

DIGITAL MAPPING TECHNIQUES 2022

The following was presented at DMT'22
May 22 - 25, 2022

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2022)

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

Benefits of a Budget-Conscious Drone Program

2022 DMT

May 23, 2022

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Bureau of Geological Survey

Presentation Overview

1. Equipment and methods
2. Safety
3. Field efficiency
4. High-resolution imagery

Equipment

DJI Mavic 2 Zoom Drone

- 12 megapixels
- 4000x3000 px resolution
- Zoom lens
- Compact form factor

Emlid Reach RS2 (GCP)

- Multiband RTK GNSS base and rover pair
- Ground Control Points necessary for high level of map accuracy

iPad Mini

- Controls all field equipment



Software

Drone Deploy

- Automated flights (A)

DJI GO 4

- Manual flights (M)

RTKLIB

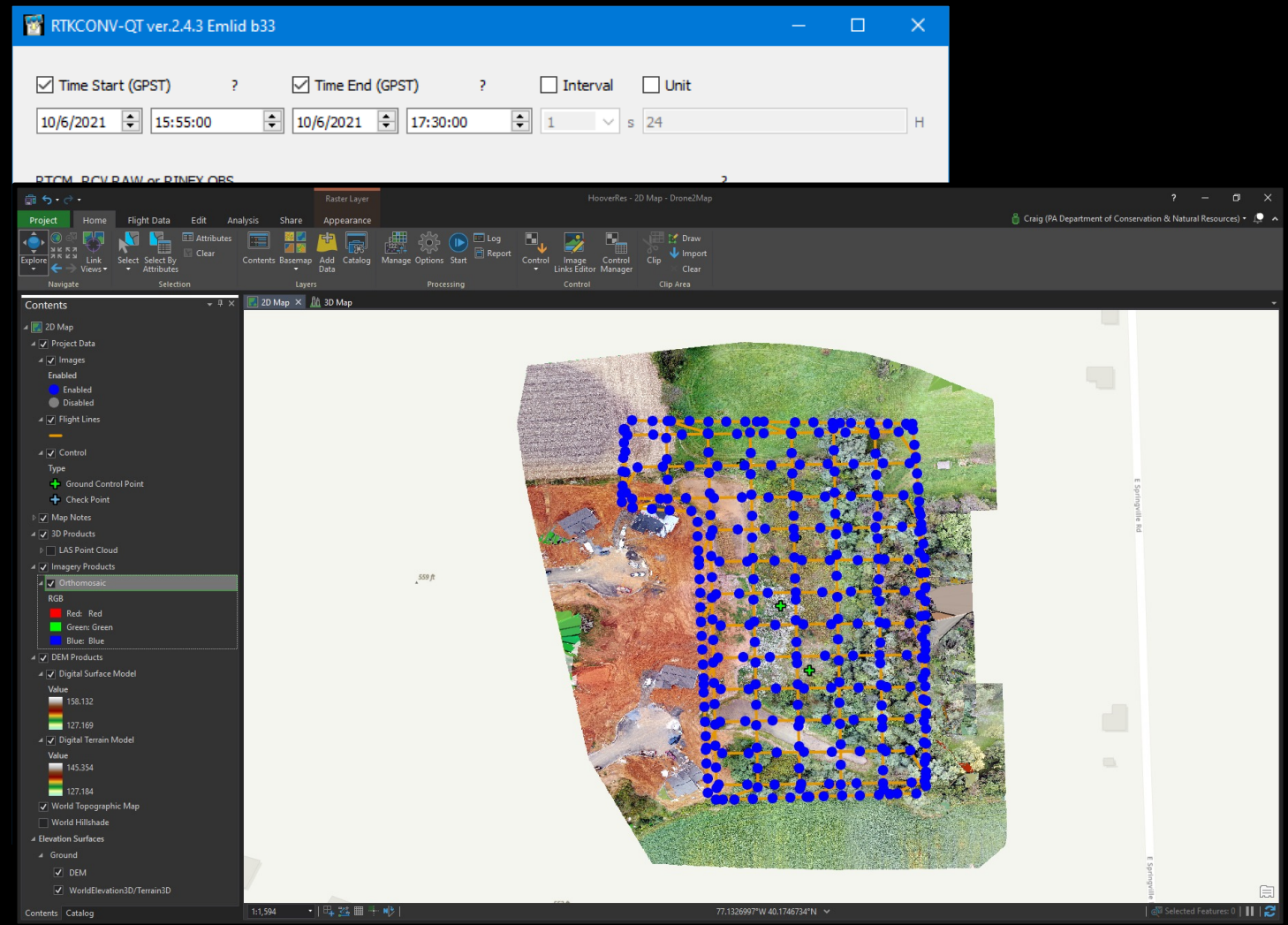
- Processes location data
- RTKCONV, RTKPOST, RTKPLOT

OPUS

- Online Positioning User Service
- Location data correction service

Drone2Map (D2M)

- Drone imagery mapping software



[Upload to Rapid-Static](#)

for data 15 min. - 2 hrs.

[Upload to Static](#)

for data 2 hrs. - 48 hrs.

* required fields

We may use your data for internal evaluations of OPUS use, accuracy, or related research.

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1. Equipment & methods

2. Safety

3. Field efficiency

4. High-res imagery

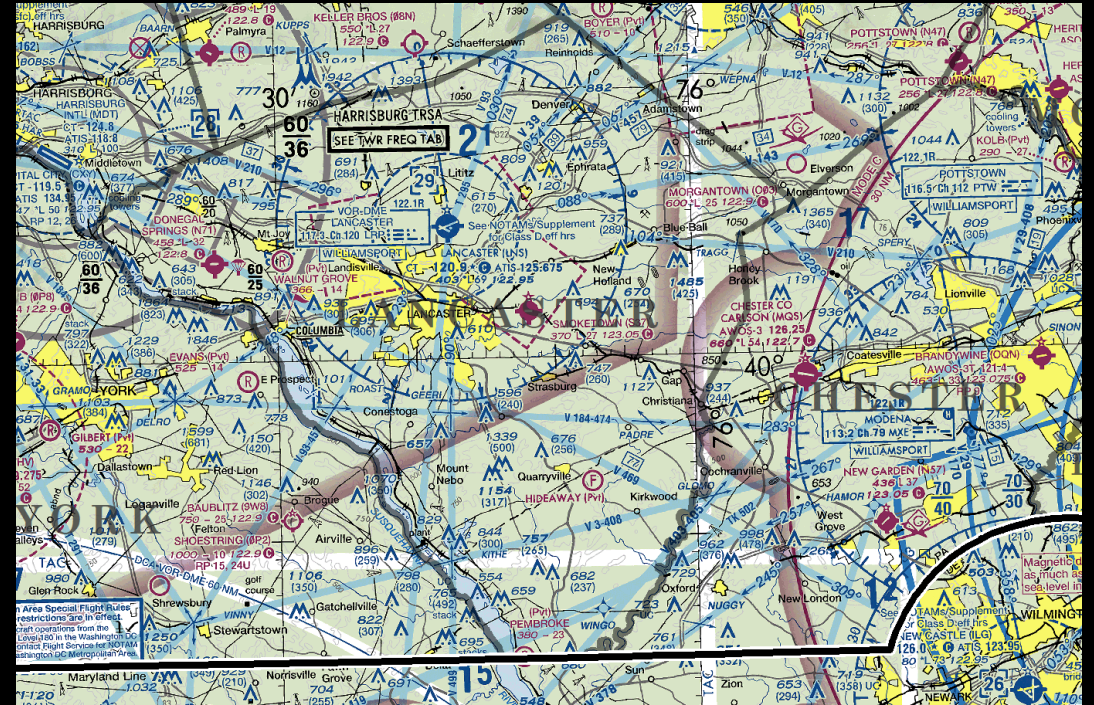
5. Conclusions

AM D2M GCP

Licensing

FAA Part 107 License

- Remote piloting regulated by 14 CFR Part 107 Small Unmanned Aircraft Systems
- Pass the Knowledge Test at any FAA-approved Knowledge Testing Centers
 - Requires Recurrent Training Course For Drone Pilots every 2 years.
- Register drone with FAA
 - \$5 and valid 3 years



