Are We Creating A Sustainable Future for Onsite Wastewater

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- Hope So – we have seen:
  - Improvements in water use efficiency
  - Improvements in site and soil assessment
  - Improvements in treatment and dispersal technologies
    - Flexibility in permitting
  - Improvements in management
  - Improvements in practice, training and certification
  - Recognition by federal and state agencies that the work you do is important element in protecting public health, environmental quality, homeowner investment and community standards
  - Management entities forming and growing
- And the necessity remains – we all continue needing a place to go

Do we have examples of sustainable systems?

- Washington Island, WI
- ARHS
- Loudon Water
- Tonaho
- Sea Ranch
- Paradise
- others

You are the future of a SUSTAINABLE onsite wastewater with -

- Some help from science and technology
- Effective rules and regulations
- Competent people to:
  - assess sites,
  - design appropriate systems,
  - permit those systems,
  - monitor, inspect and maintain systems, and
  - manage local and state programs
    - To include the public who benefit from these efforts

How did we get here

- Through 1950's – limited oversight, limited regulation
- 1950's-1970's – USPHS purple manual
- 1970's – present:

initially siloed approach to resource (w, ww, sw) management

management infrastructure develops for each

integrated management develops (ww&gw&sw&w)

comprehensive resource management developing

2016 and years following

integrates water, energy, nutrient recovery, recharge, reuse, and comprehensive management efforts

Where are we going

- Sustainable on-site and decentralized efforts require:
  - Sound science and technology
  - Effective rules and regulations that address science and engineering
  - Competent personnel
  - Effective management
  - Supportive public – citizens who value what we do

Science and technology

Science

- Watershed science
  - Assimilative capacity
  - TMDL
- Wastewater biology
  - Nutrient removal
    - N
    - P
    - Disinfection
- Soil science
  - Hydraulics
  - Nutrients
  - Pathogen removal
- Management Science and Business

Technology

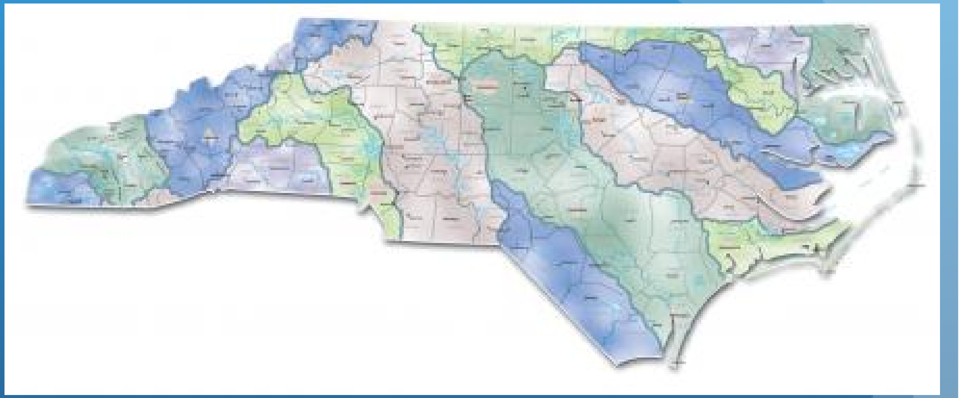
- Improved aeration
  - Fixed media
  - Suspended media
- Recirculation to achieve N loss
- Drip dispersal
- Gravity manifold

