

NCGS: Positioning NC today and for the future!



North Carolina Geodetic Survey

Establishing and Maintaining
the Official Survey Base
in North Carolina



NC General Statutes on county boundaries



- **G.S. § 153A-17. Existing boundaries.**
The boundaries of each county shall remain as presently established, until changed in accordance with law. (1973, c. 822, s. 1.)
- **G.S. § 153A-18. Uncertain or disputed boundary.**
Provides directions and procedures for resurveying uncertain or disputed county boundary lines.

If adjacent counties along a boundary elect to change the county line from its original location (as defined by law), then ratification by the NC General Assembly is required.



G.S. 153A-18(a)

Resurvey of an uncertain county line



- Two or more counties may cause the boundary to be surveyed, marked, and mapped
- The participating counties may appoint special commissioners to supervise the surveying, marking, and mapping

Upon request of each county along the uncertain/ambiguous county line, the NC Geodetic Survey can provide assistance with resurveying the county line.



G.S. 153A-18(a)

Resurvey of an uncertain county line



- Each of the participating county's Board of Commissioners must ratify the resurvey with a resolution
- Each of the participating county's ratification resolution must be referenced on the map of resurvey with the following information: date & minutes page
- The map of resurvey must be recorded in:
 - Each of the participating county's Register of Deeds office
 - Secretary of State's office



Research methods



- Original legislative descriptions
- Original surveys or first surveys
- Subsequent resurveys
- Historical maps and records of county line
- Witnesses to county line:
 - Property deed descriptions
 - Historical local witnesses



Report of research findings



- Research discovery information (evidence)
- Weighting of evidence to determine the best evidence
- Preliminary map presents the resurvey line using the best evidence of the original location



Acceptance or Redefining



- **The participating counties may elect to either:**
 - Accept the resurvey line
 - ~ or ~
 - Redefine the line (change) through legislative process



County Boundary Surveys in Progress



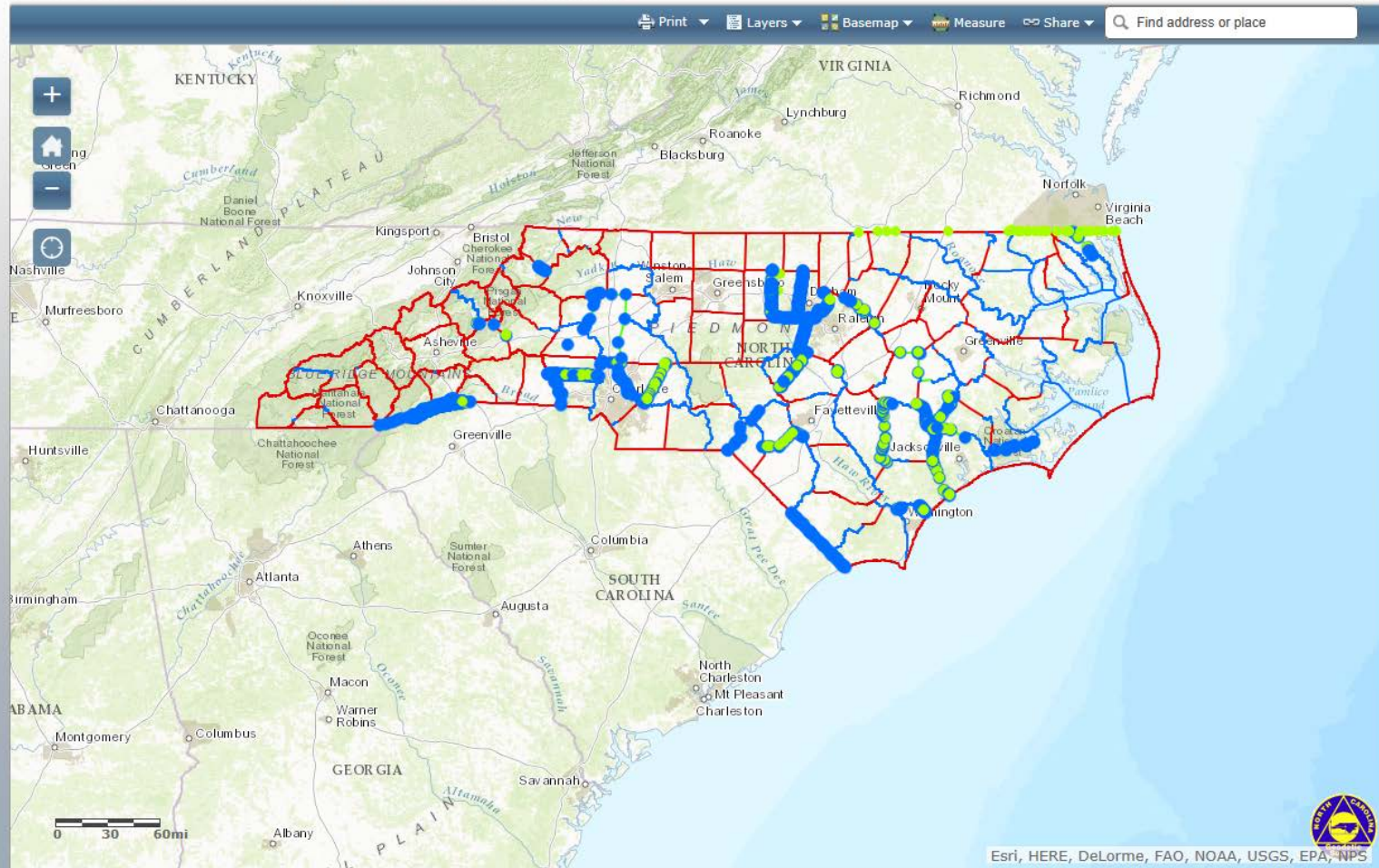
- Mitchell-Yancey
- Cabarrus – Rowan
- Harnett – Wake
- Chatham – Harnett – Wake
- Alamance – Guilford
- McDowell – Mitchell
- Jackson – Macon
- Davie – Yadkin
- Bladen – Columbus – Brunswick
- Greene – Lenoir
- Granville – Franklin



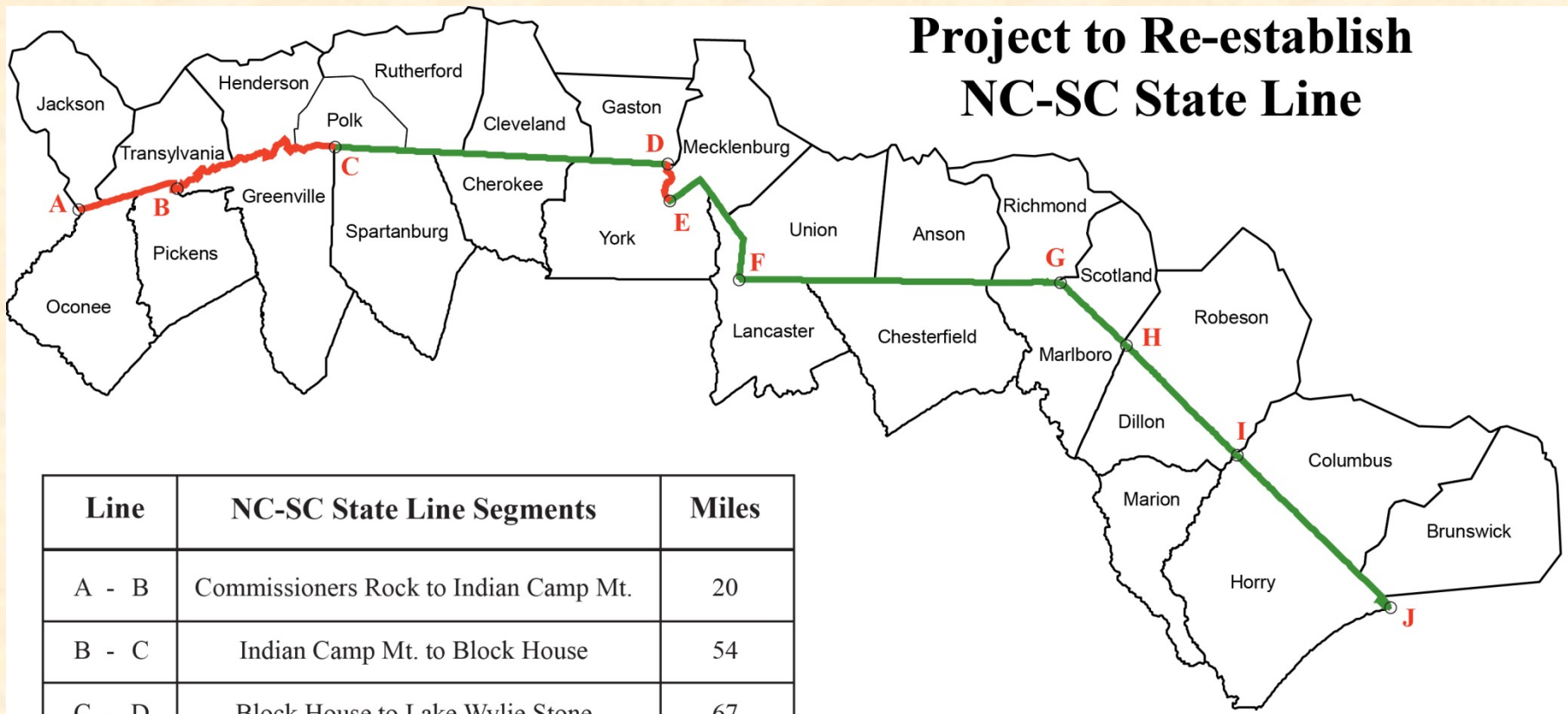
How did North Carolina get its shape?



NC State and County Boundary Status



Project to Re-establish NC-SC State Line

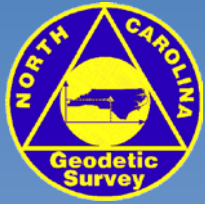


Line	NC-SC State Line Segments	Miles
A - B	Commissioners Rock to Indian Camp Mt.	20
B - C	Indian Camp Mt. to Block House	54
C - D	Block House to Lake Wylie Stone	67
D - E	Center Line of Old Catawba River Bed	8
E - F	Lake Wylie to North Corner	30
F - G	North Corner to 1905 Marlboro County Break Point Monument	64
G - H	Marlboro County SE - NW Line	18
H - I	Dillon County Line	31
I - J	Horry County Line	42

May 6, 2013 Status

- Re-established boundary approved by the NC-SC Joint Boundary Commission 82 miles
- Re-established boundary tentatively approved by the NC-SC Joint Boundary Commission 252 miles

Total 334 miles



How did North Carolina get its shape?



- NC Boundary Commission recommends that we start work on the NC-VA boundary
- NC-SC boundary
 - S575 and H834

How did North Carolina get its shape?

- **North Carolina/Virginia boundary**
 - In 1728 by his Majesty's Order, assented to by the Lords Proprietors [appointed rulers], "*The Dividing Line*" was to be surveyed, "*that neither the King's Grants may hereafter encroach upon the Lords Proprietors, nor theirs on the Right of his Majesty.*"
 - William Byrd's crew surveyed the line in 1728, but ran into a few issues:

The map shows the 36°30' North latitude line. A red line represents the line actually surveyed by William Byrd in 1728, which follows the latitude line from the Potomac River to the Currituck River. A dashed line represents the 'westerly' line called for in the charter to connect the Potomac River to Wyanoke. A vertical double-headed arrow indicates a 6-mile discrepancy between the surveyed line and the westerly line. Other geographical features shown include Nottoway Creek, Blackwater Creek, Wyanoke, and Chowan River.