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Program Phases

Phase 1 - \$2,300

- Drone
- iPad
- FAA License

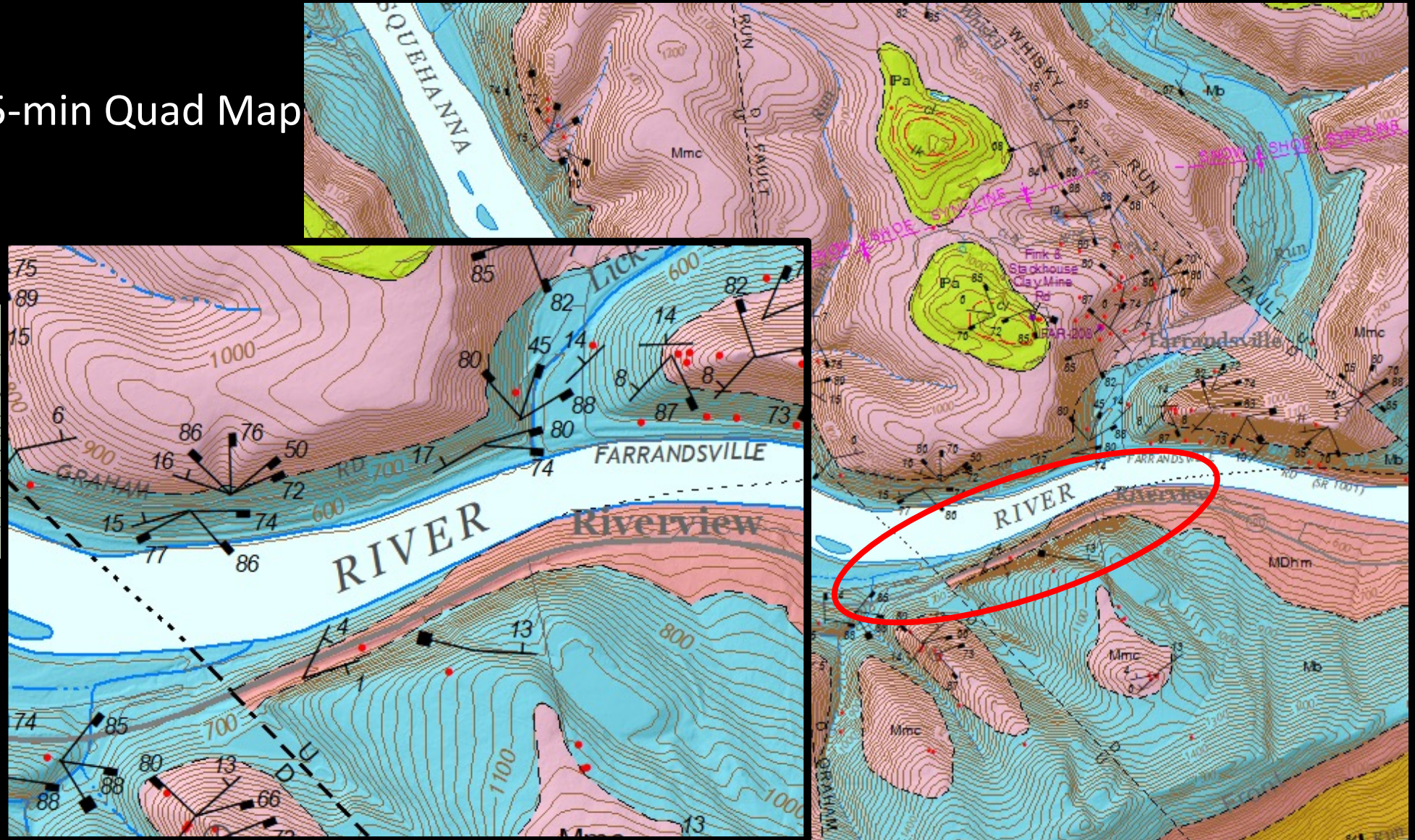
Phase 2 - \$6,700

- Emlid base and rover
- Drone2Map
- Extra batteries

Total - \$9,000

Safety

Farrandville 7.5-min Quad Map



Mapping by: Rose-Anna Behr and Viktoras Skema, PA Geological Survey

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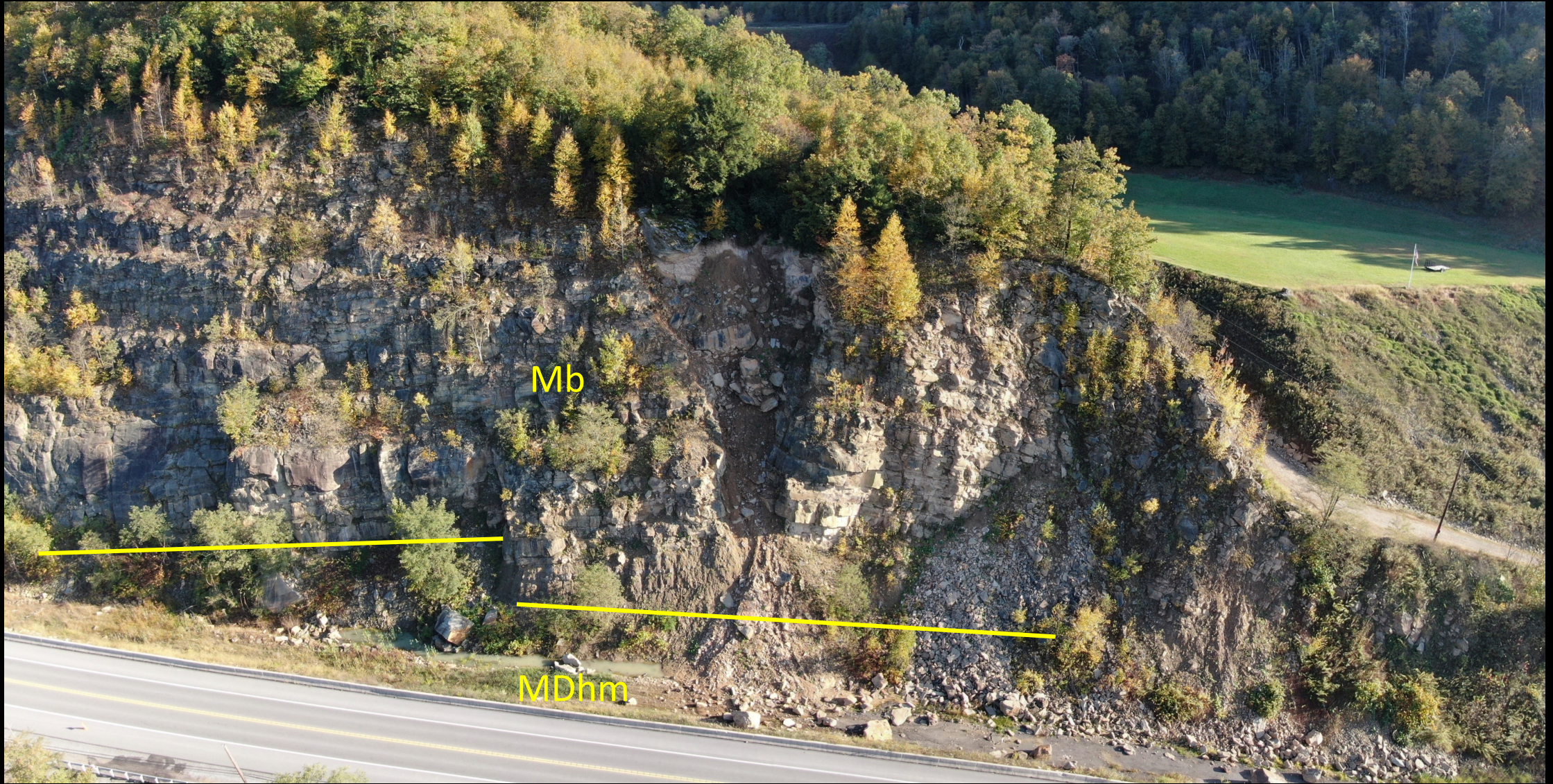
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Safety



