



Utilizing UAV Photogrammetry to Determine Proppant Stockpile Volumes

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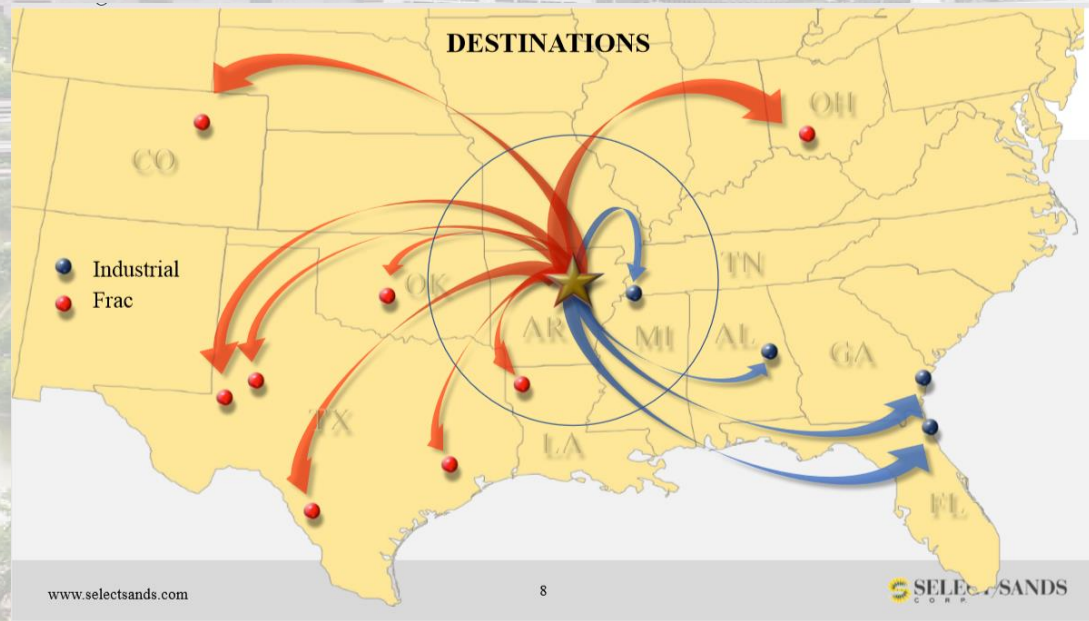
Outline

- Select Sands History/Background
- Equipment/Software
- Workflow
- Ground Control Points (GCPs)
- Mining Site Locations
- Drone Aerial Survey Specs
- Final Report
- Monitoring Mining Operations and Environmental Impact
- Traditional Vs Drone Stockpile Inventory Method
- Q&A



Select Sands History/Background

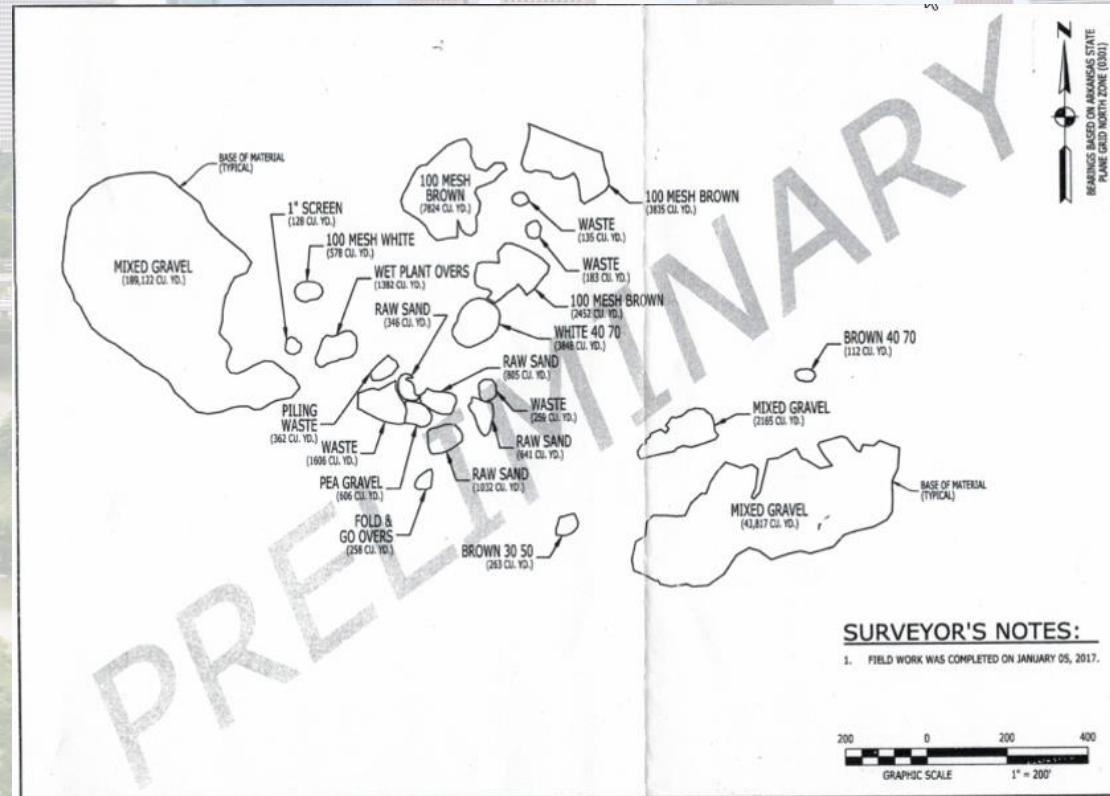
- Original Company – Ozark Premium Sand located in Newark, Arkansas
- Select Sands Corporation Acquires Ozark Premium Sand in December, 2016
- Mine White Silica Sand (99% SiO₂) from the St. Peter Sandstone Formation
- Target markets are Oil & Gas and Industrial & Specialty Products
- Site Visit and POC took place May 25-27, 2017
- Began Quarterly Drone Surveys on June 30, 2017, and continued to the Present





