Trail Planning and Design:

Foundations of Success

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AMERICAN TRAILS

Applied Trails Research

chinook LANDSCAPE ARCHITECTURE

PTBA

Jon Altschuld, PLA, ASLA

Chinook Landscape Architecture

- Landscape Architect (CO, CA)
- FAA Remote Pilot
- Author, presenter
- 3D data collection and visualization

PIX4D

Pix4D Ambassador

Professional TrailBuilders Association

SketchUp Visiting Professionals

Jeremy Wimpey, PhD

Applied Trails Research, LLC

- Geographer by training
- Supports sustainable trails system development and management
- Applied Field Investigations on visitor-use-related-impacts to wildlife, water, vegetation, soils and impacts to other recreationists
- Works with the National Scenic and Historic Trails on visitor use management

About PTBA

- Trade Association for the trail industry
- Private sector companies who specialize in trail design, planning and construction
- All PTBA companies are professionally vetted through portfolio submission and peer review process

Photo Credit: Singletrack Trails


Greenland
Iceland
Finland
Sweden
Norway
Russia
United Kingdom
Ukraine
Kazakhstan
Mongolia
France
Italy
Spain
Türkiye
China
South Korea
Japan
Afghanistan
Iraq
Iran
Pakistan
Algeria
Libya
Egypt
Saudi Arabia
India
Thailand
Mexico
Mali
Niger
Sudan
Chad
Nigeria
Ethiopia
Venezuela
Kenya
DRC
Tanzania
Indonesia
Brazil
Angola
Namibia
Botswana
Madagascar
South Africa
Argentina
New Zealand
126 Member Companies Worldwide
Professional TrailBuilders ASSOCIATION

Foundations for successful trail planning and design

Organizational needs

Processes - Project Life Cycle

Tools and Technologies

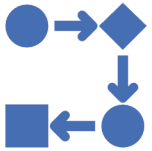
Foundations for Successful Trail Projects

Organizational Needs

Resources

Coordination

Communications



Scaling

Resources

- Human
- Landscape
- Capital
- Fundraising – Grants, Fiscal Capacities
- Experience – Knowledge, Skills, Abilities

Coordination

- Land manager(s)
- Public
- User Communities
- Regulatory & Permitting Offices (State, Local, Federal)

Communications

- Internal & External
- Fundraising
- Awareness
- Political

Scaling for success

- Walk then run
- Take on projects well matched to available resources
- Build and stretch capacity through phasing and growth
- Success creates gravity

Section 2: Tools and Techniques

Trail Planning and Design Toolbox

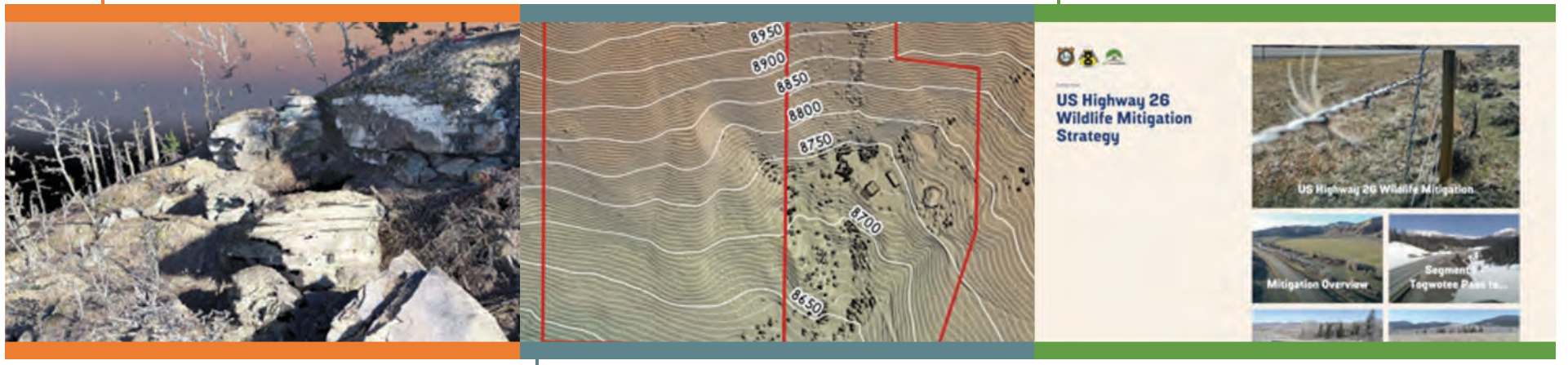
TRAIL PLANNING AND DESIGN

FOUNDATIONS OF SUCCESS

Categories of Tools

Data Collection

Presentation and Sharing



Design and Mapping

Category I: Data Collection Tools

Online Data Sources
Field Instruments
GPS, Phone Apps
Drones

Online Data Sources

GIS Data

- Can be used in QGIS, ArcGIS, Google Earth, others
- Base mapping
- Before site visits