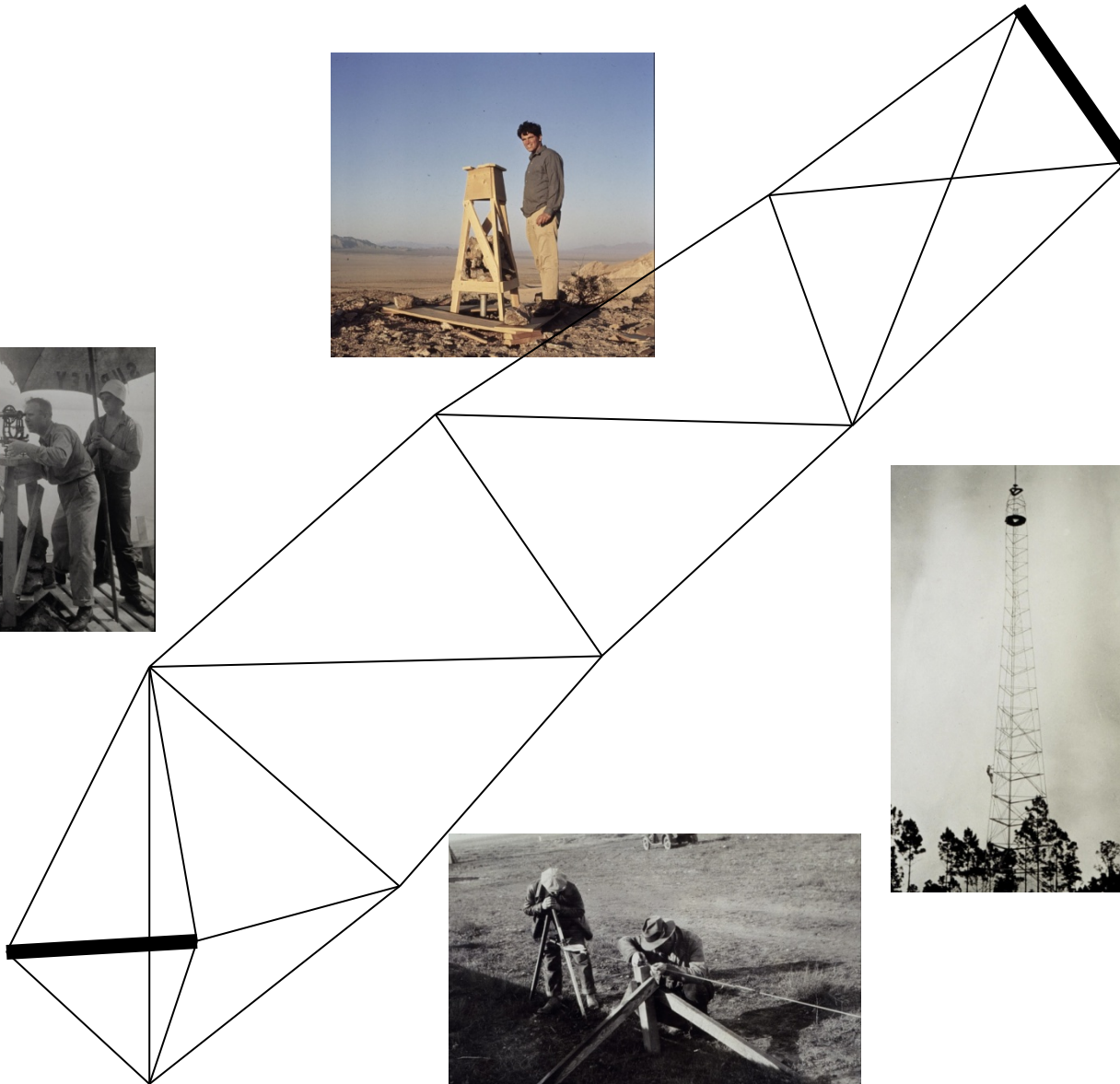
Changes to NAD83 (using North Carolina as an example)

- **NAD83(1986)**-Started as Classic horizontal network
- **NAD83(1995)**-High Accuracy Reference Network (HARN)
 - Observed with GPS using some CORS as control
- **NAD83(2001)**–Federal Base Network (FBN) and Cooperative Base Networks (CBN)
 - Observed with GPS with Tight CORS control. Also aimed at increasing ellipsoid height accuracy
- **NAD83(NSRS2007)**
 - CORS system primary control, used only quality GPS projects. CORS system well developed.
- **NAD83(2011)** - Current Adjustment

Coordinate shift between NAD83 realizations at station SMITHPORT

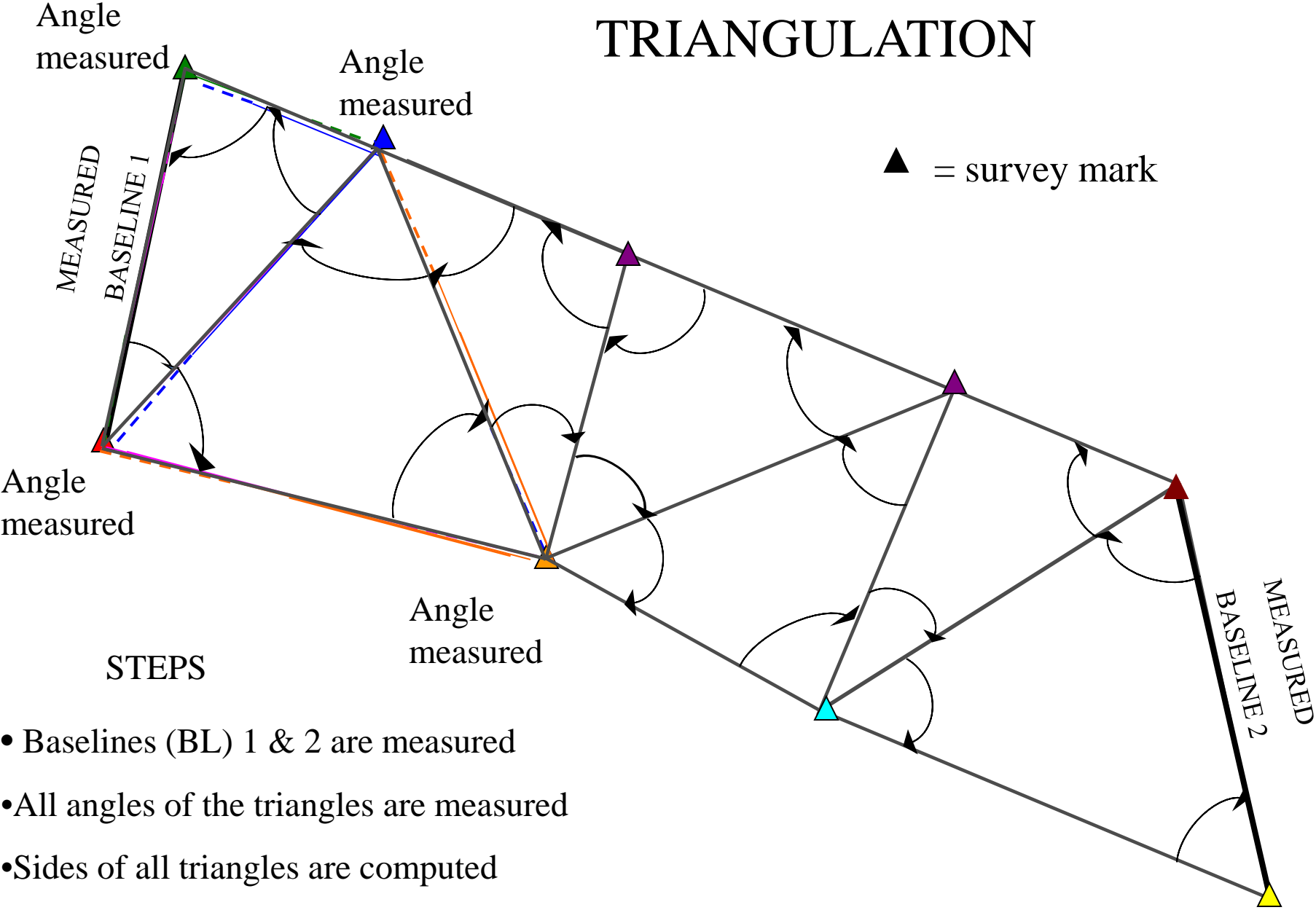
Station/ (datum)	Northing (m)	Easting (m)	Δ Northing (m) from preceding datum	Δ Easting (m) from preceding datum
SMITHPORT (83/86)	199,354.569	665,067.183		
SMITHPORT (83/95)	199,354.397	665,067.513	-0.172 m -0.56 USFt	0.330 m 1.08 USFt
SMITHPORT (83/2001)	199,354.384	665,067.503	-0.013 m -0.04 USFt	-0.010 m -0.03 USFt
SMITHPORT (NSRS2007)	199,354.377	665,067.499	-0.007 m -0.023 USFt	-0.004 m -0.013 USFt
SMITHPORT (NAD83/2011)	199,354.375	665,067.522	-0.002 m -0.006 USFt	0.023 m 0.075 USFt

Triangulation



TRIANGULATION

▲ = survey mark



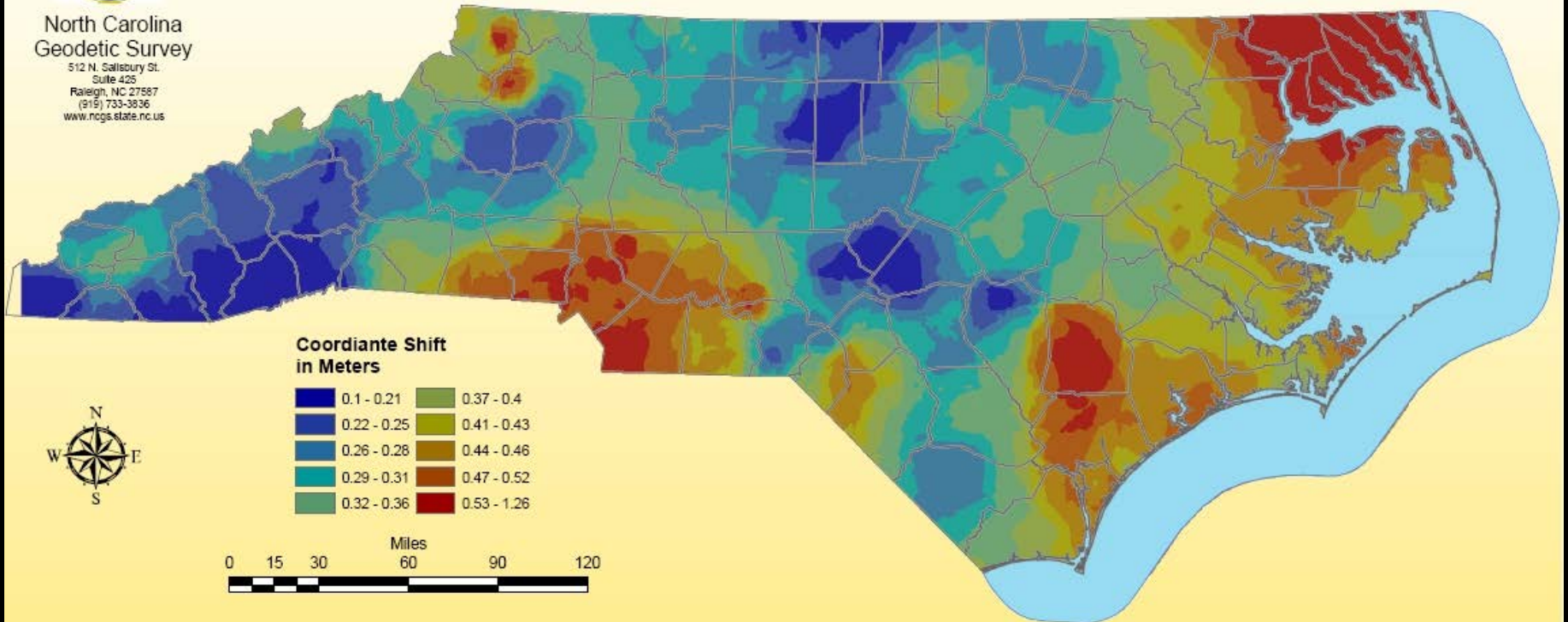
- Baselines (BL) 1 & 2 are measured
- All angles of the triangles are measured
- Sides of all triangles are computed
- Computed length BL2 is compared to measured length of BL2

Coordinate shift (m) between NAD 83/86 and NAD 83(NSRS2007) in North Carolina



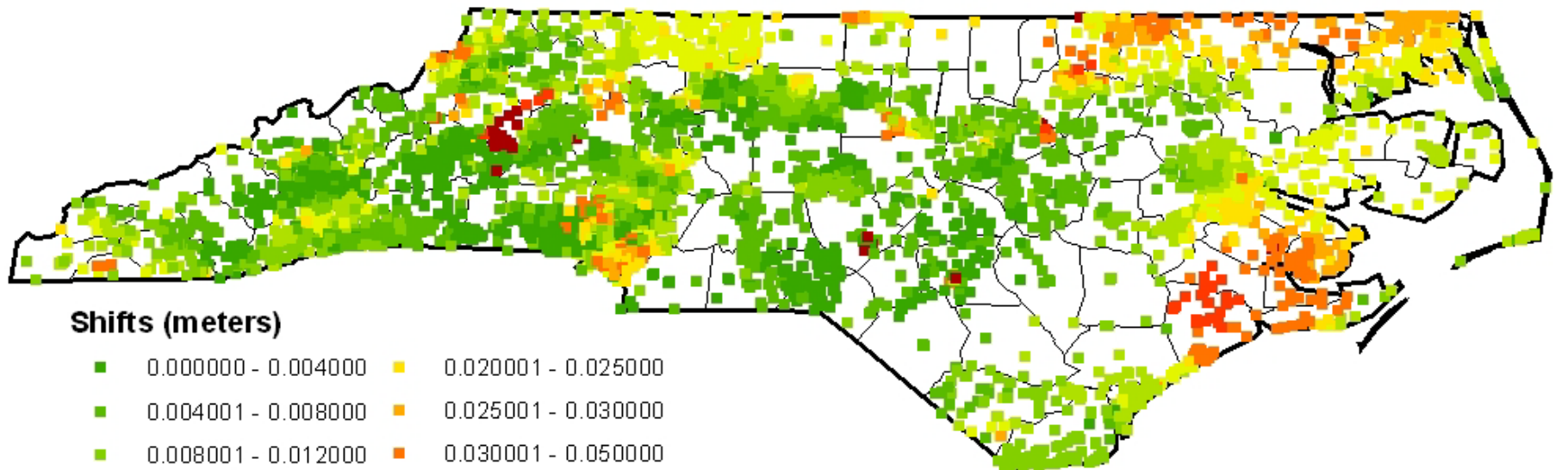
North Carolina
Geodetic Survey
512 N. Salisbury St.
Suite 425
Raleigh, NC 27687
(919) 733-3836
www.ncgs.slate.nc.us

