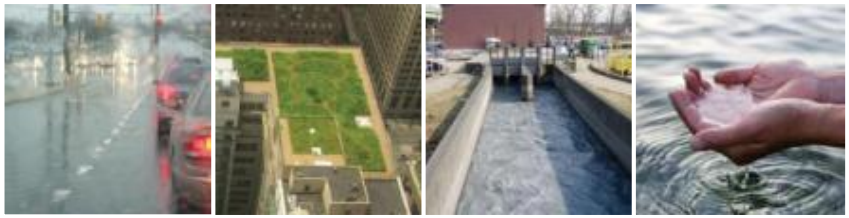
TETRA TECH

“One Water” in North Carolina: Reconnecting Water to Build Better Communities

Trevor Clements, President
Tetra Tech Engineering, P.C.
RTP, NC

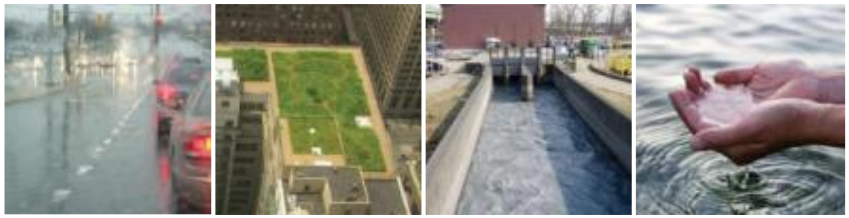
complex world | CLEAR SOLUTIONS™

Talk Objectives



- Explore how One Water approach is integral to building a more resilient North Carolina
- Highlight Stormwater Component

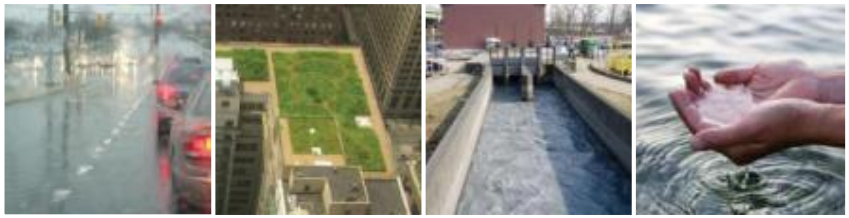
Emerging Focus for 21st Century Communities



Balanced Triple Bottom Line:

- Strong and Prosperous Economy
- High Quality of Life
- Healthy Environment

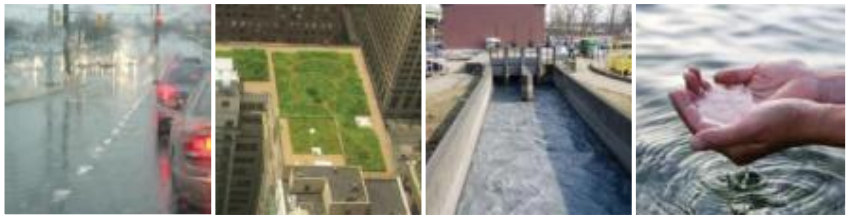
NC ARCOG Economic Development Goals



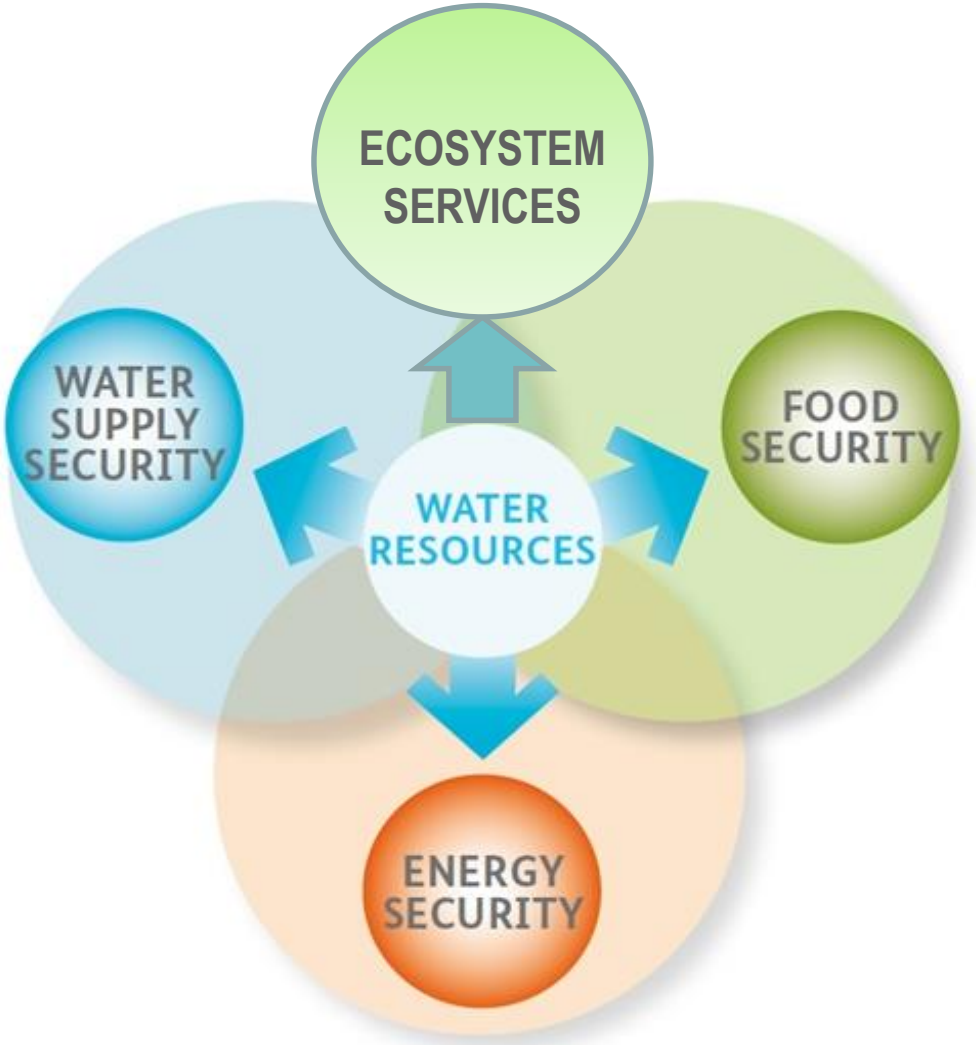
- Build on the Region's Competitive Advantages and Leverage the Marketplace
- Establish and Maintain a Robust Regional Infrastructure
- Create Revitalized, Healthy and Vibrant Communities
- Develop Talented and Innovative People

NCTOMORROW
Building Communities for Tomorrow's Jobs

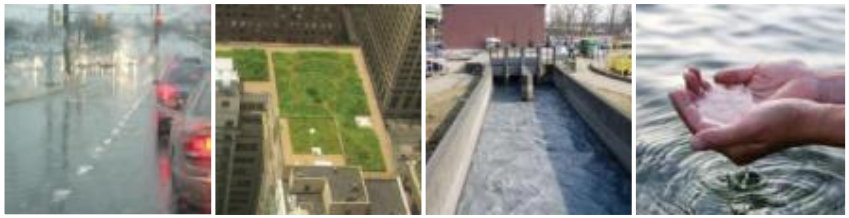
Water is the Key:
Connects to every aspect of our communities' well-being



- Water & sanitation for PEOPLE
- Rainfall & irrigation for FOOD
- Water for INDUSTRY, ENERGY, TRANSPORT….
- Water supporting ECOSYSTEM SERVICES

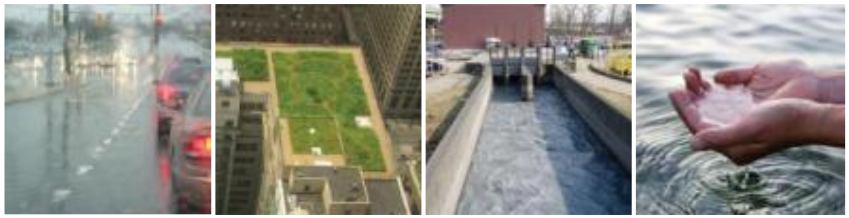


21st Century Challenges for Water



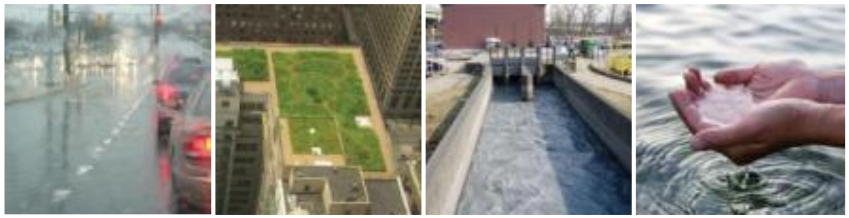
- Asset Management
  - Aging Infrastructure
- Water Quality Impairment
- Climate Vulnerability
- Polarized Public

