Natural treatment systems for waste water

Introduction on Artificial Recharge

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Background

- World population is increasing rapidly
- World water situation is precarious
- Good quality water sources are becoming scarce
- Cost of conventional treatment and transport are increasing
- New contaminants are found
- Regulations are becoming more stringent

Renewed interest for natural treatment systems

- That are relatively cheap, robust, sustainable and easy to operate
- And rely on natural phenomena comprising different physical, chemical and biological removal mechanisms

- …….. artificial recharge

Definition

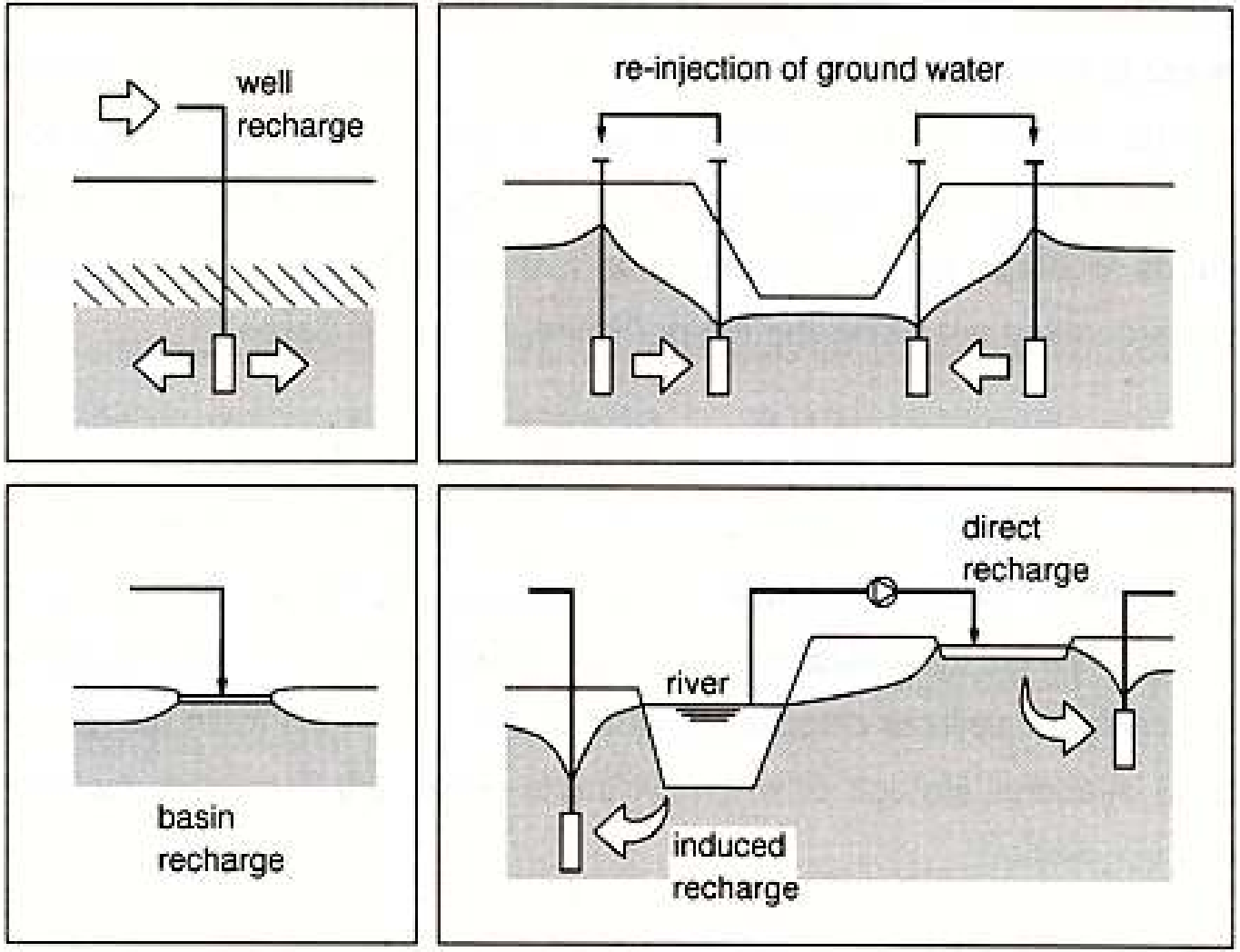
Artificial recharge

- Infiltration or injection of water in the subsoil to augment the amount of groundwater
- The source is predominantly surplus river or lake water, wastewater, urban storm water
- Under controlled conditions
- With the intention of storage or treatment