North Carolina NAD 83/86 to NSRS 2007 Coordinate Shift



Coordinate shift (m) between NAD 83/2001 and NAD 83(NSRS2007) in North Carolina

North Carolina Horizontal Position Shifts - Readjustment of 2007

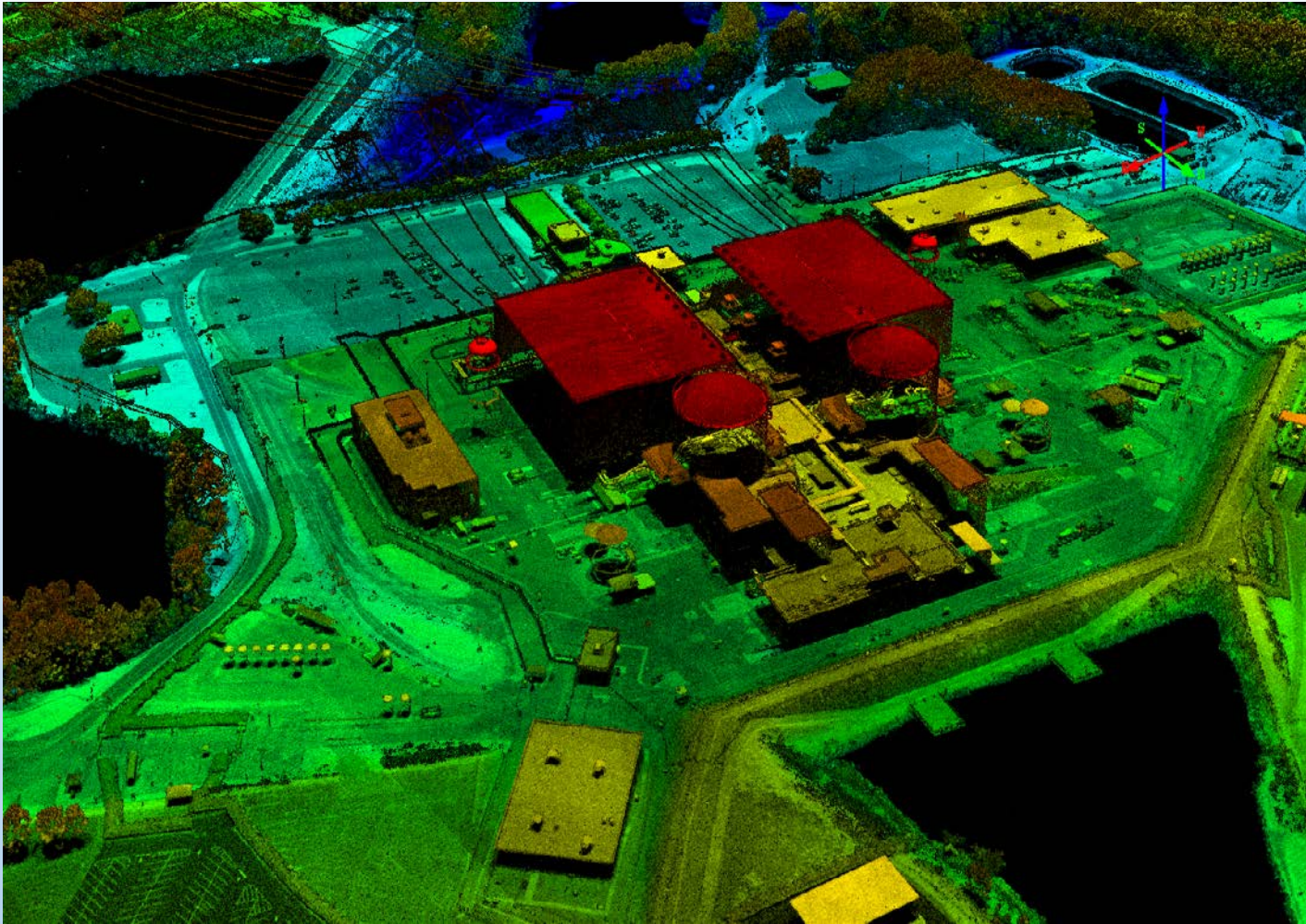


Shifts (meters)

■ 0.000000 - 0.004000	■ 0.020001 - 0.025000
■ 0.004001 - 0.008000	■ 0.025001 - 0.030000
■ 0.008001 - 0.012000	■ 0.030001 - 0.050000
■ 0.012001 - 0.016000	■ 0.050001 - 0.100000
■ 0.016001 - 0.020000	■ 0.100001 - 0.370000

0 20 40 80 120 160 Miles

National Geodetic Survey
National Oceanic and Atmospheric Administration

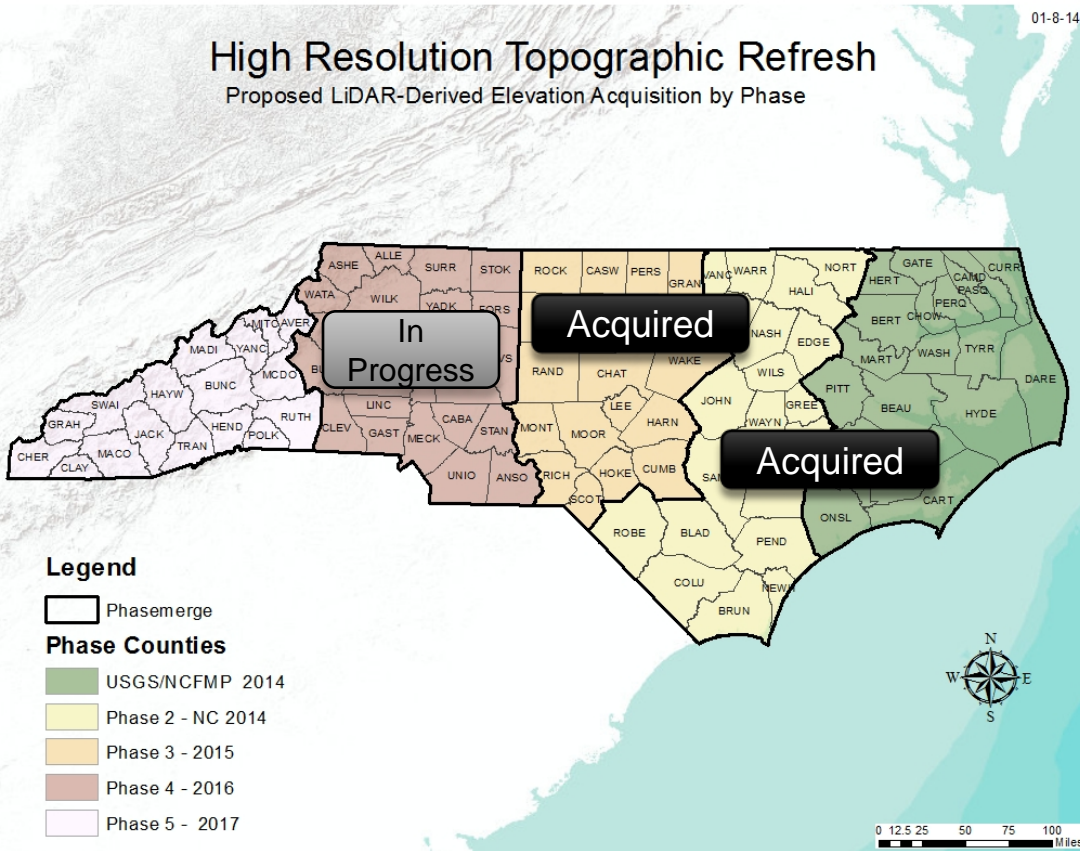


North Carolina Lidar Acquisition

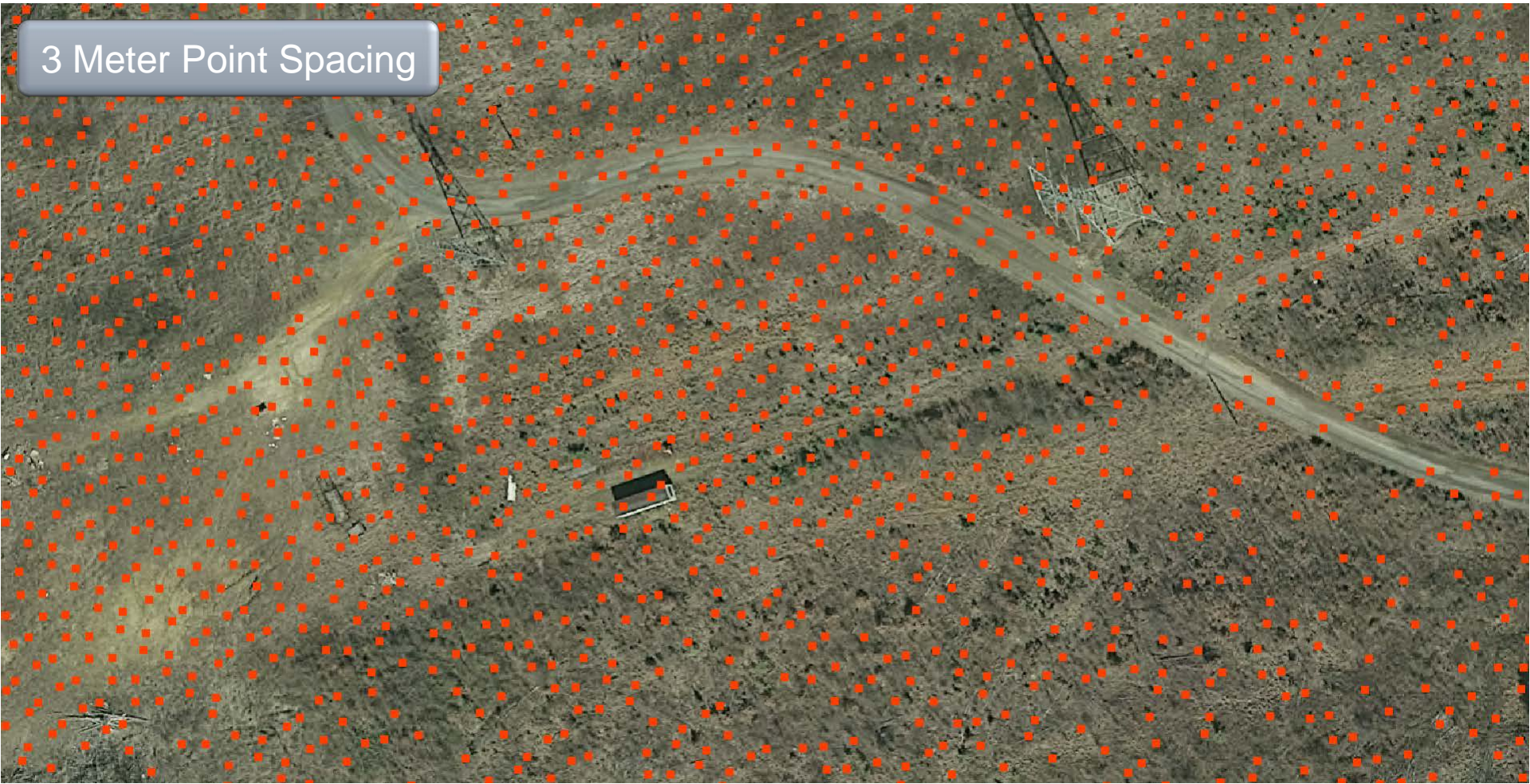
STATEWIDE PHASES

Original Plan

- The Plan put forward was a 5 phase 4 year plan
- Phase 1- USGS
- Phase 2- NC
 - Both occurred in 2014
- Phase 3 – NC (2015)
 - Wrapping up this phase
- Phase 4
 - Data collection in progress

