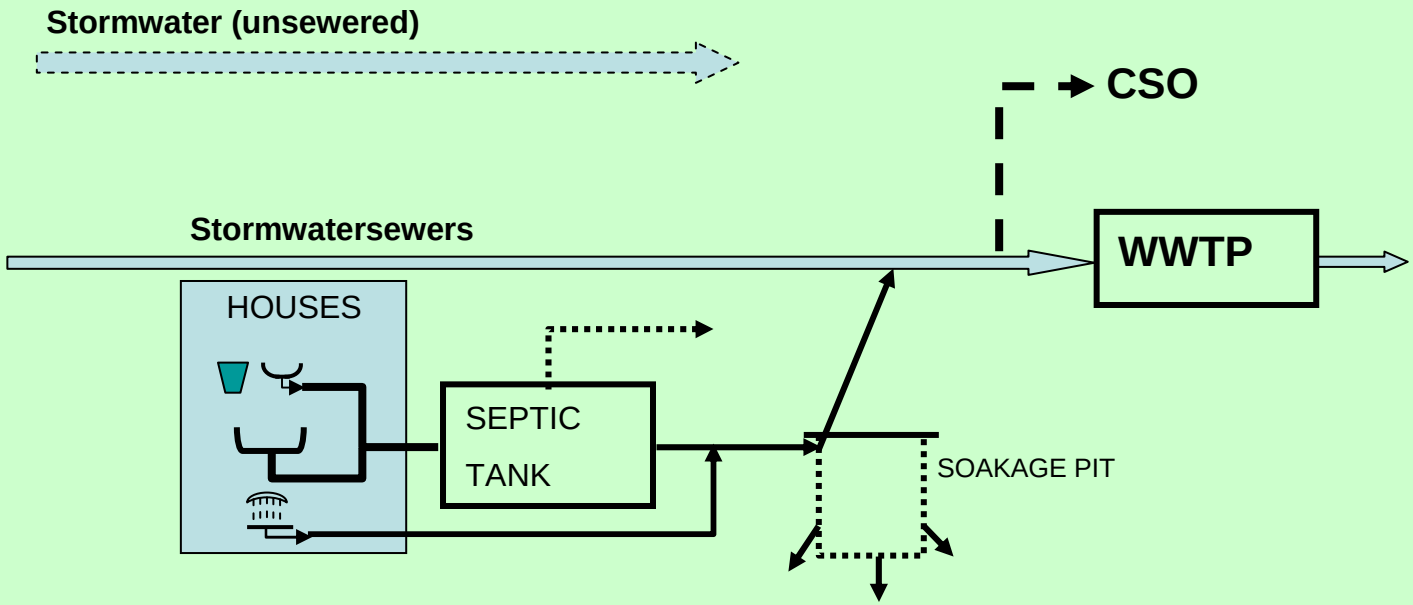
INCREMENTAL DEVELOPMENT OF ON-SITE SANITATION



- **PIT LATRINE, GREYWATER TO SOIL**
- **POUR-FLUSH LATRINE, GREYWATER TO SP**
- **PF LATRINE, GREYWATER TO SEPTIC TANK AND sp**

INCREMENTAL DEVELOPMENT

FROM ON-SITE SANITATION TO SETTLED COMBINED SEWER SYSTEM



- On-site treatment
- Off-site disposal of sewage
- Off-site combined WWT

Mixed solutions

- In a developing city we find several systems now…often they are not adequate
- Stakeholders wonder what options there are to improve concrete situations
- Future infrastructure: unified/centralised or mixed?
- Intervention preparation and decisions:

  -Business-as usual: providers and their experts

  -Participatory approach: all stakeholders play a role in design and system selection

DESIGN STAGE OF INFRASTRUCTURE

STAKEHOLDERS NEED:

- TO BE INFORMED ABOUT A WIDE RANGE OF ALTERNATIVE DRAINAGE AND SANITATION OPTIONS
- METHOD TO SELECT THE BEST OPTION

= MULTICRITERIA DECISION ANALYSIS = PROACT (HAMMOND, RAIFFA, KEENEY, 1999)

The PROACT METHOD consists of 5 STEPS

Problem Clarification

Objectives

Alternatives/ options

Consequences

Tradeoffs

PROACT

WE CARRY IT OUT IN A STAKEHOLDERS' WORKSHOP (EXPERTS AND NON-EXPERTS)

STAKEHOLDERS' ROLES

ROLE OF TECHNICAL EXPERTS

THEY KNOW:

- A VARIETY OF OPTIONS
- OPTIONS' PERFORMANCE DEPENDENT ON CIRCUMSTANCES

THEY ADVISE THE NON-EXPERTS AND POLITICIANS

ROLE OF NON-EXPERTS (POLITICIANS, USERS):

THEY INFORM ABOUT:

