Richard C. Pais, Principal Environmental Scientist
Groundwater & Environmental Services

Certified Wildlife Biologist/Ecologist

- BS Cook College Rutgers University, Natural Resource Management
- MS University of Kentucky, Forest Science
- Instructor of Forest Ecology, Forest Stand Delineation and Forest Conservation Planning at Johns Hopkins University
- Developing Maryland Forest Conservation Act
- Pipeline Wetland Restoration Expert
- 30 years experience in ecological construction and permitting
- Current Chairman of Marcellus Shale Coalition Restoration Subcommittee, Member PA DEP Prioritized PermitReview Committee

Ecological Construction and Restoration of Pipelines

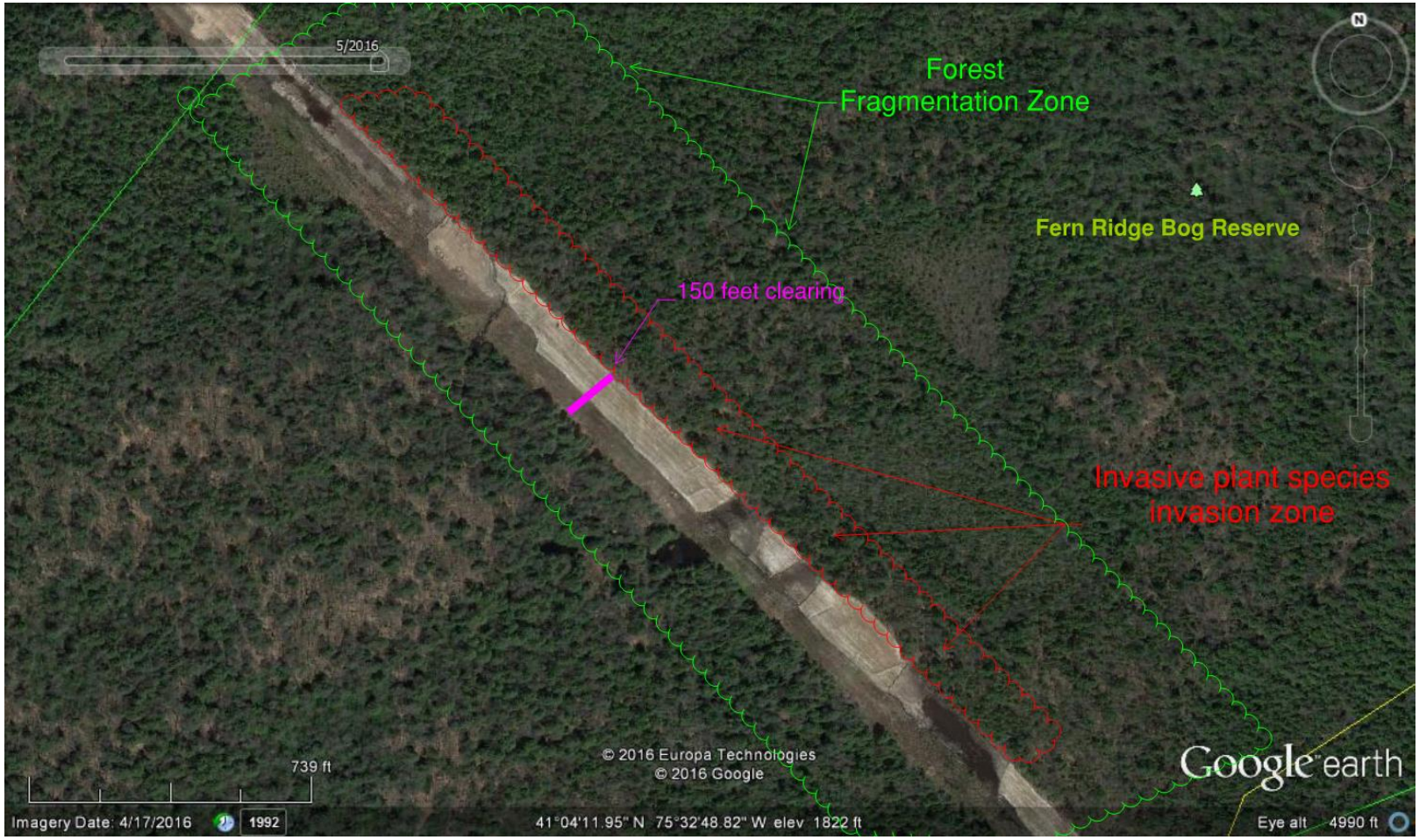
Richard Pais, Certified Wildlife Biologist/Ecologist


