

Vetiver Grass for Stabilizing Highway Slope Failures in Mississippi



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Overview

- Introduction to Vetiver Grass
- Application of Vetiver Grass for Slope Stabilization
- Laboratory and Field Testing of Vetiver Grass
- Vetiver Slope Stabilization Test Sites
 - I-20 - Jackson
 - US 49 - Mt. Olive
 - I-55 - Grenada

Vetiver Grass (*Chrysopogon Zizanioides*)



Plant Guide

'SUNSHINE' VETIVERGRASS *Chrysopogon zizanioides* (L.)Roberty Plant Symbol = CHZI

Contributed by: USDA NRCS Pacific Islands Area Plant Materials Program



Michael Robotham, USDA NRCS Pacific Islands Area State Office.
'Sunshine' with Bermudagrass used to stabilize waterway.

Alternate Names

Vetiveria zizanioides (L.) Nash; symbol=VEZI80
English: kus-kus, cuscus, vetiver
Fijian: mulimuli
French: chiendent odorant, vetiver
Hindi: garara, khas khas
Maori (Cook Islands): ai, mauku ai
Portuguese (Brazil): patchuli-falso
Spanish: zacate violeta, pacholi
Tamil: vetiver
Tongan: ahisiaina

Vetivergrass is a perennial bunch grass with many uses. The 'Sunshine' genotype is described here. Sunshine is the domesticated type from South India and must be propagated asexually because it is non-fertile. It is the only vetivergrass recommended by NRCS and land-grant universities for use in the NRCS Pacific Islands Area (American Samoa, Federated States of Micronesia, Guam, Hawaii, Marshall Islands, Northern Mariana Islands, and the Republic of Palau).

Vegetative planting material of Sunshine was received by the Hoolehua Plant Materials Center from the Agricultural Research Service (ARS) Plant Introduction Station in Griffin, Georgia. Several official germination tests of 400 seeds per sample were conducted by the State of Hawaii Department of Agriculture in 1993 and 1994 on seeds harvested from observational plantings at Hoolehua, Hawaii and Barrigada, Guam. A seed germinated in one of the tests; however, the seedling did not survive after being transplanted from the blotters to soil and taken from the germinator to the greenhouse. In 1993, an unofficial test was also conducted by the Hawaii Department of Agriculture with 100 seeds in a vermiculite substratum and one seed germinated, but it did not survive for more than a week. For approximately the past 15 years, no volunteer seedlings have been observed from conservation plantings of Sunshine in the Pacific Islands Area. Sunshine was evaluated for invasiveness by the Hawaii-Pacific Weed Risk Assessment and Pacific Island Ecosystems at Risk. It received a low risk score (-8) for the potential to become invasive.

Uses

Erosion control: A vegetative barrier is a dense hedge or row of plants growing on or near the contour. Vetivergrass is well adapted to the vegetative barrier practice used to control erosion on farm land because of its strong, compact root system and numerous stiff stems. The stiff stems slow the movement of the silt-laden runoff, spreading it out, trapping sediment, and causing deposition of the silt behind the barrier. Slowing of the runoff allows more water to infiltrate into the soil. Water infiltration is also aided by the deep root system of the grass. Over time, a natural terrace-like bench is formed behind the barrier.

The standard minimum barrier width of a vegetative barrier for the Vegetative Barrier Practice (Conservation Practice Code 601) to reduce sheet and rill erosion and manage water flow is 36 inches. The Pacific Islands Area received a variance from the standard minimum width of 36 inches to 12 inches when using vetivergrass for vegetative barriers. Sunshine vetivergrass, when planted in a single row at the correct within-row spacing and with proper care, will form a functional vegetative barrier, 12 inches wide at a height of 6 inches, within one growing season. A minimum amount of crop land is devoted to these single-row vegetative barriers and there is minimal competition with the crop plants because the root system grows essentially straight down.

Other conservation uses include road bank stabilization, stream bank stabilization, waterway stabilization, as a

Vetiver Grass Plant and Root System



Early Growth Stage



Vetiver Foliage



**Uprooted Older Vetiver
Grass Plant**



**6-Month Old Vetiver
Plant Root System**

Freshwater



Sandy Soil

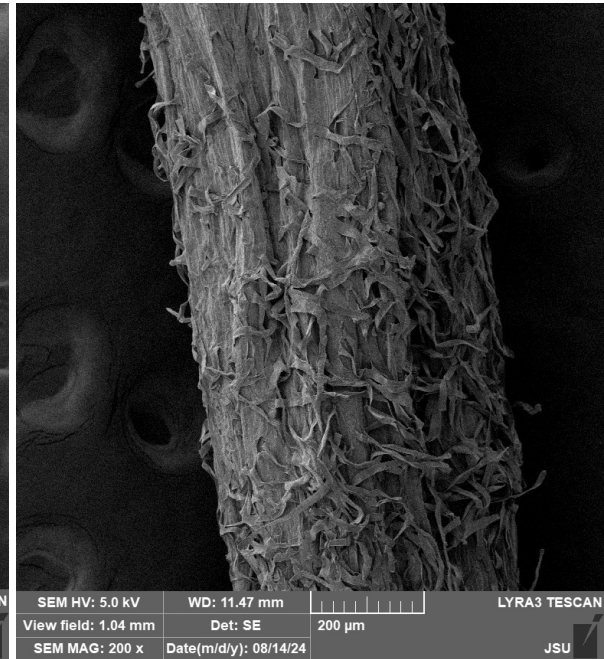
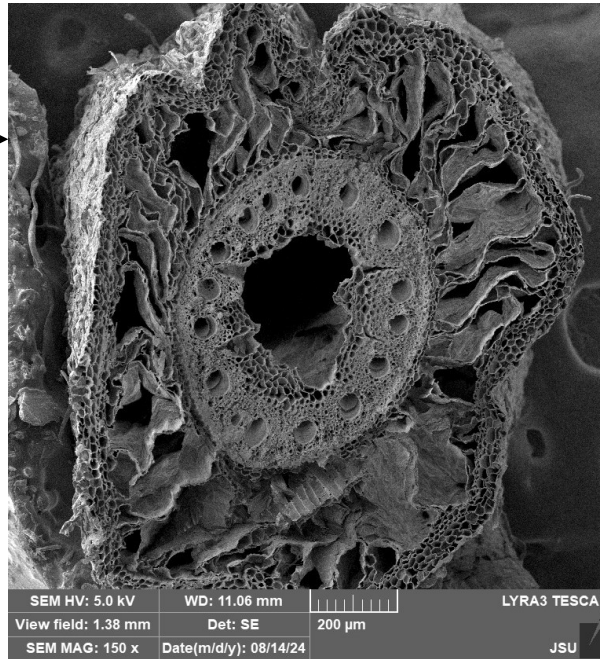


Clayey Soil

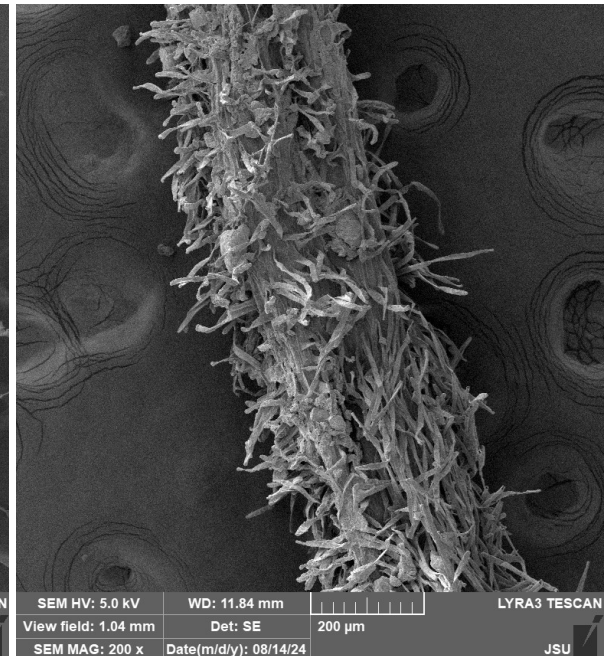
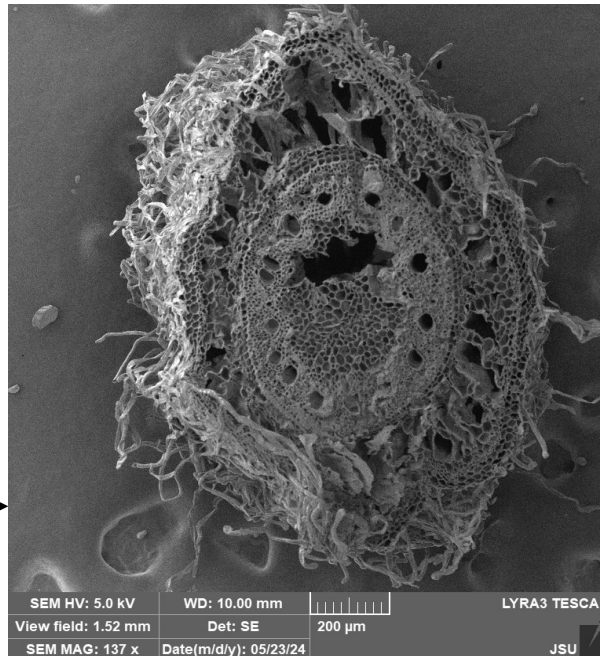