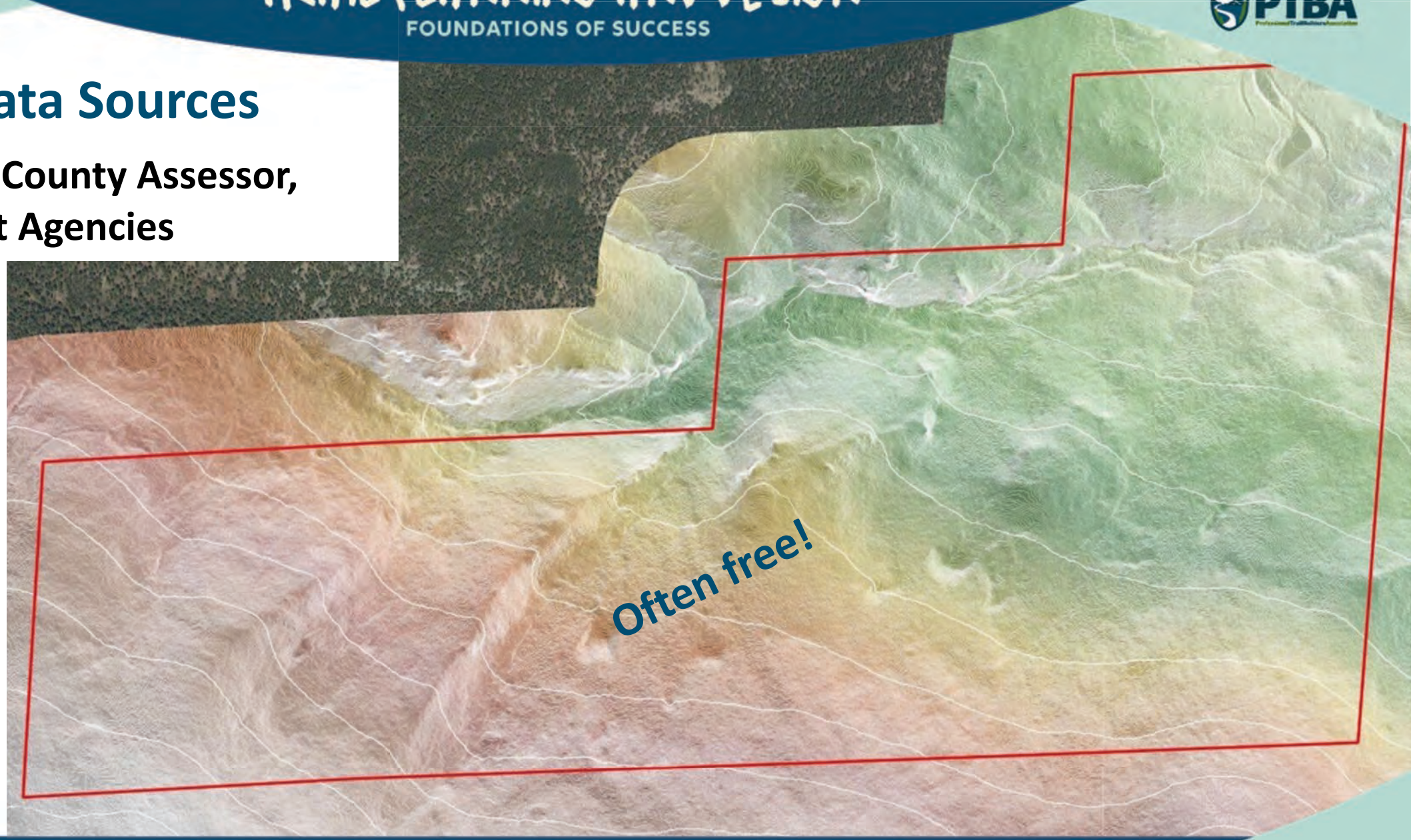
Goals:

1. **Understand a site enough to prepare scope and fees for a planning project**
2. **Jump start the planning process before visiting the site**

