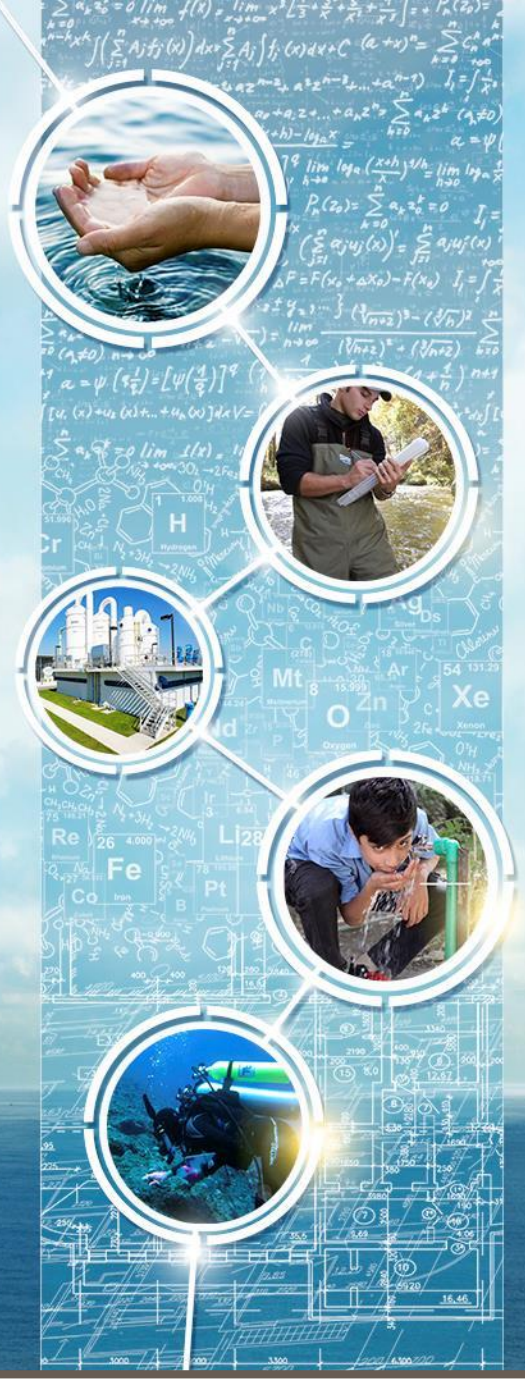


TETRA TECH

Preliminary Wastewater Evaluation for Seaforth Road High School Site

December 19, 2016

Victor D'Amato, PE

History

- Tetra Tech has worked for Chatham County Schools since 2011
  - Vic designed Chatham Central system in early 2000s
  - Bennett School sand filter rehab
  - Silk Hope Elementary concept plan
  - Ongoing small engineering on-call support for contract operators
- Contacted early last week about potential high school site on Seaforth Road
  - Provided rough range of onsite system costs
  - Provided list of North Carolina schools with surface and subsurface onsite systems installed in the past 10 years
  - Provided input about DWQ and DHHS permitting processes
  - Subcontracted with soil scientist for preliminary evaluation of site

Onsite Wastewater Permitting Processes

- DHHS process for large *subsurface* dispersal systems
  - DHHS approves design, Chatham County Environmental Health issues permits
  - Three-stage process
    - Improvement Permit = site approval (design flow + soil/site evaluation)
    - Construction Authorization = design approval (engineering design)
    - Operation Permit = installation approval (construction)
- DWQ – Land Application Unit for *surface* dispersal system
  - Approval and permitted by State
  - Main steps are largely the same as DHHS process

DHHS versus DWQ

- DHHS requires 100% repair area; DWQ requires large storage lagoon
- Surface dispersal = spray irrigation, surface drip irrigation
- Subsurface dispersal = conventional drainfield, low pressure pipe, subsurface drip irrigation