SEM of Root Structure

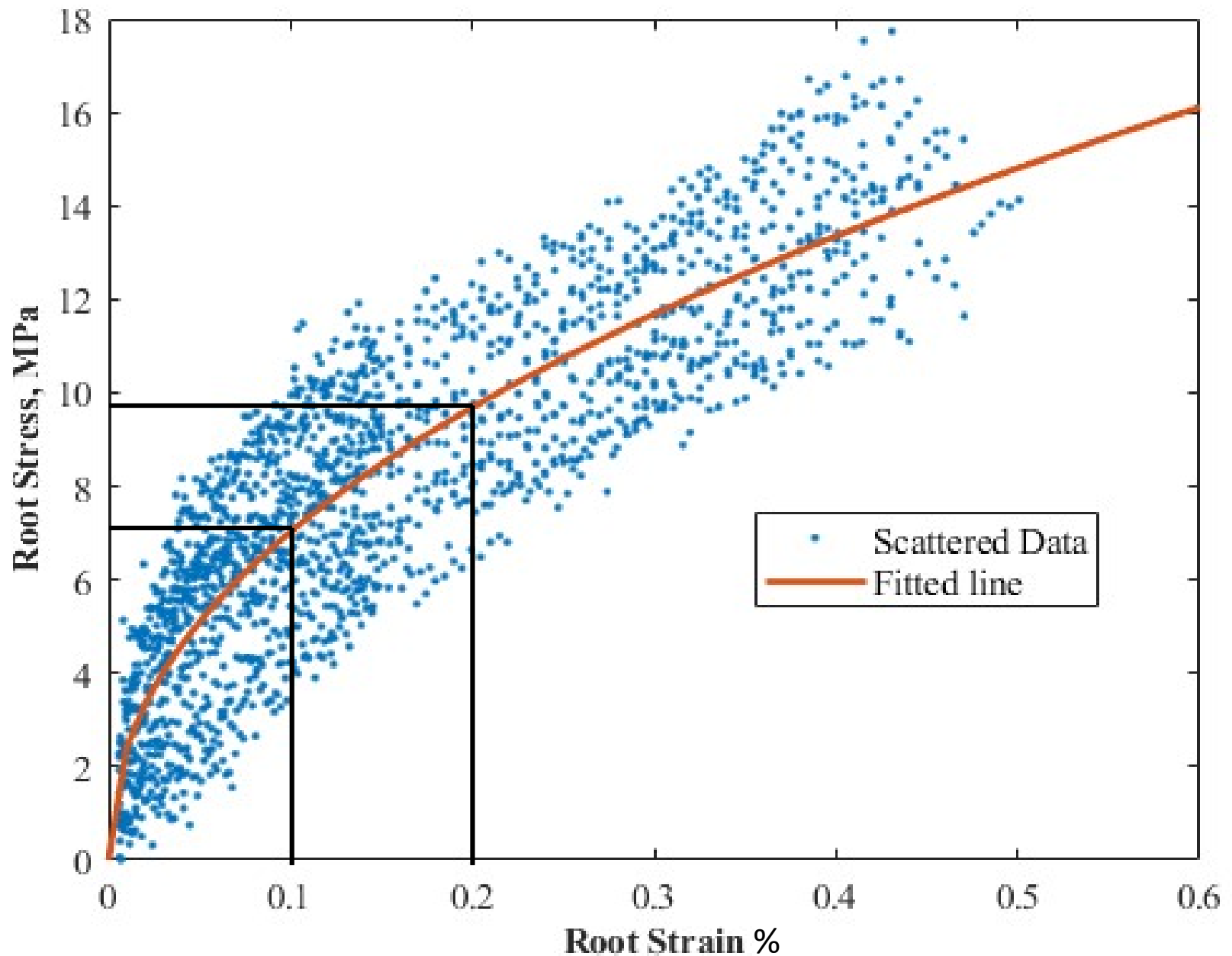
Clay →



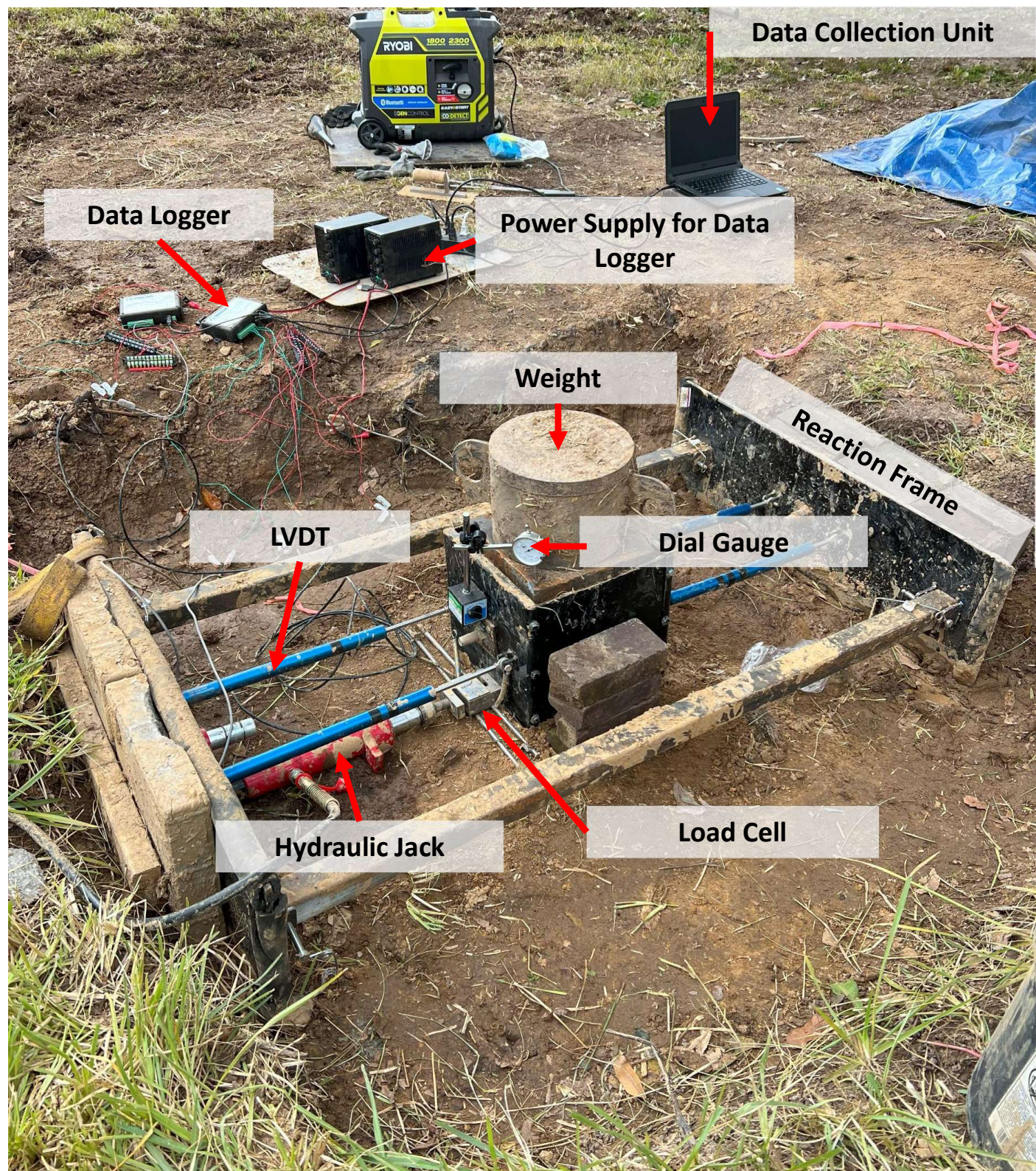
Sand →



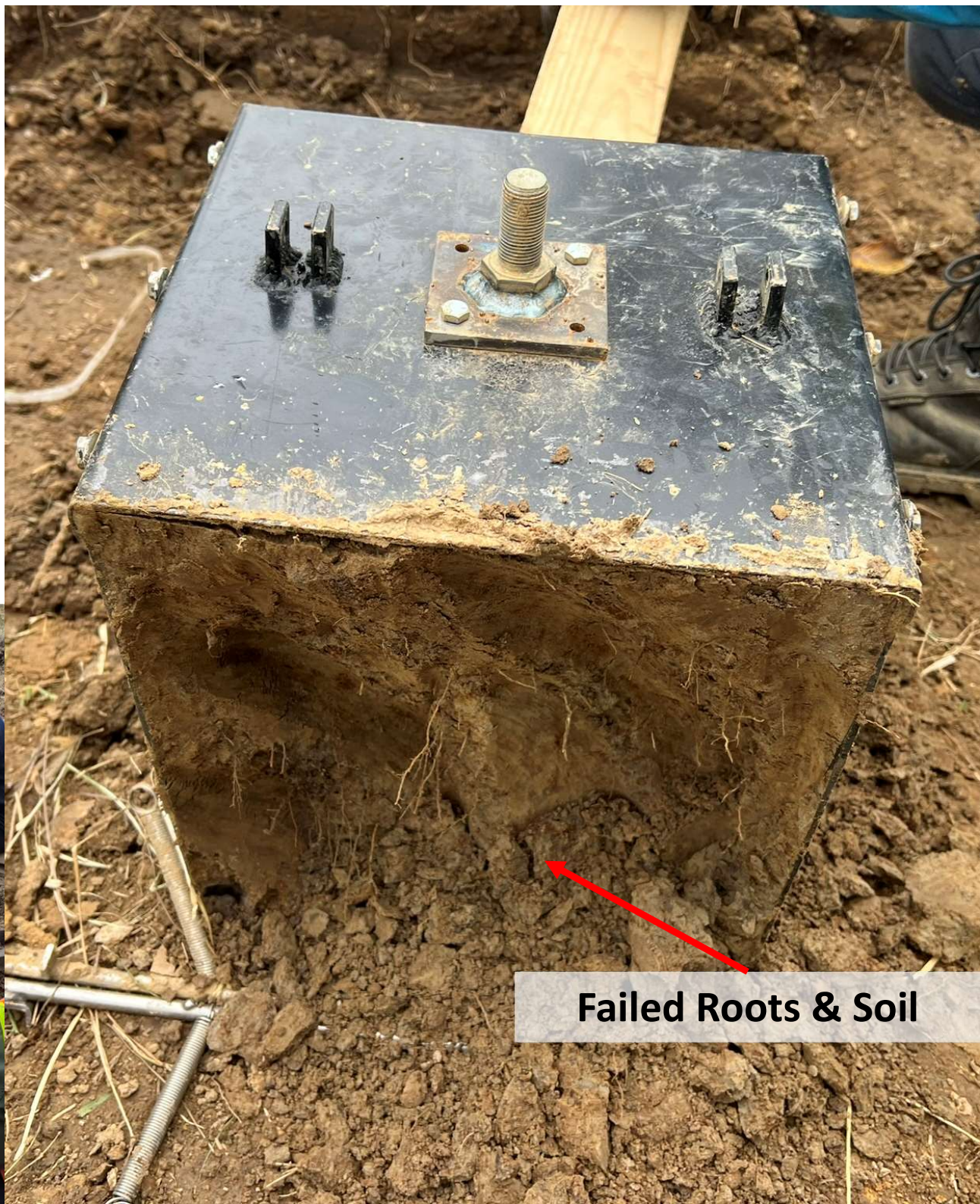
Tensile Strength of Vetiver Roots



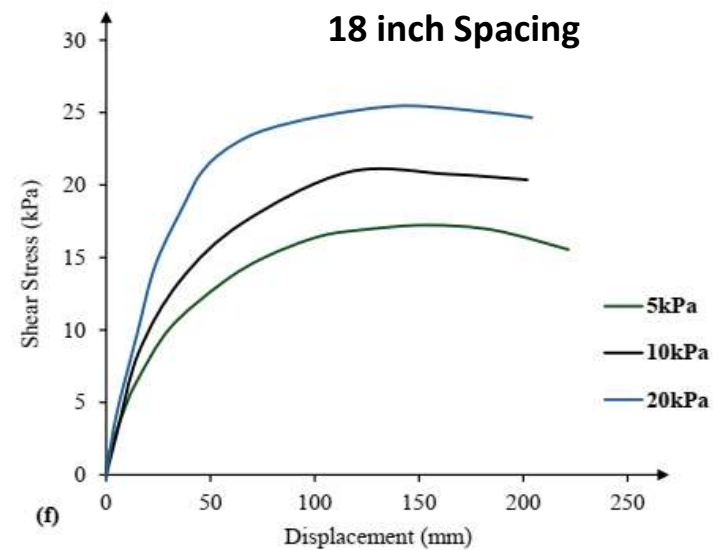
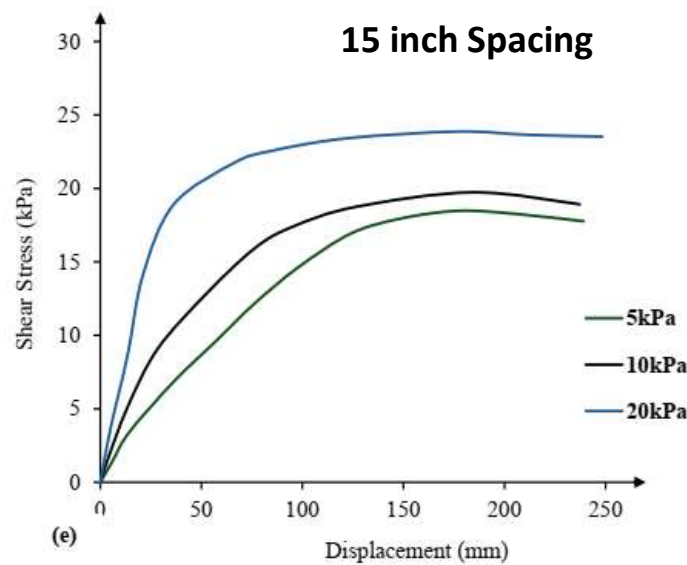
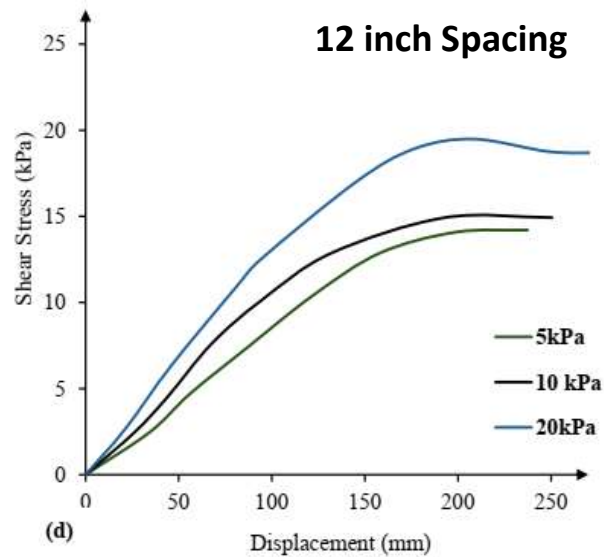
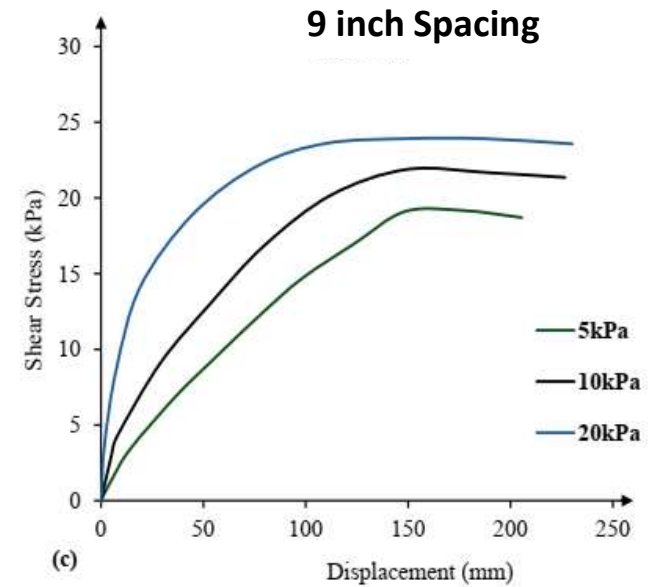
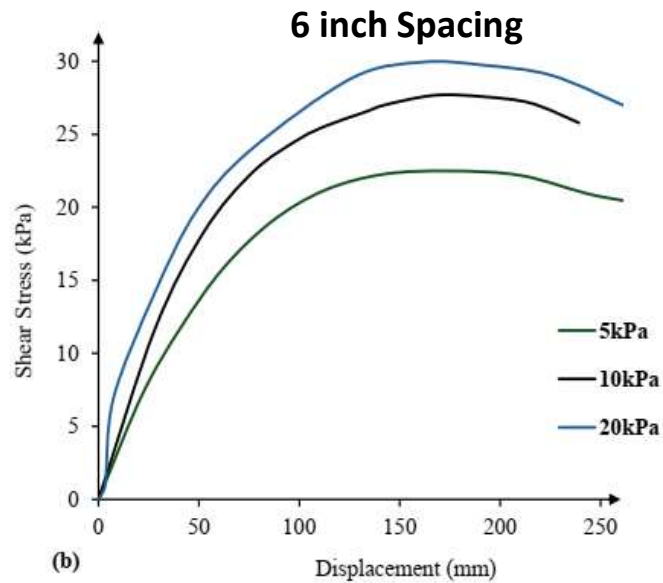
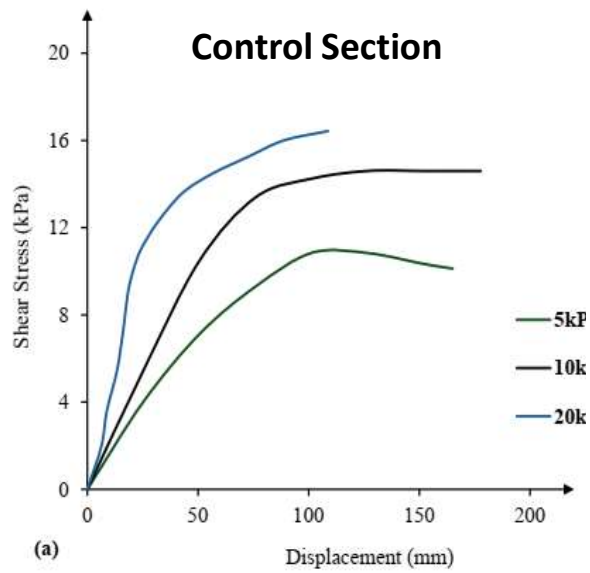
Field Direct Shear Device