Select Sands History/Background

- Inventory Surveys Performed with Traditional Survey Methods started in late December, 2016
- Work Took 1-2 Weeks to Complete the Inventory at all 3 sites
- Preliminary Hardcopy Reports Issued in January, 2017





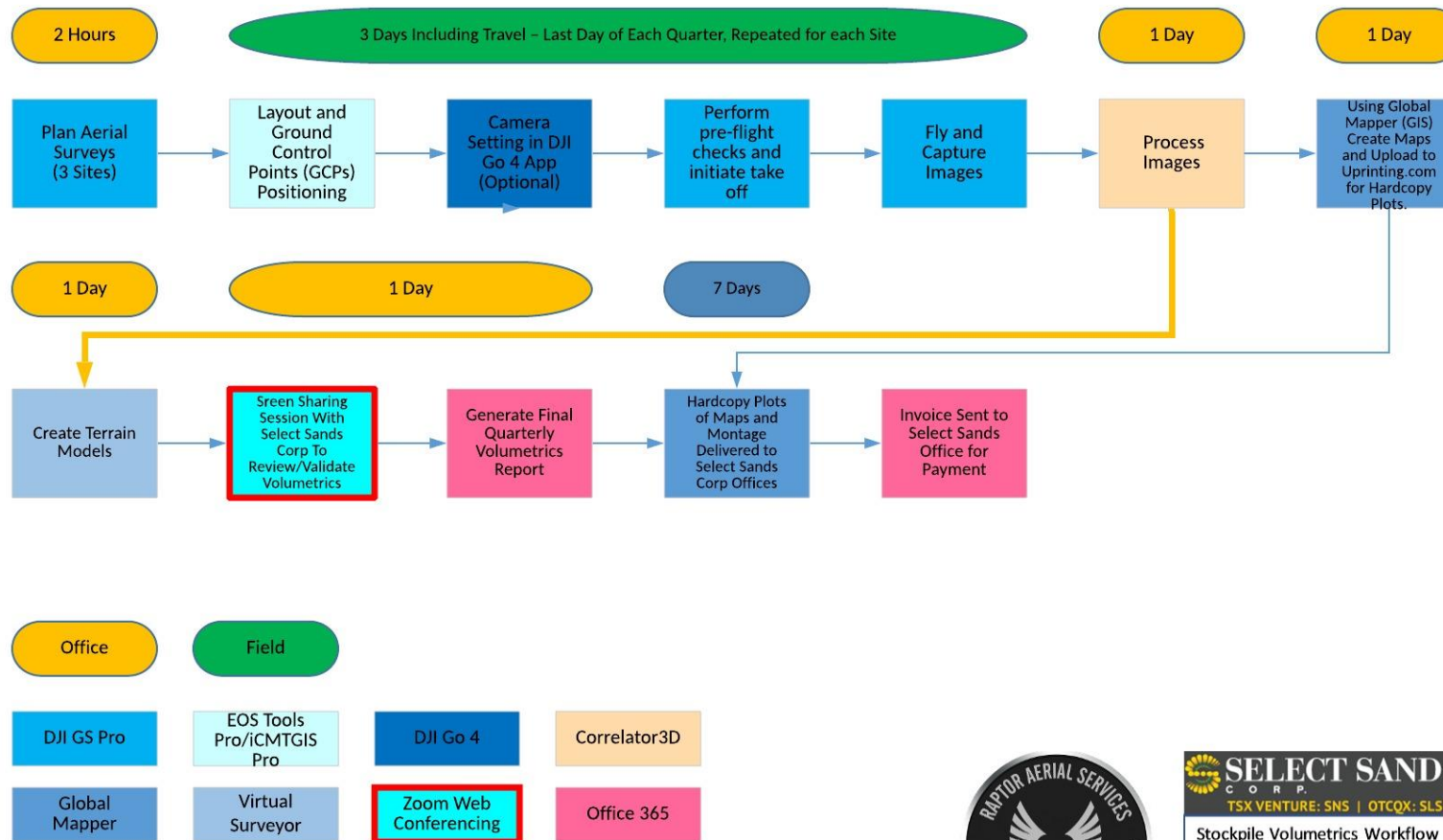
Equipment/Software



- Drone:
 - DJI Inspire 2 with Zenmuse X5S Camera (2 – primary and backup)
- Ground Control Points (GCPs):
 - EOS Arrow Gold RTK GNSS Positioning System
 - GNSS Networks: Missouri DOT (MDOT) or TopCon's TopNet Live
 - GCP Targets
- DJI GS Pro (Mission Planning)
- DJI GO 4 (Drone Settings and Compass Calibration)
- EOToolsPro/ICMTGIS PRO/MDOT RTK Network (GCP Positioning)
- SimActive Correlator3D (Processing)
- Blue Marble's Global Mapper GIS (General Mapping)
- Virtual Surveyor (Visualization, 3D Measurements including Volumes)
- Snagit (Screen Capture)
- MS Office Suite (Reports)
- "Zoom" Web Conferencing (Collaboration)



Select Sands American Corporation Silica Sand (Proppant) Stockpile Volumetrics Workflow