Broad Environmental Science

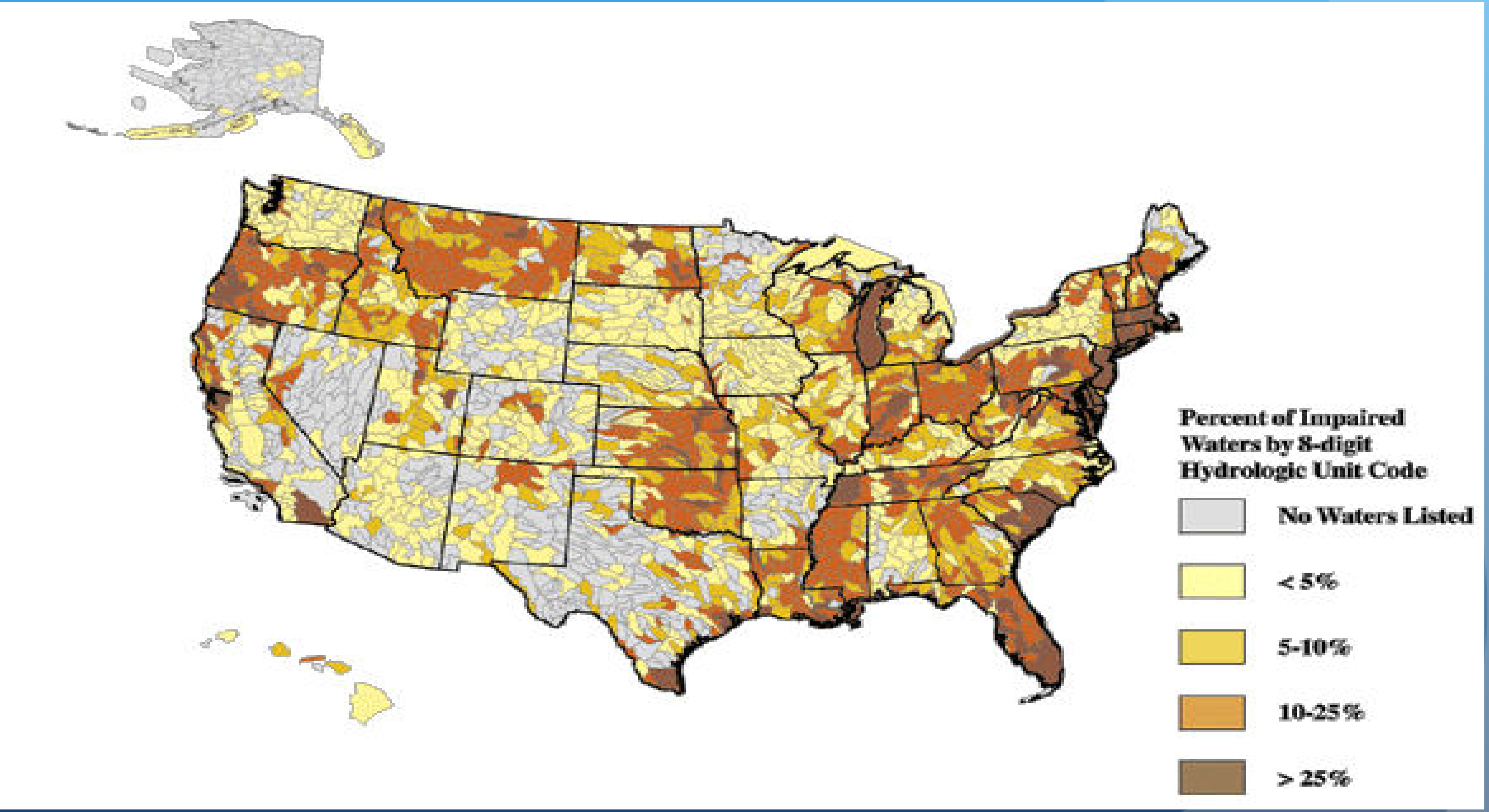
Watershed

- Falls and Jordan Lakes strategy
- Neuse and Tar-Pam basins
- Partition nutrients to various sources - including onsite
- Ultimately applicable in all NC basins – but NOT the same standard

NC Basins



Environmental issues – Impaired waters



Leading Causes of Impairment (305b)

	Rivers and Streams	Lakes, Ponds and Reservoirs	Estuaries
Pollutants	Siltation (38%)[a]	Nutrients (44%) [a]	Pathogens (47%) [a]
	Pathogens (36%)	Metals (27%)	Organic enrichment (42%)
	Nutrients (28%)	Siltation (15%)	Metals (27%)
Sources[b]	Agriculture (59%)	Agriculture (31%)	Municipal point sources (28%)
	Hydromodification (20%)	Hydromodification (15%)	Urban runoff/storm sewers (28%)
	Urban runoff/storm sewers (12%)	Urban runoff/storm sewers (12%)	Atmospheric deposition (23%)

[a] Values in parentheses represent the percentage of surveyed river miles, lake acres, or estuary square miles that are classified as impaired.