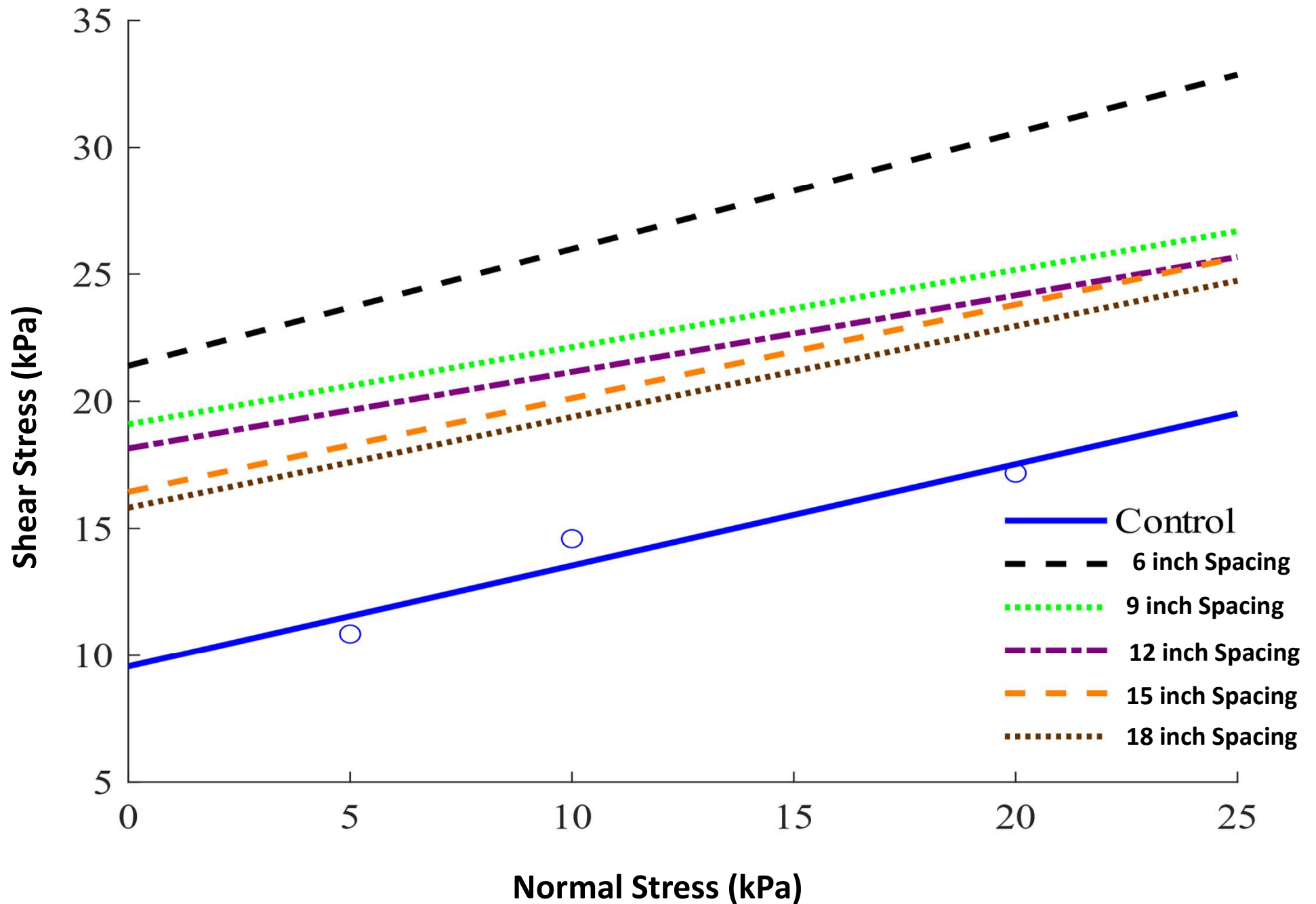
Field Direct Shear Test

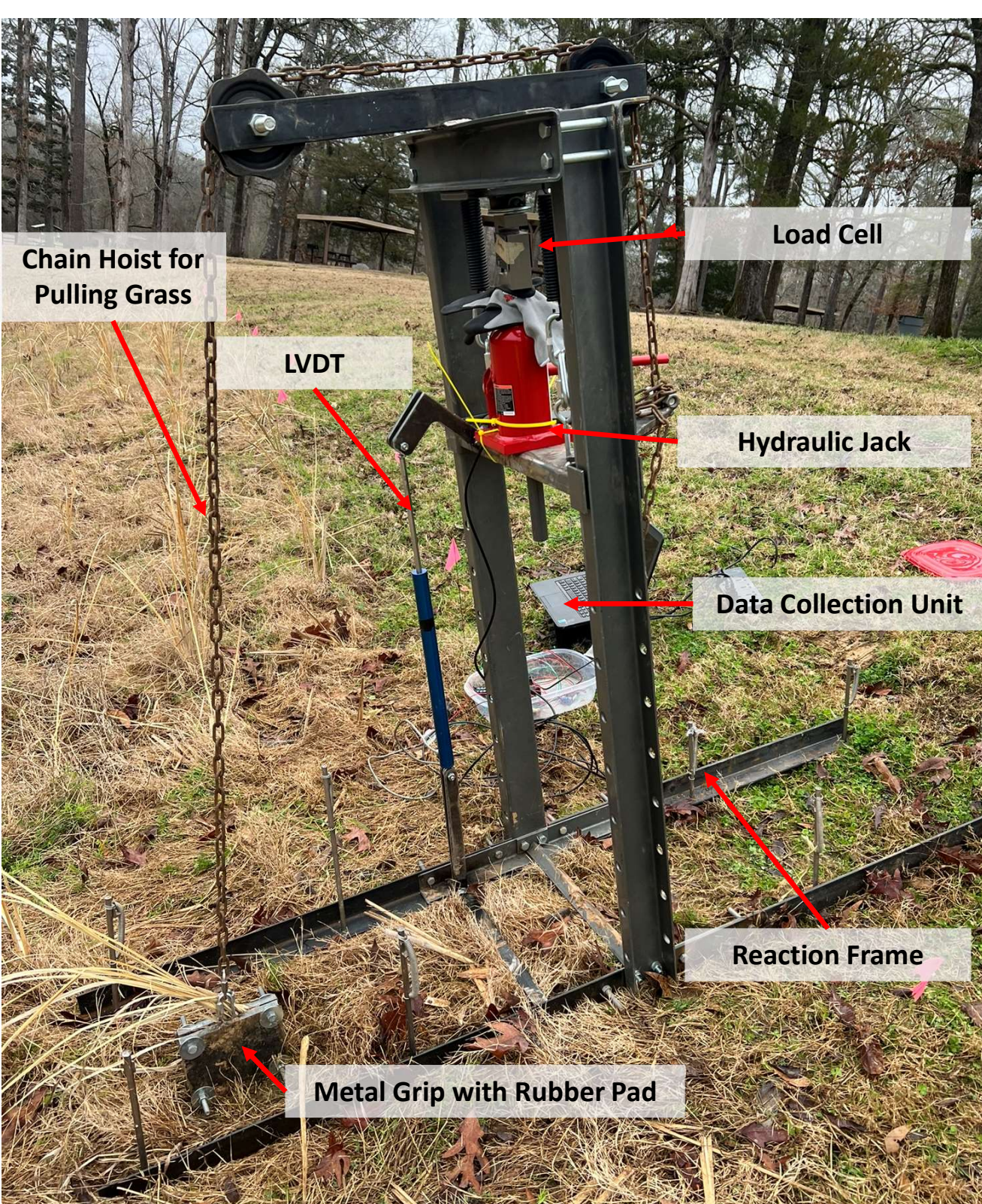


Field Direct Shear Results



Field Direct Shear Results





Field Pullout Test Device

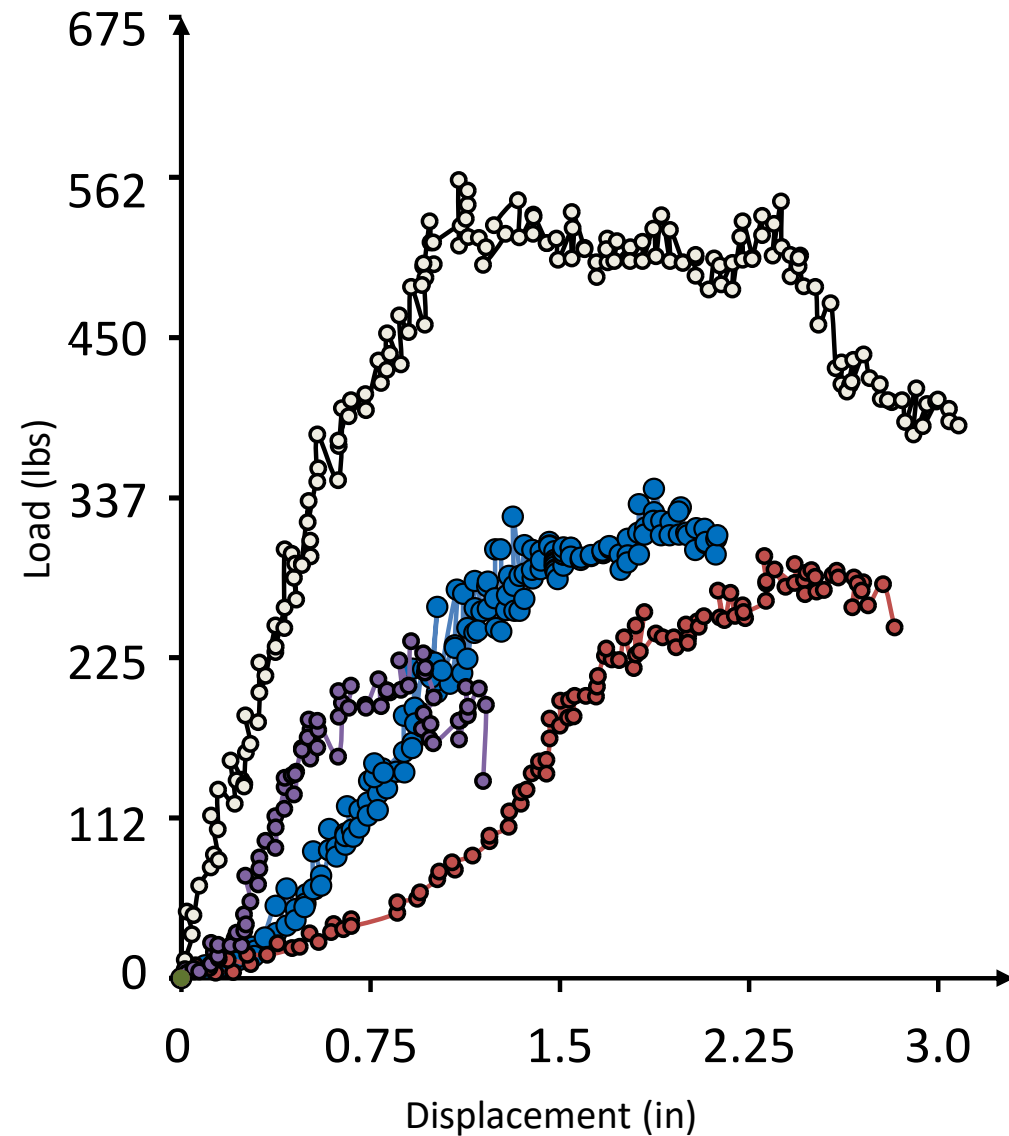
Field Pullout Test



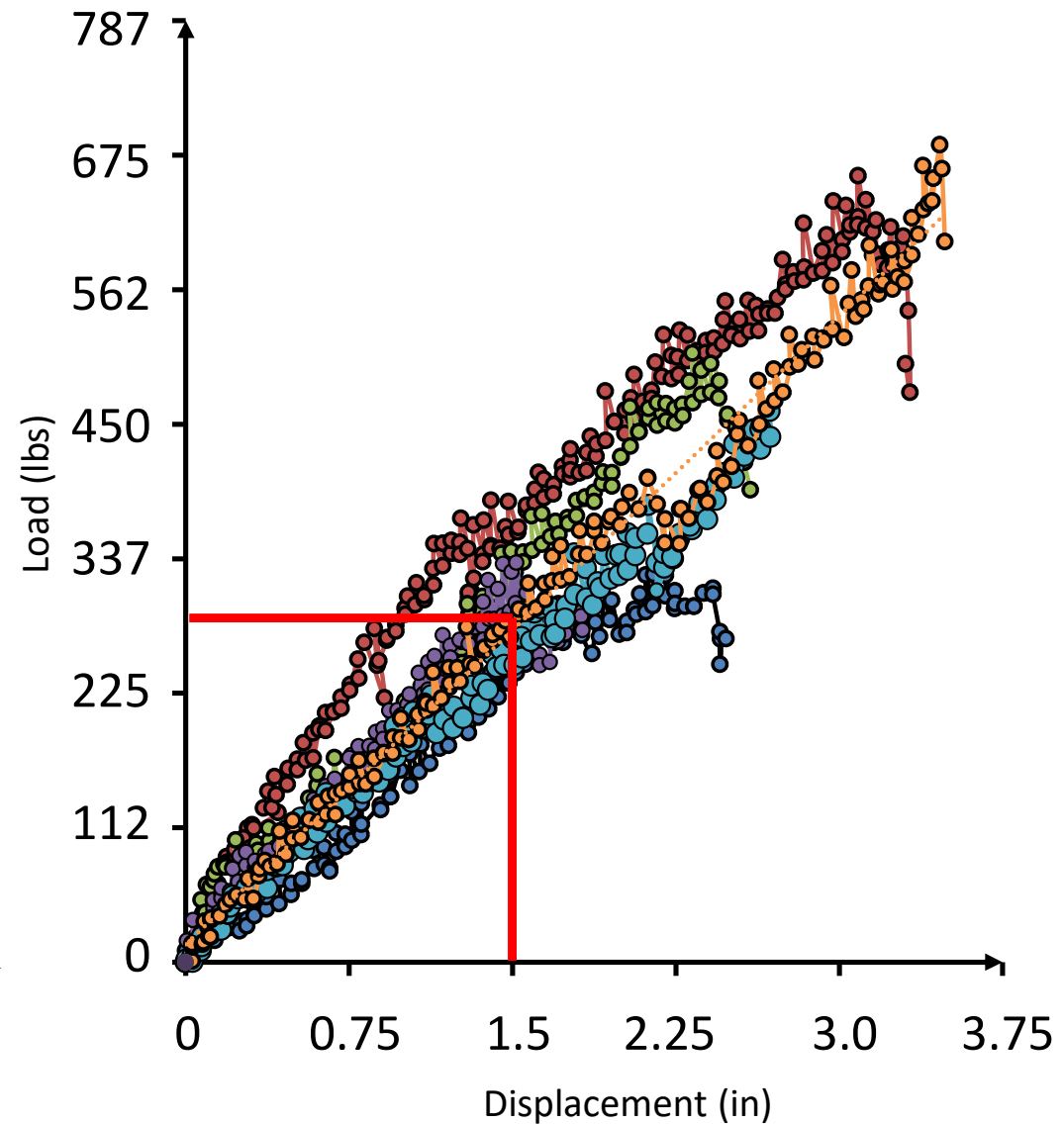
Field Pullout Test



Field Tensile Strength of Vetiver Roots



