Stratigraphic Investigation Techniques

2026 PA Aquatic Resource Restoration Conference
March 3, 2026

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FRANKLIN & MARSHALL COLLEGE

Date

11,000 | 10,000 | 9,000 | 8,000 | 7,000 | 6,000 | 5,000 | 4,000 | 3,000 | 2,000 | 1,000 | 0 | 1,000 | 2,000

BC | AD

Present

Date

11,000 | 10,000 | 9,000 | 8,000 | 7,000 | 6,000 | 5,000 | 4,000 | 3,000 | 2,000 | 1,000 | 0 | 1,000 | 2,000

Pleistocene | **9,640 BC** | **BC | AD** | **Present**

Land Studies

Date

11,000 | 10,000 | 9,000 | 8,000 | 7,000 | 6,000 | 5,000 | 4,000 | 3,000 | 2,000 | 1,000 | 0 | 1,000 | 2,000

9,640 BC — Holocene — BC | AD — Present

Land Studies

Date

11,000 | 10,000 | 9,000 | 8,000 | 7,000 | 6,000 | 5,000 | 4,000 | 3,000 | 2,000 | 1,000 | 0 | 1,000 | 2,000

| 9,640 BC

BC | AD

Present

“The past is a foreign country;

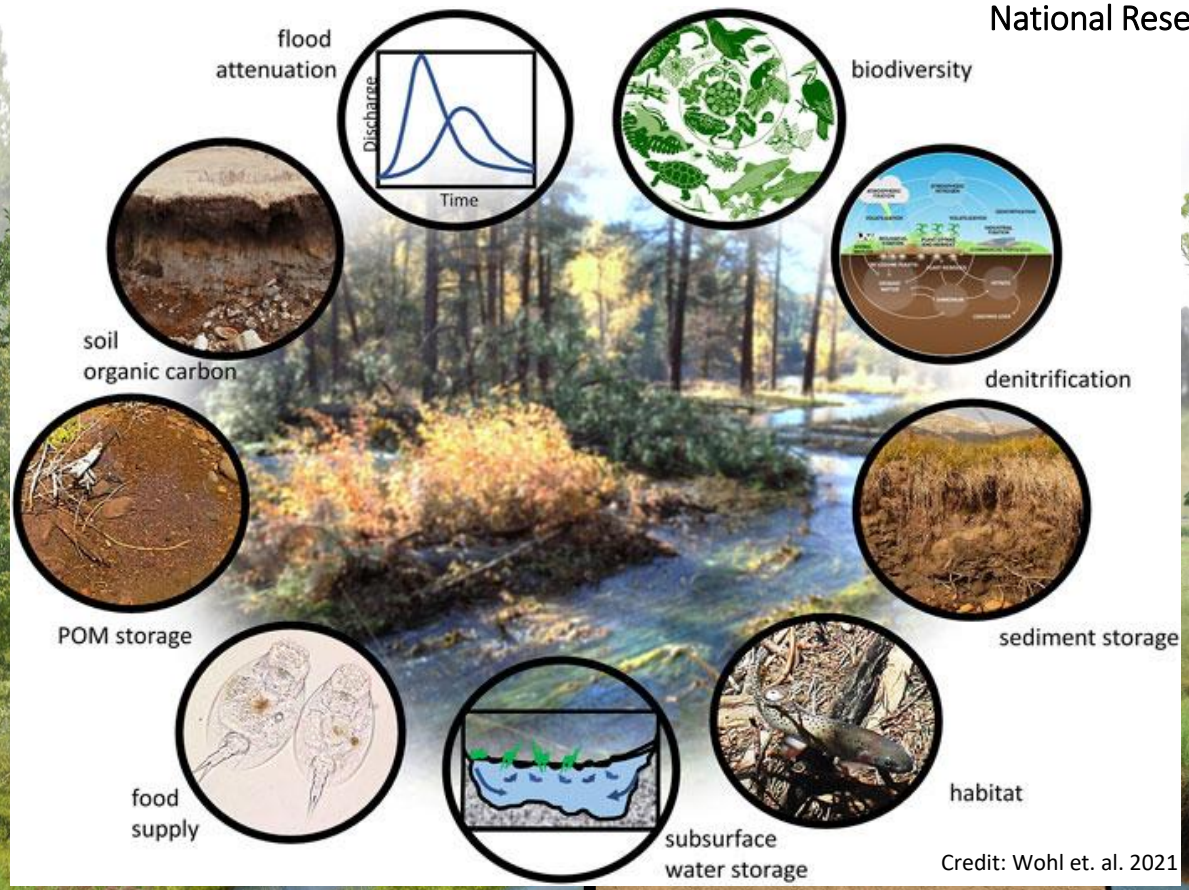
They do things differently there.”

L.. P. Hartley, The Go-Between

RESTORATION:

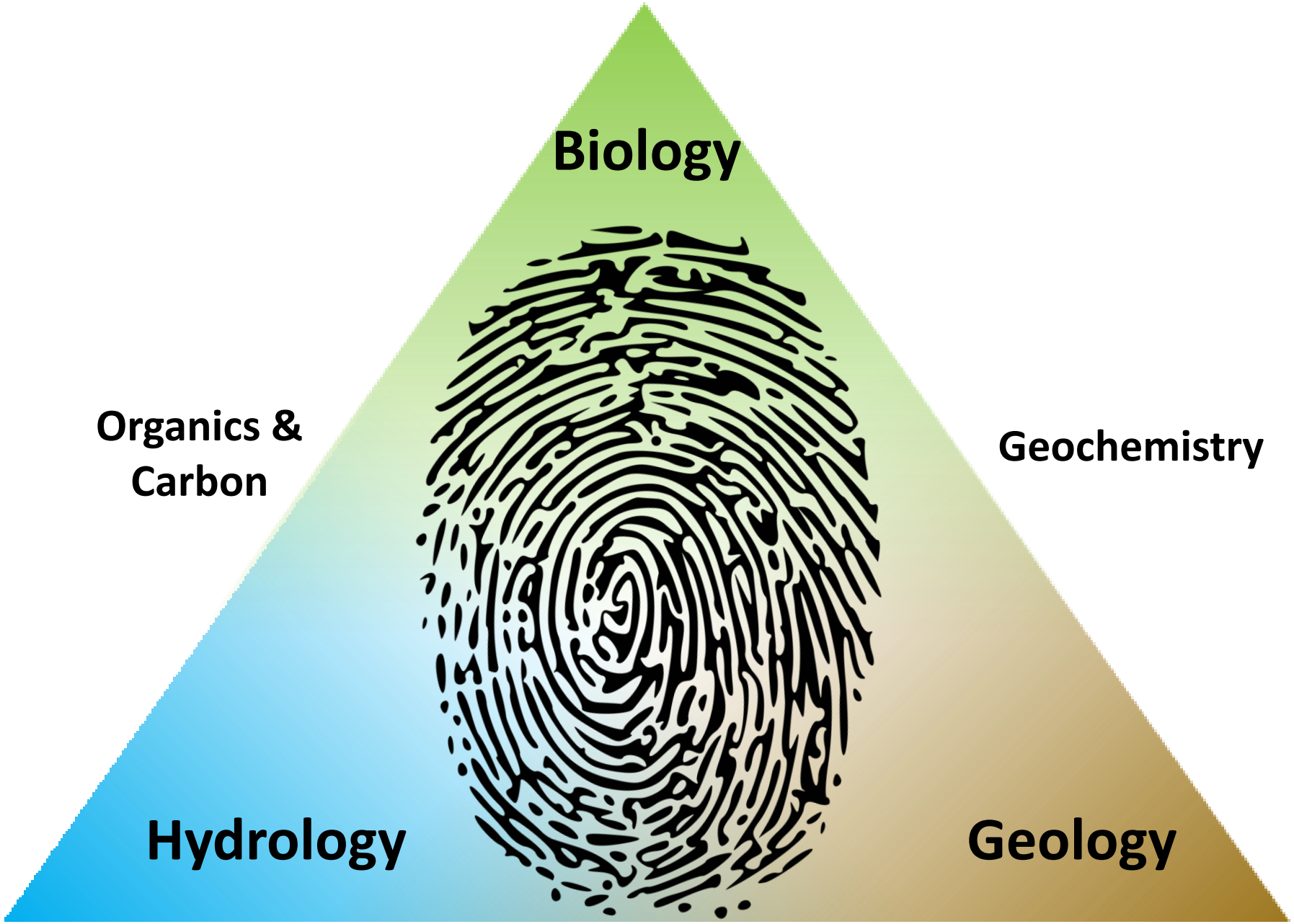
"<u>return</u> of an ecosystem to a close approximation of its condition prior to disturbance."

