# DIGITAL MAPPING TECHNIQUES 2021

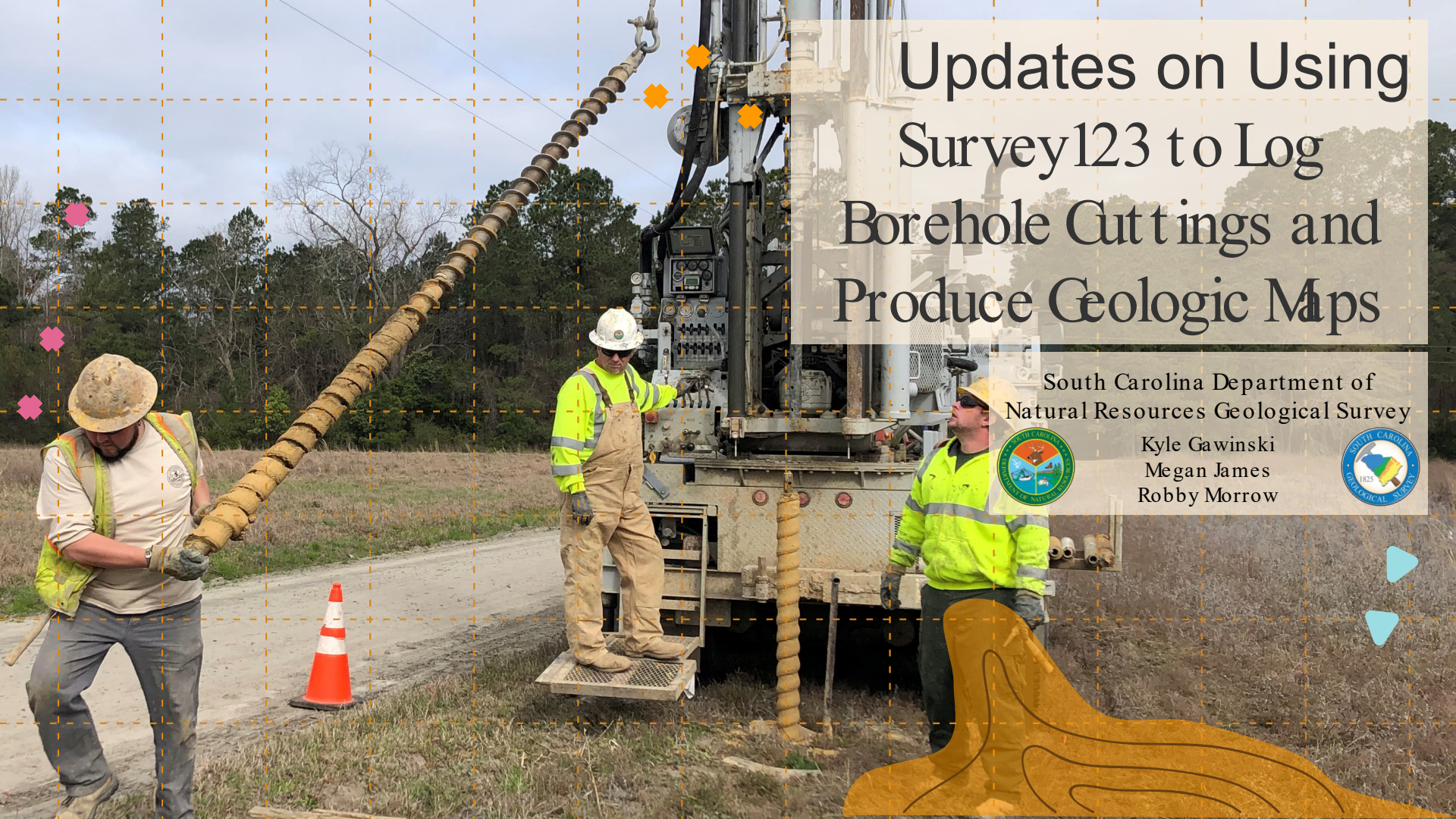
The following was presented at DMT'21
(June 7 - 10, 2021 - A Virtual Event)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2021)

http://ngmdb.usgs.gov/info/dmt/

The following slides were presented by Kyle Gawinski at DMT '21. They explain the current method the South Carolina Geological Survey is using to collect, display, and store subsurface data. Standardization and consistency are two of the major themes of this presentation. A method for inputting subsurface data into GeMS databases is also described.



