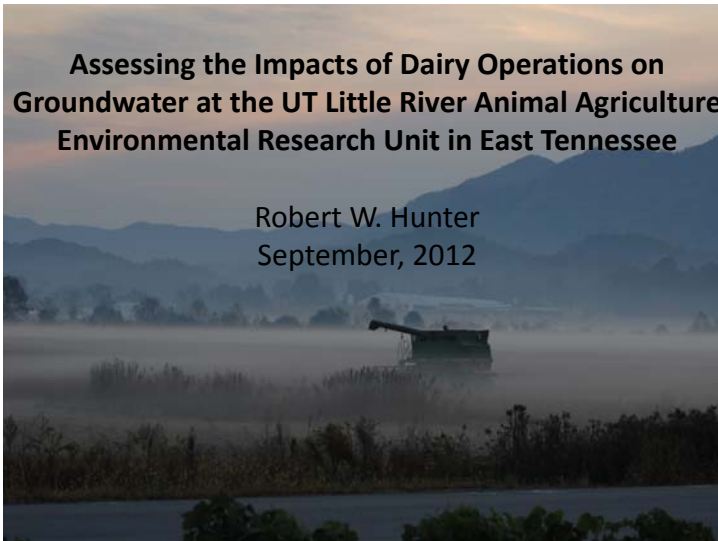


Assessing the Impacts of Dairy Operations on Groundwater at the UT Little River Animal Agriculture Environmental Research Unit in East Tennessee

Robert W. Hunter
September, 2012



Objectives

- Review: Little River Watershed Status
- Review: Alluvial well installation & characterization: Upland weathered shale well installation
- Review: Hydrogeologic conceptual models
- Review: Seasonal water level monitoring program
- Review: Floodplain Flow Systems: Streams Surface Water Groundwater

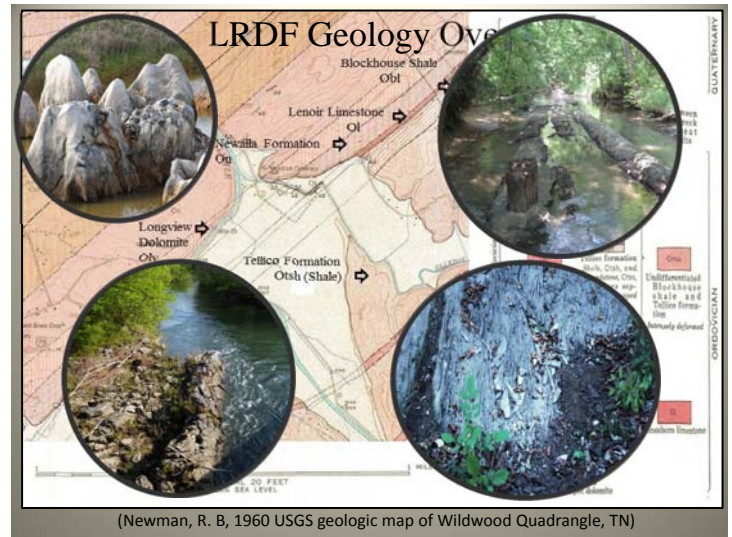
Little River Watershed Non-Point Source Impacts

1,030 total stream kilometers within the Little River Watershed
370 stream kilometers impaired

Fish	
	Duskytail Darter, <i>Etheostoma percnurum</i>
	Snail Darter, <i>Percina tanasi</i>
Fresh Water Mussels	
	Fine-rayed Pigtoe, <i>Fusconaia cuneolus</i>
	Pink Mucket Pearlymussel, <i>Lampsilis abrupta</i>
	Orange-foot Pimpleback Pearlymussel, <i>Plethobasus cooperianus</i>
Fresh Water Snail	
	Anthony's River Snail, <i>Athearnia anthonyi</i>

[US EPA, 2005]
[TDEC, 2004, 2005, 2012 draft 303(d) report]

