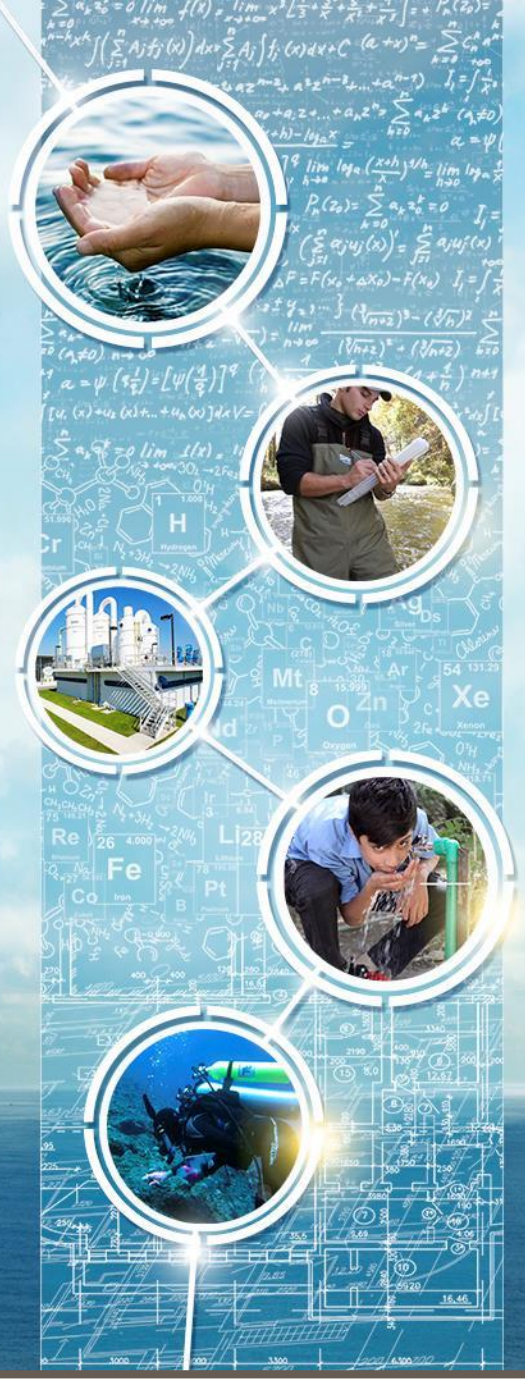

TETRA TECH

Chatham County Wastewater Management as it Relates to Comprehensive Plan

19 January 2017

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Senior Engineer & VP

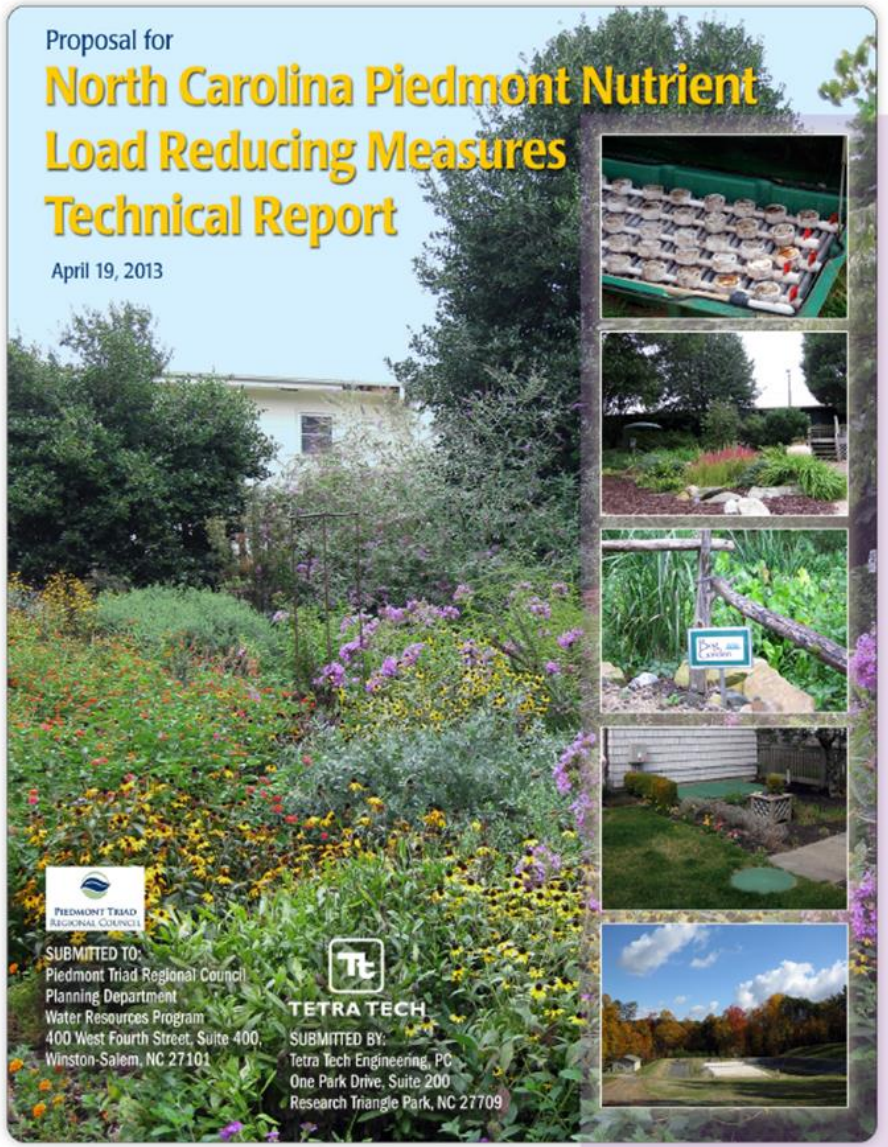
Tetra Tech Engineering, P.C.

Outline

- Introduction
  - Tetra Tech
  - Wastewater management approaches
- Experience in other communities
  - NC Piedmont water quality impacts
  - WERF case studies
- Paths forward
  - Status quo
  - Distributed wastewater planning/implementation

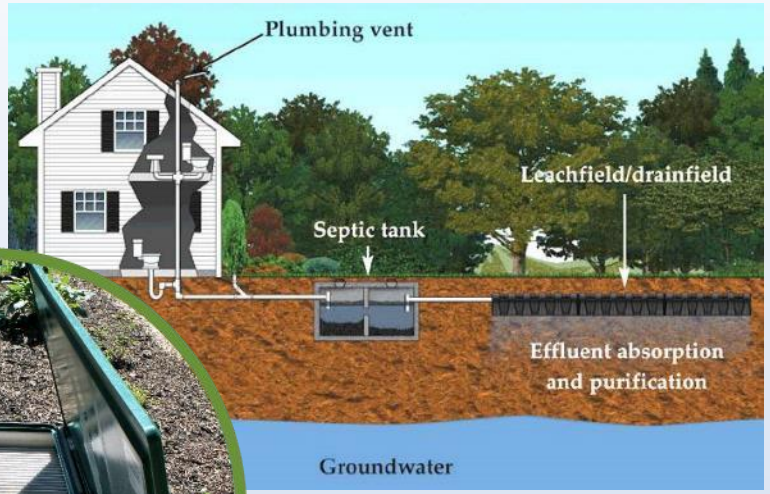
Tetra Tech

- Tetra Tech is a US consulting firm with 400 offices in 20 countries
  - #1 in Water for 13 years (ENR)
  - Developed USEPA's decentralized (and much centralized) wastewater guidance
  - RTP office opened in 1996 and includes 18 scientists, engineers, and planners
  - Developed latest Jordan Lake water quality model
- Vic manages engineering group
  - Lives on Crows Creek off Jones Ferry Rd. and on Chatham ERAC since 2009
  - Have worked on both centralized and decentralized wastewater entire career
  - Relevant projects with NC DEQ, Chesapeake Bay Program, Chatham County Schools, others