DEERE

Typical Footprint of Pipeline

Ecological Concerns:
Zone of Influence of from Edge Disruption

Ecological Concerns:
Potential Range of Forest Fragmentation



Aesthetic Concerns:
Steep Slope After Pipeline Construction

Aesthetic Concerns:
Valley Crossing After Pipeline Construction

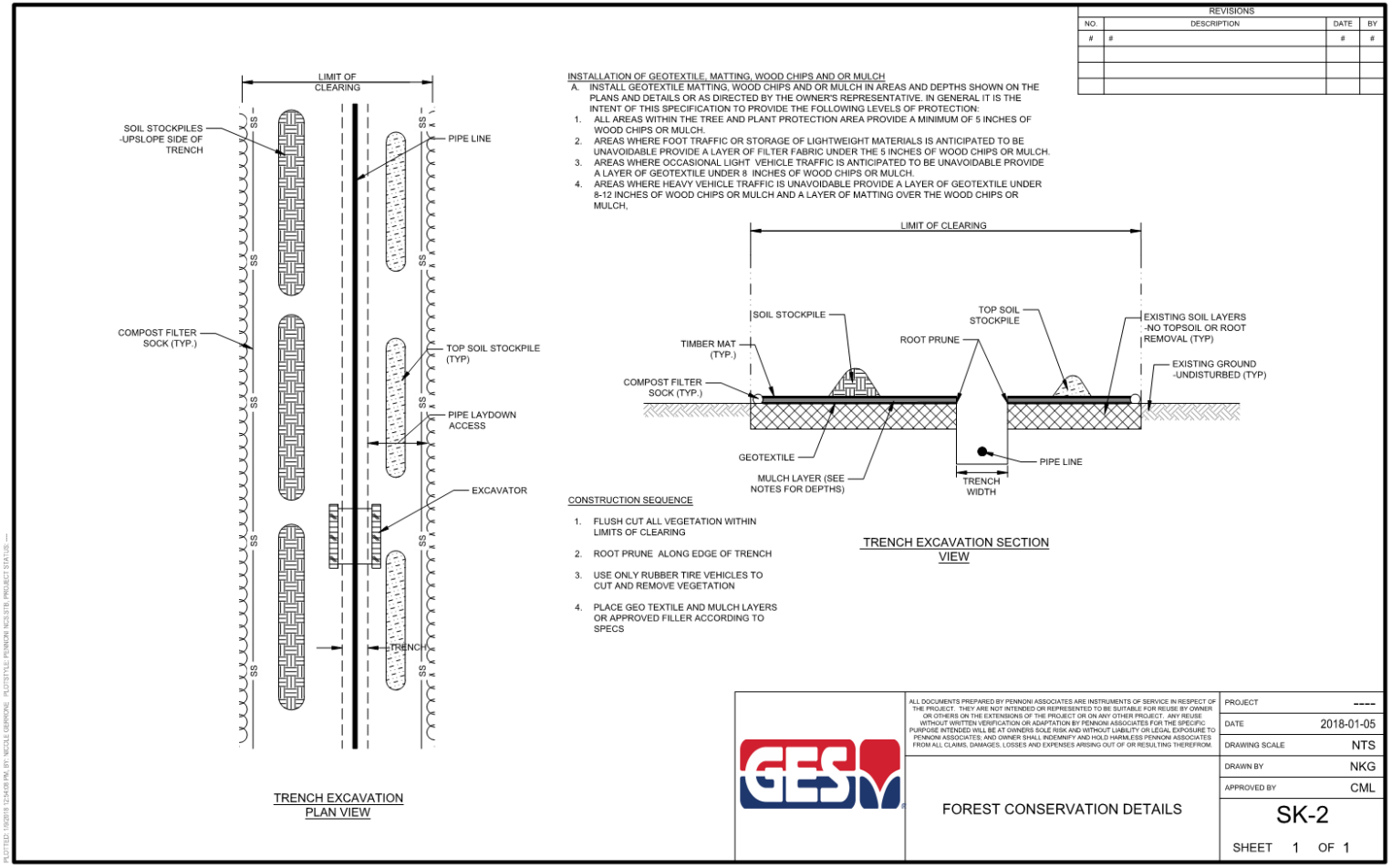
Low impact construction techniques are used commonly in Maryland as part of compliance with the Forest Conservation Act