[b] Excluding unknown, natural, and "other" sources.

Source: EPA 2000. *National Water Quality Inventory 1998 Report to Congress*

TMDL Approach

- Allocate nutrient discharge by watershed/sub-watershed
- Severe limits
- Consequences if communities fail to meet standards
- We will be looking at improved technology for wastewater and stormwater

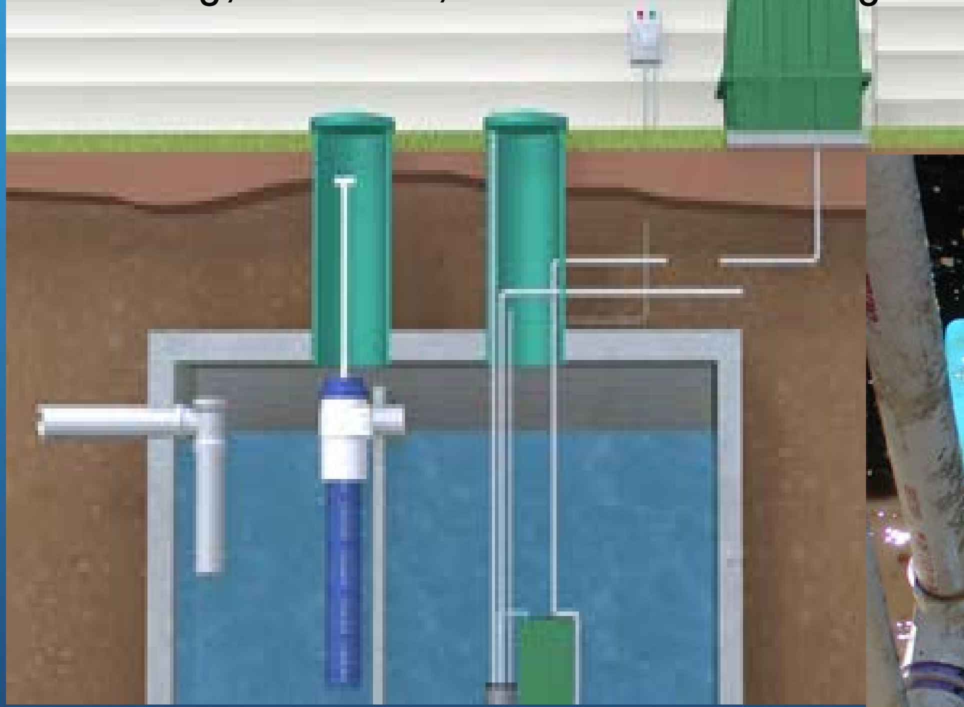
Wastewater
Improved characterization

- Nutrient removal (n and P)
- Aerobic and Anaerobic processes required
- ON (TKN) -> NH4 -> NO3 -> N2
- OP -> biological selection ->lower P
- OP -> chemical treatment ->lower P

MBR with nutrient removal and advanced disinfection

MBR and other treatment

Settling, aeration, clarification through membrane



Membrane filters out to in

Aeration cleanses filter/scour

Reuse in Critical area of Water Supply Watershed

- Site sensitive
- No sewer service allowed
- 250 acre gift to city
- Onsite reuse selected

  as system of choice

  indoor

  outdoor

Wilkerson Park, Wake Co

- Indoor reuse and SAS
- Building Code approval
- MBR treatment/Pressure manifold/Chamber
- NO REDUCTION
- HQW achieved
- Award winner
- On-line turbidity monitor

	BOD	TS	N	coli	Turbidity (5 min/3 yr)
Av	ND	ND	37	ND	.05
Max	7	ND	51	ND	.08

Treatment technologies

Constructed wetland

Large land area
Influent BOD 400-600 PPM,
Effluent BOD and TSS <30

Fixed media systems

Recirculating media filter, small footprint
Influent BOD 200+
Effluent BOD and TSS <10, TN <20