National Research Council



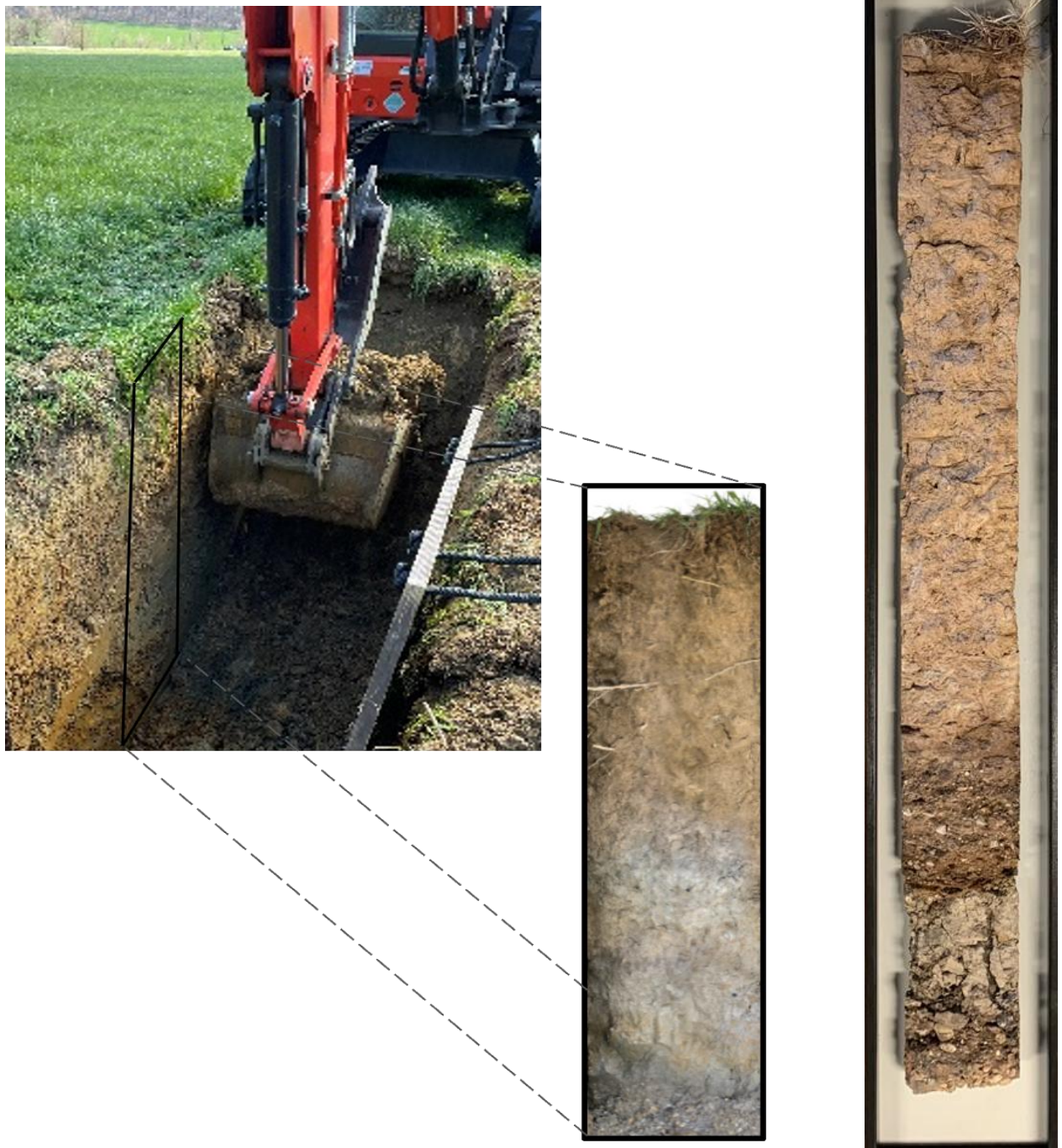
Credit: Wohl et. al. 2021

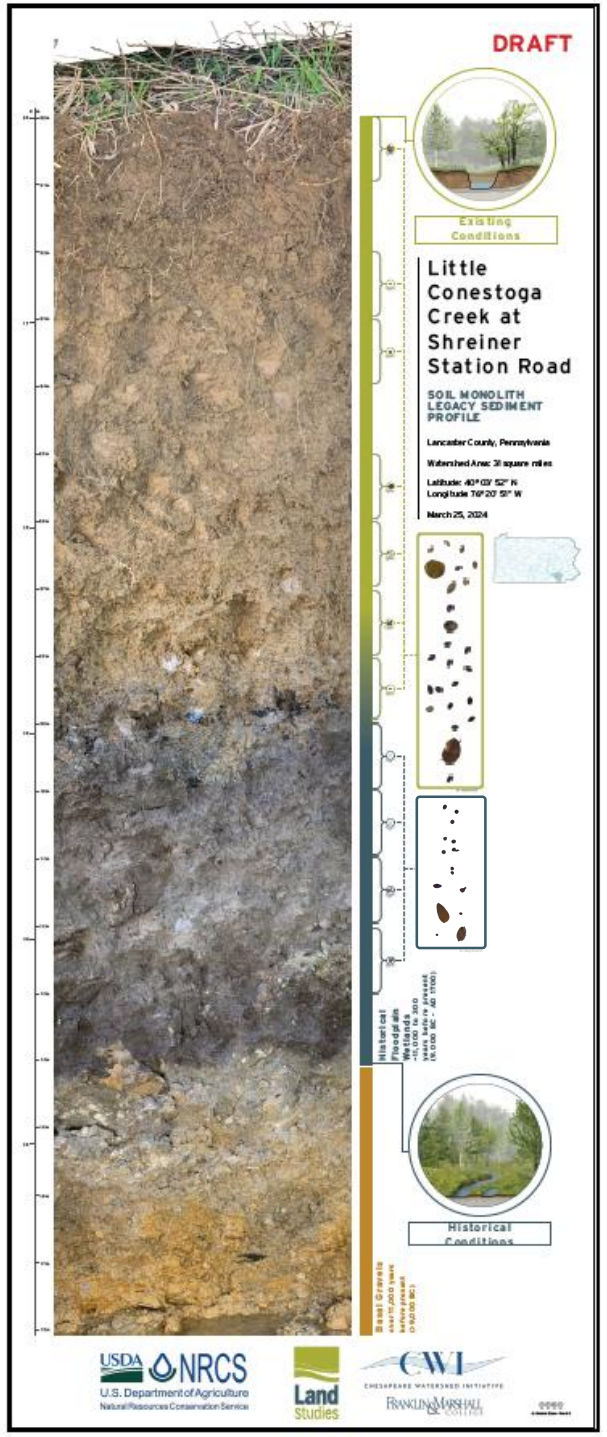
Land Studies



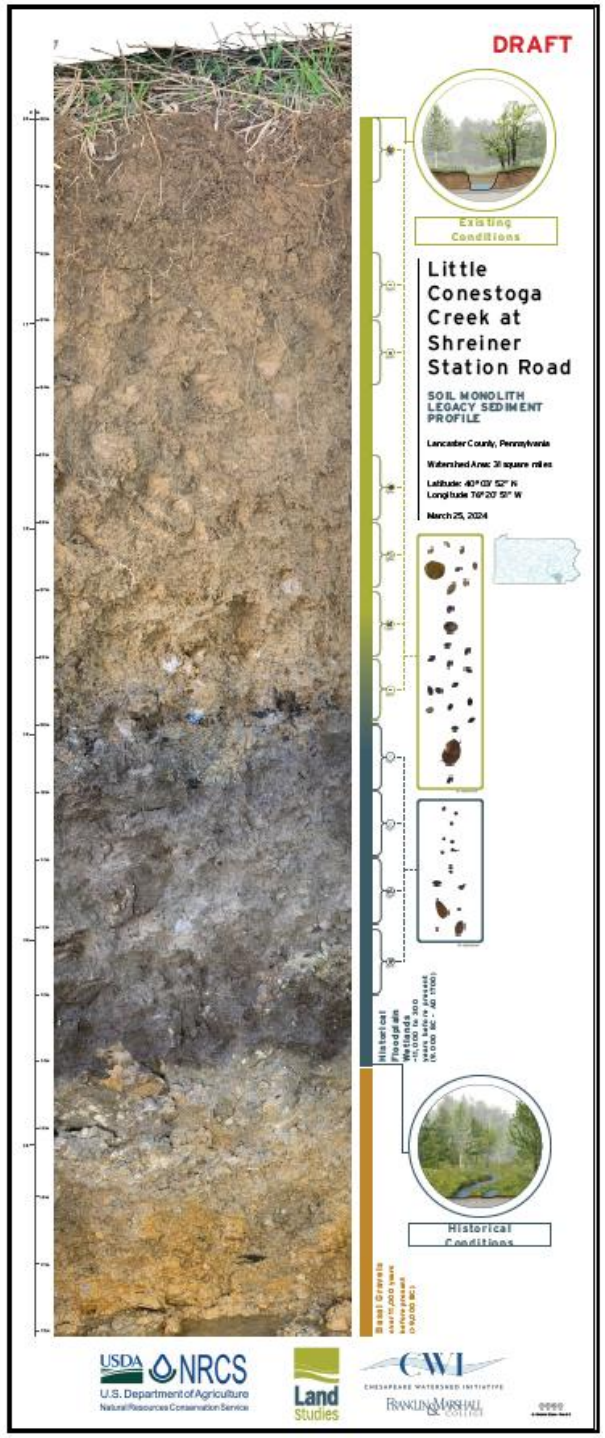
Adapted from Castro & Thorne, 2019

Land Studies

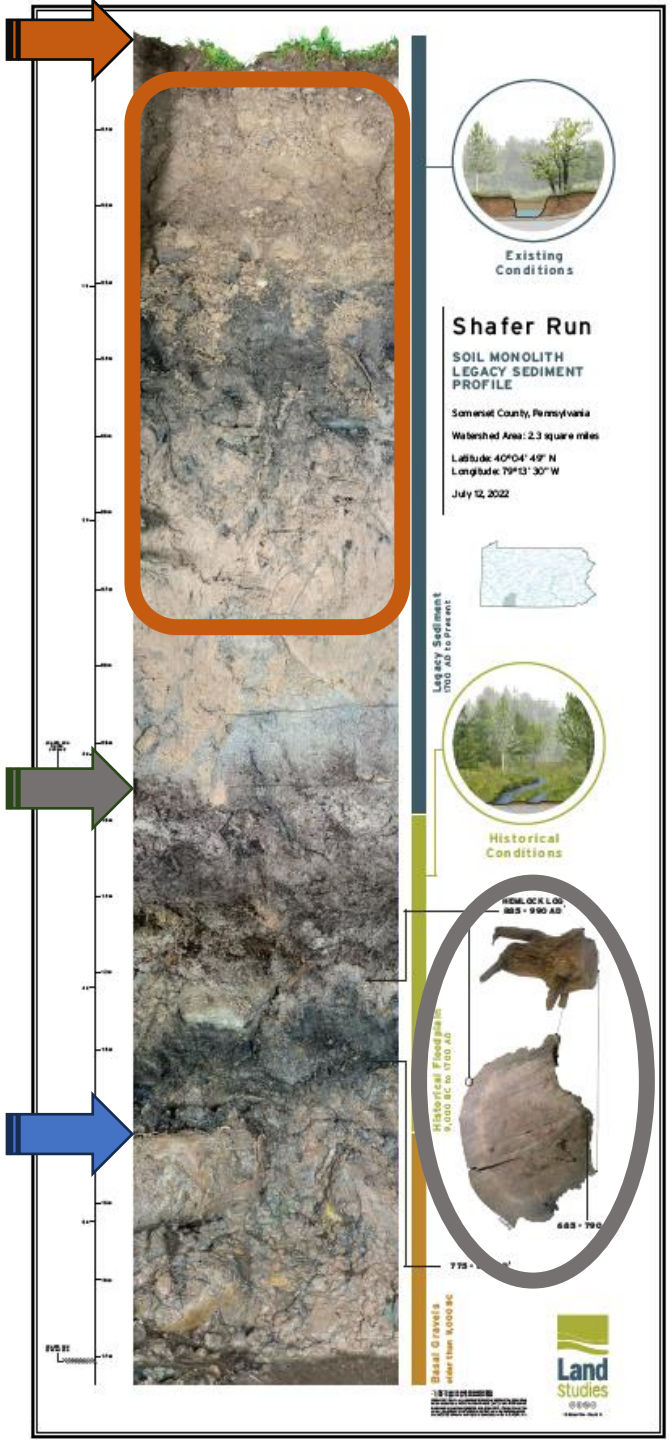


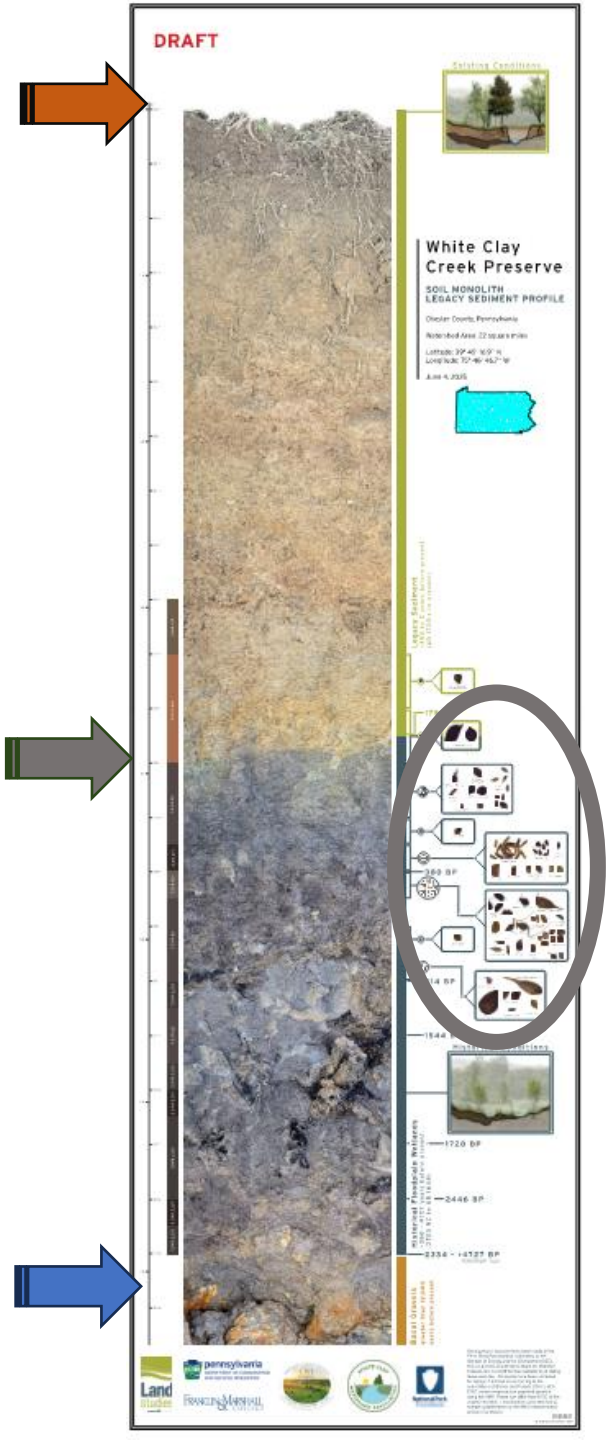


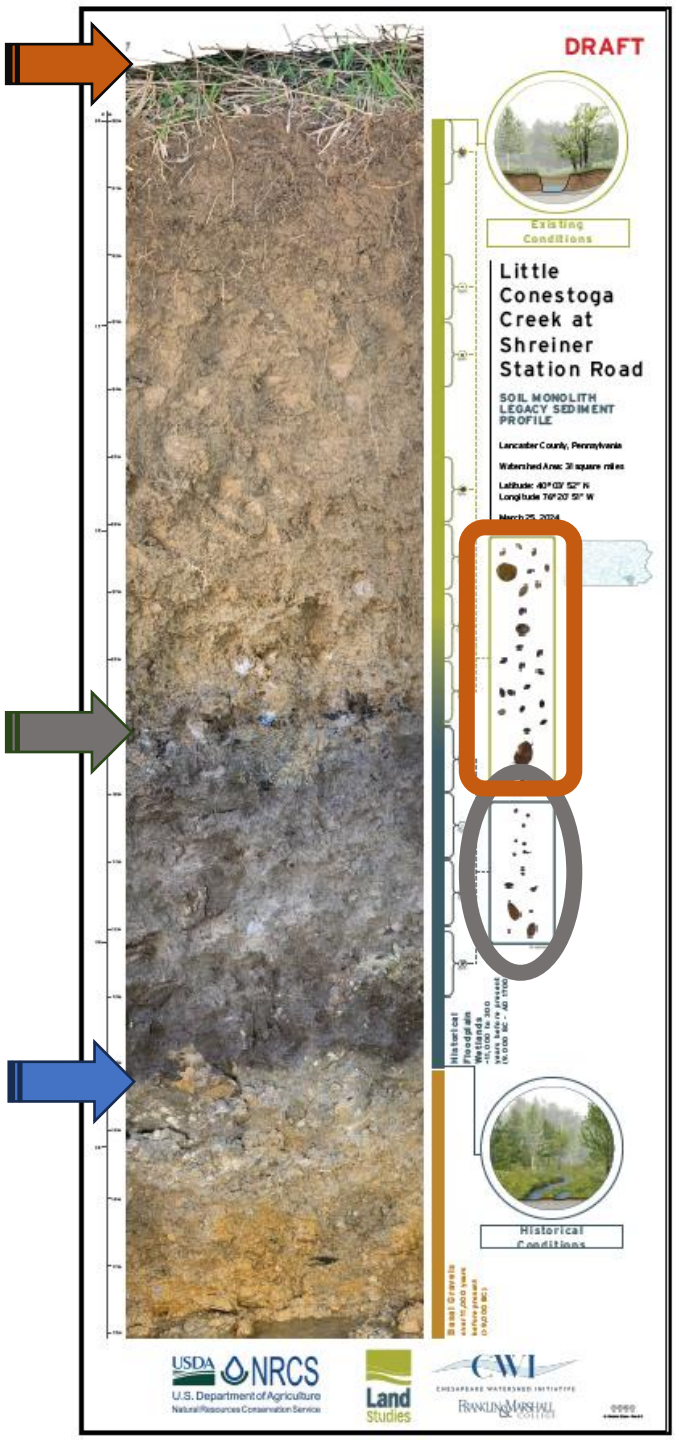
Land Studies


DRAFT
Existing Conditions
Little Conestoga Creek at Shreiner Station Road
SOIL MONOLITH LEGACY SEDIMENT PROFILE
Lancaster County, Pennsylvania
Watershed Area: 31 square miles
Latitude: 40° 03' 52" N
Longitude 76° 20' 51" W
March 25, 2024
Historical Floodplain Wetlands
Historical Conditions
Basal Gravels
USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service
Land Studies
CWI
CHESAPEAKE WATERSHED INITIATIVE
FRANKLIN & MARSHALL COLLEGE