# Updates on Using Survey123 to Log Borehole Cuttings and Produce Geologic Maps

South Carolina Department of Natural Resources Geological Survey

Kyle Gawinski
Megan James
Robby Morrow

# Subsurface Data

## Collection

Using Survey 123

## Display

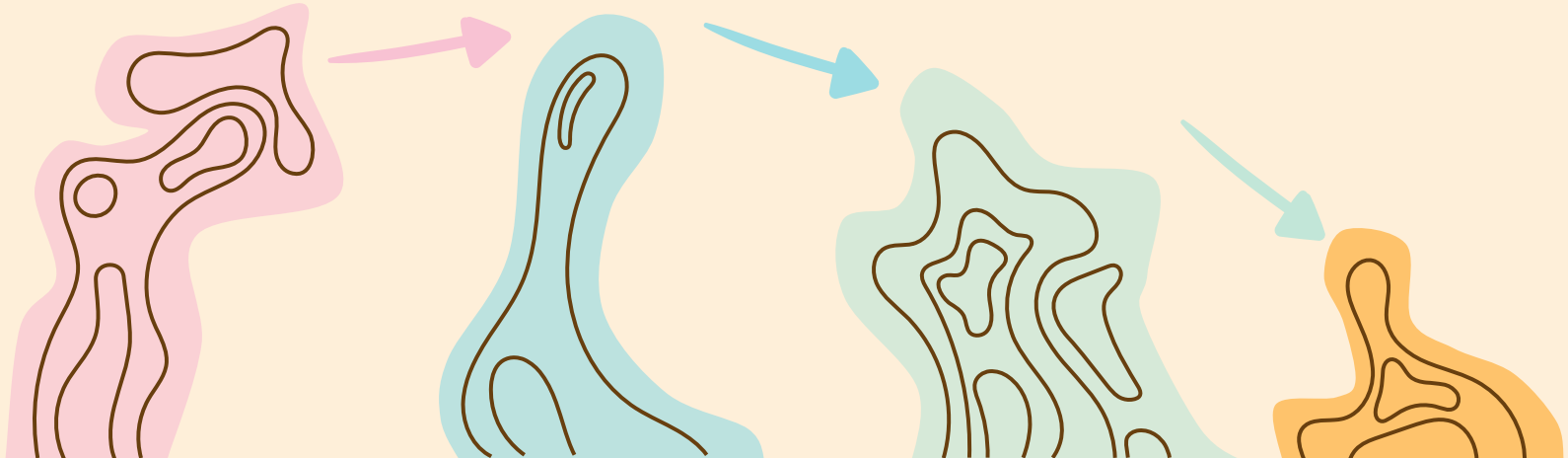
Exporting from Survey 123 to Strater

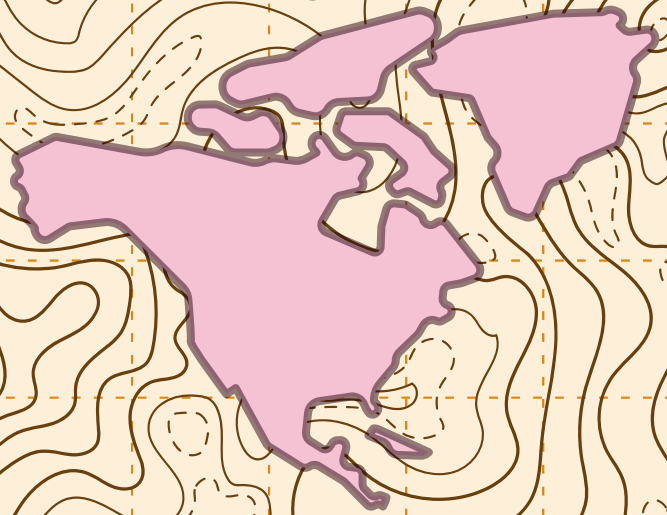
## GeMS

Exporting from Survey 123 to a Shapefile

## 3D

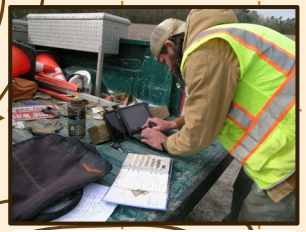
Using ArcHydro

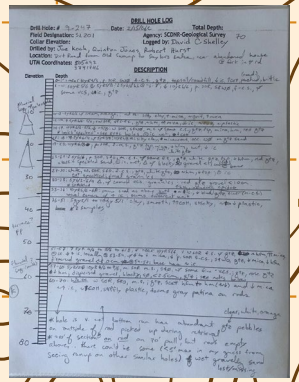


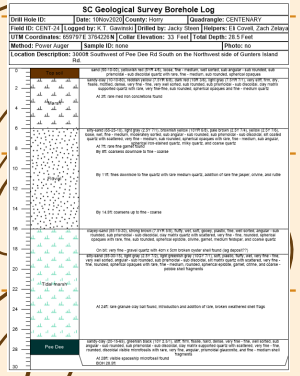


# Borehole Logging

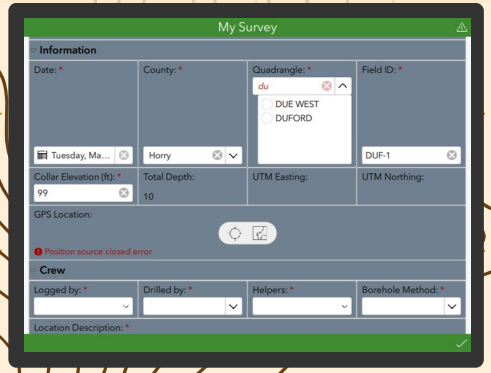
Using Survey 123








Manual Entry or Dropdown Selection




# Purpose

- Paper → Digital Logs
- Standardized Data Collection
- Survey 123 → tailored to fit needs, exportable, GeMS compliant

