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# ABOVE and BEYOND: DRONE-BASED SOLUTIONS FOR ENVIRONMENTAL ASSESSMENT AND FACILITY DESIGN



# SynTerra UAS Background: ENGINEERING & SURVEYING



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Began offering UAS Survey/Recon services in 2015



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Initial foray in to drones via fixed-wing SenseFly eBee





eBee SenseFly  
(AmEagle)  
2 lbs, 14 oz.



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Began offering UAS Survey/Recon services in 2015  
Initial foray in to drones via fixed-wing SenseFly eBee  
Adopted Multi-rotor drones in 2017 for smaller projects  
and added versatility



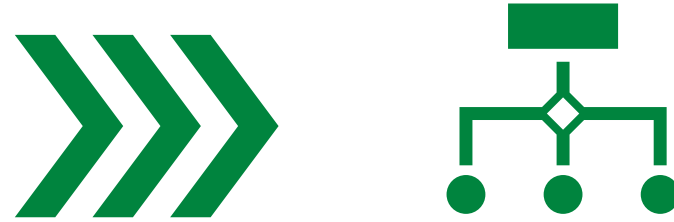


## DJI Phantom 4

- Inexpensive
- Built-In HD Camera

## DJI Matrice 210

- Higher payload
- Top- and/or Bottom-mounted Cameras



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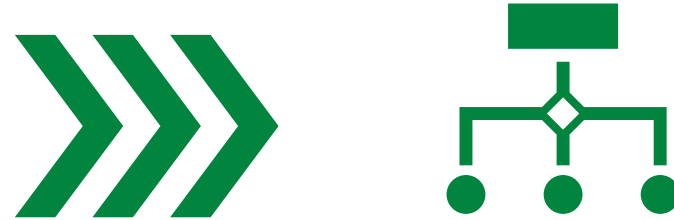
Added LiDAR and Thermal Imaging capabilities in 2024



## DJI 350T

- LiDAR capable, with the L2 unit
- Thermal Imaging, H20T camera





## ACCURACY/SPECIFICATIONS:

L2 LiDAR Scanner ..... 5 cm horizontal @ 150m altitude AGL  
..... 4 cm vertical @ 150 m altitude AGL

H20T Thermal Camera .....8x zoom  
..... Thermal range -40° C to 150° C  
..... Rangefinder 1200 m

eBee RTK w/S.O.D.A. 3D 20 megapixel camera.....1.5 cm (w/GCPs)

# COMMON USES FOR SURFACE SURVEY DRONE DATA

INFRASTRUCTURE PLANNING

TOPOGRAPHIC CONTOUR MAPPING

ENVIRONMENTAL REMEDIATION

PROPERTY DUE DILIGENCE

ENGINEERING COMPUTATIONS

INSPECTION/MONITORING





# MOST POPULAR OUTCOMES

EACH PIXEL CONTAINS 3D GEO-DATA

HIGH RESOLUTION ORTHOMOSAIC

LiDAR 3D POINT CLOUDS

(USED TO CONVERT TO CONTOUR MAPS)