Barrier to Resilience = The Way We Work in Silos



Wastewater Drinking Water Stormwater Others

Overcoming the Barrier: One Water Concept

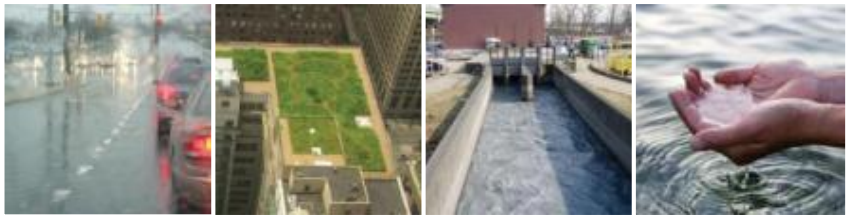


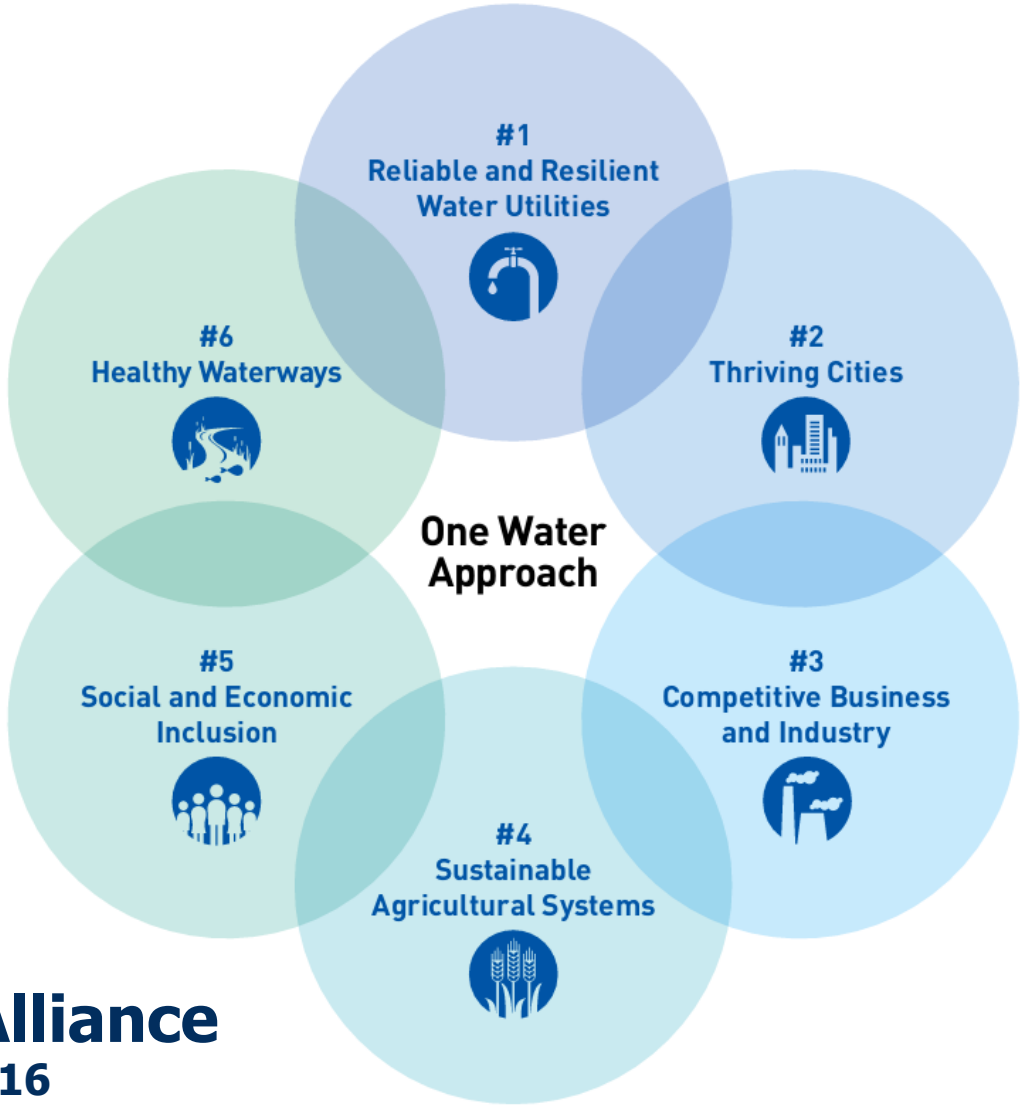
- Definition of One Water (WERF/WRF, 2015)
  - All urban water flows are recognized as potential **resources**…

  AND

  - the **interconnectedness of water supply, groundwater, stormwater and wastewater is optimized**, and their **combined impact** on flooding, water quality, wetlands, watercourses, estuaries and coastal waters **is recognized**

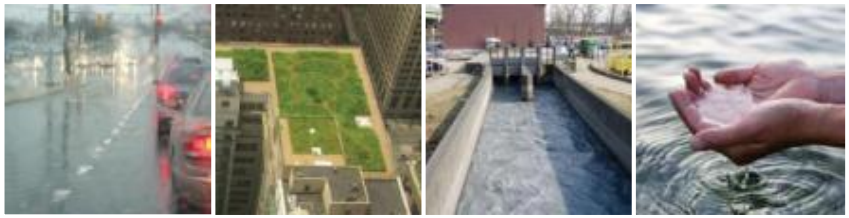
Connecting water to desired community traits





From: U.S. Water Alliance
Roadmap for One Water, 2016

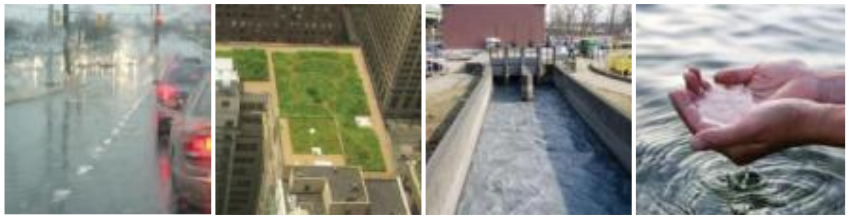
Summary of Transformational Principles

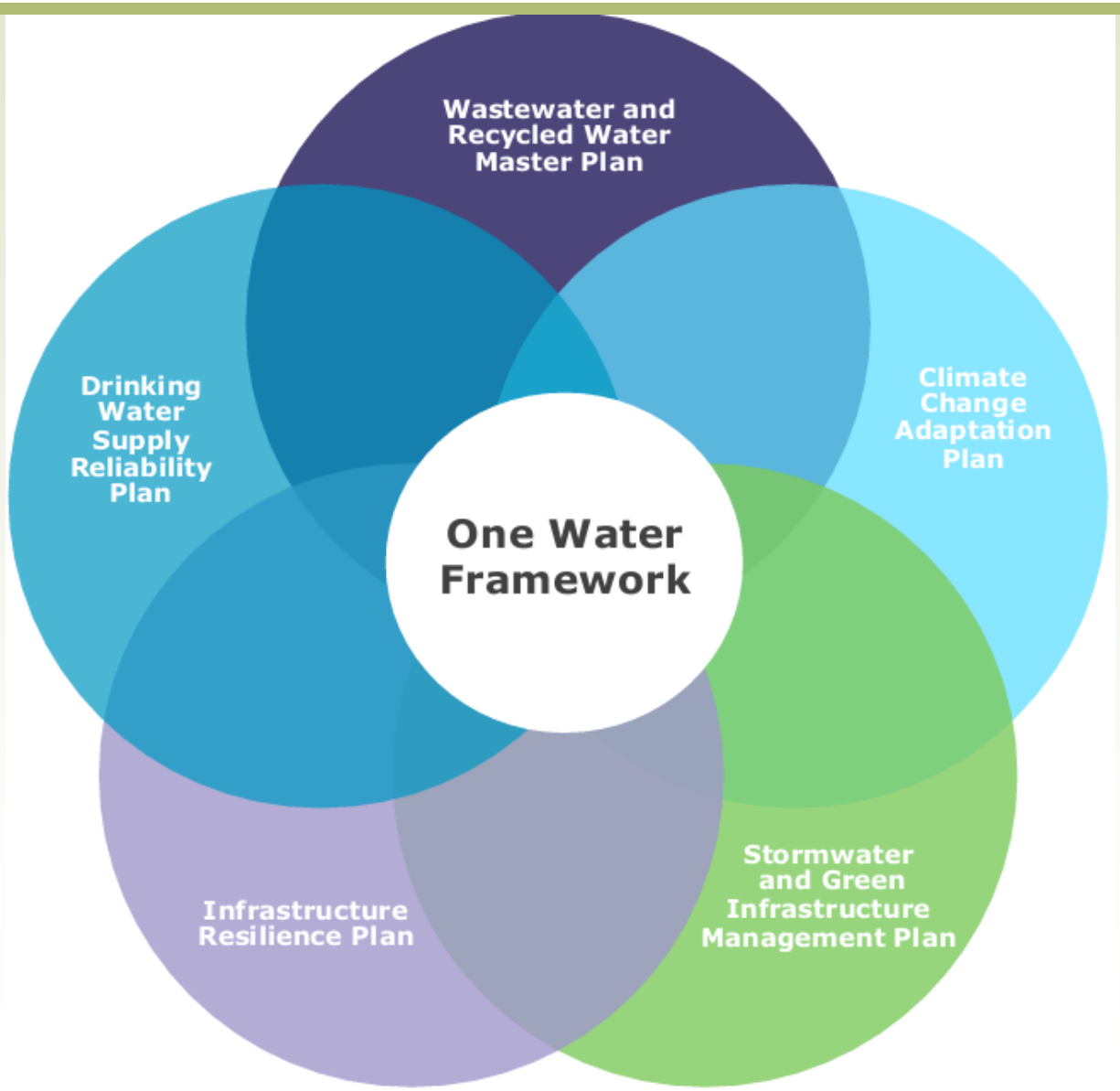


- Value all water
- Aspire to higher community objectives
- Consider all aspects of community development
- Integrate scales and multiple functions
- Recognize life-cycle costs/maximize TBL benefits
- Choose smart, clean and green approaches
- Foster innovation
- Adapt and evolve (better, stronger)