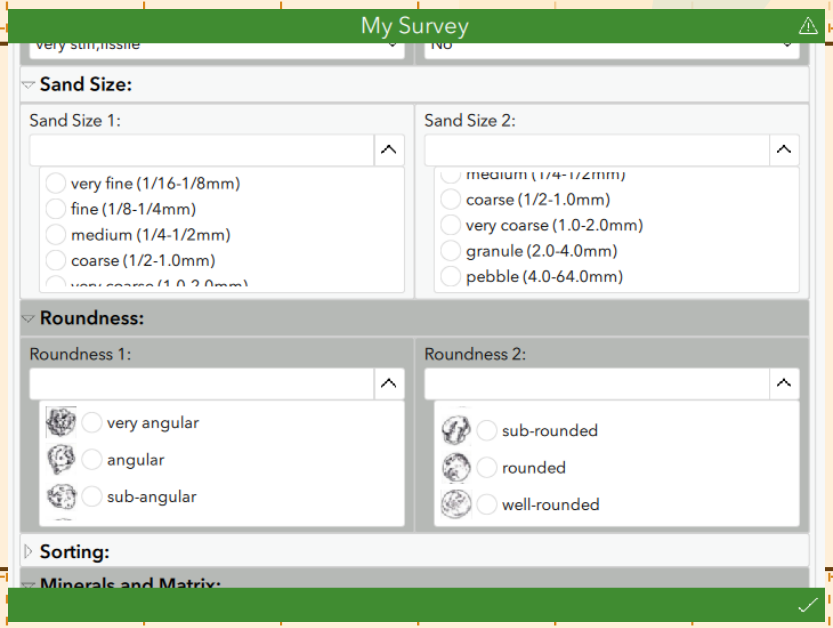
Tradition Description

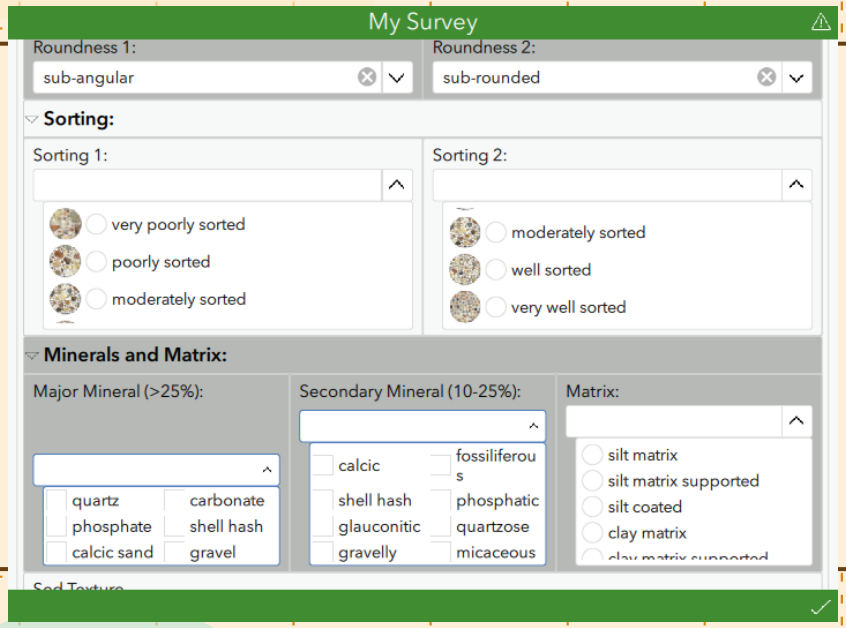
Dark yellowish orange, silt matrix supported, well sorted, subangular to subrounded, very fine to fine quartz sand.

Survey 123 Generated Description

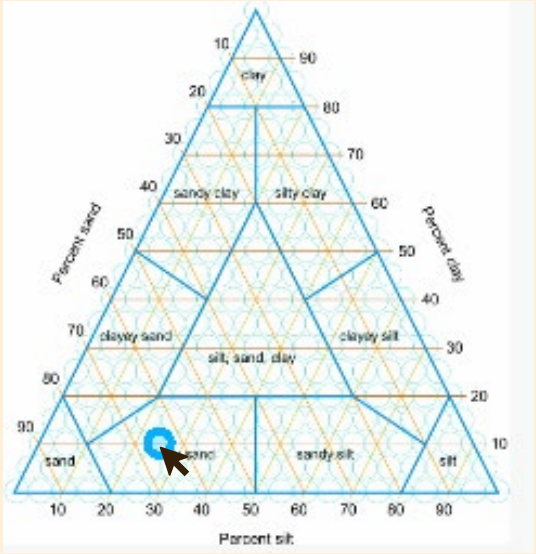
clayey-sand (55-15-30), very dark gray (10YR 3/1), light brownish gray (10YR 6/2), yellowish brown (10YR 5/8), light bluish gray (10B 8/1), stiff, dense, medium - coarse, moderately sorted, sub angular - sub rounded, sub prismoidal - sub discoidal, clay matrix quartz with scattered, very fine - fine, sub rounded, spherical opaques with rare, medium-coarse, sub angular, smoky quartz, rutile, and very coarse - granule iron-stained quartz and quartz