Online Data Sources

Local COGs, County Assessor, Government Agencies

- Property lines
- Elevation
- Roads
- Trails
- Buildings



Field Instruments

Clinometer*

- Measures slope/grade
- Key for assessing, planning, and flagging trails

**Don't trust a trail builder/planner who doesn't use a clino!*

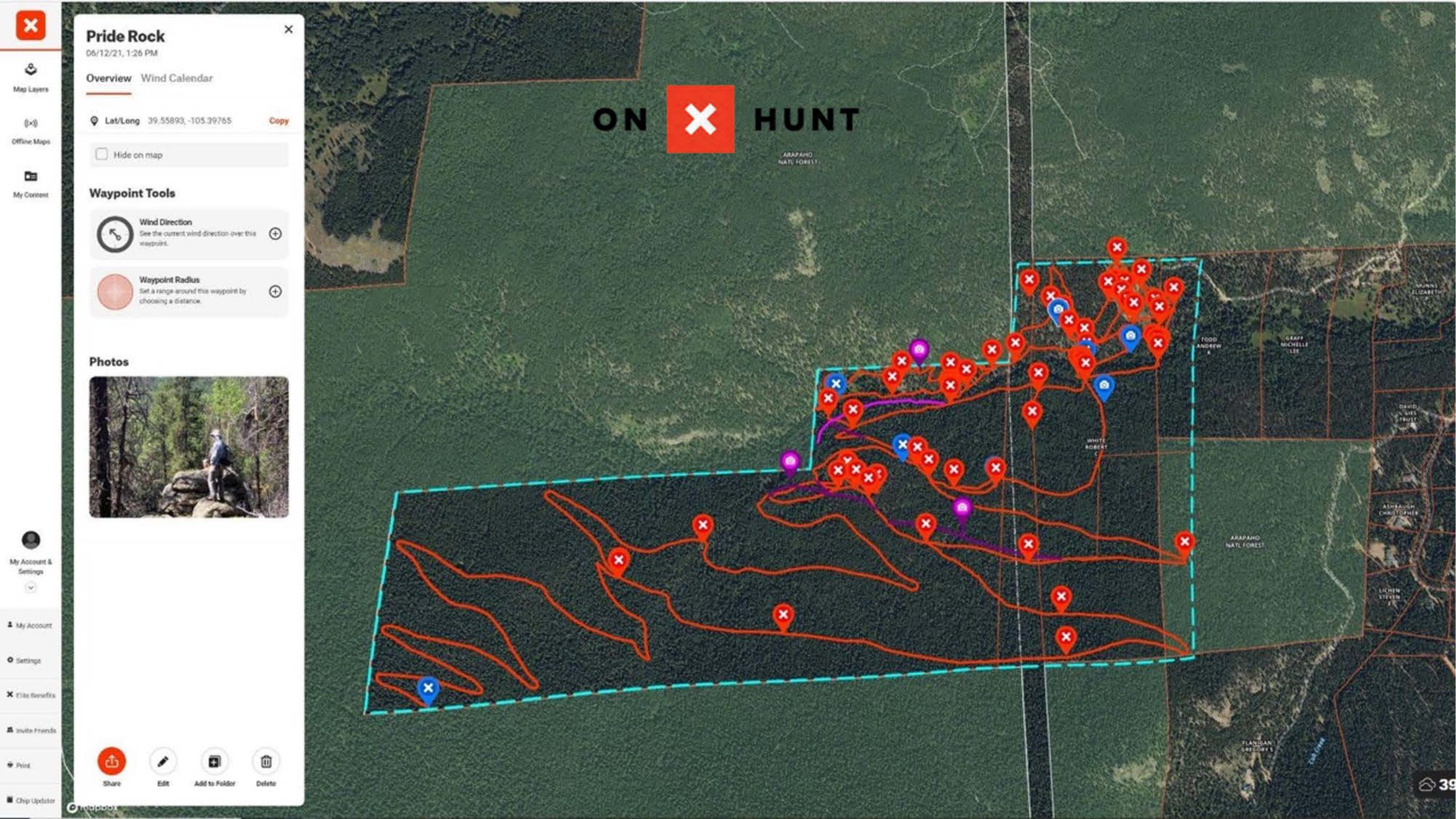
Field Instruments

Laser Rangefinder, Handheld GPS, Measuring Wheel

GPS and Phone Apps

- Decent accuracy
- Easy to use
- Phone apps have largely replaced handheld GPS units
- OnX, ArcGIS Collector, Survey123

ON X HUNT


Pride Rock
06/12/21, 1:26 PM
Overview
Wind Calendar
Lat/Long 39.55893, -105.39765
Copy
Hide on map
Waypoint Tools
Wind Direction
See the current wind direction over this waypoint.
Waypoint Radius
Set a range around this waypoint by choosing a distance.
Photos
Share
Edit
Add to Folder
Delete
Map Layers
Offline Maps
My Content
My Account & Settings
My Account
Settings
Elite Benefits
Invite Friends
Print
Chip Updater
ON HUNT
ARAPAHO NATL FOREST

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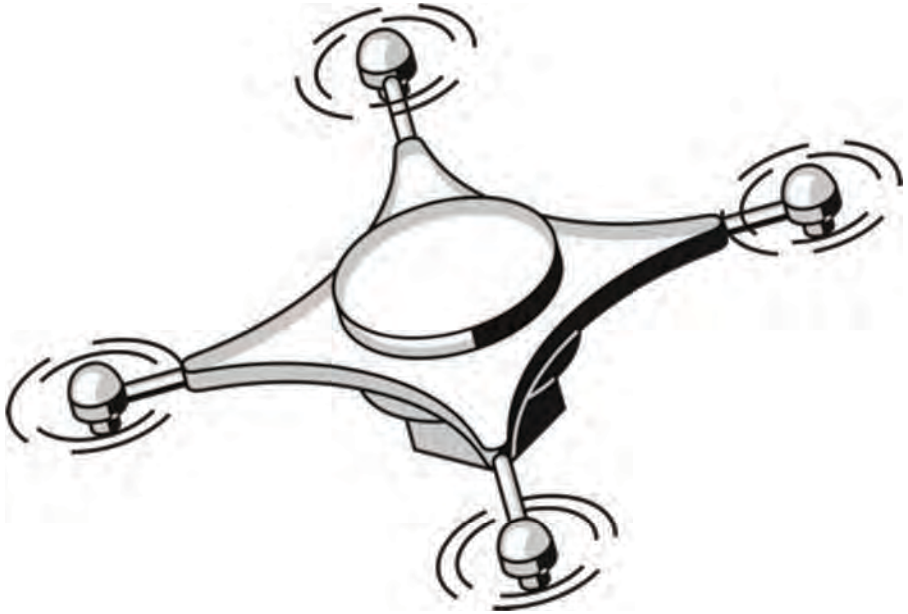