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Safety



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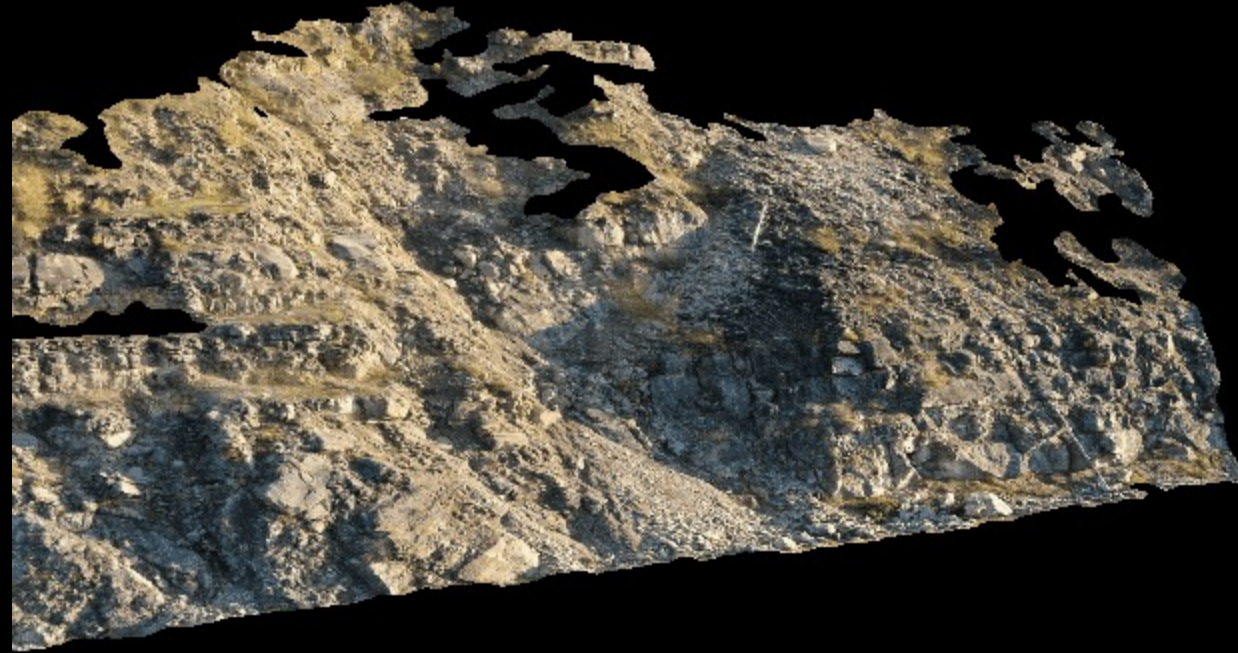
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Safety



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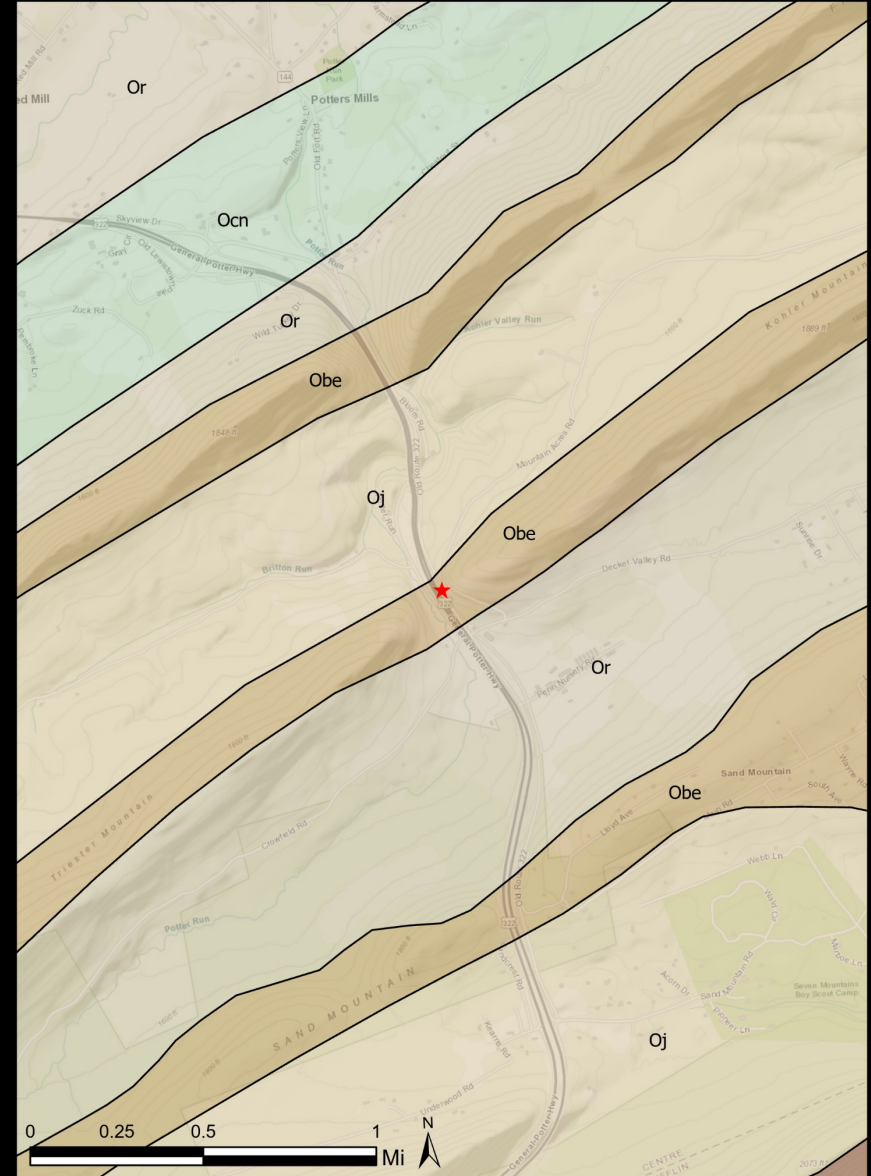
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Field Efficiency

Seven Mountains area, Centre County
Pennsylvania Route 322



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Field Efficiency

Temporarily
Available
Stratigraphic
Information
Collection



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Field Efficiency



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Field Efficiency



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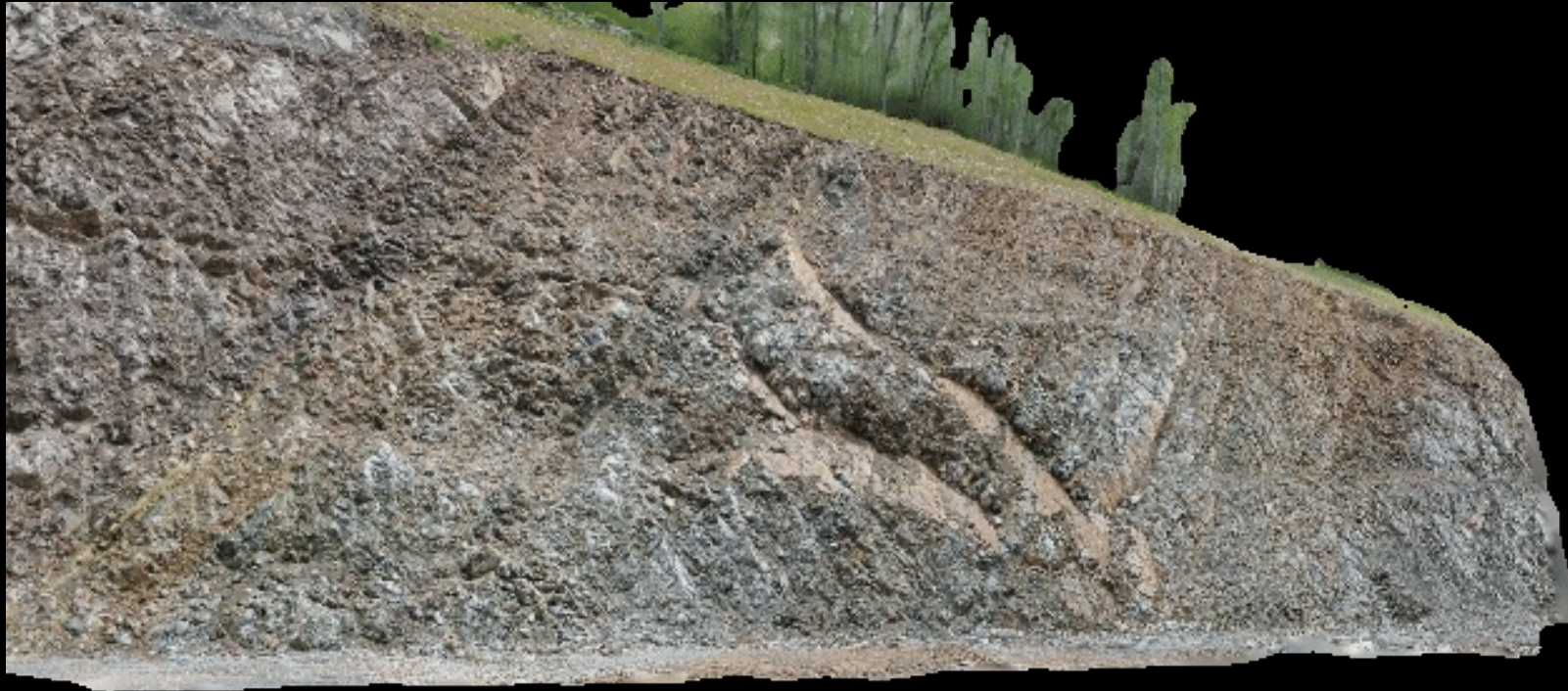
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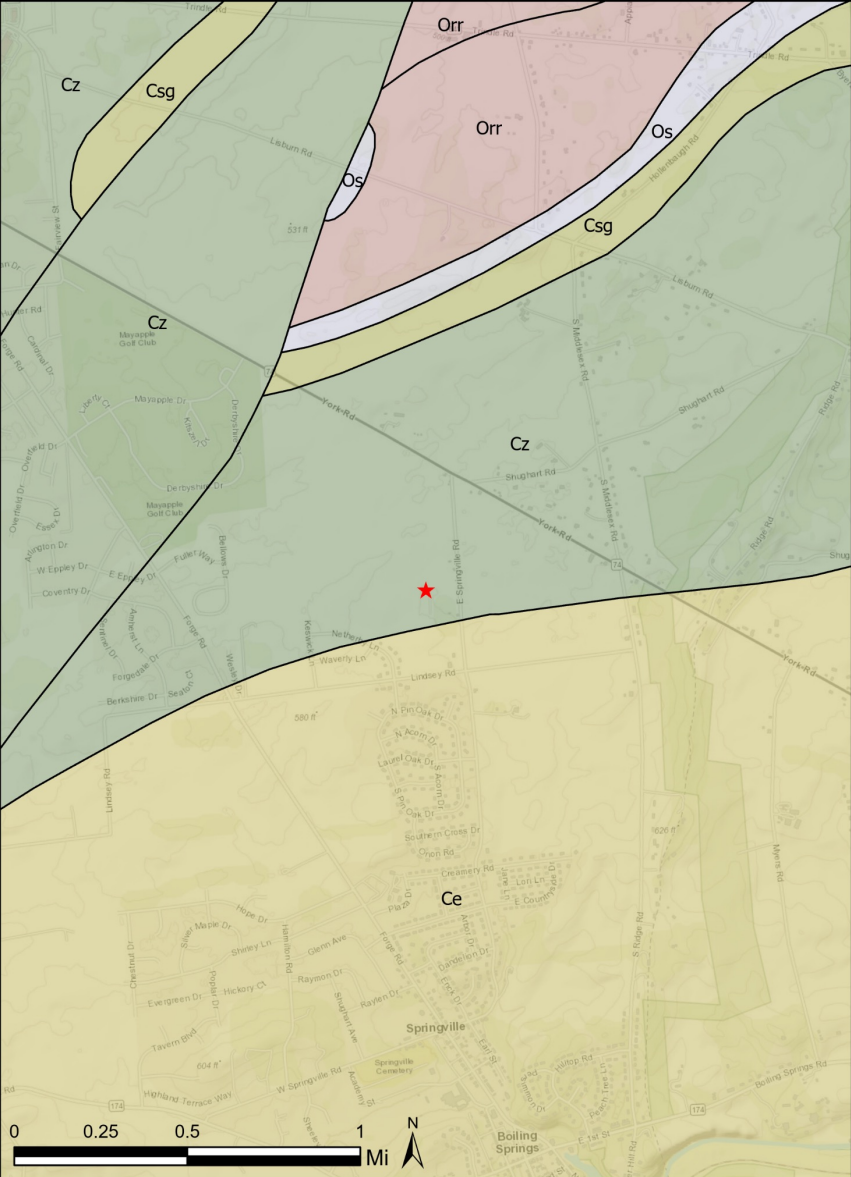
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Field Efficiency