Seaforth Road Site

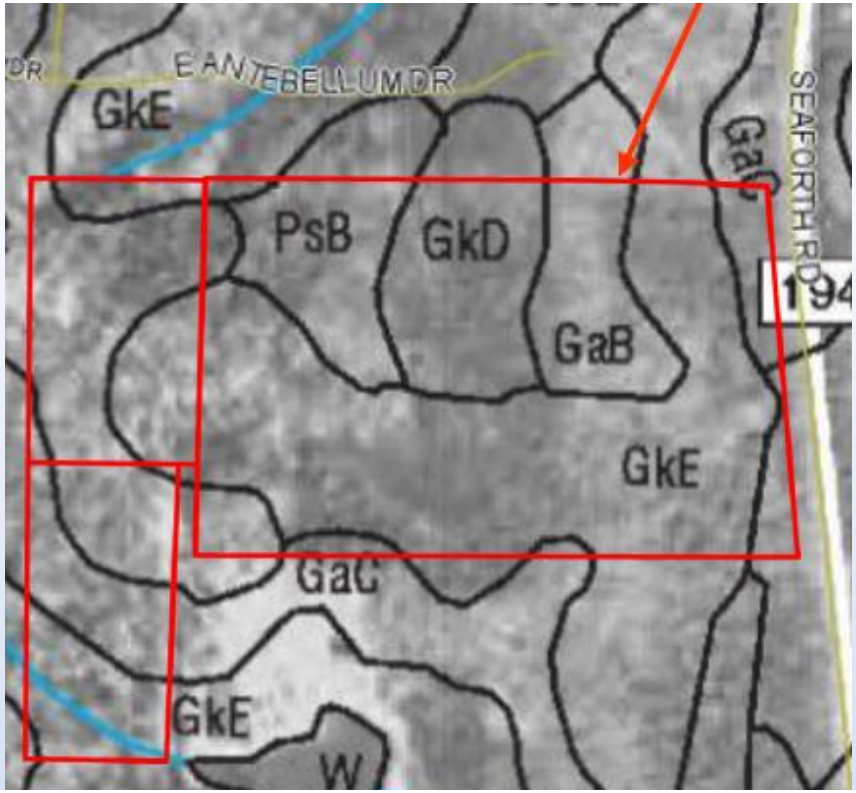
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

In cooperation with North Carolina Department of Environment and Natural Resources, North Carolina Agricultural Research Service, North Carolina Cooperative Extension Service, Chatham Soil and Water Conservation District, and Chatham County Board of Commissioners

Soil Survey of Chatham County, North Carolina



GaB—Georgeville silt loam, 2 to 6 percent slopes

Setting

Landscape: Piedmont uplands; mainly in the central and western parts of the county, in the Carolina Slate Belt
Landform: Broad ridges
Shape of areas: Rounded or irregular
Size of areas: 5 to 300 acres