- CLARIFICATION OF THE SITUATION
- THE REQUIREMENTS TO GOOD SOLUTIONS
- PREFERRED OPTIONS

HAVE TO BUILD, USE AND PAY THE INFRASTRUCTURE

STAKEHOLDERS' ROLES IN THE DECISION PROCESS

	PROBLEM CLARIFI-CATION	OBJECTIVES & ALTERNATIVES	CONSE-QUENCES TABLE	TRADE-OFF
EXPERTS		X	X	
NON-EXPERTS	X	X		X

- NON-EXPERTS: DECISION MAKERS, INTEREST GROUPS, USERS/ REPRESENTATIVES
- EXPERTS: PLANNERS AND INFRASTRUCTURE SPECIALISTS

LEARNING SUPPORT: ALTERNATIVES

- PARTICIPANTS ASK THEMSELVES:

WHAT ARE ALTERNATIVE SOLUTIONS TO OUR PROBLEM?

ALTERNATIVES ARE:
SANITATION CHAINS MADE UP OF <u>BUILDING BLOCKS</u>

BUILDING BLOCKS OF DRAINAGE AND SANITATION SYSTEMS

FUNCTIONAL ELEMENT	BUILDING BLOCK
WATER SUPPLY	PIPE/CARTAGE
HOUSEHOLD APPLIANCES	TOILET, KITCHEN SINK, SHOWER, ETC
ON-SITE WASTEWATER	TREATMENT
	RECYCLING AND REUSE
STORMWATER/RUNOFF	TRANSPORT
	TREATMENT
	REUSE
OFF-SITE WASTEWATER	TRANSPORT
	TREATMENT
	RECYCLING AND REUSE
SLUDGE HANDLING	TREATMENT & DISPOSAL
	REUSE

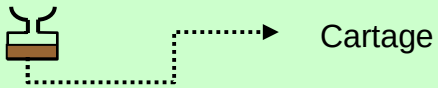
SYSTEMS FOR DRAINAGE AND SANITATION

POSSIBLE DIFFERENCES TO DECIDE ABOUT:

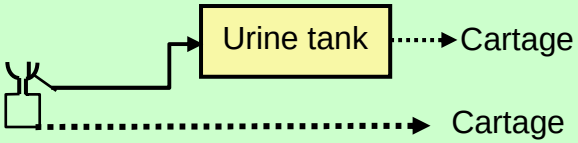
- **ON-SITE OR OFF SITE TREATMENT**
- **VARIOUS TOILET SYSTEMS**
- **COMMUNAL/ INDIVIDUAL TOILETS**
- **VARIOUS TYPES OF SOURCE-SEPARATION (1- 4 STREAMS) AND CONNECTED REUSE**
- **NUMBER OF PIPE NETWORKS (1, 2 OR 3)**
- **STORAGE BASINS FOR COMBINED SEWAGE: YES OR NO**
- **TREATMENT OF STORMWATER: YES OR NO**
- **PUMPING OF SEWAGE: YES OR NO**