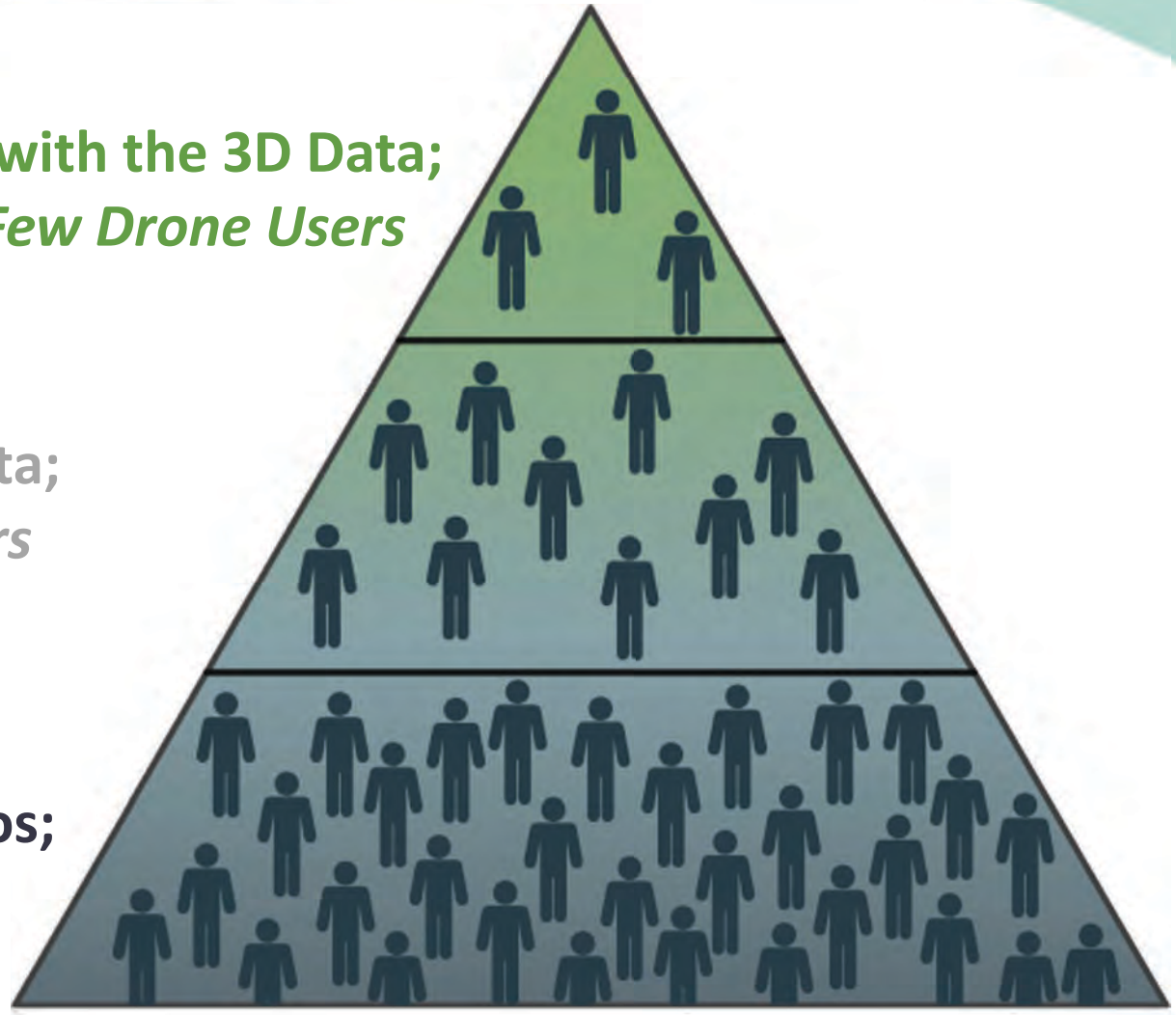
Types of Drone Users

3 Main Tiers/Categories

Working with the 3D Data;
Only a Few Drone Users

Collecting 3D Data;
Less Drone Users

Collecting Photos and Videos;
Many Drone Users



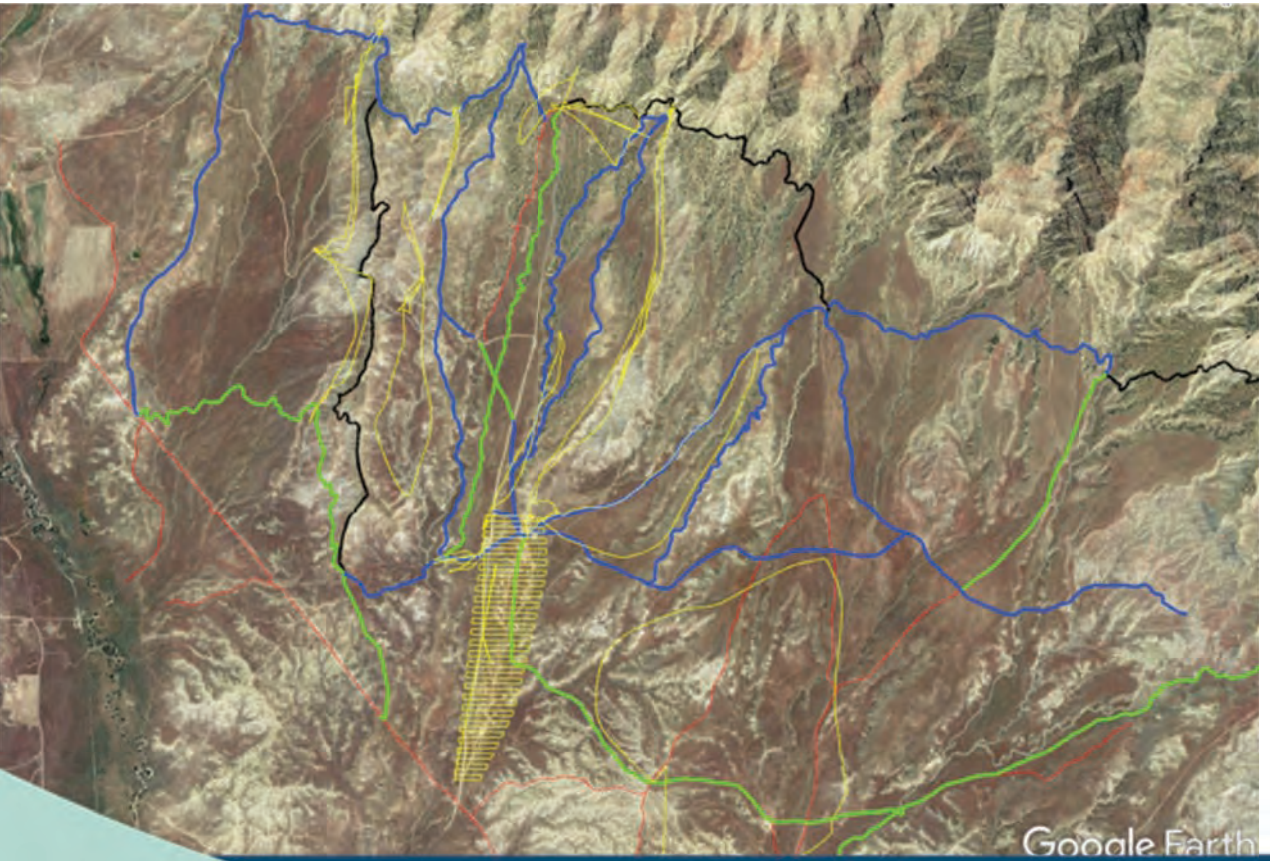
Tier 1: Photographs and Videos

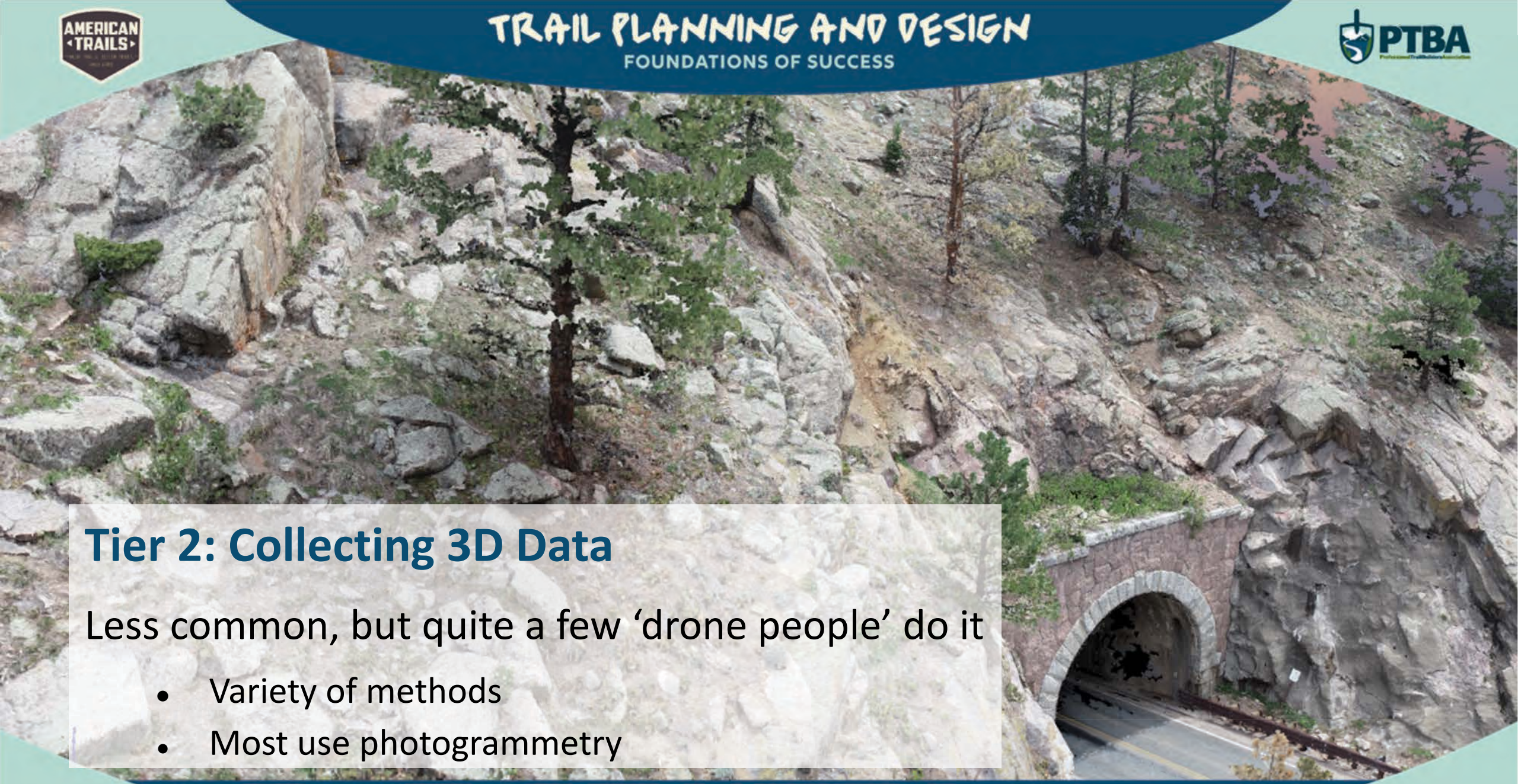