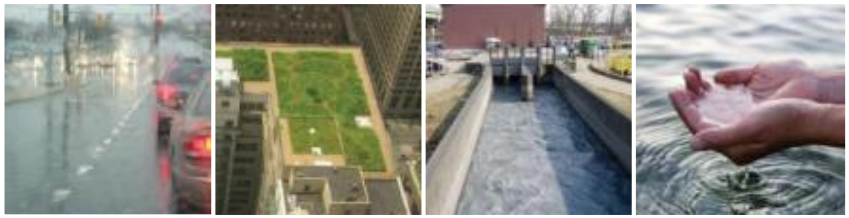
WRF diagram

Blue Print for One Water, 2016

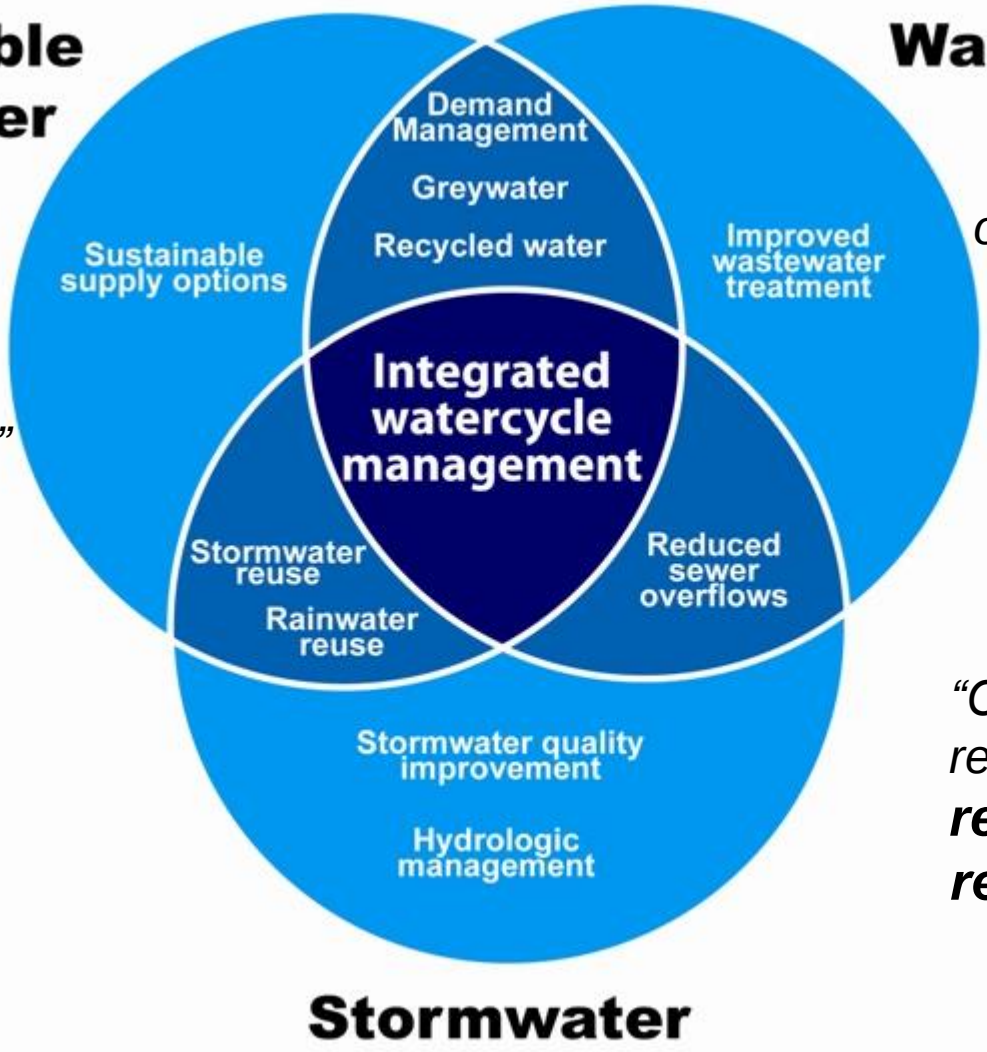




"One Water" Management Model



*"Address scarcity or supply expansion through **alternative sources of supply**"*

