

Delivering Solutions for Water and Sanitation

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Civil Infrastructure for Water, Sanitation, and Improved Health: Existing Technology, Barriers, and Need for Innovation

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Background:

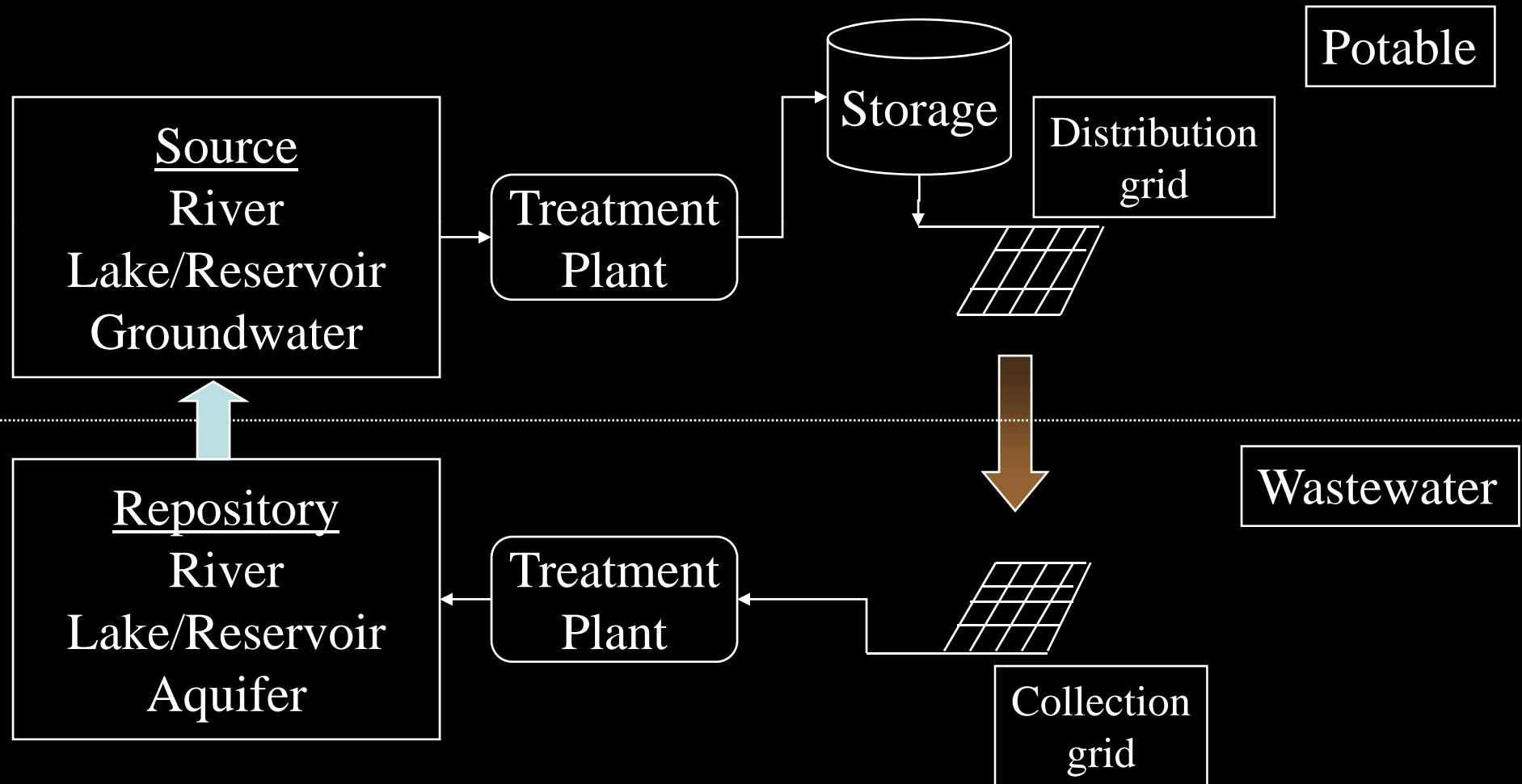
Engineering Perspective

- Systems for the treatment of potable water and wastewater are available
- “Silver bullet” technologies do not exist
- Solutions are based around water supply and water quality needs
- In the developed world, water infrastructure is enormous in scale and is both capital and resource intensive

Common U.S. Civil Infrastructure

- Create water supply
 - Reservoirs, intake structures, well fields
- Resource protection
 - Wastewater treatment, landfill placement, hazardous waste management, well head protection, aquifer remediation, preventing salt water intrusion
- “Heavy” Infrastructure
 - Potable water treatment plant, wastewater treatment plants, conveyance systems, above ground storage, residuals management

Engineering the Hydrologic Cycle for Improved Health



Improved Health and Water Quality Parameters

- Potable Water
 - Pathogens
 - Nitrate
 - Fluoride
 - Arsenic
 - Heavy metals
 - Synthetic chemicals
 - Secondary concerns
- Wastewater
 - Oxygen demand
 - Nutrient removal
 - Sludge disposal
 - Suspended solids
 - Heavy metals
 - Synthetic chemicals
 - Secondary concerns

Essential Elements of U.S. Water Infrastructure

- Water supply
- Resource protection
- “Heavy” infrastructure
- Energy
- Chemicals
- Subsidies
- Regulatory frameworks
- Available capital
- Property ownership
- Social Acceptance

Most are lacking
in the developing
world and all are
needed to translate
our model...

Barriers

- Water supply
 - Shallow groundwater is limited
 - Urbanization focuses water demand and waste production
 - Increasing demand on surface water for drinking, and for wastewater discharge
 - Agriculture and energy
- Resource protection
 - Externalization of water resources during development
 - Groundwater contamination from poor sanitation and agriculture
 - Coastal development and salt water intrusion

Barriers

- Energy
 - Energy is the largest operational cost in water and waste water treatment
 - Water and wastewater conveyance requires pumping
 - Wastewater treatment is energy intensive (aeration)
 - Residuals management can be energy intensive
 - Desalination
 - Energy demands have the greatest influence on modifications of water resources globally
 - Growth in energy production projected to be highest in water poor regions

Barriers

- Chemicals
 - Flocculants
 - Disinfectants
- Subsidies
 - Requires that government considers clean water and appropriate sanitation in the public interest
 - Subsidies for agriculture impact water availability

Barriers

- Regulatory frameworks
 - Particularly important for sanitation
 - Wastes are inherently low value, why spend money them?
 - Public trust for safe water
- Available capital
 - Typically financed by public sector
- Property ownership
 - Access, planning, and distribution systems
 - Knowledge of users, and ability to bill for services

Barriers

- “Heavy” Infrastructure
 - Population growth and changing demographics
 - Implementation timetables are long
 - Reservoir development
 - Construction
 - Public acceptance
 - Operations and maintenance costs
 - Cost ineffective for small communities

The Technology Spectrum



Large, interconnected
complex systems

*Are intermediate
solutions in water
and sanitation
possible?*

Small, distributed
simple solutions

*Can these
be improved?*

The Innovation Challenge

- Most water and sanitation technologies were mature decades ago
- Research focus in U.S. universities has been on advances to our water and sanitation approach
- No clear, sustained, funded mandate for research and development to existing NGO's
- The need for “different solutions” has not changed

Summary

- “Heavy” infrastructure model possesses many barriers for solving needs in the short term
- Increasing demands from agriculture and energy are a serious threat to water security
- Advances in energy systems, materials, biology, and micro-finance show promise for innovation in water and sanitation fields
- Business models need to be integrated early in solution formulation
- Scaling factors need to be better understood