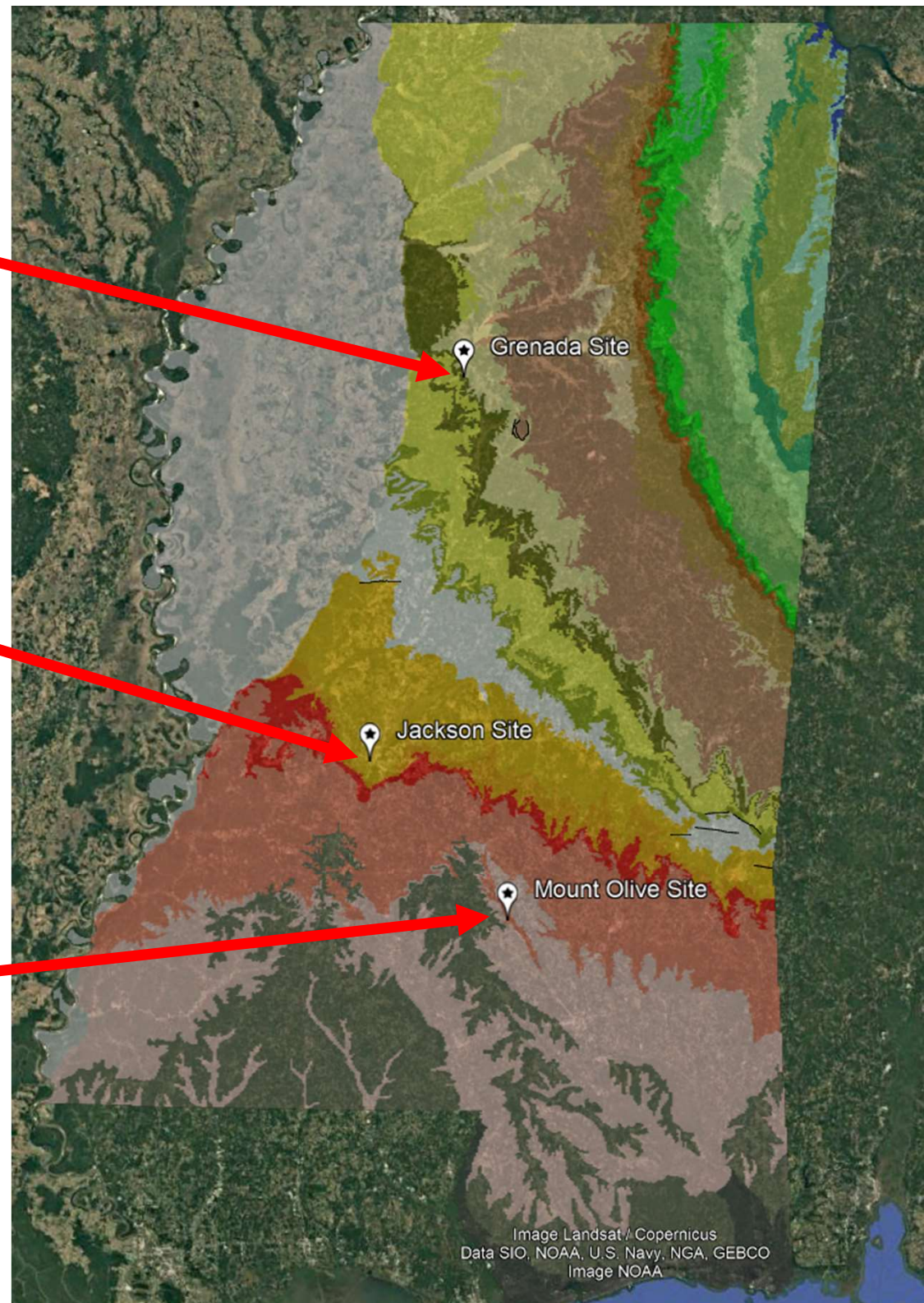
1 Month After Planting



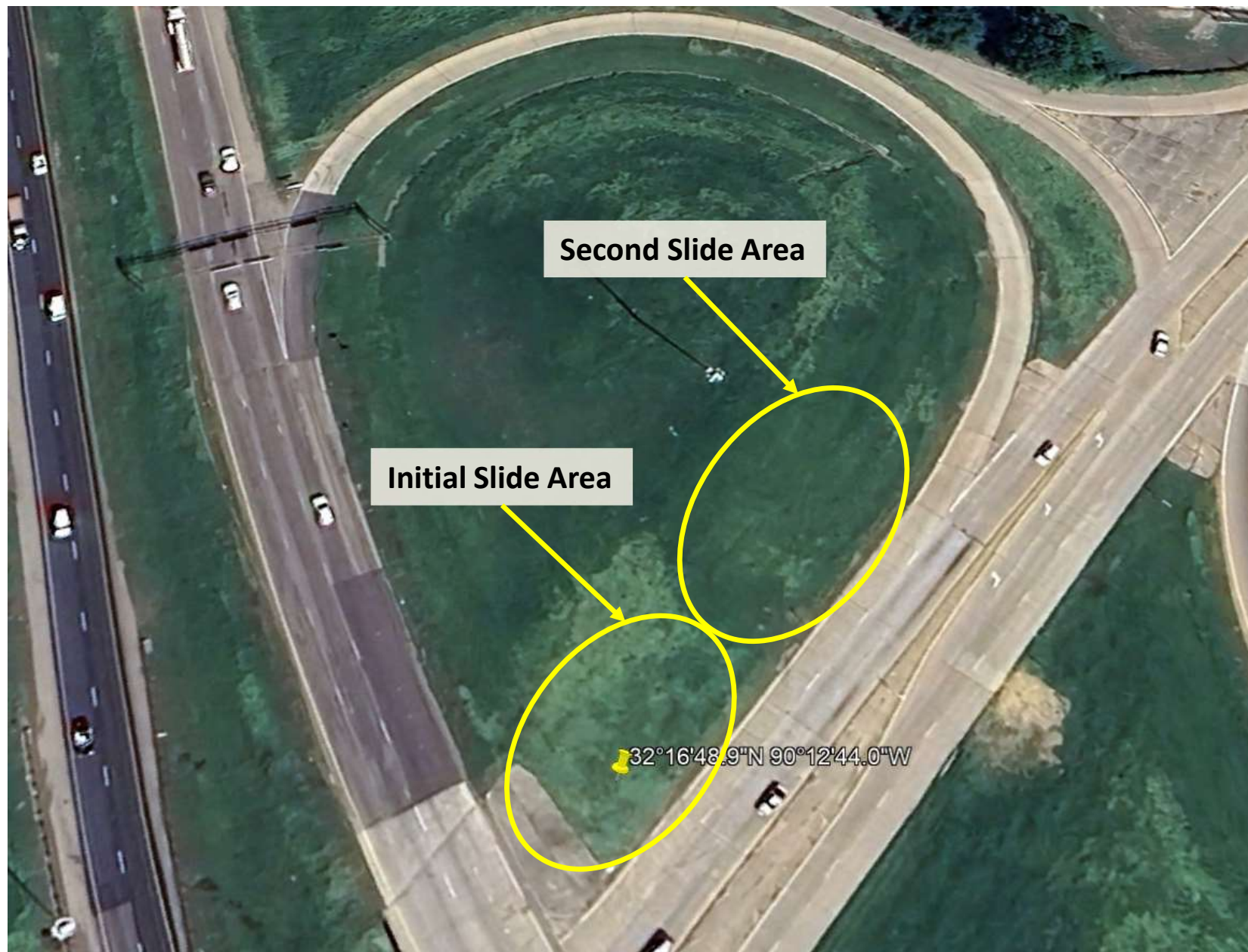
6 Months After Planting

TEST SITE GEOLOGY

- I-55 Grenada Site
 - Kosciusko Fm.
 - Sandy Silt with Some Iron Nodules
- I-20W Jackson Site
 - Jackson Group (Yazoo Clay)
 - Highly Expansive Calcareous Fat Clays
- US 49 Mt. Olive Site
 - Catahoula Fm.
 - Silty Sands over Fat and Lean Clays