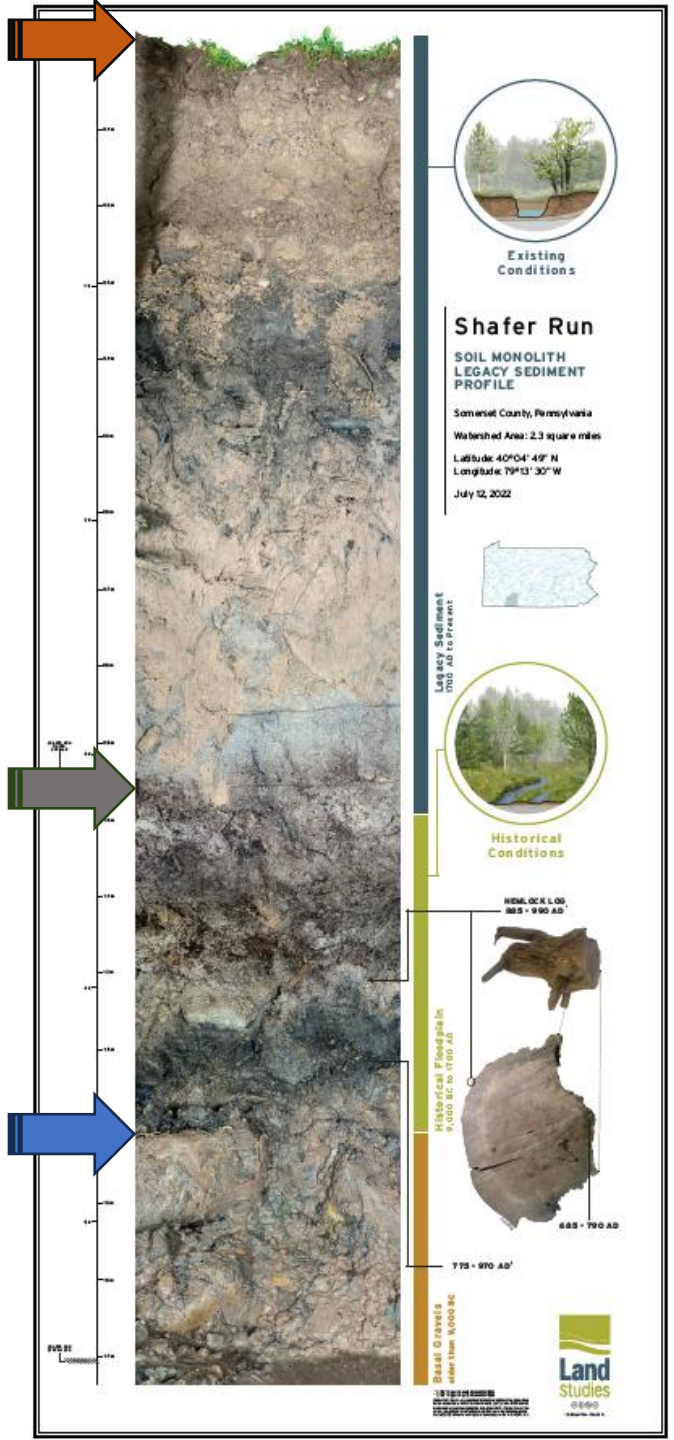

10x Magnification
Land Studies

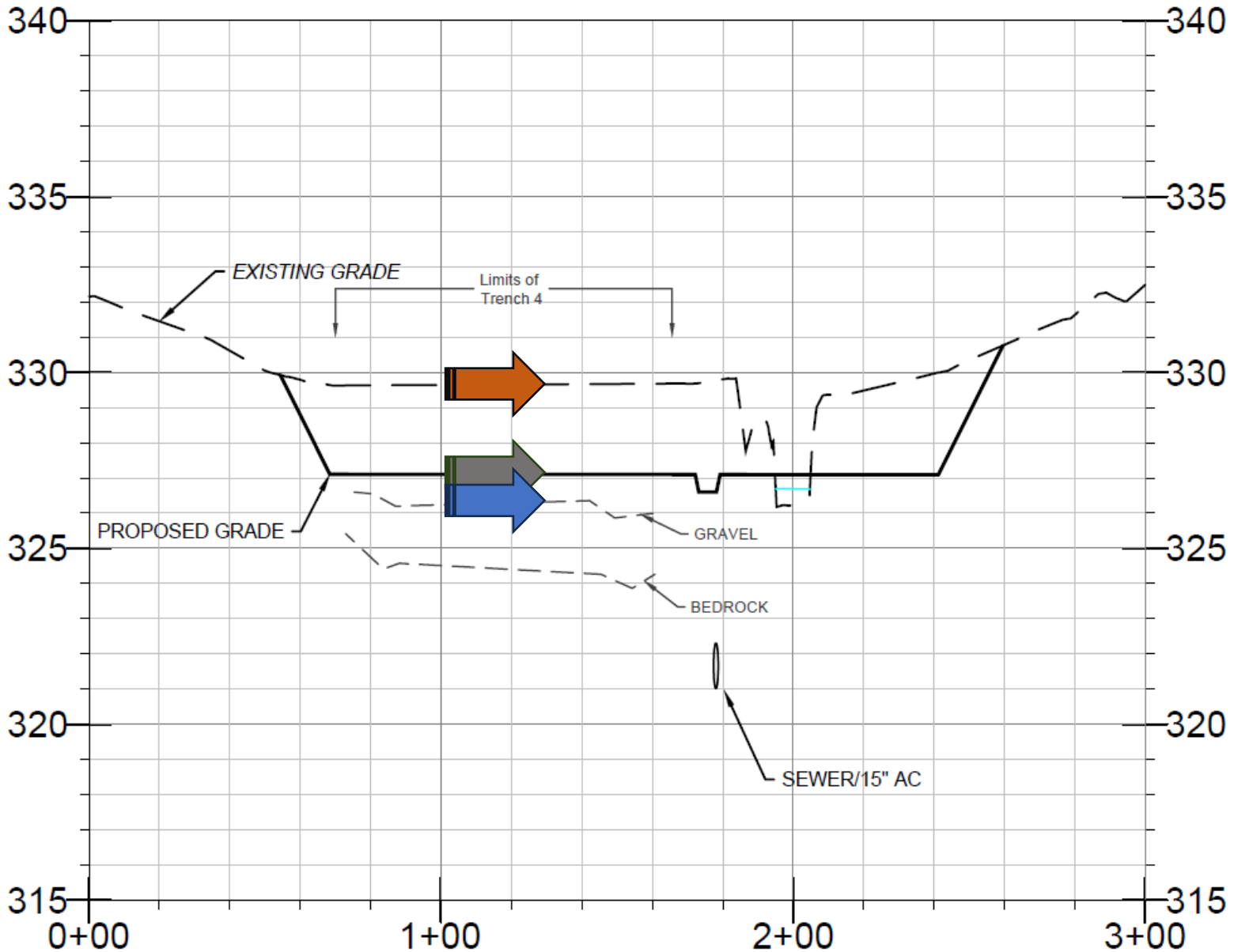






Land studies



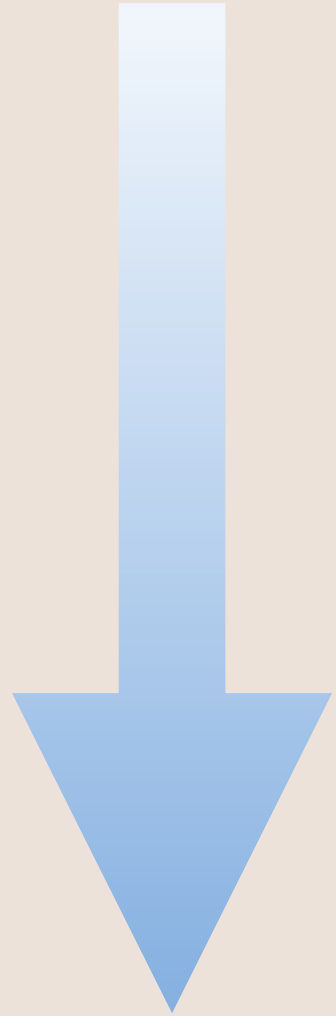


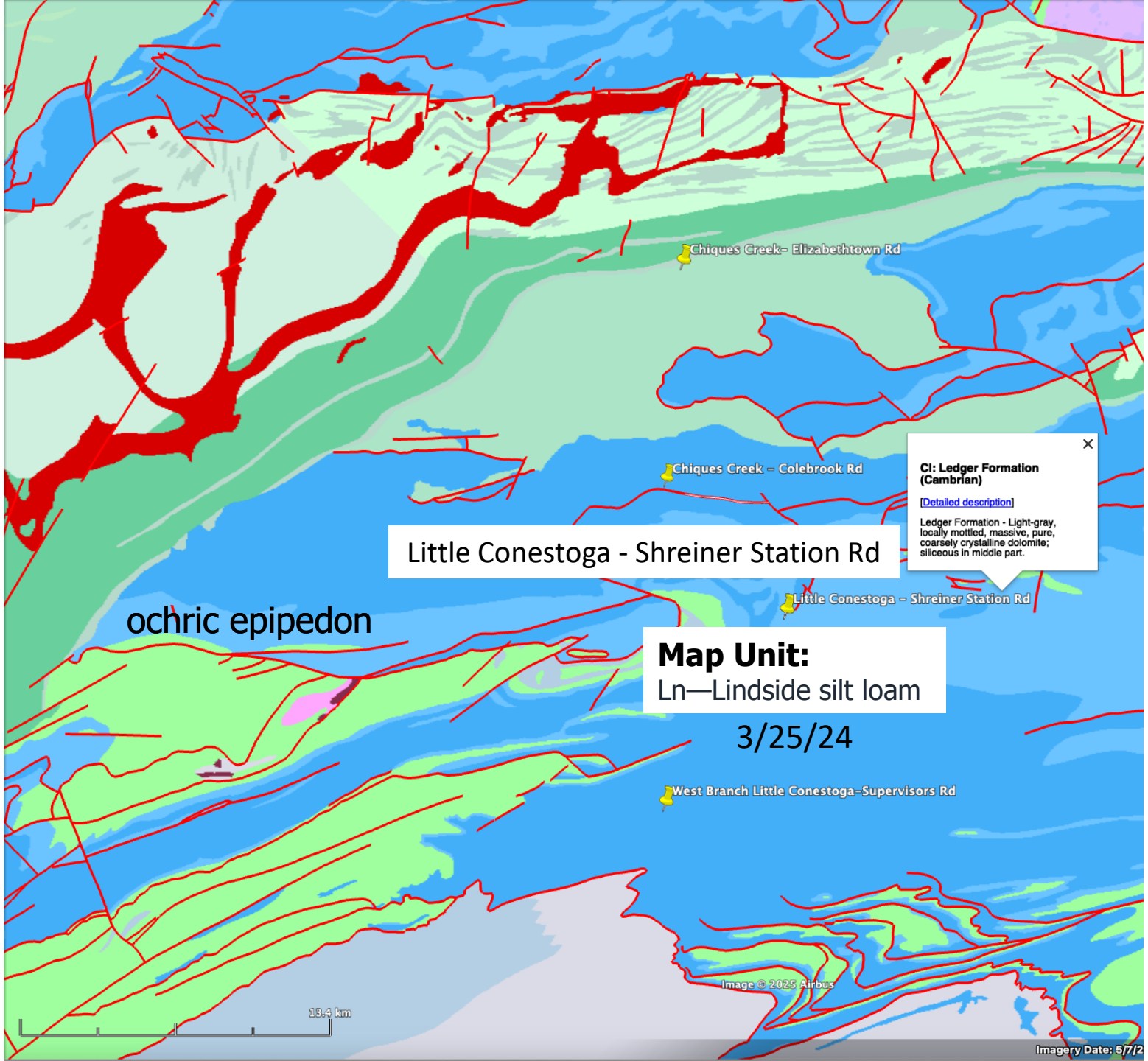
Land Studies

Stratigraphic Investigation Techniques

- Photodocumentation (camera, phone)
- Soils and Bedrock Geology Maps (USDA/NRCS, Rockd apps)
- Munsell Color (book)
- Particle Texture (finger method)
- Bulk Density (some basic lab equipment, oven, and scale)
- pH (pH meter, beakers, scales)
- Carbon Content (Loss on Ignition: high-T furnace, ceramic crucibles)
- Magnetic Susceptibility (MS probe)
- Subfossil seeds, pollen, diatoms, etc. (binocular microscrope and special training)
- Chemostratigraphy (expensive analytical equipment or send out to 3rd party lab)
    - Nutrients (N and P)
    - Elemental Analyses (e.g., trace metals)
    - Radioisotope Analyses (^{7}Be, ^{137}Cs, and ^{210}Pb)
    - Stable Isotope Analyses (H, C, and O)
    - Radiocarbon dating (^{14}C)

Increasing level of training and cost



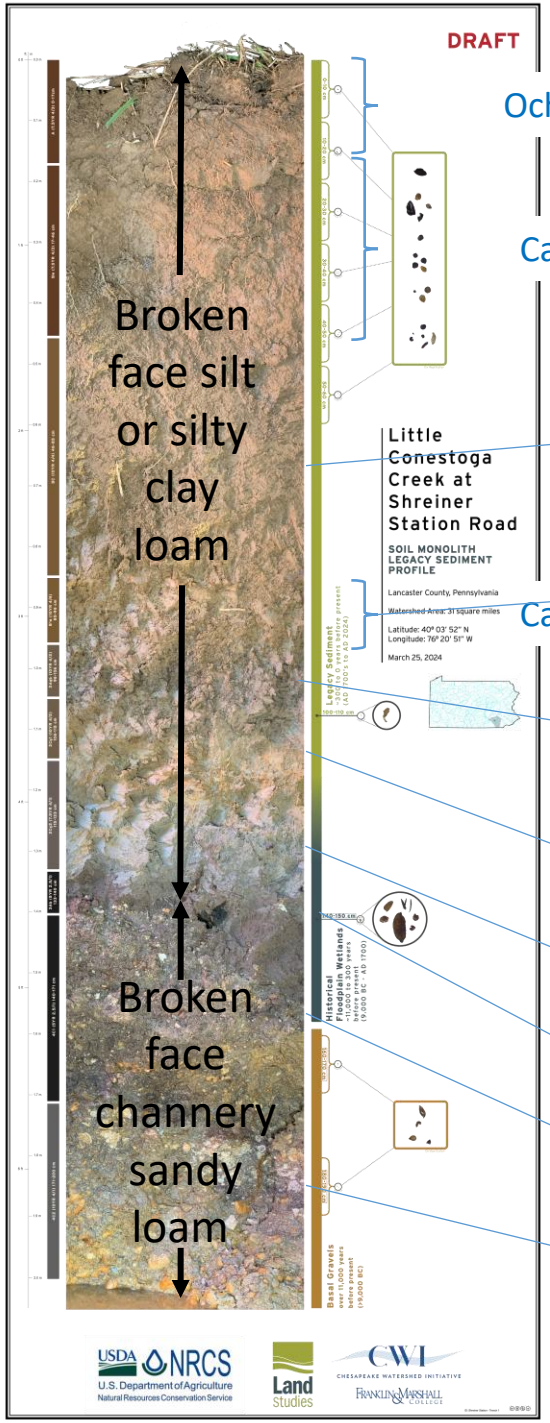


Little Conestoga - Shreiner Station Rd

ochric epipedon

Map Unit:
Ln—Lindside silt loam

3/25/24



USDA NASIS Report

Ochric

A—0 to 17 cm, brown (7.5YR 4/3)