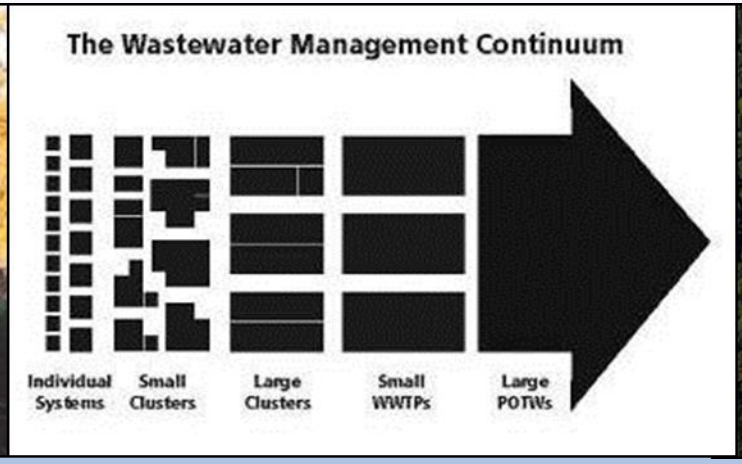
Wastewater Treatment Options

- Individual onsite (“septic”) or advanced wastewater treatment systems
- Small/large clustered systems with soil infiltration or effluent reuse
- Small “package” plants with ditch/stream discharge
- Large centralized plant with lake/river/ocean discharge

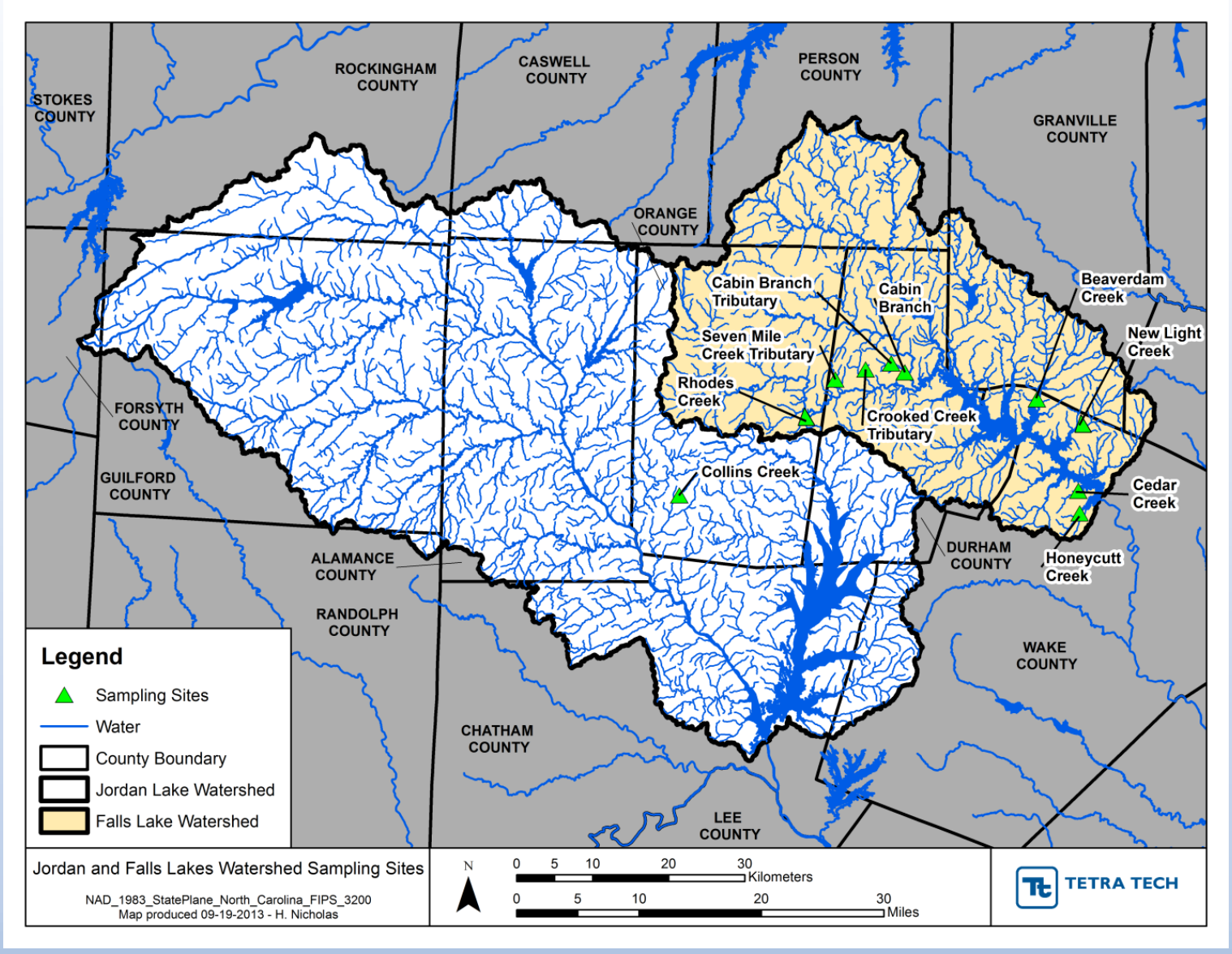


Decentralized Systems and Distributed Management

- **Decentralized systems**: multiple smaller systems
  - Onsite
  - Cluster
- **Distributed management**: all of the above
  - Recognizes the importance of scale in managing water
    - Small systems can be as or more effective than large ones
  - **Recognizes that ALL systems need to be managed**



Are Septic Systems Effective in the Piedmont?