Composition

Georgeville and similar soils: 90 percent
Dissimilar soils: 10 percent

Typical Profile

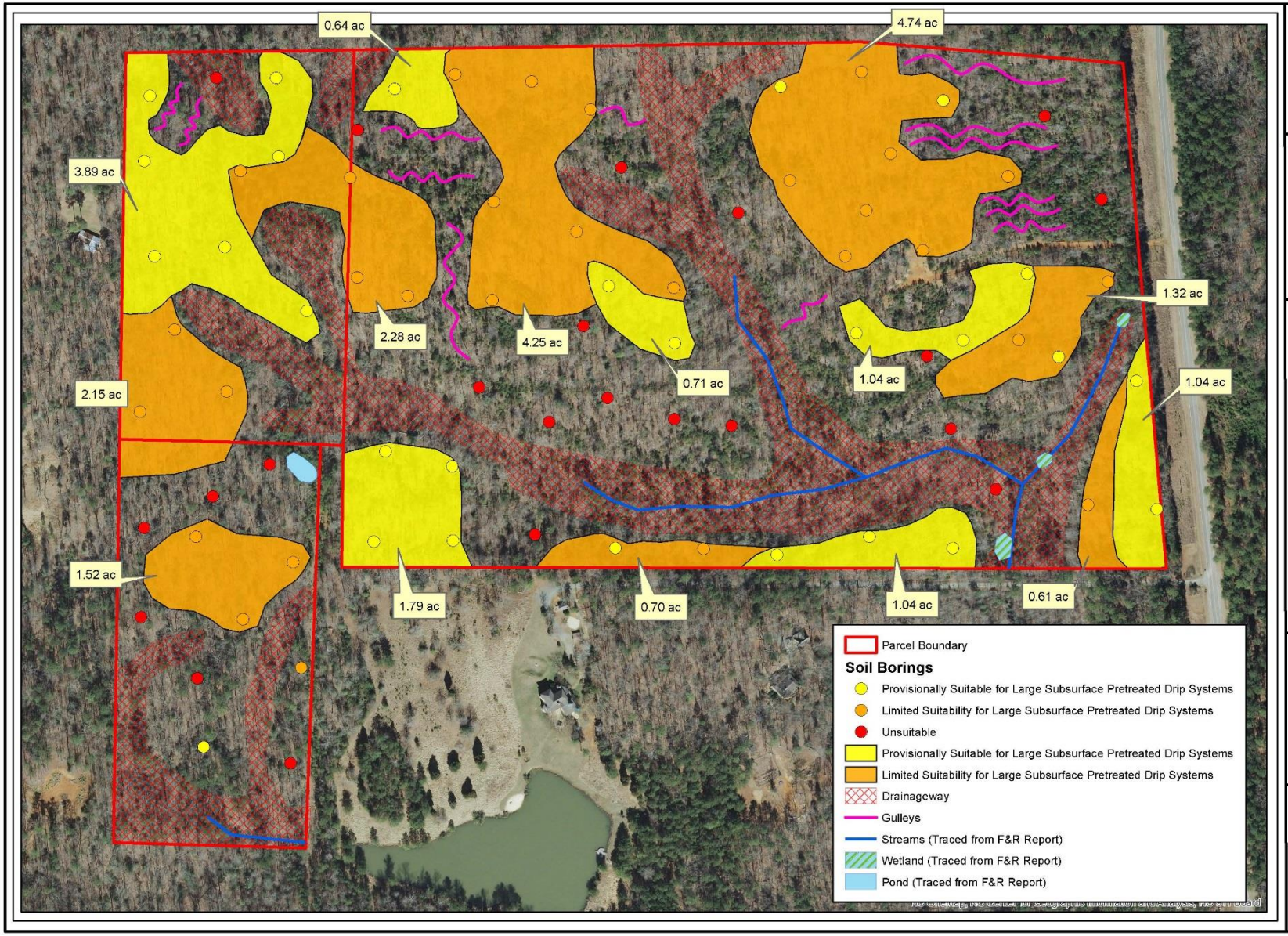
Surface layer:
0 to 7 inches—brown silt loam

Subsoil:
7 to 10 inches—yellowish red silty clay loam
10 to 36 inches—red clay
36 to 44 inches—red clay that has strong brown mottles

Soil/Site Evaluation

- **Preliminary**: hand-augered borings to identify potential sites, issues, and other considerations
- **Detailed**: backhoe-dug pits on a 50’ grid to characterize soils for site sizing, layout, and permitting
- **Hydraulic Analysis**: saturated hydraulic conductivity (K_{sat}) across site in various soil layers; calculation of site’s hydraulic capacity for large system approval

Preliminary Evaluation Results



THREE OAKS ENGINEERING

Prepared For:

Tetra Tech Engineering, PC

Preliminary Soil and Site Evaluation

Seaforth Road Tracts

Site Map

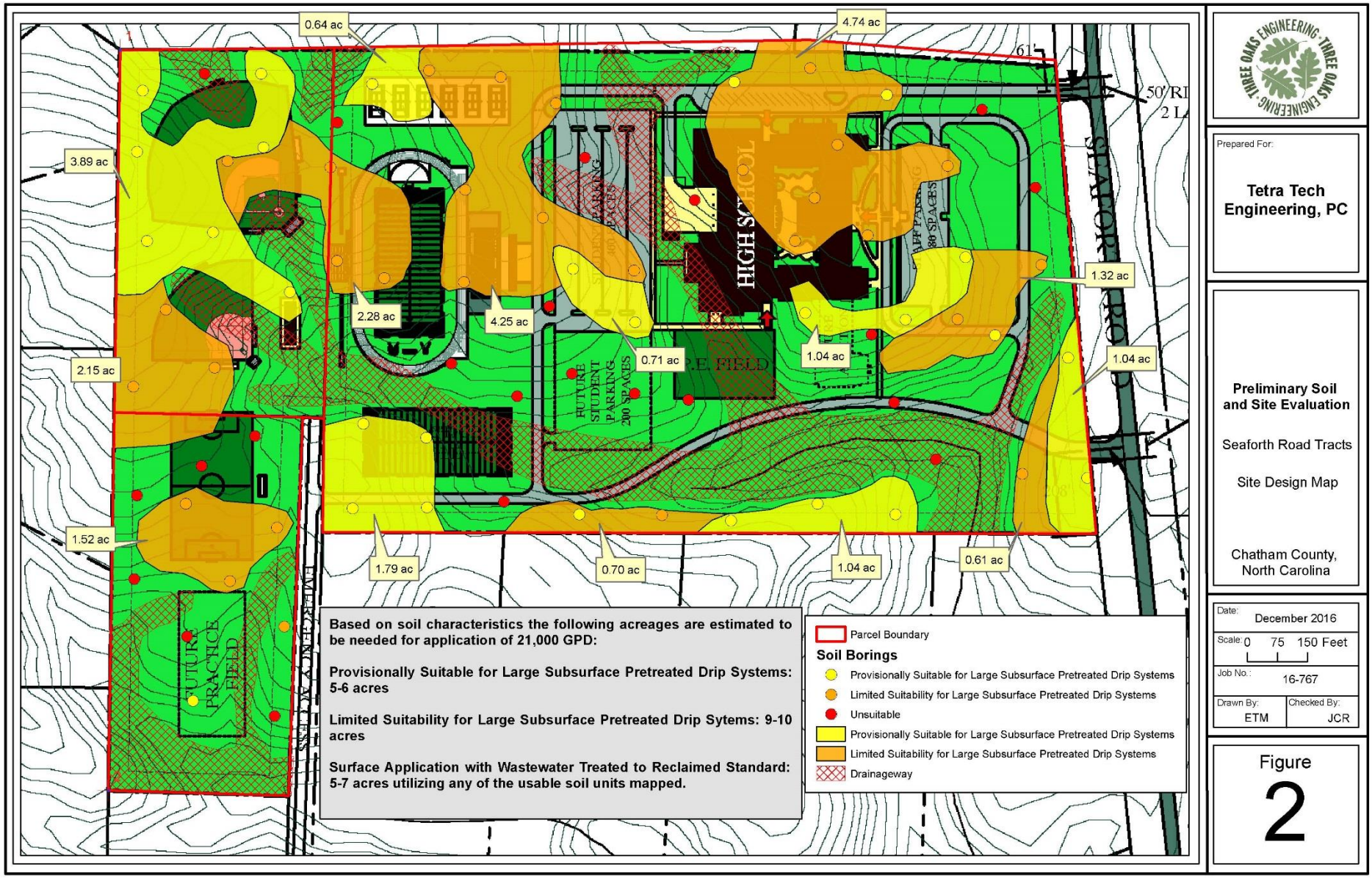
Chatham County, North Carolina

Date:	December 2016
Scale:	0 75 150 Feet
Job No.:	16-767
Drawn By:	ETM
Checked By:	JCR