TOILET TYPES

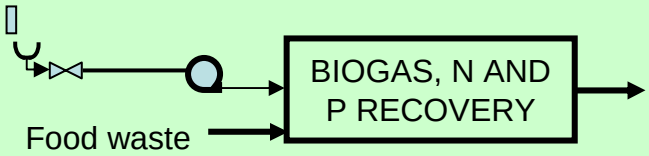
ANAEROBIC DIGESTION TOILET



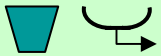
URINE-DIVERTING DRY TOILET



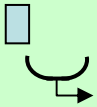
VACUUM TOILET



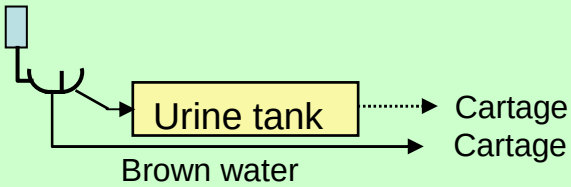
POUR-FLUSH TOILET



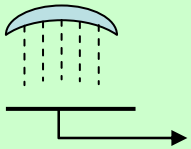
CISTERN FLUSH TOILET



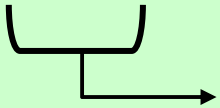
URINE-DIVERTING FLUSH TOILET



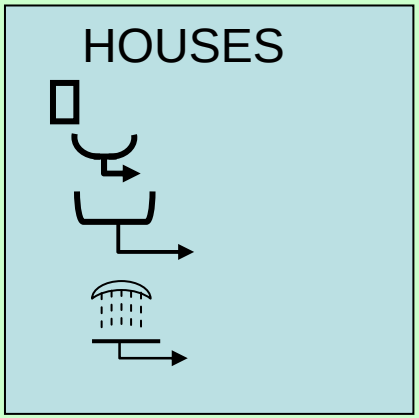
SHOWER/ BATH, WASHING MACHINE



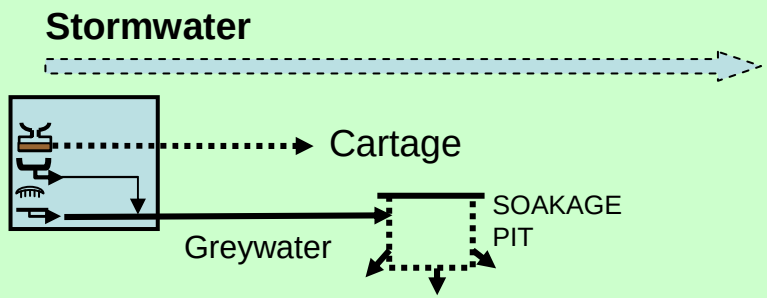
KITCHEN SINK



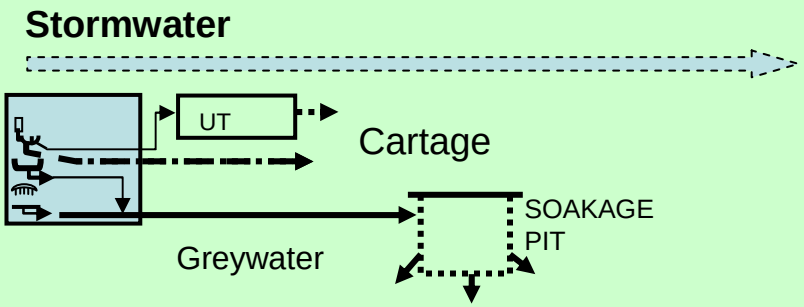
APPLIANCES IN THE HOUSEHOLD



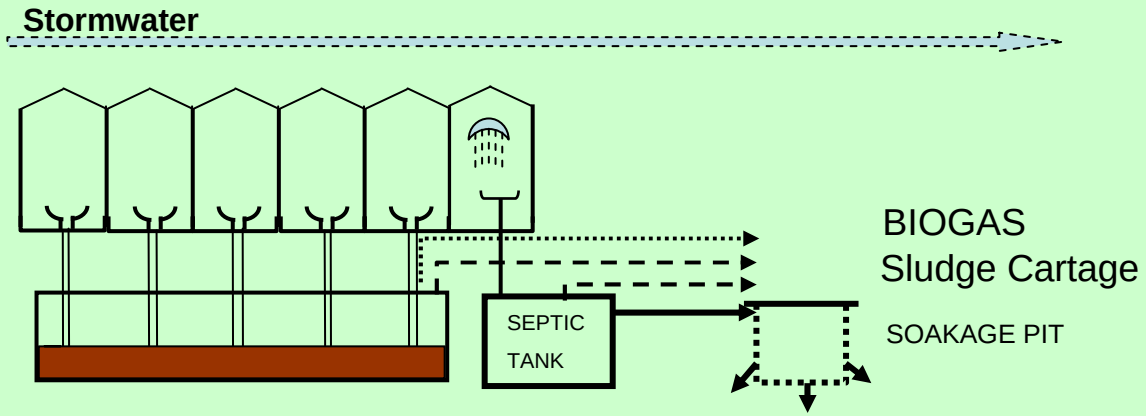
INDIVIDUAL AND COMMUNAL ON-SITE OPTIONS



Option 1: dry AD toilet + cartage, greywater to subsoil. Stormwater not sewered



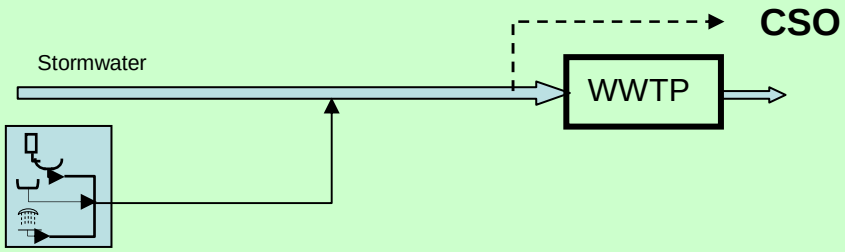
Option 2 Dry UD toilet, urine and faeces collected by cartage, greywater to soakage pit. Stormwater not sewered



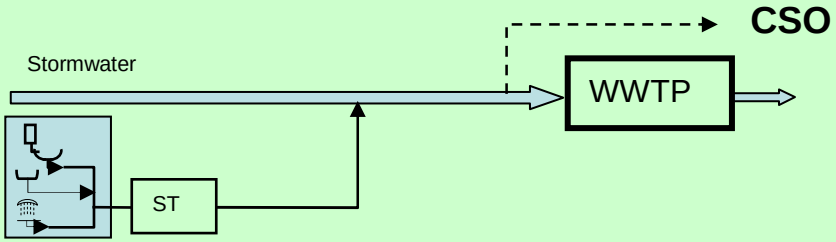
Option 05: Communal dry AD toilets + accumulating anaerobic digester; greywater to soakage pit. Stormwater not sewered