I-20W near Jackson



- 15 ft high - 3.5:1 - 4:1 slope
- Repair Area: 1500ft²
- 1,000 Vetiver Plants

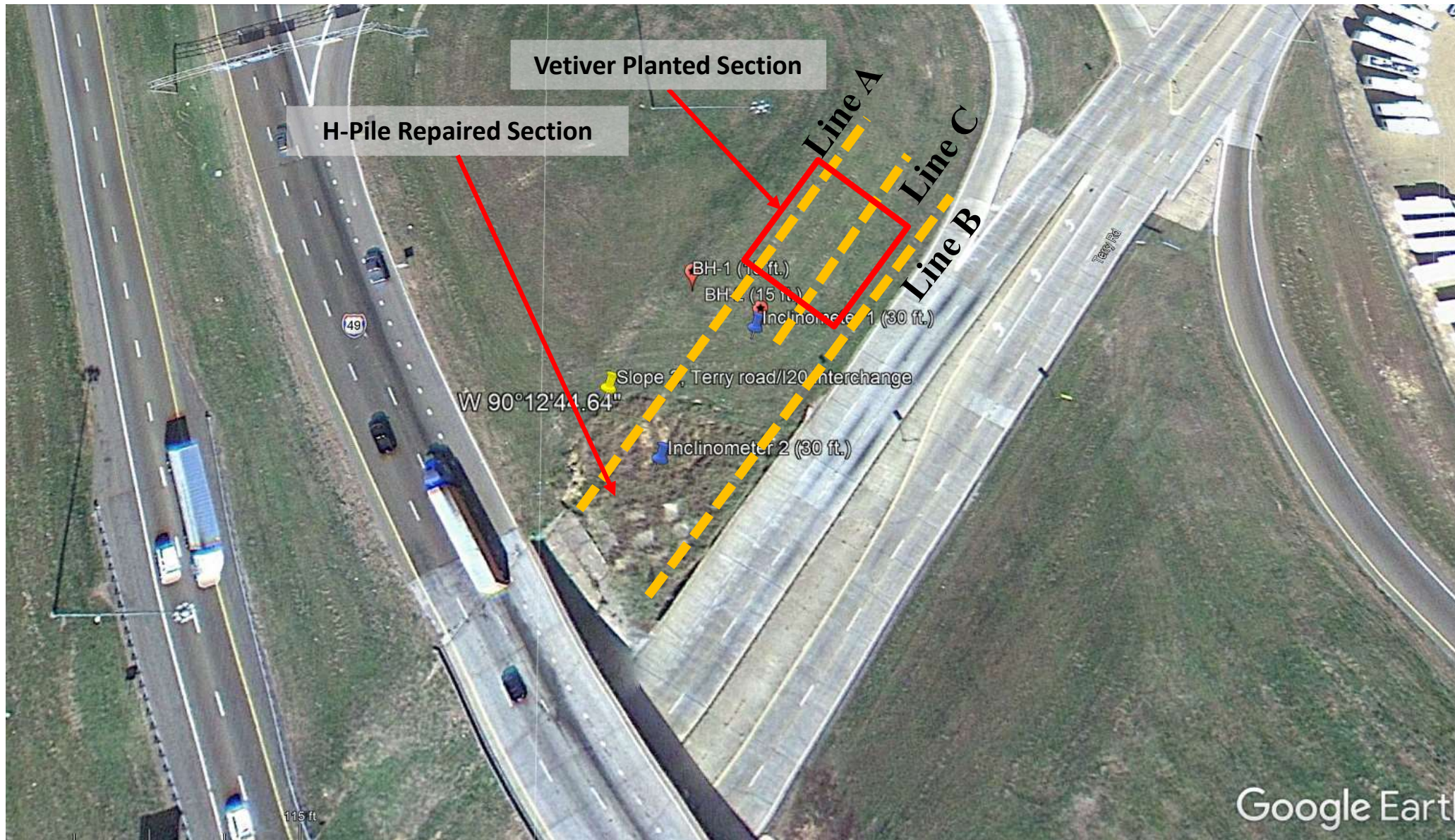
I-20W Vetiver Layout



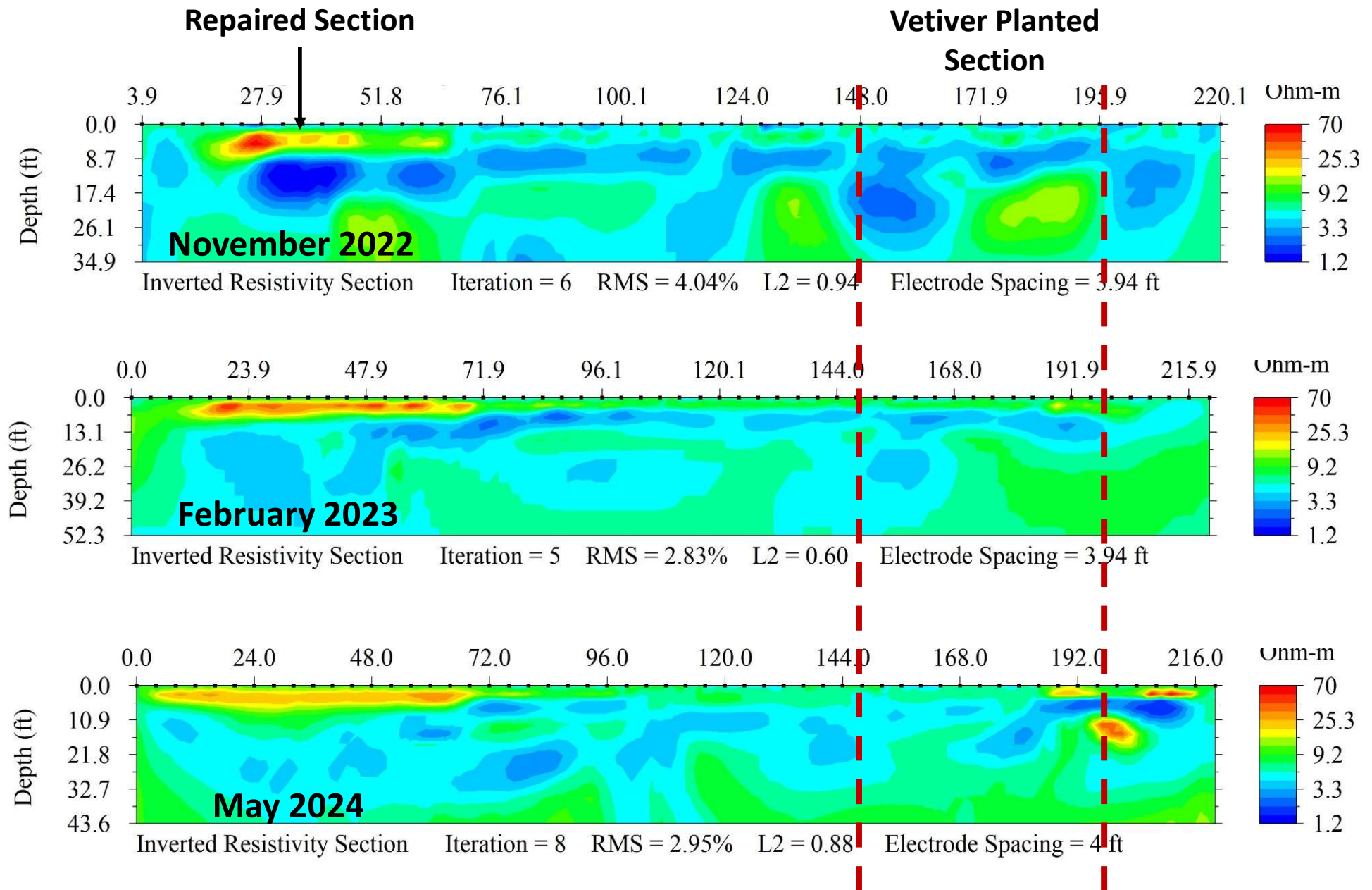


Planting Vetiver Grass on I-20W in Jackson

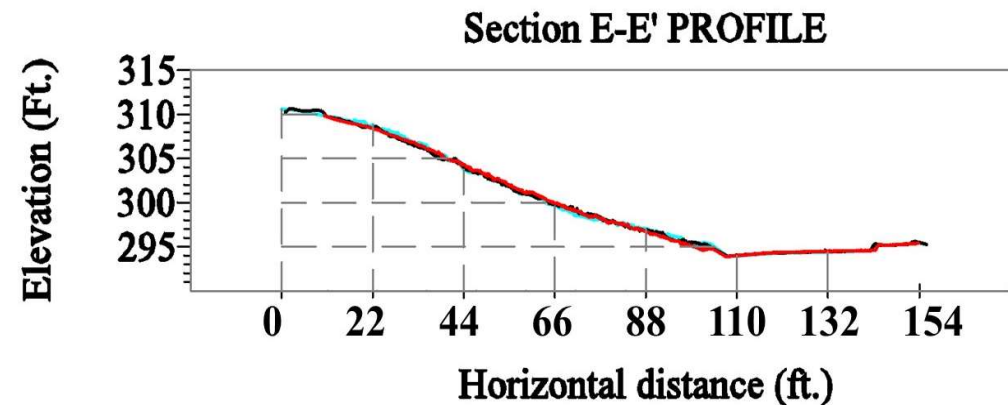
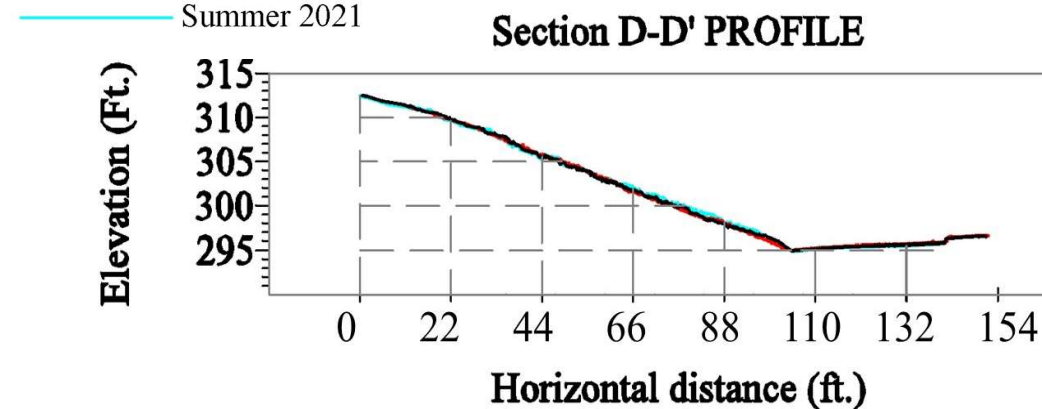
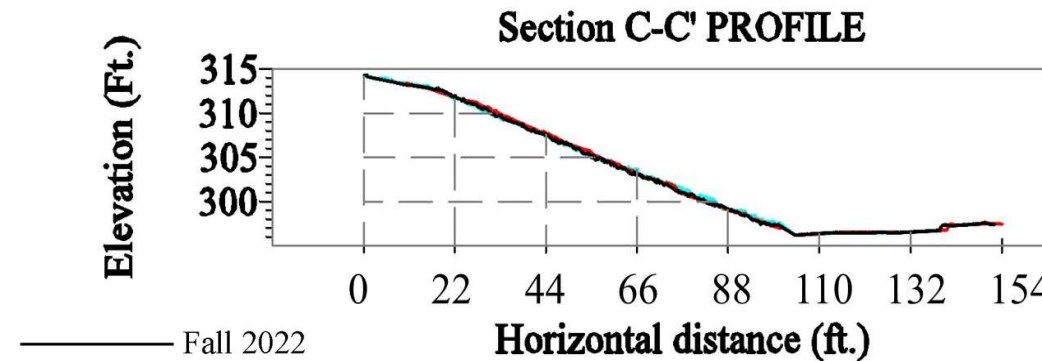
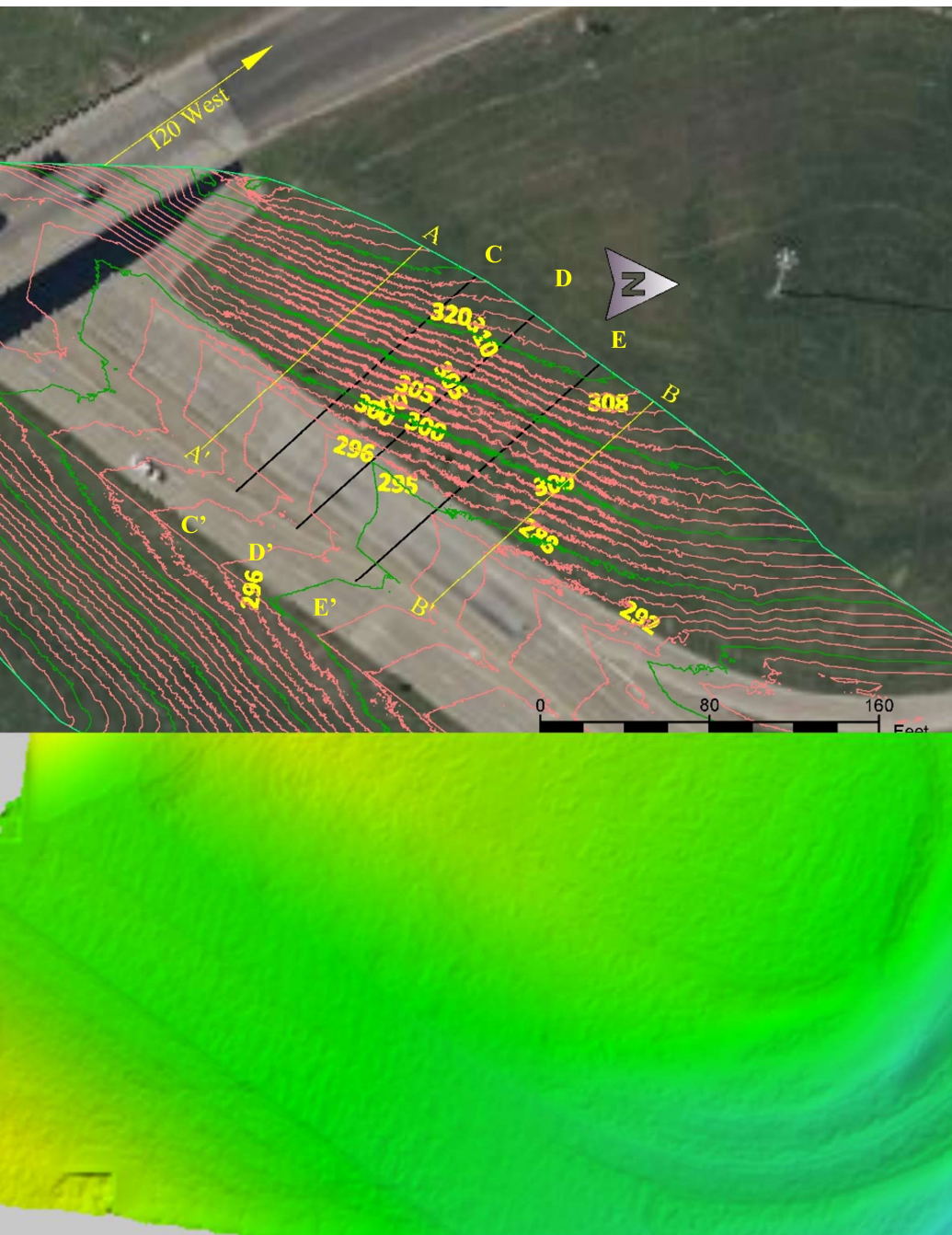
I-20W Site ERI Lines