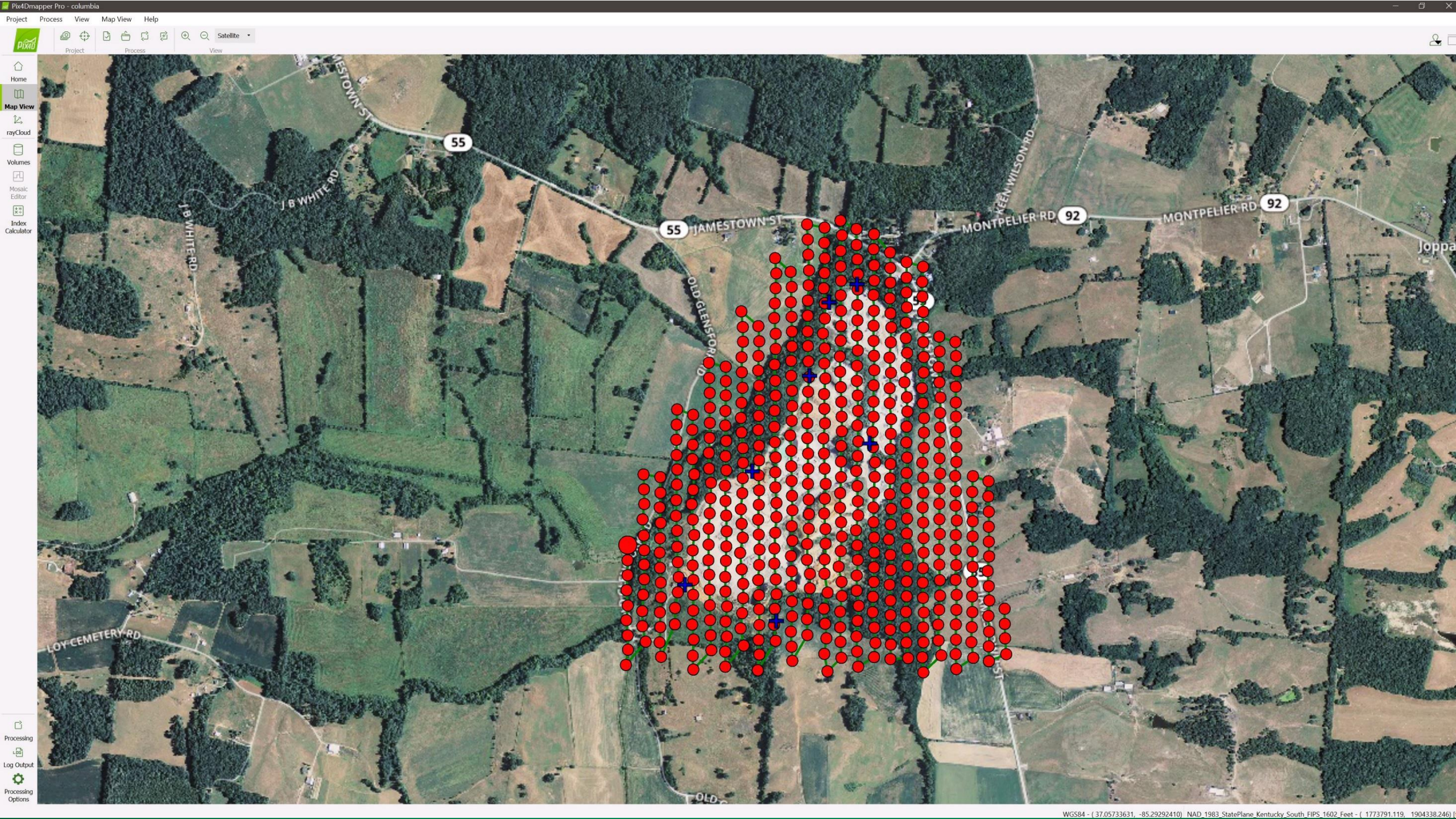
CONSTRUCTION VIDEOS

# MISSION PARAMETERS SET-UP and POST-PROCESSING

eMotion or DJI GO 4







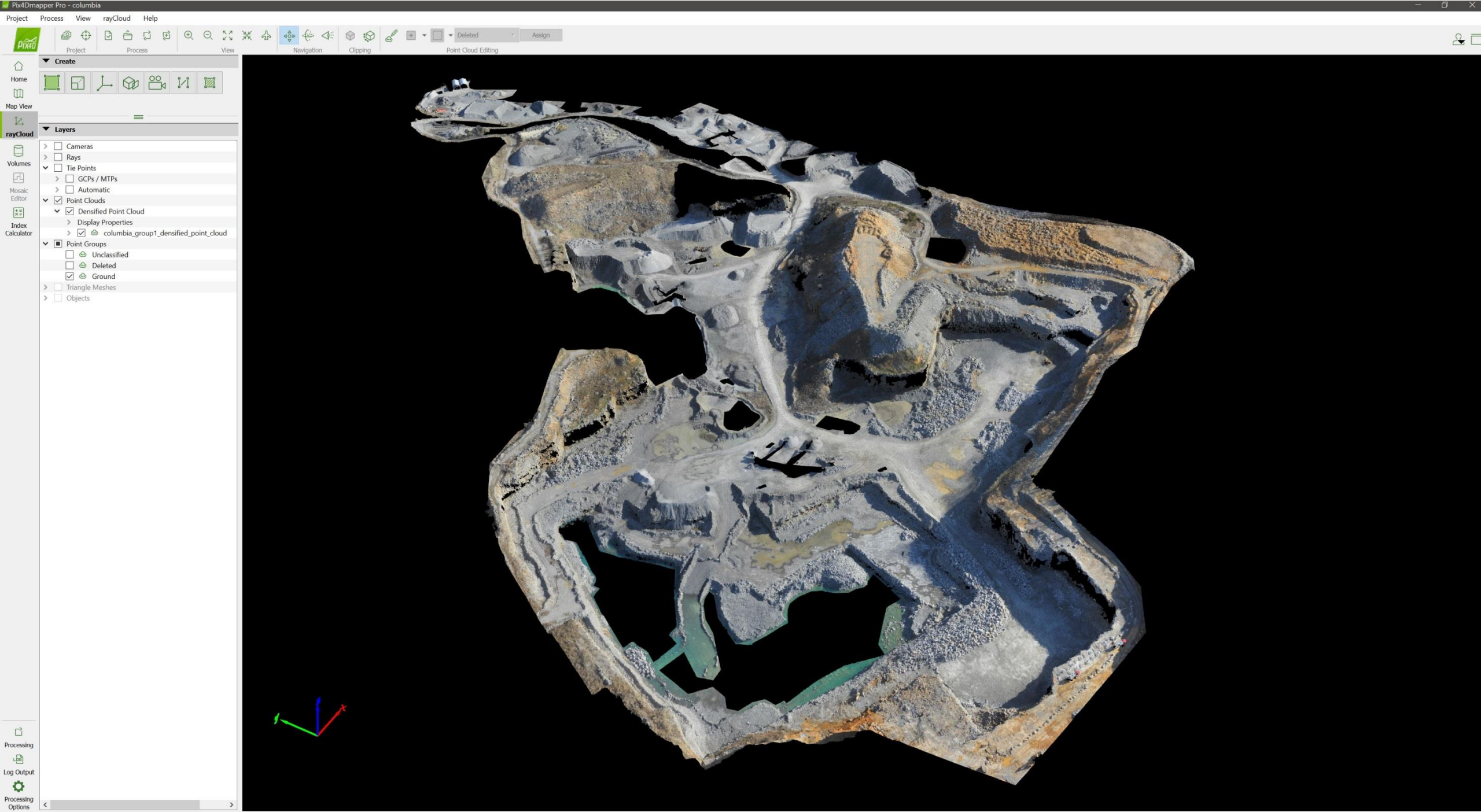


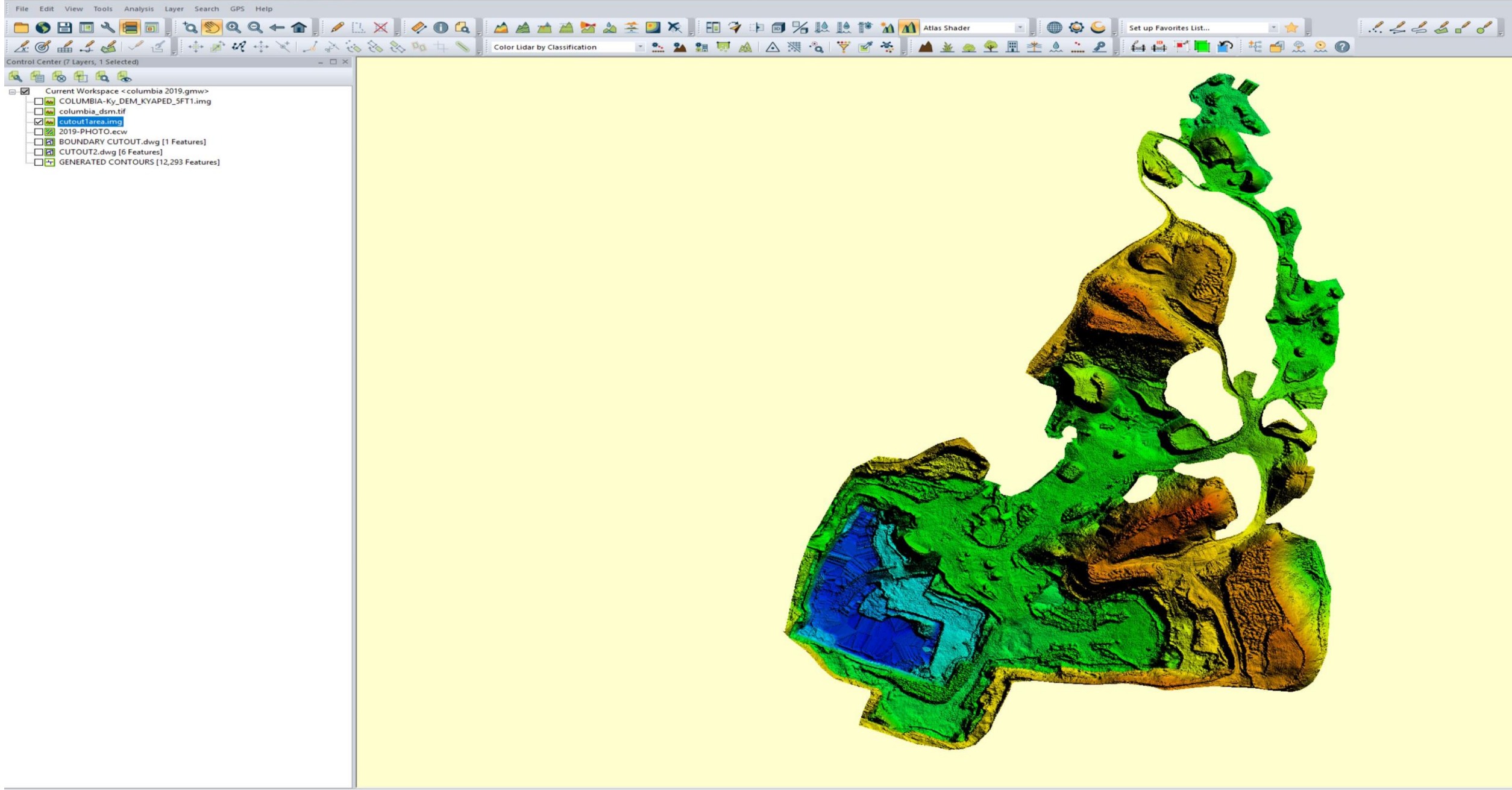