Cambic

Bw—17 to 46 cm, brown (7.5YR 4/3)

BC—46 to 85 cm, dark yellowish brown (10YR 4/4)

Cambic

B'w—85 to 96 cm, dark yellowish brown (10YR 4/4)

2Agb—96 to 106 cm, dark grayish brown (10YR 4/2)

2Cg1—106 to 115 cm, dark grayish brown (10YR 4/2)

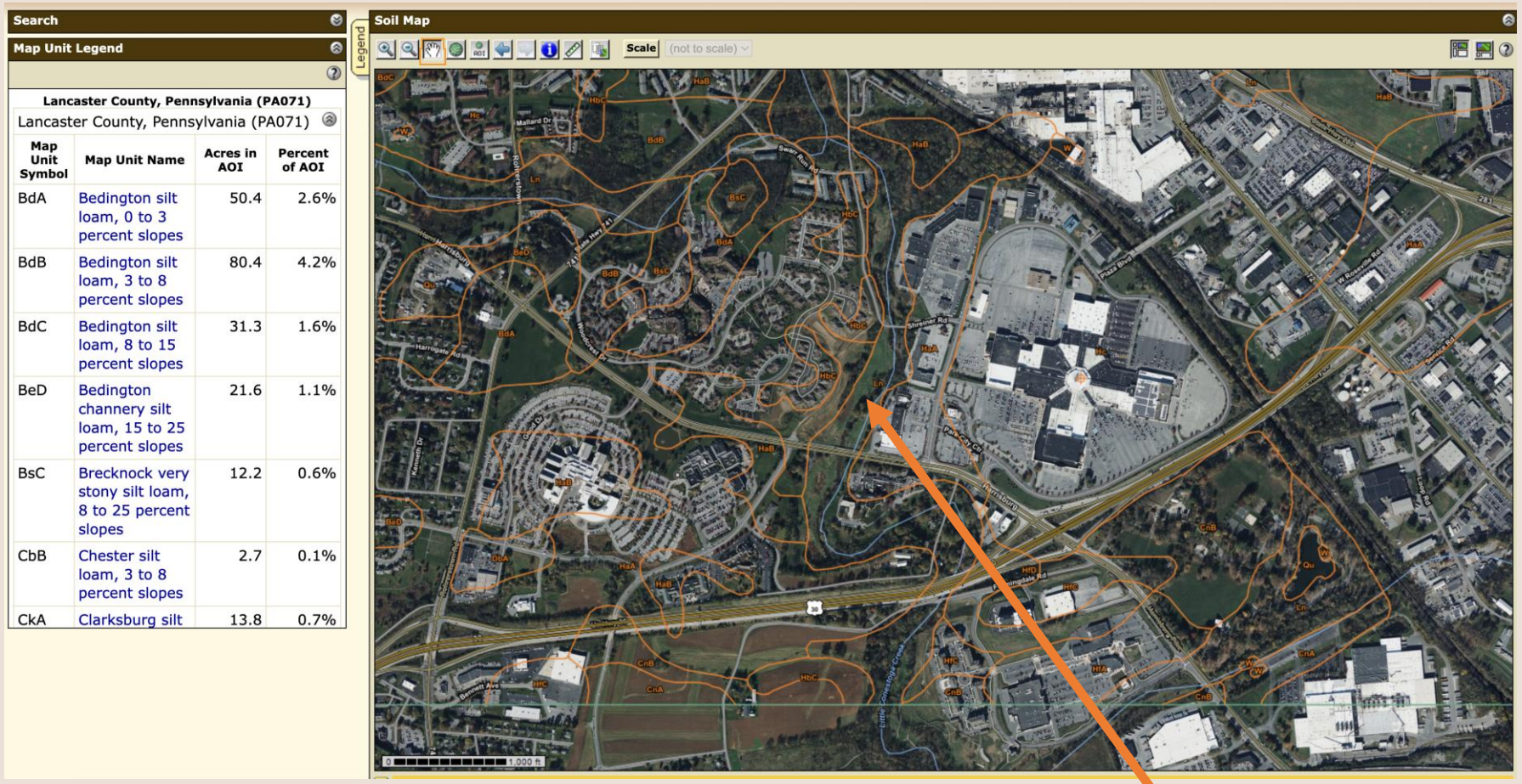
2Cg2—115 to 133 cm, dark gray (7.5YR 4/1)

3Ab—133 to 140 cm, black (5YR 2.5/1)

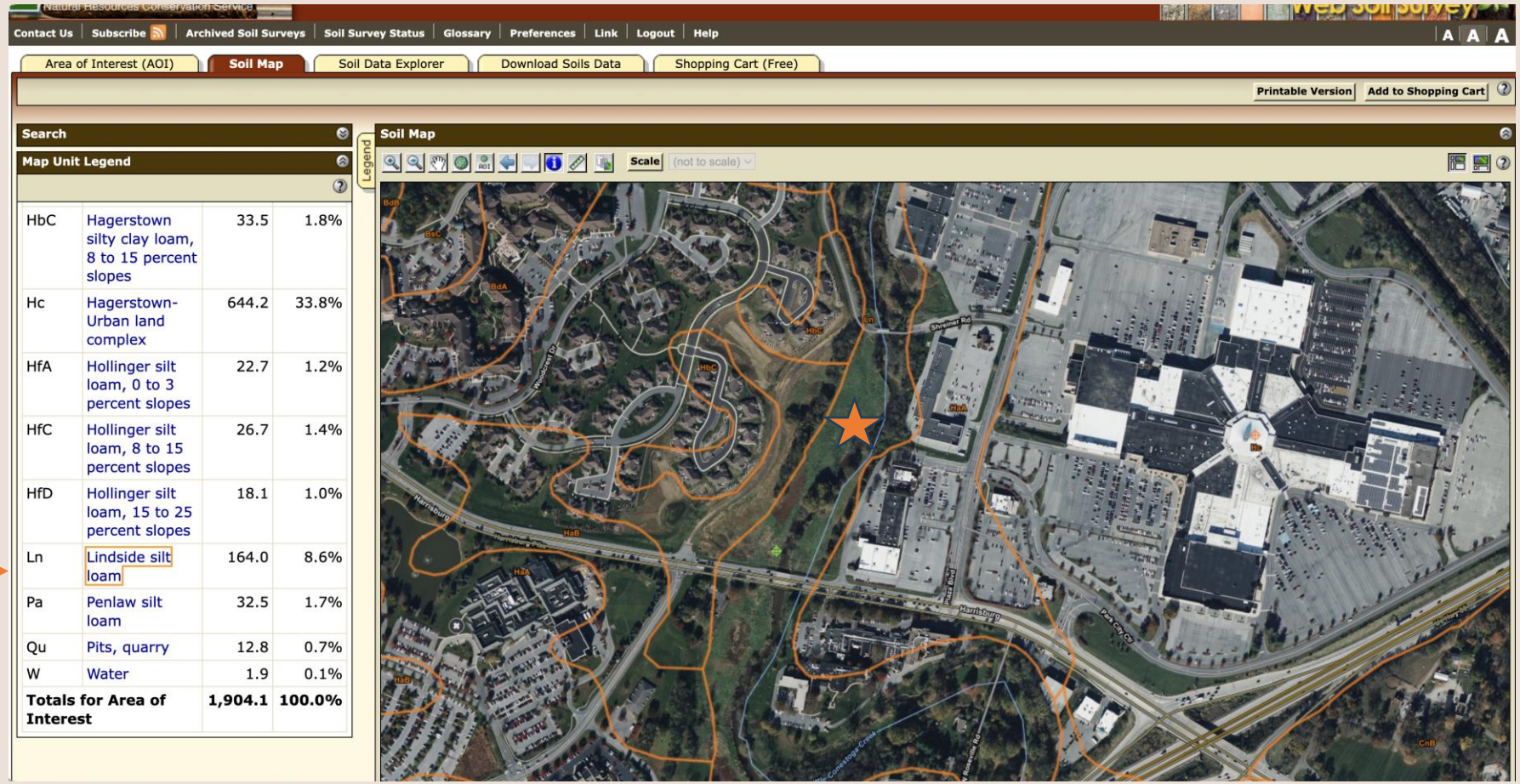
4C1—140 to 171 cm, black (5YR 2.5/1)

4C2—171 to 200 cm, variegated 50 percent dark gray (10YR 4/1)

USDA Web Soil Survey, Lancaster Co., PA https://websoilsurvey.nrcs.usda.gov/app/



LCC-Woodcrest Villa Valley Bottom Soils Lindside Silt-Loam (Ln)



HbC	Hagerstown silty clay loam, 8 to 15 percent slopes	33.5	1.8%
Hc	Hagerstown-Urban land complex	644.2	33.8%
HfA	Hollinger silt loam, 0 to 3 percent slopes	22.7	1.2%
HfC	Hollinger silt loam, 8 to 15 percent slopes	26.7	1.4%
HfD	Hollinger silt loam, 15 to 25 percent slopes	18.1	1.0%
Ln	Lindside silt loam	164.0	8.6%
Pa	Penlaw silt loam	32.5	1.7%
Qu	Pits, quarry	12.8	0.7%
W	Water	1.9	0.1%
Totals for Area of Interest		**1,904.1**	**100.0%**

★ Woodcrest Villa Trench Site

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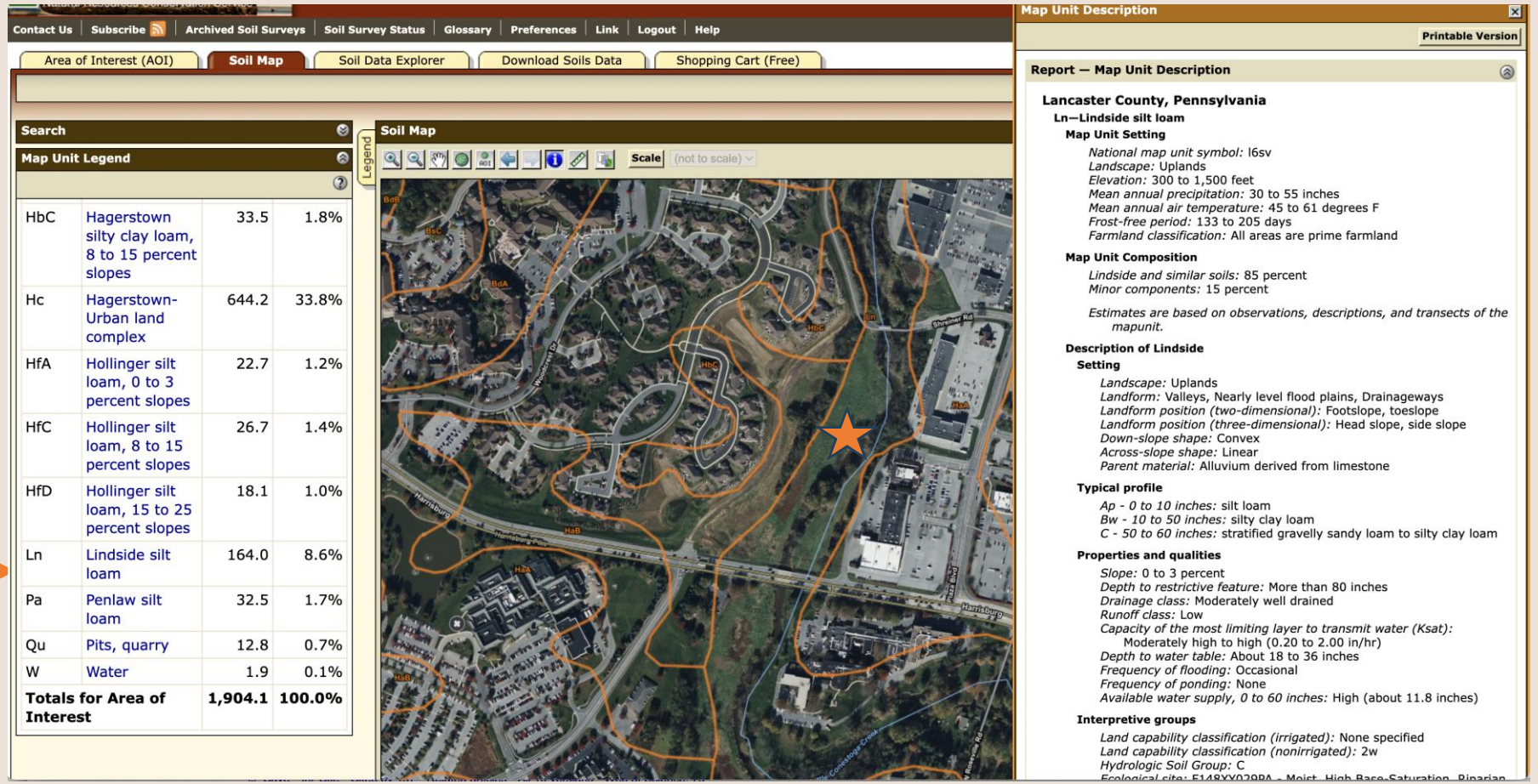

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★ Woodcrest Villa Trench Site

LCC-Woodcrest Villa Valley Bottom Photography

Lindside Silt-Loam (Ln)