SELECT SANDS
CORP.
TSX VENTURE: SNS | OTCQX: SLSDF

Stockpile Volumetrics Workflow
Mike Allison
Last Updated: 02-11-18

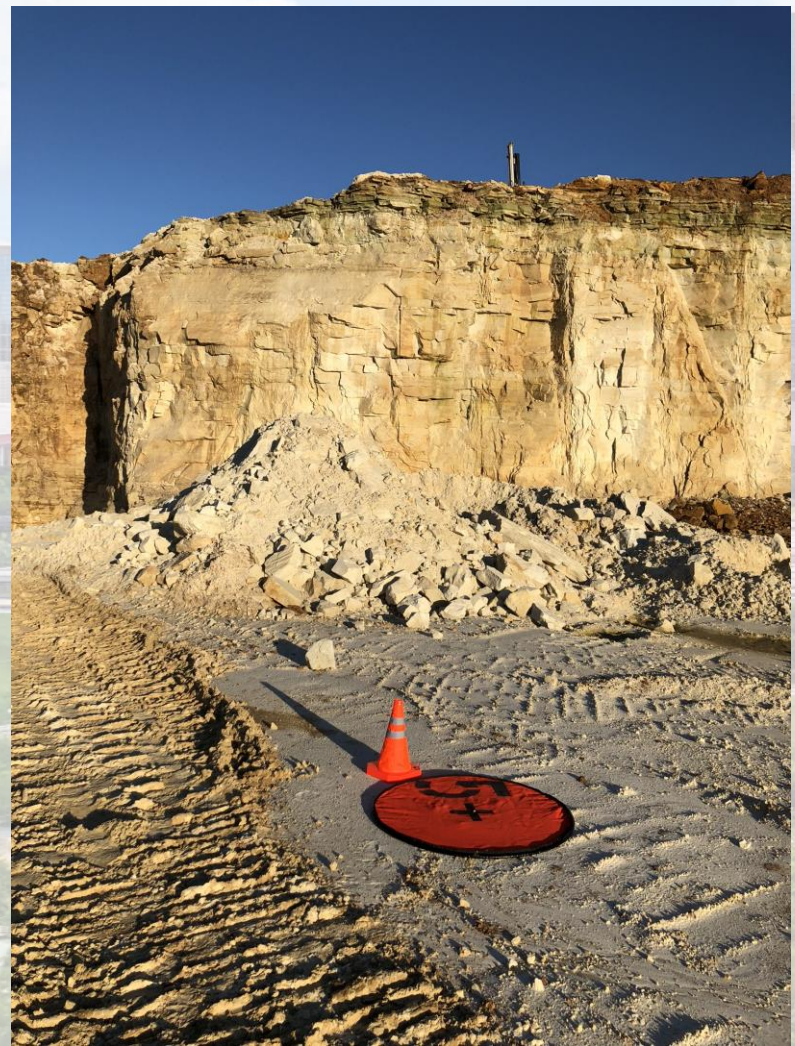


Ground Control Points (GCPs)

- GCPs are clearly marked targets on the ground, spaced strategically throughout your area of interest.
- The GCPs and their coordinates are then used to help drone mapping software accurately position your map in relation to the real world around it.
- Recommend at least 5-7 GCPs located in the 4 corners, the center and highest and lowest points in your area of interest.
- GNSS (Global Navigation Satellite System) Network for the most accurate GCP positioning.