Most common and basic type of drone use

- Photos and videos are geotagged
- Cover a lot of ground quickly
- Gain a better overall perspective of the site

Tier 1: Photographs and Videos

Geotagged videos and photos





Tier 2: Collecting 3D Data

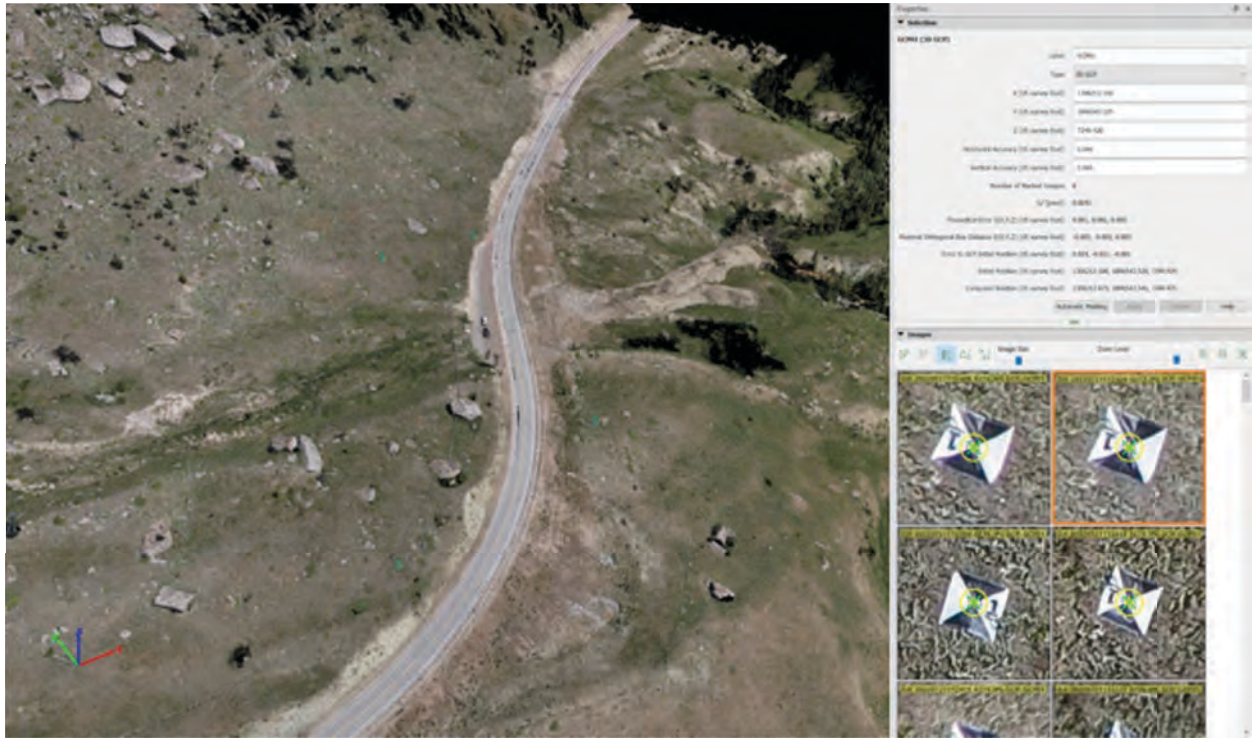
Less common, but quite a few ‘drone people’ do it