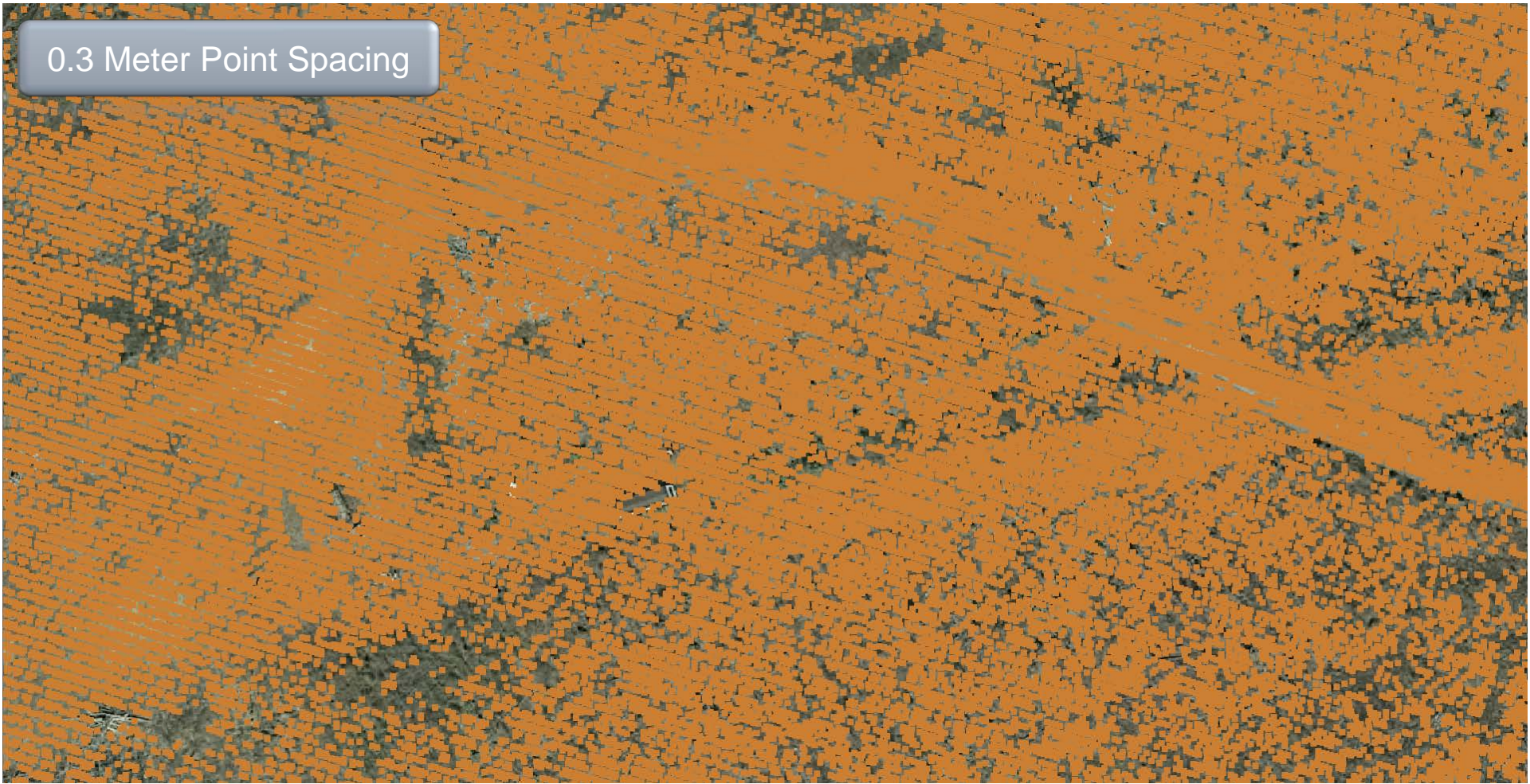


3 Meter Point Spacing



3 Meter Elevation Model (2003 NC LiDAR)

0.3 Meter Point Spacing

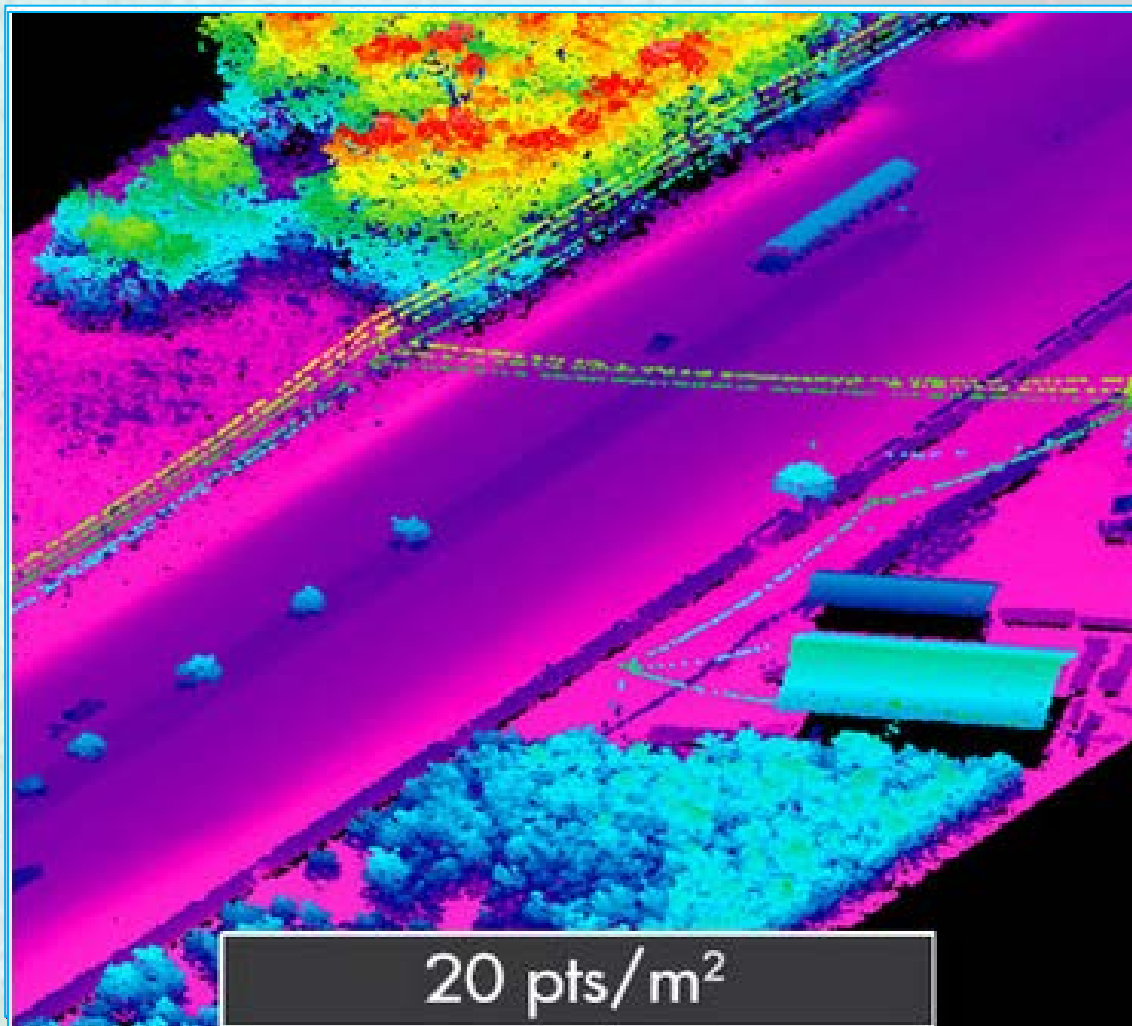


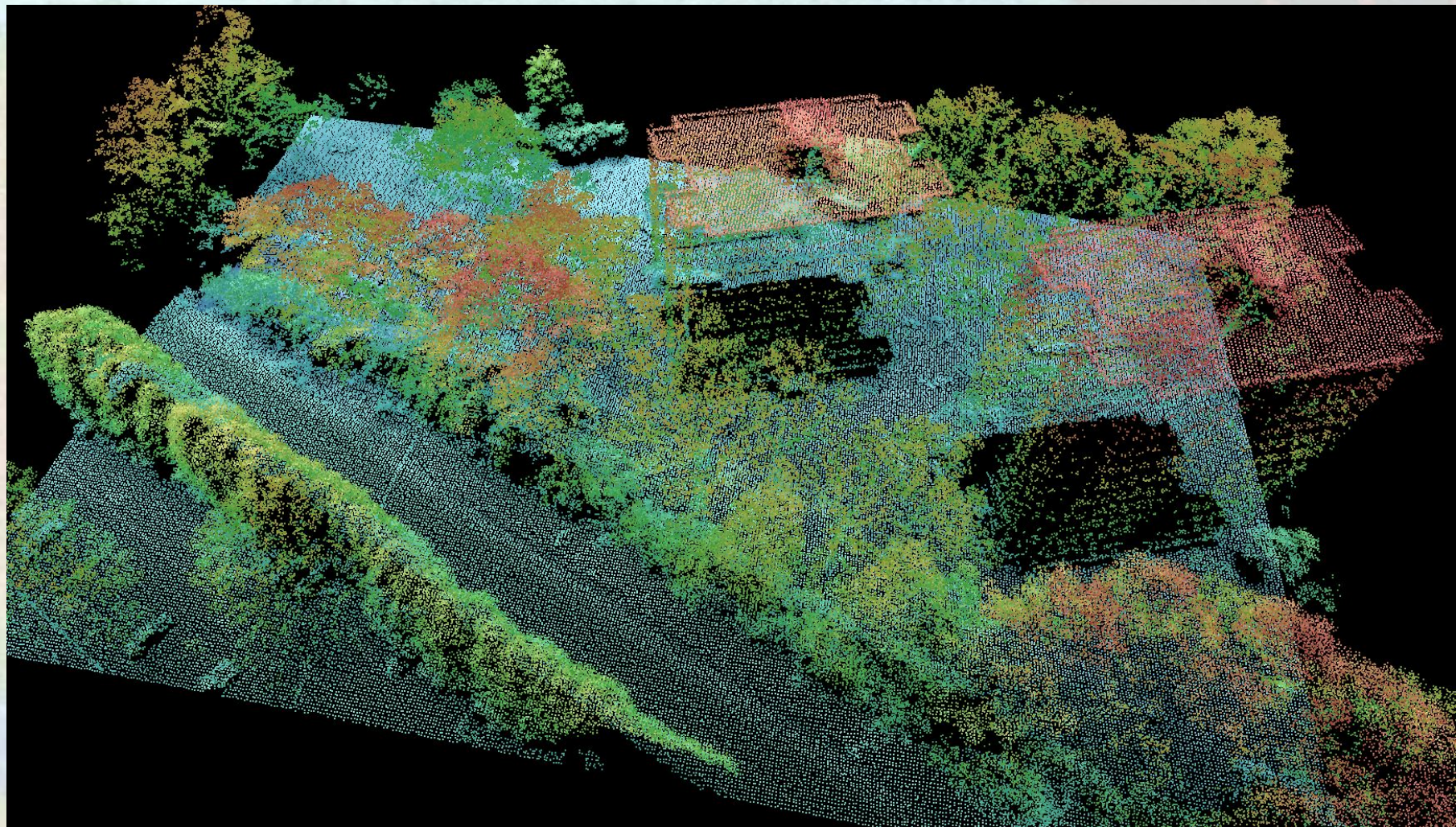
QL2 Elevation Model

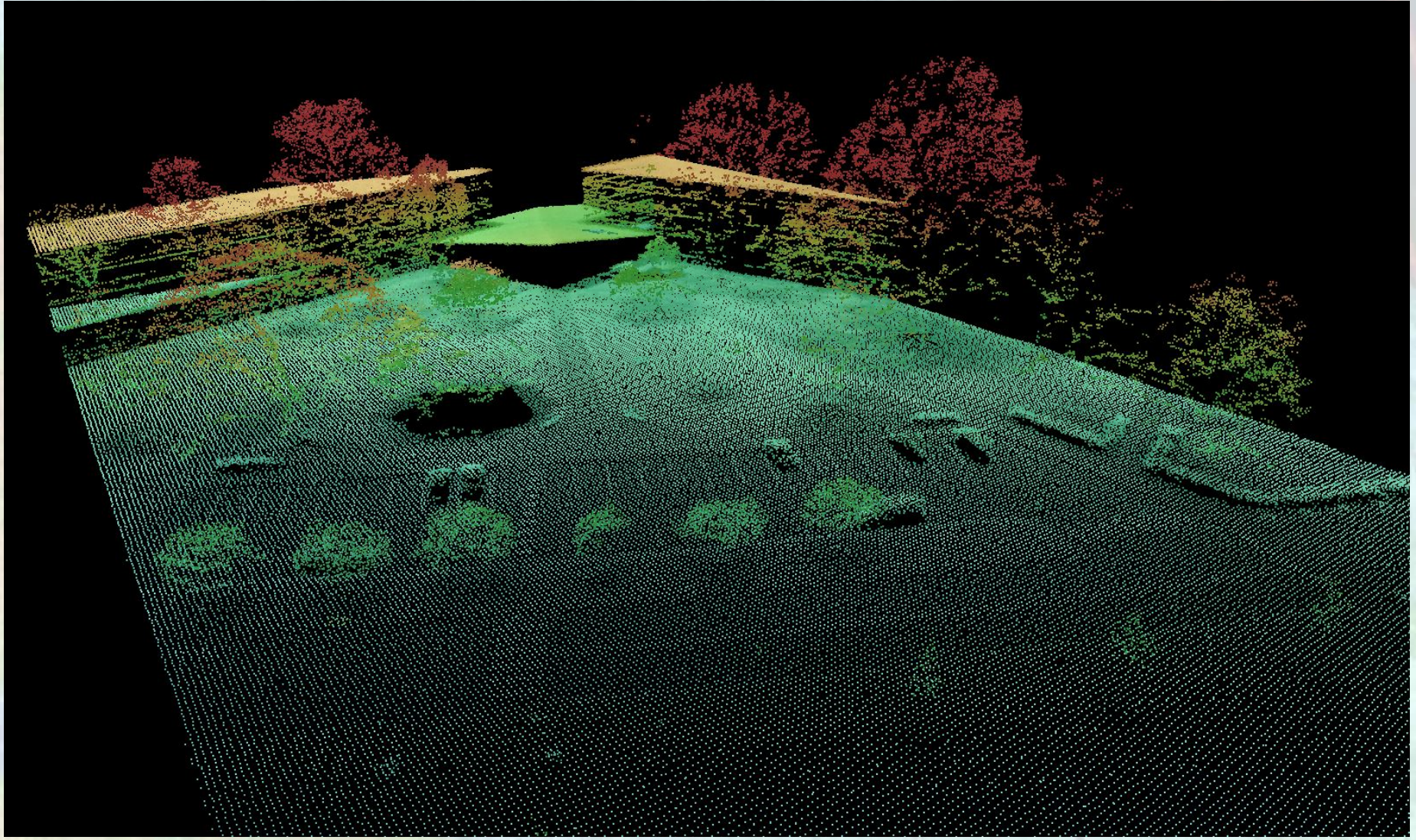
2016 Data Collection