Low Impact versus Standard Practice

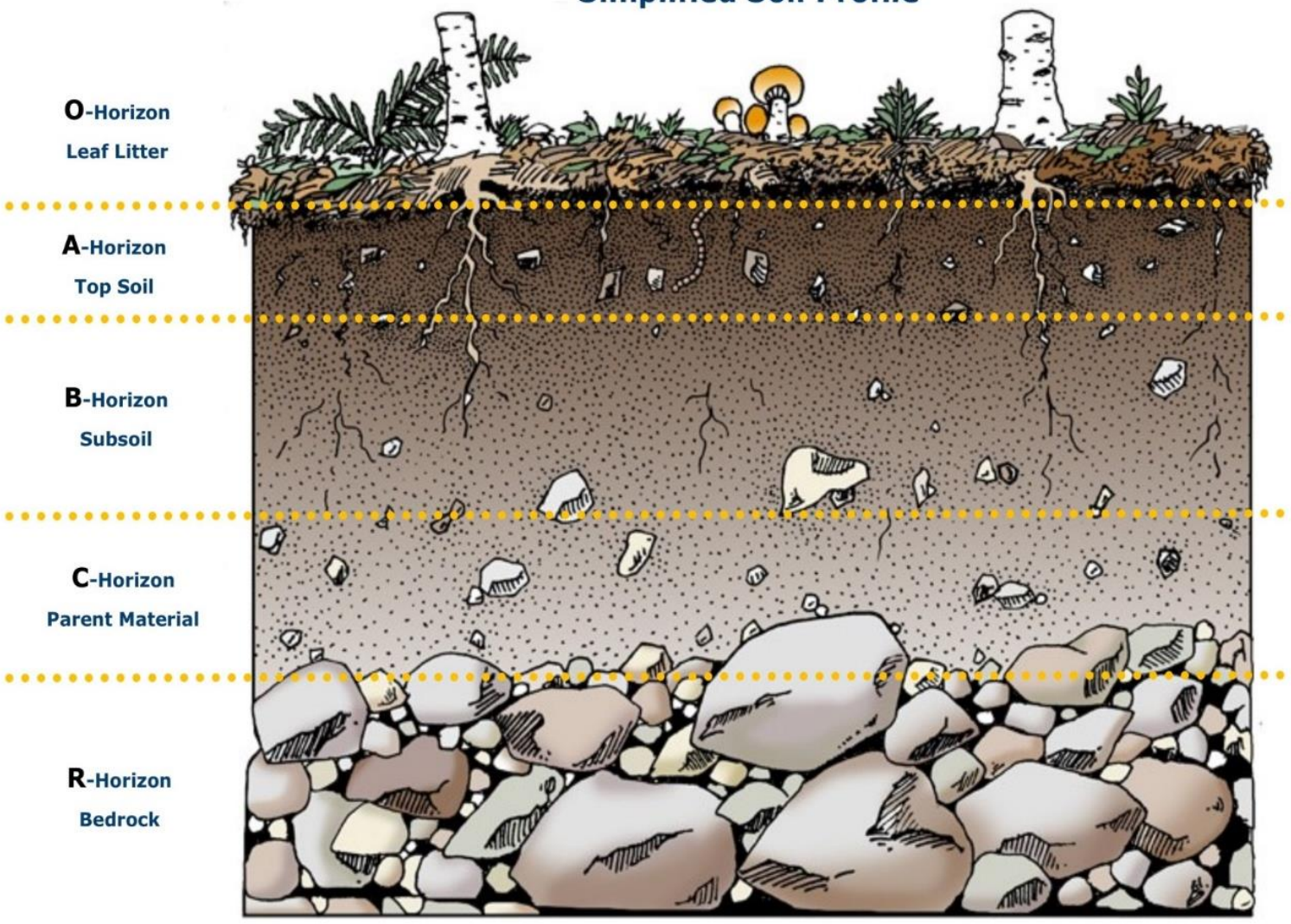
LEFT – Excavation occurring from fill placed to prevent soil and root compaction. Tree roots pruned.