Woodcrest Villa Stratigraphic Section

LCC-Woodcrest Villa Valley Bottom Photography

Legacy Sediments

Buried Wetland

Basal Gravels

Woodcrest Villa Stratigraphic Section

LCC-Woodcrest Villa Valley Bottom Photography

Legacy Sediments →

Buried Wetland →

Basal Gravels →

Woodcrest Villa Stratigraphic Section

Little Conestoga Creek Groundwater

Woodcrest Villa Trench Site 2/13/23

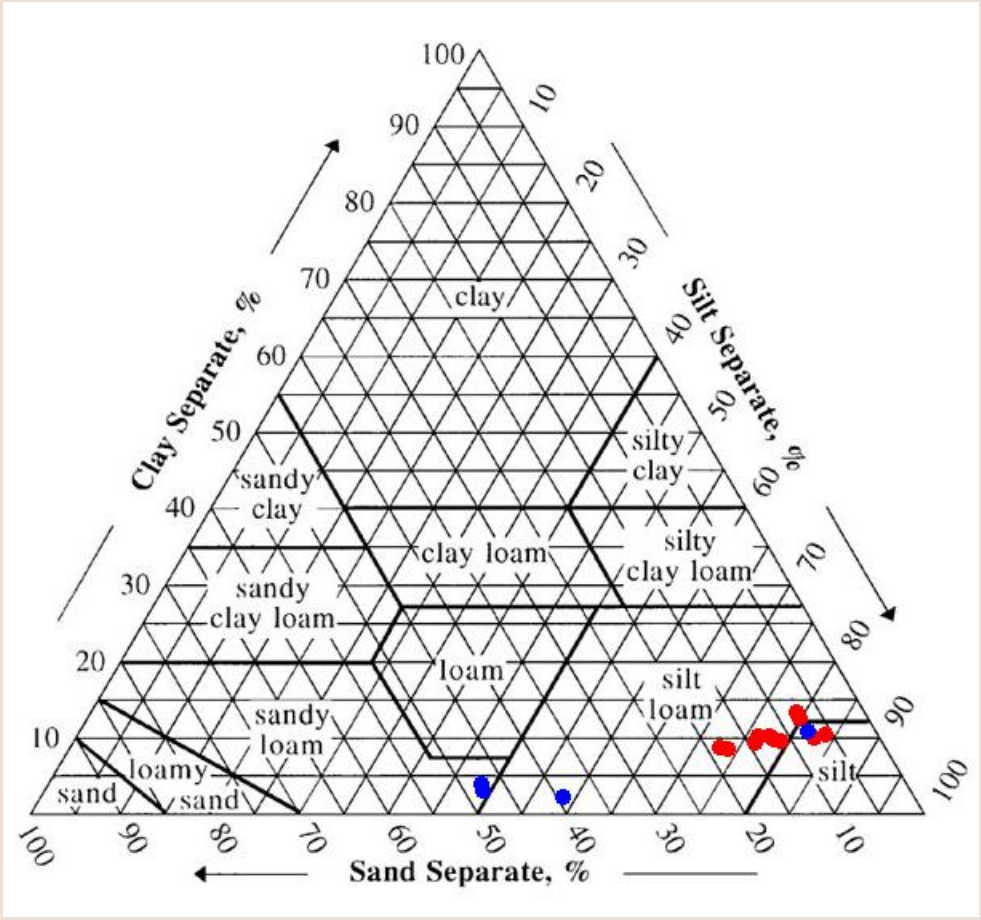
Little Conestoga Creek Groundwater

Woodcrest Villa Trench Site 2/13/23

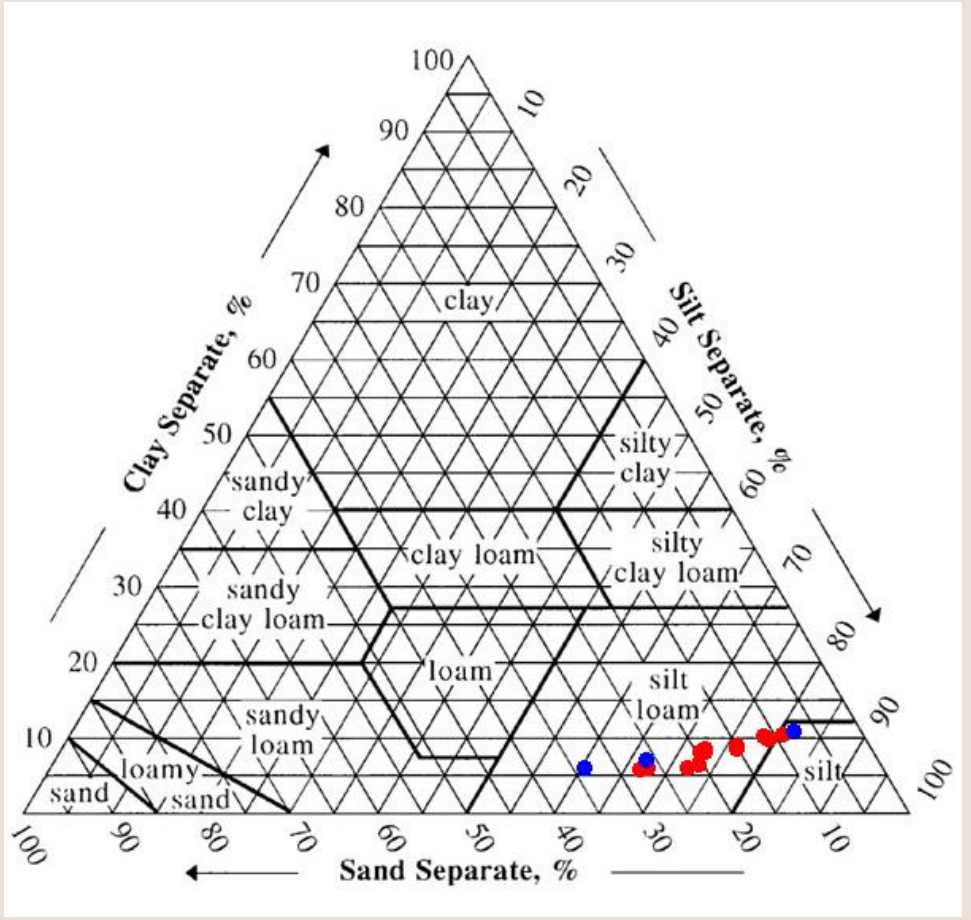
Particle Size Analyses

Legacy Sediment

Buried Hydric Soil

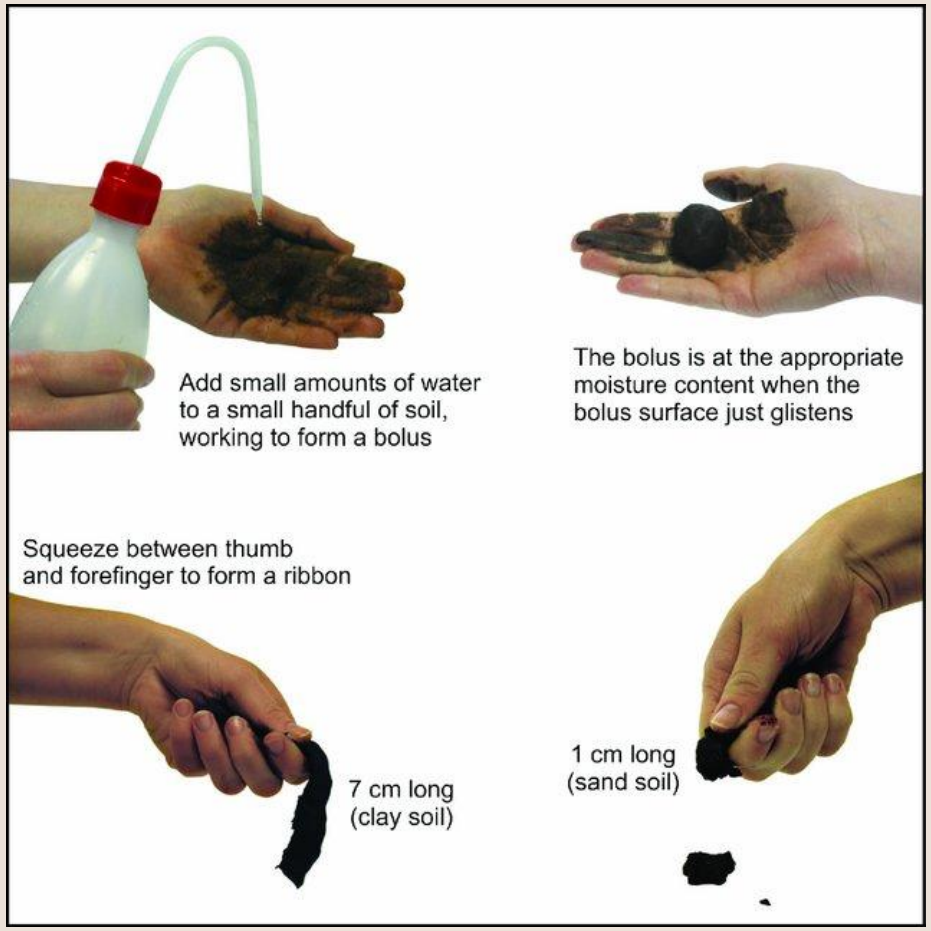


Site 1



Site 4

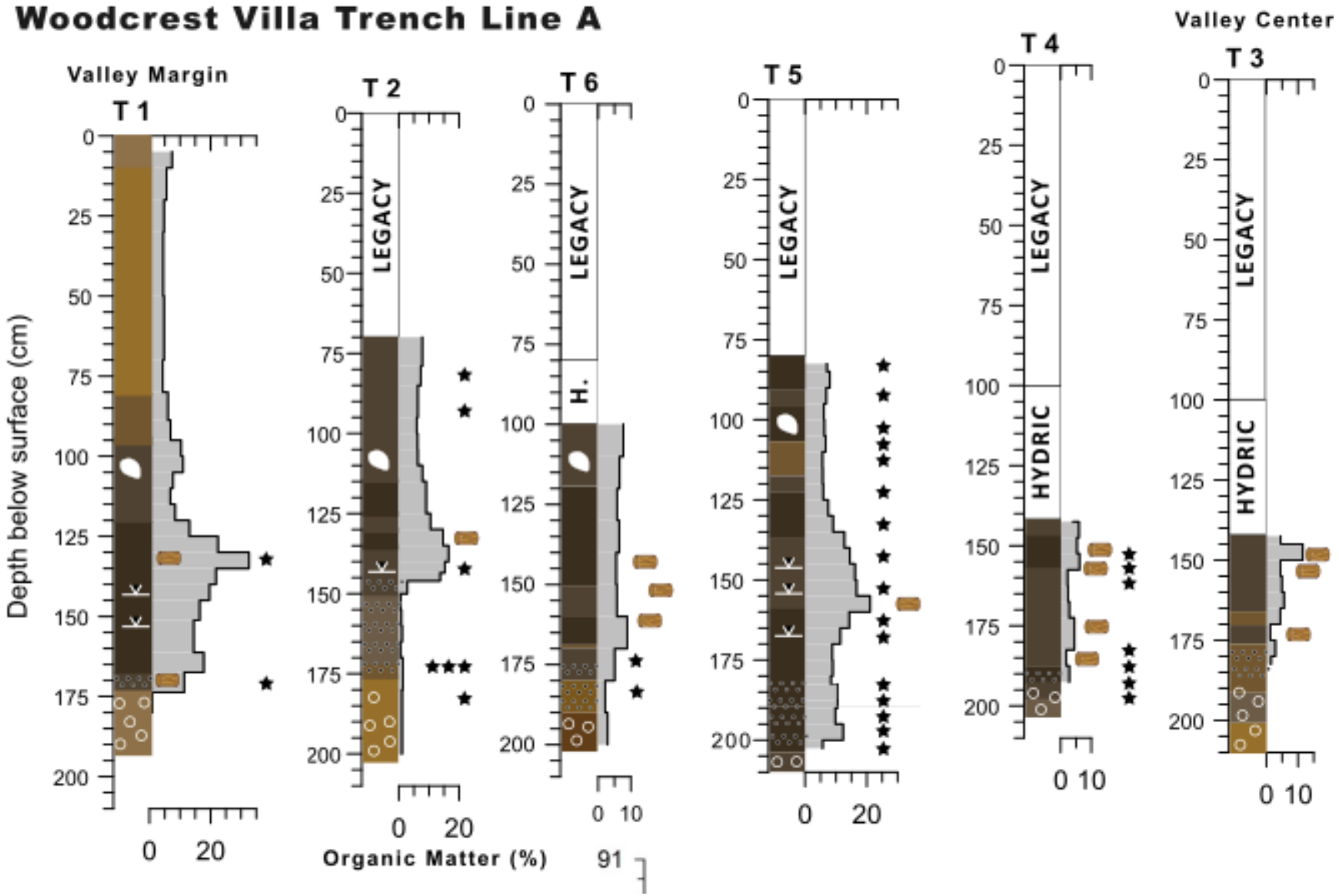
Soil & Sediment Texture By Feel



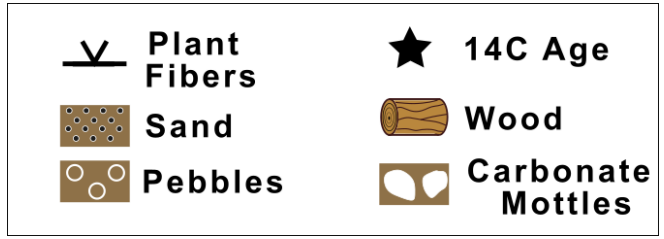
Field texture	Description	Approximate clay content
Sand	Nil to slight coherence. Ribbon of 0 – 15 mm.	Less than 10%
Sandy loam	Coherent but very sandy to touch. Ribbon of 15 – 25 mm.	10 – 20%
Loam	Coherent, spongy and greasy feel with no obvious sandiness or silkiness. Ribbon of about 25 mm.	About 25%
Silt loam	Coherent, very smooth to often silky when manipulated. Ribbon of about 25 mm.	About 25% and with silt 25% or more
Sandy clay loam	Strongly coherent, sandy to touch with medium size sand grains visible in finer matrix. Ribbon of 25 – 40 mm.	20 – 30%
Clay loam	Coherent plastic bolus. Smooth to touch with no obvious sand grains. Ribbon of 50 – 75 mm.	30 – 35%

USDA Method: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nrcs.usda.gov/sites/default/files/2022-11/texture-by-feel.pdf