8 options

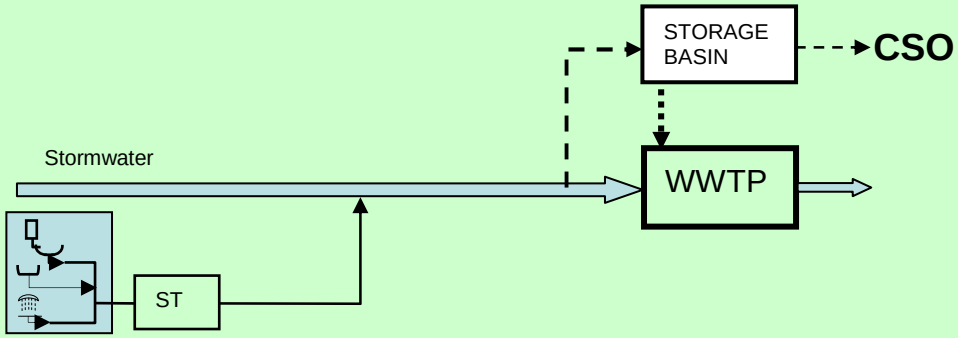
SINGLE PIPE OPTIONS
1 STREAM : COMBINED SEWAGE



Option 11 Combined sewer system stormwater and sewage treated jointly



Option 13: Combined sewer, sewage pre-treatment in septic tank = Combined settled sewer system

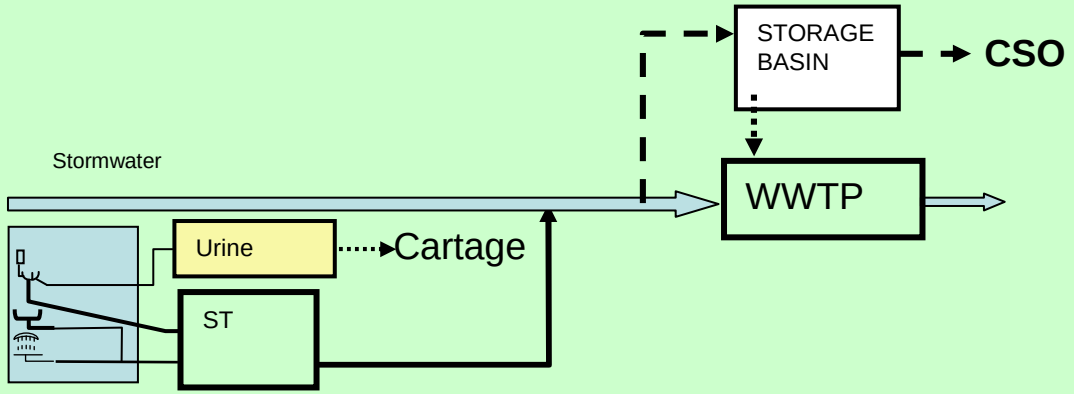


Option 14 Settled sewer system: stormwater and sewage treated jointly

TOTAL: 12 OPTIONS BASED ON SINGLE PIPE NETWORK

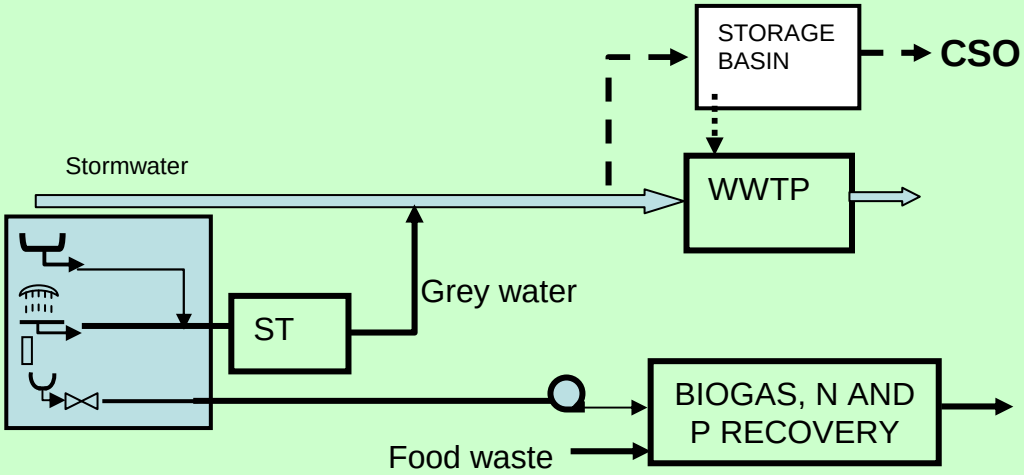
ONE PIPE NETWORK: HOUSEHOLD SOURCE SEPARATION

2 STREAMS



Option 20 Settled combined sewer system with separated urine collection and treatment of greywater/stormwater