- Variety of methods
- Most use photogrammetry

Tier 2: Collecting 3D Data

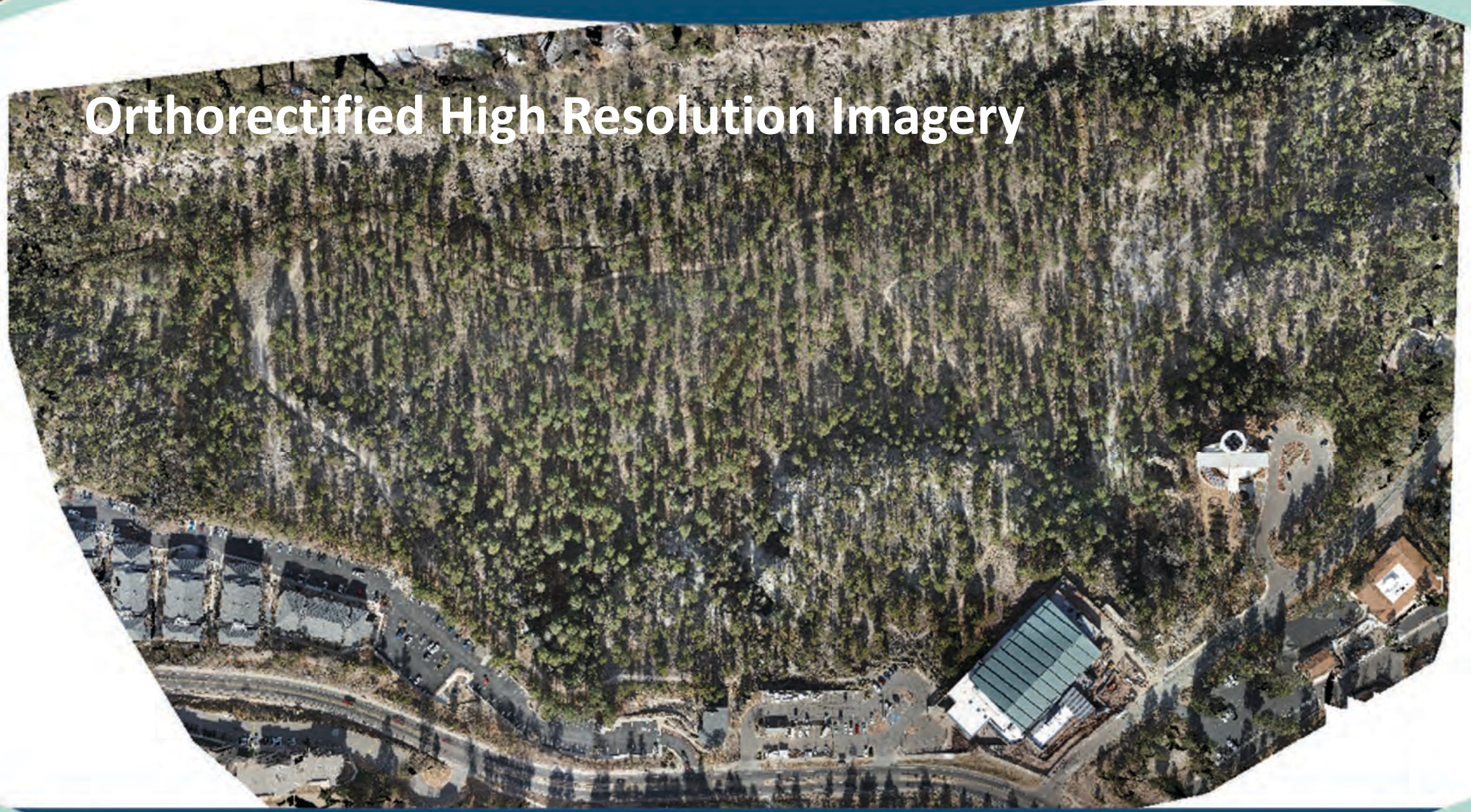
Photogrammetry

- Uses a series of overlapping photograph
- Creates a 3D model (point cloud and mesh)
- Accuracy heavily relies on:
  - Photograph overlap
  - Angle of images (flight pattern)
  - Distance to subject
  - Ground Control Points (GCPs)