NC Piedmont Onsite System Performance

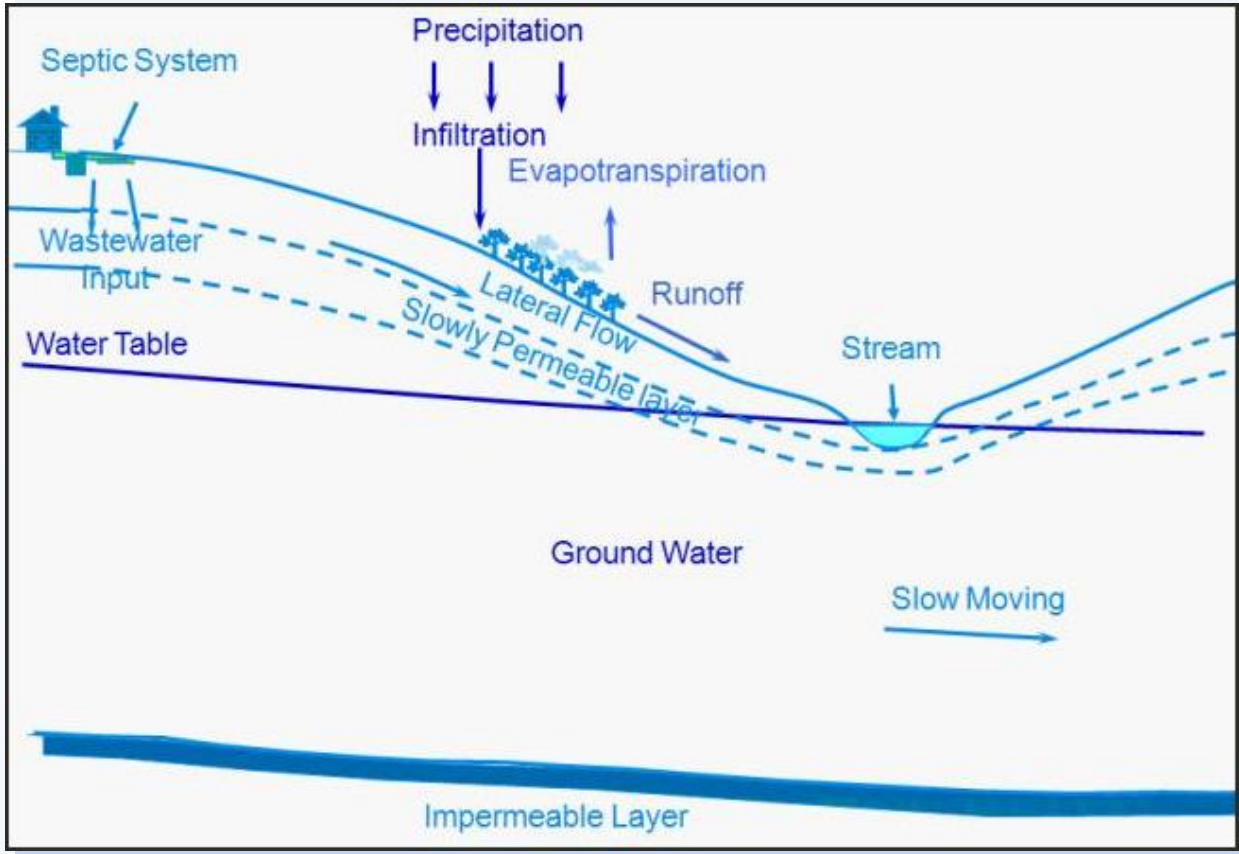
		Septic-Generated Nutrients		Measured Load in Stream		Percent Septic Load Delivered to Stream	
Basin	**Stream Order***	**TN ($lb/d/mi^2$)**	**TP ($lb/d/mi^2$)**	**TN ($lb/d/mi^2$)**	**TP ($lb/d/mi^2$)**	**TN (%)**	**TP (%)**
Rhodes Creek	unk.	-	-	0.57	0.012	-	-
Seven-Mile Creek	4^{th}	30.4	3.9	0.139	0.0068	0.46	0.18
Cabin Branch	8^{th}	30.2	3.86	0.57	0.0178	1.89	0.46
Crooked Creek	2^{nd}	27.0	3.45	1.53	0.0286	5.67	0.83
Beaverdam Creek	unk.	3.83	0.42	0.20	0.024	5.1	5.7
New Light Creek	unk.	4.68	0.60	0.37	0.033	8.0	5.4
Honeycut Creek	unk.	15.5	1.99	0.33	0.025	2.2	1.3
Cedar Creek	unk.	29.7	3.81	0.66	0.039	2.2	1.0
AVERAGE		**20.2**	**2.6**	**0.55**	**0.023**	**3.6**	**2.1**

- Equivalent “effluent” concentrations: 2.0 mg/l TN, 0.2 mg/l TP
- Equivalent reductions: 96% TN, 98% TP
- Corroborated by more recent USGS and ECU data and ChesBay Program work

Data from:
NCDENR 2010
Berkowitz 2014

Decentralized Soil-Based Treatment can be Effective

- Decentralized technologies are robust
- Multiple soil dispersal areas enhance assimilation
- Conserves water/restores local hydrology through groundwater recharge
- Soil is an effective treatment medium



Distributed System Applications

- **Green Buildings/Sustainable Sites**
  - Integration into buildings/landscapes
  - Resource recovery and reuse
  - Education and recreation
- **Independent Communities**
  - Maintain fiscal control
  - Preserve community character
  - Underserved communities
- **Utility Optimization**
  - Managed distributed systems
  - Sewer mining
  - Satellite reuse
- www.werf.org/distributedwater
  - Includes decision-support tool

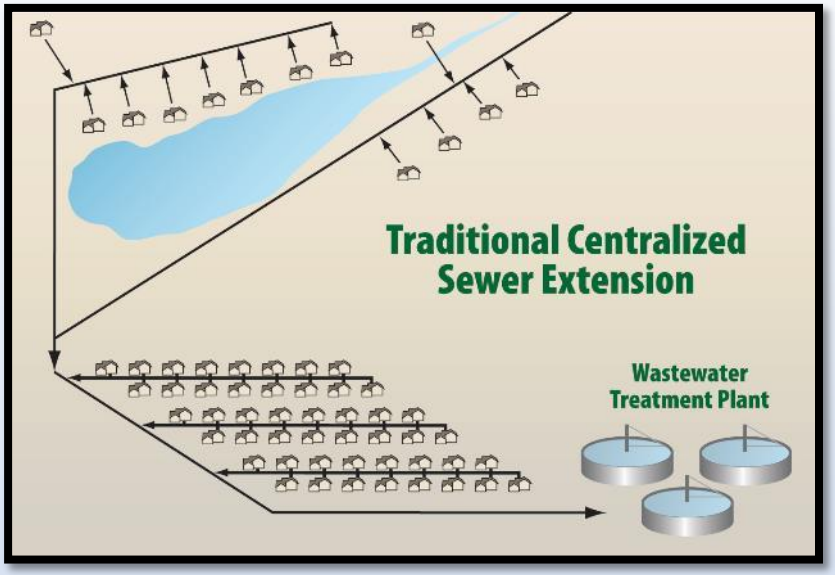
Case Studies Listed by Type
Green Building/Sustainable Sites (GB)
Battery Park City, New York City (UO)
Couran Cove Island Resort, Queensland, Australia (IC)
Currumbin Ecovillage, Queensland, Australia (IC)
Dockside Green, Victoria, British Columbia, Canada (UO)
Philip Merrill Center, Annapolis, Maryland
Sidwell Friends School, Washington, D.C.
Workplace6 Recycled Water Factory, Sydney, Australia (UO)
Independent Communities (IC)
Bethel Heights, Arkansas
Gillette Stadium, Foxborough, Massachusetts (GB)
Lake Elmo, Minnesota
Piperton, Tennessee
Warren, Vermont
Weston Solar Aquatics, Weston, Massachusetts (GB)
Wickford Village, Rhode Island
Utility Optimization (UO)
LOTT Alliance, Lacey, Olympia, and Tumwater, Washington
Loudoun Water, Loudoun County, Virginia (IC)
Mobile Area Water and Sewer System, Mobile, Alabama
Pennant Hills Golf Club, Sydney, Australia
Sand Creek, Aurora, Colorado
University of North Carolina at Chapel Hill, North Carolina (GB)