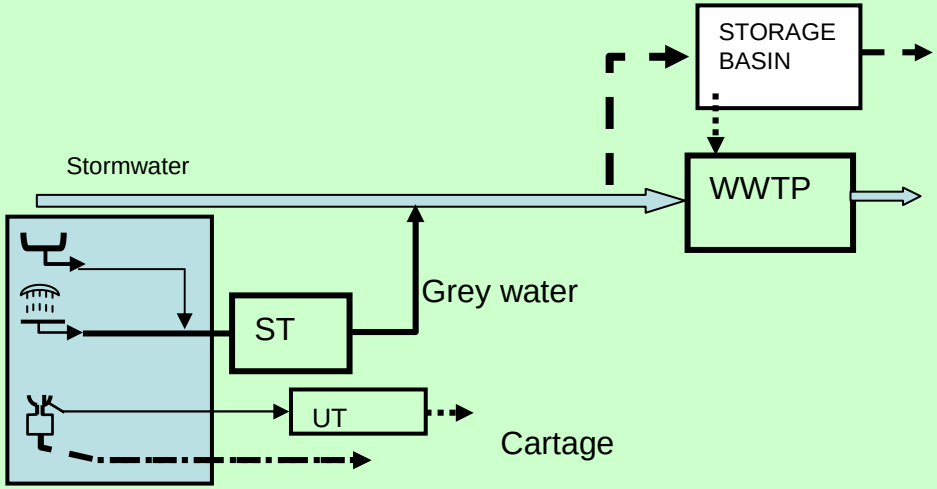
2 STREAMS



Option 25: Vacuum toilets, anaerobic blackwater treatment + Biogas, N and P recovery, combined treatment of storm- and grey water

ONE PIPE NETWORK, HOUSEHOLD SOURCE-SEPARATION

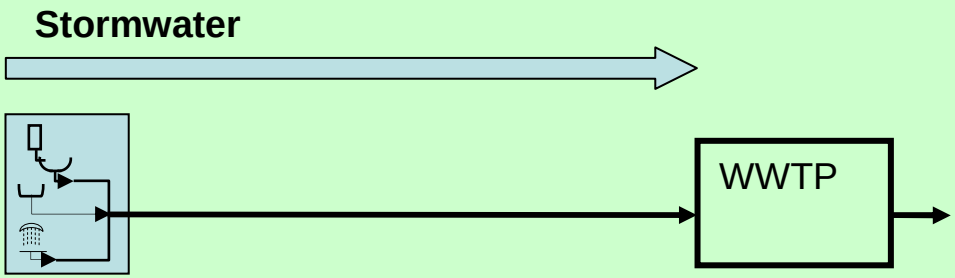
3 STREAMS



Option 24: UD dry toilets, combined treatment of storm- and grey water, urine and faecal matter treated separatedly

TWO PIPE OPTIONS/ STORMWATER AND SEWAGE SEPARATED

2 STREAMS



Option 31: Separated sewer system:
stormwater and sewage though different pipes

Total 30 OPTIONS based on a two-pipe network

SETTING OBJECTIVES

- PARTICIPANTS ASK THEMSELVES: WHAT WOULD DISTINGUISH BETWEEN A GOOD SOLUTION AND A BAD ONE TO SOLVE OUR PROBLEM?

OBJECTIVES FOR DRAINAGE AND SANITATION INFRASTRUCTURE

	OBJECTIVES	CRITERIA
1	TECHNICAL FUNCTIONALITY	COMPATIBILITY WITH LOCAL CONDITIONS
2		COMPLIANCE WITH LOCAL POLICY FRAMEWORK
3		RELIABILITY AND FLEXIBILITY
4	ENV^{L} PROTECTION AND RESOURCES CONSERVATION	EMISSIONS TO WATER, ATMOSPHERE AND SOIL
5		RESOURCES RECOVERY
6	SOCIAL MANAGEABILITY	ADEQUATE MANAGEMENT BY PROVIDERS
7		USER ACCEPTANCE
8	ECONOMIC DESIRABILITY	ECONOMIC EFFCIENCY

CONSEQUENCES OF THE ALTERNATIVES

- PARTICIPANTS ASK THEMSELVES:

HOW DO OUR DIFFERENT ALTERNATIVES/OPTIONS PERFORM WITH REGARD TO OUR OBJECTIVES?