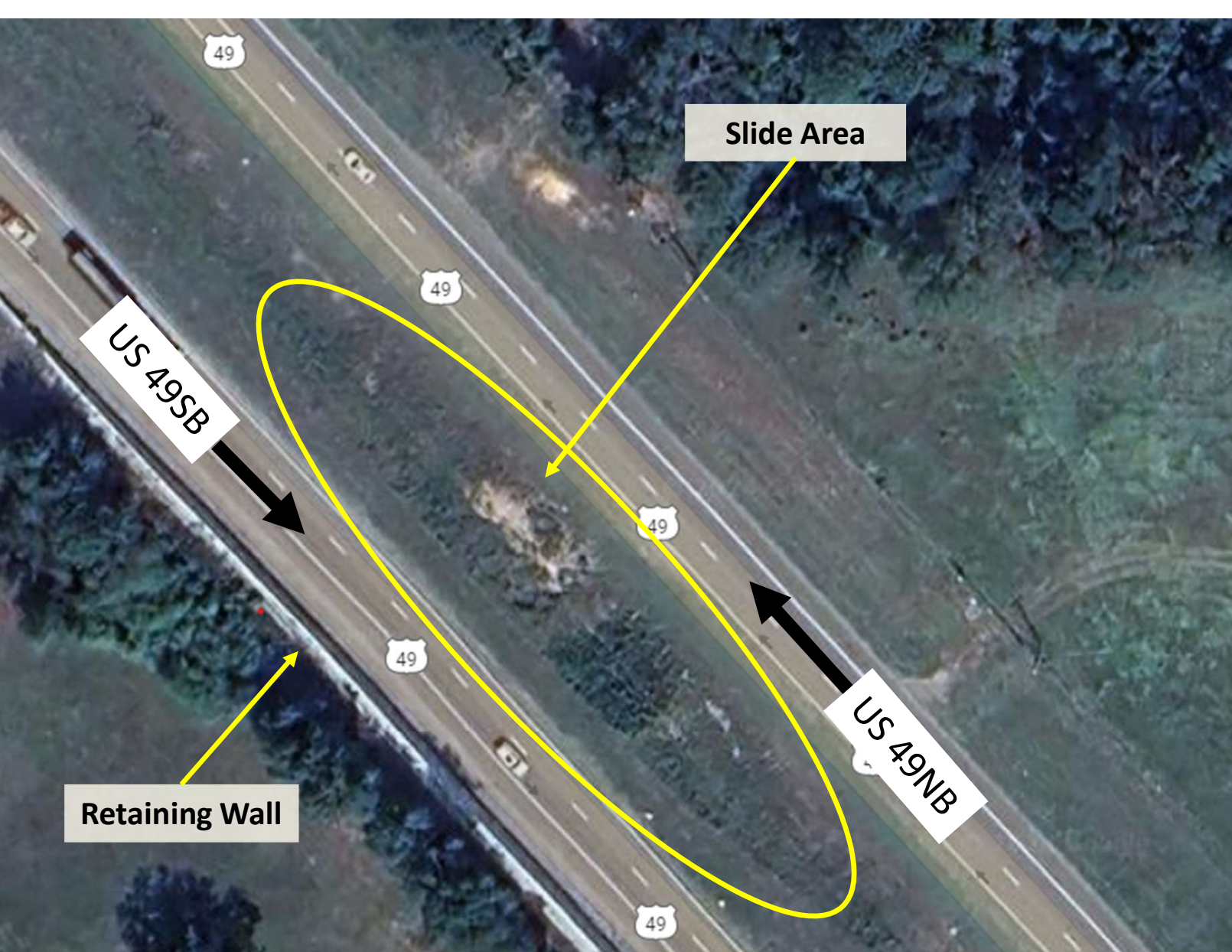


I-20W Site ERI Results



I-20W LiDAR Survey Results

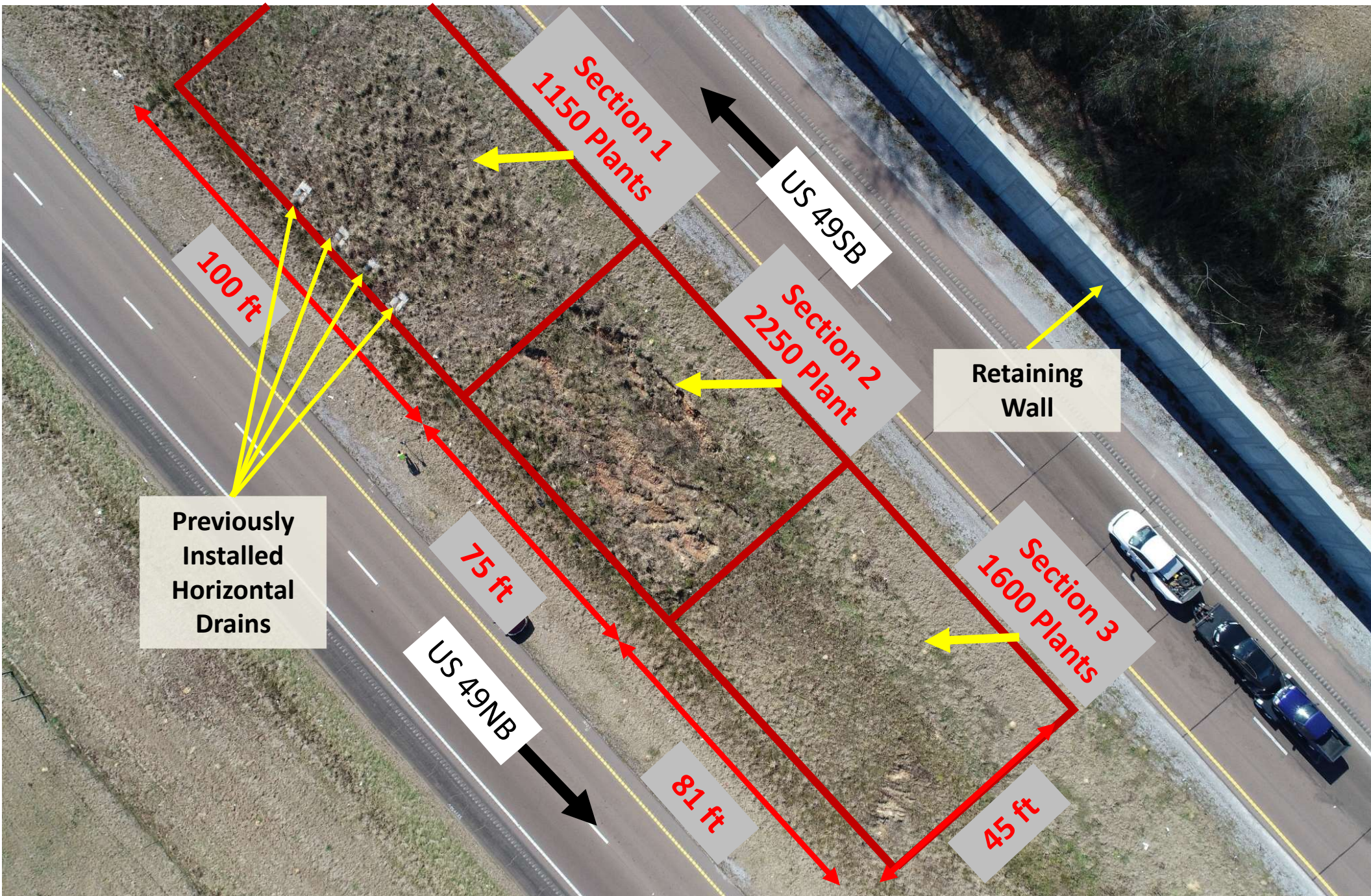




US 49 near Mt. Olive

- 20 ft high - 3:1 slope
- Repair Area: 11,520ft²
- 5,000 Vetiver Plants

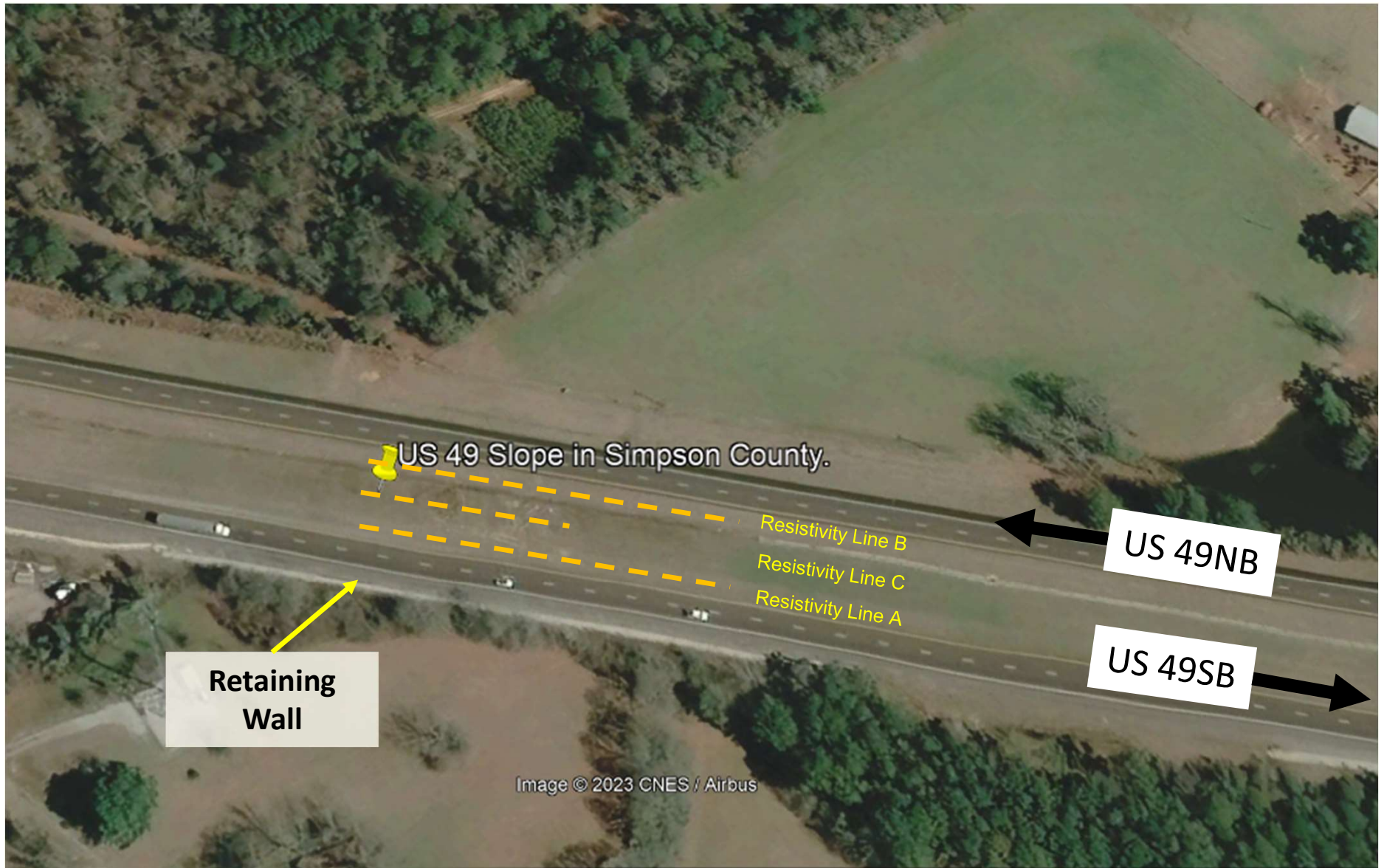
US 49 Vetiver Layout



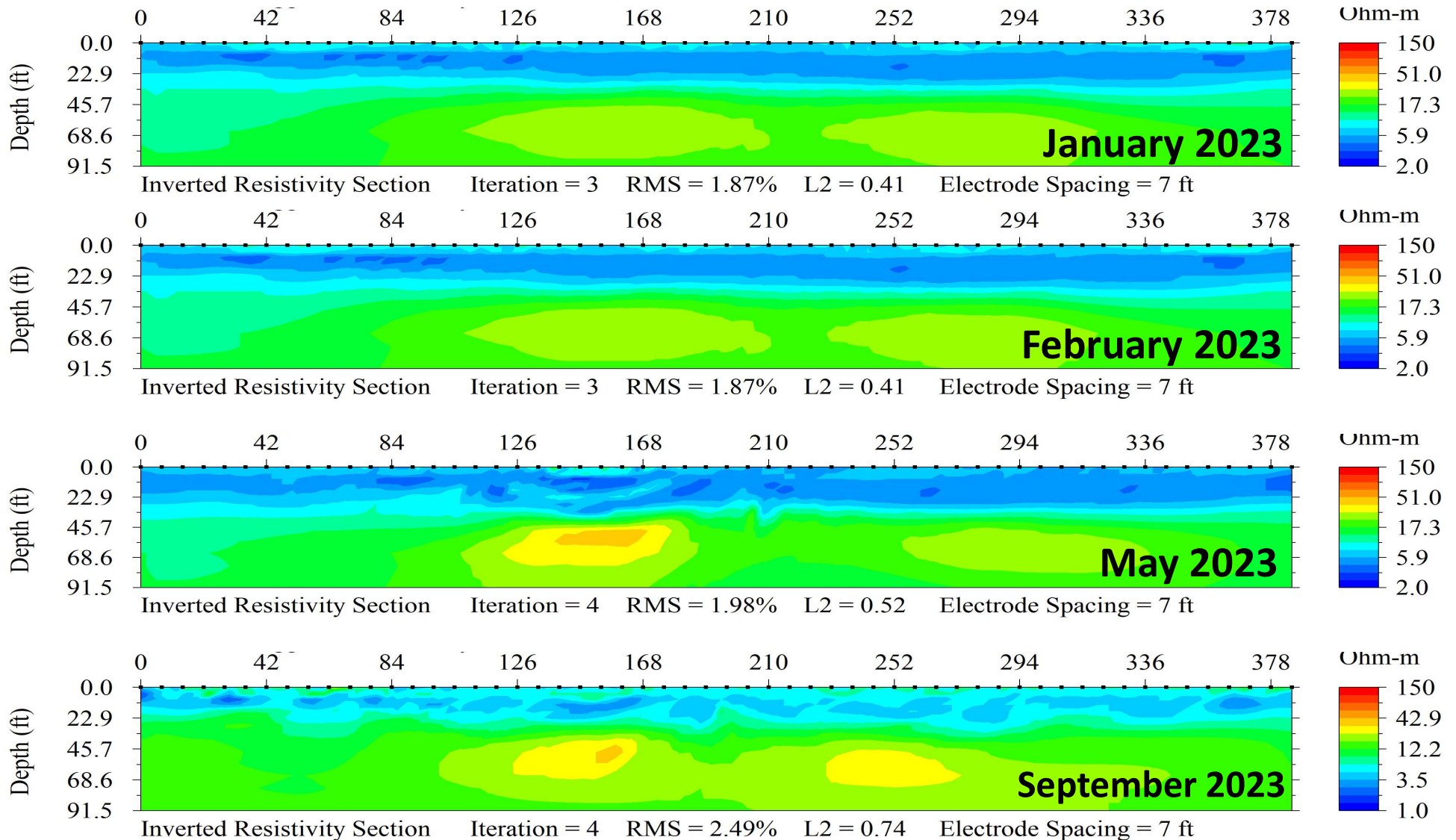


Planting Vetiver Grass on US 49 near
Mt. Olive

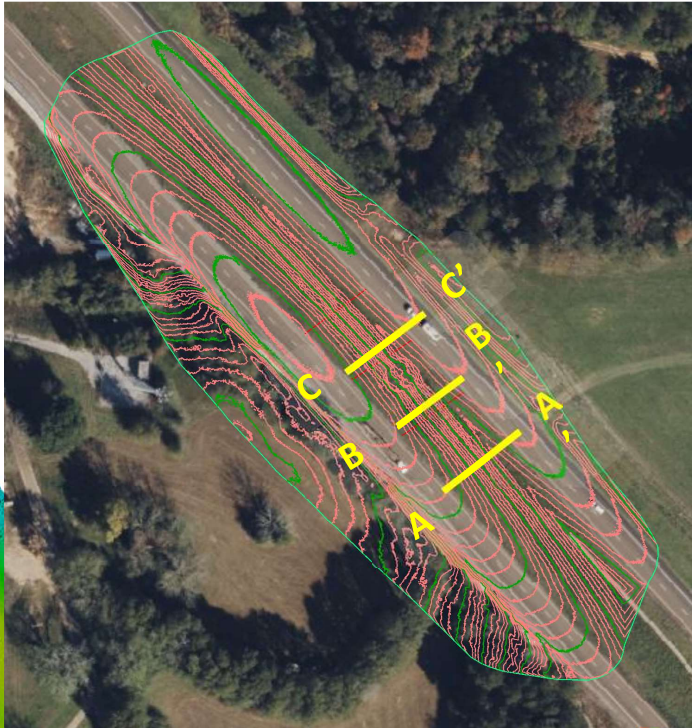