South Middletown Township,
Cumberland County



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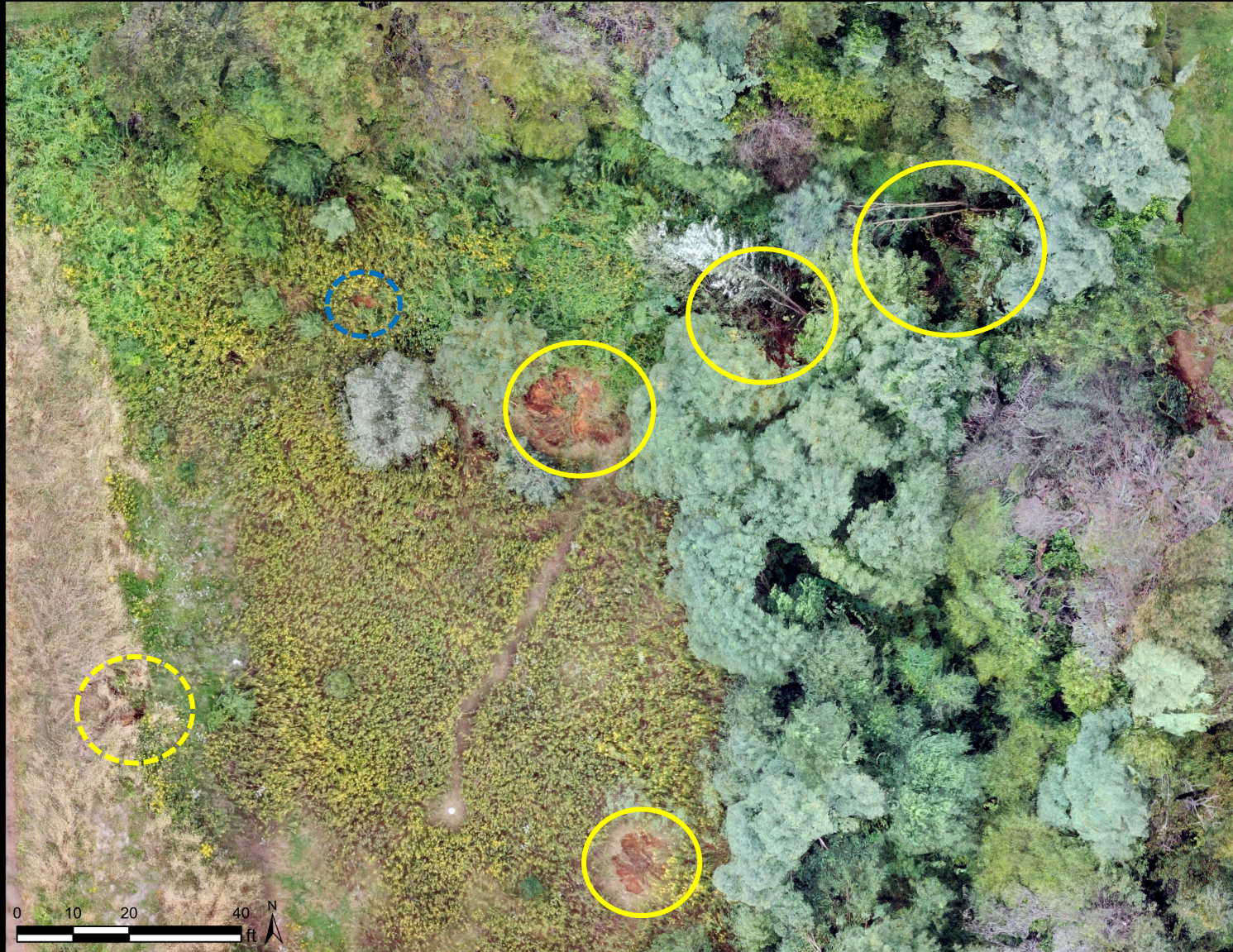
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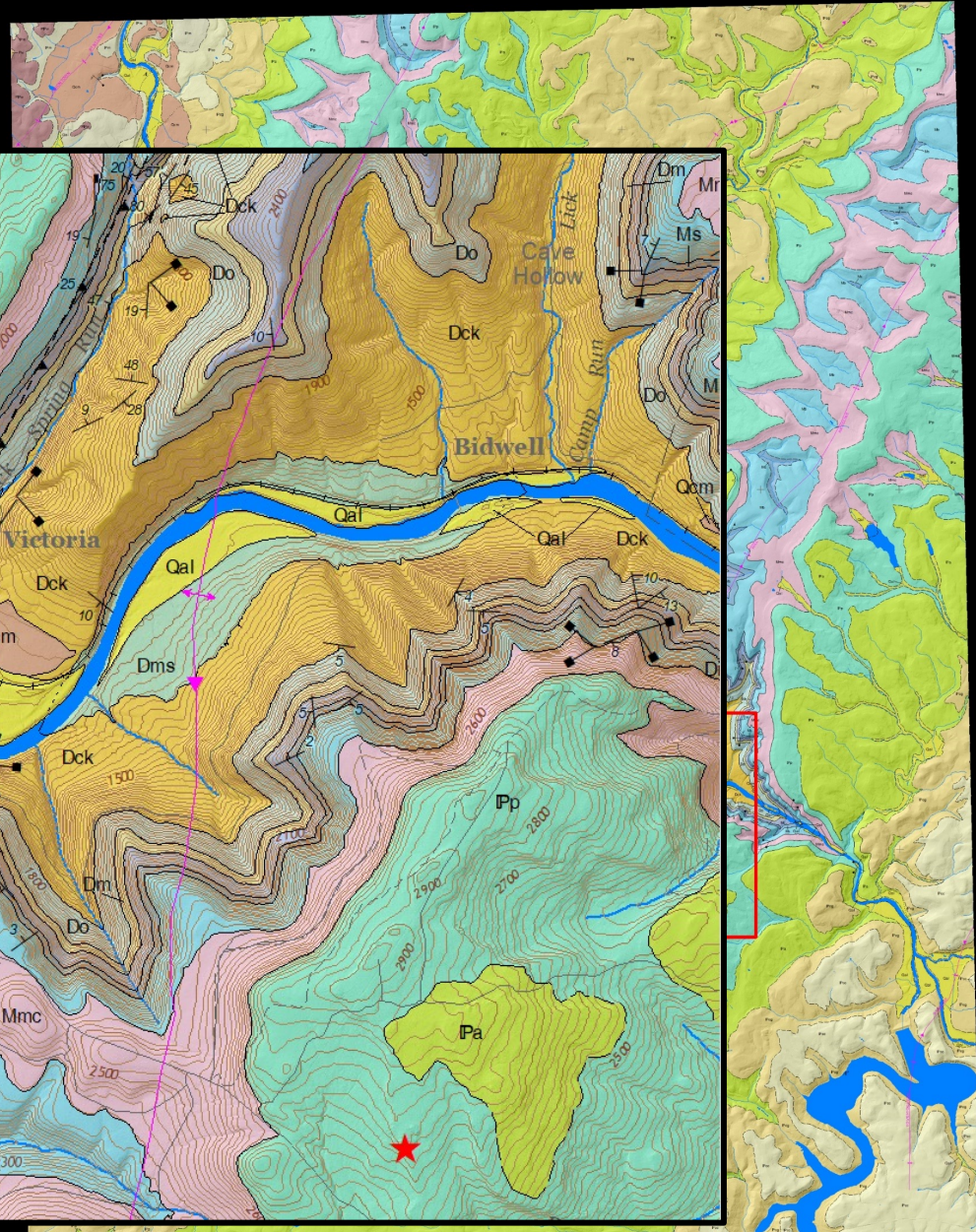
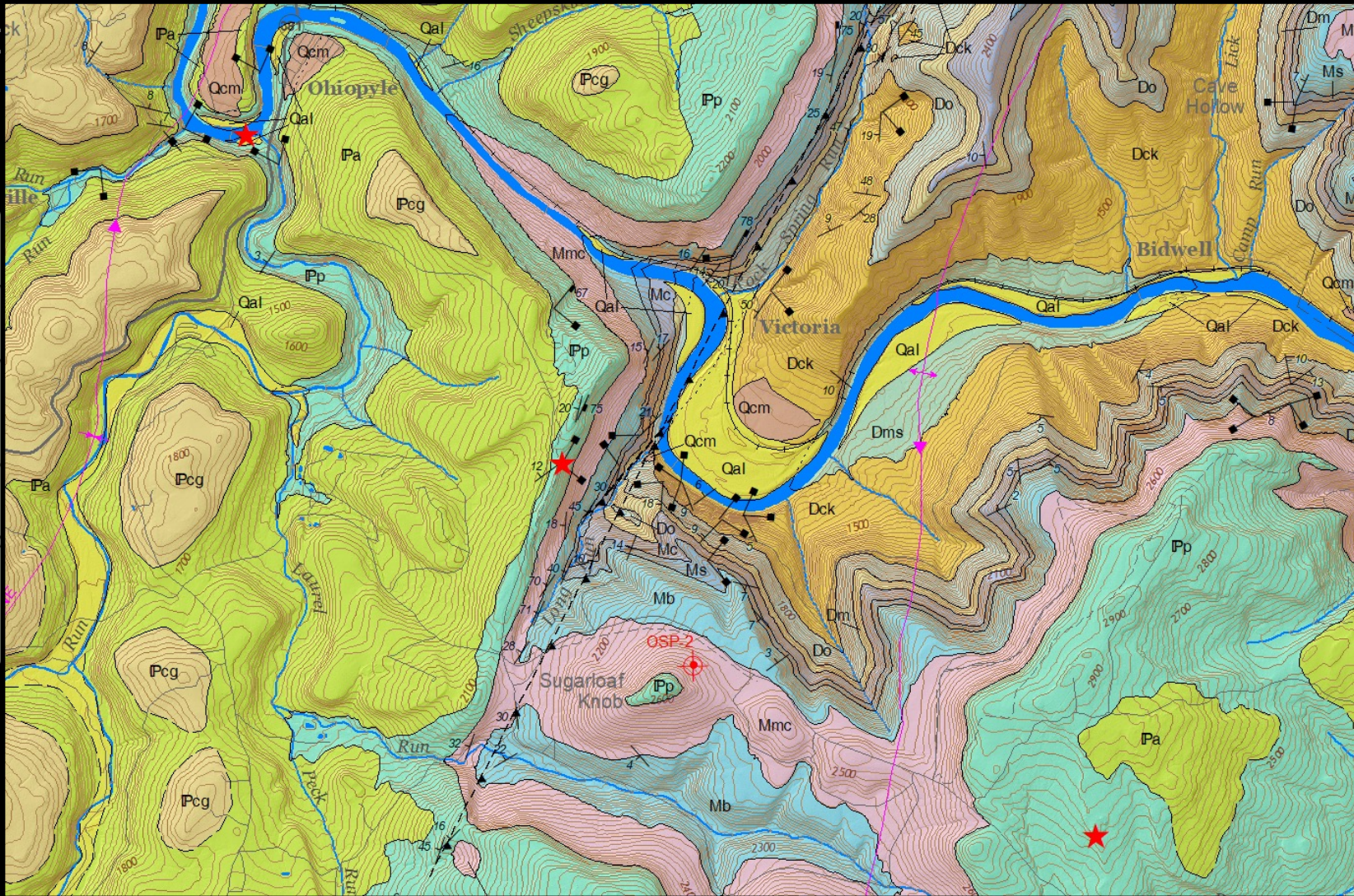