# Picture References



# Interactive Images

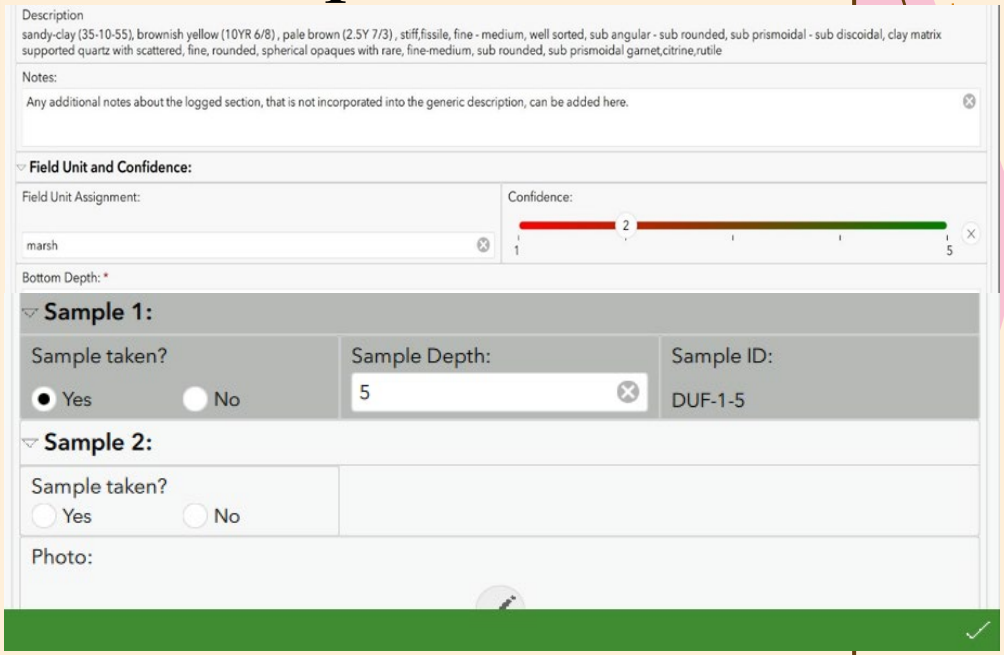


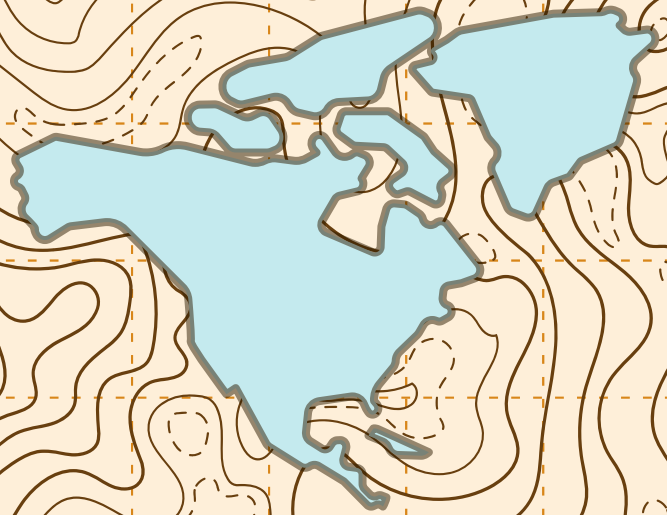

Interactive Ternary Diagram

Sand - Silt - Clay %
65-25-10

Sed Composition
silty-sand

# Automatic Descriptions
# Notes
# Field Unit / Confidence
# Sample/ Photo Data



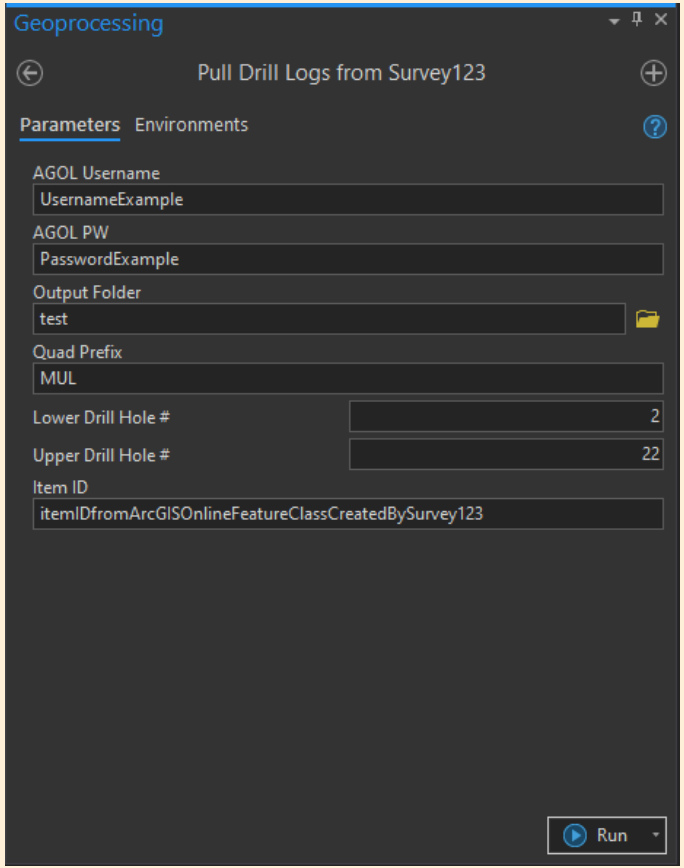


# Borehole Logs

Using Strater

# PythonScript

Quinn Nisbet & Tanner Arrington



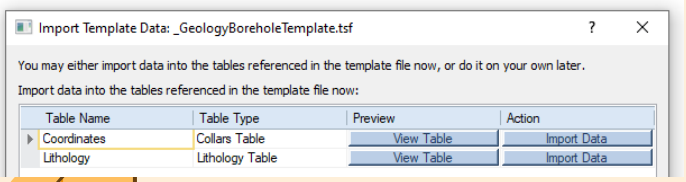

## Collars / Coordinates

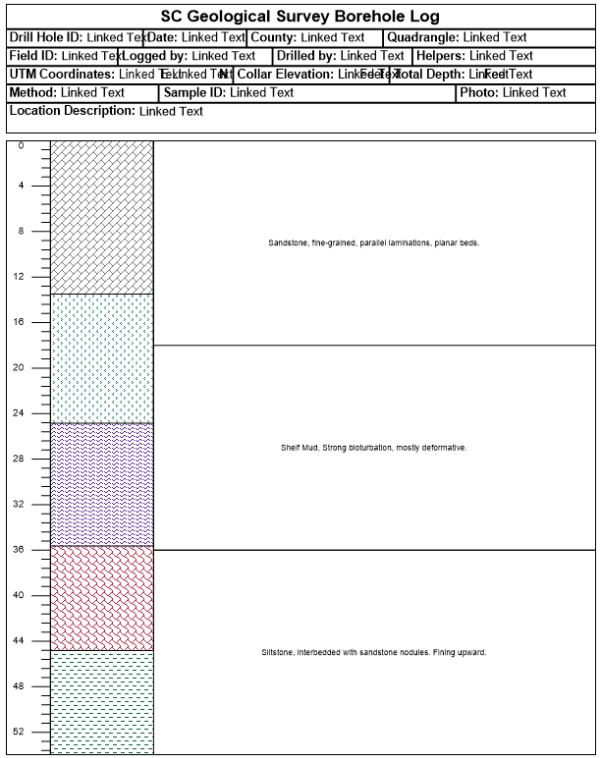
| Hole ID | Easting | Northing | Starting D | Ending De | Location D | Date | Logged by | County | Quadrang | Drilled by | Helpers | Sample ID | Photo | Drill Hole | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MUL-6 | 660612 | 3780143 | 0 | 50 | 3000ft We | 02March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger (measure |
| MUL-7 | 657796 | 3777440 | 0 | 50 | 4700ft So | 02March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | MUL-7-47. | no | | Power Auger (measure |
| MUL-8 | 660003 | 3783684 | 0 | 60 | 1000ft No | 04March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-9 | 656868 | 3779568 | 0 | 32 | 200ft East | 04March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-11 | 655037 | 3783050 | 0 | 7 | 200 feet s | 05March2( | C. Andrew | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-12 | 653230 | 3779779 | 0 | 27 | 1700ft So | 08March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | MUL-12-2( | no | | Power Auger |
| MUL-13 | 654842 | 3778863 | 0 | 9 | 2000ft Eas | 08March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-14 | 650560 | 3779390 | 0 | 7.5 | 150ft Sout | 08March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-15 | 652148 | 3783030 | 0 | 30 | 1500ft So | 10March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-16 | 650528 | 3782699 | 0 | 5 | 100ft Nort | 11March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-17 | 653557 | 3785888 | 0 | 40 | 300ft Nort | 11March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | MUL-17-1( | no | | Power Auger |
| MUL-18 | 653056 | 3787042 | 0 | 9 | 350ft Wes | 17March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-19 | 652661 | 3788110 | 0 | 50 | 200ft Wes | 17March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |
| MUL-20 | 660208 | 3790944 | 0 | 40 | 2000ft Eas | 19March2( | Kyle T. Ga | Marion | MULLINS | Jacky Stee | Eli_Covell | none | no | | Power Auger |