NC .1900 Rule and others

- Recognizes varying levels of treatment
- Mandates inspection and requires management
- Technologies perform as designed when operated, managed and maintained properly
- In the future, rules will encourage treatment and reuse

NC 2T and 2U rules

- Recognize varying levels of treatment, but only high quality water can be applied in landscape irrigation or for reuse
- Mandate inspection and monitoring on large systems (soon will for small systems using reuse)
- Technologies perform as designed when operated, managed and maintained properly
- Beneficial use encouraged – replace potable supply with non-potable, fit for purpose water

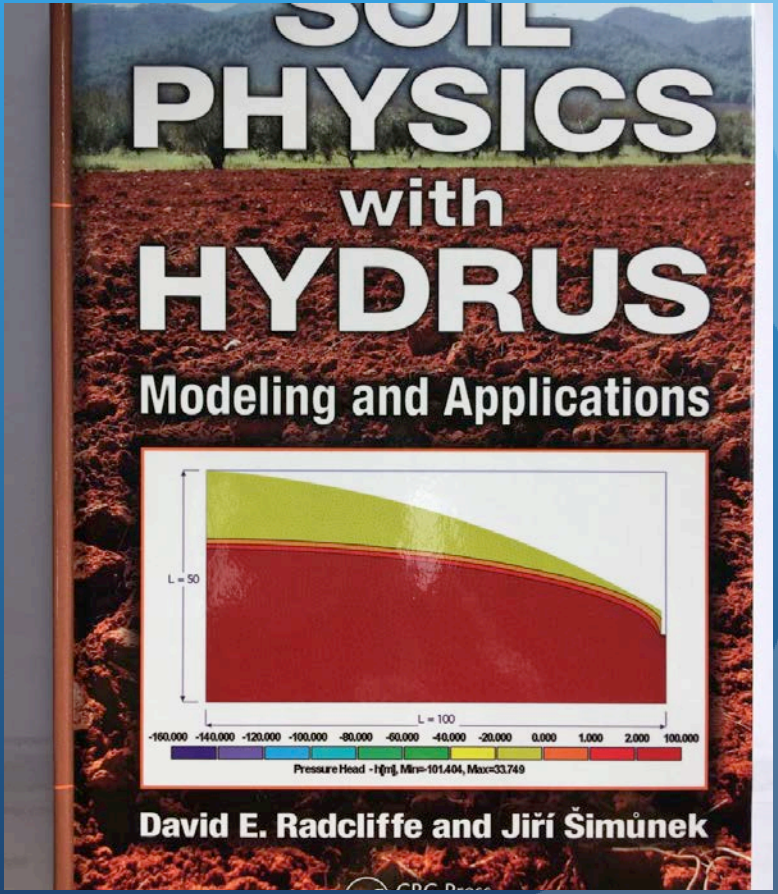
Soil Science
Improvements in site assessment

- Profile description/permeability test/landscape position

- Liquid loading
  - Influence of BOD
- Nutrient loading
  - N
  - P
- Pathogen removal
  - Influence of texture
  - Influence of pretreatment

Improvements in modeling

- STUMOD and HYDRUS
- Hydrus - Applicable to all land based systems
- STUMOD
  - N fate
  - Organic wastewater constituents
  - Bacteria/virus
  - Applicable to sub-surface systems
    - STU=soil treatment unit



Management Science and Business

- Management must be science/fact based – not innuendo or tradition
- Management involves developing harmony not discord
- Management inculcates a cooperative ethic
- Good managers strive to be the best and develop excellence in themselves and their staff

- Business plan
- Succession
- Asset management plan
- Business is business-not Pro Bono
- Business involves production, purchasing and distribution of goods, services, and ideas
- Business requires standard transaction
- Business=PROFIT
- Business=Risk
- Business involves managing people
  - Employees, patrons, agency personnel

Challenges

- Resilience – accommodate change in operation, response to storms, flooding, etc.
- Budget challenges (CAPEX and OPEX funds, Bonding capacity,
- Changing climate
- Succession planning