Figure

1

Preliminary Evaluation Results



THREE OAKS ENGINEERING

Prepared For:

Tetra Tech Engineering, PC

Preliminary Soil and Site Evaluation

Seaforth Road Tracts

Site Design Map

Chatham County, North Carolina

Date:	December 2016
Scale:	0 75 150 Feet
Job No.:	16-767
Drawn By:	ETM
Checked By:	JCR

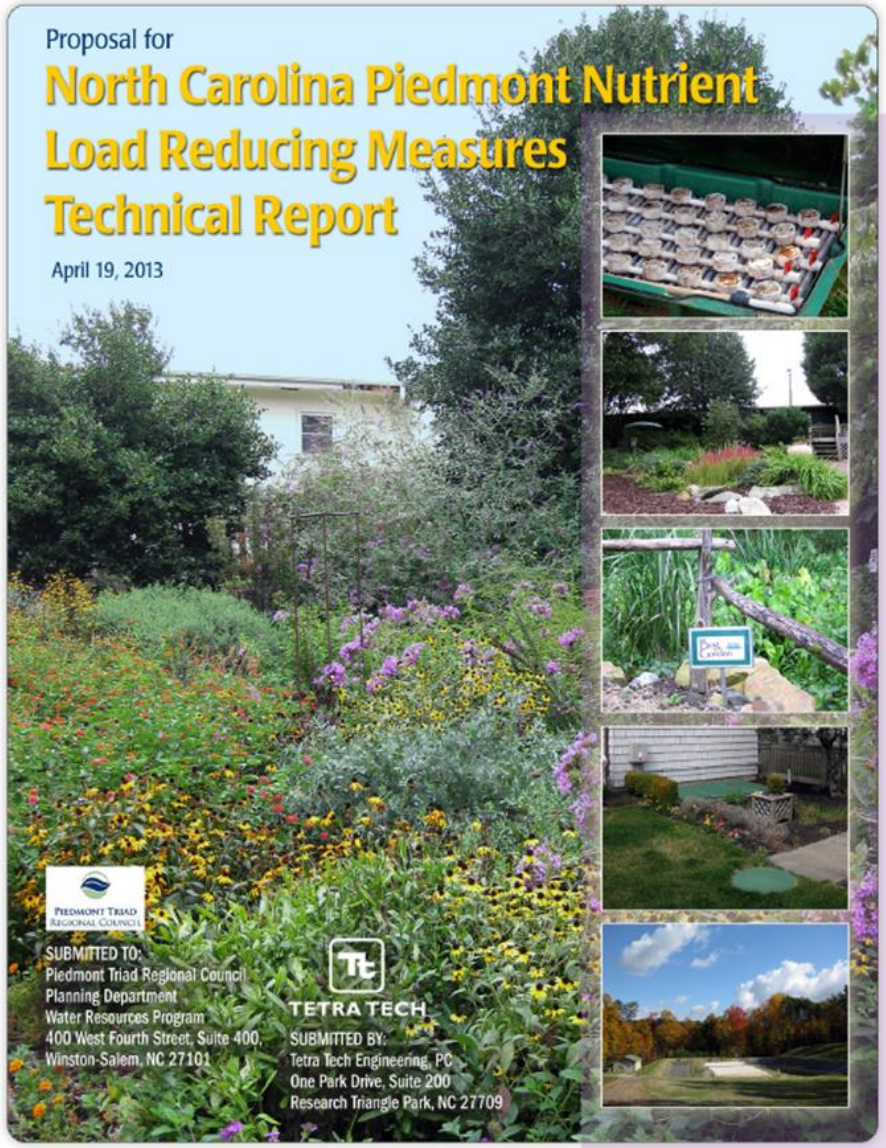
Figure 2

Preliminary Evaluation Summary

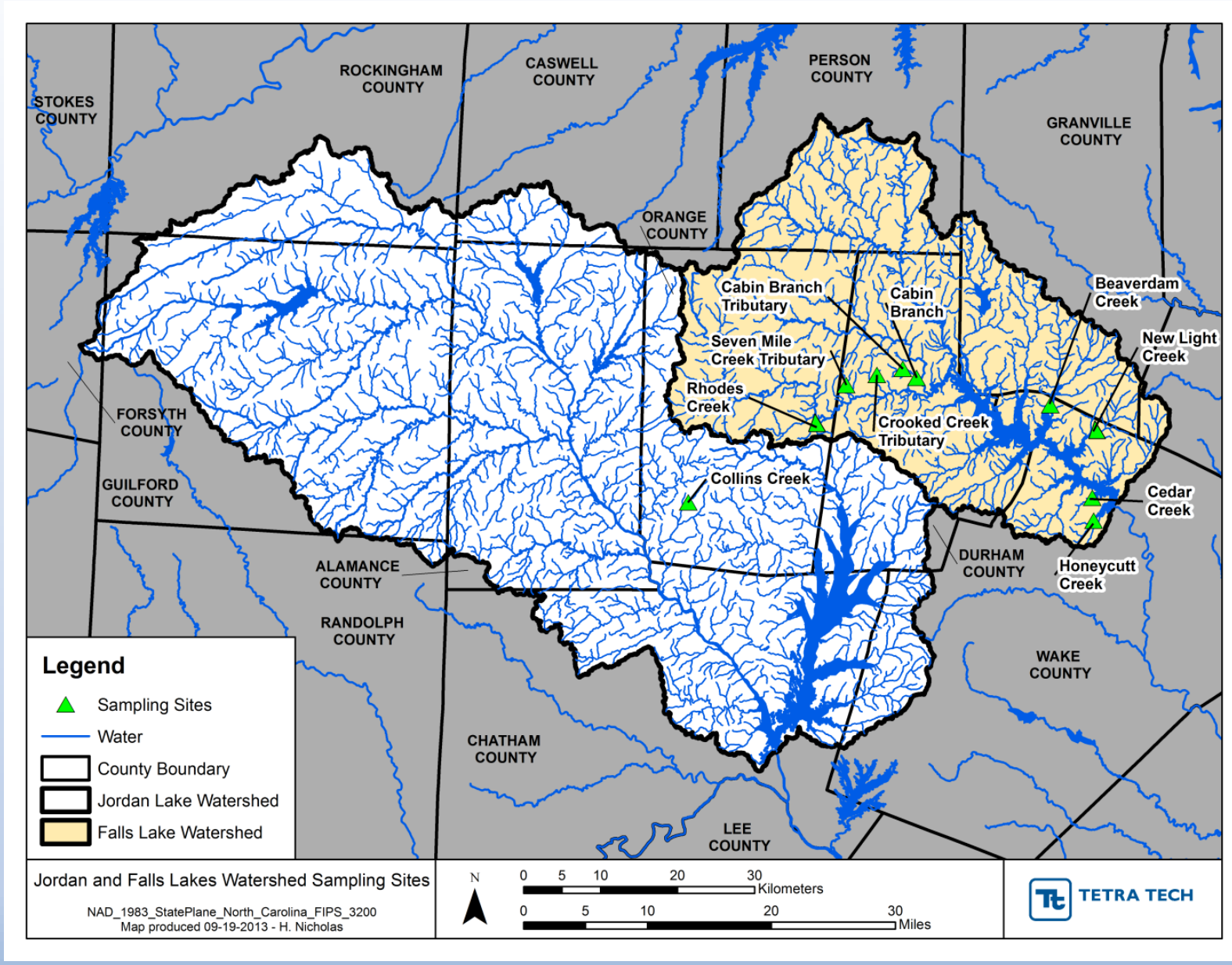
- Large onsite wastewater treatment system (OWTS)
  - 1,400 students = 21,000 gallons per day
- Although results are preliminary, there appears to be usable soil on the property for an OWTS
  - "Provisionally Suitable" soils are good – will require about 6 acres for primary and 6 acres for repair area
  - "Limited Suitability" soils are okay – will require more acreage
  - Reuse on ballfields, etc. is also possible
- Site is approximately 1 mile from Jordan Lake: what about water quality?