RIGHT – All vegetation and topsoil removed from entire ROW. Tree roots unprotected, compacted and stripped.

Typical Specifications:
Forest Protection in Pipeline Construction

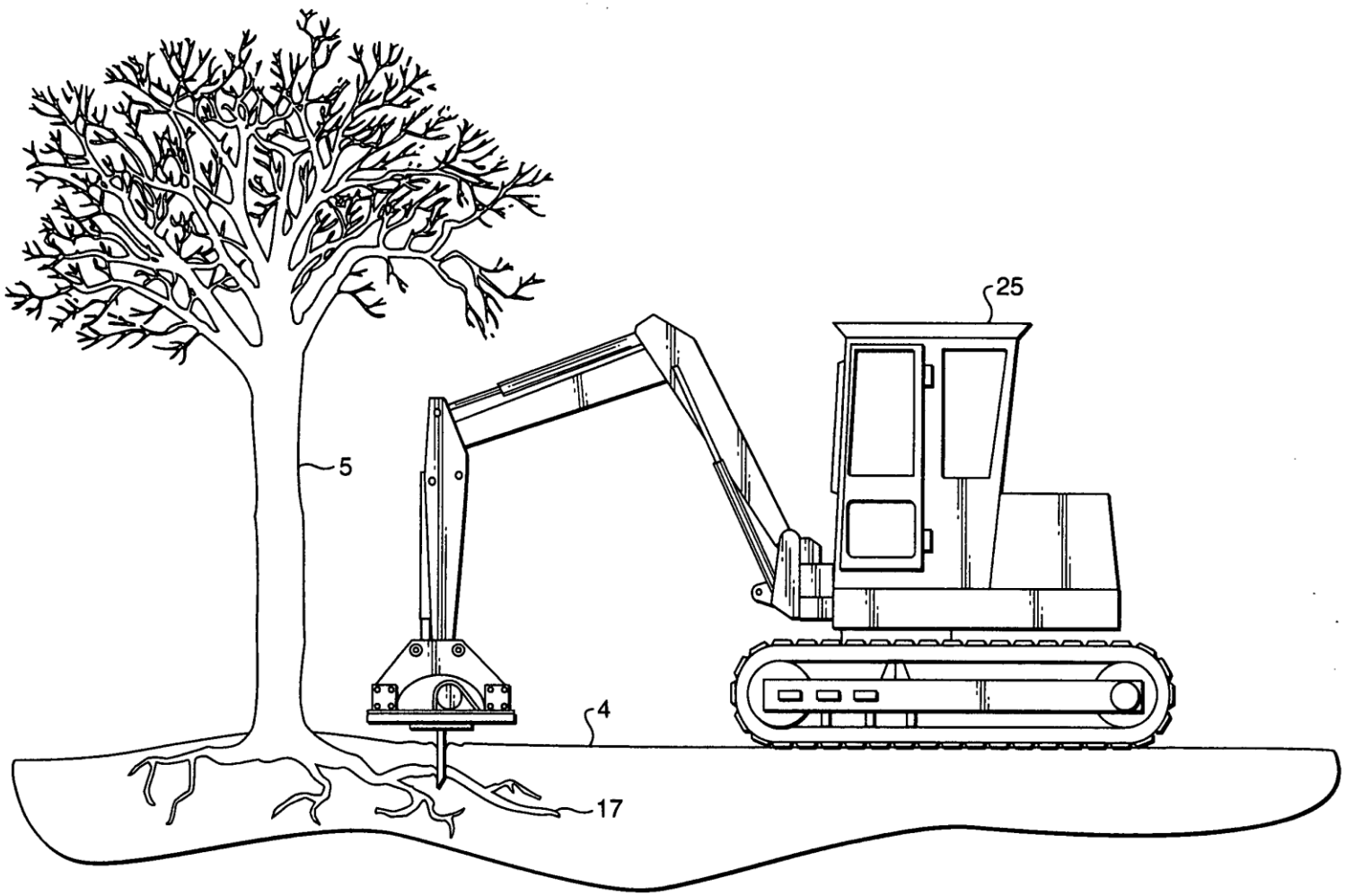


Simplified Soil Profile



Roots Exposed in Pipeline Construction

Clean cuts along forest edge



Forest Edge Protection to Insure Canopy Preservation
Root Pruner

Post Construction
Ecological Restoration in Forest