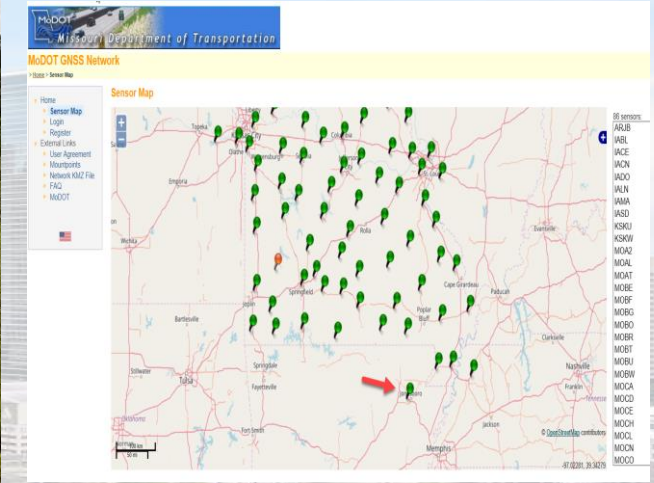
GCP



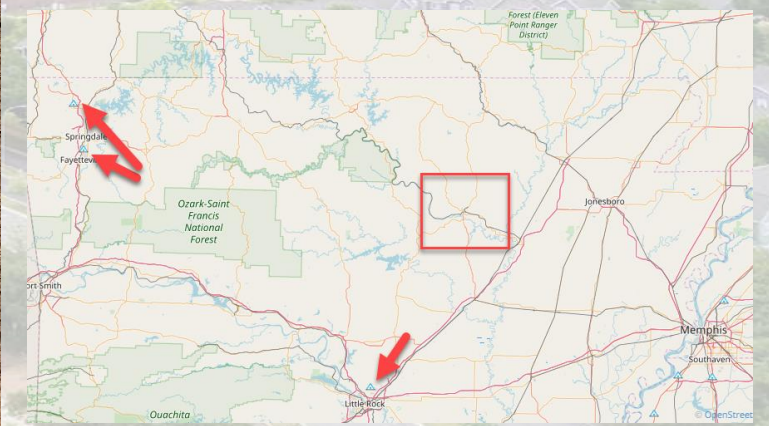
GNSS Networks



MDOT

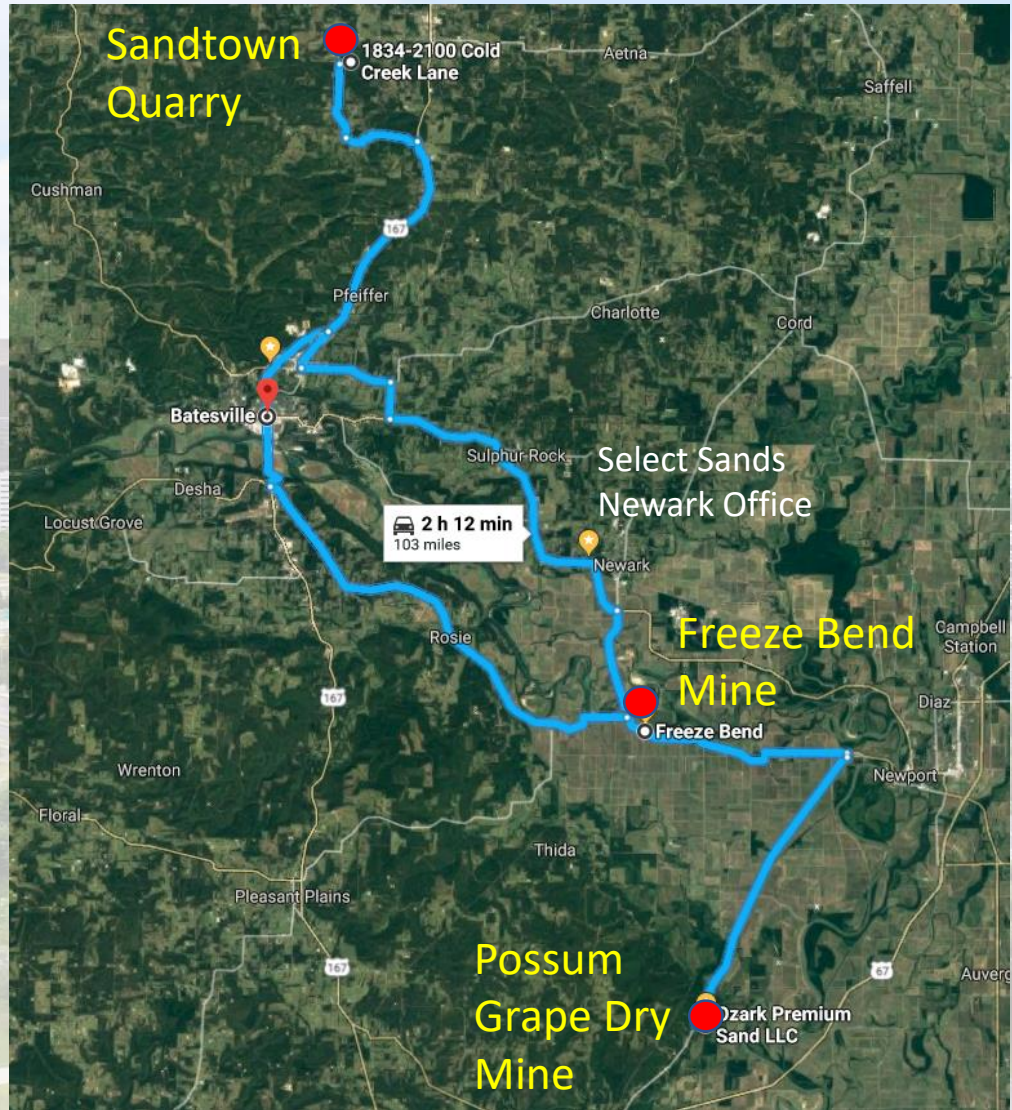
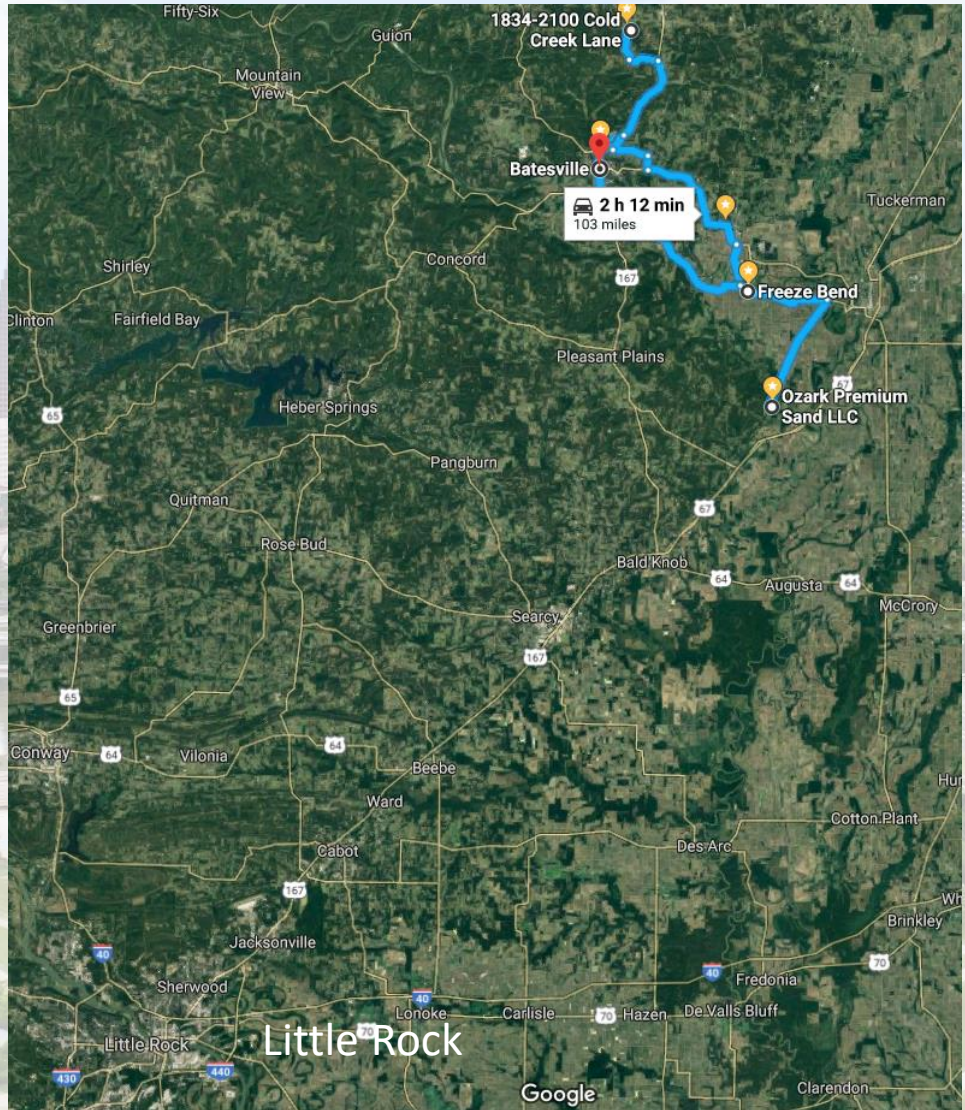