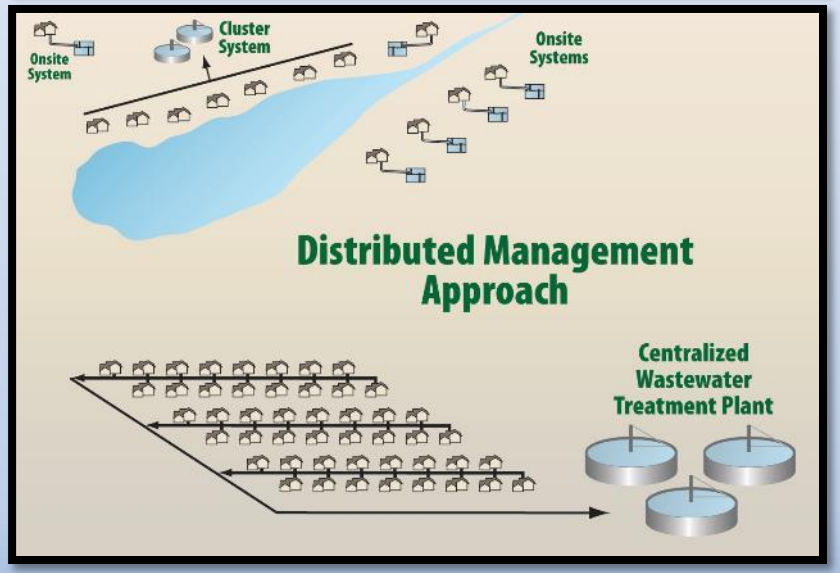
Distributed System Applications

- **MAWSS, Mobile Alabama**
  - Owns and operates two conventional and at least 12 decentralized wastewater facilities
- **Sydney Water**
  - Privately-driven *sewer mining* project
  - Treated water is used to irrigate 55 acres of greens, tees and fairways
- **Bethel Heights, Arkansas**
  - Rapidly-growing population on septic systems
  - City selected two cluster systems phased-in to meet increasing demand with growth
- **Dockside Green, Victoria, B.C.**
  - On-site, closed-loop treatment provides *fit-for-purpose*, reclaimed water supply
    - Toilet flushing, landscape irrigation, green roof watering, and natural stream/pond

Case Study Benefits: Efficiency

- 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





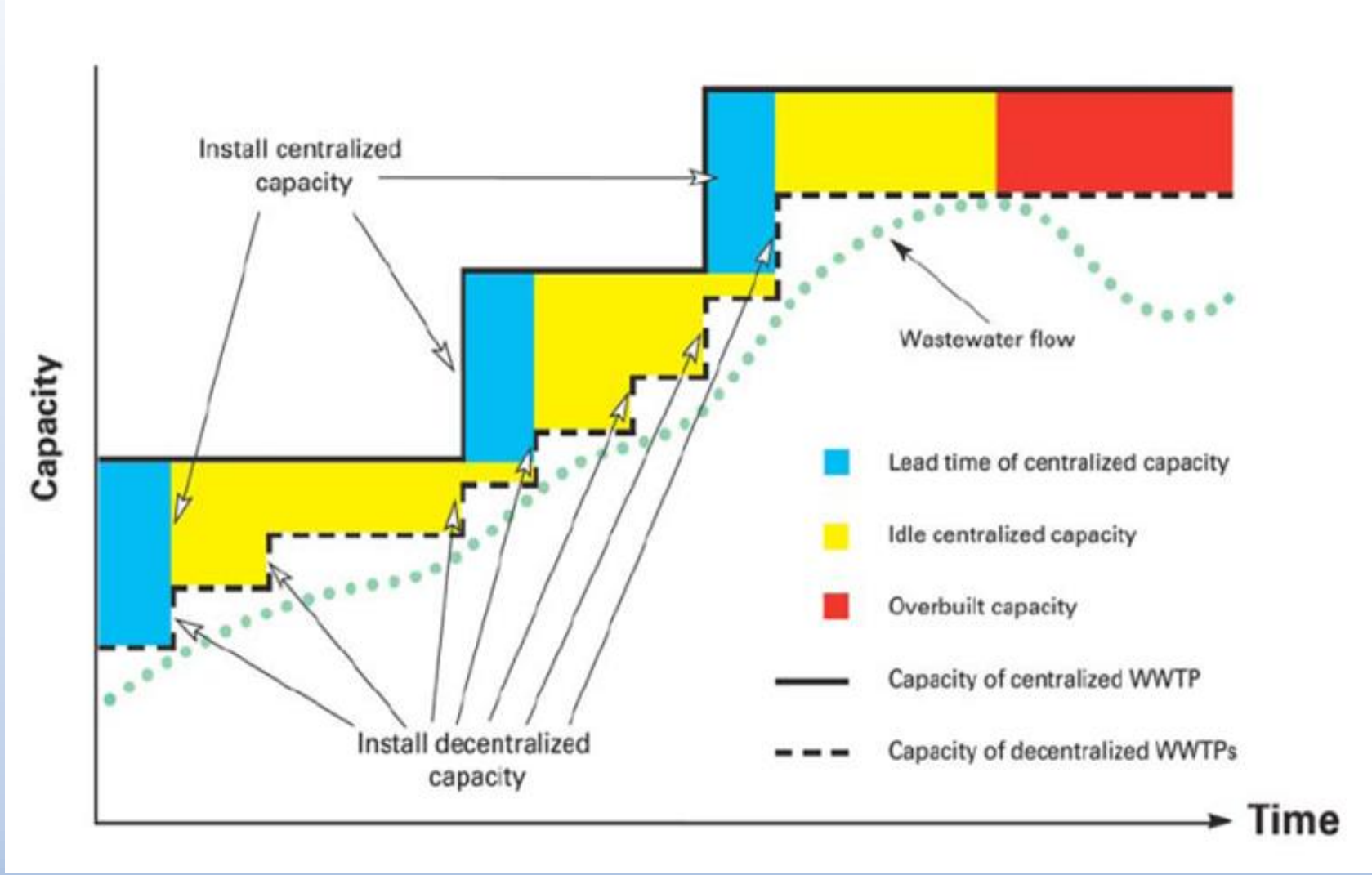
Energy Efficiency

Electrical energy demand for 5,000 gpd decentralized reuse systems

System Type	Reuses	Power	Units
Conventional Gravity Septic System	Aquifer Recharge	0.0	kWh/MG
Pumped / Pressurized Drainfield System	Aquifer Recharge	200.0	kWh/MG
Gravity Collection to Recirculating Filter	Irrigation	520.0	kWh/MG
Gravity Collection to RF and UV Disinfection	Unrestricted	580.0	kWh/MG
Pressure Sewer to RF and UV	Unrestricted	780.0	kWh/MG
California WWTPs (CEC, 2005)	Not Specified	1,500 to 5,800	kWh/MG