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High Resolution Imagery

Ohiopyle State



Mapping by: Jim Shaulis, PA Geological Survey

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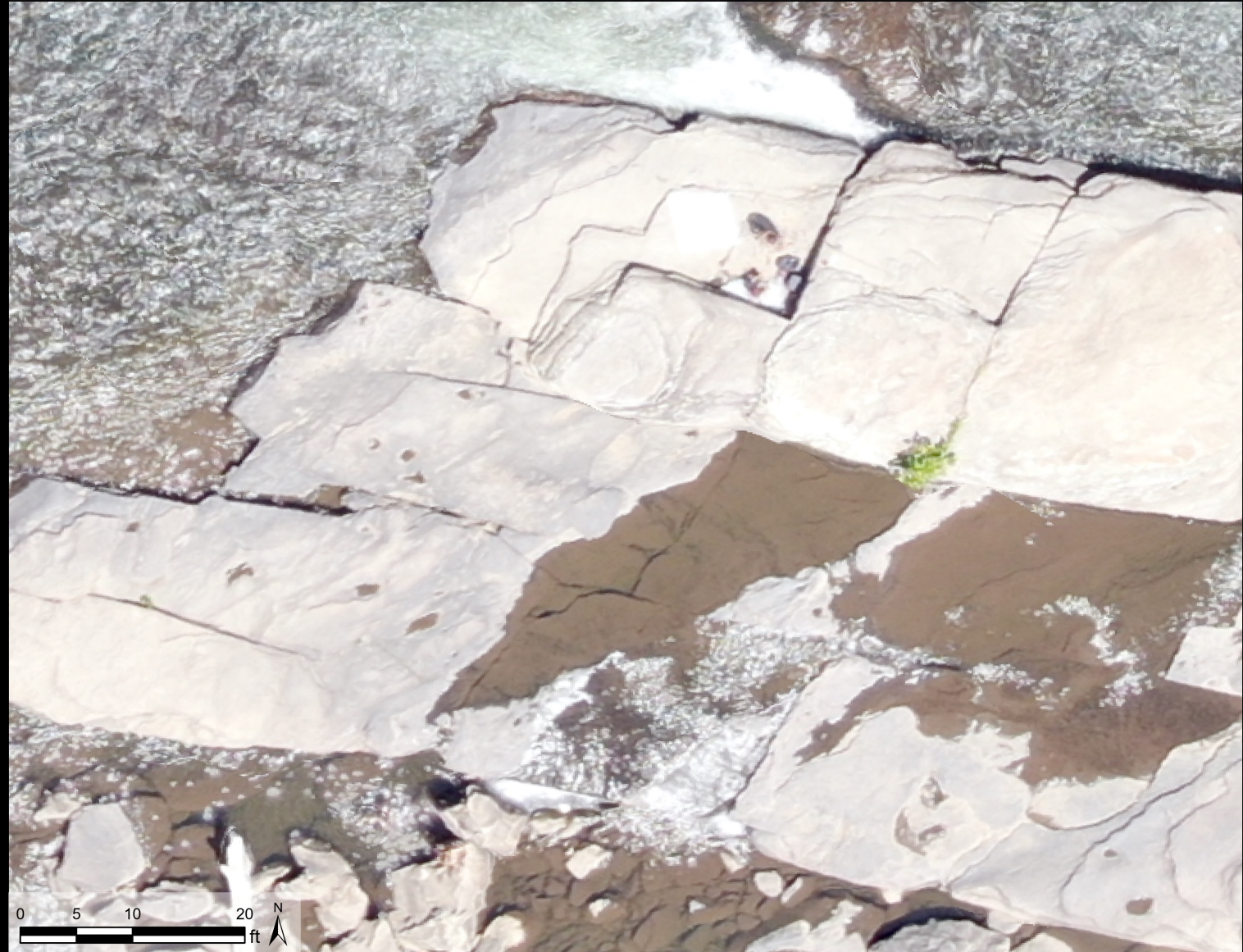
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High Resolution Imagery