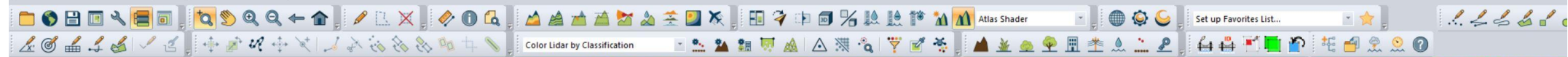






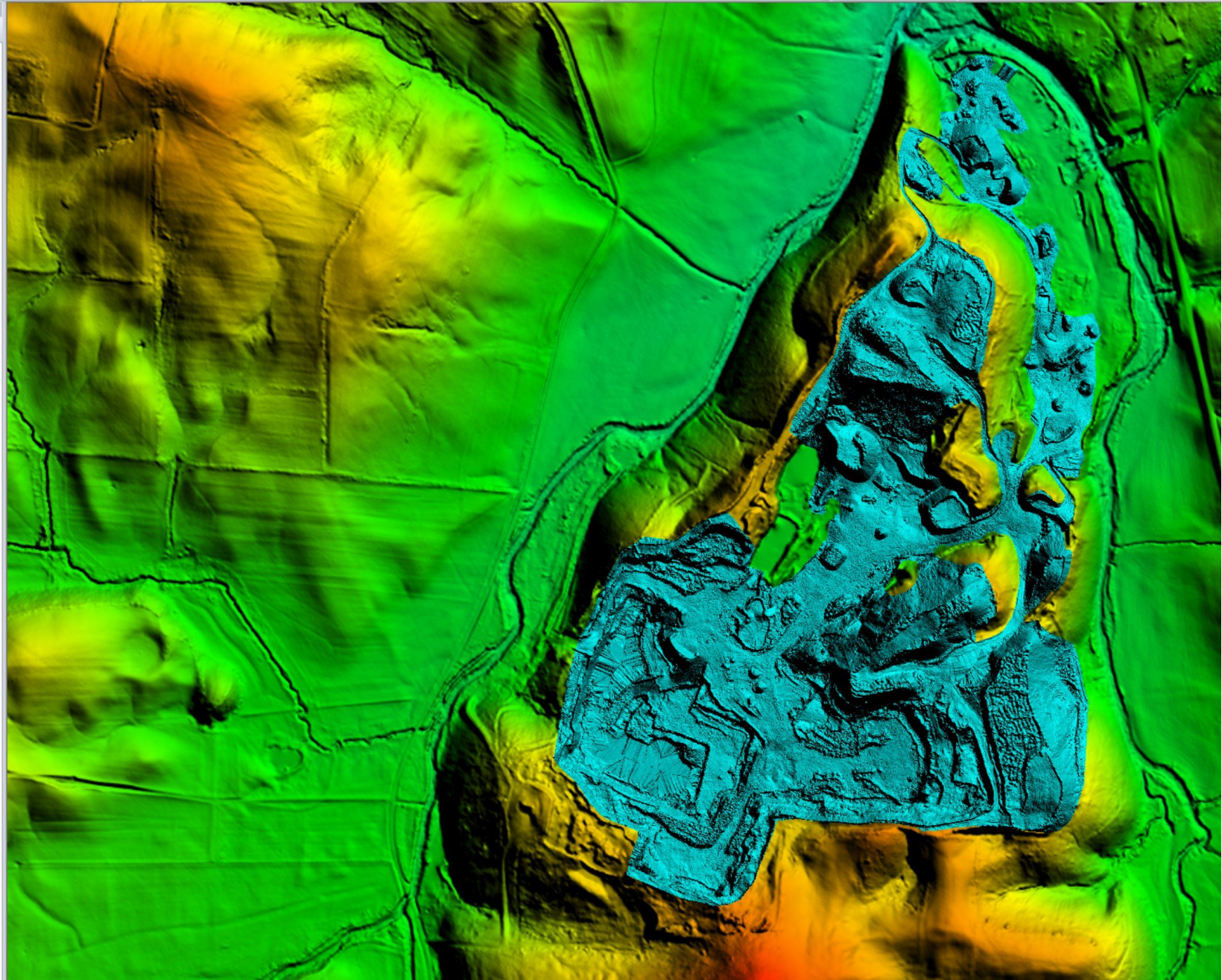




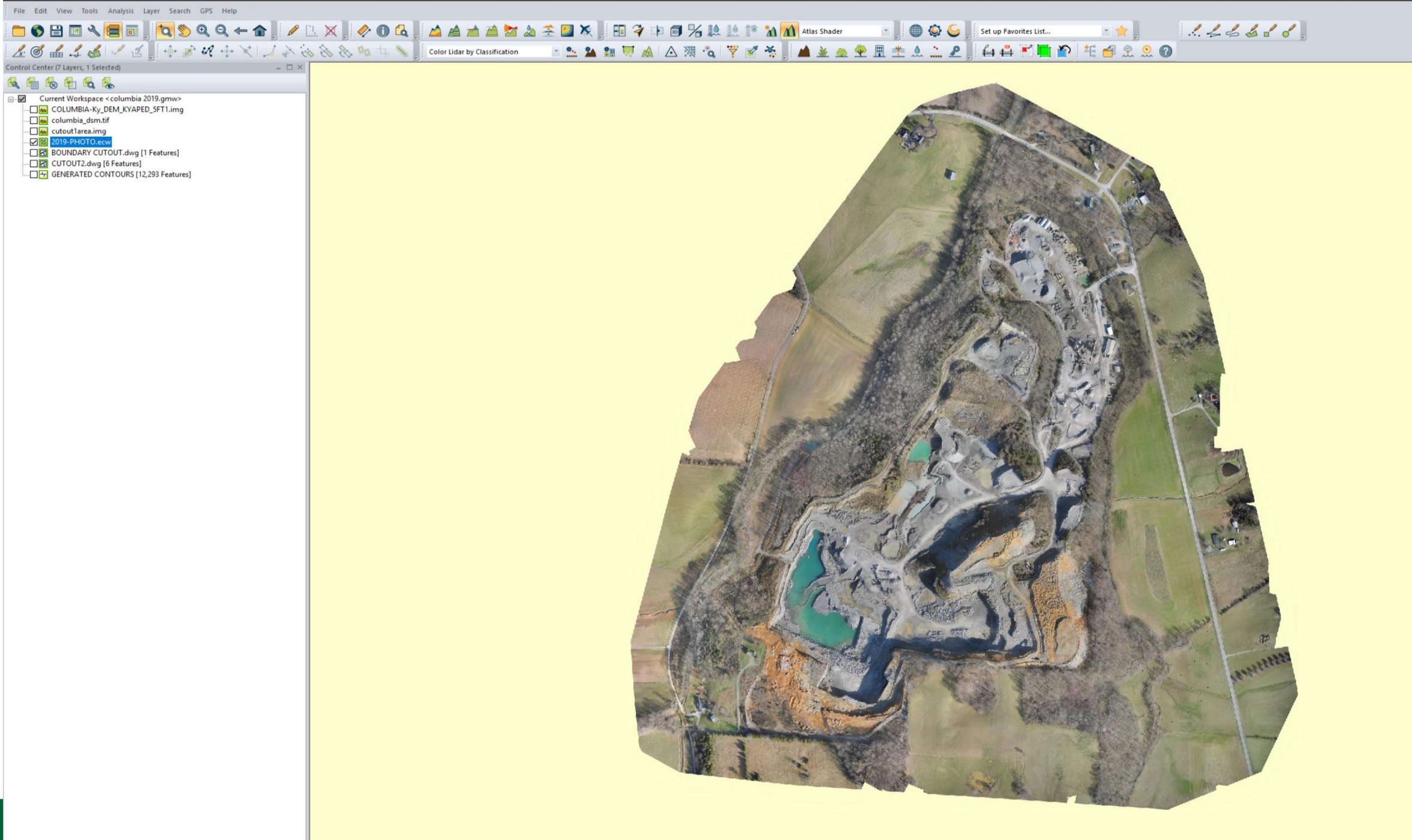


Control Center (7 Layers)

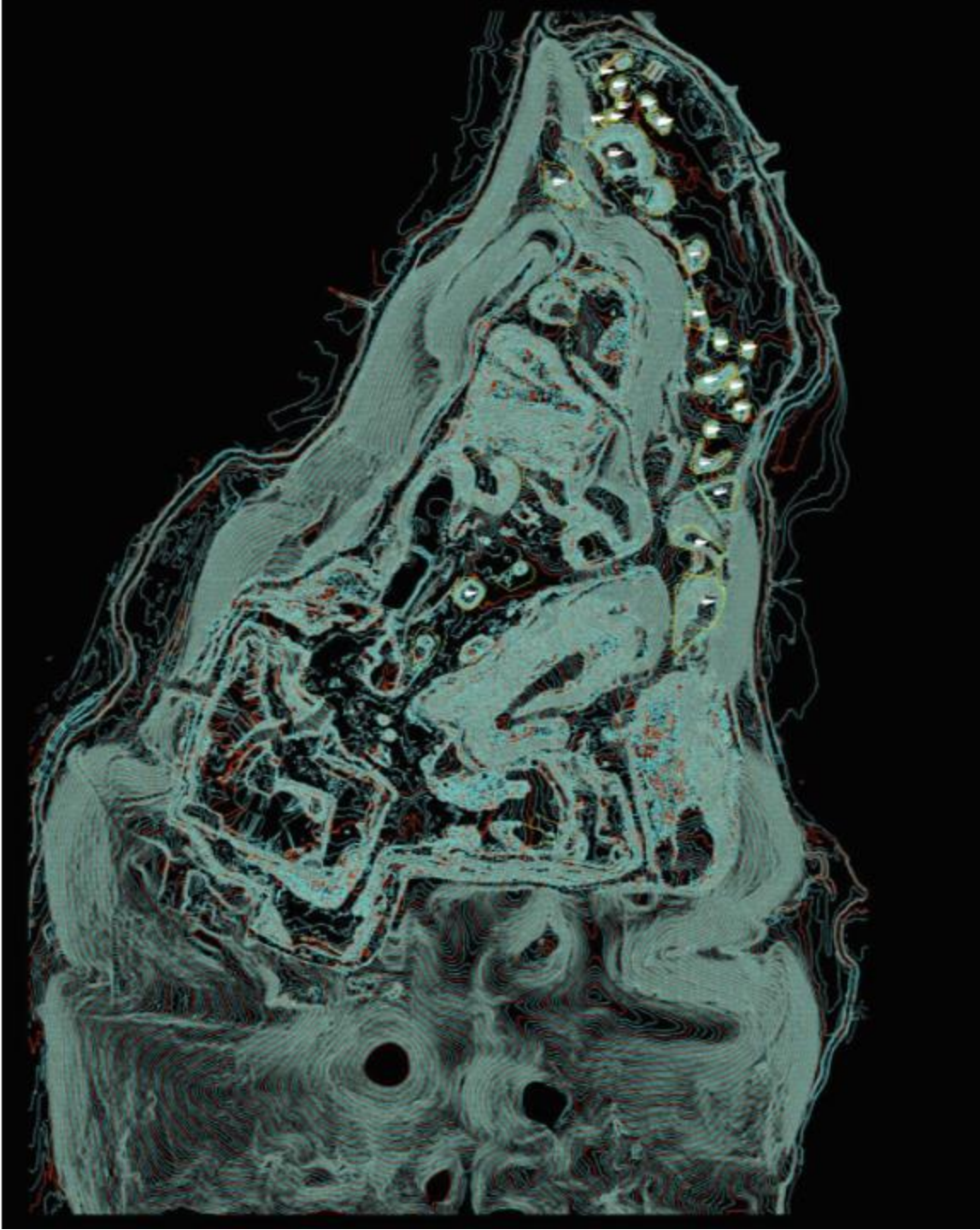
- Current Workspace <columbia2019.gmw>
  - ☒ COLUMBIA-Ky\_DEM\_KYAPED\_5FT1.img
  - ☐ columbia\_dsm.tif
  - ☒ cutout1area.img
  - ☐ 2019-PHOTO.ecw
  - ☐ BOUNDARY CUTOUT.dwg [1 Features]
  - ☐ CUTOUT2.dwg [6 Features]
  - ☐ GENERATED CONTOURS [12,293 Features]