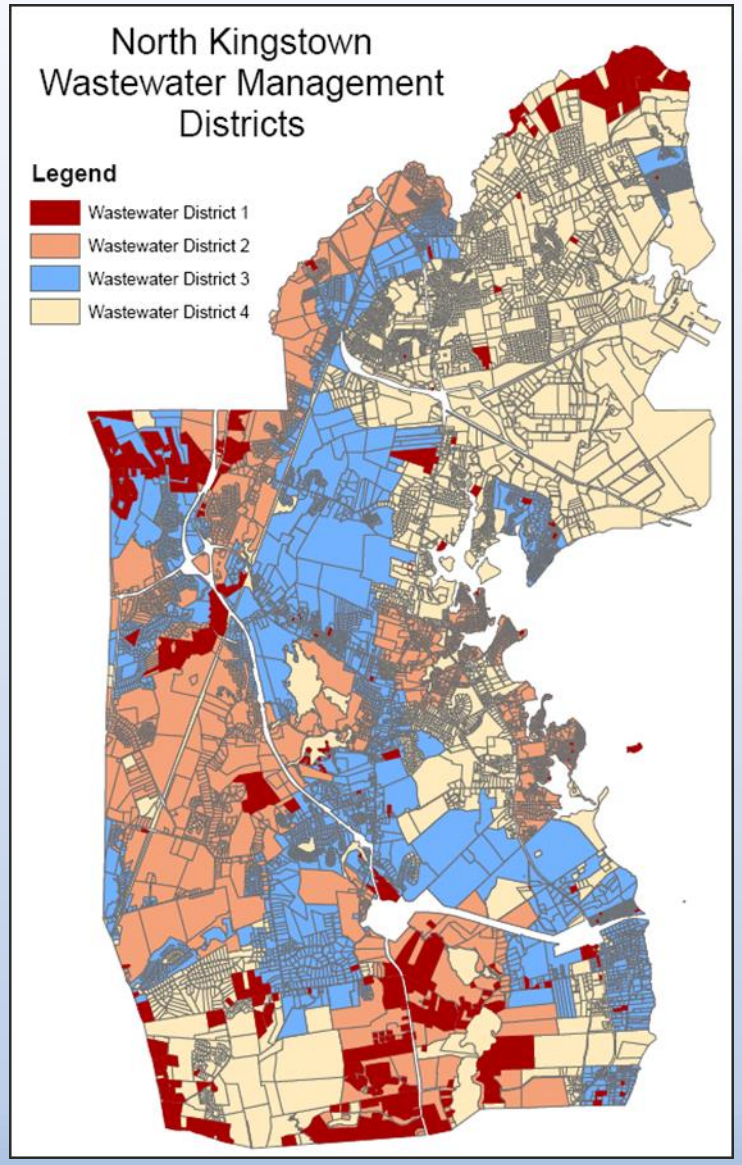
Case Study Benefits: Affordability

"Pay as You Grow" or "Right-Sized, Just-in-Time"



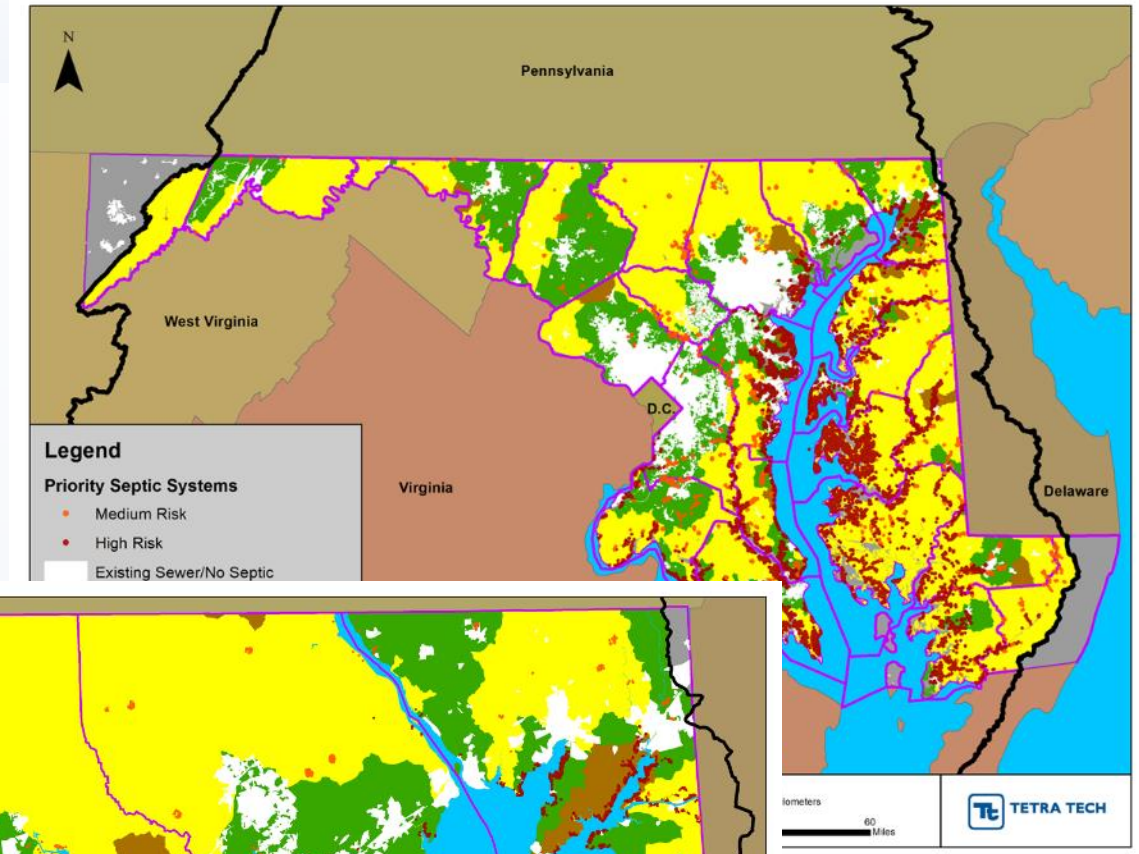
Paths Forward

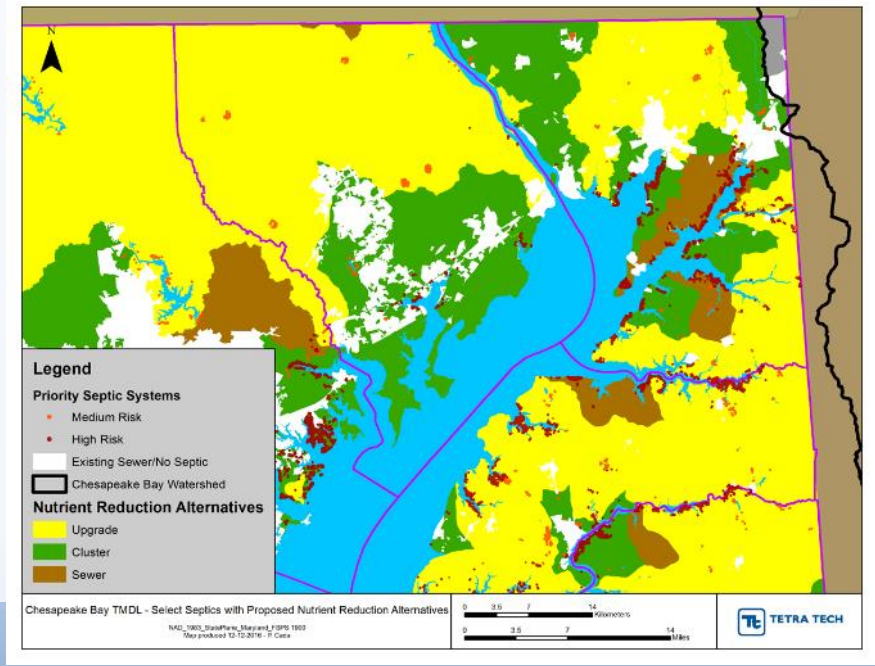
- Status quo
  - Health Department continues permitting septic systems and privately owned and operated "cluster" systems *ad hoc*
  - Centralized sewer implemented over time
- Proactive distributed sewer management
  - **Inventory**: what do you have?
    - GIS data, permit data, field reconnaissance
  - **Prioritize** systems for improvement
    - Stakeholder goals and values
    - Indicators might include: proximity to water, soil characteristics, system age, etc.
  - **Manage**: intensity tied to risk
    - Onsite improvements, cluster systems, sewer
    - Implementation (design, installation, OM&M)
    - Capacity building