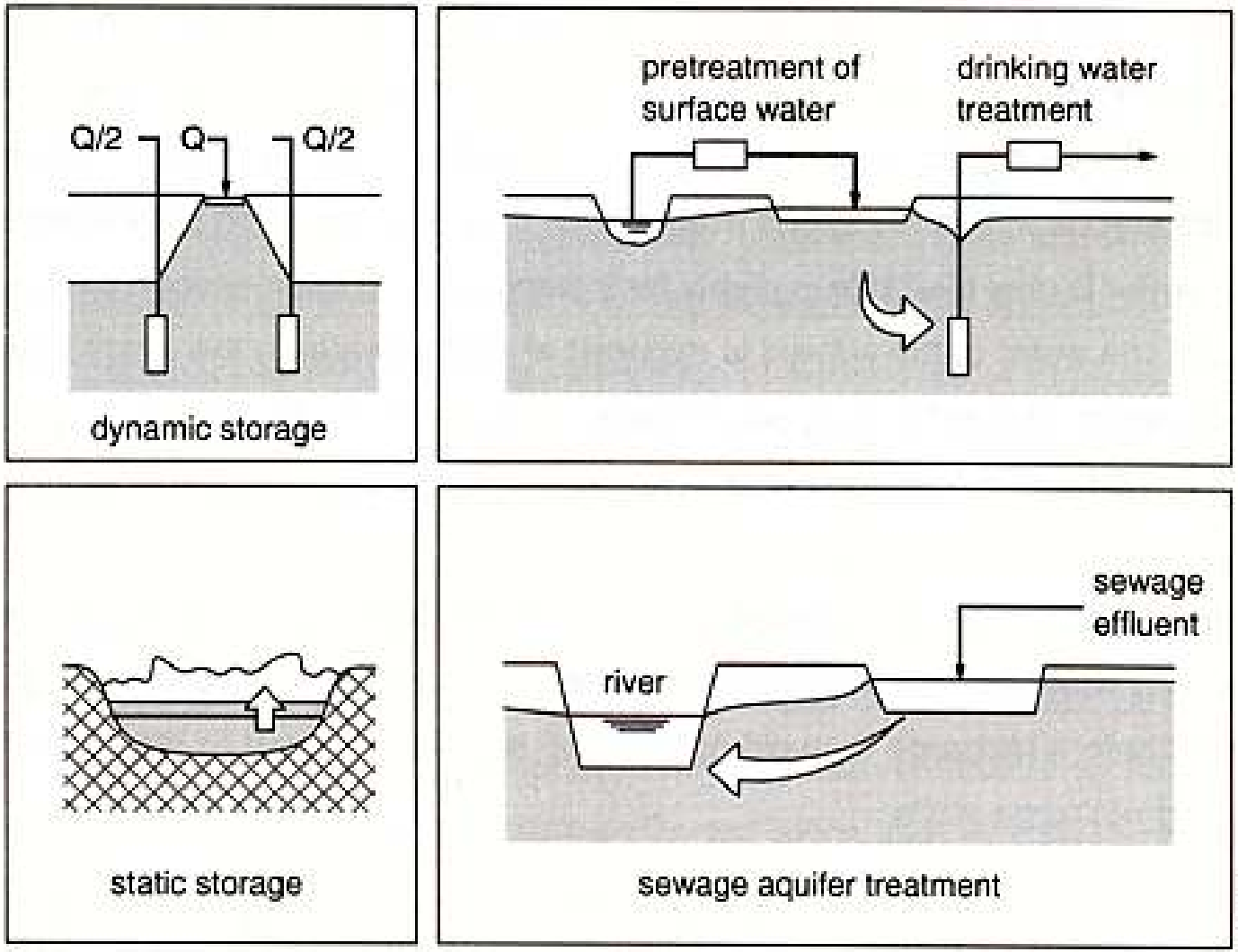
Prerequisites for artificial recharge

- Suitable target aquifer (preferably shallow, unconfined, not covered with a thick confining layer, large aquifer thickness, permeable, no shallow groundwater table)
- Water source with good quantity and quality (fresh, meeting local standards and regulations)