PAMAP Imagery
Collected 2006
1 ft/px resolution

PEMA collected
imagery Spring 2018
(Published Jan 2021).
Unavailable when we
needed it!

Drone Imagery
Collected July 9, 2020
0.84 in/px resolution



1. Equipment & methods

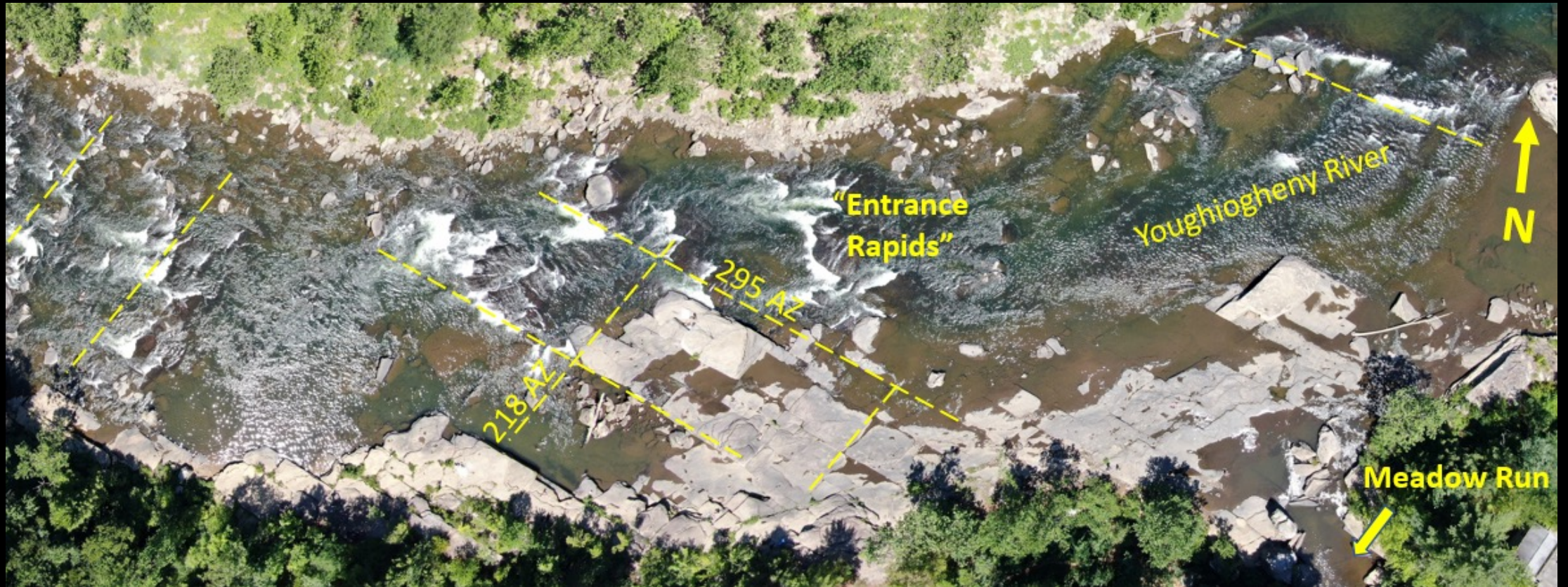
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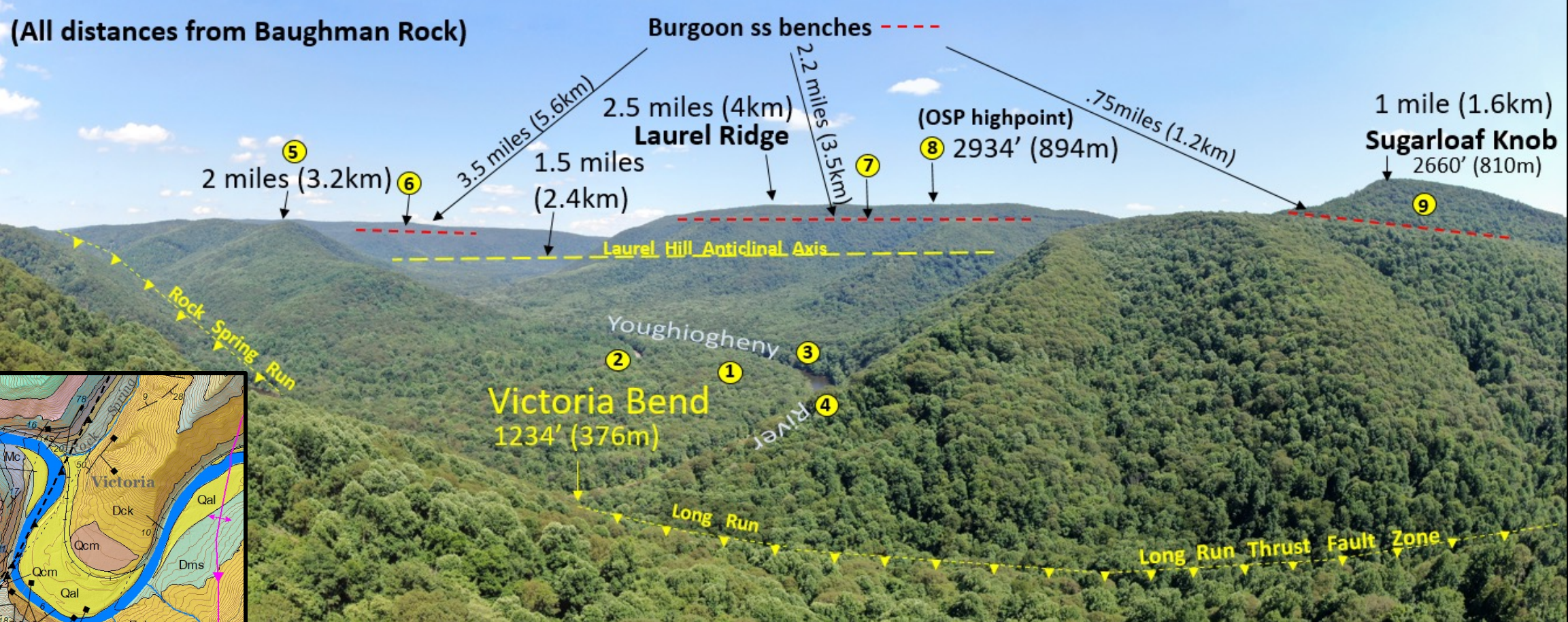
High Resolution Imagery



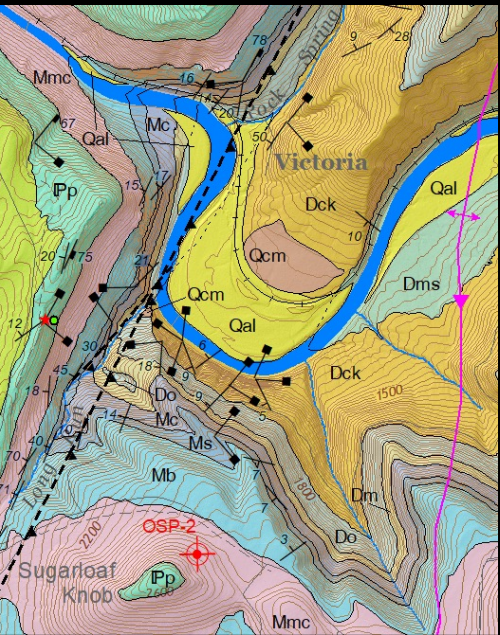
Source: Jim Shaulis (FCOPG Guidebook, 2021, p. 77)

High Resolution Imagery

(All distances from Baughman Rock)