TopCon TopNet Live





Mining Site Locations



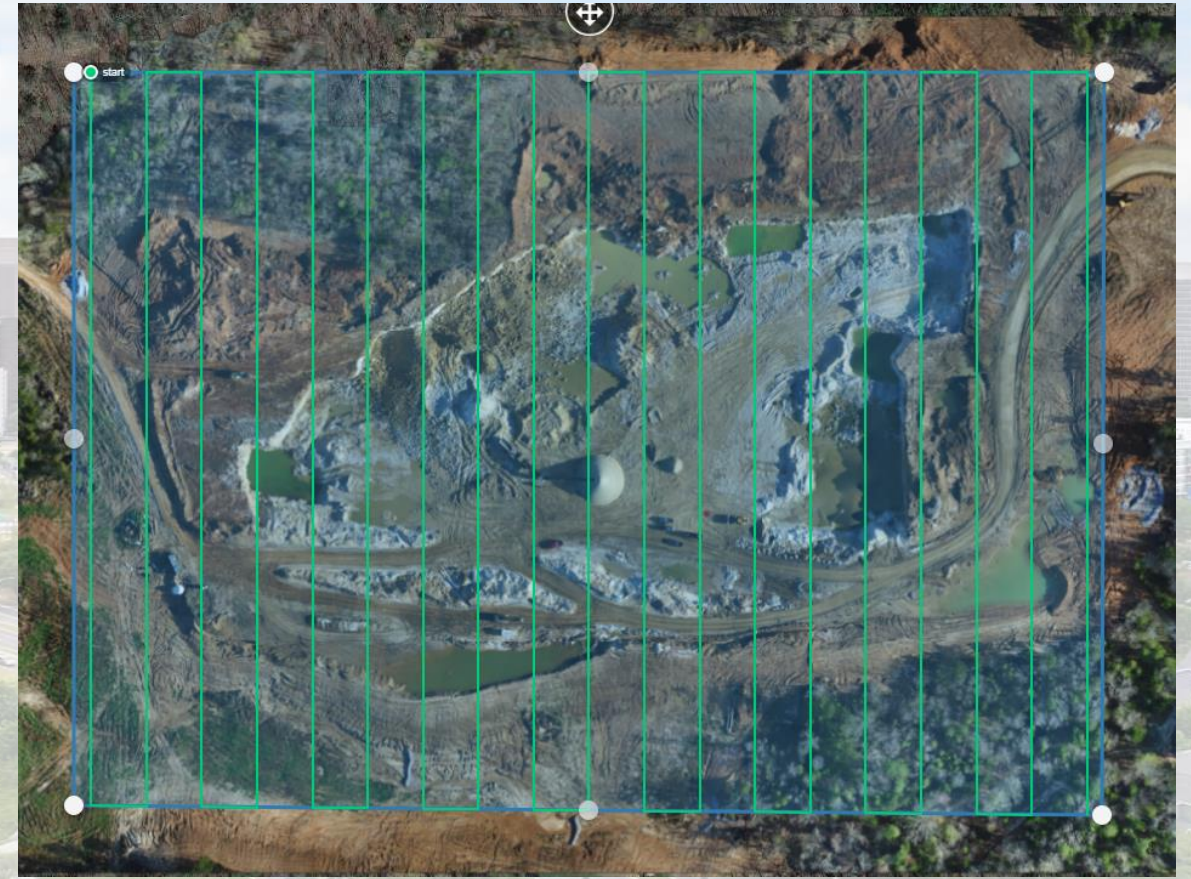
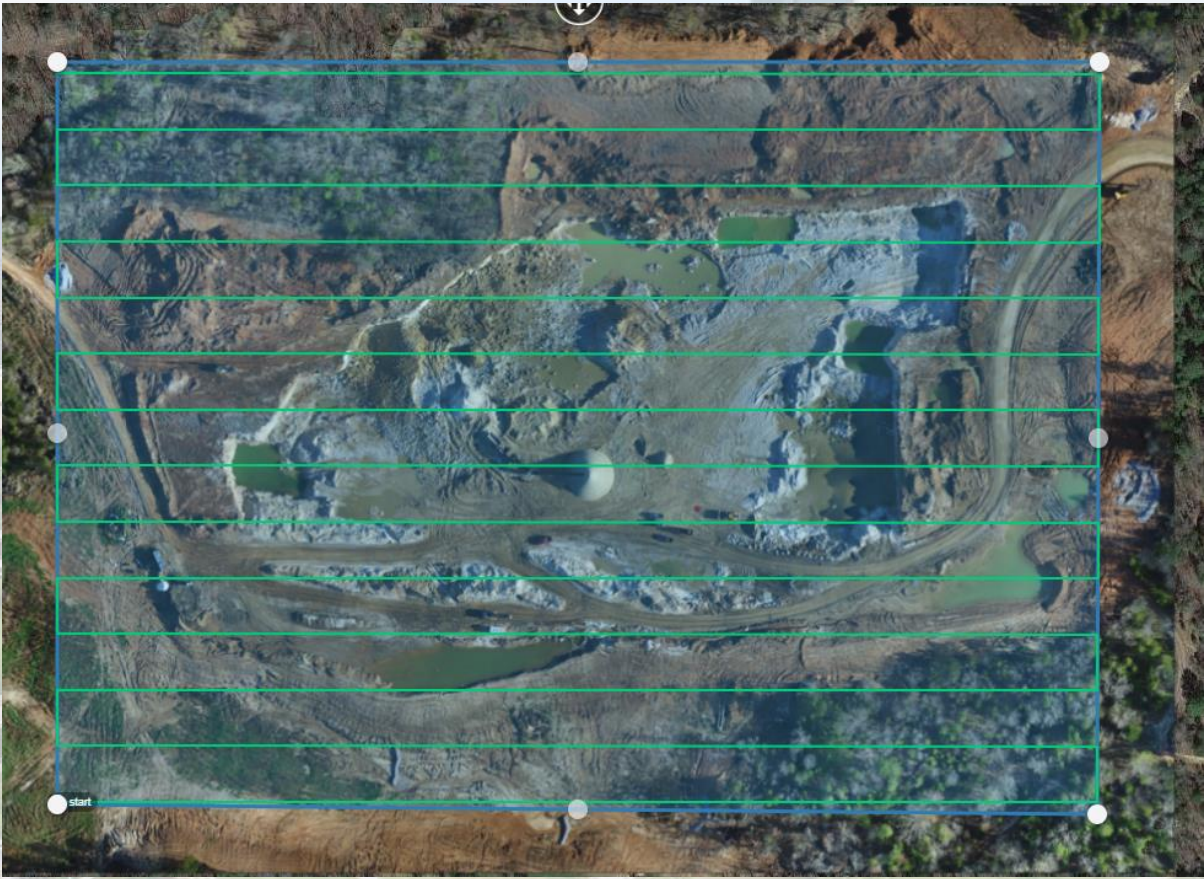