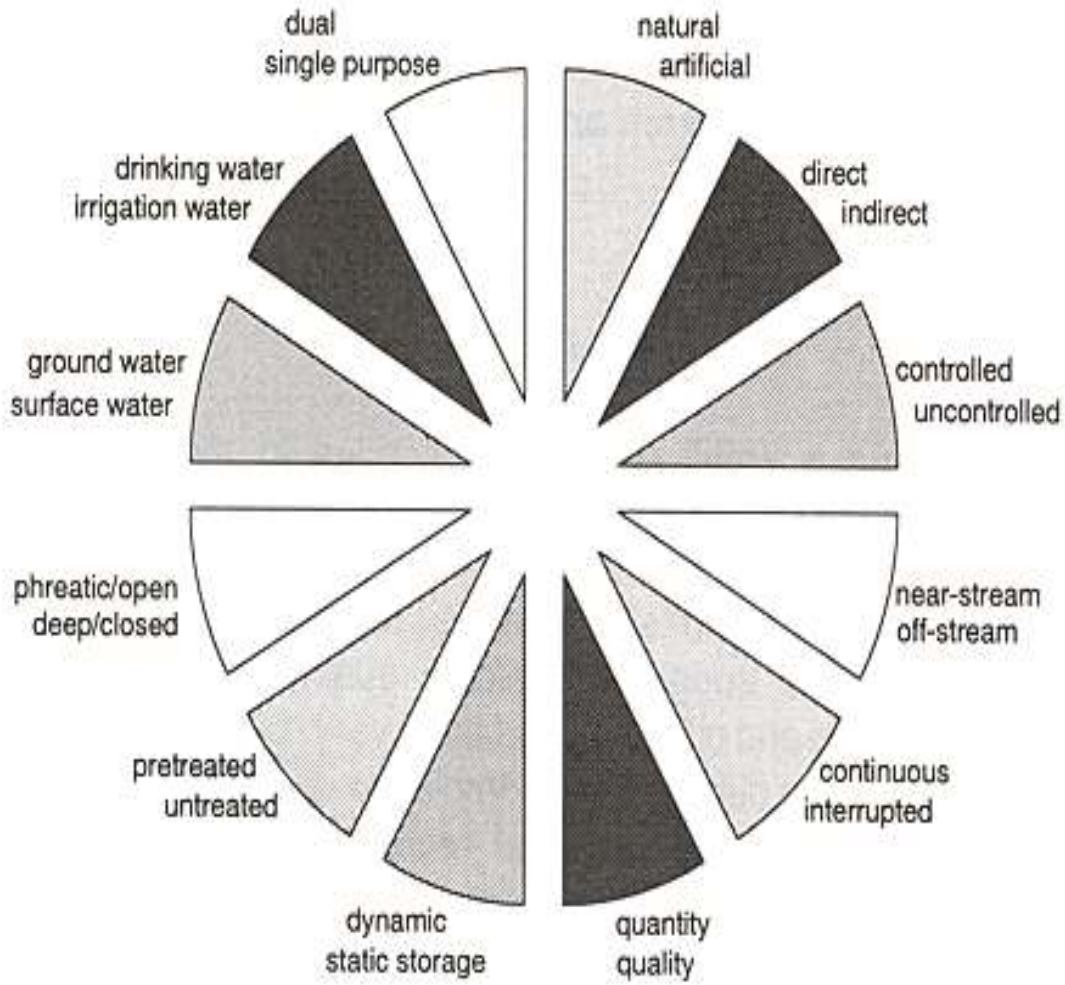
Types of recharge schemes (1)



Types of recharge schemes (2)



‘The wheel of recharge’
Objectives of AR schemes



Factors to be considered for successful implementation of AR

- A specific scheme that makes efficient use of all waters
- Information on water quantity and reliability
- Full understanding of aquifer behavior/hydraulics (flow, storage, permeability, geohydrology profile)
- Information on water quality, including necessity for some kind of pre-treatment
- Costs/economics/financing arrangements
- Environmental, legal, regulatory issues (since feasibility is a matter of economy, technology, environment, health concern, public acceptance)
- Management and technological know how
- Extensive pilot testing

Dutch water situation

- Average rainfall 800 mm/year
- Rhine/Meuse bring 78 billion m³/year
- Fresh water availability 7000 m³/person/year
- Fresh water is not scarce
- 400 municipalities collect waste water
- treatment is done by 25 waterboards
- 350 WWTPs, 1.7 billion m³/year
- At least secondary treatment
- Experience with irrigation is very little
- Reuse of waste water is not well developed
- Only process water, urban water maintaining water level or discharge
- Much experience with AR of river (!) water for drinking water supply
- Drinking water supply is 1.2 billion m³/year

Basin recharge in the Netherlands

- Started in the mid 50's
- At present almost 200 million m^3/year
- Direct, controlled, off-stream, continuous
- 90% is in dune area along Northsea coast
- Average water transport 60 km
- 90% of water pretreated (to meet requirements of regulator and to avoid clogging)
- Average entry rate 0.15 m/day