Source: Jim Shaulis (FCOPG Guidebook, 2021, p. 105)



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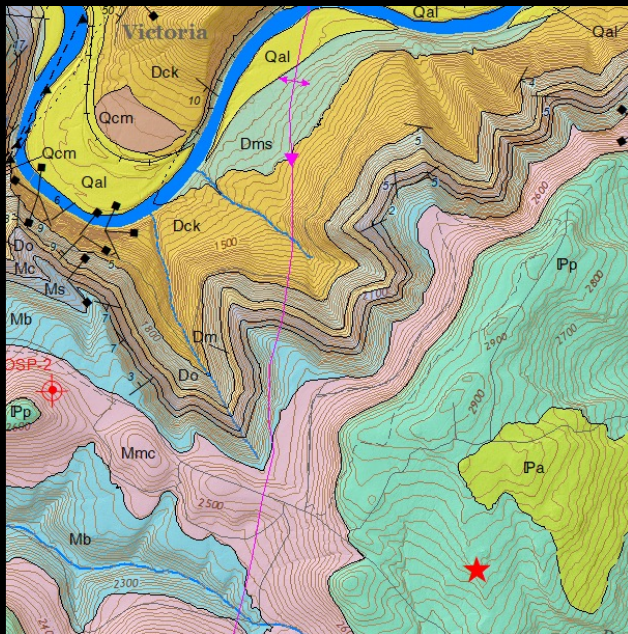
High Resolution Imagery



Photo source: Jim Shaulis, PA Geological Survey



Photo source: Jim Shaulis, PA Geological Survey



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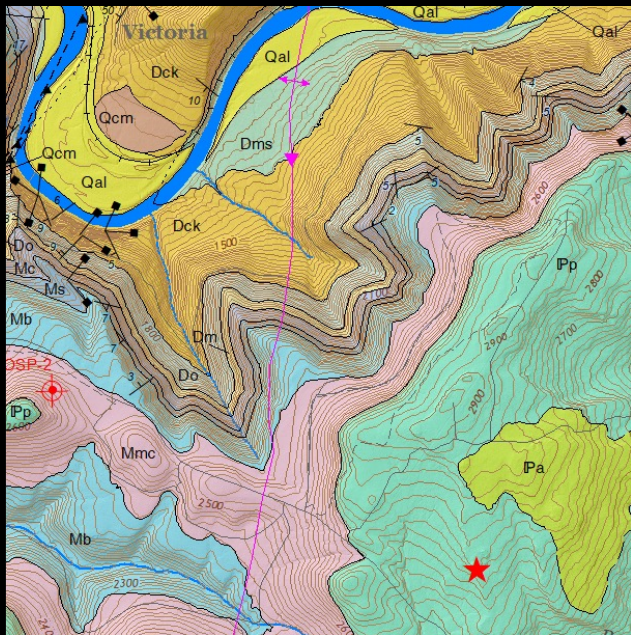
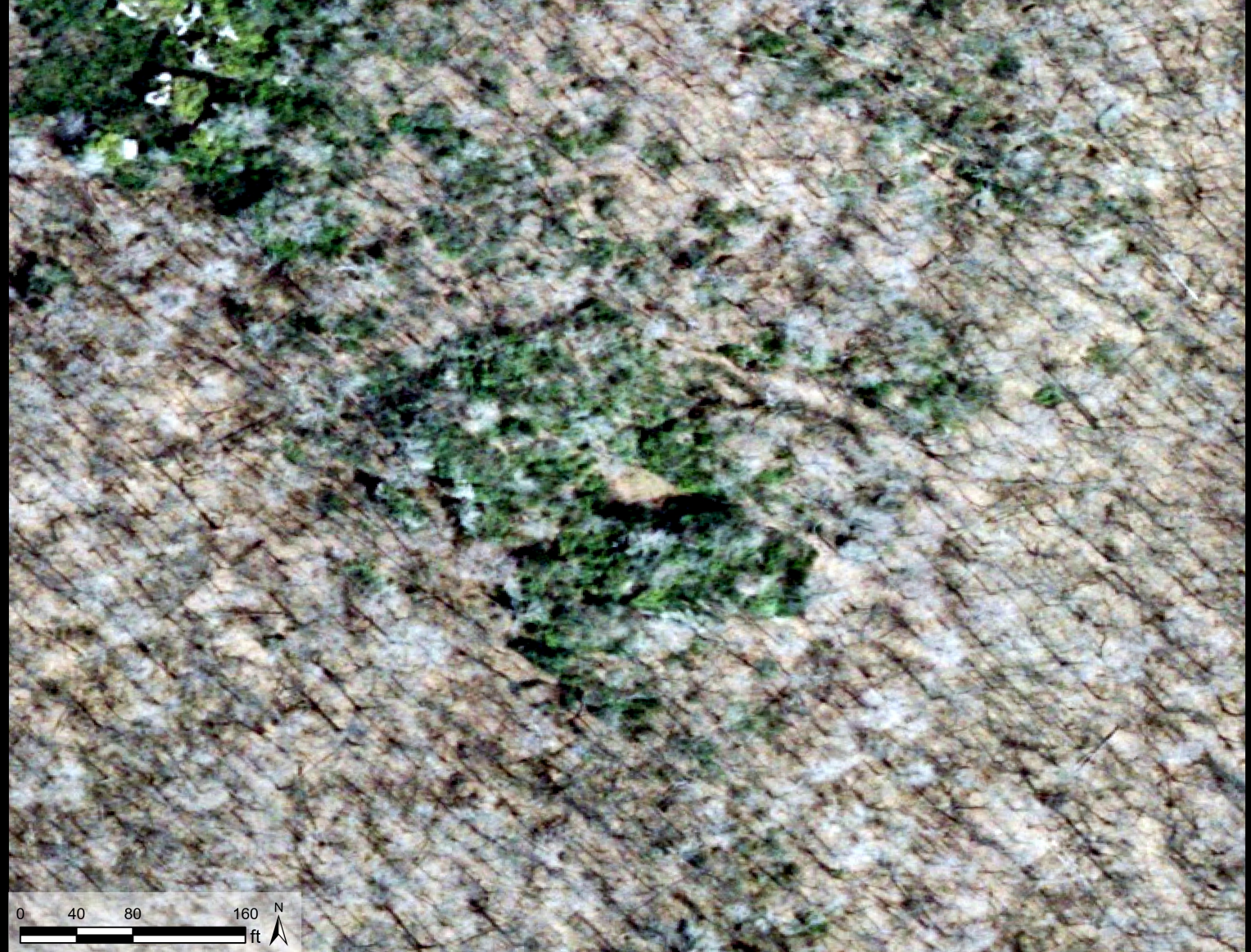
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AM D2M GCP