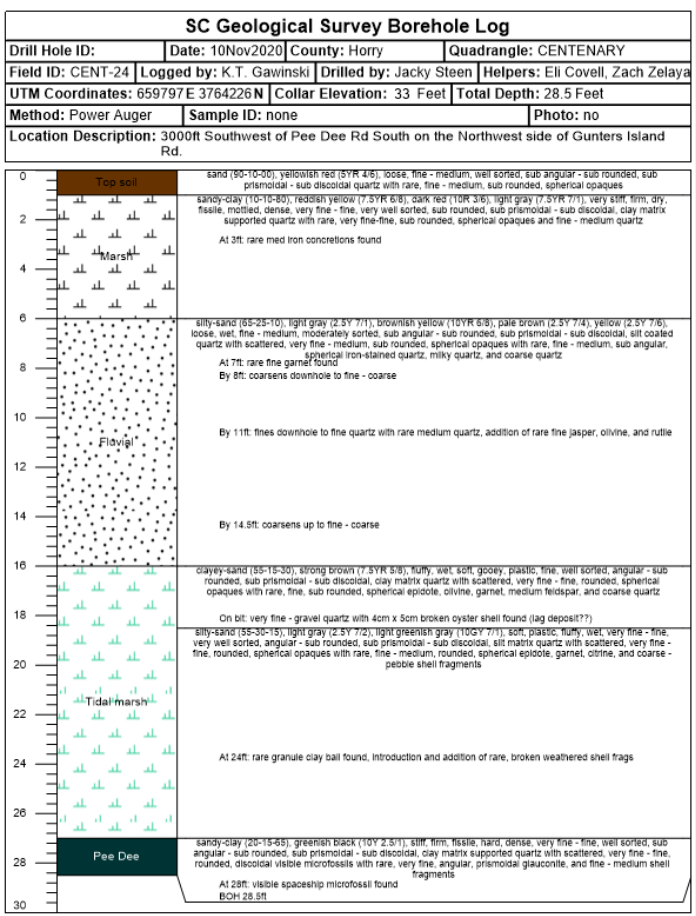
## Lithology

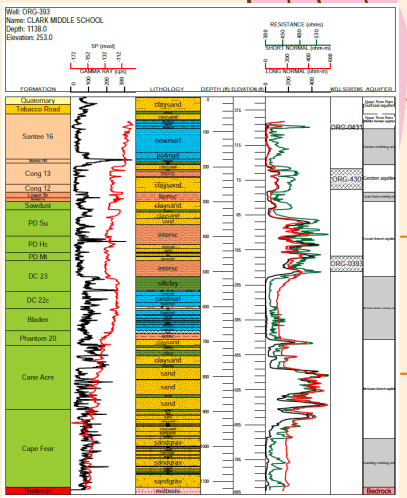
| Hole ID | From | To | Lithology Keyword | Lithology Description | Notes 1 | Notes 2 | Notes 3 | Notes 4 | Notes 5 | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| MUL-6 | 0 | 1 | Road fill | Road fill | | | | | | |
| MUL-6 | 1 | 24 | Marsh | clayey-sand (50-15-35), strong brown (7.5YR 5/8), crumbly f | By 5.0ft: a | From 7.0-{ | At 8.5ft: c( | At 10.0ft: ( | By 13.0ft: | By 16 |
| MUL-6 | 24 | 31 | Fluvial | sand (85-15-00), brownish yellow (10YR 6/8), loose, wet medium -very coarse, moderately sorted, very angular -roun | | | | | | |
| MUL-6 | 31 | 32 | Weathering horizon | clayey-sand (50-15-35), strong brown (7.5YR 5/6), soft, sticky, gooey fine -medium, well sorted, angular -sub rounded | | | | | | |
| MUL-6 | 32 | 44 | Re-worked Pee Dee | clayey-sand (45-15-40), black (5Y 2.5/1), strong brown (7.5Y | From 32.0- | 34.0ft: strong brown (6.5YR 4.0/6) color is mottl | | | | |
| MUL-6 | 44 | 49 | Pee Dee | sandy-clay (10-10-80), greenish black (10Y 2.5/1), light gray | By 47.0ft: | By 48.0ft: addition of scattered very fine visible | | | | |
| MUL-7 | 0 | 4 | Floodplain deposit | clayey-sand (65-10-25), olive yellow (2.5Y 6/6), wet, plyable, medium plasticity, soft fine -coarse, moderately sorted, | | | | | | |
| MUL-7 | 4 | 30 | Fluvial system | sandy-clay (25-10-65), white (5Y 8/1), dark red (2.5YR 3/6), ( | By 7.5ft: a | By 11.0ft: | By 15.0ft: | By 22.0ft: | At 27.0ft: ( | At 28. |
| MUL-7 | 30 | 41 | Marsh | sandy-clay (20-10-70), pale brown (10YR 6/3), sticky, slightl | Rip up cla | At 36.0ft: color changes to light yellowish brow | | | | |
| MUL-7 | 41 | 49 | Pee Dee | sandy-clay (20-15-65), light gray (2.5Y 7/1), slightly stiff, mo | From 41.0 | By 42.0ft: | At 44.0ft: ( | By 45.0ft: | At 46.0ft: ( | At 47. |
| MUL-8 | 0 | 12 | Marsh | clayey-sand (50-15-35), yellowish brown (10YR 5/8), soft, p | By 3.0ft: c( | By 5.0ft: l( | By 7.0ft: c( | By 10.0ft: | At 12.0ft: | color ( |
| MUL-8 | 12 | 20 | Fluvial | silty-sand (65-35-00), pale brown (2.5Y 8/3), loose, wet fine | From 13.0 | From 14.0 | From15.5- | From 16.5 | At 17.0ft: ( | By 19 |
| MUL-8 | 20 | 26 | Marsh | sandy-clay (30-10-60), reddish yellow (5YR 6/8), sticky, goo( | From 24.0- | 26.0ft: addition of dark bluish gray color (8.0B 2 | | | | |
| MUL-8 | 26 | 33 | Salt marsh | clayey-sand (40-20-40), dark bluish gray (10B 4/1), wet, soft | From 31.0- | 33.0ft: color changes to pinkish gray (5.5YR 4.0/ | | | | |
| MUL-8 | 33 | 34 | Lag deposit | sand (85-15-00), pale brown (10YR 6/3), loose fine -medium pebble, very poorly sorted, angular -sub rounded, prismo | | | | | | |
| MUL-8 | 34 | 36.5 | Fluvial | sand (80-20-00), white (10YR 8/1), loose medium -coarse, w | From 36.0- | 36.5ft: color changes to light yellowish brown ( | | | | |
| MUL-8 | 36.5 | 49 | Oyster bed | clayey-sand (65-10-25), light bluish gray (10B 7/1), firm, der | Throughot | At 37.5ft: rare sub-rounded, sub-discoidal coars | | | | |