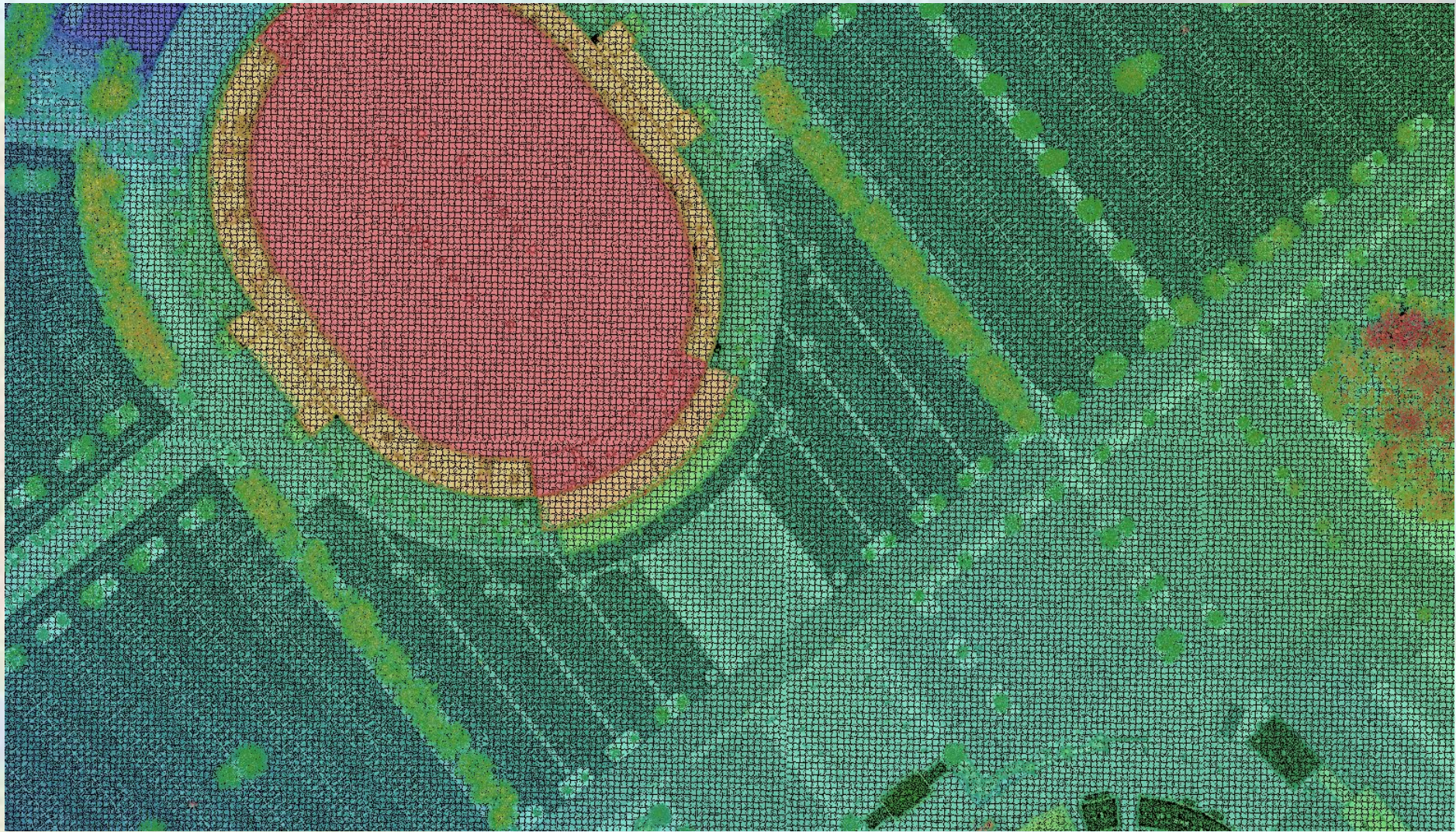
Geiger Mode Sensor

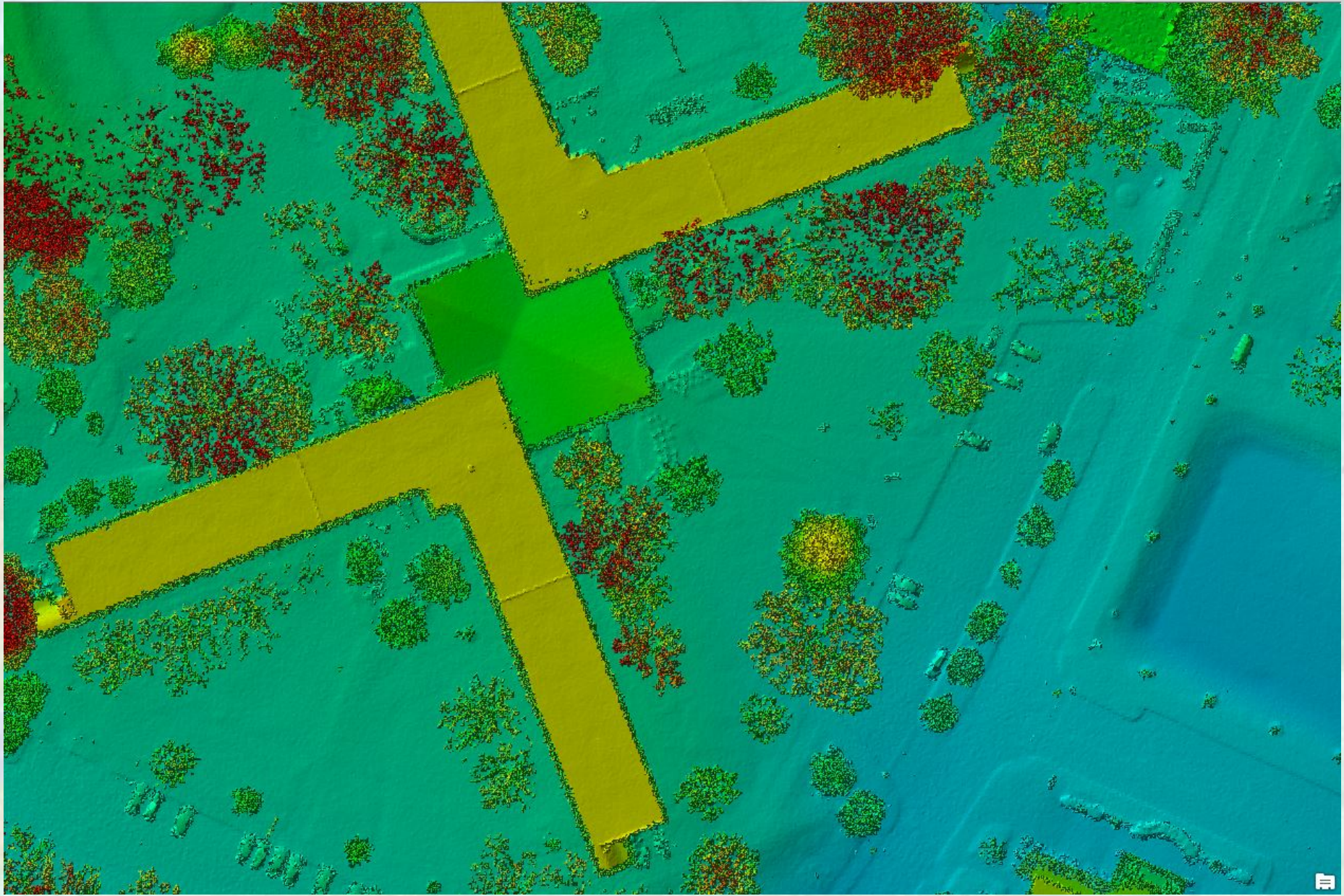
- Pilot test area in Mecklenburg County.
 - 20 points per square meter with nominal post spacing of 0.7 meters.
 - 8 ppm deliverable at same or reduced cost.
 - Data collected will support a 9.25 cm (3.36 inches) RMSEz.