Drone Aerial Survey Specs

- 3 Sites Ranging from 35-89 Acres
- 5-7 Ground Control Points (GCPs)
- 250' Above Ground Level (AGL)
- 80% Sidelap/Frontlap
- DJI Inspire 2 with Zenmuse X5S Camera
- 0.8 Inches/Pixel Ground Sample Distance (GSD) or Resolution
- 2 Passes Each, Perpendicular Grid Pattern

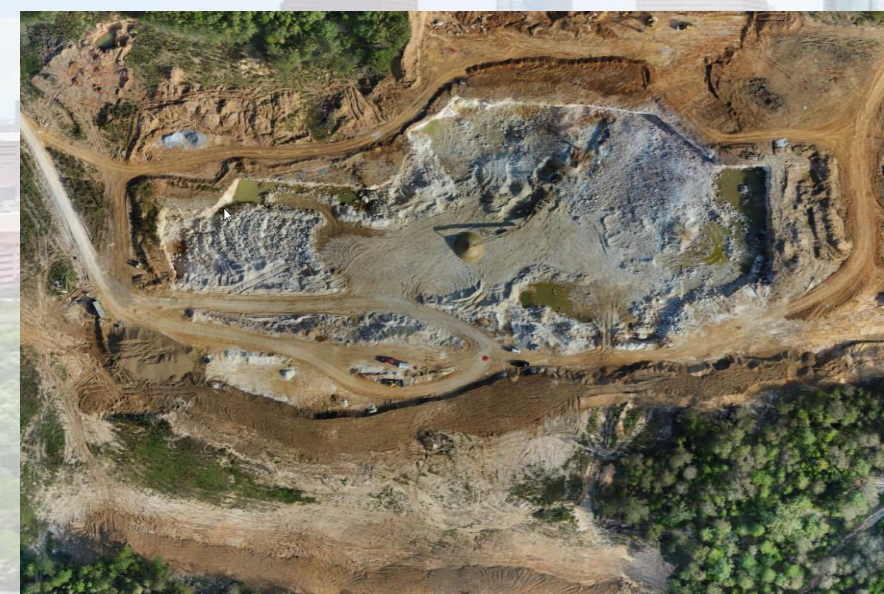


2 Passes, Perpendicular Grid Pattern

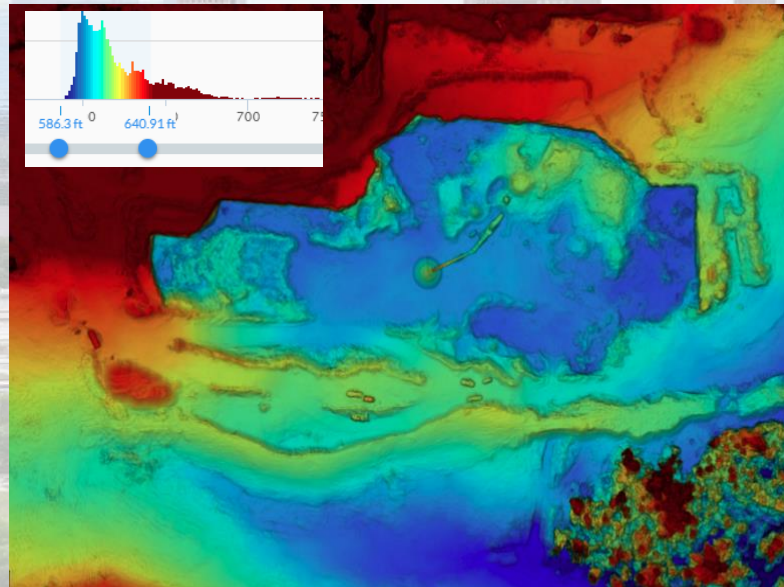




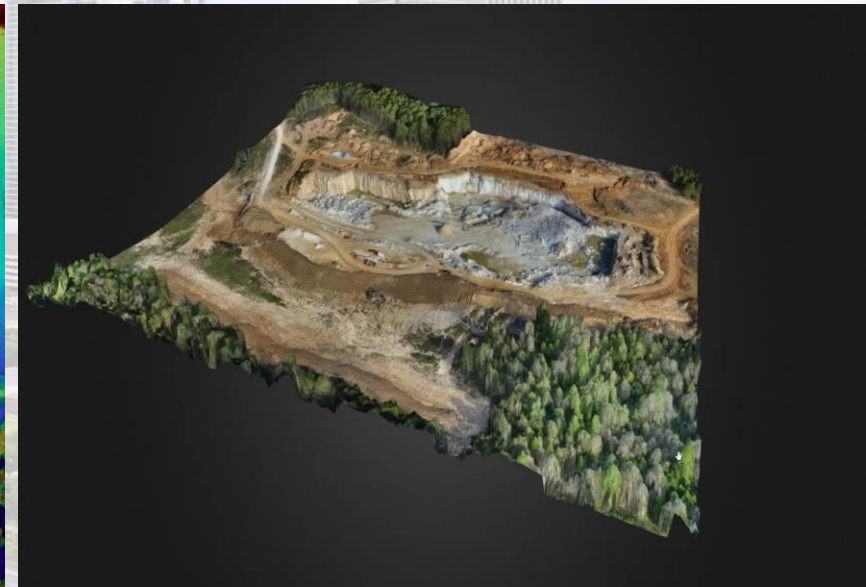
Sandtown Quarry (36 Acres)