Maryland Plan for Chesapeake Bay TMDL

- Statewide plan for reducing nutrients from existing decentralized systems
  - Loading analysis
  - Reduction analysis
- Tied into State smart growth objectives
  - Onsite upgrades
  - Clustering
  - Sewering



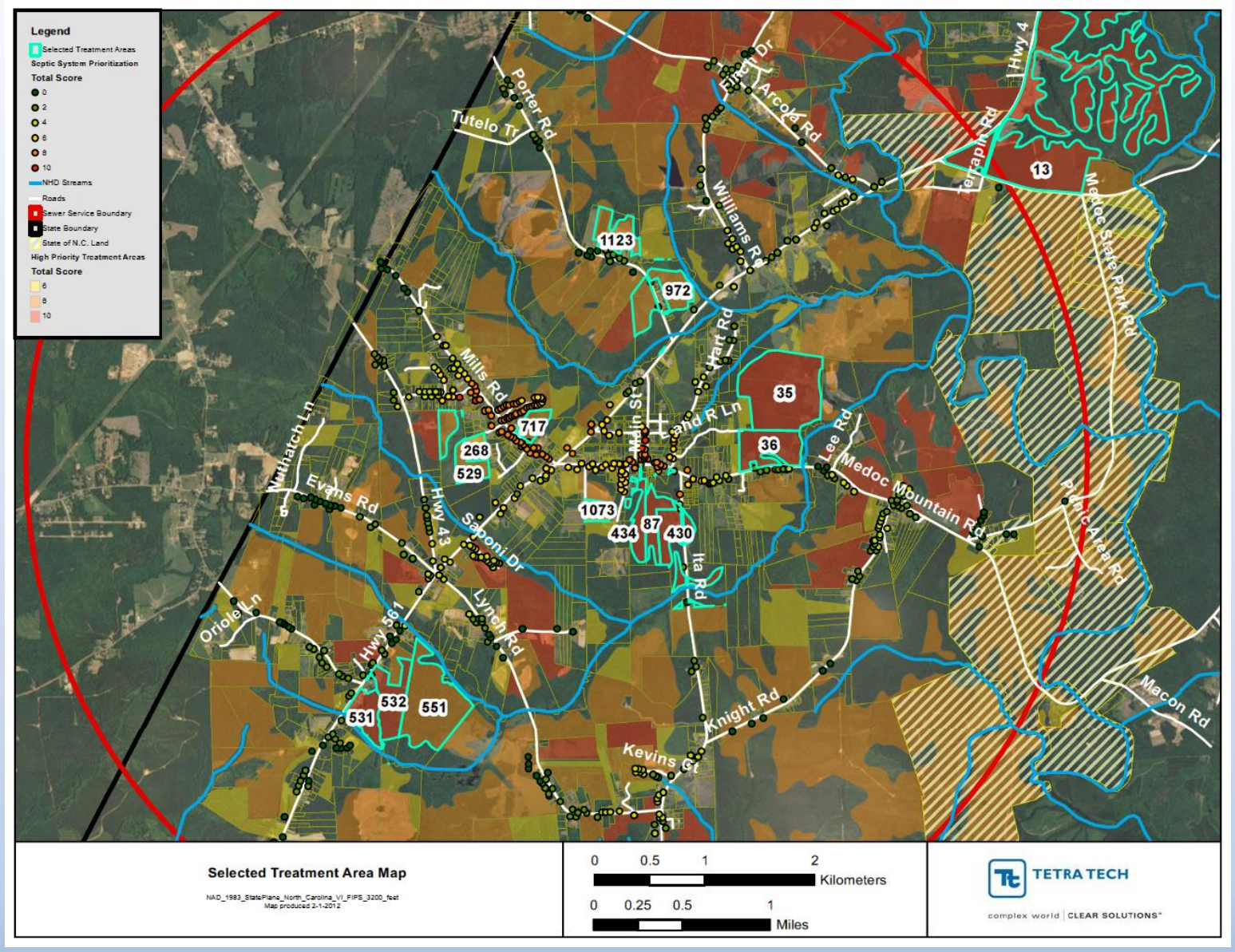


Meadows Sewer District Cluster Systems Study: *Background*

- Rural, with clusters of homes interspersed with large parcels
- ~37% non-compliant or problematic septic systems
- Minimal opportunity to grow or open businesses
- Prior engineering study recommended sewer extension
  - ~$22,000/home capital cost; ~$95/month service fee
- Multiple stakeholders: Halifax County, Haliwa-Saponi Tribe, Hollister REACH, NC RCAP

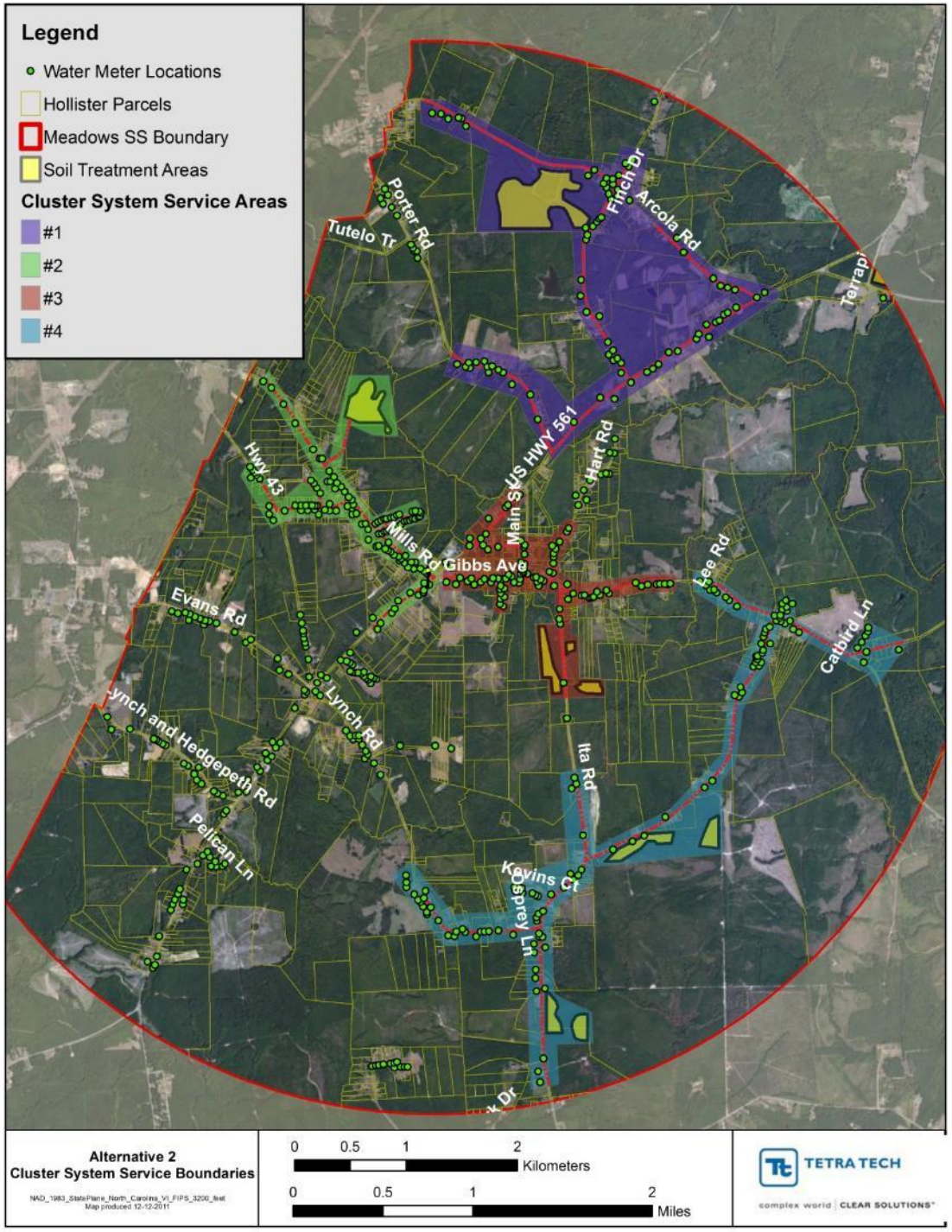
- Client: Halifax County, NC
- Funding: North Carolina Rural Economic Development Center planning grant
- Hollister, NC - disadvantaged community without public sewer