RESULT : PERFORMANCE TABLE

Example of PERFORMANCE MATRIX

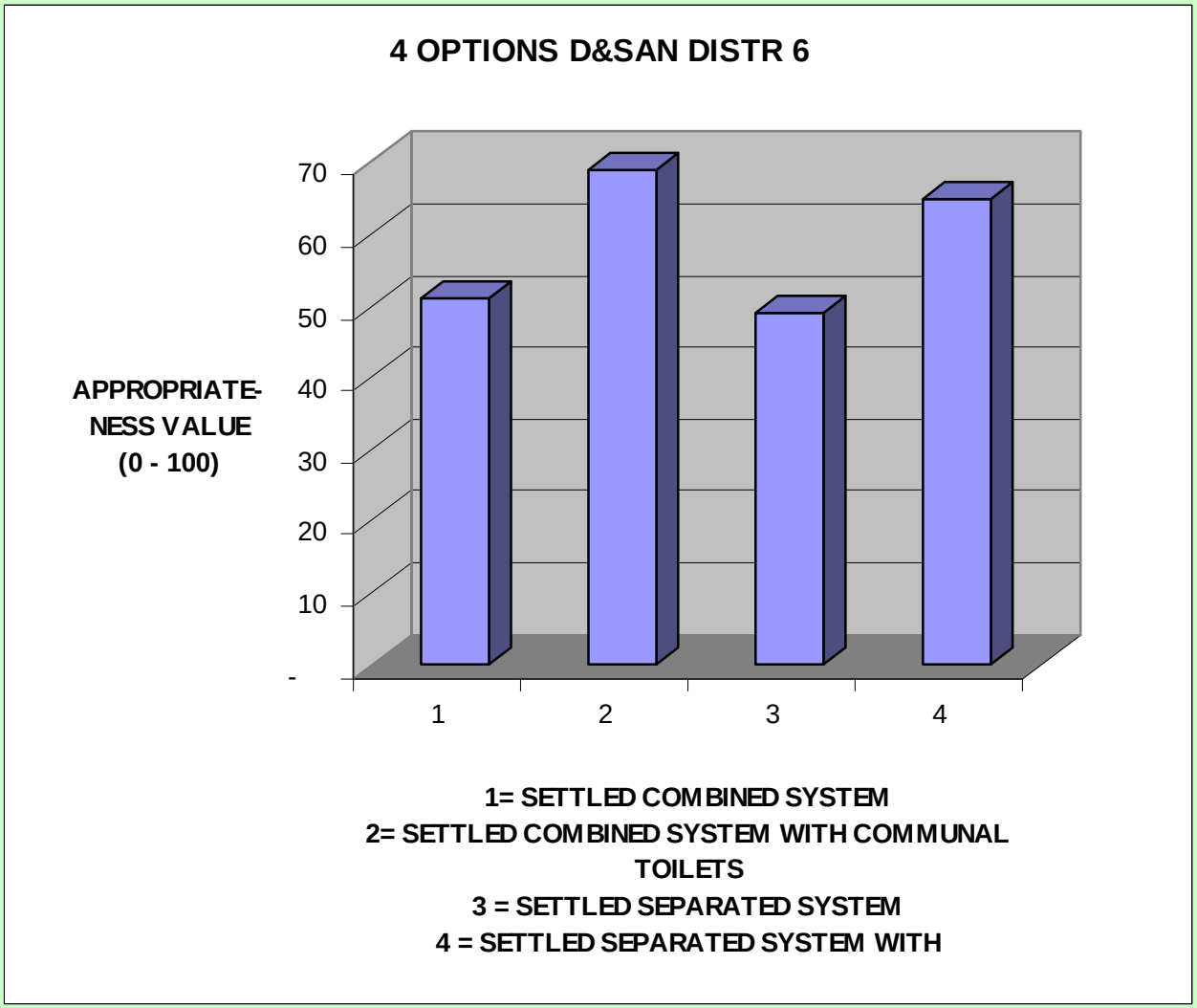
DISTR 6, HCMC, VIETNAM

PERFORMANCE SCORES: 0 - 100

		ALTERNATIVES			
OBJECTIVES	**NORM. WEIGHT**	1	2	3	4
TECHNICAL FUNCTIONALITY	**0.4**	30	90	30	90
ENVIRONMENTAL PROTECTION AND RESOURCE RECOVERY	**0.1**	90	90	90	90
USER AND PROVIDER ACCEPTANCE	**0.3**	80	40	80	40
NET COSTS	**0.2**	30	60	20	40

AFTER WEIGHTING THE CRITERIA……

APPROPRIATENESS OF 4 DRAINAGE AND SANITATION OPTIONS IN D.6 OF HO CHI MINH CITY



WORKSHOPS

- 2 WORKSHOPS (2 DAYS EACH) IN HO CHI MINH CITY, VIETNAM, IN WHICH **PROACT** WAS APPLIED

  (ISSUE-2 PROJECT)

CAPACITY BUILDING WITH PROACT LEARNING AND DECISION DATA BASE

STRONG:

- GENERATION OF ALTERNATIVES AND OBJECTIVES
- TRADING-OFF METHOD

TO BE IMPROVED STILL:

CONSEQUENCES TABLE

CONCLUSIONS:
WHERE DOES PROACT MAKE A DIFFERENCE?

- Data base facilitated quick understanding how to compose sanitation chains
- Intensive mutual learning
  - Experts inform about environmentally most sustainable options
  - Non-experts inform about feasible and most preferred options
- Shared objectives and alternatives/options
- Processing consequences required more time and advice than available (12 hrs)
- A basis for a decision that is well supported

THANK YOU FOR YOUR ATTENTION..