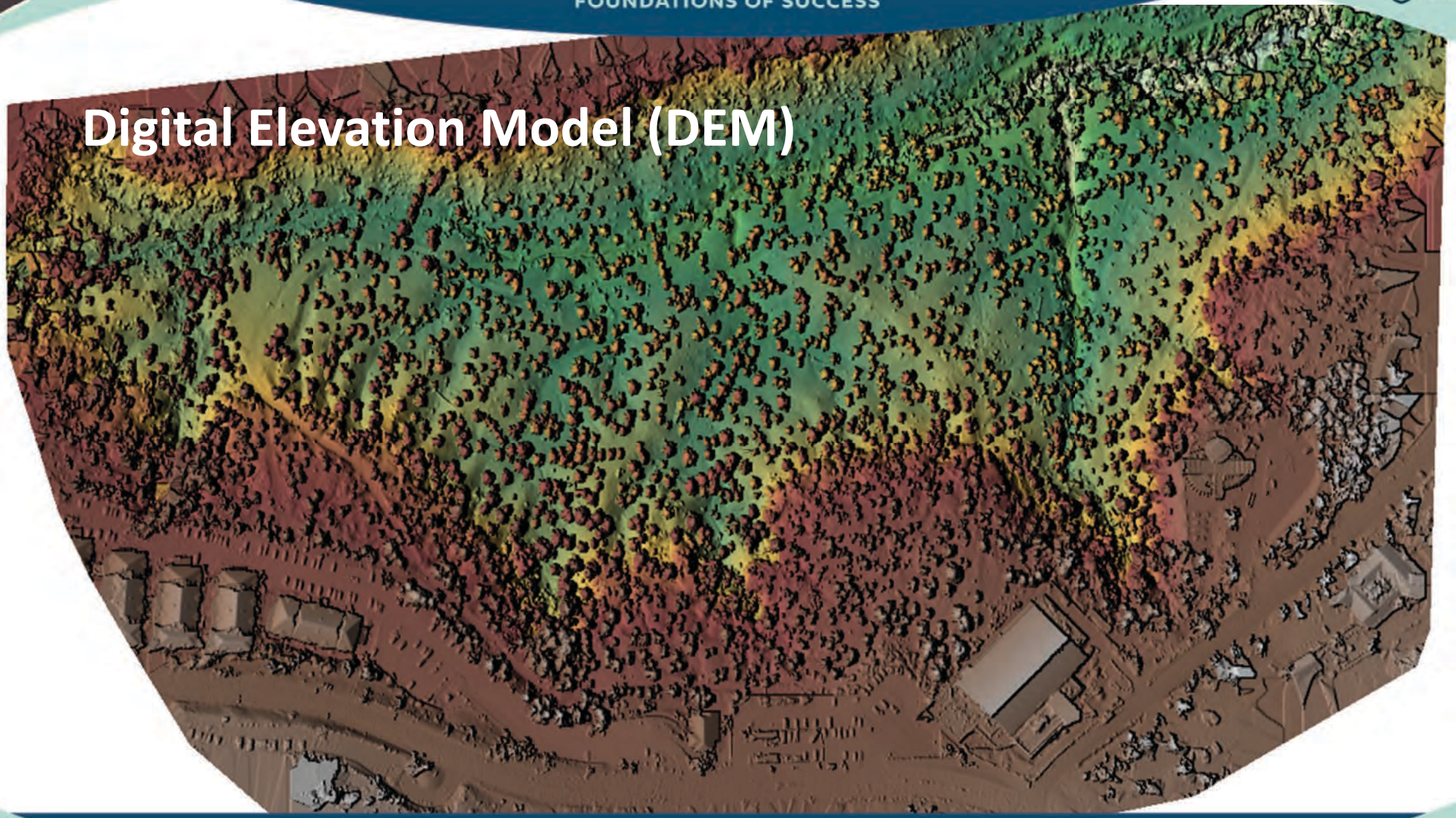


What can we get out of photogrammetry?