US 49 Site ERI Lines



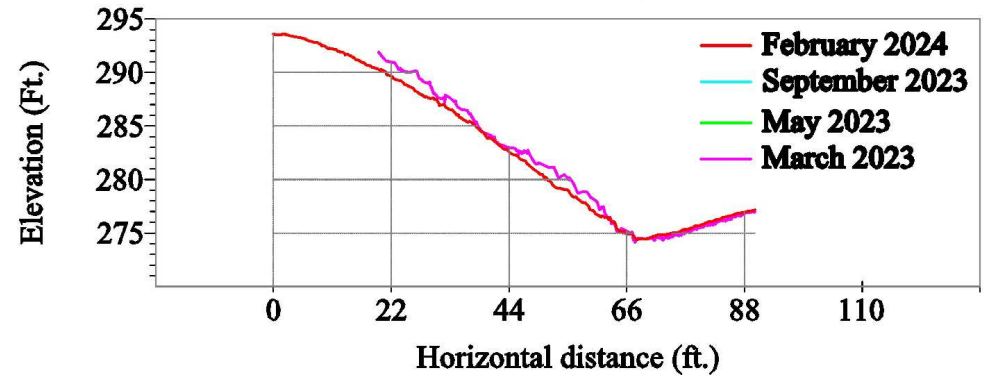
US 49 Site ERI Results



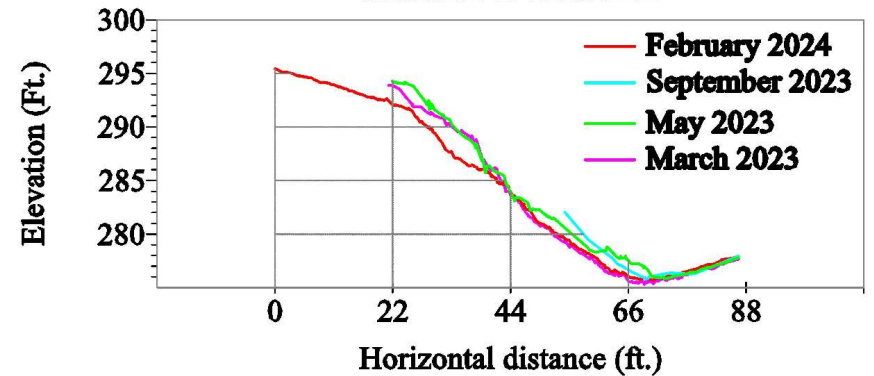
US 49 LiDAR Survey Result



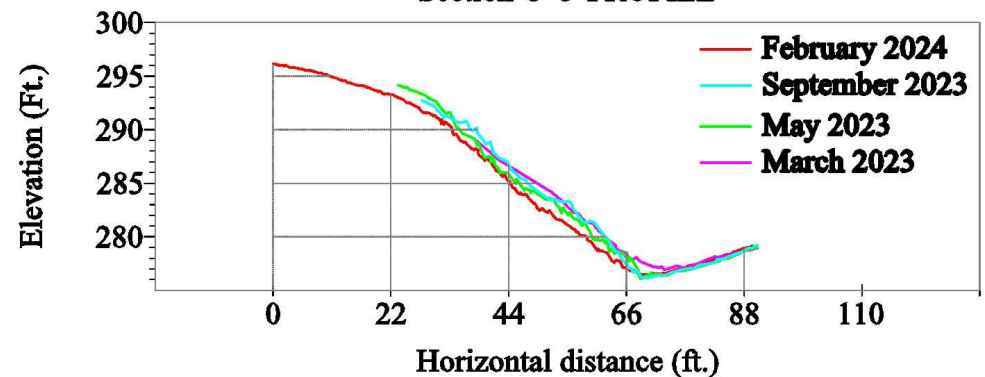
Section A-A' PROFILE



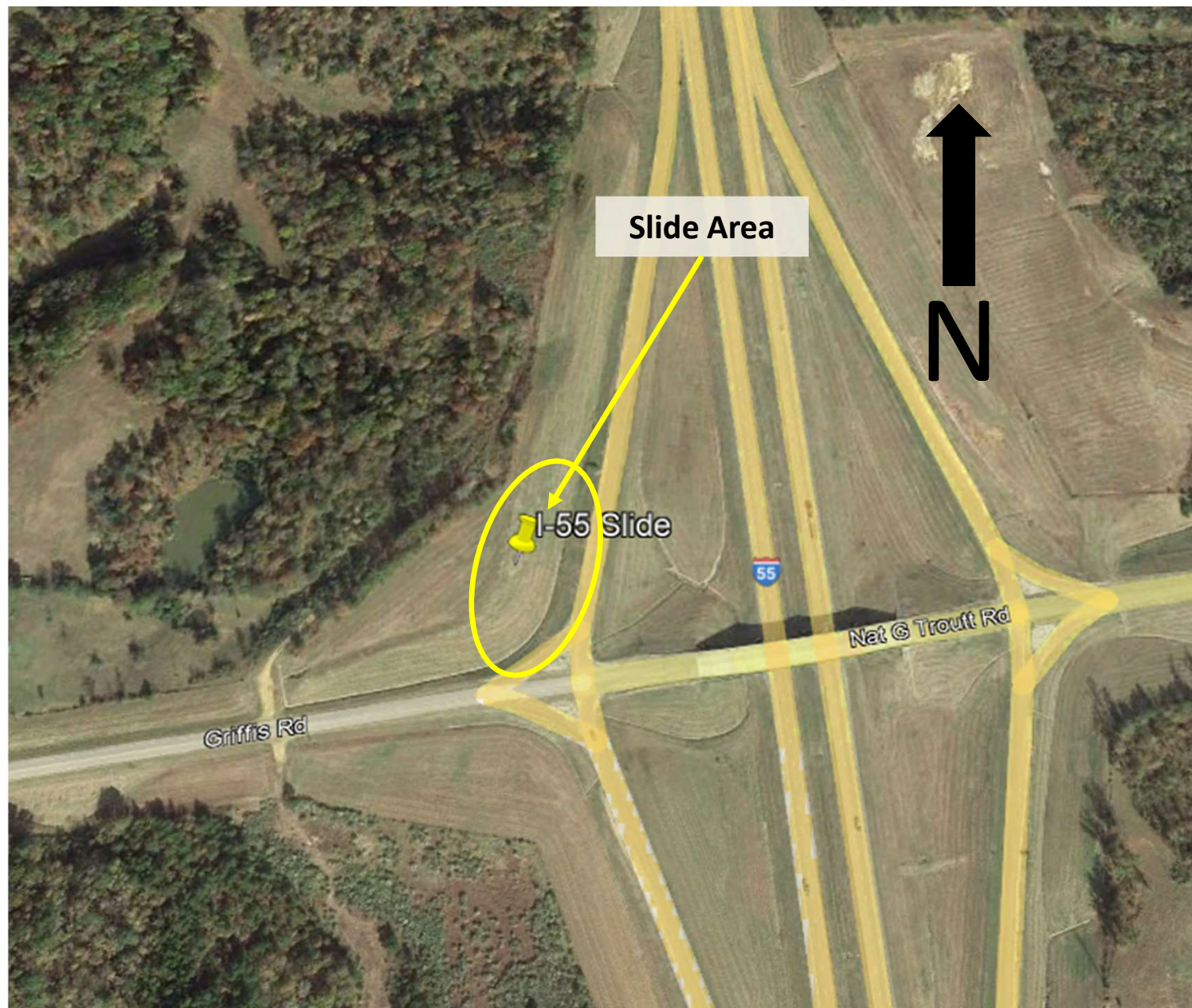
Section B-B' PROFILE



Section C-C' PROFILE

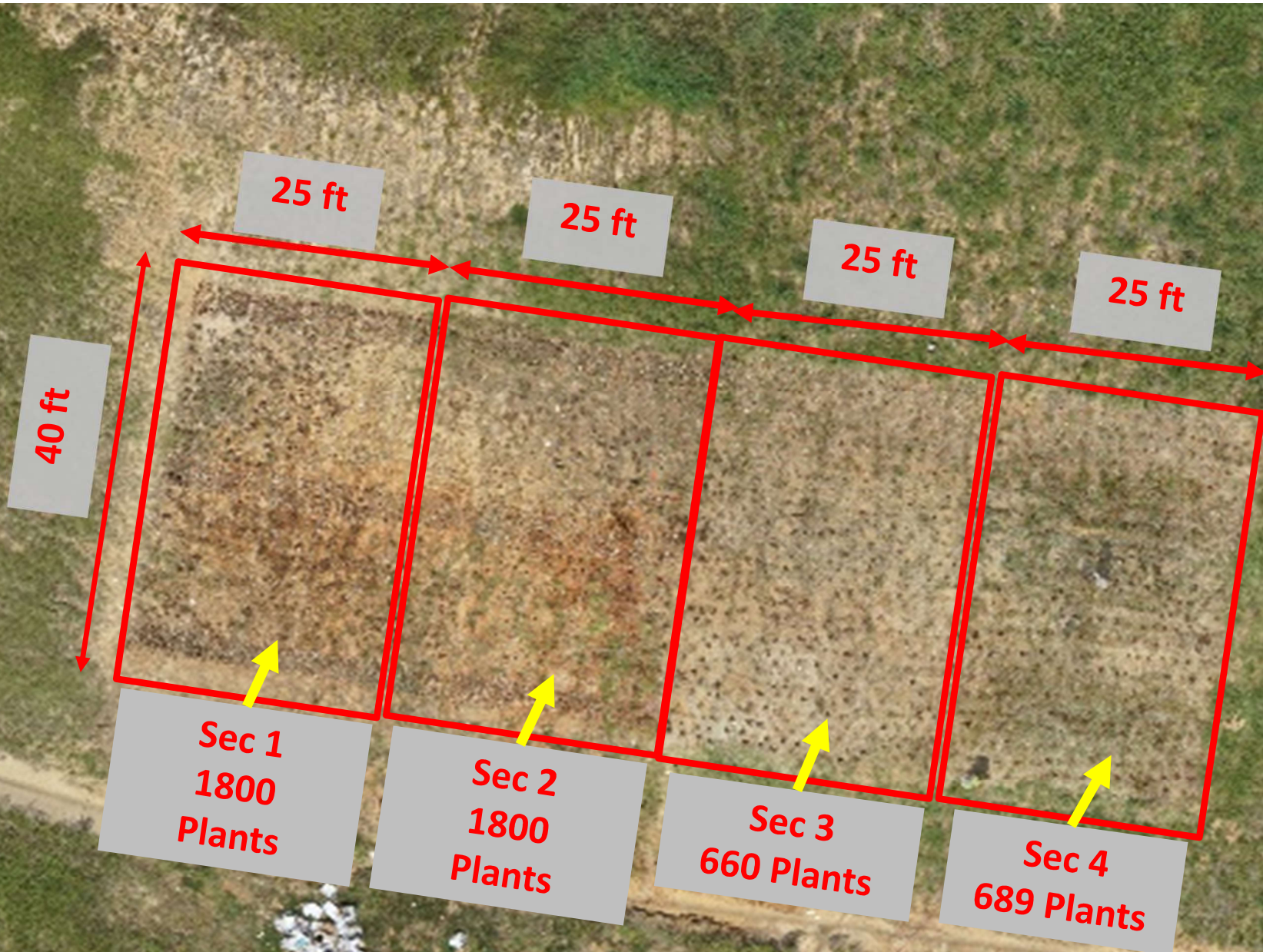


I-55 near Grenada



- 30 ft high - 3:1 slope
- Repair Area: 4000ft²