Watershed map after Wilkerson, John - 2011



Physical Characterization

- Well Construction
- Stratigraphy
- Alluvium
- Upland Weathered Shale

Alluvial Floodplain Well Installation



15 wells installed

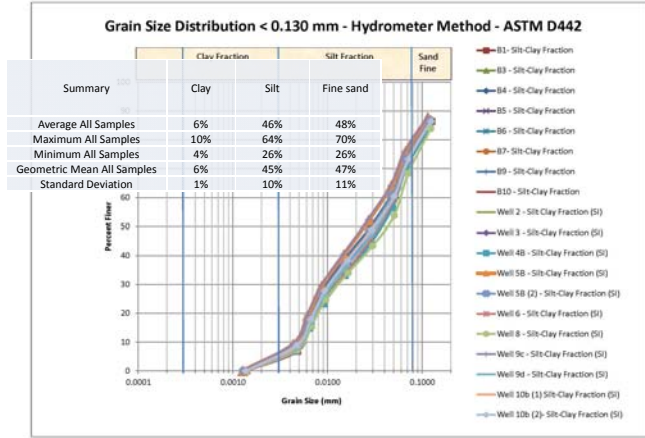


Well Development

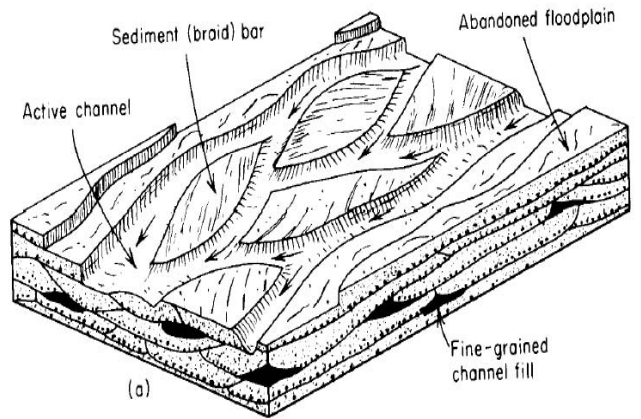
Split Spoon Samples



19 Composite Samples from Soil & Well Borings



Floodplain Alluvium Stratigraphy

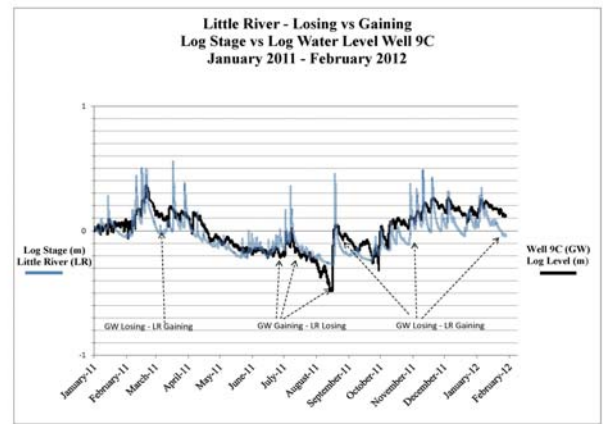


Alluvial River Bed Cartoon - Freeze & Cherry 1979

Surface and Groundwater Interactions
Active Sinkhole Development

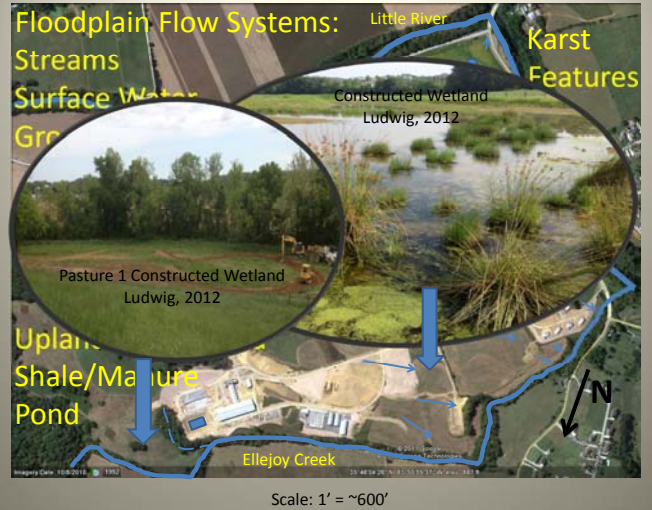


Little River - Losing vs Gaining
Log Stage vs Log Water Level Well 9C
January 2011 - February 2012