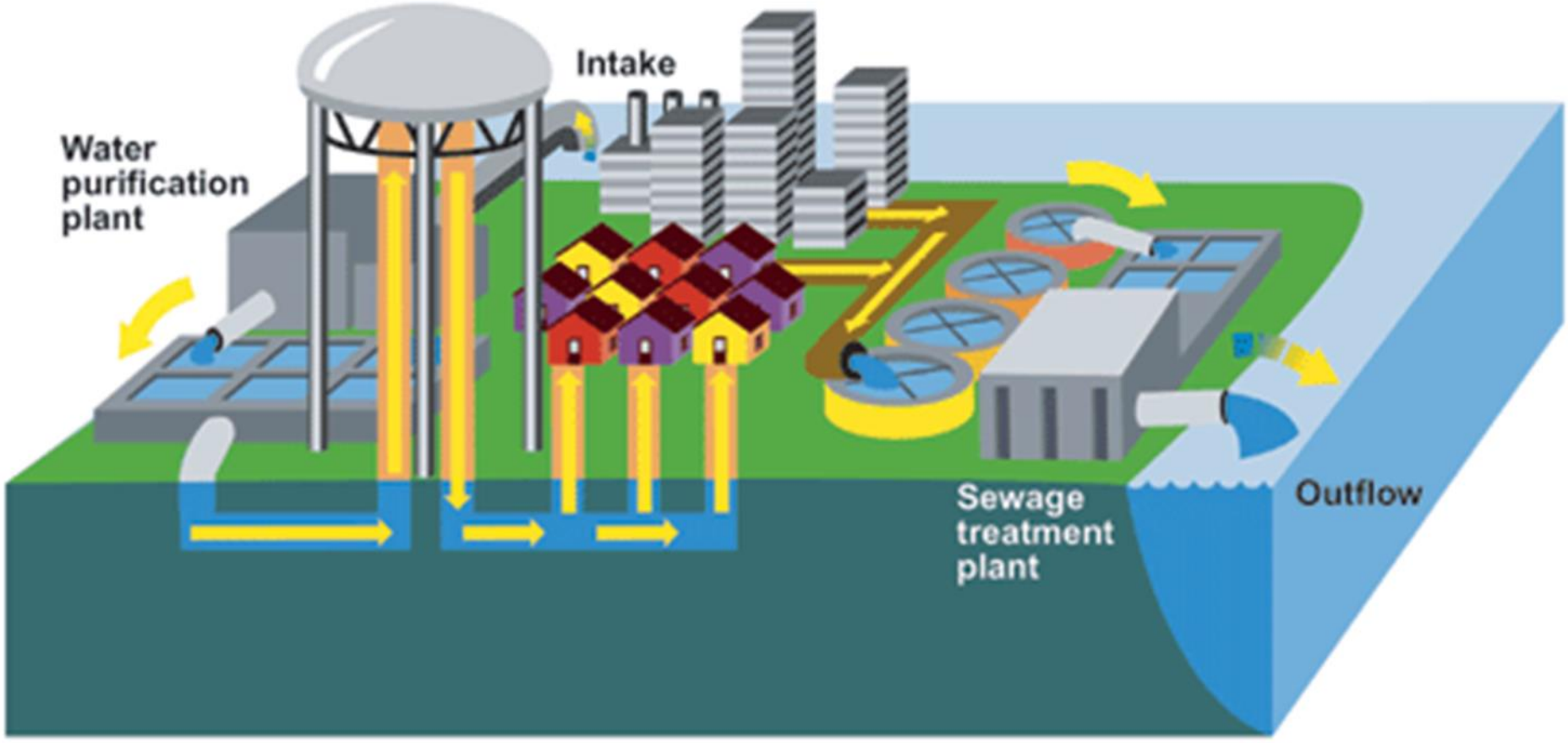


*Broader Spectrum of **Technologies: mimic nature, emerging, distributed***

*"Close the loop on resource cycles; **recovery and reuse"***

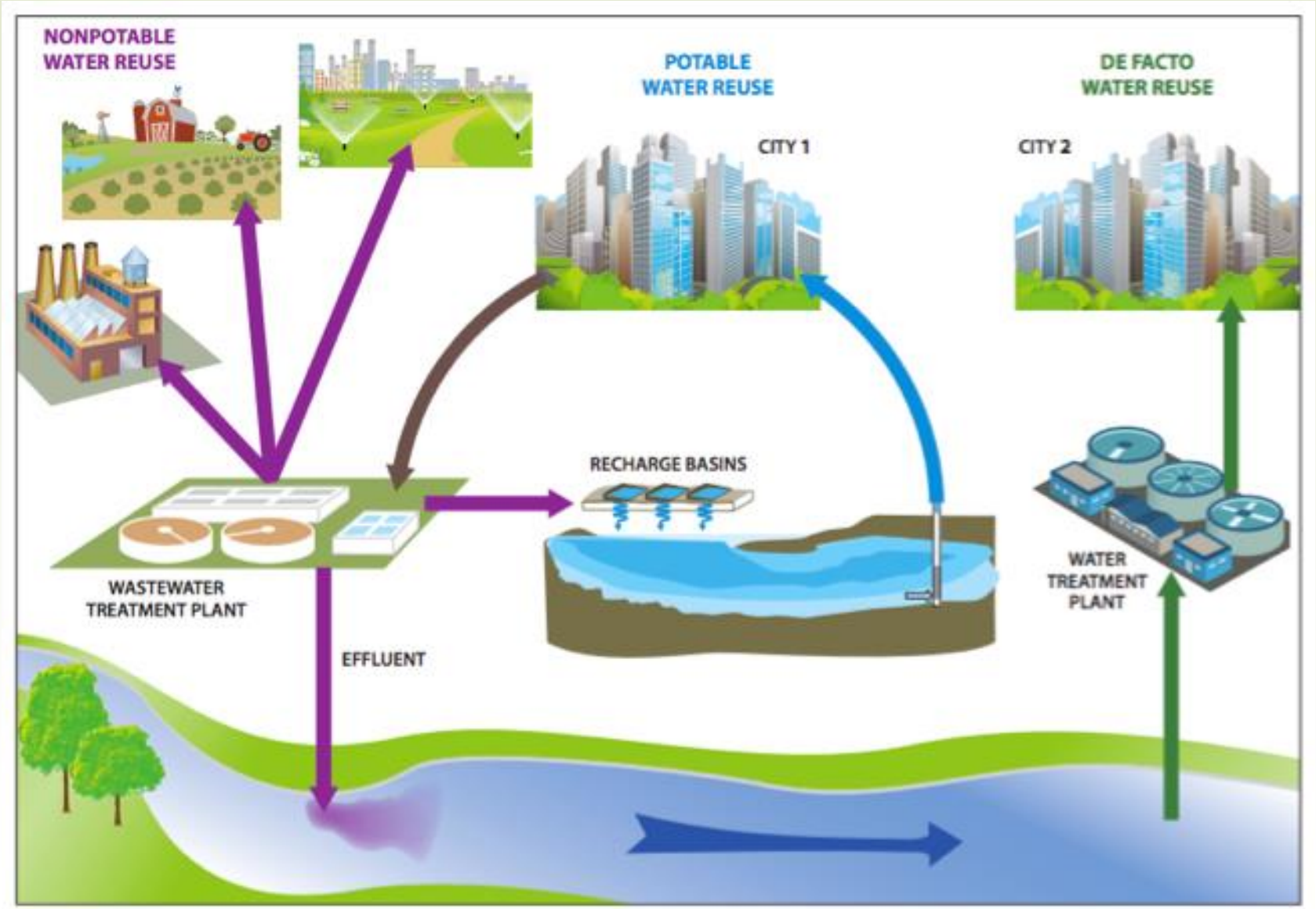
Current Paradigm: large centralized, single-use systems



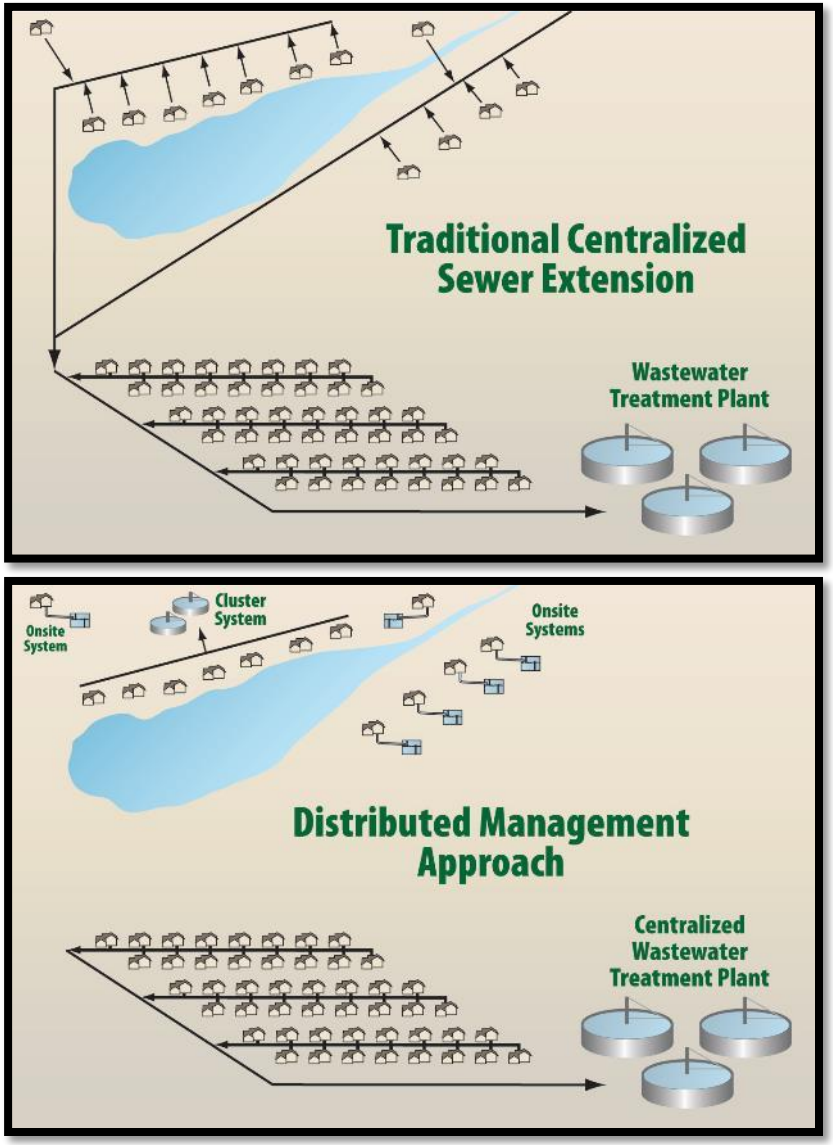
Some Reuse Now Occurring



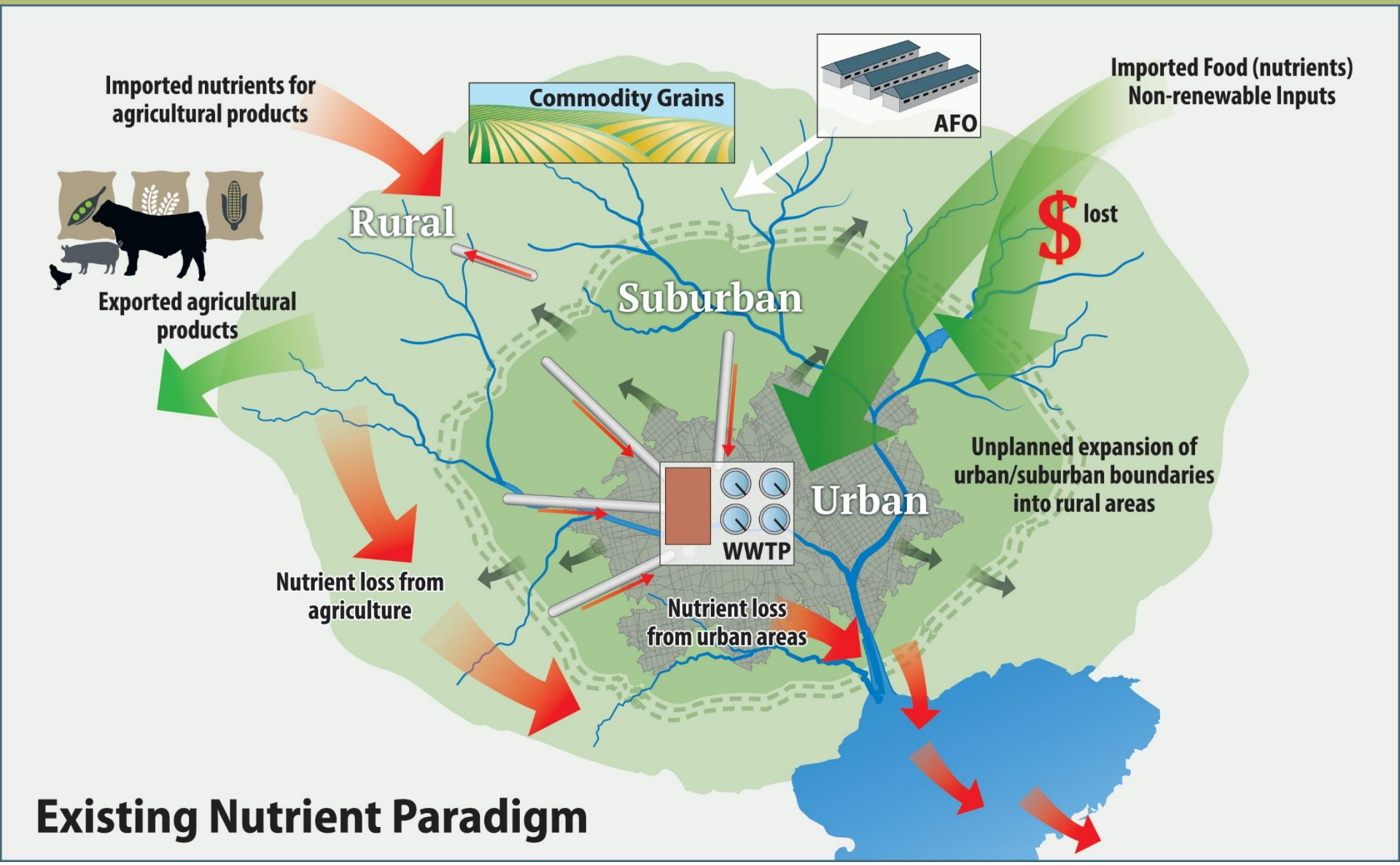
Integrating "Distributed" and "Go as you Grow" Approaches