Meadows Sewer District: *Parcel Prioritization Map*

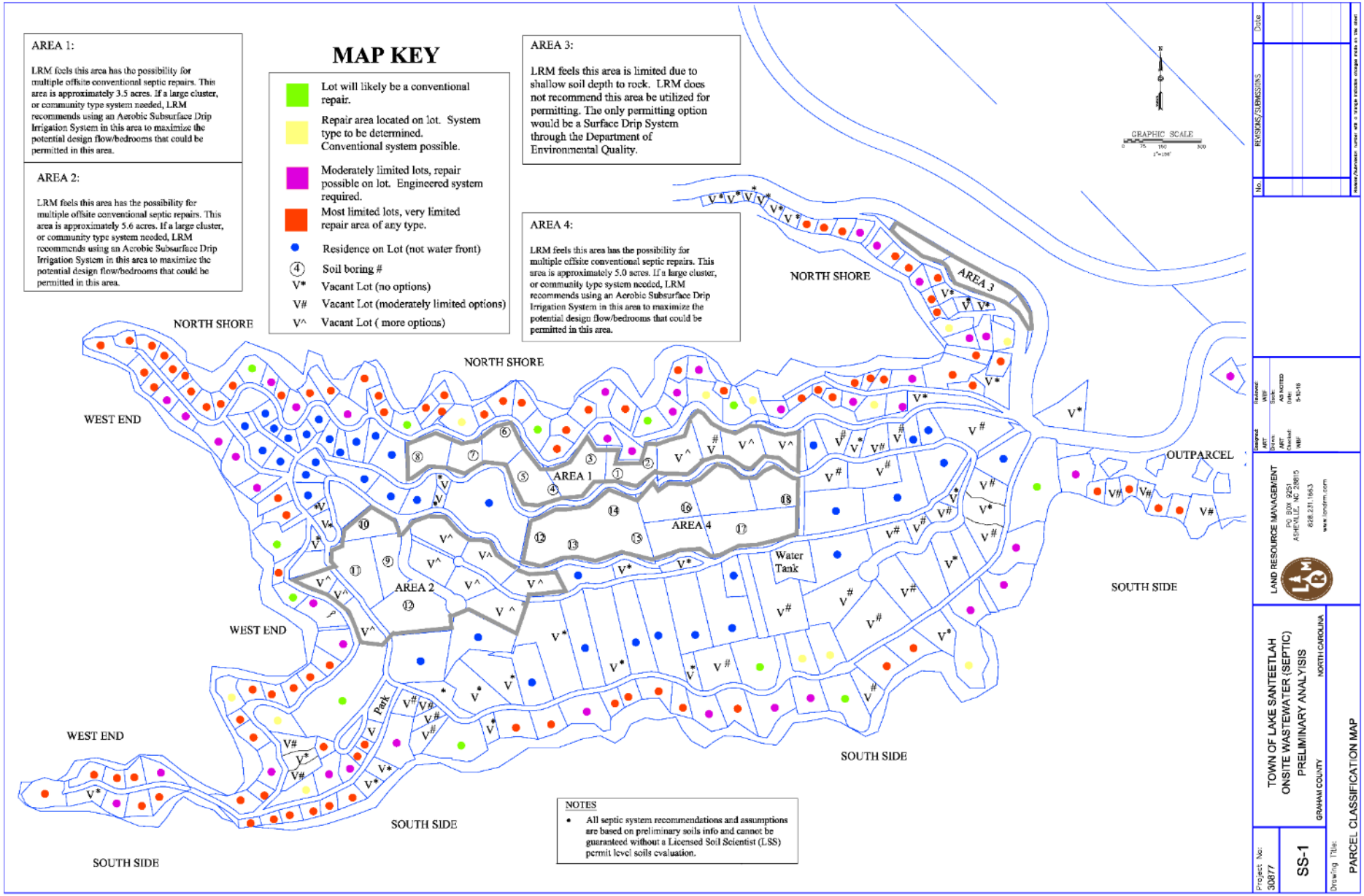


Meadows Sewer District:
Multiple Cluster Option

- Large cluster treatment and dispersal systems
- STEP > Small Diameter Pressure Sewer
- Capacity can be added incrementally
- Cost effective
  - Sewer connection… $21K/home
  - Single cluster… $16K/home
  - **Multi-cluster… $11K/home**
  - Smaller clusters may be less expensive