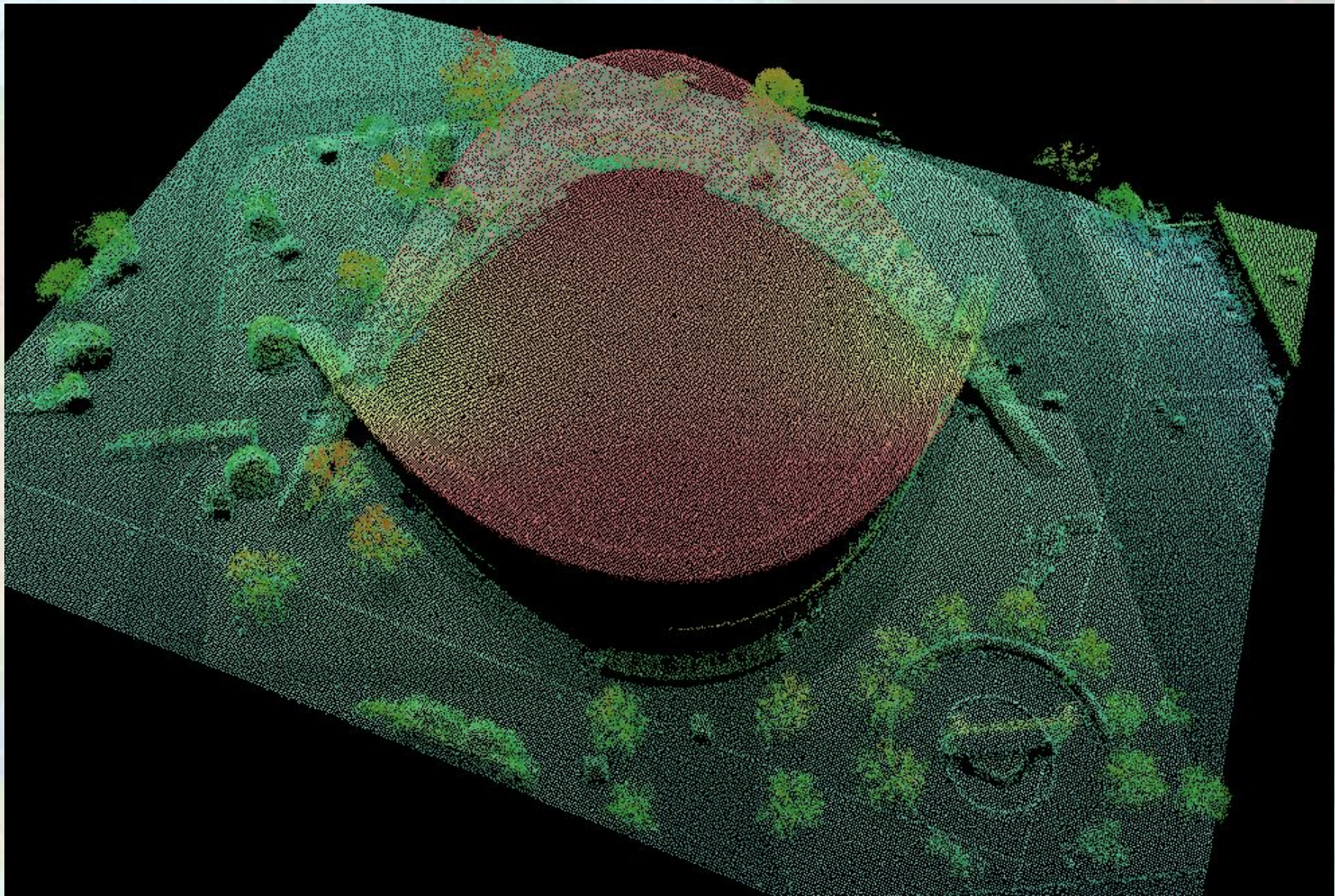


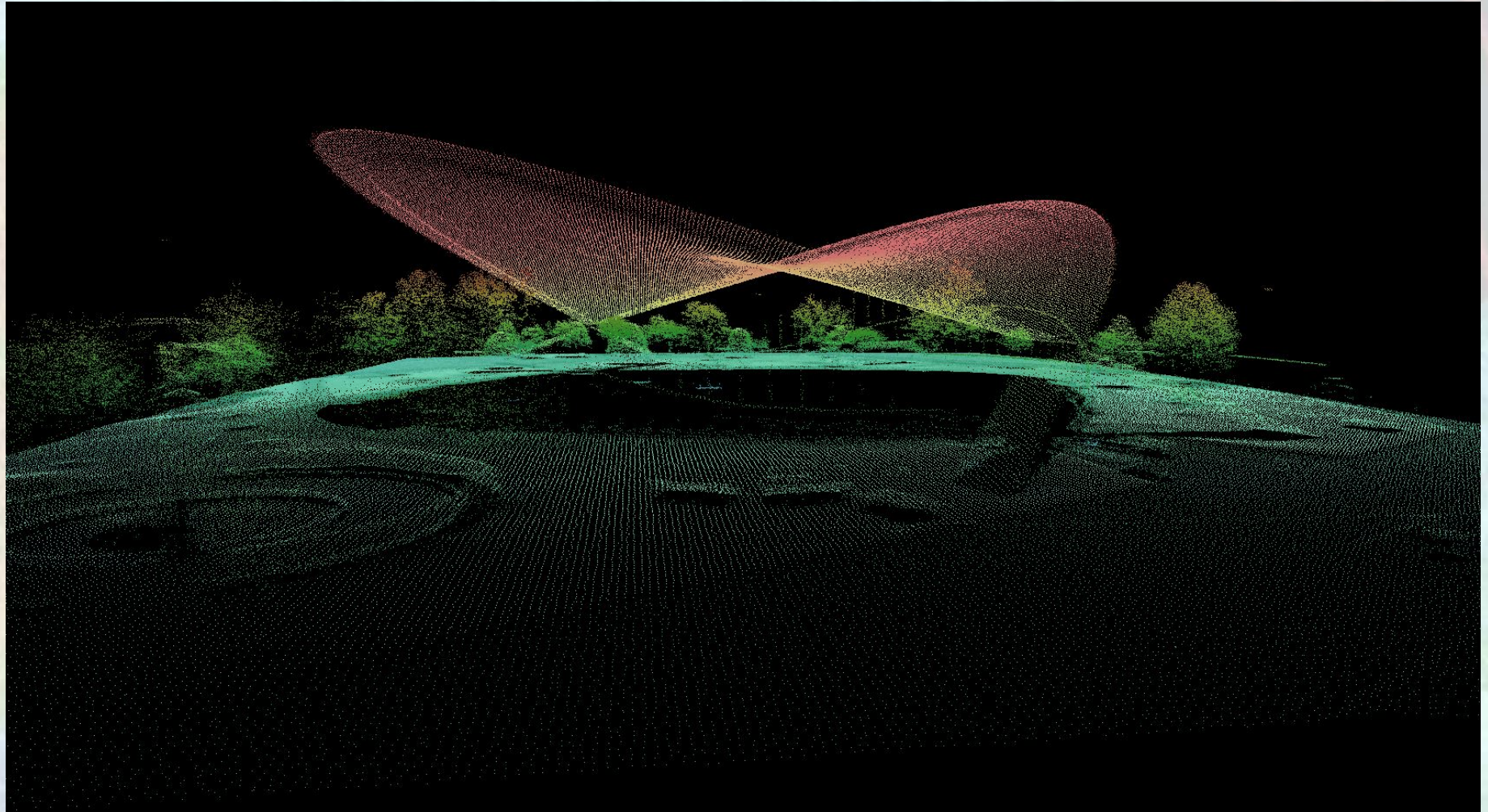


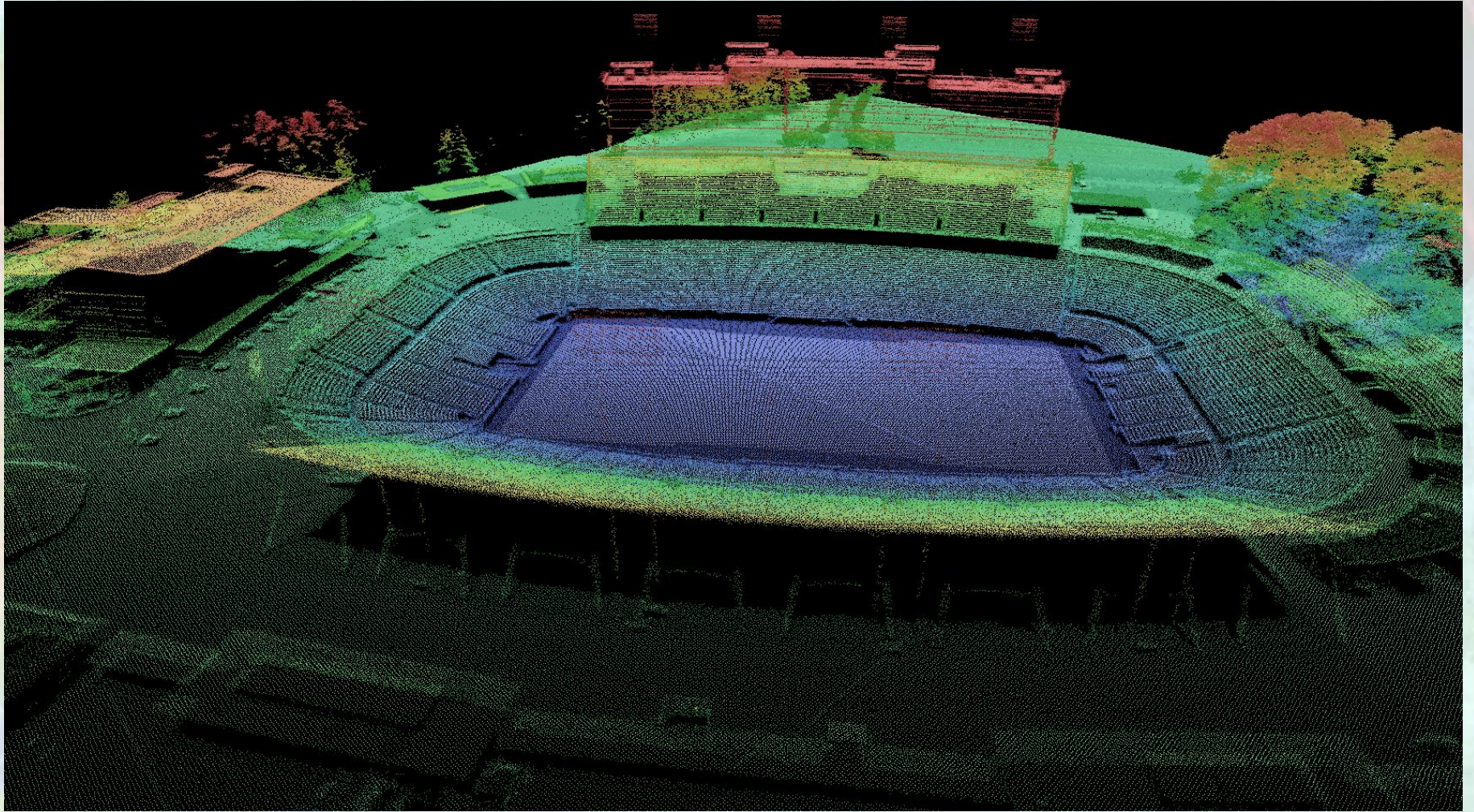


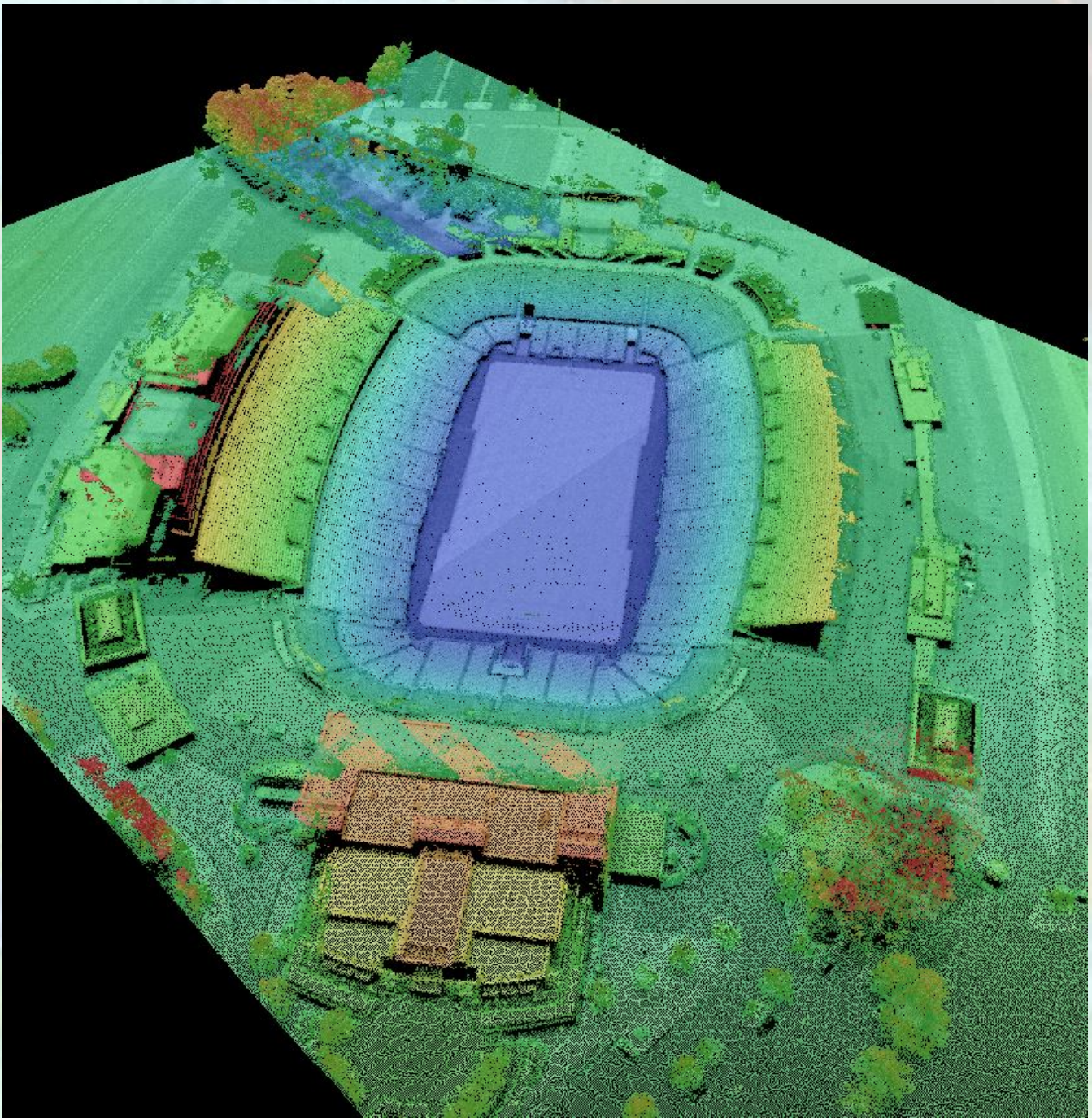














Login with NCID

A North Carolina ID (NCID) is required.
Don't have a NCID? Sign up [here](#).

NCID USER NAME:

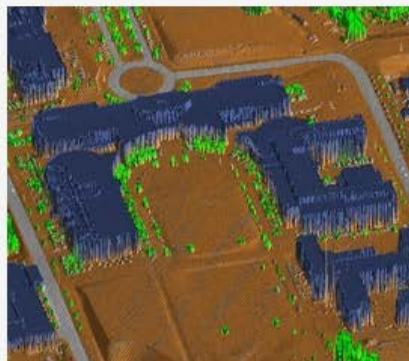
skaufman

PASSWORD:

.....

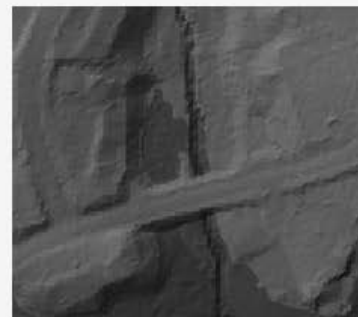
LOGIN

Login here for QL2 LiDAR



This data is Quality Level 2 (QL2) and was collected at a spacing of approximately 2 points per meter. All returns classified data is available.

Download legacy LiDAR at NC FRIS



All counties in North Carolina currently have legacy bare earth LiDAR from the initial statewide collection conducted from 2001-2005. This data was collected at a spacing of approximately 1 point per 3-4 meters.



This is a beta version of the Spatial Data Download site.