- Treatment close to the source and/or reuse requires less energy
- Urban reuse retrofits are more feasible
- *Smart, clean and green* technology
  - Smart
    - Remote monitoring of multiple systems
    - Responsive to user feedback
  - Clean
    - **Resource recovery** within facilities
    - Match water quality to intended reuse (Fit-for-Purpose)
  - Green
    - Efficient/passive ecological treatment
    - **Multifunctional:** Landscape/facility integration
    - Relatively infiltration-resistant

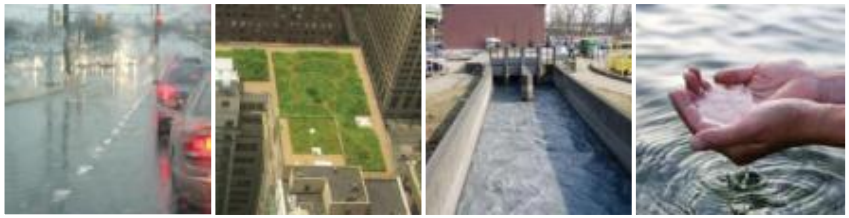


Current Unsustainable Approach to Nutrient Management



Top Down Prescriptive Approach Not Working (e.g., Falls/Jordan)



Determination of Water Quality Use Impairment

↓

Prescriptive Policies & Regulations

↓

Control Based Implementation

↓

Outcomes:

- Economic Opposition
- Social Opposition
- Remand of Environmental Rules

Root cause not addressed

- Open loop nutrient flows
- Poor land management

Weak links

Social:

- "Problem"- vs "Vision"-based

Economic:

- Large cost of required controls
- Public question of benefits

Environmental:

- Single parameter focus

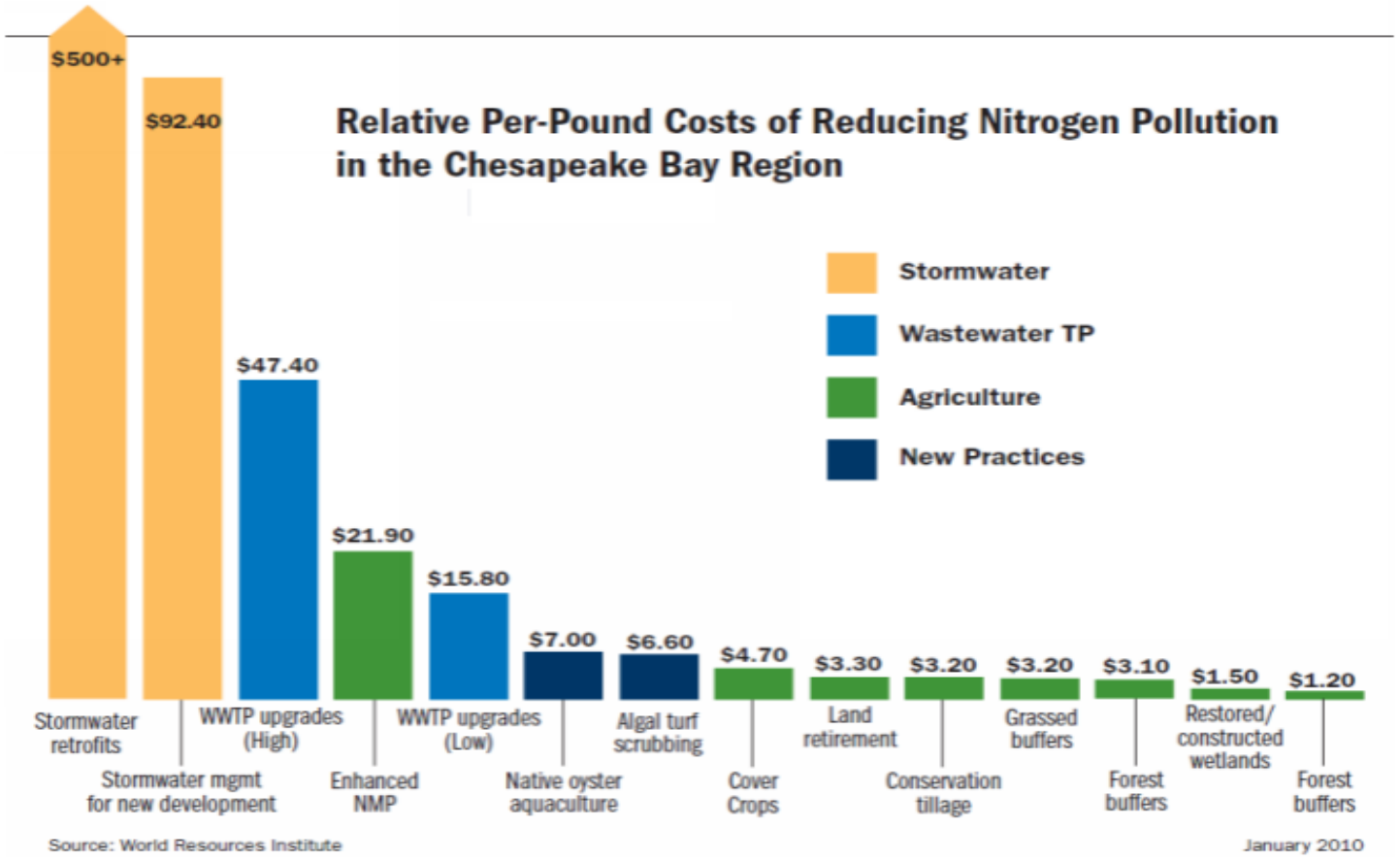
Missing alternatives to "treat and discharge" options