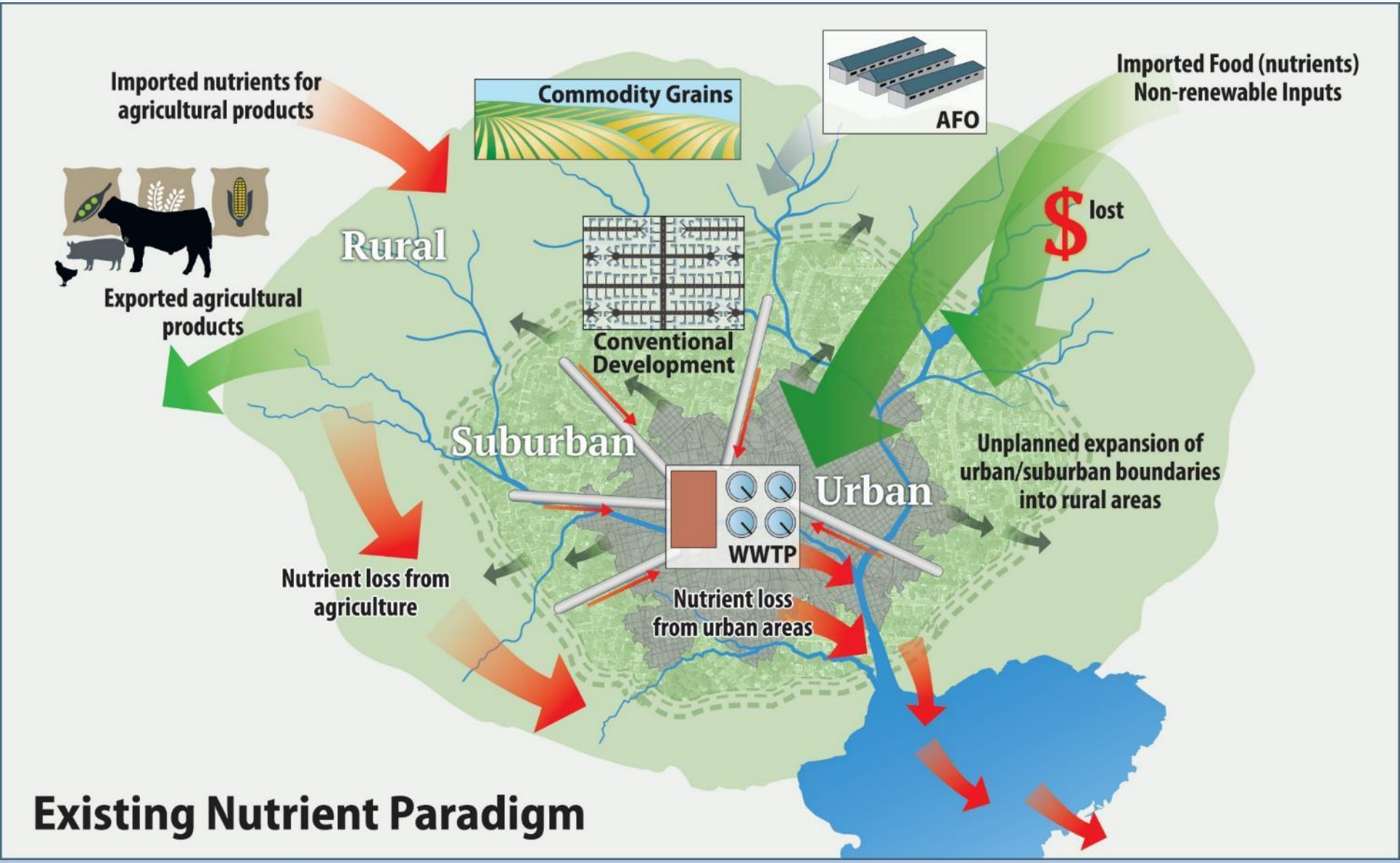
Town of Lake Santeetlah - Parcel Evaluation



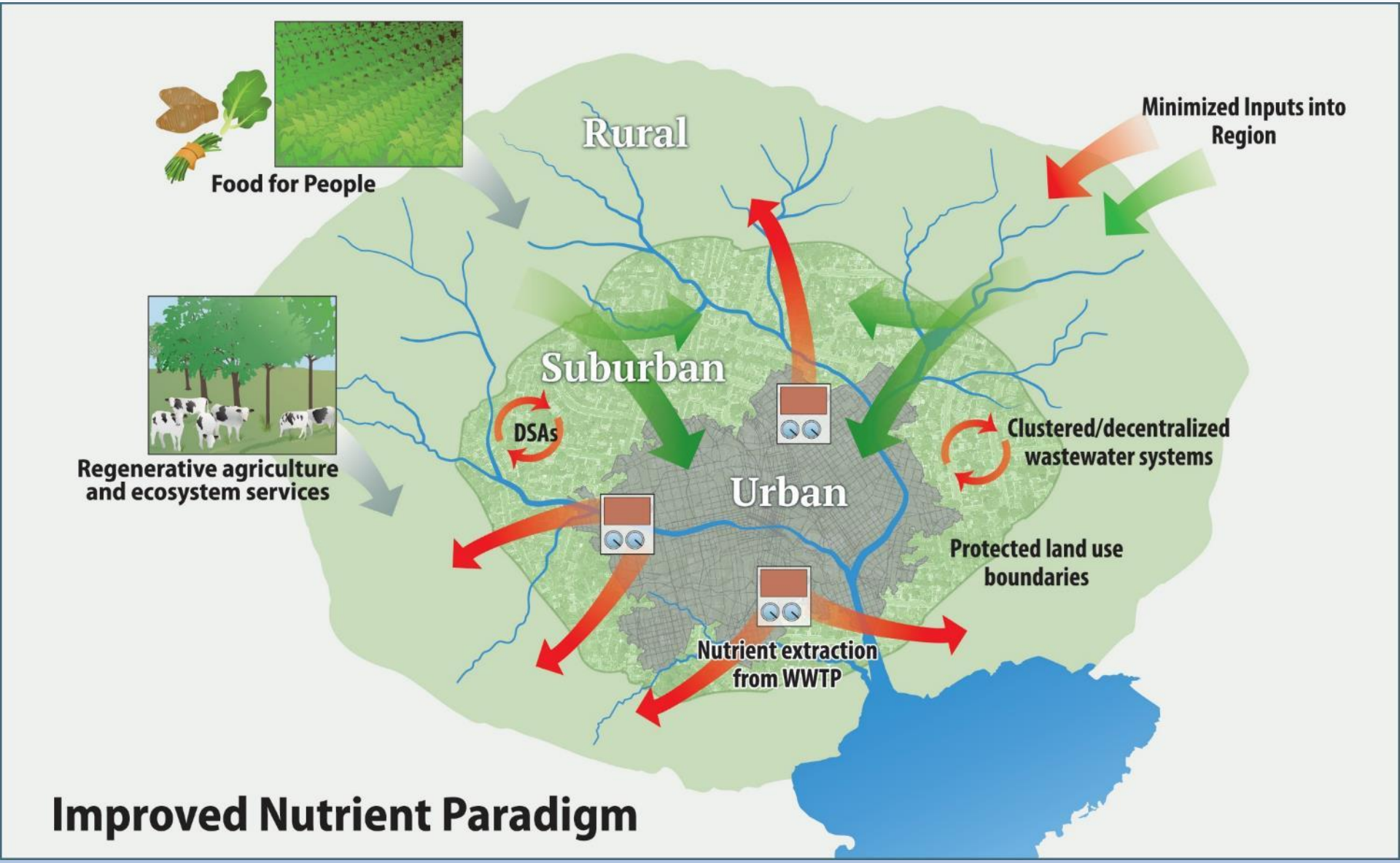
Resources in Wastewater

- Clean water
  - Landscape/agriculture irrigation
  - Flushing toilets
- Nutrients: nitrogen and phosphorus primarily
  - Fertilizer for landscape/agriculture
- Carbon/energy
  - Biogas for direct burning or electricity generation
  - Compost for soil amendment

An Unsustainable Model



Resilient Model Connects Rural and Urban Areas



Comp. Plan Recommendations and Contact Information

- Recognize attributes of centralized and decentralized approaches
- Recognize importance of a distributed sewer architecture
- Consider water/sewer approaches when identifying development zones
- Avoid “leapfrog” development
- Recommend distributed wastewater scoping study

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