# Strater Template

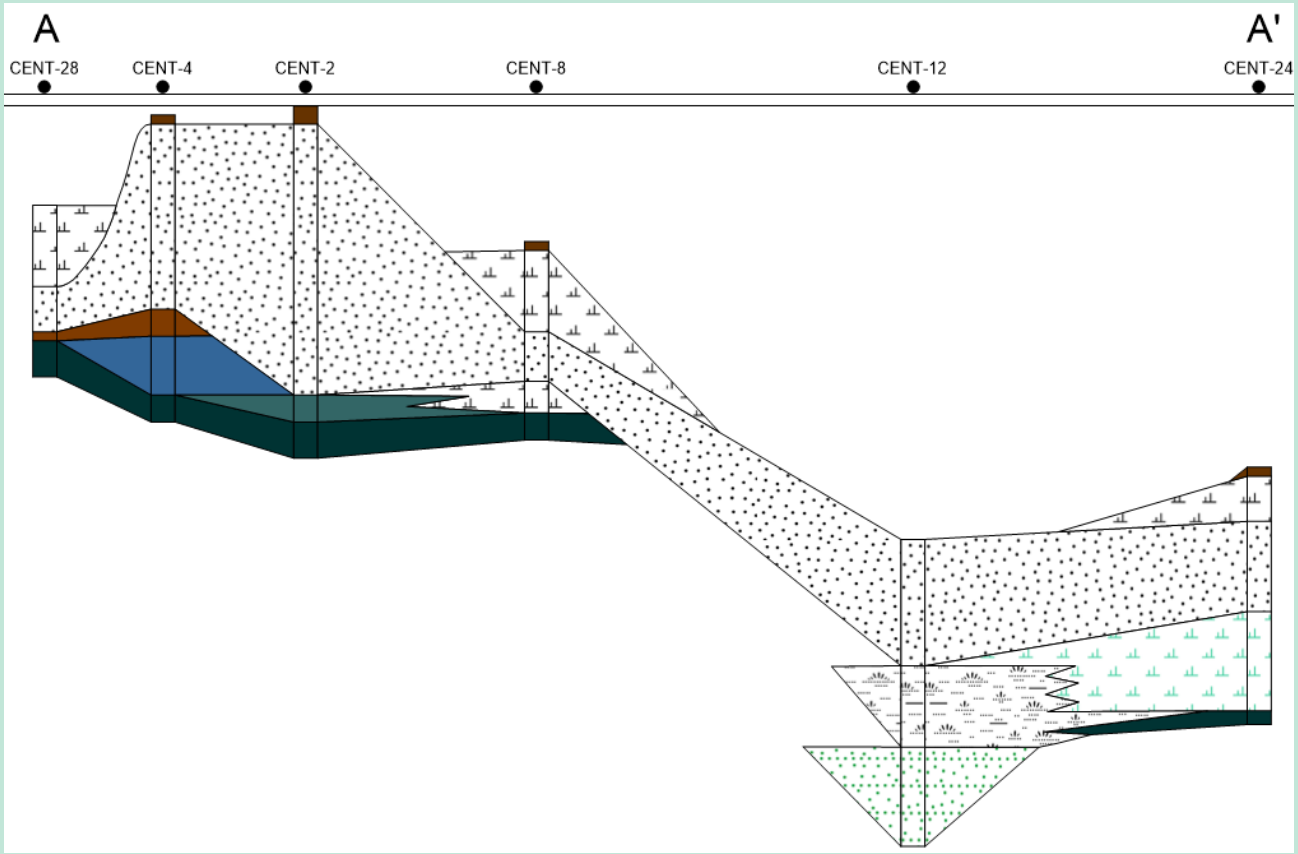


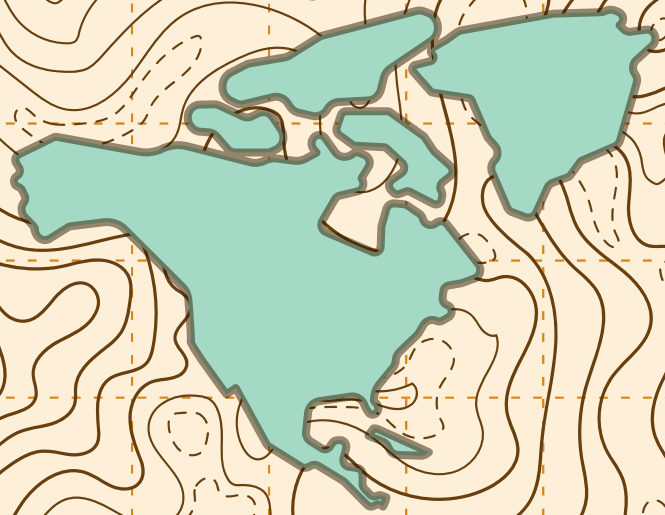



# Cross Section

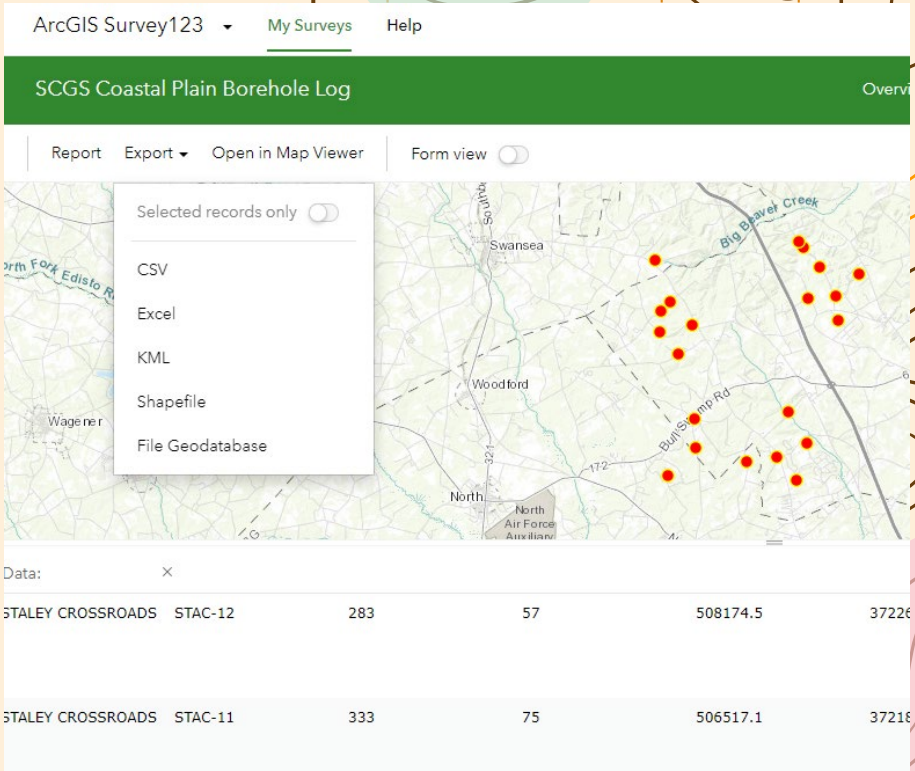




# Boreholes in GeMS

# Methods

- Export shapefile from Survey 123
- Script → fill in “Stations” feature class and “StationsBoreholeLogs” table



# GeMS Feature Classes and Tables

## Stations (GeMS Feature Class)

FieldID
LocationConfidenceMeters
ObservedMapUnit
MapUnit
Symbol
Label
PlotAtScale
DataSourceID
Notes
Stations_ID
TimeDate
Observer
SignificantDimensionsMeters
LocationMethod
GPSX
GPSY
PDOP
MapX*
MapY*
ElevationMeters*
LocationDescription*
LoggedBy*
County*
Drilled By*
Helpers*
SampleID*
Photo*
Method*

## StationsBoreholeLogs*

FieldID