- Community-based decisions promote local innovation

Insight from Chesapeake Bay Program




Costs per pound vary over 4 orders of magnitude

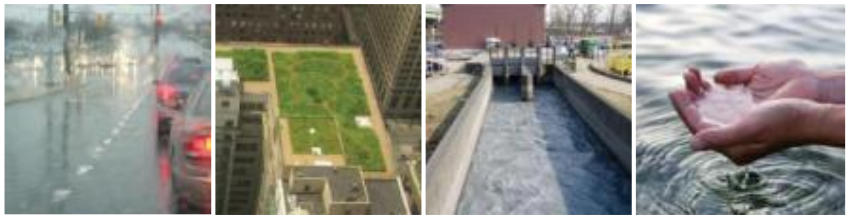


More Resilient Approach




Improved Nutrient Paradigm

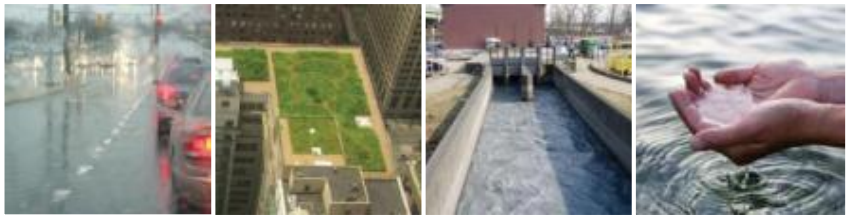
The Urban-Rural Continuum



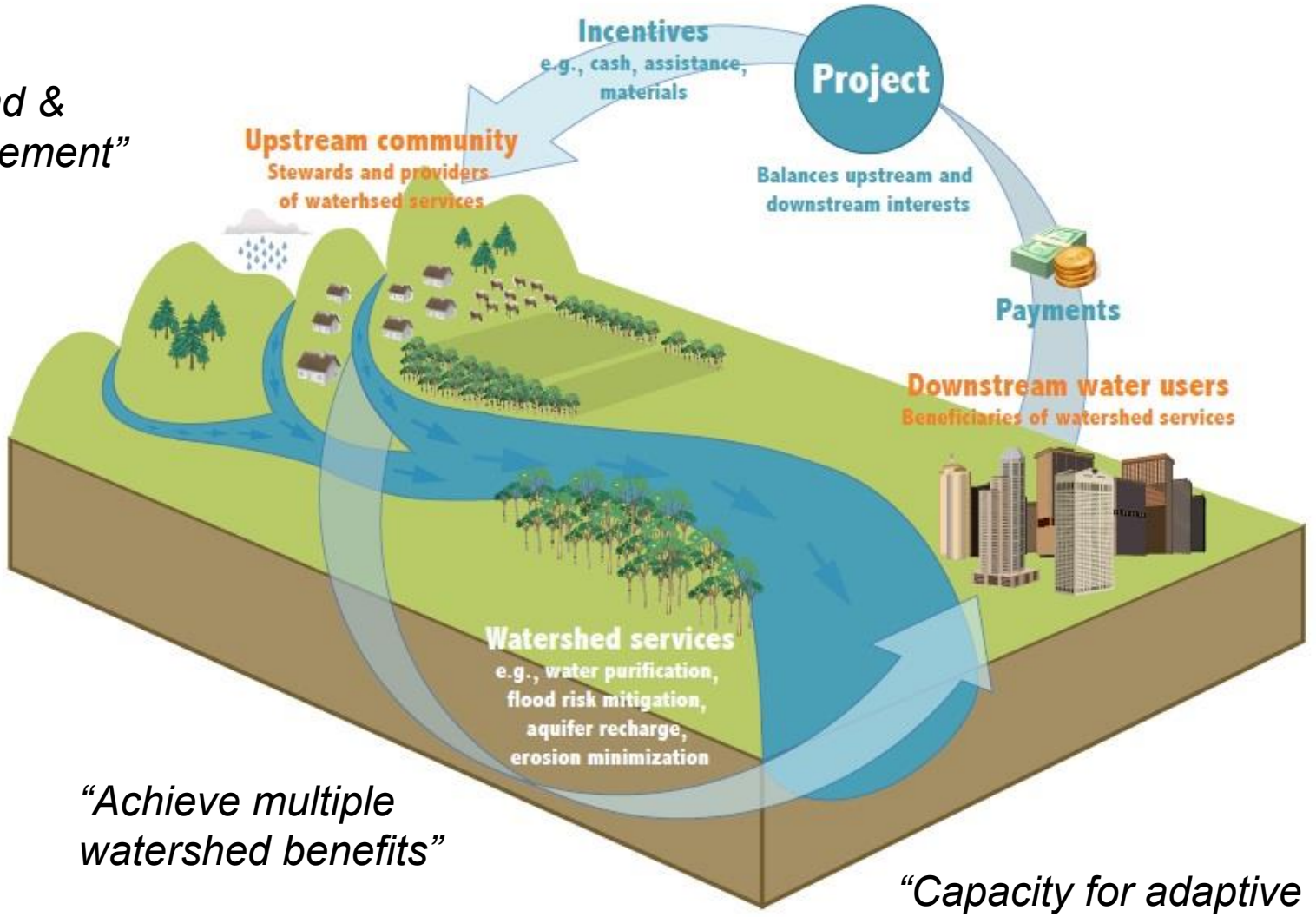
Interdependent concept that consists of:

- Strategic planning
  - Matching ag enterprise w/ land use, infrastructure, and market
- Socio-economics
  - Regional value-chains
  - Processing/storage/distribution hubs
  - Agri/eco-tourism
  - Jobs/education
- Agriculture-Supported Development
- Waste-to-resource markets
  - Minerals (struvite, biosolids, compost, feedstock organics, etc.)
  - Bio-energy
  - Irrigation supply
- “Working-lands” Mitigation
  - Performance-based, carbon-focused

Water connects upstream and downstream communities: manage as a system



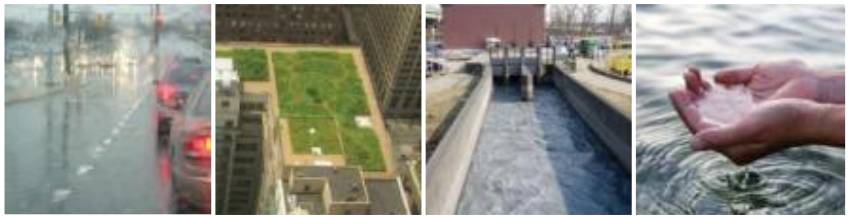
"Integrate land & water management"



"Achieve multiple watershed benefits"

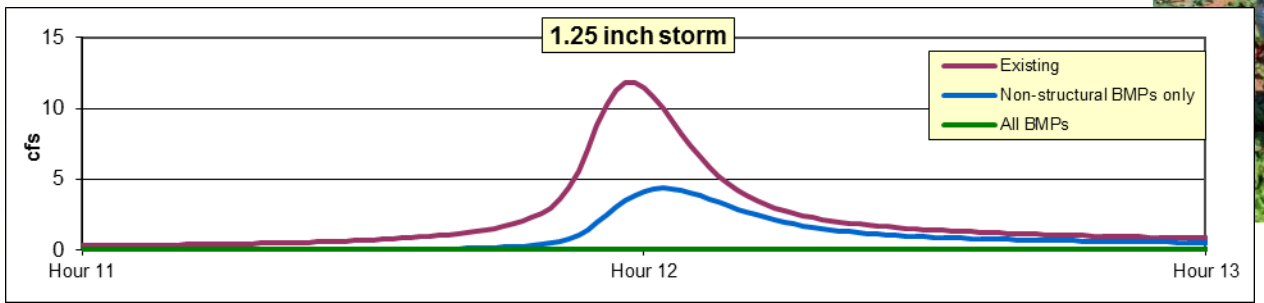
"Capacity for adaptive management"

Urban Pervious – The Next Frontier

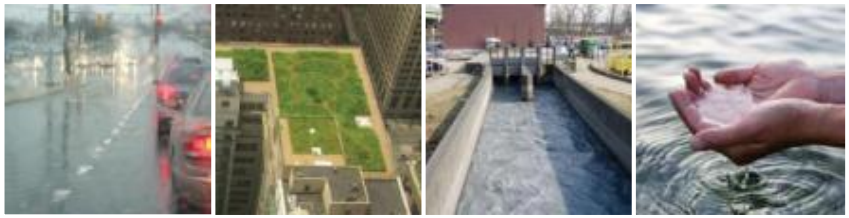


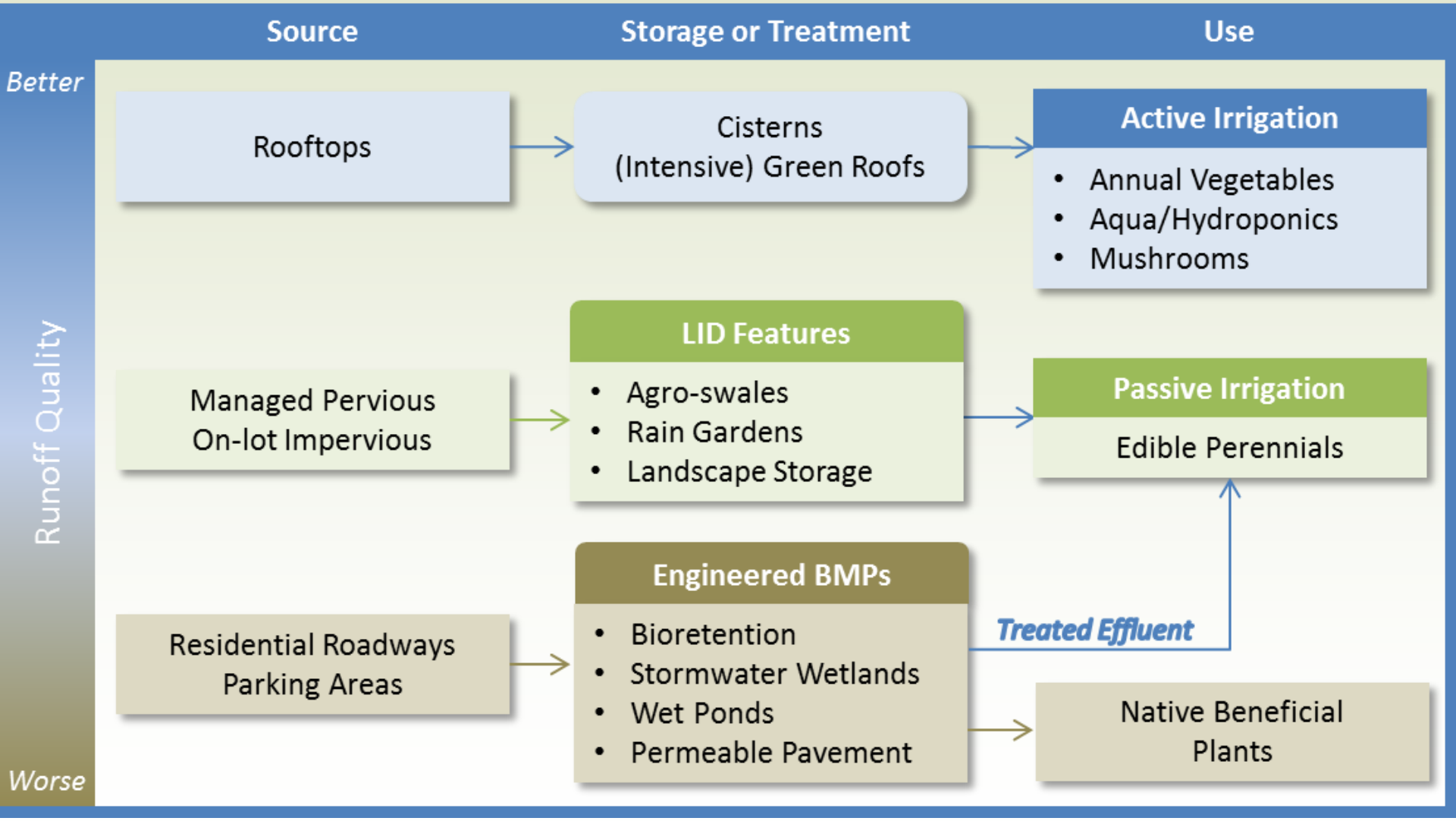
- Socio-economic driver for stormwater solutions
- "Problem to solution"
- Productive landscapes
  - Food, fuel, medicine, habitat, etc.
- Working with nature
- A new stormwater "business model"