Excavator removing noncompaction layer and adding topsoil

Post Construction
Ecological Restoration in Forest

Reforestation Planting

Forest Restoration
Ten Years After Construction

Line installed in 2006

Photos from March 2017

Pipeline Restoration
Ten Years After Construction

LEFT – Invasive grass, forest fragmentation, changes in wetland hydrology

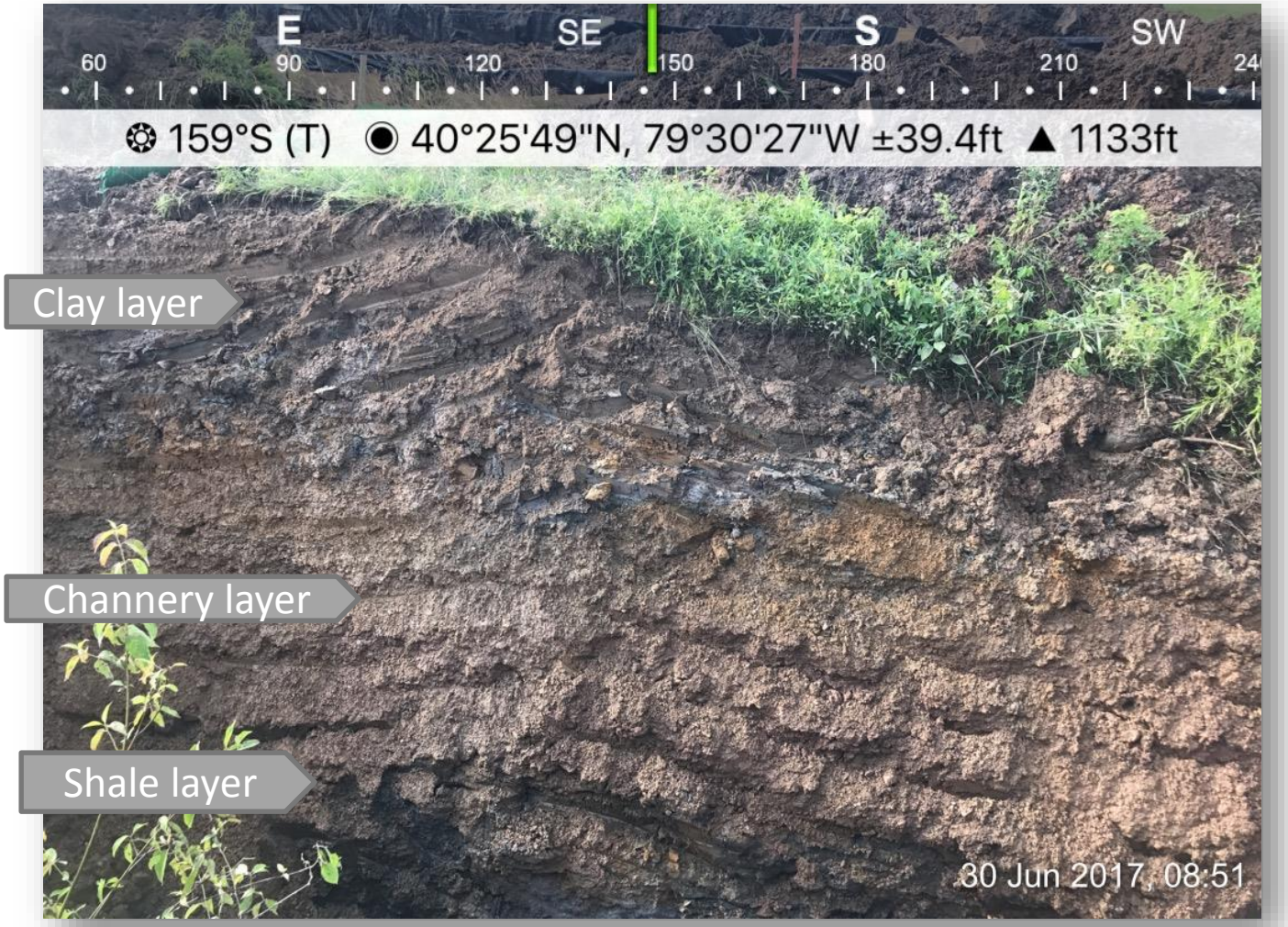
RIGHT – Ecological restoration of forest community