# INFRASTRUCTURE PLANNING

## Water Treatment Lagoon Layout

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ASSESSMENT AND FACILITY DESIGN





• Pix4D Quality Report

# Quality Report

Generated with Pix4Dmapper version 4.6.4

⚠ **Important:** Click on the different icons for:

❓ Help to analyze the results in the Quality Report

ℹ Additional information about the sections

💡 Click [here](#) for additional tips to analyze the Quality Report

## Summary

Project	WILLETT 1-13-22
Processed	2022-03-16 11:27:55
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	1.99 cm / 0.78 in
Area Covered	0.110 km <sup>2</sup> / 10.9832 ha / 0.04 sq. mi. / 27.1541 acres



- Summary of Key Parameters

### Quality Check



Images	median of 60036 keypoints per image	✓
Dataset	120 out of 120 images calibrated (100%), all images enabled	✓
Camera Optimization	1.6% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 18636 matches per calibrated image	✓
Georeferencing	yes, 6 GCPs (6 3D), mean RMS error = 0.075 US survey foot	✓

### Preview

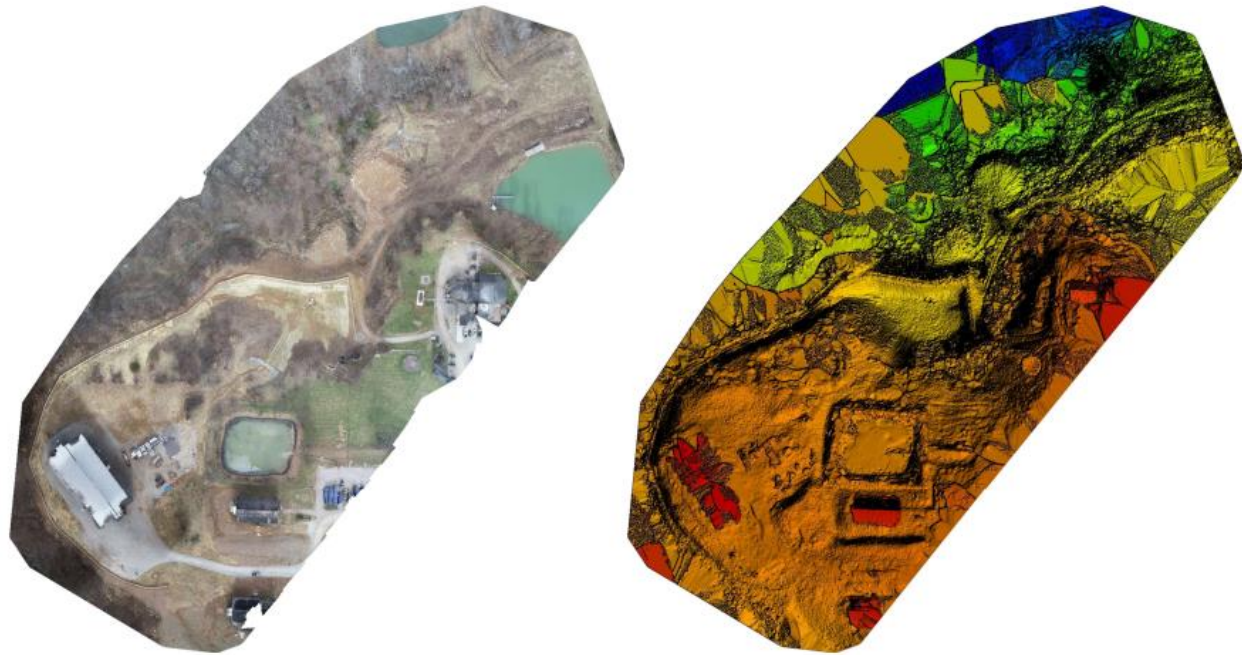


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

- Flight Path

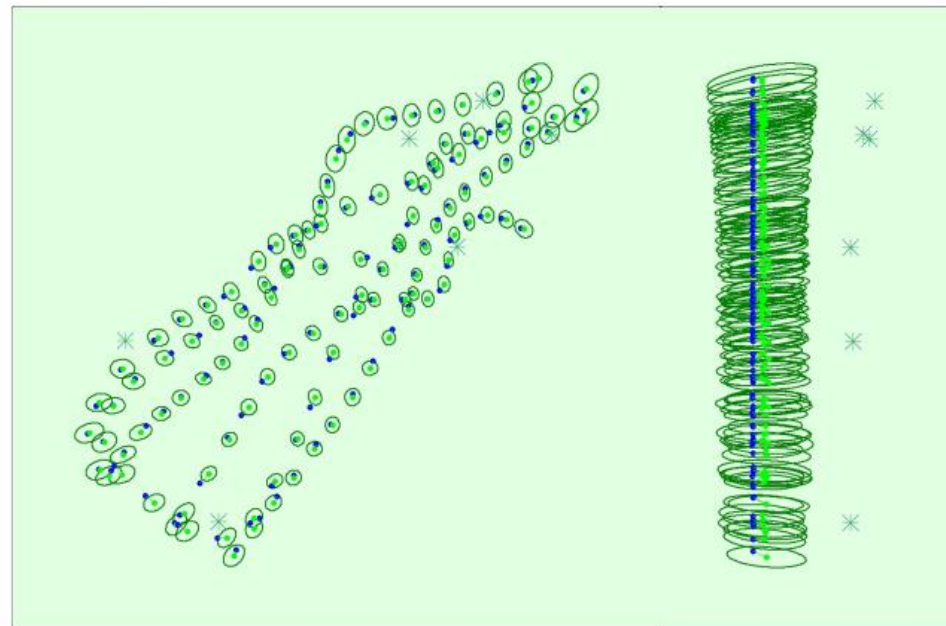
- Ground Control Point correlation

Initial Image Positions

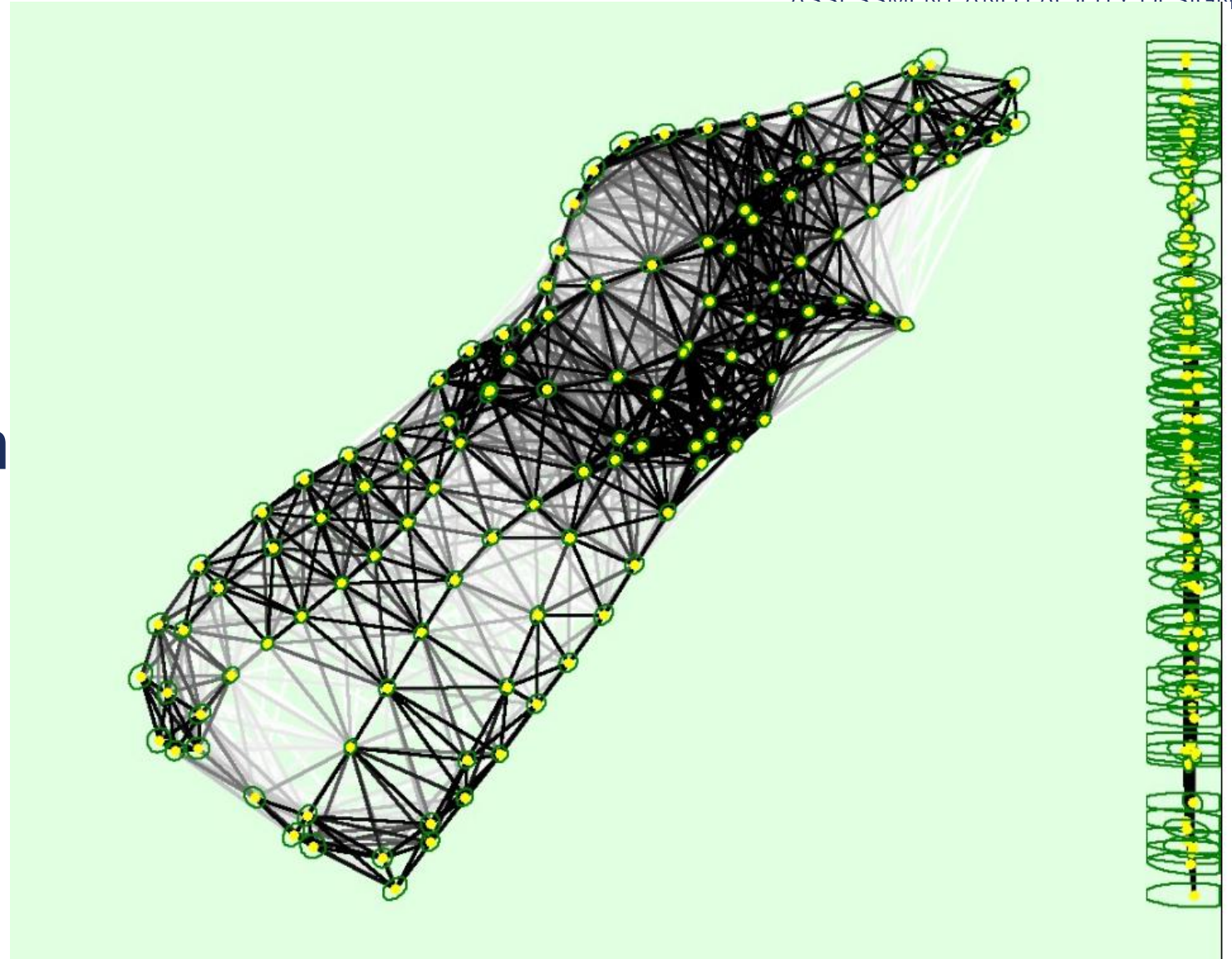


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



- TIN (Triangulated Irregular Network) from 120 photo observation points





# TOPOGRAPHIC CONTOUR MAPPING



## Pre-SMCRA Dragline Pit in Ohio





## Unreclaimed Open Highwall

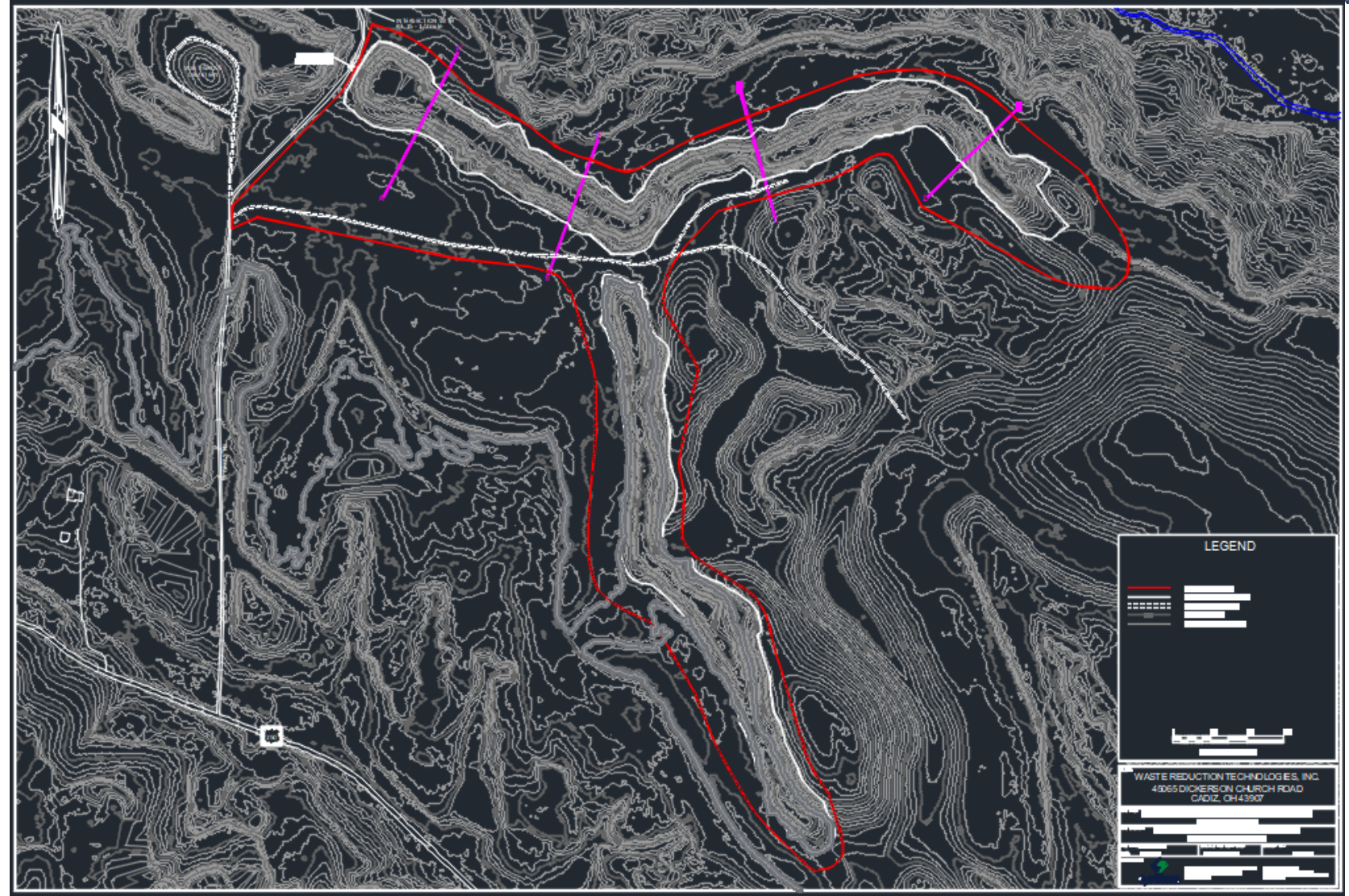


- Aerial Photo of Site





- Flown topographic contours of site
- Design of Waste Disposal Area using topo data