GrowingPower.org

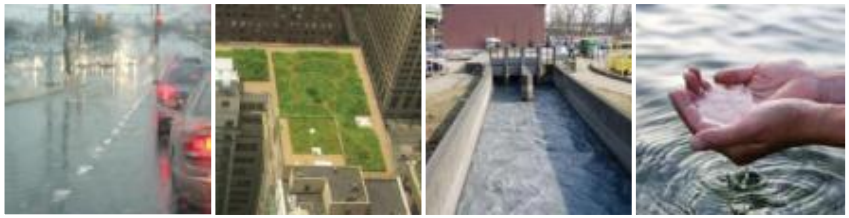


Linking Stormwater Management and Urban Agriculture: Site-scale





Urban Ag Collaboration
TBL Community Benefits



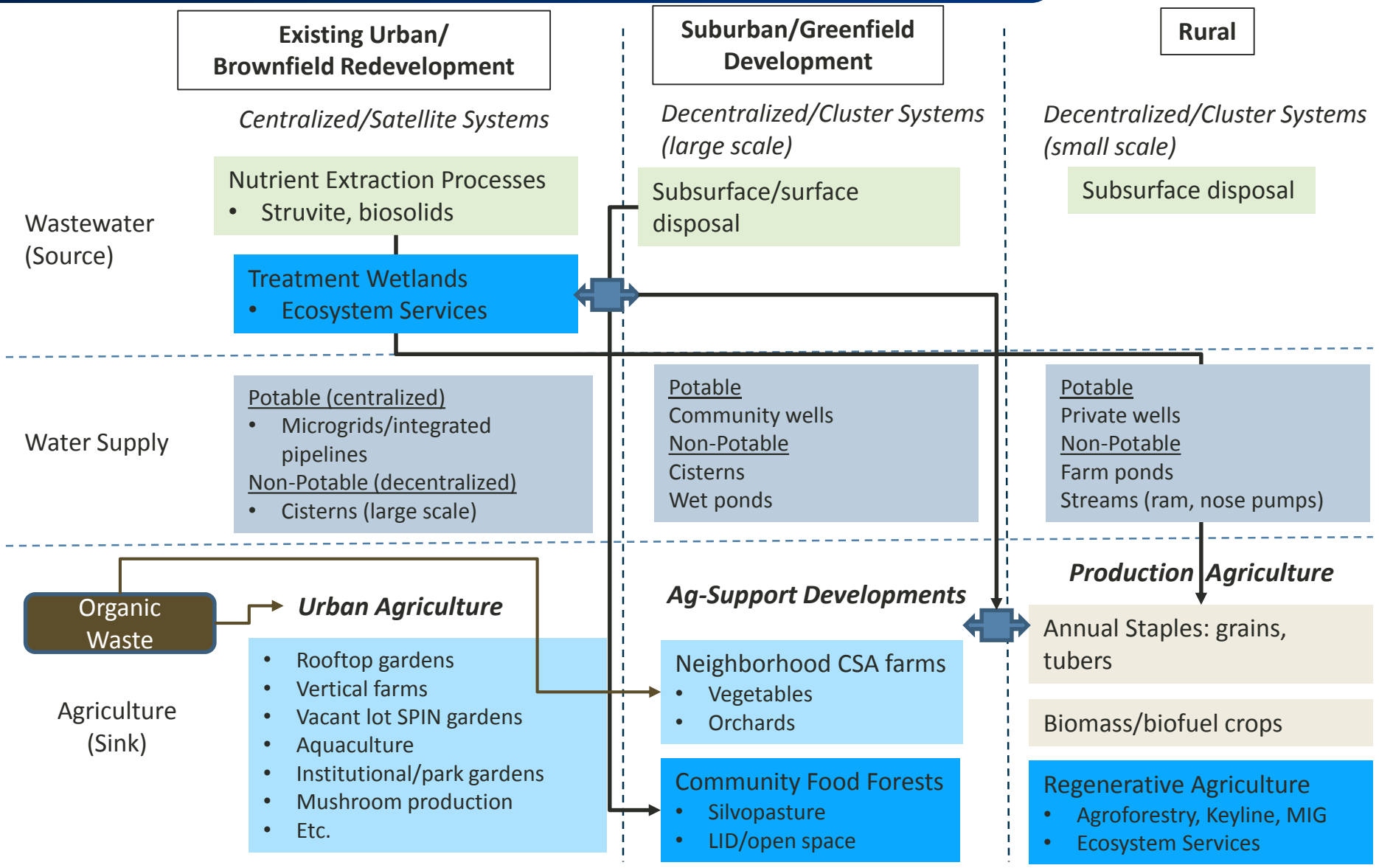
- Social
  - Food-Energy-Water security
  - Health
  - Empowerment
  - Youth development
  - Safe spaces

- Economic
  - Local $
  - Micro-enterprises
  - Food affordability
  - Energy savings

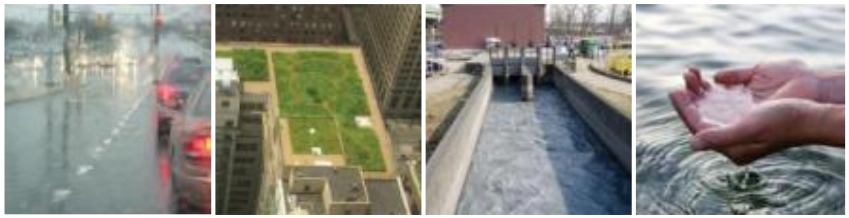
- Environmental
  - Soil improvement
  - Stormwater mgmt.
  - Biodiversity
  - GHG reduction

Matching Source to Sink to Scale

TETRA TECH



Green Infrastructure (GI) for Climate Resiliency



Resilient Outcomes

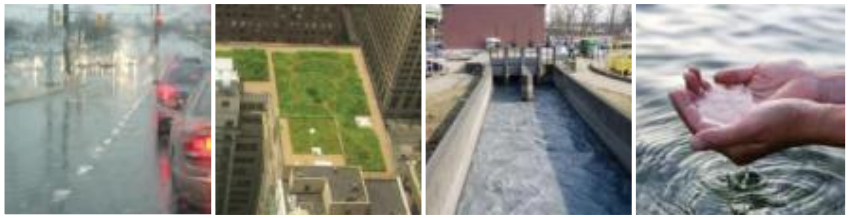
- Manage flooding
- Prepare for drought
- Reduce urban heat islands
- Lower building energy demands
- Spend less energy managing water
- Protect the coast