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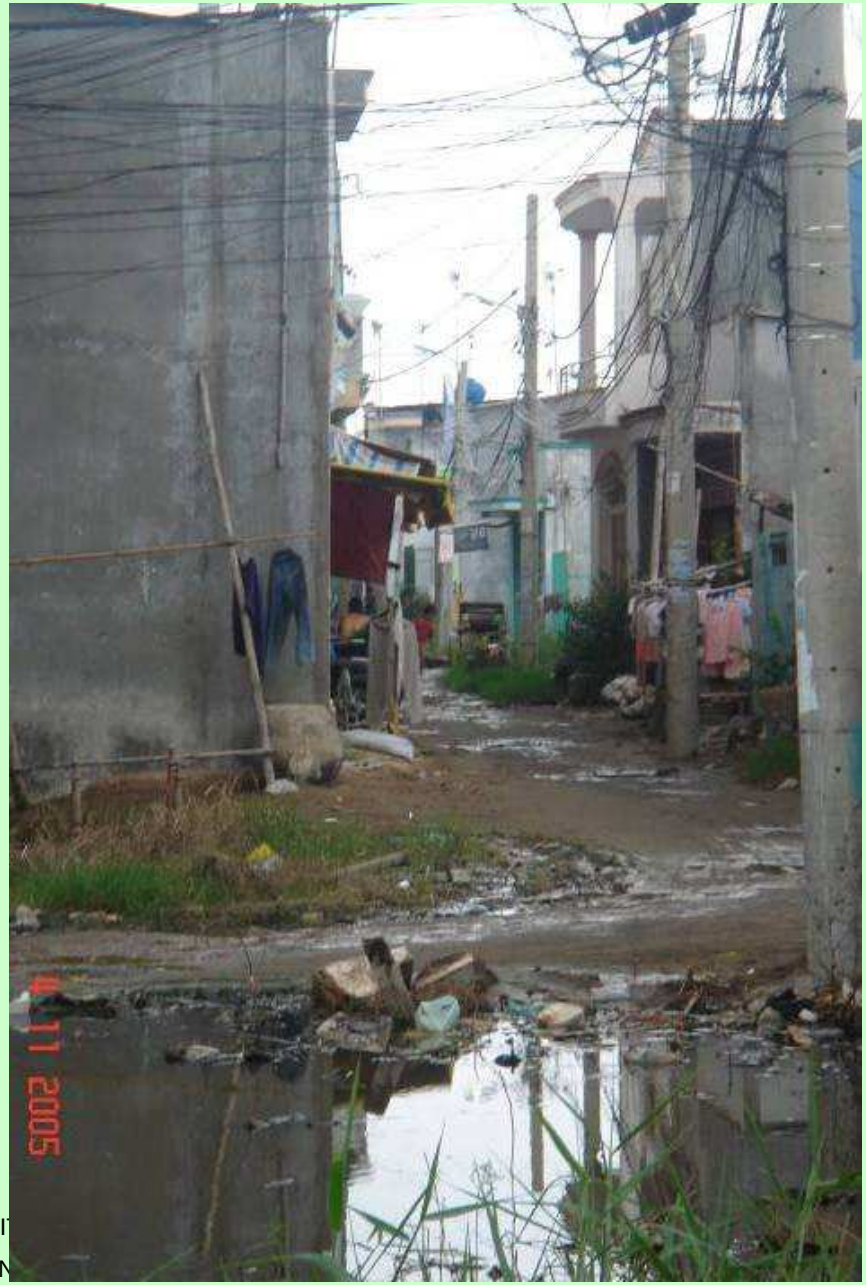
POPULAR HOUSING: PROBLEM AREAS OF THE FUTURE