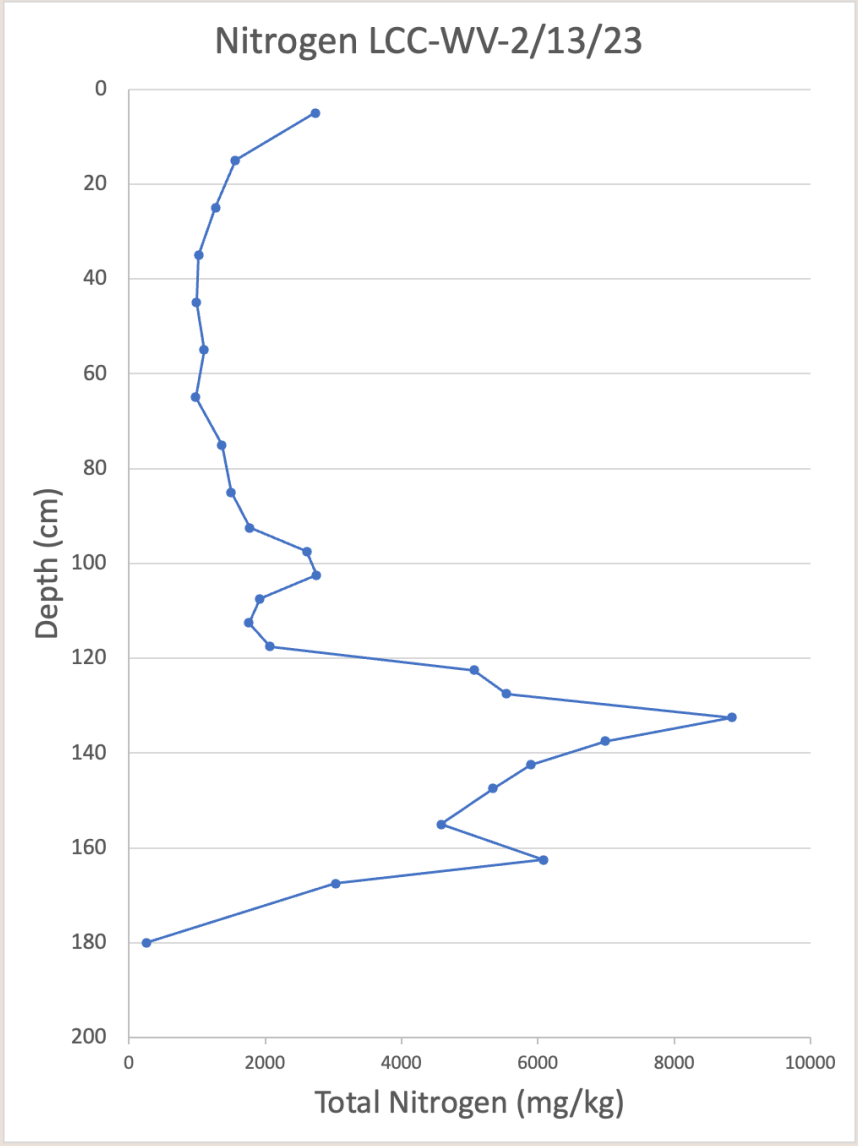
Little Conestoga Creek Stratigraphy - Woodcrest Villa Tench

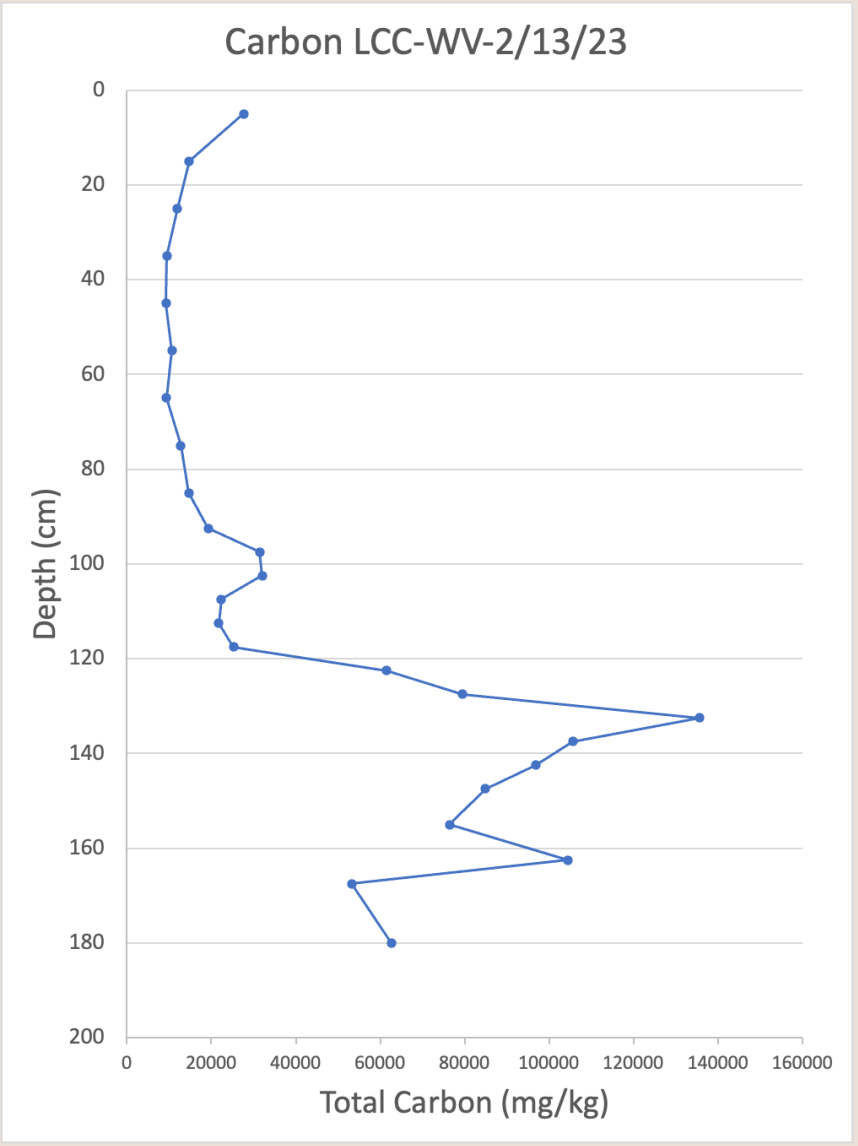


Summary stratigraphy of Woodcrest Villa trenching



LCC-Woodcrest Nutrient Stratigraphy





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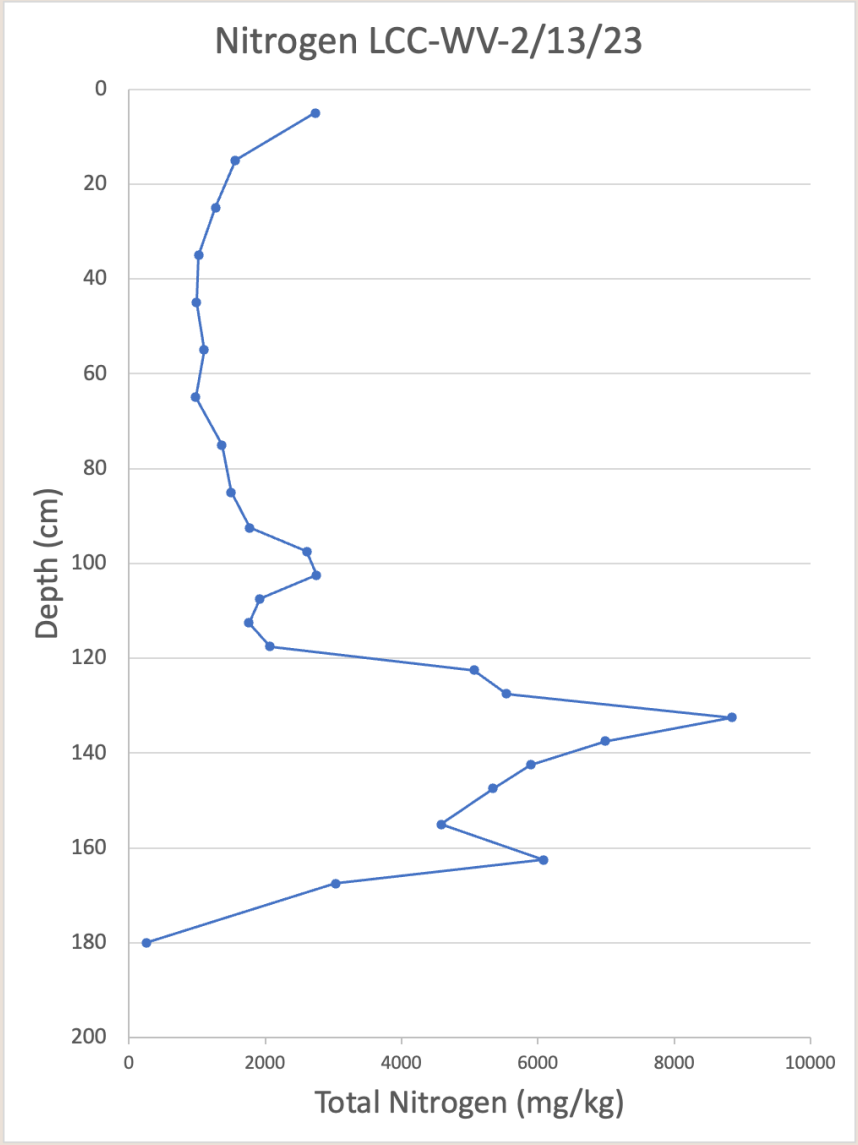