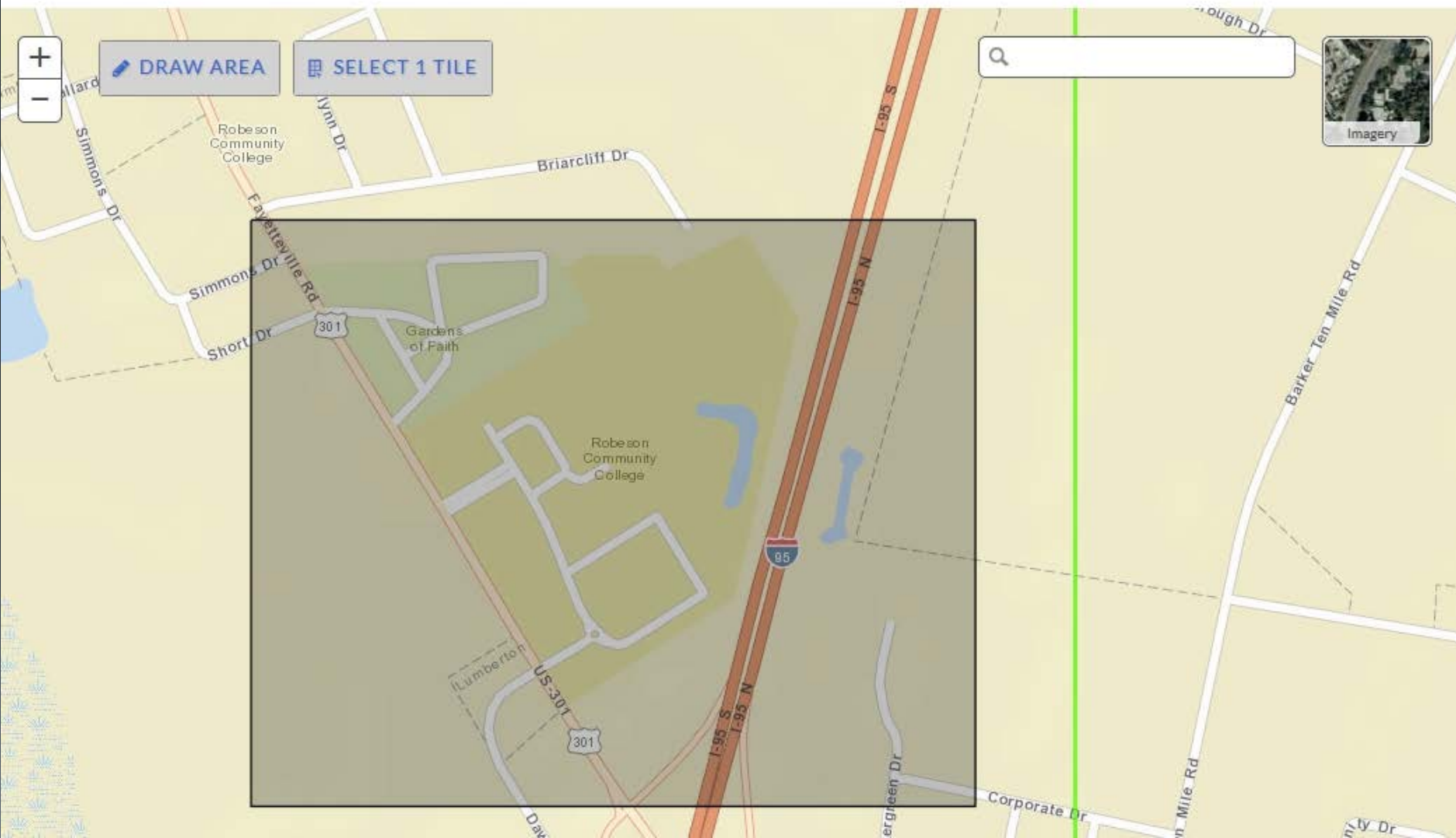
This is not the final version and you may encounter downtime, errors or bugs. If you do: [Email Your Feedback](#)

NCFMP will not be liable for any loss suffered by any party as a result of their use of the site. Any downloading of material is done at the users own risk and the user will be solely responsible for any loss that results from such activities.

❓ QL2 LiDAR is available on the **green areas** on the map. To select an area crossing multiple tiles, click "Draw Area" and then draw a small box on the map. Areas must be less than 4 tiles.

❓ Click Next to Continue

NEXT



QL2 LIDAR DATA DOWNLOAD

To request an entire city or county, go to the [Large Data Request](#) page. Download legacy LiDAR at [NC FRIS](#)



Select Area



Select File Output



Submit Request

Select the classes of LiDAR you wish to include in your output **.LAS** file.

ALL CLASSES

This dataset contains all classes including ground, roads, vegetation and water

BARE EARTH

This dataset represents the earth's surface with all vegetation and human-made structures removed. The output .LAS file will contain classes 2 (Ground) and 13 (Roads).

INDIVIDUAL CLASSES

- Ground
- Strata/Vegetation
- Buildings
- Roads
- Bridges

PREVIOUS

SUBMIT REQUEST





QL2 LIDAR DATA DOWNLOAD

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Select Area



Select File Output



Submit Request

Your request has been submitted!

Jobs are processed in the order they are received and may require up to 24 hours for processing. You will receive an email from rmclipandship@ncdps.gov when your files are ready for download. Please make sure to add rmclipandship@ncdps.gov to your safe sender list.

[SUBMIT ANOTHER REQUEST](#)

[VIEW REQUEST HISTORY](#)



This is a beta version of the Spatial Data Download site.

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NCFMP will not be liable for any loss suffered by any party as a result of their use of the site. Any downloading of material is done at the users own risk and the user will be solely responsible for any loss that results from such activities.

SPATIAL
Data Download

NC Floodplain Mapping Program
4105 Reedy Creek Drive
Raleigh, NC 27607

Mailing Address
4218 Mail Service Center
Raleigh, NC 27699-4218

Phone: (919) 715-5711

REQUEST SUMMARY

Request Summary

⌵ Click the column names to sort your requests.

🕒 Pending requests may take up to 24 hours to process. You will receive an email when your data is ready for download.

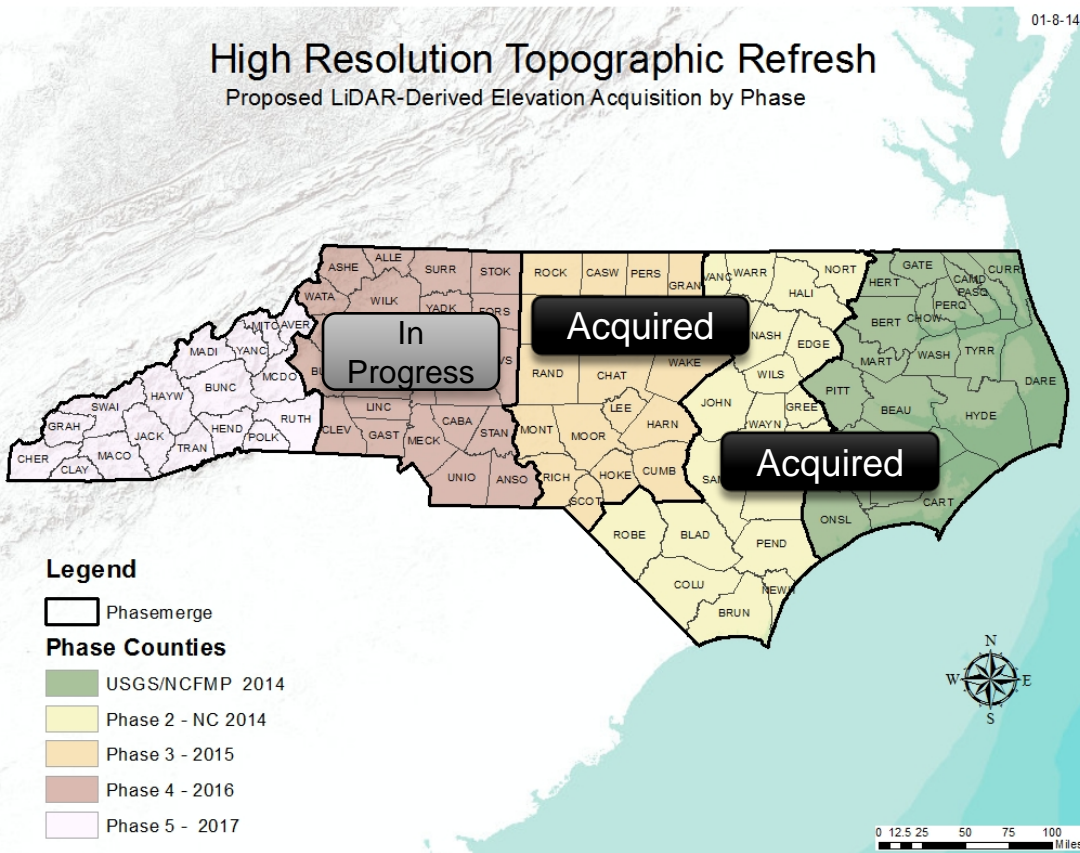
⬇️ Click the Download button to access your completed data request files.

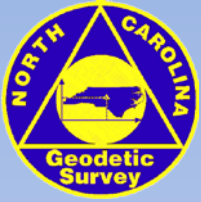
Status	ID	Date	Type	
🕒 Pending	61	3/11/2015 9:30:40 AM	Rectangle	
✅ Complete	32	3/2/2015 1:54:51 PM	Rectangle	⬇️ DOWNLOAD

STATEWIDE PHASES

Original Plan

- The Plan put forward was a 5 phase 4 year plan
- Phase 1- USGS
- Phase 2- NC
 - Both occurred in 2014
- Phase 3 – NC (2015)
 - Wrapping up this phase
- Phase 4
 - Data collection in progress





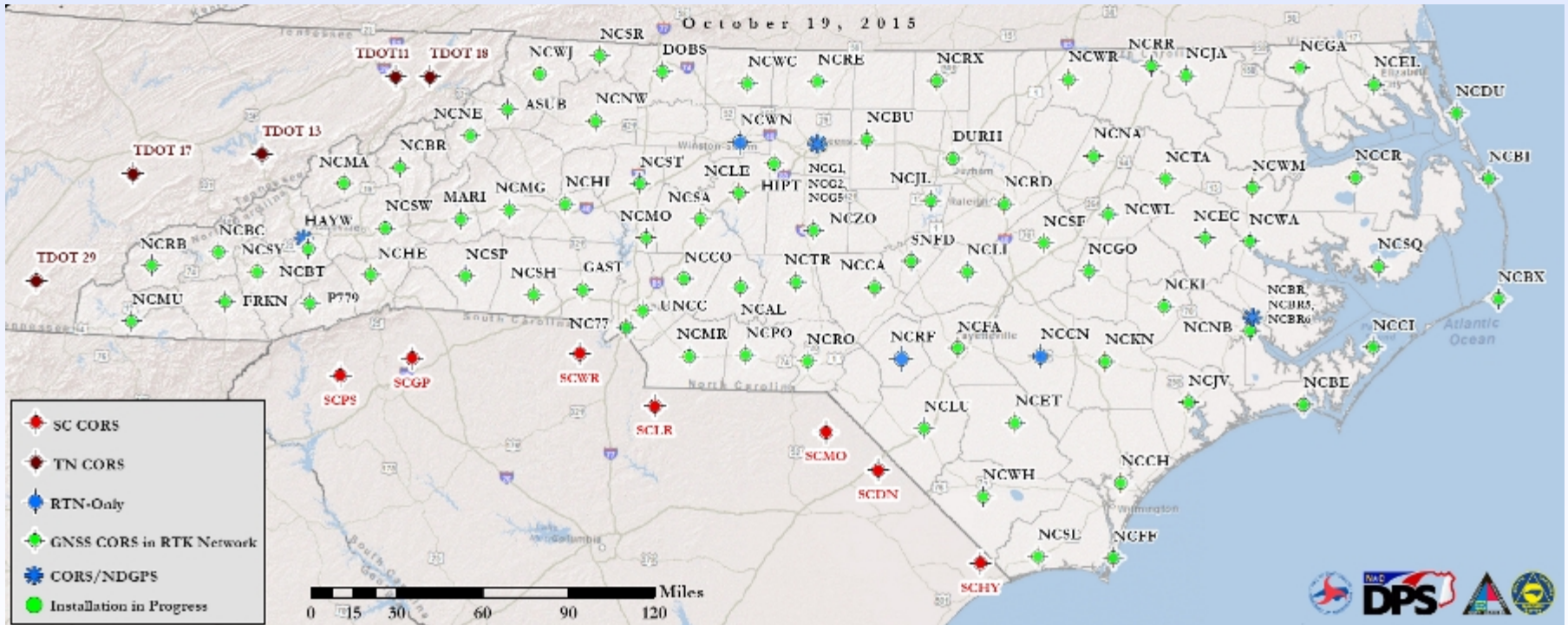
NC CORS Network



- Continuously Operating Reference Station (CORS)
 - A permanent and continuously recording Global Navigation Satellite System (GNSS) receiver, antenna (with a surveyed reference position), & support equipment
 - Composed of 94 CORS
 - 1 new CORS installation in progress
 - Dare County (Oregon Inlet)
 - Replacement of NCSQ
 - Receiver upgrade in 2015 at:
 - NCBI
 - NCWA
 - NCJV



NC CORS Network



<http://geodeticsurvey.nc.gov/Pages/CORS-and-GNSS.aspx>



North Carolina Emergency Management



RTN port request

NCEM - Geospatial and Technology Management
NORTH CAROLINA GEODETIC SURVEY
Positioning North Carolina today and for the future.

Home About NCGS Geodetic Control **CORS and GNSS** County and State Boundaries Library Other Programs Tools Kids Page

North Carolina Geodetic Survey

North Carolina GNSS Real Time Network

Geodetic News
Cabarrus-Stanly County Boundary Recorded

Monday, June 30, 2014

The Cabarrus-Stanly County Boundary resurvey has been approved and recorded.

Cabarrus County Register of Deeds:

- Plat Book 66, pages 26-29

Stanly County Register of Deeds:

- Plat Book 23, pages 290-293

Unmanned Aircraft Systems Forum

Monday, June 02, 2014

AGENDA
Unmanned Aircraft Systems (UAS) Forum

June 12, 2014
9:00 a.m. to 12:15 p.m.