The recharge mix, the reasons why

- Expansion of ground water pumping
- To overcome problems with brackish water (overexploited aquifers)
- Hygienic safety (‘aquifer treatment’)
- Constant quality (due to mixing and processes in the subsoil)
- Storage (daily, seasonal)
- Filter enigmatic/emerging constituents
- Simple, Solid, Safe & Sustainable

- Intake for artificial recharge

Consultancy and Engineering

- Intake for artificial recharge
- Basin recharge site
- Transport

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Water supply Province North-Holland

Water supply Amsterdam

Consultancy and Engineering

Water supply The Hague I

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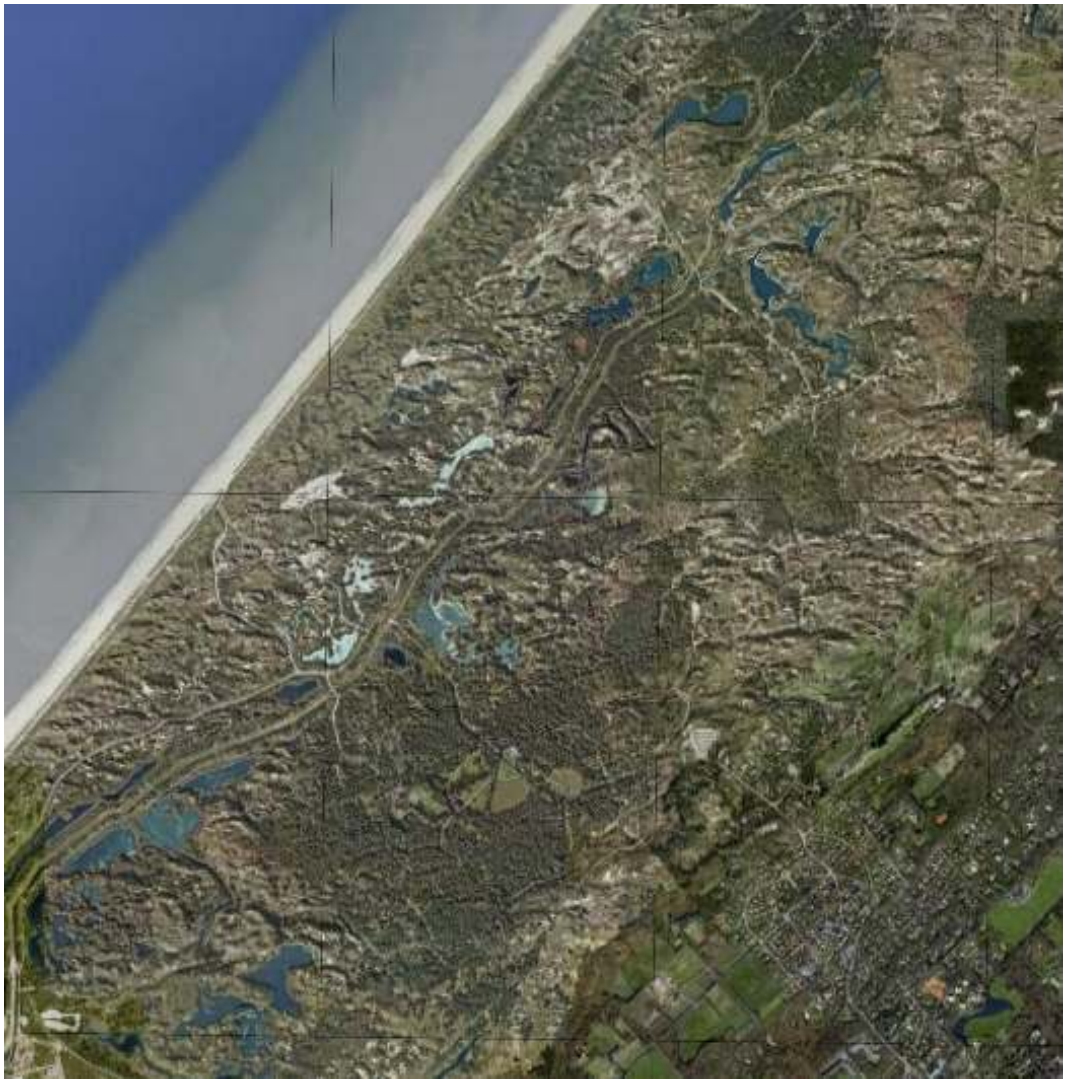

Water supply The Hague II

Water supply Province Limburg

Concluding remarks

- Differences in AR-systems worldwide are big
- Every problem is unique, so should be the solution
- No such thing as a blueprint for an AR-scheme
- AR helps to make efficient use of water resources
- Feasibility is a matter of economy, technology, environment, health concern, public acceptance

Further reading and acknowledgement

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