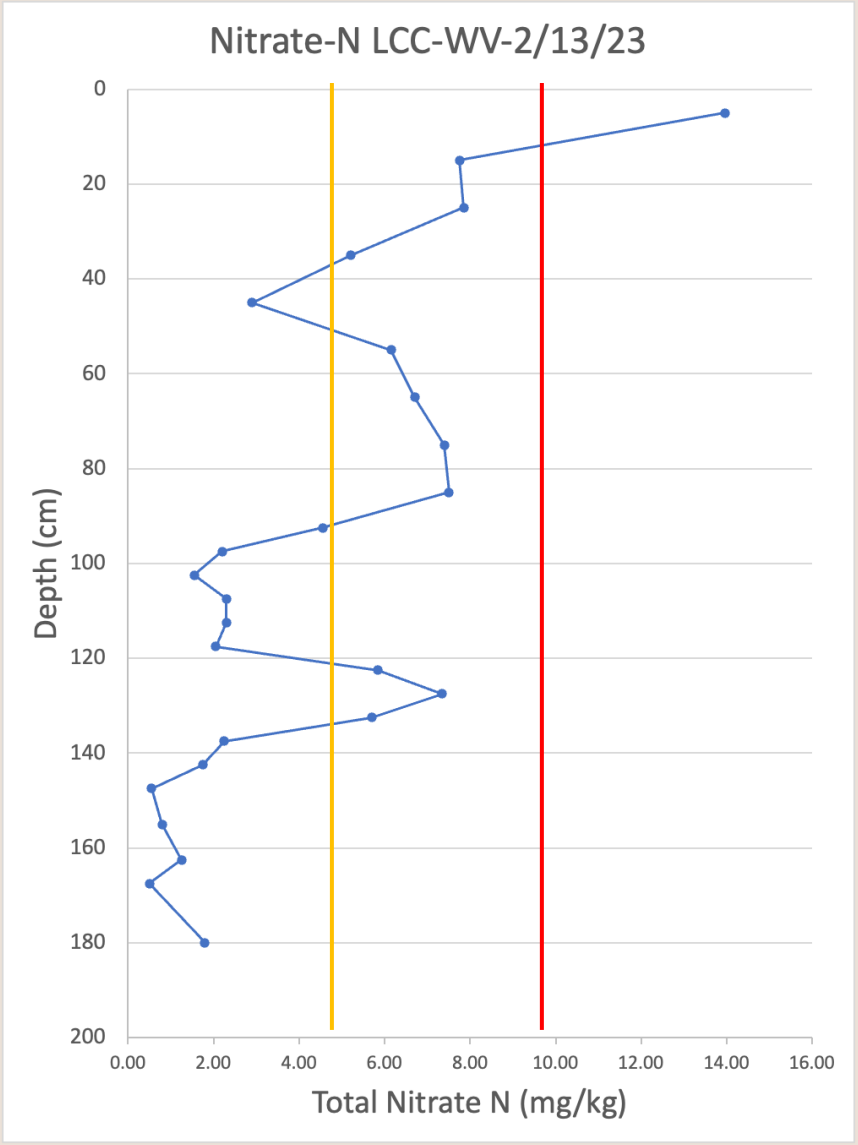

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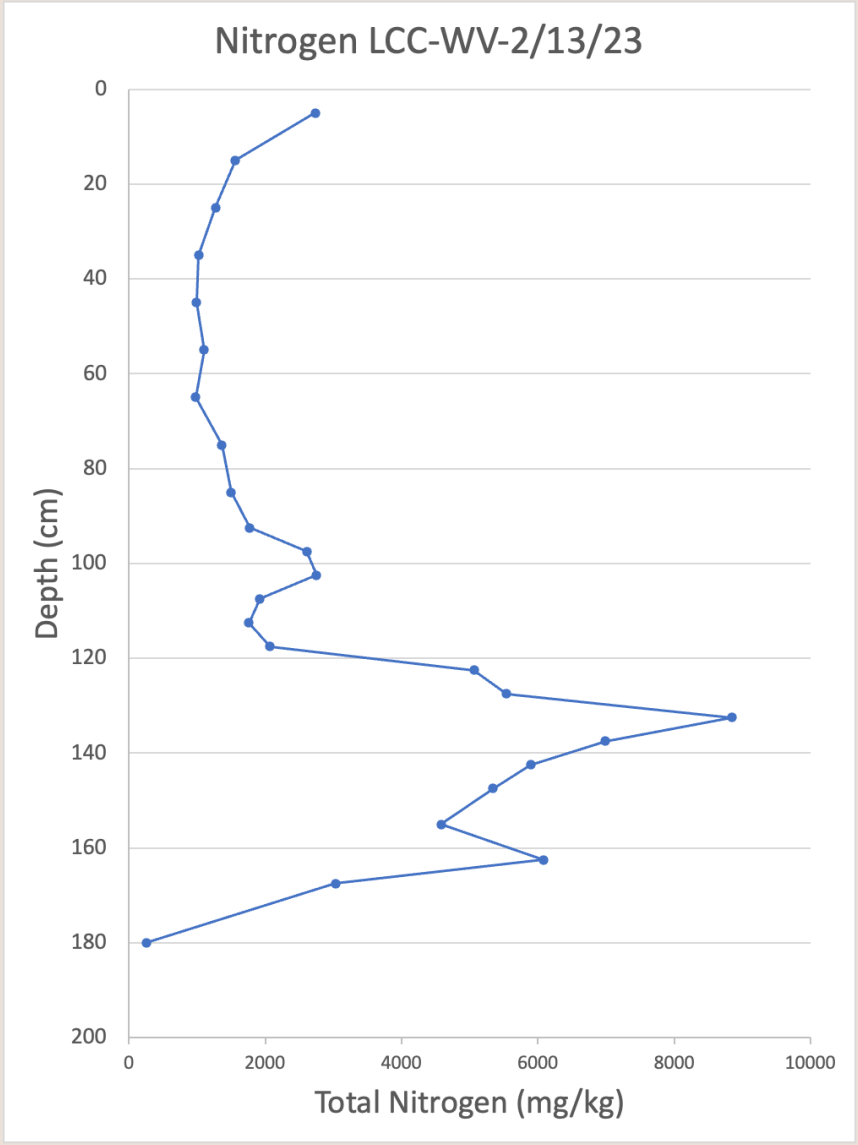
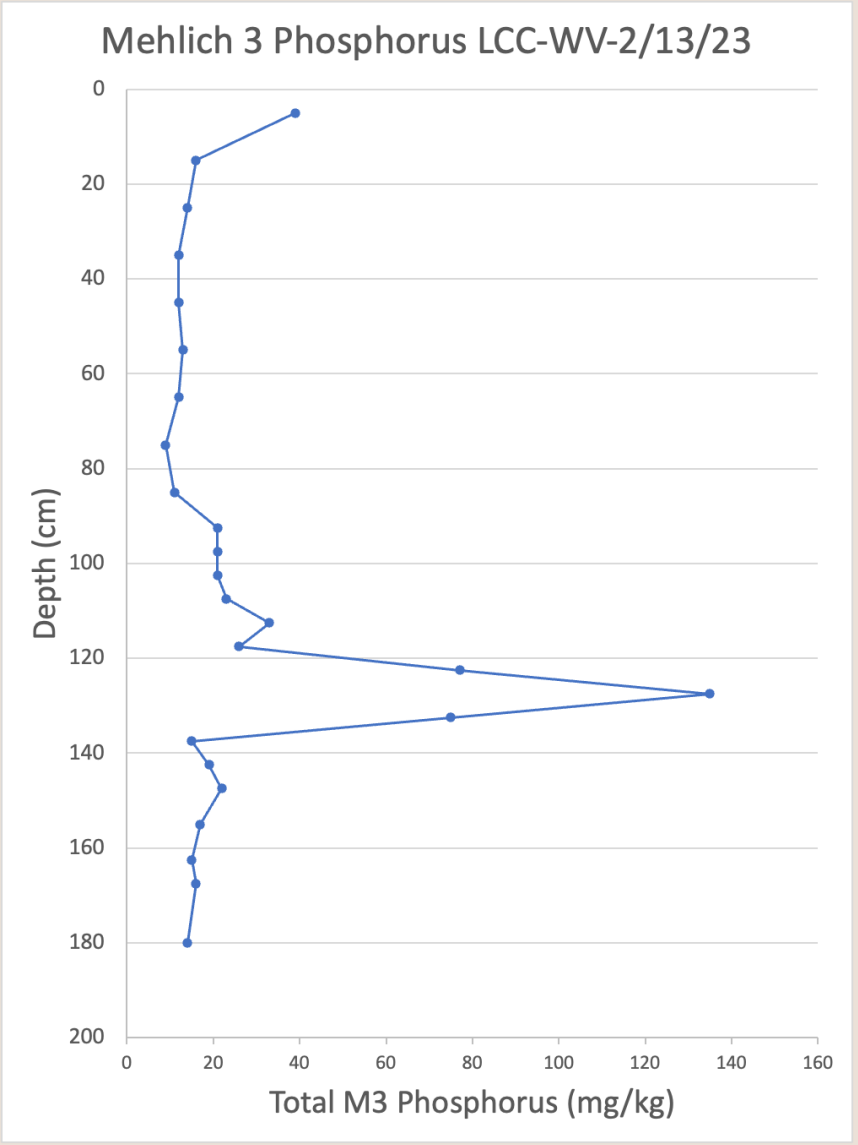
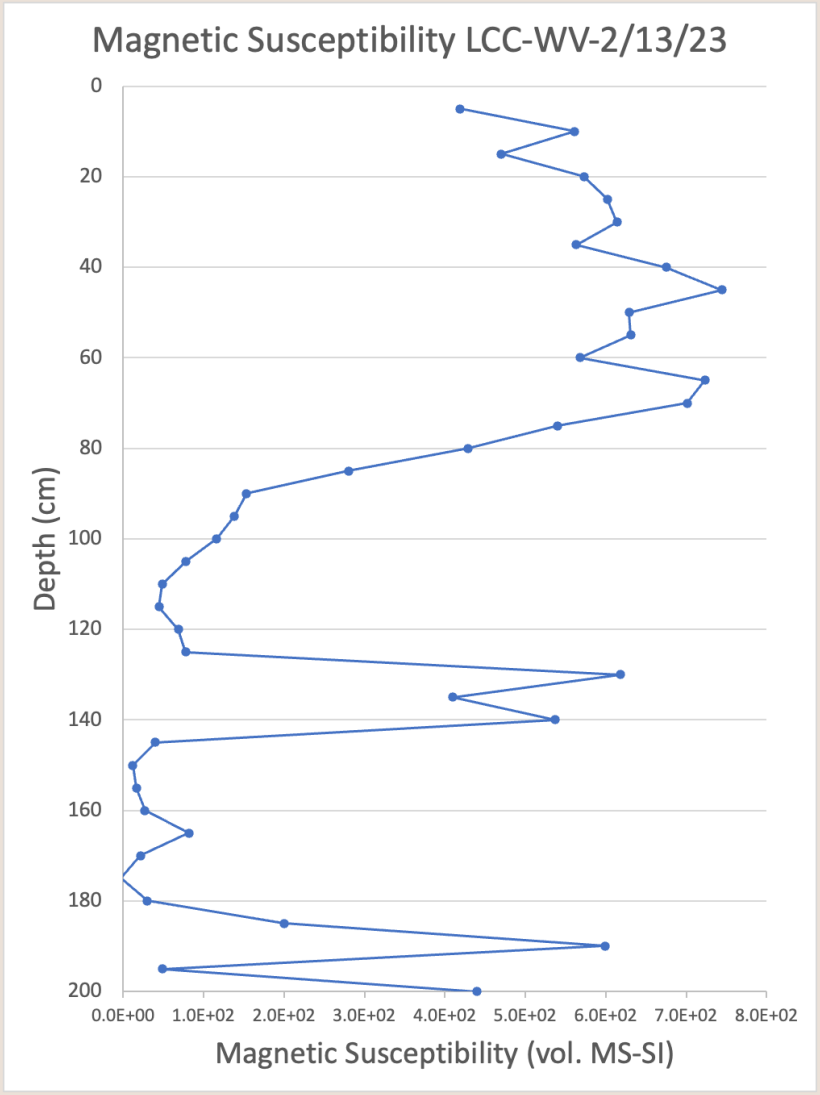
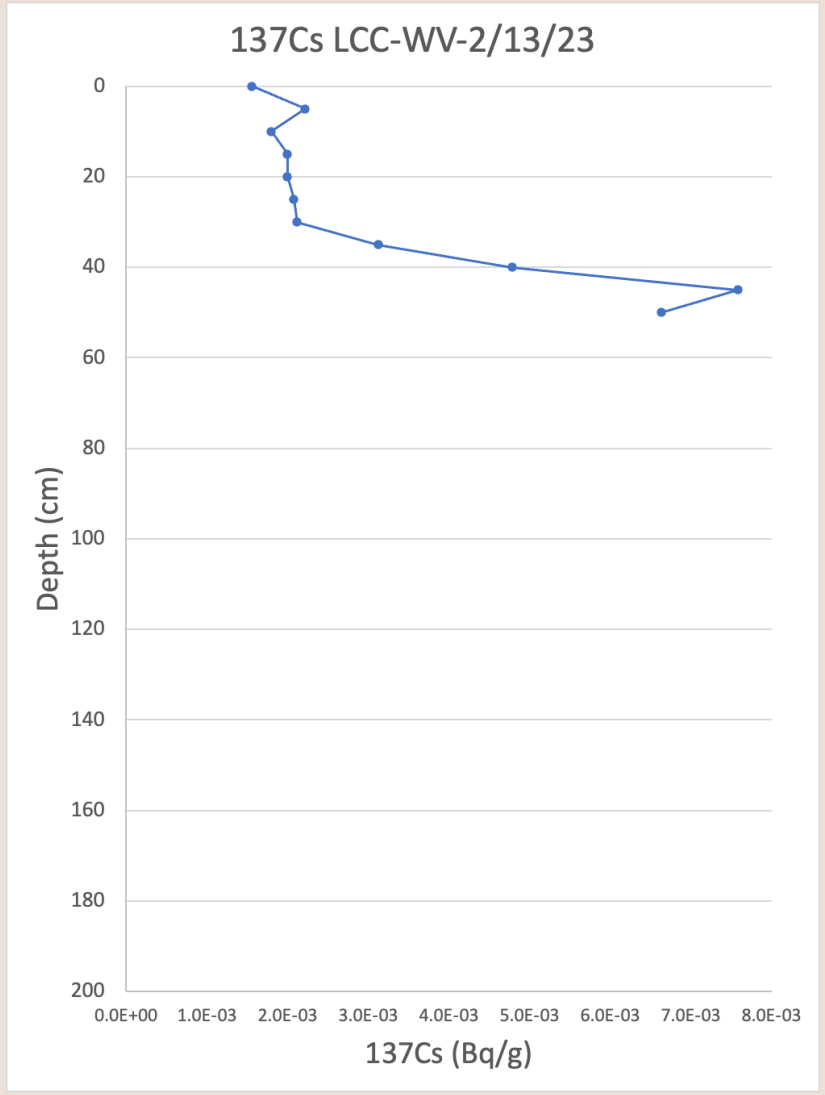
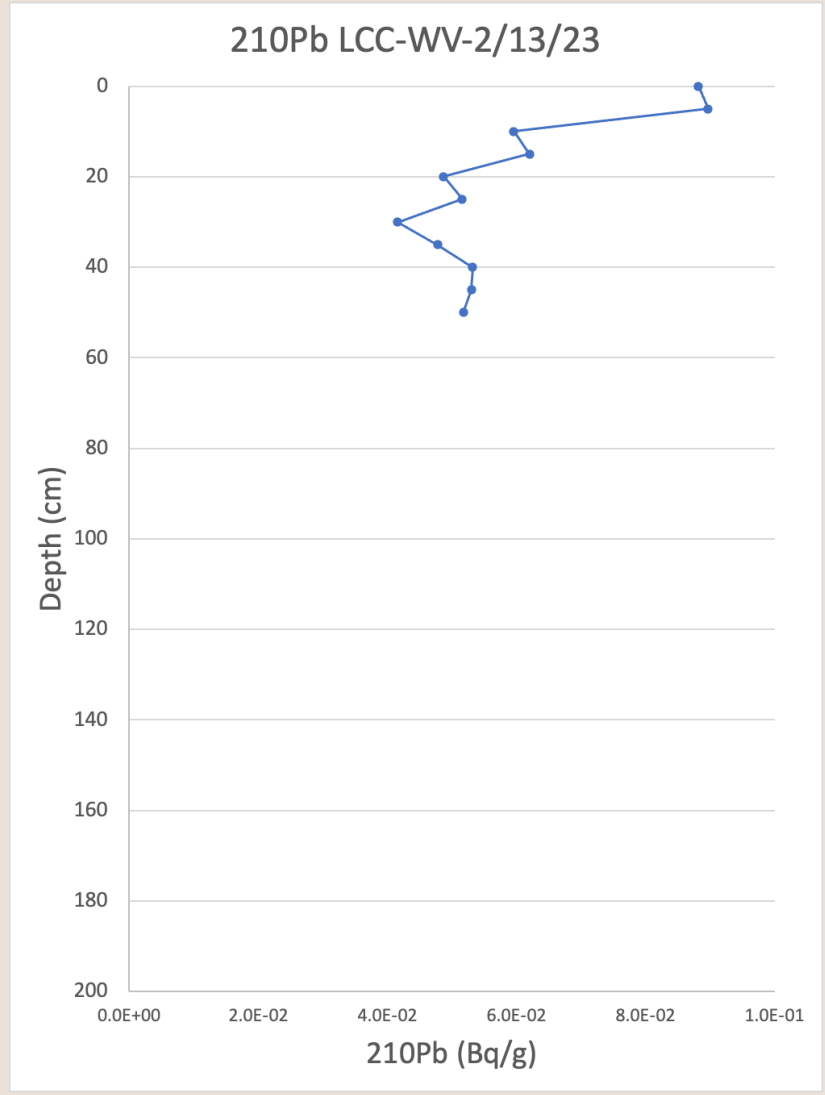