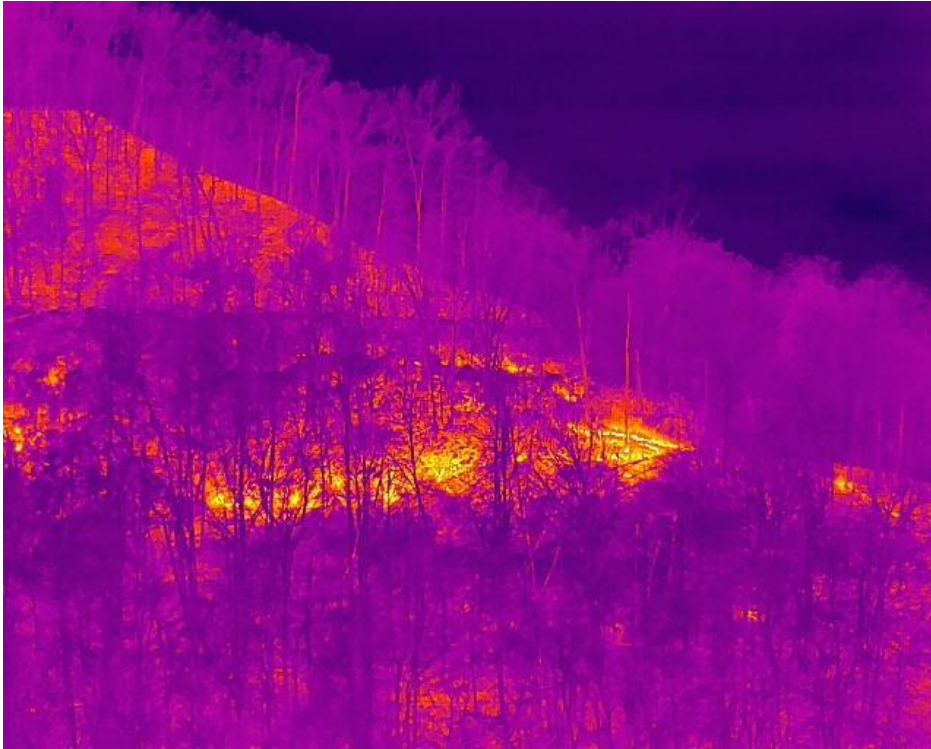




## ENVIRONMENTAL REMEDIATION

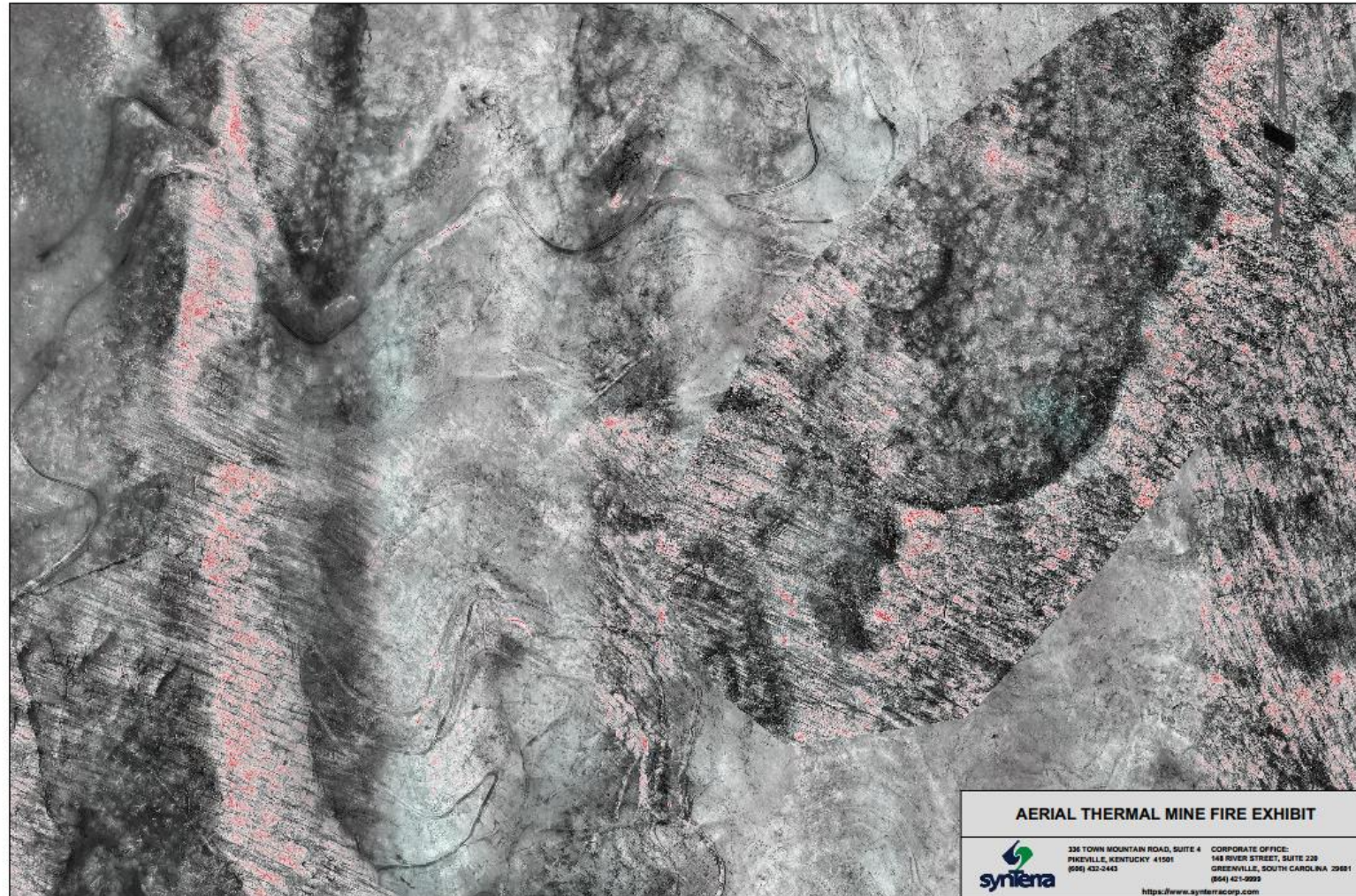


- Sight and smell indicating a mine fire
- Known pre-law mine works



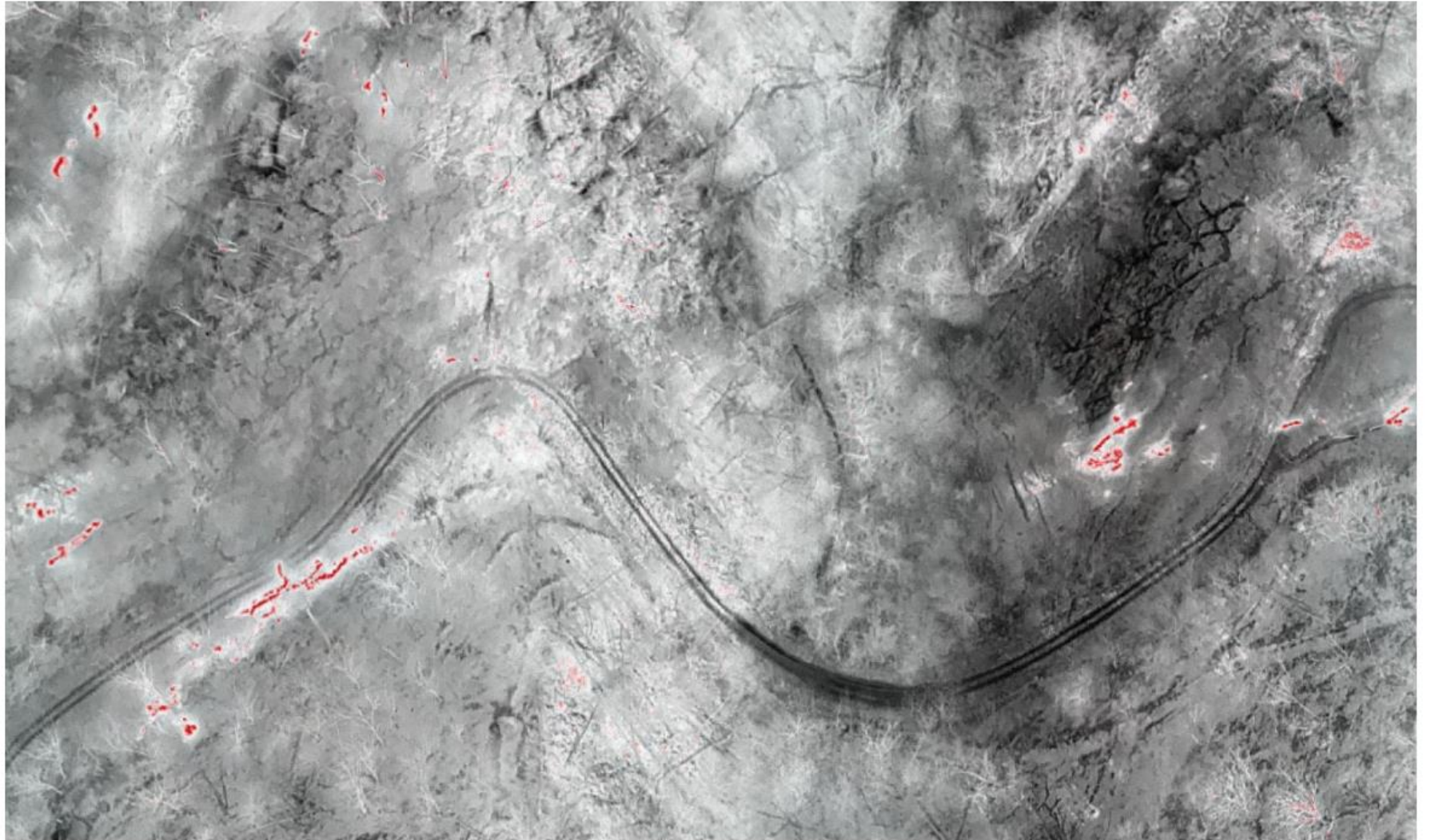
- Thermal Image of observed mine fire





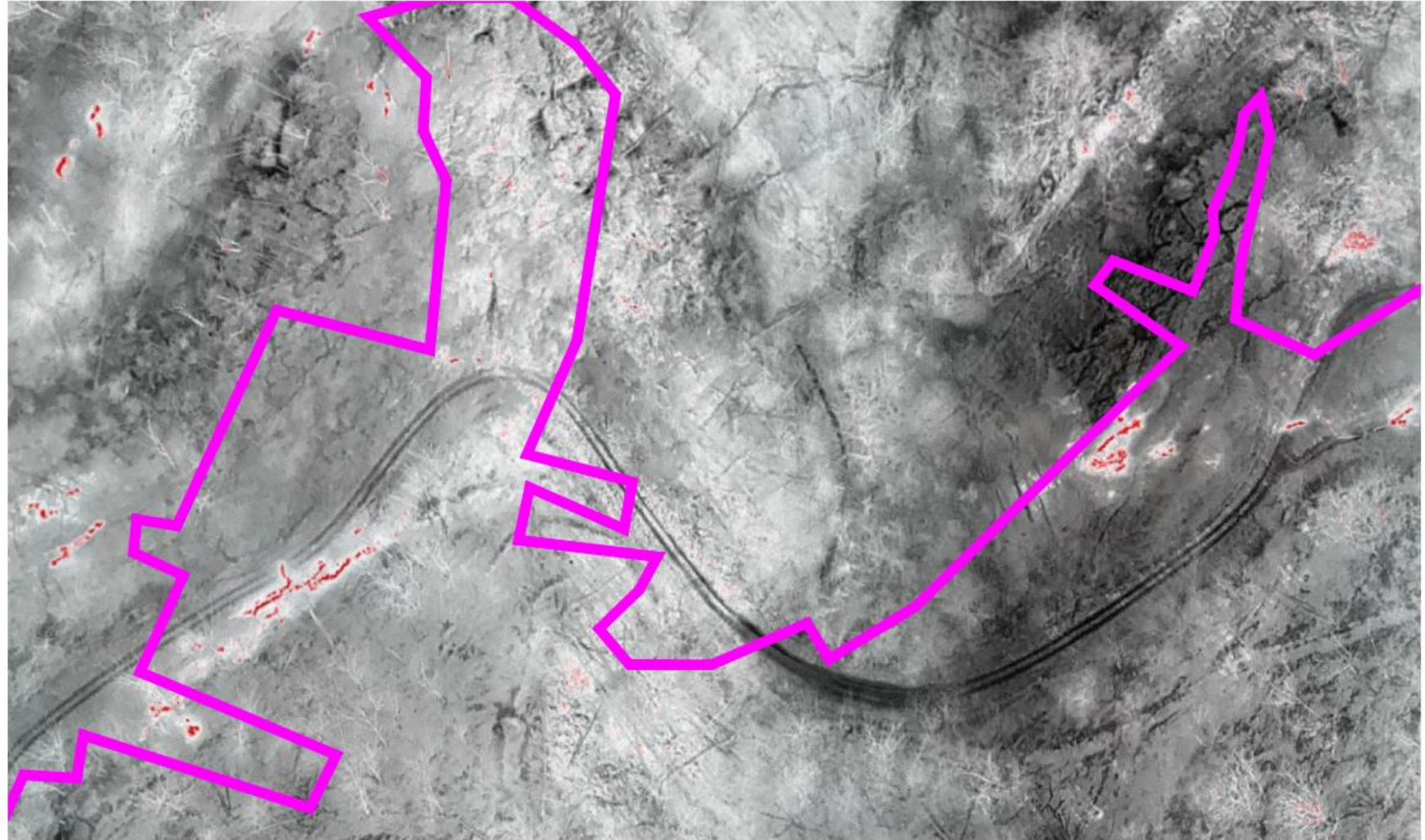


## Identify Target Hot Spots





## Mine Works Overlay



# PROPERTY DUE DILIGENCE

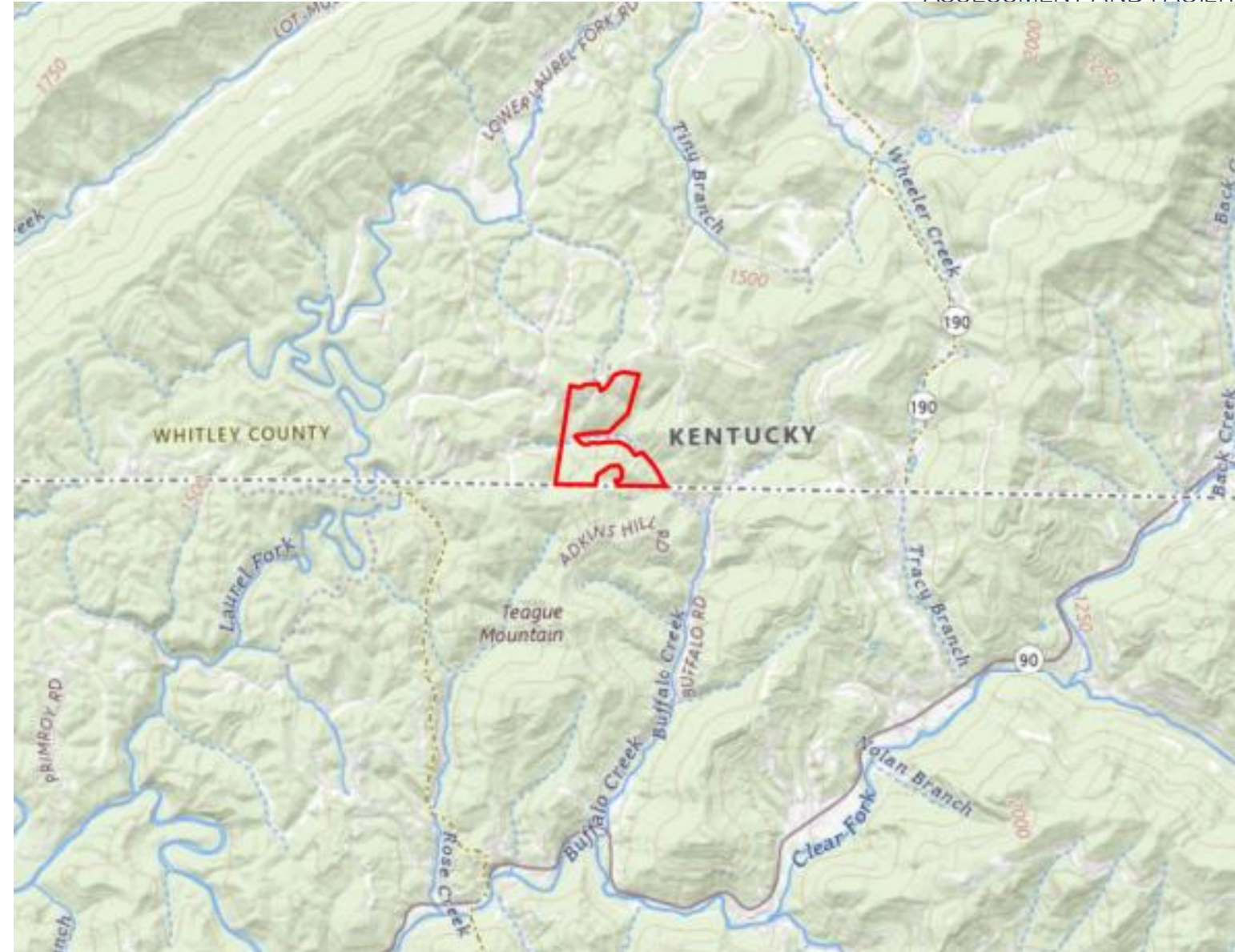




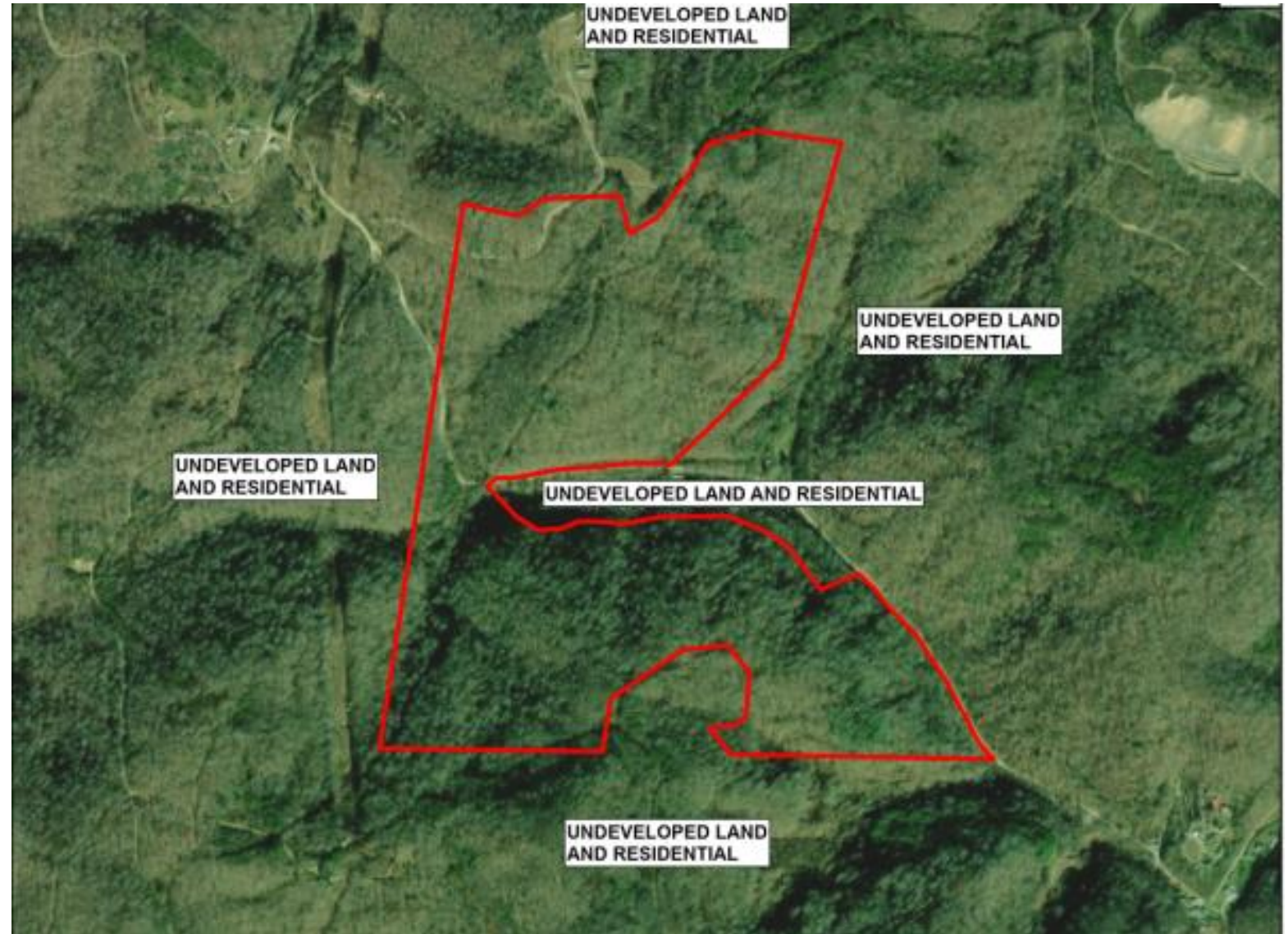