TopContactDepth_ft
TopContactDepth_m
BottomContactDepth_ft
BottomContactDepth_m
TopContactElevation_ft
TopContactElevation_m
BottomContactElevation_ft
BottomContactElevation_m
BoreholeUnitThickness_ft
BoreholeUnitThickness_m
BoreholeUnit
Description
IdentityConfidence
DataSourceID
StationsBoreholeLogs_ID

*Added

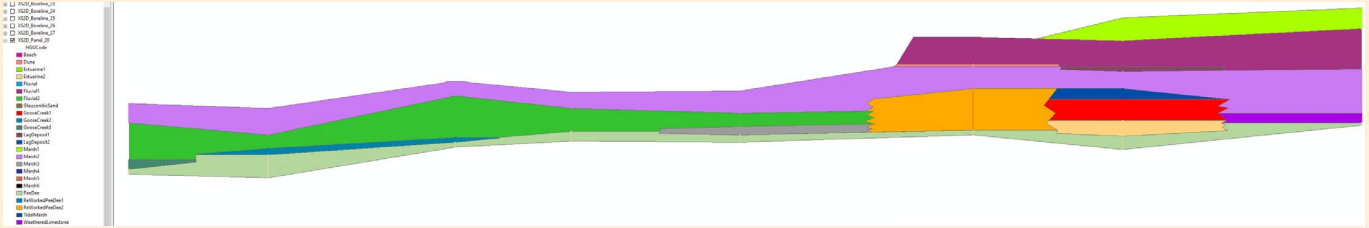
# 3- D Geology

Using Archydro by Aquaveo

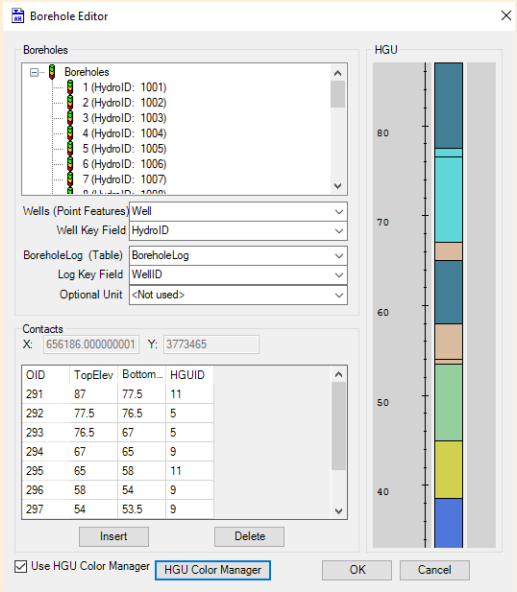
## DISCLAIM

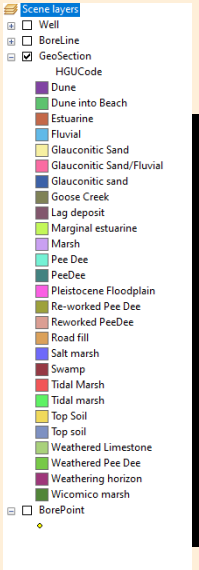
"While it is important to recognize the importance of geologic features for groundwater analysis, we did not attempt to create a comprehensive geologic map database in the groundwater data model design" (Strassberg et al., 2011).