LCC-Woodcrest MS & Fallout Radionuclides



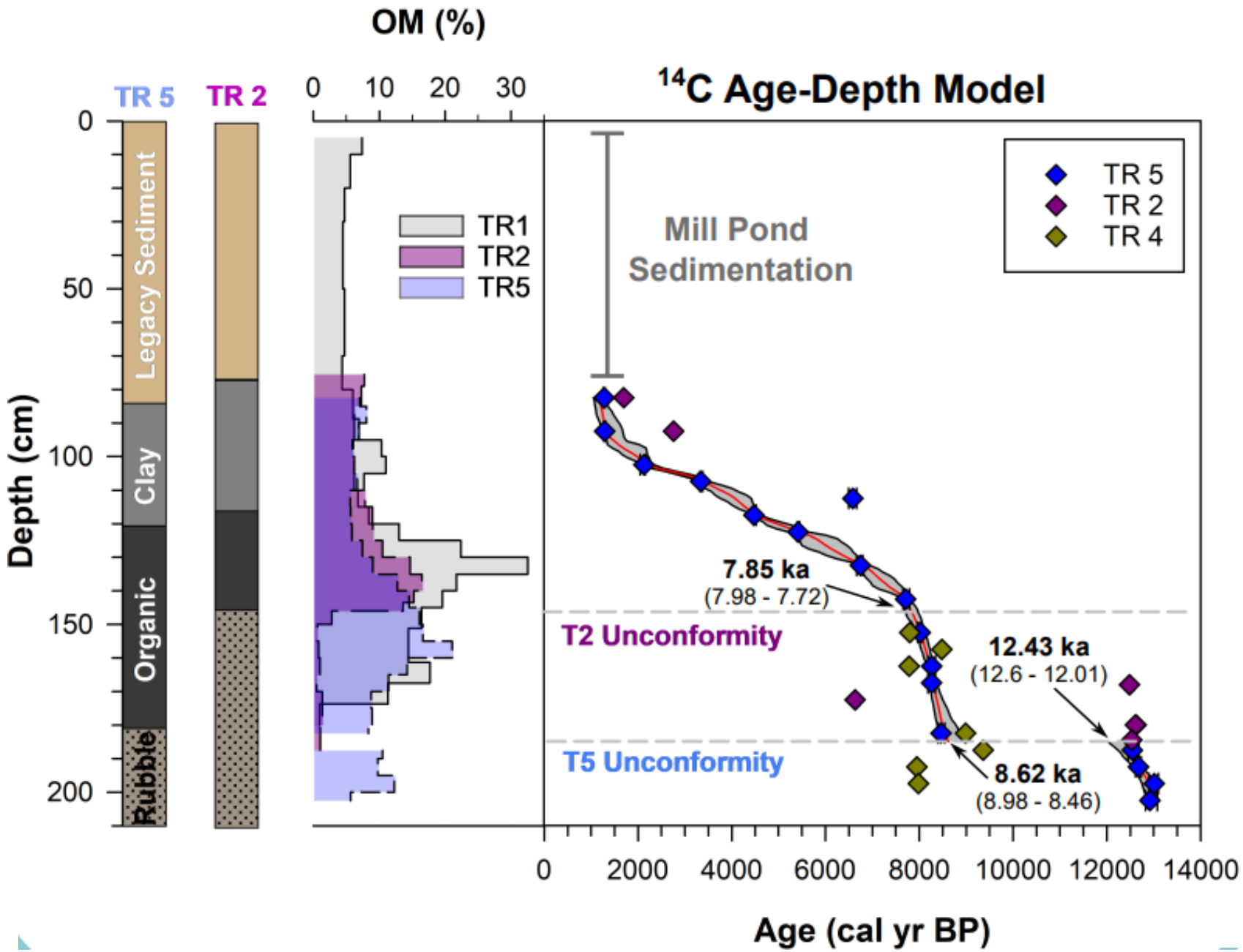




Timing of events

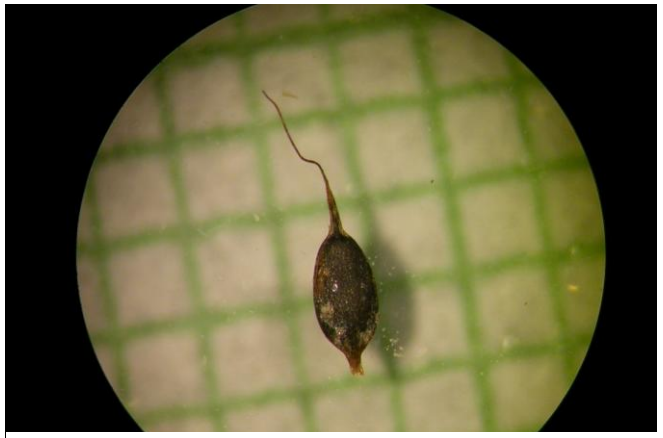
N = 34 Radiocarbon Dates

- Organic-poor hydric soil ages:
  7.85 ka – 5.52 ka
- Organic-rich hydric soil ages:
  9.23 – 7.62 ka
- Top of “Rubble” age:
  12.43 - 12.49 ka



Tracking the growth and expansion of the floodplain wetland

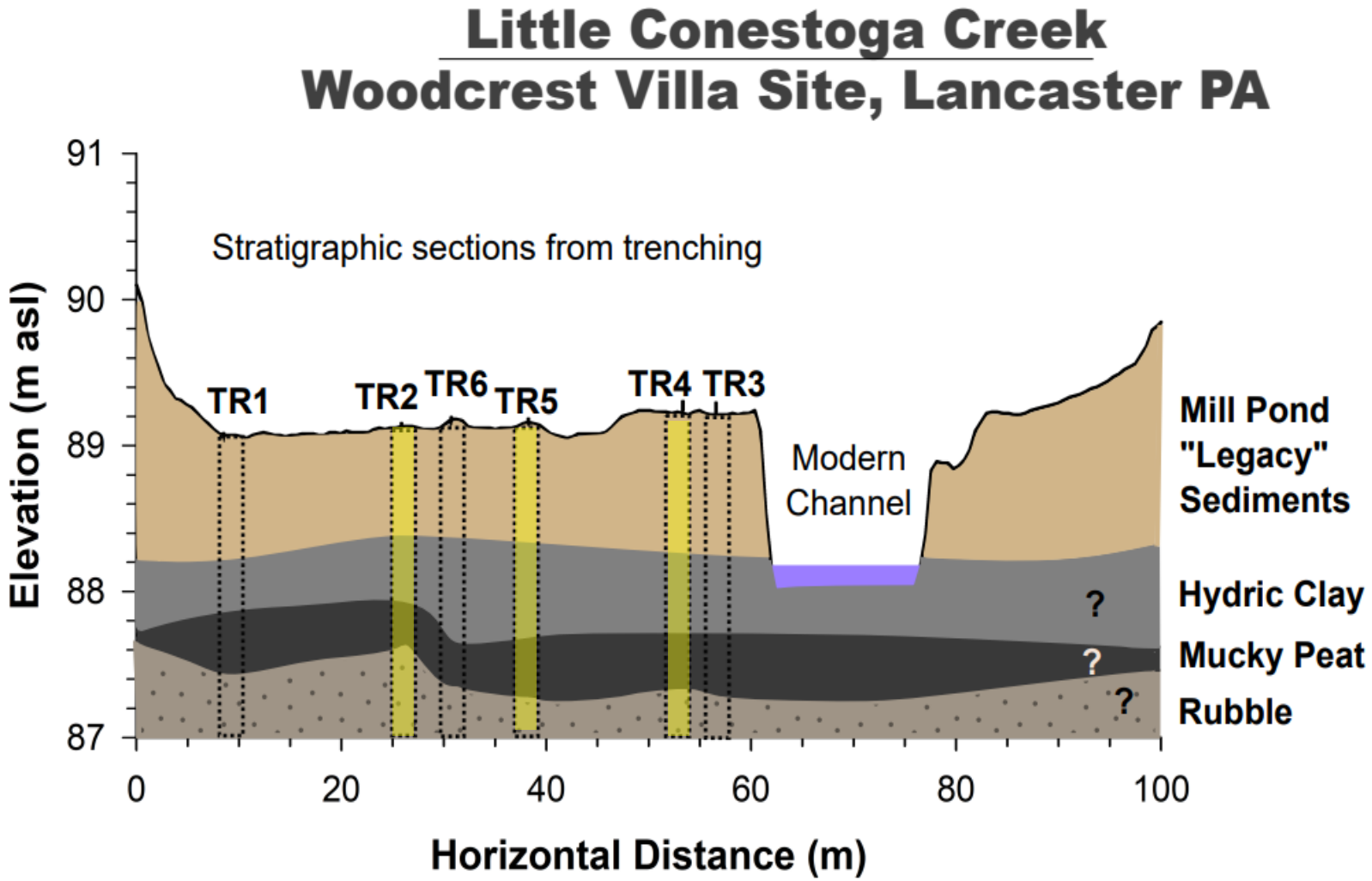
Seed Macrofossils



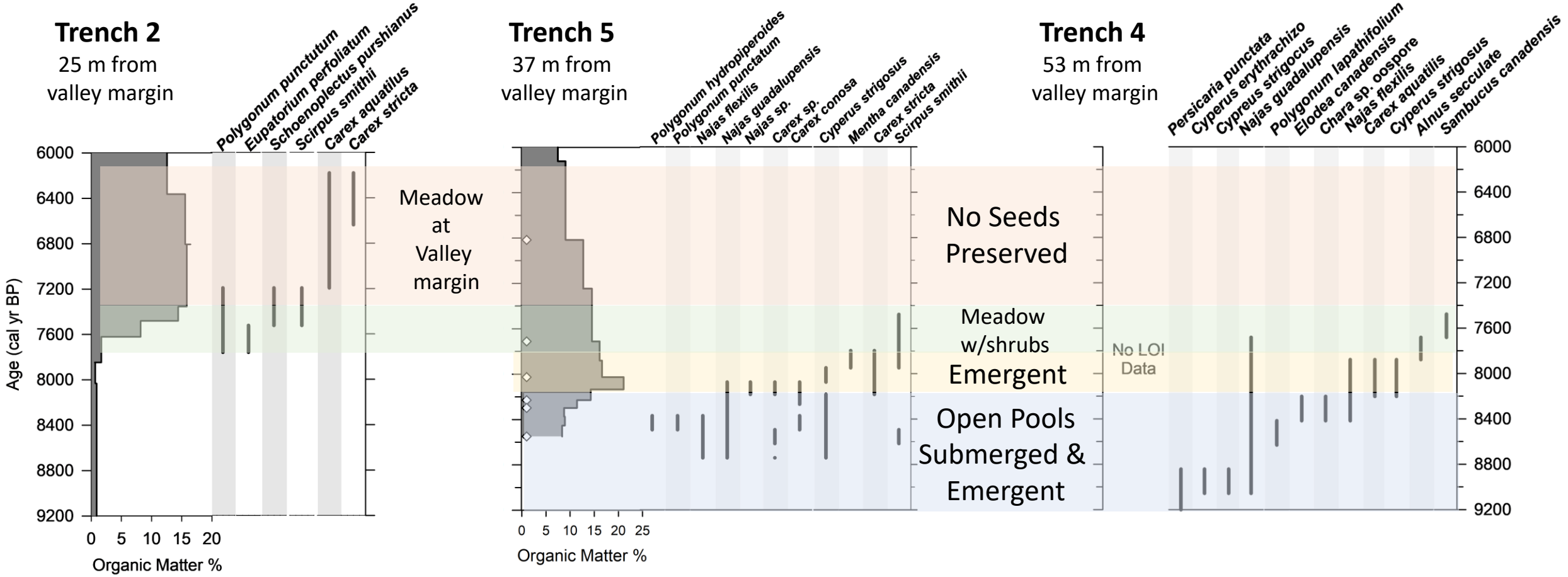
Carex scoparia—marsh, wet meadow

Palynology

Doug Rosa, Senior Thesis



Tracking the growth and expansion of the floodplain wetland 9200 – 6000 yr BP at Little Conestoga Woodcrest Villa



Macrofossil Evidence for Wetland Succession

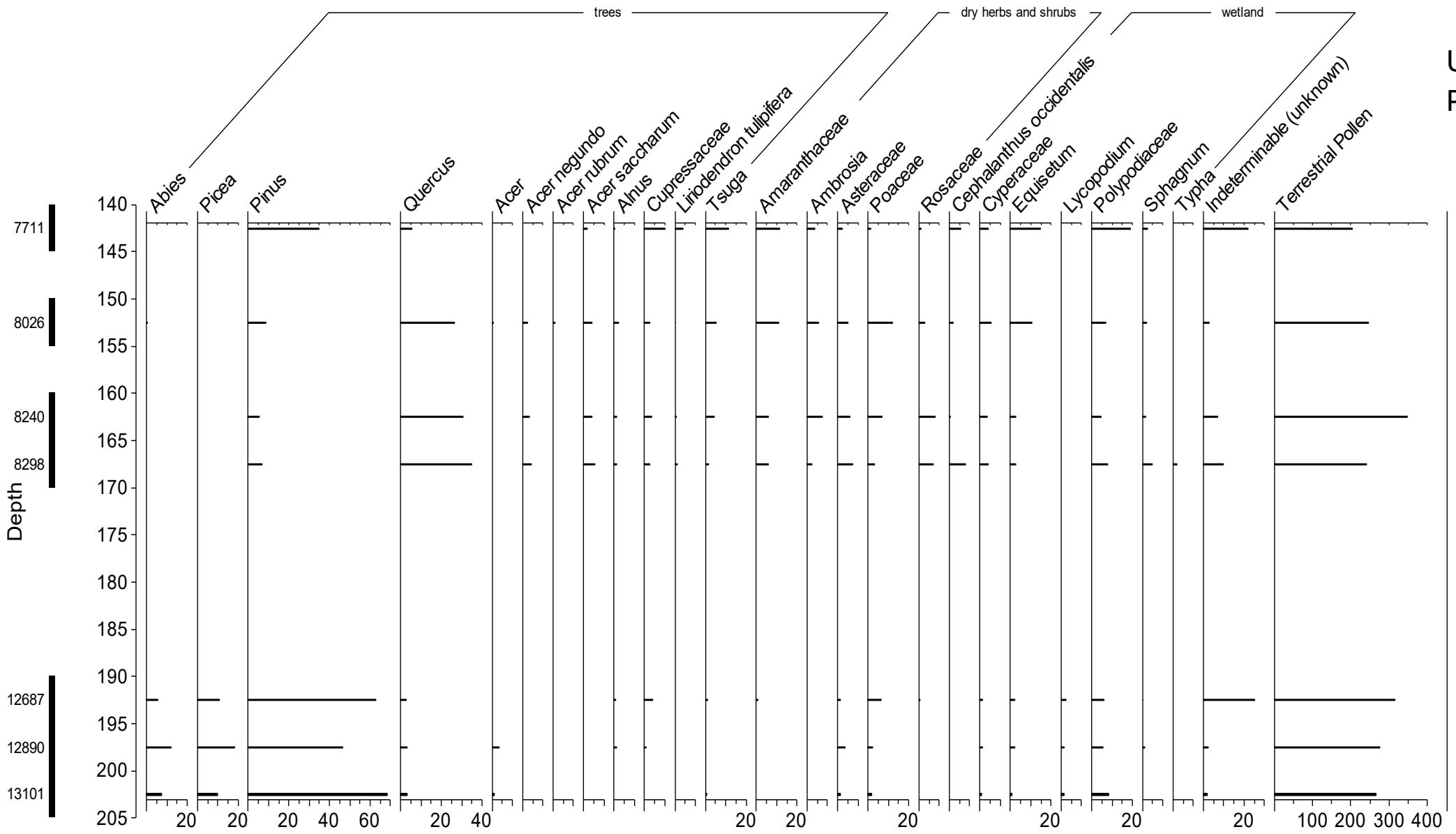
Trench 2

Trench 5

Trench 4

Douglas Rosa Poster 26-11

Preliminary Little Conestoga Creek Trench-Face 5 Pollen



Underappreciated
Paleo archives

Summary

- Understanding valley bottom stratigraphy is essential for designing restoration strategies.
- Are legacy sediments everywhere? No, but they are ubiquitous.
- Are legacy sediments always from millpond deposition? No, but it is the dominant mechanism in the unglaciated mid-Atlantic region.
- There are many types of human disturbances to valley bottoms: be patient, and let the stratigraphy guide you.
- A multidisciplinary approach is best: geologists, environmental scientists, biologists, soil scientists, environmental engineers, excavators, and landowners!