GI Practices

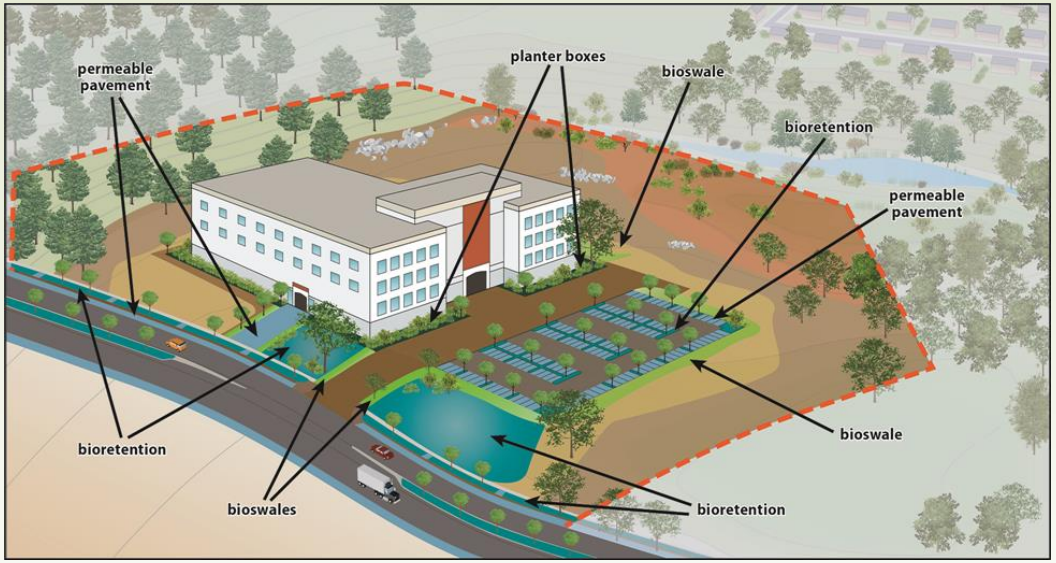
- Infiltrate water (bioretention, raingardens, swales, permeable pavement)
- Harvest rainwater (cisterns, rain barrels, vaults)
- Plant trees
- Build greenroofs
- Conserve natural areas: riparian buffers, wetlands, dunes, living shorelines

http://water.epa.gov/infrastructure/greeninfrastructure/climate_res.cfm

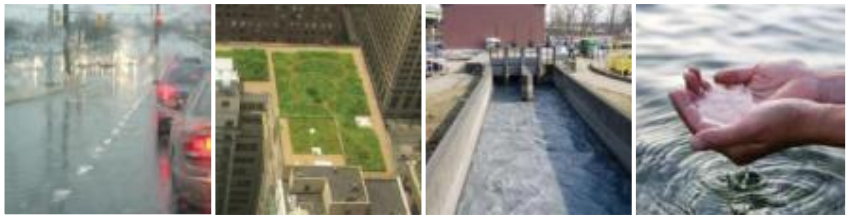
Enhancing Built Environment: LID & Green Infrastructure



- Values hydrologic cycle
- Reflects multiple objectives & benefits
- Part of asset management solution
- Smart, clean and green
- Integrated water approach
- Effective at multiple scales
- Adaptable



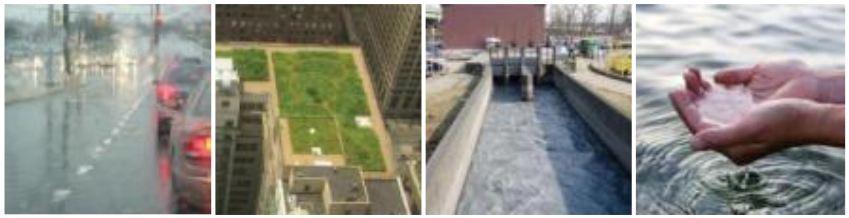
U.S. Examples – Urban: Battery Park NYC (Site Scale)

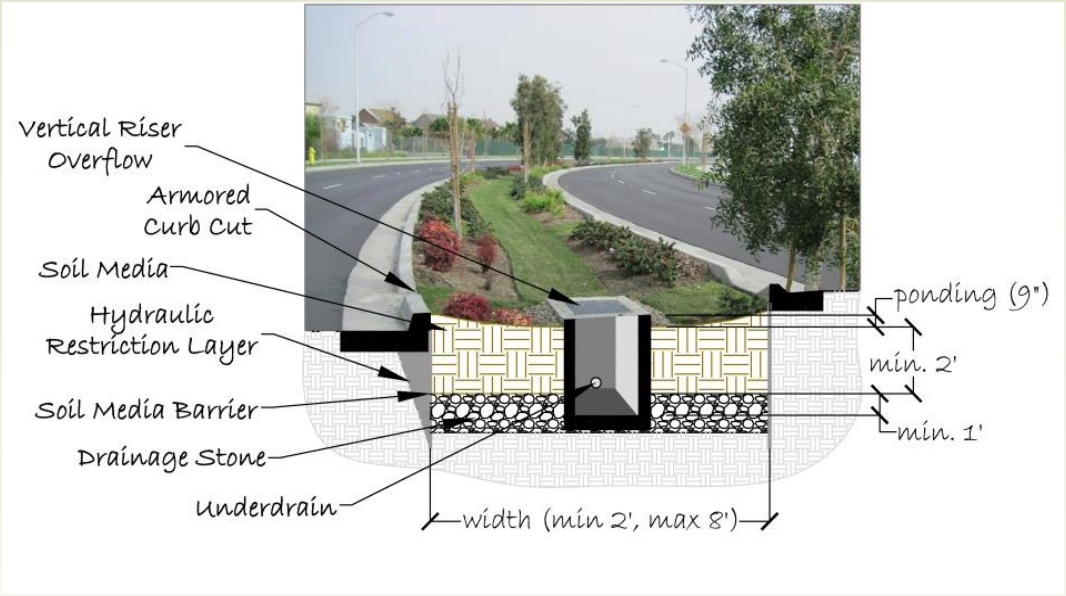


- Decentralized reuse in highly urbanized area
- LEED Platinum
- Green roof filters and captures stormwater
- Wastewater and stormwater treated for reuse
  - Toilet flushing
  - Cooling tower supply
  - Irrigation of park
- 48% reduction in potable water consumption
- 56% reduction in wastewater discharge

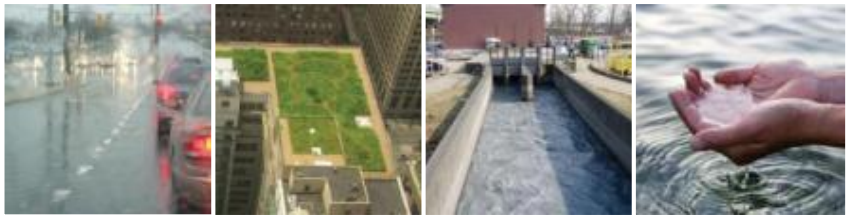
Reference – Battery Park City Authority Manhattan Borough, NYC, The Solaire – Alliance Environmental, LLC

U.S. Examples – Urban: Green Streetscapes (Neighborhood Scale)



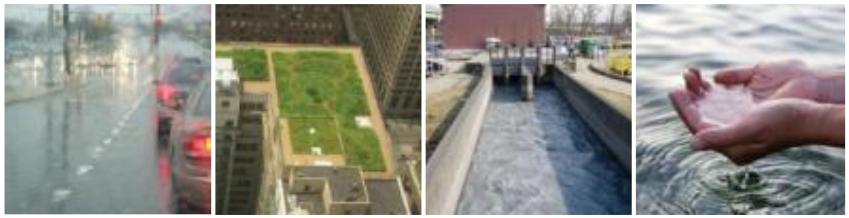


Example: Building GI/LID Framework in Raleigh NC



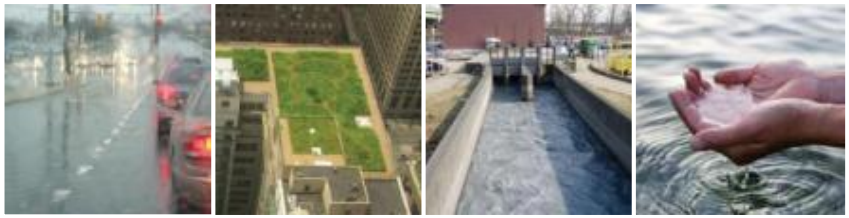
Policies & Ordinances	Coordinated & Trained Staff	Tools & Incentives	Outreach & Education
• City Policy • Refined Codes • Legal Representation	• Administration • Standard Operating Protocols (SOP) – Development – City Property (roads, parks, facilities) – Utilities – Emergency services – Solid Waste services	• GI/LID Templates • GI/LID Checklists • Performance Standards • Cost Tool • O & M Manual • Strategic Plan • Expedited Approval • Fees Reduction • Cost Rebate	• Demonstration Projects • Multi-Media Program • Training & Certification

One Water Goals – It Takes Collaboration



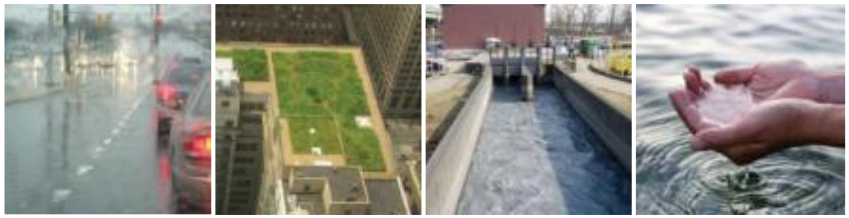
From WRF Blueprint for One Water, 2016

Enabling a TBL approach: Put community first



- Practically speaking, requires local leadership…
  - Good governance
  - Strong backing of the business community
- Functionally, requires…
  - Incentives
    - Financial, social, regulatory
  - Institutional capacity
    - Ability to administer and support implementation
    - Link science, technology and policy

Q&A/Discussion



Contact Information:

Trevor Clements, President, Tt Engineering P.C.

Email: trevor.clements@tetratech.com

Direct: (919) 485 – 2058