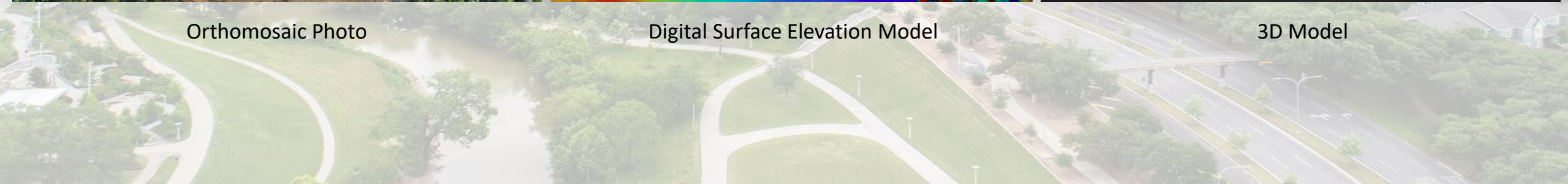
Orthomosaic Photo



Digital Surface Elevation Model

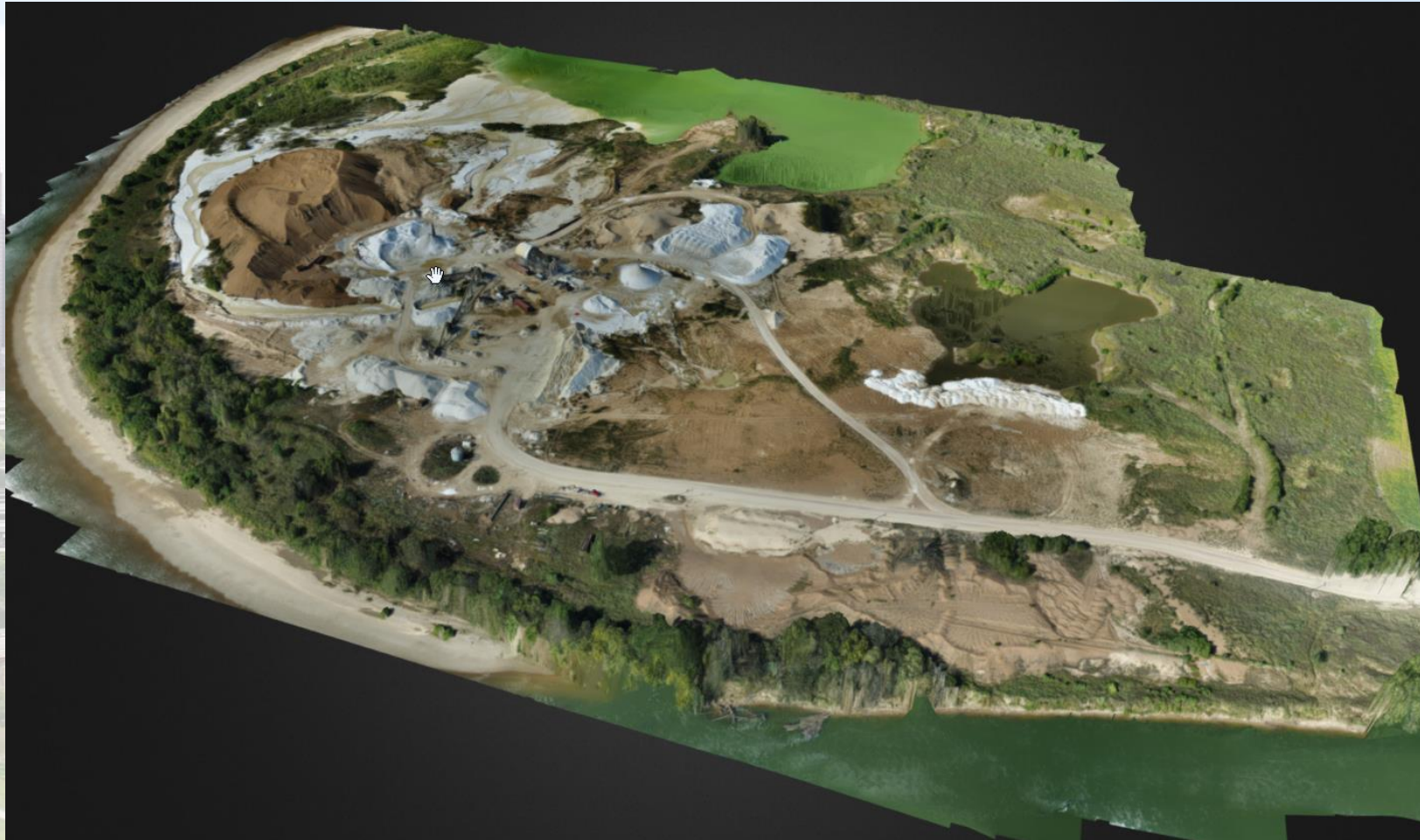


3D Model





Freeze Bend Mine (89 Acres)



Orthomosaic Photo



Possum Grape Dry Plant (35 Acres)