## Cross Sections

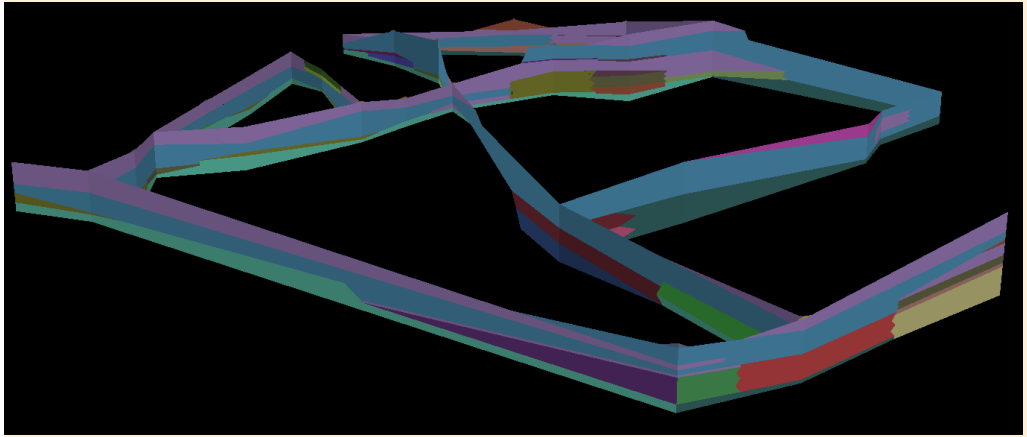


## Borehole Viewer

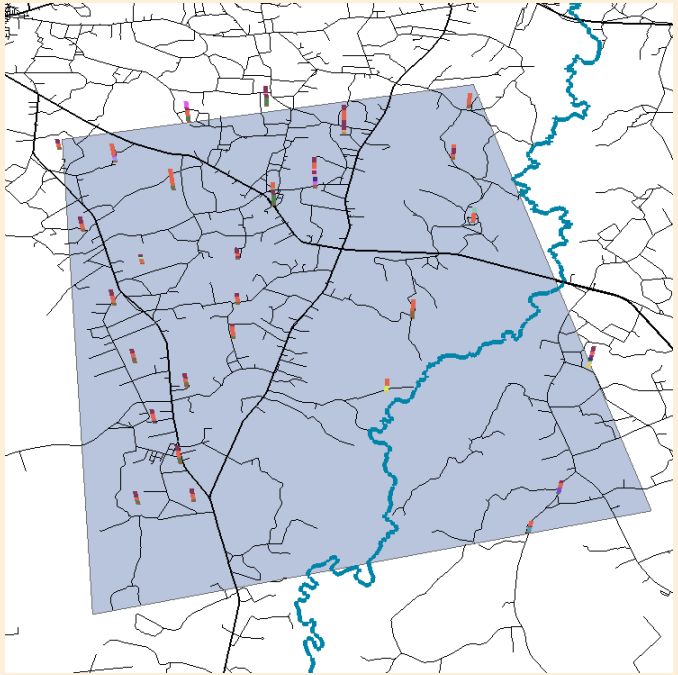


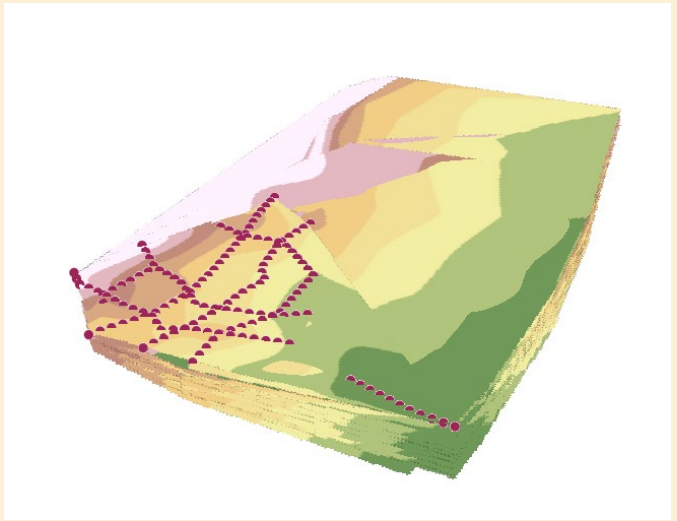

## Fence Diagrams



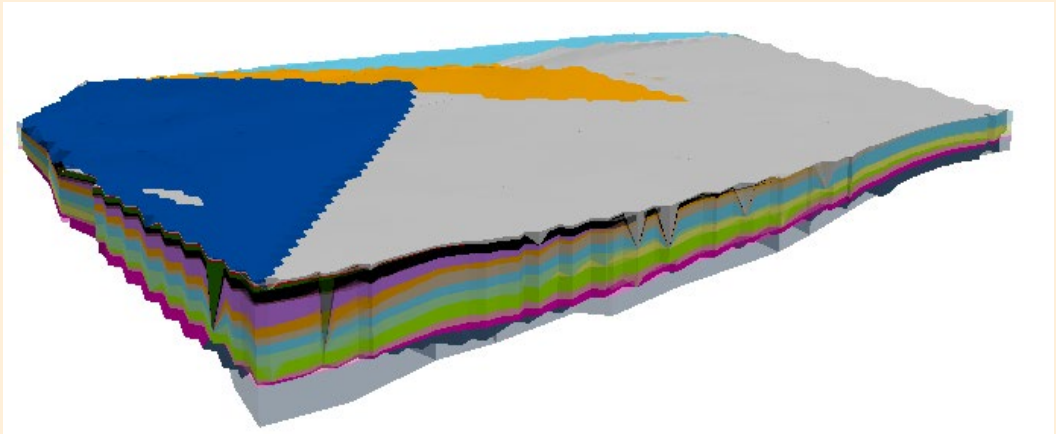
## Borehole Visualization



## Raster Creation



## Solids



# Thanks!

MorrowR@dnr.sc.gov

https://www.dnr.sc.gov/geology/