TBL approach may help address challenges

Motivation	Activity	Technical/Management Innovation
Finance (economy)	Resource recovery, material conversion, value added products	Industrial innovation, new treatment technology, irrigation, nutrient recovery, biomass, algae
	Operational efficiency	Asset management, EMS,
	Energy recovery and use	Fuel cell, anaerobic digestion,
Sustainability (environment)	Watershed assessment	Distributed systems
	Energy optimization	Energy recovery, improved efficiency (VSD pump),
	Green Infrastructure	Green roof, porous paver, local management
Social issues, EJ, Community well-being	Planning	Targeted improvements
	Greening	Managed distributed systems
	Partnering	Bio-resource recovery

Some examples – then and now

entity	est	cust	Rate 1	Rate 2	$ flow
Wash Is.	1980	700	0.15/gal	0.15/gal	-
Loudon Water	2001	1600+	variable	22.60+11.30/k-gal	+ (now)
Paradise	1992	11,000	14.40/YR	35/YR	+
Sea Ranch	1970	760	31/mo		
Tohona	1999	1600	hourly	hourly	+
ARHS	1990	3500	100/yr	120/yr	+

Sustainable Systems Require

- Sound technology
- Good Science
- Effective rules
- Competent personnel
- Supportive public

Sustainability requires

- Product/service quality
- Resource protection
- Customer satisfaction
- Financial viability
- Community sustainability and economic development
- Stakeholder support/community involvement
- Employee satisfaction/leadership
- Operational optimization
- Asset management practices
- Resiliency (system repair, staff changes, hazard response)

Sustainable –Viable operations

- Technical criteria
  - Common technologies utilized throughout system, few parts, few operational issues,
  - Reliable technologies – meet user needs, effective monitoring and management
  - Appropriate for climactic zone
  - Optimize operator skills
  - Critical mass, circuit rider approach

WERF, Yeager et al.

Management issues

- Paid, professional management staff for budgeting, forecasting, accounting, scheduling, monitoring
- Mechanism for overdue debt collection
- Reserve capacity for unexpected costs (this is inadequate in many areas because utility commissions do not understand onsite needs)
-

Finance issues

- Fiscal plan
- Sustainable recurring charge (cable model)
- Independent financial oversight committee

Governance

- Political will and public support
- Enforcement/corrective action
- Laws, rules and ordinances

My vision

- TBL Research
- Regulatory improvements – enabling legislation
- trained/certified practitioners

Research

- Low energy wastewater treatment with energy and nutrient recovery
- Emergence from siloed approach environmental management toward comprehensive program
- Examination of codes, rules, regs based on new science
- Behavioral economics

Regulation

- Regulations are incentives, not barriers
- Reward superior performance, penalize poor performance
  - Set target – if met, reward participant with rebate on tax
  - Set target – if not met, penalize participant with increased tax or pay high nutrient fee in sensitive watershed
  - Establish performance codes for water, wastewater, graywater, review codes frequently to incorporate new innovation, upgrade to avoid crisis (water reuse, Groundwater contamination, etc)

Regulation (cont.)

- If Goal is Nutrient Reduction (NC Watersheds, Chesapeake Bay, TMDL limited areas), then shouldn't all sources be regulated appropriately?
- Research required to partition allocation to appropriate sources in scientifically sound manner

Training and certification

- Movement toward performance code will force improved operations, training essential.
- Create additional operator classifications: advanced wastewater, graywater,
- Aggressive enforcement of certification-there is value in your work, public must recognize that and you must be rewarded appropriately
- Training is a cost, you should be able to recover that through fees

So, What does the future hold for us?

- Technology must be managed: inspection, monitoring, repair and replacement, reporting
- Can not be out-sourced, requires site visits
- Secure future if you stay current, continue to learn, improve business practice, participate in management programs, and
- It's not just going to disappear
- SO – BE NICE TO YOUR LOCAL REGULATORS, THEY ARE PARTNERS

Water reuse influencing the NYC skyline