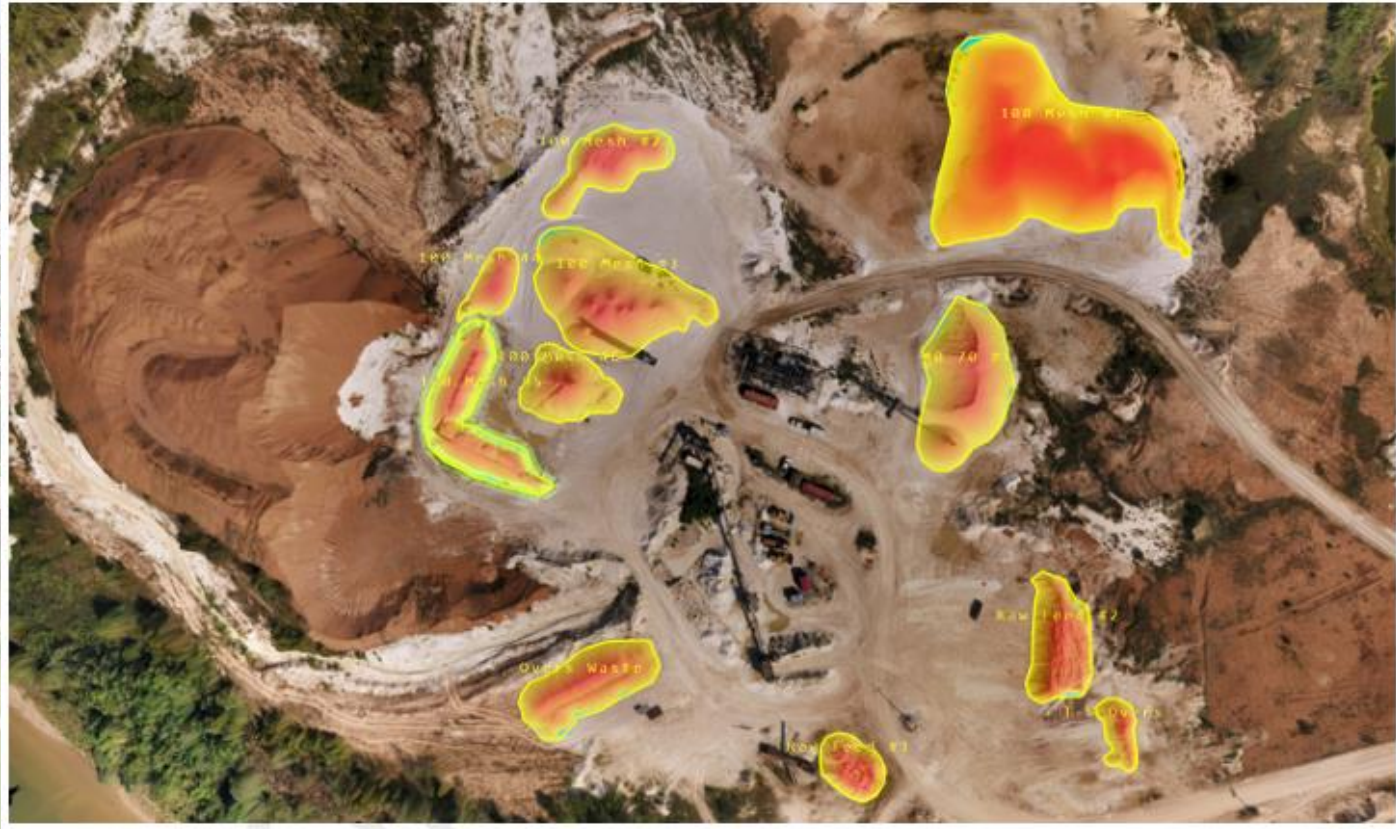
Orthomosaic Photo



Quarterly Stockpile Volumes Report



Site	Stockpile	Area (sq. ft.)	Volume (cu. Ft.)	Volume (cu. yd.)	Tons	Reference	Totals
Freeze Bend Mine	100 Mesh #1	44,386.00	646,705.00	23,952.01	30,658.58	Flat 232	
Freeze Bend Mine	100 Mesh #2	7,836.00	49,320.00	1,826.66	2,338.13	3D Polygon	
Freeze Bend Mine	100 Mesh #3	18,790.00	240,829.00	8,919.58	11,417.07	Flat 232	
Freeze Bend Mine	100 Mesh #4	3,224.00	12,724.00	471.26	603.21	3D Polygon	
Freeze Bend Mine	100 Mesh #5	11,793.00	56,543.00	2,094.18	2,680.55	3D Polygon	
Freeze Bend Mine	100 Mesh #6	6,841.00	52,416.00	1,941.33	2,484.90	3D Polygon	50,182.44
Freeze Bend Mine	40-70 #1	15,176.00	158,542.00	5,871.92	7,516.06	3D Polygon	7,516.06
Freeze Bend Mine	Overs Waste	10,032.00	64,518.00	2,389.55	3,058.63	3D Polygon	3,058.63
Freeze Bend Mine	Raw Feed #1	4,002.00	25,834.00	956.81	1,224.72	3D Polygon	
Freeze Bend Mine	Raw Feed #2	8,126.00	56,396.00	2,088.74	2,673.59	3D Polygon	3,898.31
Freeze Bend Mine	T-6 Overs	2,649.00	11,220.00	415.56	531.91	3D Polygon	531.91





Sandtown Quarry Evolution



Orthophotomosaic – 12/18



Orthophotomosaic – 03/19



Orthophotomosaic – 06/18



Orthophotomosaic – 09/19





Environmental Impact Monitoring





Traditional Stockpile Inventory Method

- Performed Annually
- Time Consuming and Labor Intensive Resulting in Higher Costs
- 1-2 Weeks Turnaround from Start to Finish
- Safety Risks with Survey Team Climbing on Stockpiles
- Summarized Final Report for Each Site





Drone Stockpile Inventory Method

- Performed Quarterly (10)
- 7 Days or Less (Goal is 5 Days) Turnaround including Travel
- Stockpile Polygons for Each Site Visually Confirmed Collaboratively
- Detailed Final Report (Spreadsheet and Word Documents)
- 34"x44" (ANSI E) Scaled Hardcopy Plots Provided for Each Site Delivered To Offices within 10 days
- Digital Data delivered via Dropbox including Georeferenced Orthomosaic Photos, Digital Surface Elevation Models , 3D Models, and Plot Files for Each Site





Thank Select Sands America Corporation
for Permission to do this Presentation



And IPEC for the opportunity to present
this talk.





Q&A





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