Magnolia Building (#15 on the campus map), rm #103
Asheville-Duncombe Tech
340 Victoria Rd (Google coords: 35.570079, -82.557235)
Asheville, NC 28801

Tweets

- NC Geodetic Survey @ncrtn**
The NCAL (Albemarle), NCLE (Lexington) and NCMR (Monroe) CORS are operating again.
- NC Geodetic Survey @ncrtn**
The NCAL (Albemarle), NCLE (Lexington) and NCMR (Monroe) CORS are currently not operating.
- NC Geodetic Survey @ncrtn**
The NCBE (Beaufort) CORS is operating again.
- NC Geodetic Survey @ncrtn**
The NCBE (Beaufort) CORS is currently not operating.
- NC Geodetic Survey @ncrtn**
The NCWJ (West Jefferson) CORS operating again.
Expand

Tweet to @ncrtn

Create Account
Register a new account

Personal Data

First Name:

Last Name:

Address:

Zip Code:

City:

District:

Country:

E-Mail:

Separate multiple e-mails by ", "

Additional E-Mail:

Phone Number Home:

Phone Number Business:

Phone Number Mobile:

GSM Phone Number for TNC:

Language:

<http://geodeticsurvey.nc.gov/Pages/CORS-and-GNSS.aspx>

Virtual Reference Station



North Carolina Geodetic Survey

North Carolina GNSS Real Time Network

- ▼ Home
 - ▶ Sensor Map
 - ▶ Position Scatter Plot
 - ▶ Status Messages
- ▼ Network Information
 - ▶ 195 Ionosphere
 - ▶ IRIM/GRIM
- ▶ Reference Data Shop
- ▼ My Account
 - ▶ Personal Data
 - ▶ Change Password
 - ▶ Logins
 - ▶ Sessions
- ▶ Active Subscriptions
- ▼ Administration
 - ▼ Status Messages
 - ▶ Add Status Messages
 - ▶ Edit Status Messages
 - ▼ Regions
 - ▶ Add Regions
 - ▶ Edit Regions
 - ▼ User Management
 - ▶ User Management
 - ▶ Create User
 - ▶ Approve Users
 - ▶ Export e-mail addresses
 - ▼ Extended User Info
 - ▶ Extended User Info
 - ▶ Info Fields
 - ▶ Add Field

Reference Data Shop - Virtual Reference Station

Enter the coordinates of a virtual reference station or drag the marker to the desired location on the map. You can switch between the geographical and geocentric coordinate system.

Virtual Reference Station - Geographical Position		
Latitude:*	<input type="text"/>	<input checked="" type="radio"/> N <input type="radio"/> S
Longitude:*	<input type="text"/>	<input checked="" type="radio"/> E <input type="radio"/> W
Elevation:	<input type="text" value="100.0000"/>	m
<input type="button" value="Switch to geocentric Cartesian coordinate system"/>		

<< Back: Station Type Selection Next: Time Selection >>

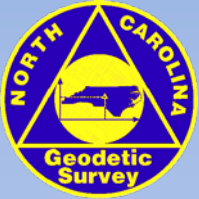
* You can enter the geographical coordinates in three formats:

- Deg Min Sec Example: 48 1 21.60
- Deg Min Example: 48 1.36
- Deg Example: 48.02267

New Datums are Coming in 2022!

- Both a new geometric and a new geopotential (vertical) datum will be released in 2022.
- The realization of the new datums will be through GNSS receivers.
- NGS will provide the tools to easily transform between the new and old datums.





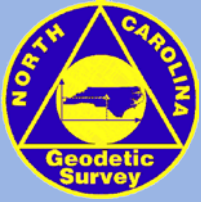
Publications/Videos



- Developed instructional videos
 - NCGS database
- Plan to develop additional instructional videos in 2016
 - Suggestions?
- NC-SC boundary video

A series of short video tutorials are now available to help navigate the most-recently developed NC Geodetic Database. The videos can be accessed by clicking the link below:

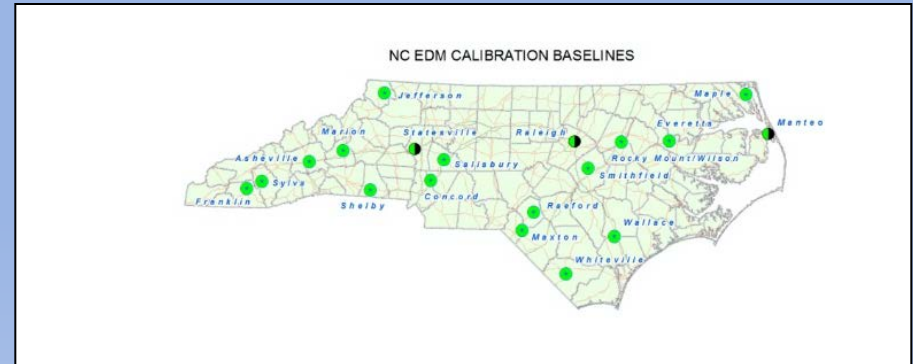
- [NCGS 1 Access Database](#)
- [NCGS 2 Navigating](#)
- [NCGS 3 View Details](#)
- [NCGS 4 Station Recovery](#)
- [NCGS 5 Export Data](#)



Future projects

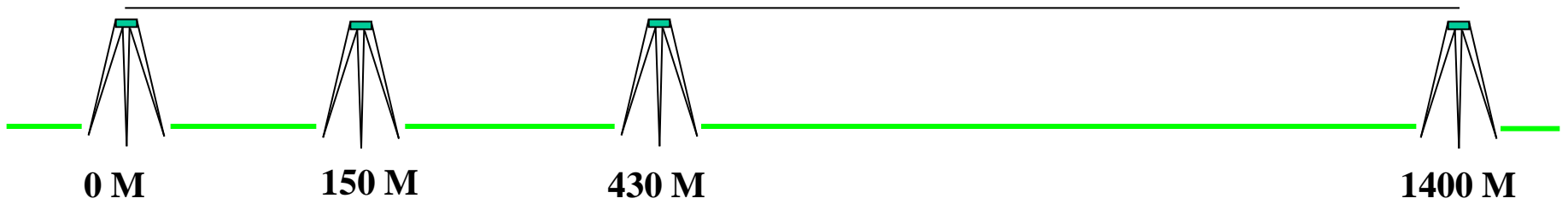


- Check EDM baseline
 - Asheville (replace)
 - Maxton (check)
 - Whiteville (check)
 - Maple (check)
 - Raleigh (replace)
 - Manteo (check)

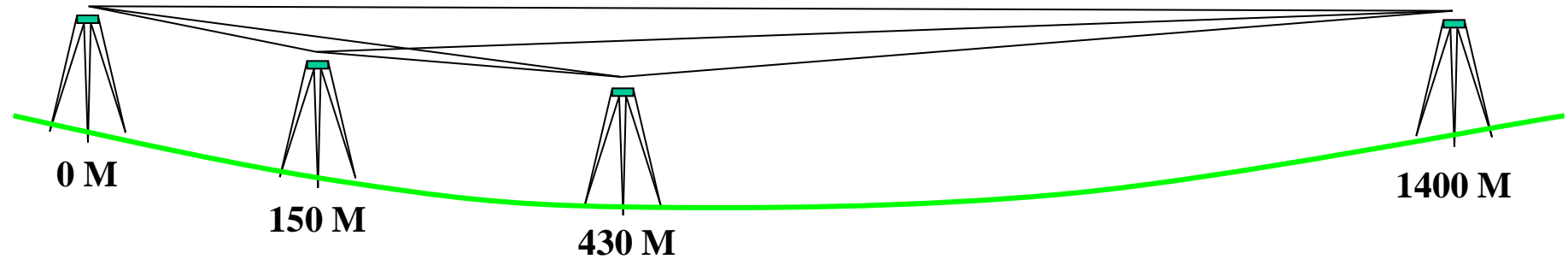


What Is A Calibration Base Line?

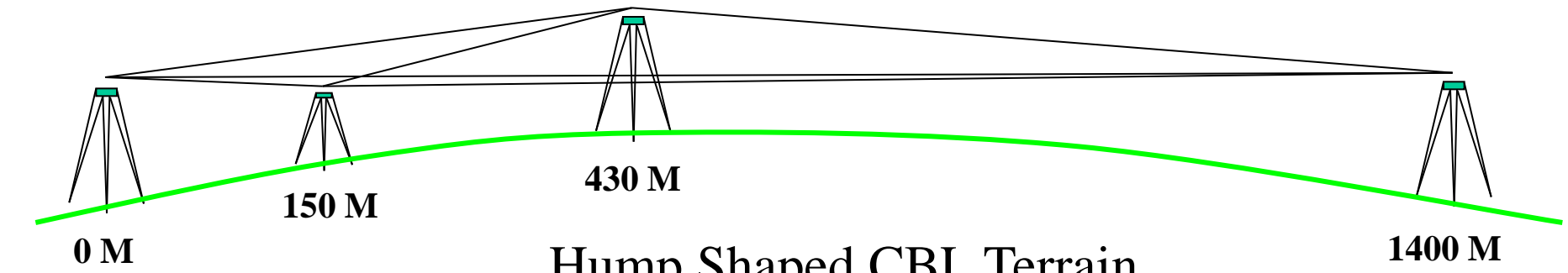
- **A series of stable monuments (marks) in a straight line (to within 2 arc minutes) whose published mark-to-mark distances and horizontal distances between all marks compare favorably with the National Standard of Unit Length.**
- **The National Standard of Unit Length is determined by the National Institute of Standards and Technology (NIST).**
- **NIST calibration services link the makers and users of precision instruments to the basic and derived units of the International System (SI) of measurements.**
- For more information see http://www.nist.gov/public_affairs/guide/



Flat CBL Terrain



Sag or "Dish" Shaped CBL Terrain



Hump Shaped CBL Terrain

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DIVISION OF LAND RESOURCES

HOME LAND QUALITY GEOLOGICAL SURVEY GEODETIC SURVEY Search DENR ... - Text +

Display distances in **Meters** Monument search My Folder Inverse Calculator Data Export Station Recovery Contact NCGS

Station name:

Search Radius:

PID:

Latitude: ° ' " N

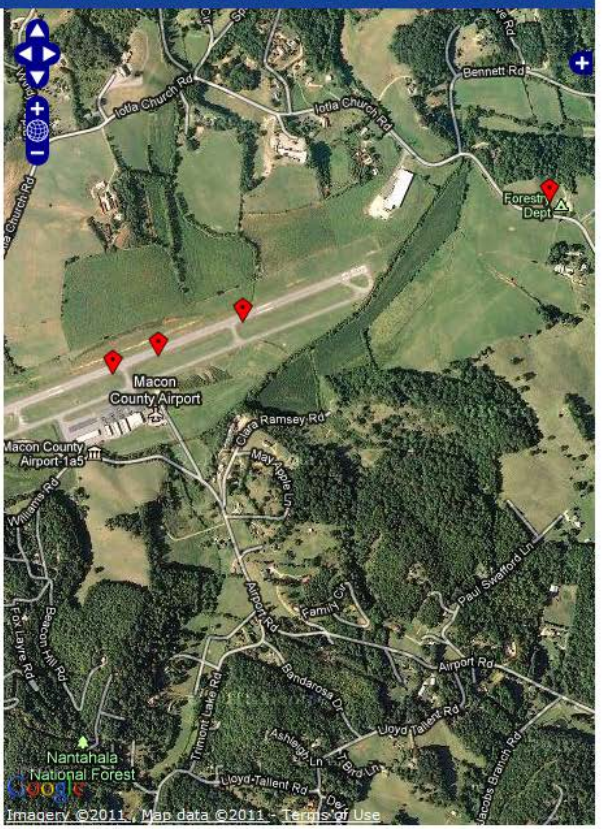
County:

Longitude: ° ' " W

Order:

Showing 1 to 9 of 9 monuments << prev next >>

<input type="checkbox"/>	County	Name	PID	Type	Condition
<input type="checkbox"/>	Macon	1A5 A	AJ3424	Disk	Good
<input type="checkbox"/>	Macon	AIRPORT	FB3509	Disk	Not found
<input type="checkbox"/>	Macon	FRANKLIN CBL 000	FB4103	---	---
<input checked="" type="checkbox"/>	Macon	FRANKLIN CBL 1400	FB4104	Disk	Good
<input type="checkbox"/>	Macon	FRANKLIN CBL 150	FB4105	---	---
<input checked="" type="checkbox"/>	Macon	FRANKLIN CBL 410	FB4106	Disk	Good
<input type="checkbox"/>	Macon	MAC 1	AJ3419	Disk	Good
<input checked="" type="checkbox"/>	Macon	MACON CBL 000 2	AJ3417	Disk	Good
<input checked="" type="checkbox"/>	Macon	MACON CBL 150 2	AJ3418	Disk	Good



feedback

NC SURVEYORS

**Following
In Their
Footsteps**

**1939
P
S**

NORTH CAROLINA

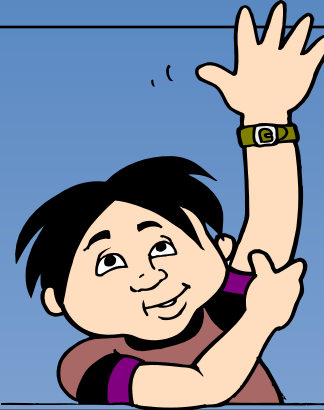
Questions?

Gary W. Thompson, PLS

Office: 919-733-3836

Direct: 919-948-7844

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Mailing address:	Building (shipping) address:
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