# Phase I Environmental Site Assessment

ABOVE and BEYOND: DRONE-BASED SOLUTIONS FOR ENVIRONMENTAL  
ASSESSMENT AND FACILITY DESIGN



- Large, rural tract
- Limited Access
- Hazardous terrain





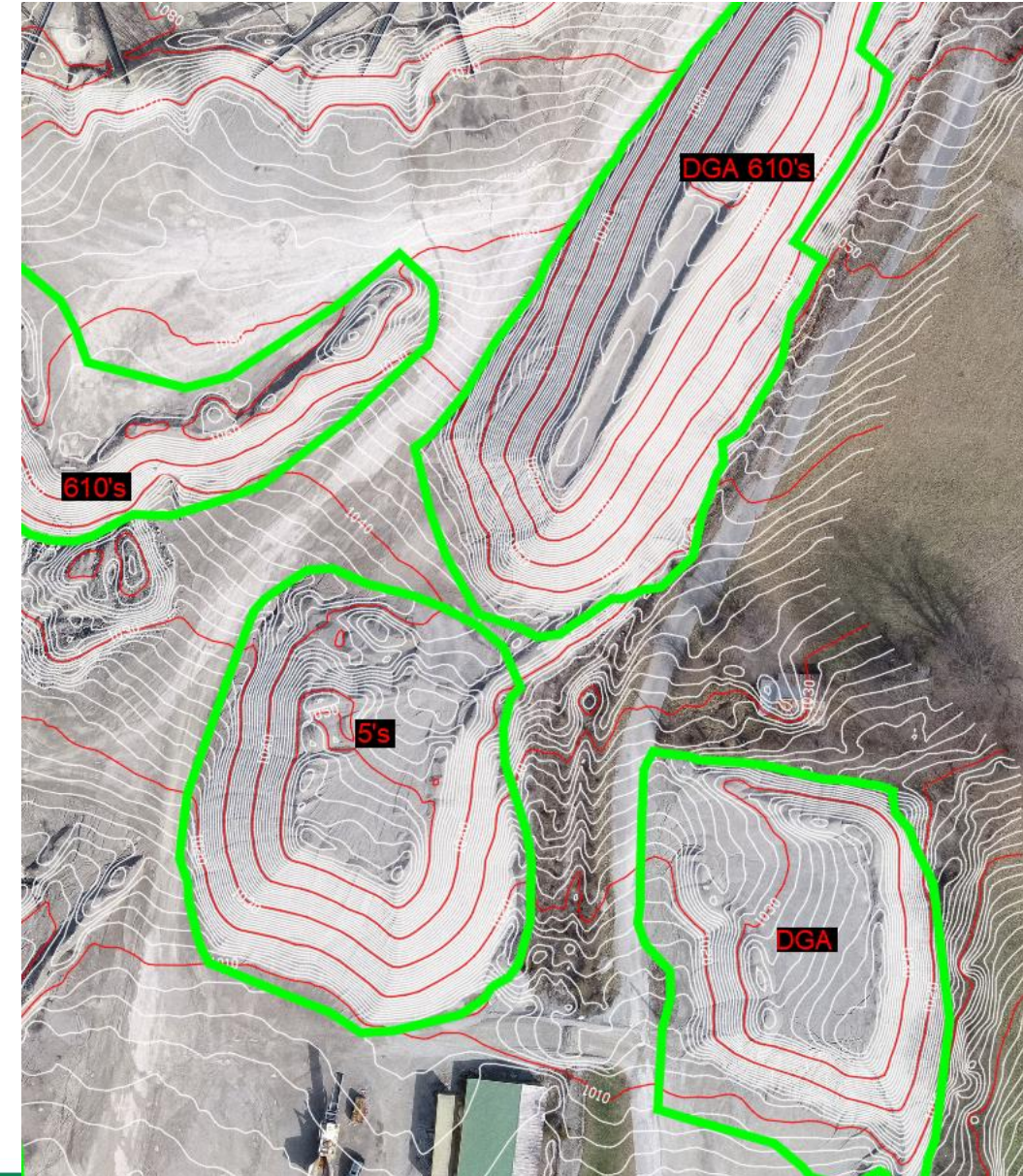


Individual aerial  
photos may be used  
for detailed  
observation





# POINT CLOUD PROCESSED INTO CONTOUR MAPPING





# INSPECTIONS/MONITORING





# CALCULATE COVER MATERIAL VOLUME







## POND INSPECTIONS





BRIDGE INSPECTION – UNDERDECK UTILITIES



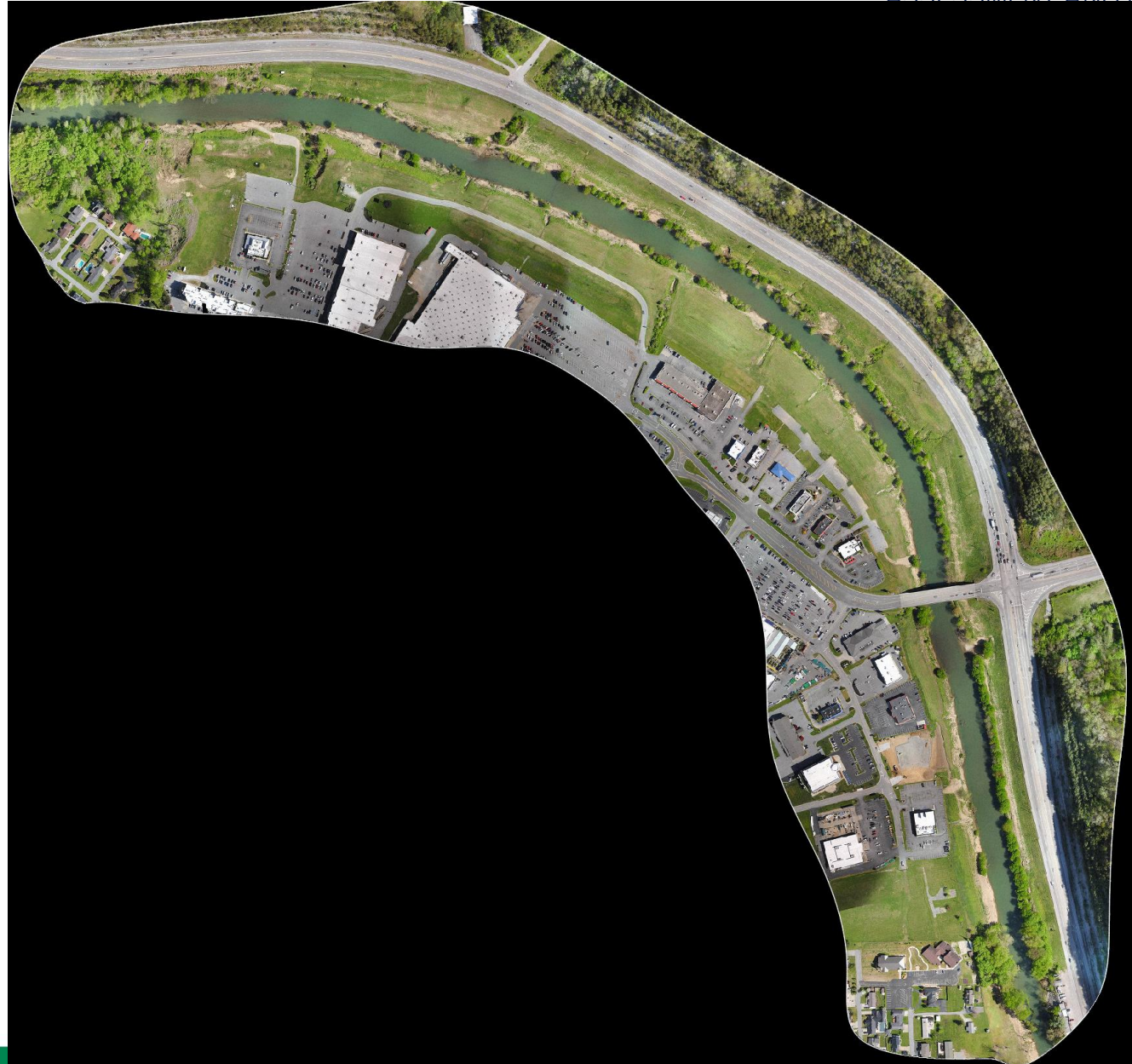
BRIDGE INSPECTION – UNDERDECK UTILITIES





## BRIDGE INSPECTION – UNDERDECK UTILITIES

## MONITORING RIVERBANK EROSION





# CERTIFICATION

## ELIGIBILITY:

- AT LEAST 16 YEARS OLD
- READ, SPEAK, WRITE, AND UNDERSTAND ENGLISH
- PHYSICAL AND MENTAL CONDITION TO SAFELY FLY A DRONE
- PASS THE INITIAL AERONAUTICAL KNOWLEDGE EXAM
- OBTAIN AN FAA TRACKING NUMBER PRIOR TO EXAM

## REMOTE PILOT CERTIFICATE:

- MUST BE EASILY ACCESSIBLE BY THE REMOTE PILOT DURING ALL UAS OPERATIONS
- COMPLETE ONLINE RECURRENT TRAINING EVERY 2 YEARS



# QUESTIONS ???