What About Water Quality?

- Tetra Tech developed the latest water quality model for Jordan Lake
  - Detailed inventory and nutrient load estimates for OWTS
- Data on nutrient loading from OWTS in the NC Piedmont
- We have developed applicable methodologies in the Chesapeake Bay watershed
- More detailed site assessment and modeling can be done
- Can use advanced treatment for water reuse



Jordan and Falls Lake Watershed Water Quality Monitoring Locations



NC Piedmont OWTS 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

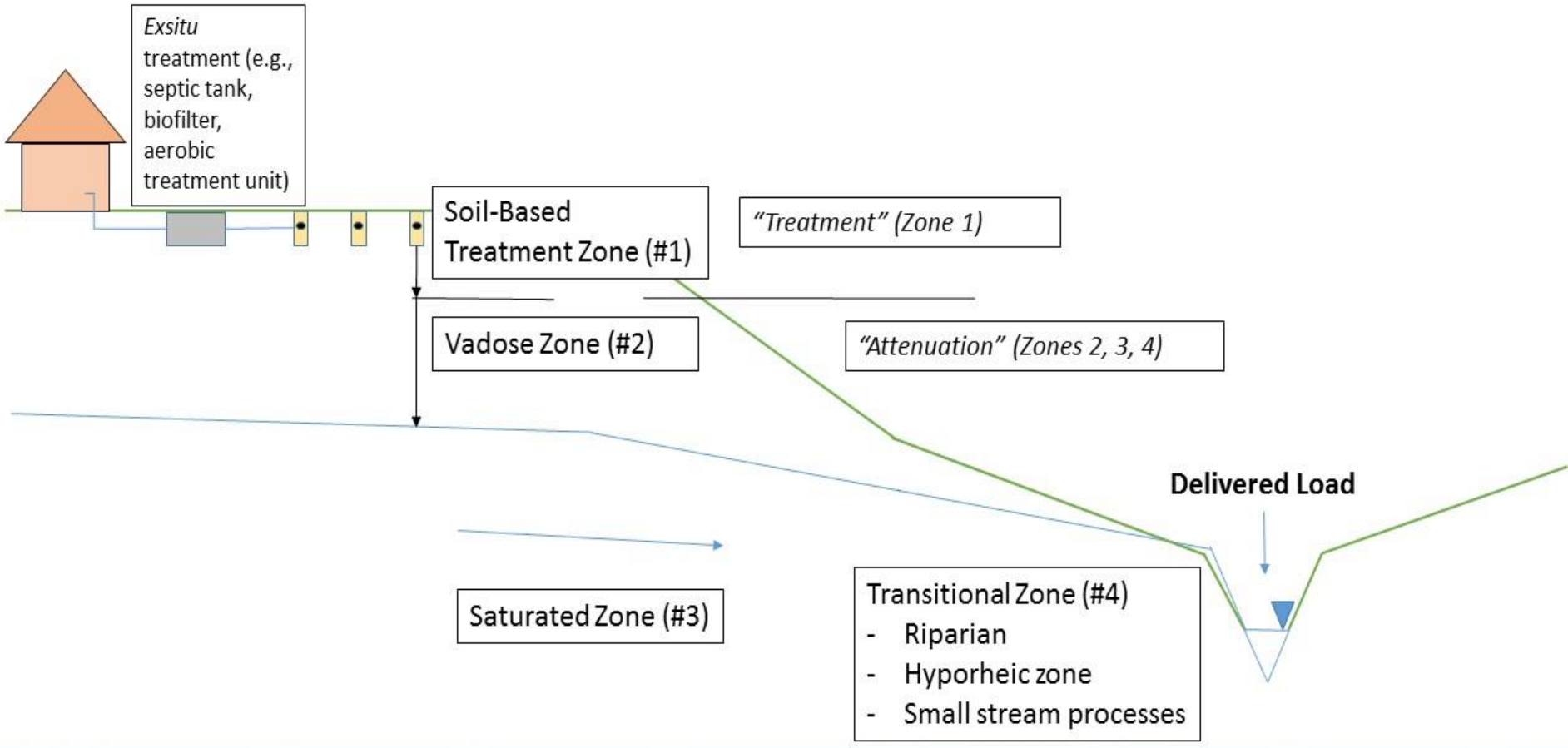
ChesBay OWTS Attenuation Expert Panel

Review science on how to factor nutrient attenuation into Chesapeake Bay TMDL OWTS load estimates

- Assess variable total nitrogen (TN) attenuation rates
- Determine whether 100% removal of total phosphorus (TP) is warranted
- Recommend methodologies to be used and specific attenuation rates to be used in different contexts
- Final report approved in October

Attenuation Panel Conceptual Framework

Assume: residential wastewater, 5 kg TN/cap/year



TN Reductions in OWTS Components

Component	Comment
Exsitu unit 1 (e.g., septic tank)	No TN reduction assumed in septic tank (e.g., TN = 5 kg/cap /day)
Exsitu unit 2 (e.g., intermittent sand filter)	TN reductions based on CBP approved BMP credits
Insitu Zone 1 (Soil-Based Treatment)	Varies by soil texture, based on STUMOD and field observations