- 4,949 Vetiver Plants

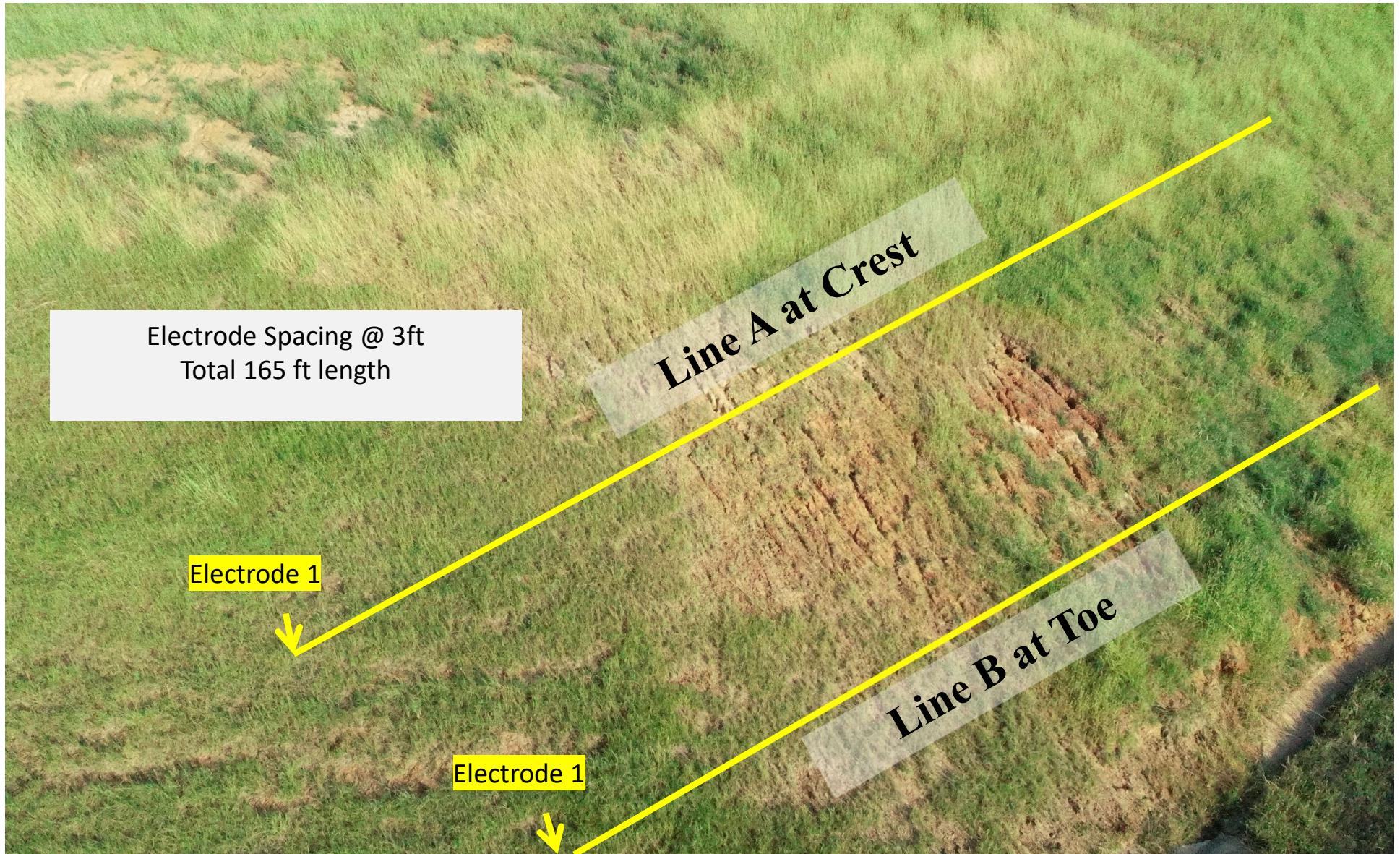
I-55 Vetiver Layout



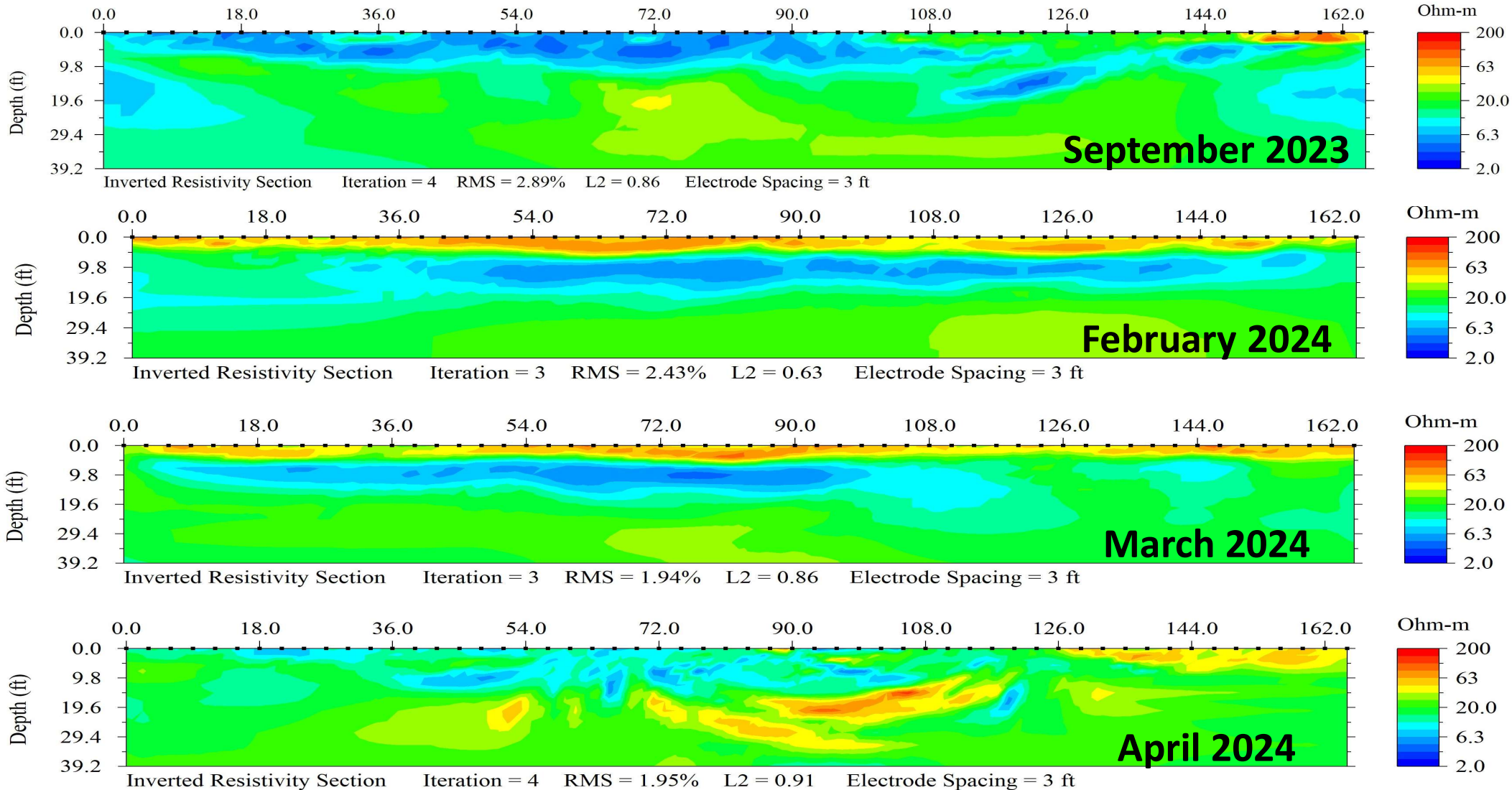


Planting Vetiver Grass on I-55 near
Grenada

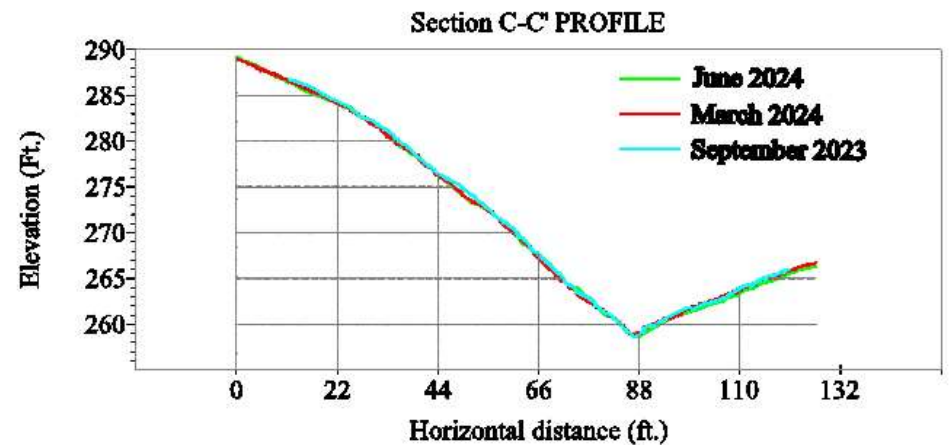
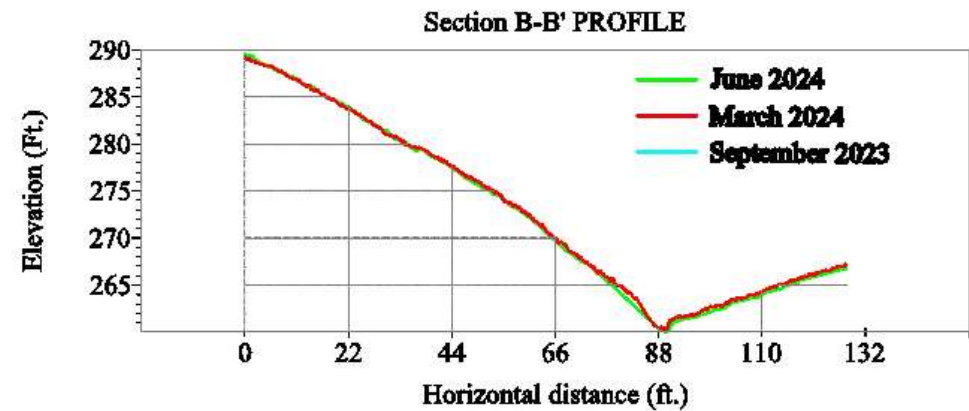
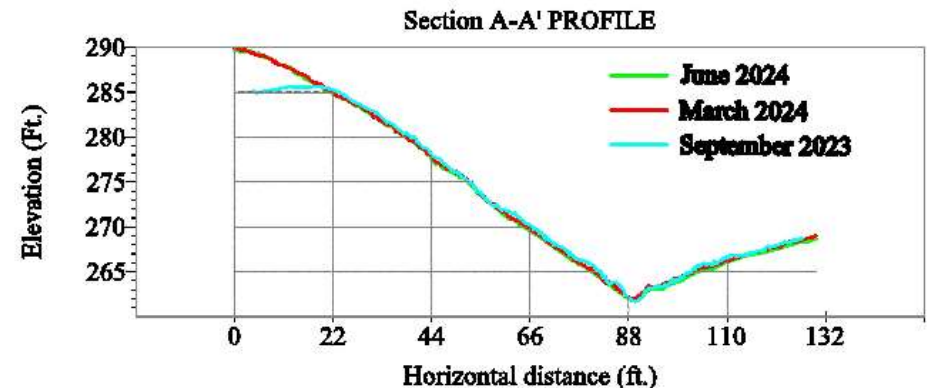
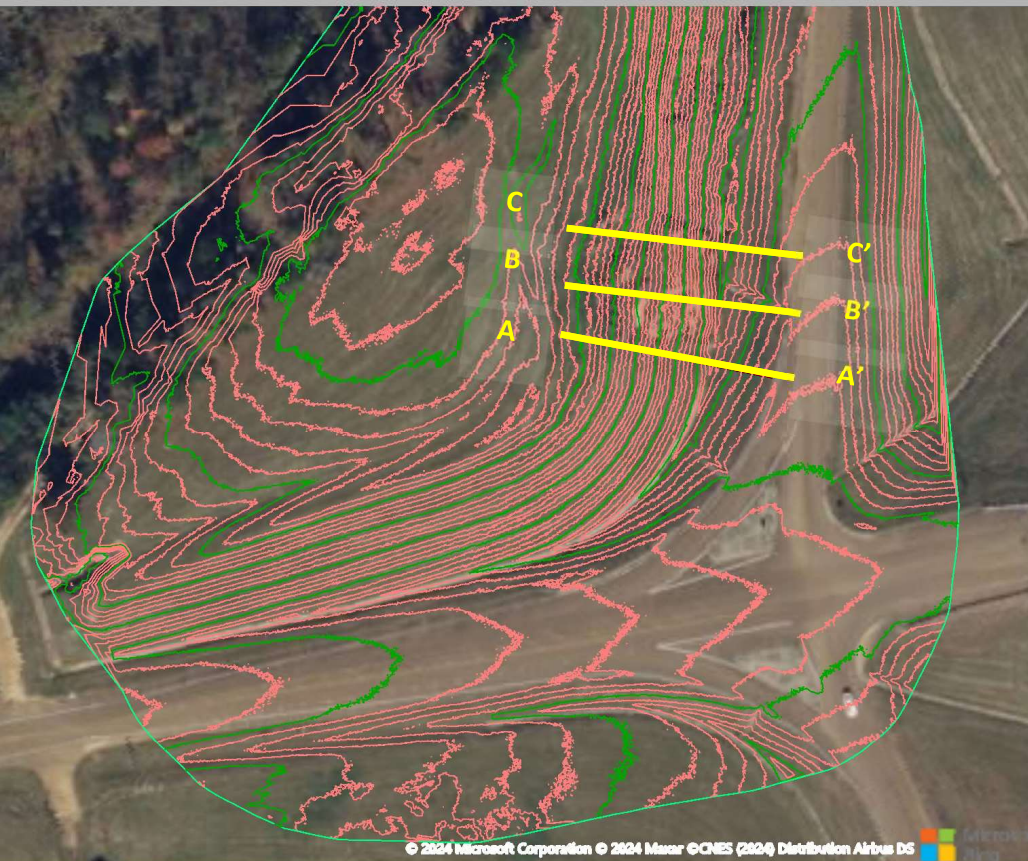
I-55 Site ERI Lines



I-55 Site ERI Results



LiDAR Survey Result





QUESTIONS

Thank You.