UNPLANNED NEIGHBORHOOD (BINH CHANH)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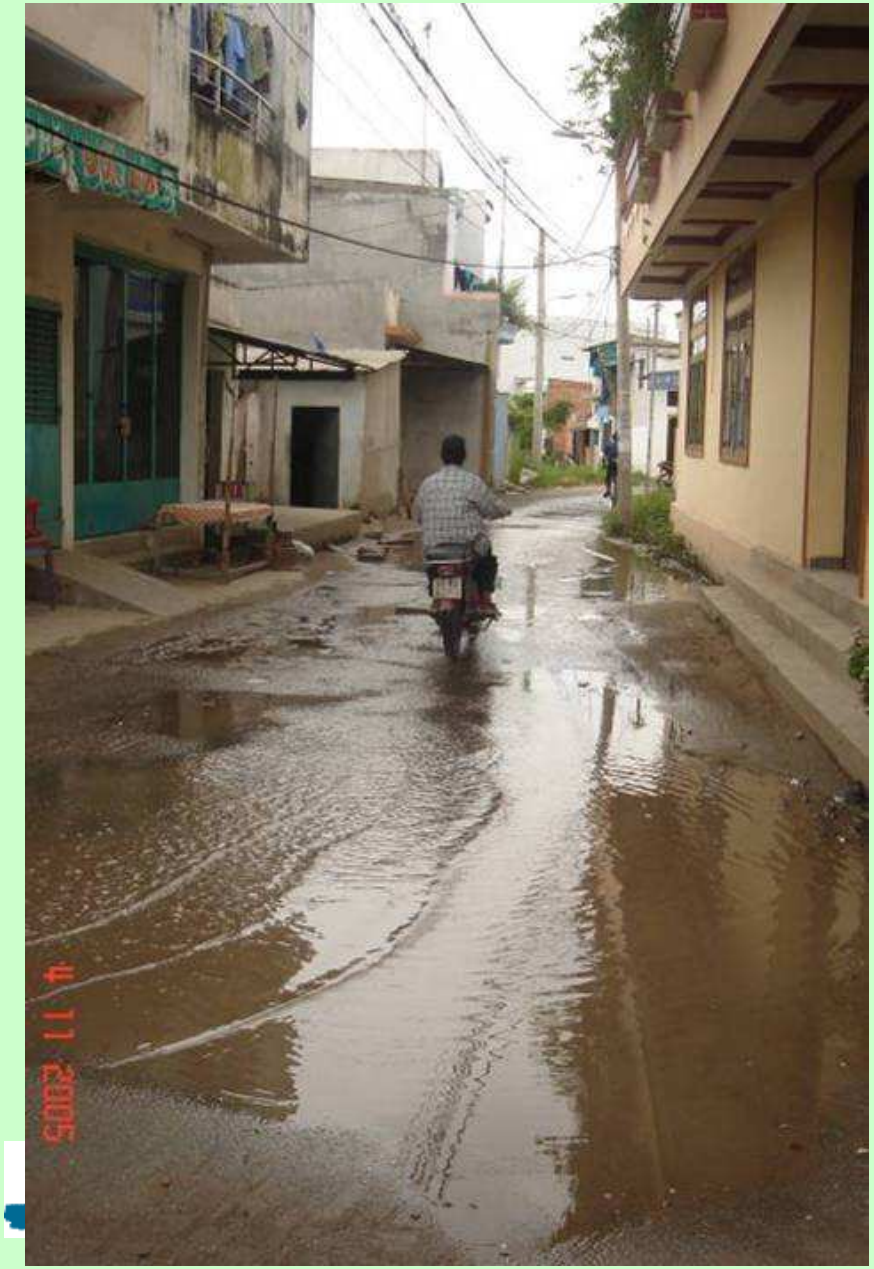
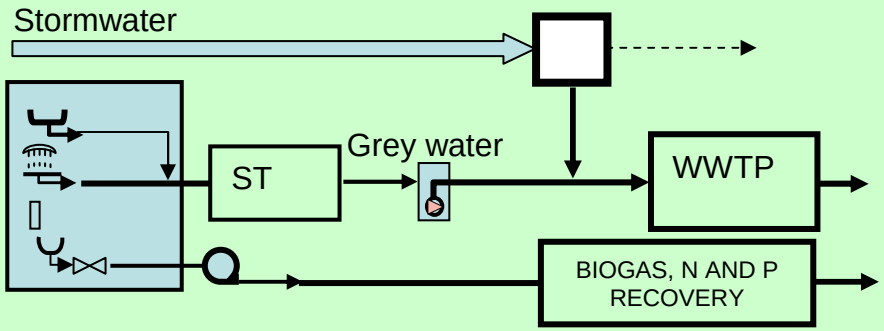


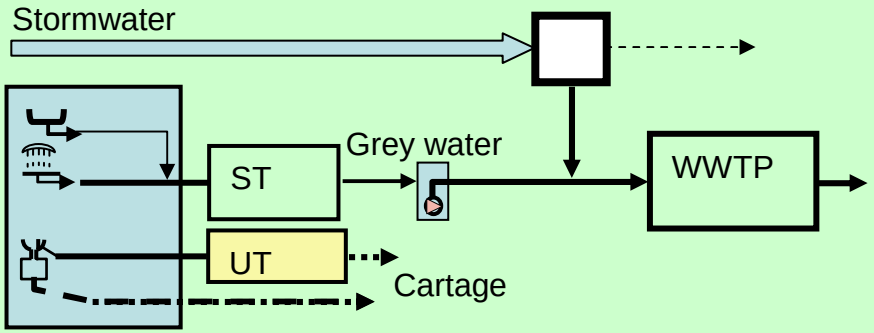
TWO PIPE OPTIONS/ STORMWATER AND SEWAGE SEPARATED
SOURCE-SEPARATED STREAMS

3 STREAMS



Option 66: Vacuum toilets, separated handling of storm- , black and grey water

4 STREAMS



Option 64: Dry UD toilet + settled enhanced separated sewer system