Regulatory Compliance: Wetland Restoration

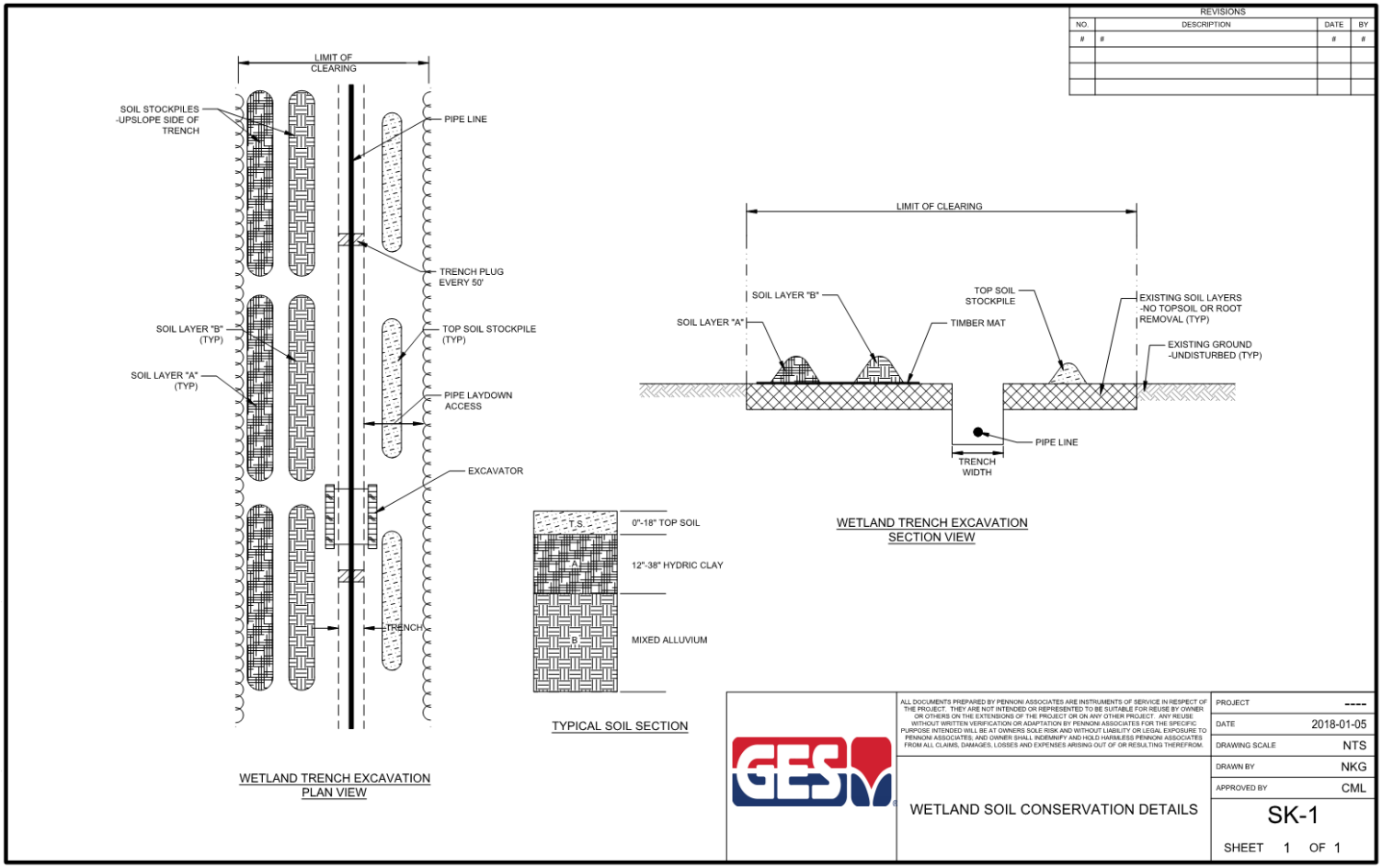
LEFT: 16-inch pipeline with no discernable changes to stream or wetland hydrology after construction – Low Impact Construction Practices.