Insitu Zone 2 (Vadose Zone)	Assumed low in comparison to Zones 1 and 3; not explicitly addressed by Panel
Insitu Zone 3 (Groundwater Zone)	Varies by physiography and geology, informed by SPARROW modeling and field observations
Insitu Zone 4 (Transitional Zones)	Small stream and riparian processing being partially addressed by other CBP efforts

Overall Panel Recommendations

Soil Textural Classification	USDA Soil Textures	Low TN Transmission Area	Medium TN Transmission Area	High TN Transmission Area	Very High TN Transmission Area
Sandy	Sand, Loamy Sand, Sandy Loam, Loam	1.1 kg/cap/yr (-31%)	1.7 kg/cap/yr (6%)	2.3 kg/cap/yr (44%)	2.7 kg/cap/yr (69%)
Loamy	Silt loam, Clay Loam, Sandy Clay Loam, Silty Clay Loam, Silt	0.8 kg/cap/yr (-50%)	1.3 kg/cap/yr (-19%)	1.8 kg/cap/yr (13%)	2.1 kg/cap/yr (31%)
Clayey	Sandy Clay, Silty Clay, Clay	0.6 kg/cap/yr (-63%)	0.9 kg/cap/yr (-44%)	1.3 kg/cap/yr (-19%)	1.5 kg/cap/yr (-6%)

Represents delivery to Zone 4 (additional removal possible)

Change from current CBP load (1.6 kg/cap/yr) in parentheses

Advanced Treatment and Reuse

- Advanced Treatment
  - Recirculating filters (can be vegetated)
  - UV disinfection
- Resource Recovery and Reuse
  - Water (advanced treatment)
  - Nutrients (urine diversion)
  - Energy (anaerobic digestion)

Contact Information

Victor A. D'Amato, PE
Tetra Tech Engineering, P.C.
P.O. Box 14409
1 Park Drive, Suite 200
Research Triangle Park, NC 27709
Direct: 919.485.2070
victor.damato@tetratech.com