High Resolution Imagery

PAMAP Imagery
Collected 2006
1 ft/px resolution



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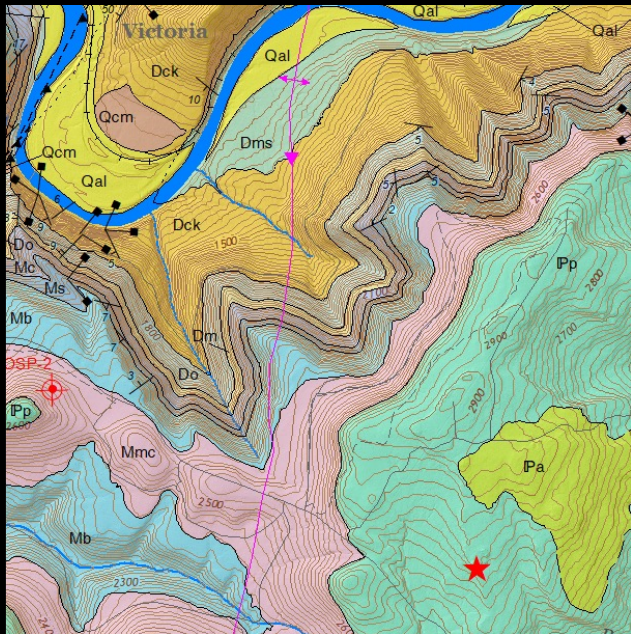
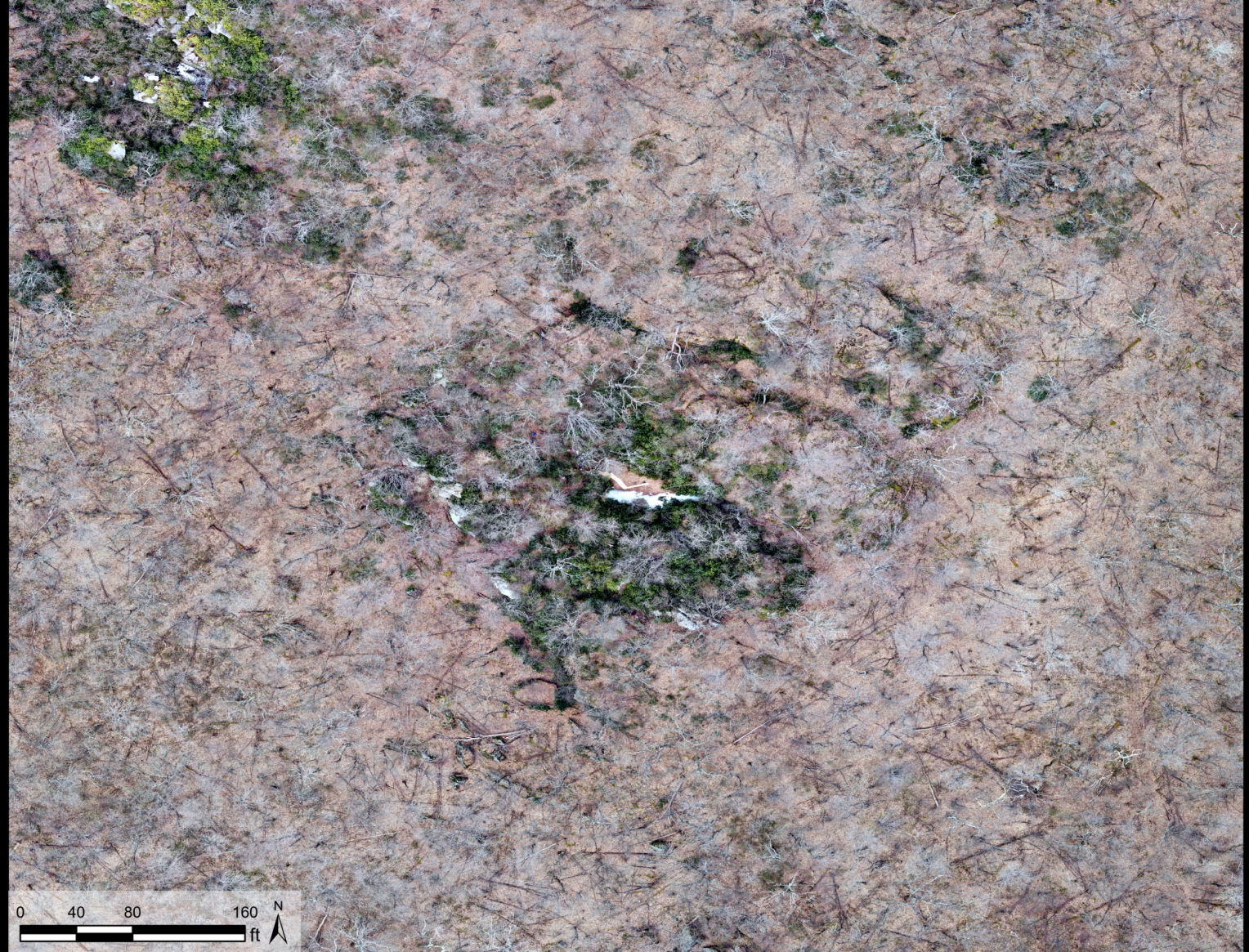
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High Resolution Imagery

Drone Imagery

Collected April 2, 2019

0.89 in/px resolution



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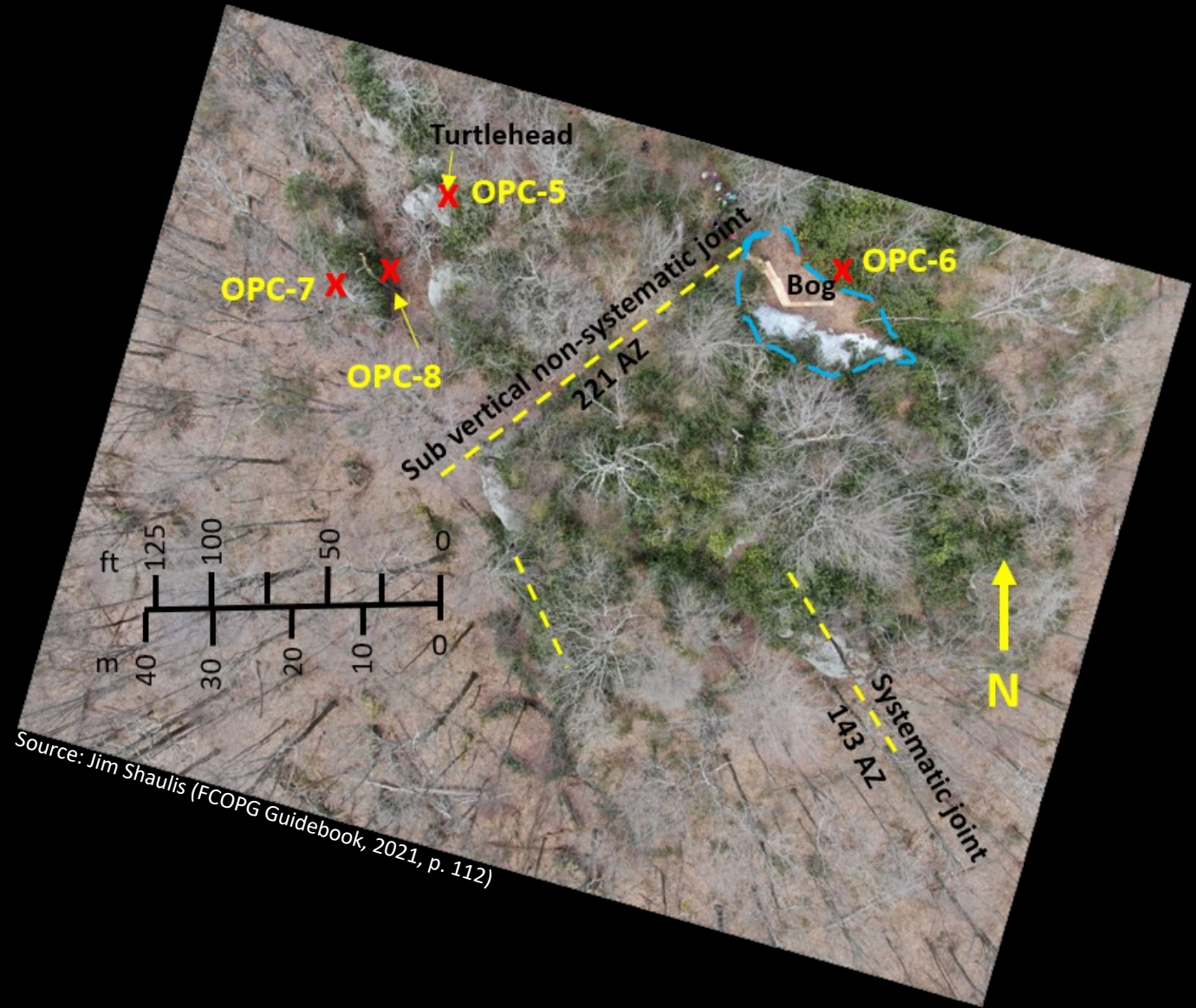
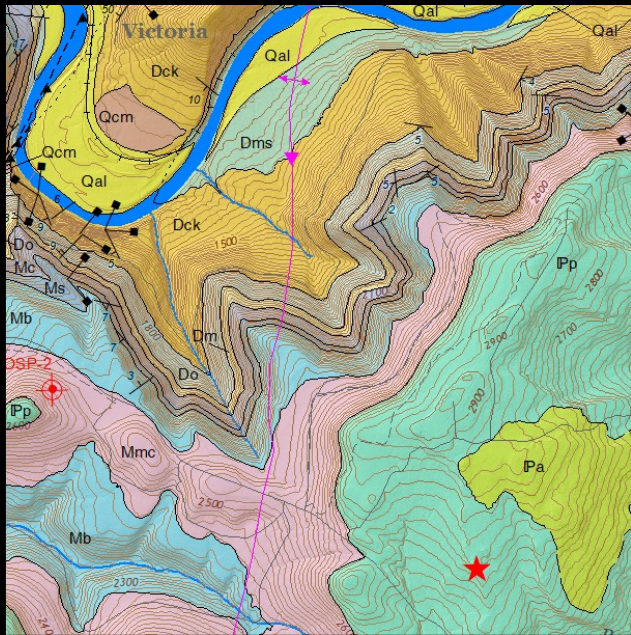
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High Resolution Imagery



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Conclusions

Consumer level drones will work.

Modestly priced alternatives for drone mapping exist.

Benefits Survey staff geologists

- Mapping
- Services Requests
- Outreach
- Publications

Similar setups can be implemented

- Academic departments
- Business



Thank You!

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717-702-2023



pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