RIGHT: Twin pipelines with severe alteration of on-site and off site wetland hydrology – Standard Construction Practices

Stratification in Wetland Subsoil



Typical Specifications:
Wetland Hydrology in Pipeline Construction



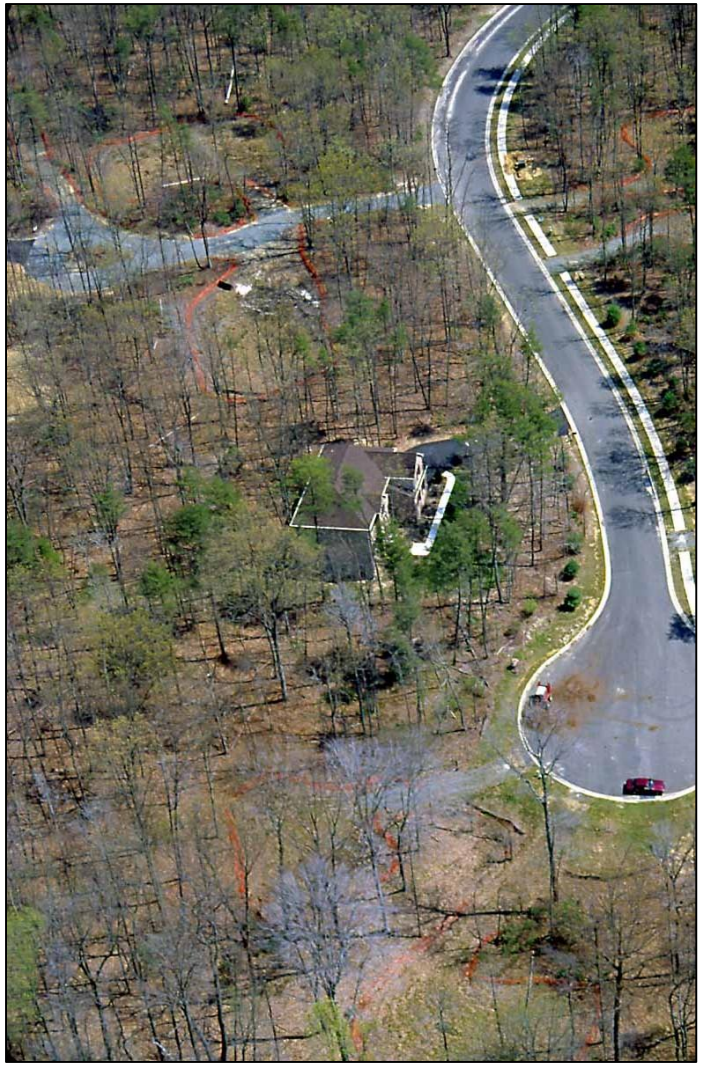
Replacing Harvested Wetland Soil

Replacing Harvested Wetland Soil

Replacing Harvested Wetland Soil

Replacing Harvested Wetland Soil

Forest Restoration with Vehicle Access
Streets and Lots Cleared Using Low Impact BMP's



Villages at Elk Neck, Cecil County, MD - 2002

Forest Restoration with Vehicle Access
Streets and Lots Cleared Using Low Impact BMP's

Forest Restoration with Vehicle Access
Streets and Lots Cleared Using Low Impact BMP's