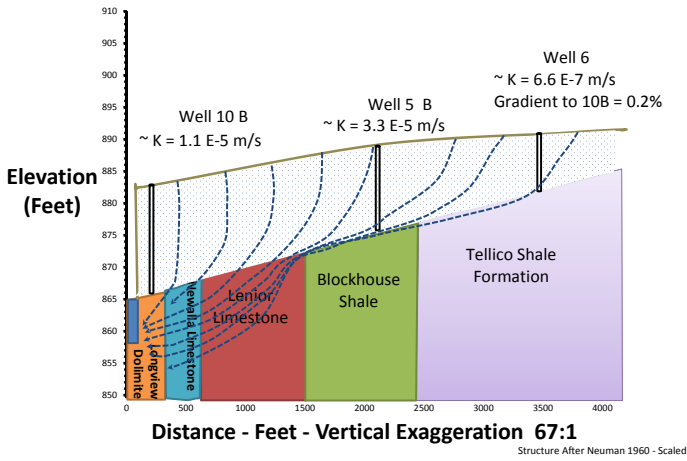


Hydrostratigraphic Flow Systems

- Floodplain Alluvium
- Floodplain Bedrock/karst
- Upland weathered shale / pond



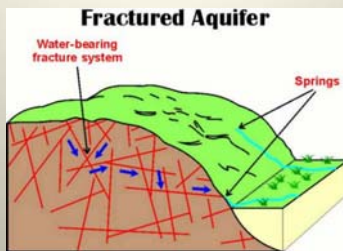
Hydrostratigraphic Flow Patterns



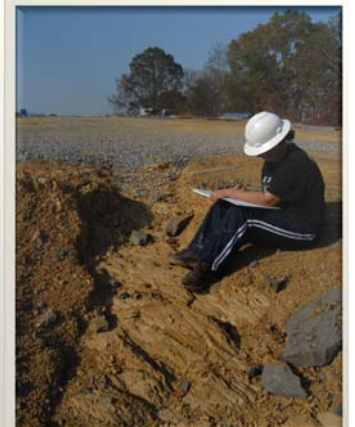
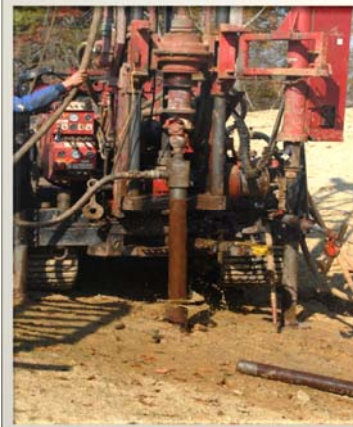
Bedrock Wells & Groundwater Flow Patterns Shale Shot Rock, Weathered and Fractured Shale



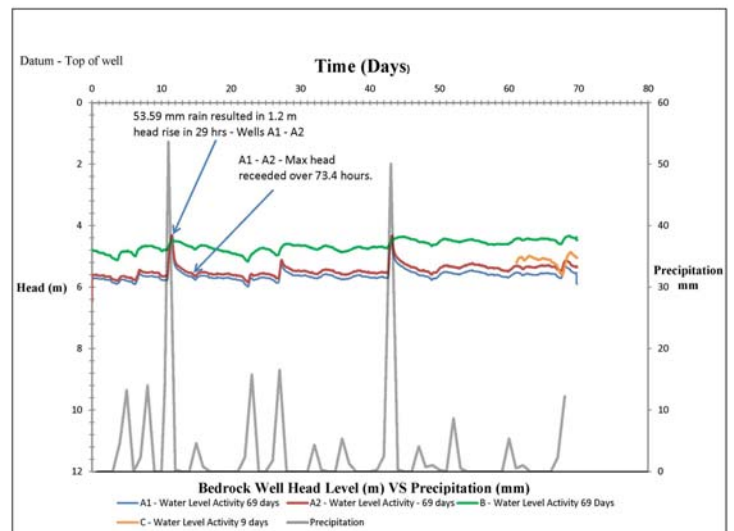
Fractured Shale, Conduits & Fracture Networks

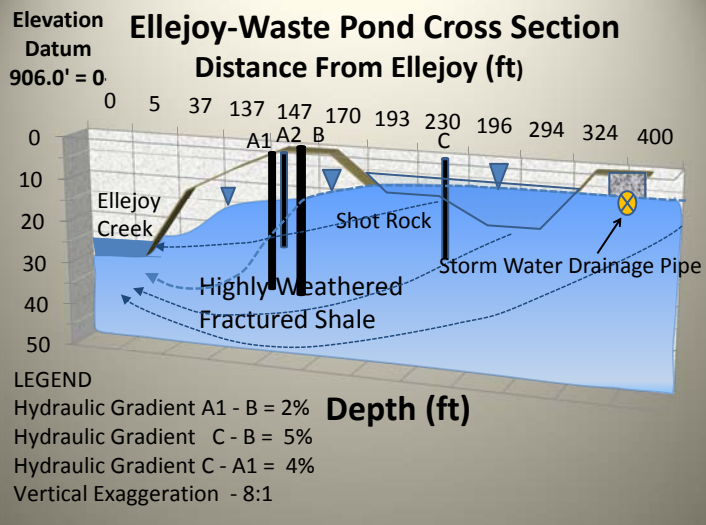


2010 Well Installations in Weathered Shale Adjacent to Manure Waste Pond



Fractured Shale Continued





Preliminary Findings

• Flood Plain

- Fine- to med-sands, moderate hydraulic conductivity (10 -5 m/s)
- Most flow systems are shallow, with discharge to Little River, Ellejey Creek & central drainage ditch
- Deeper flow into karst bedrock in southeast portion of LRDF

• Shale bedrock

- Highly weathered & fractured
- Hydraulic connection to waste pond



Acknowledgements



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