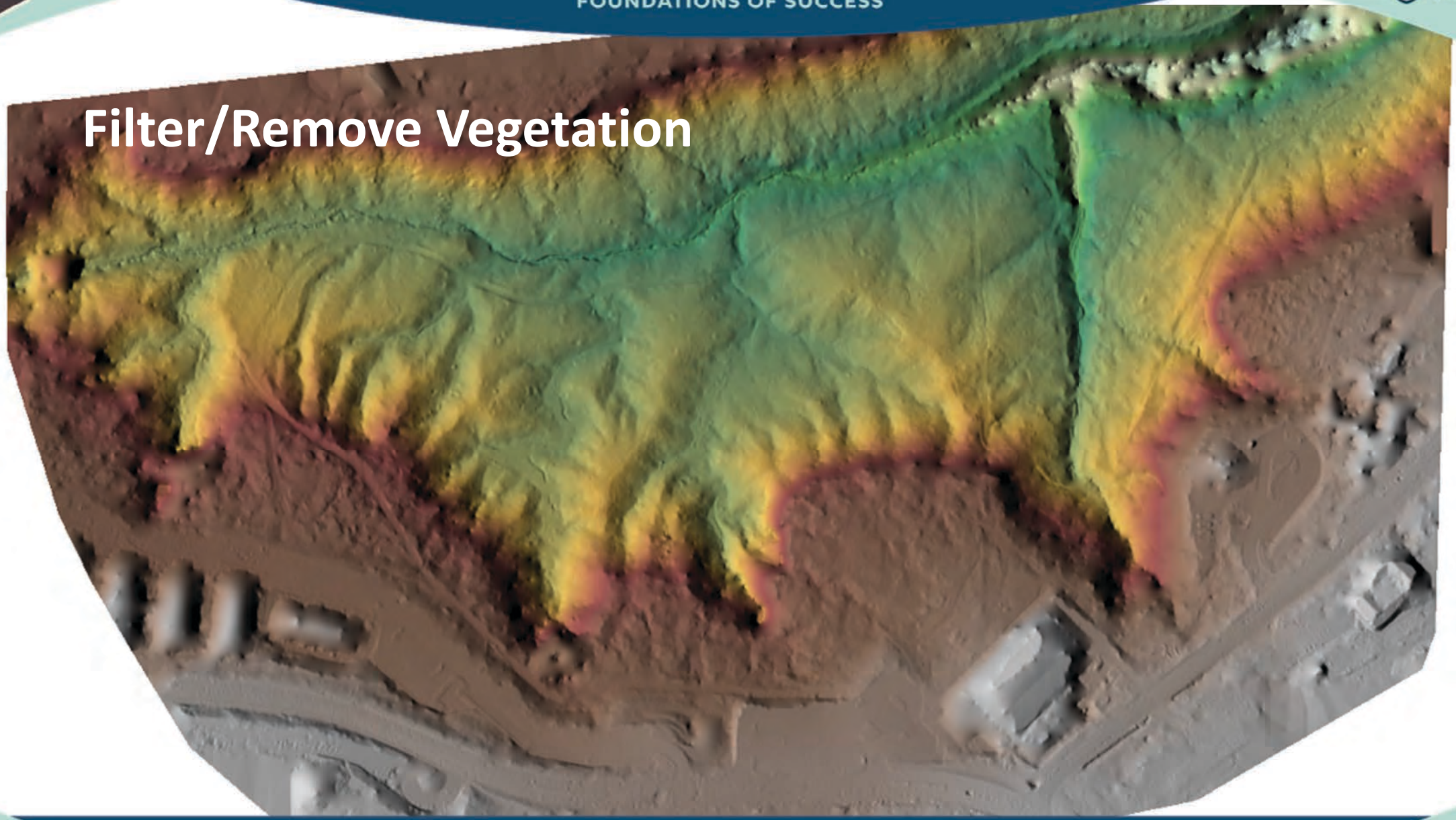
Orthorectified High Resolution Imagery



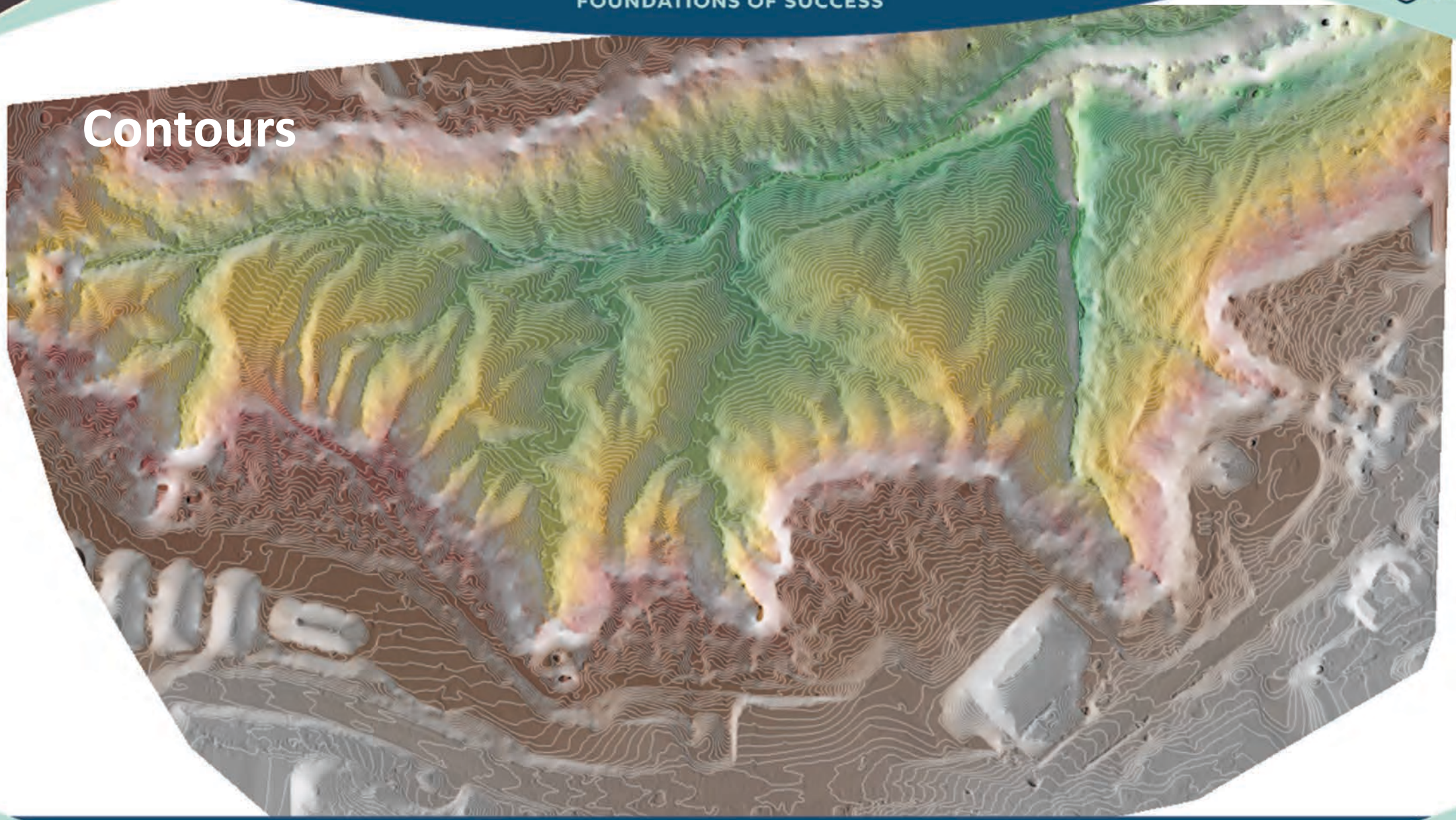
Digital Elevation Model (DEM)



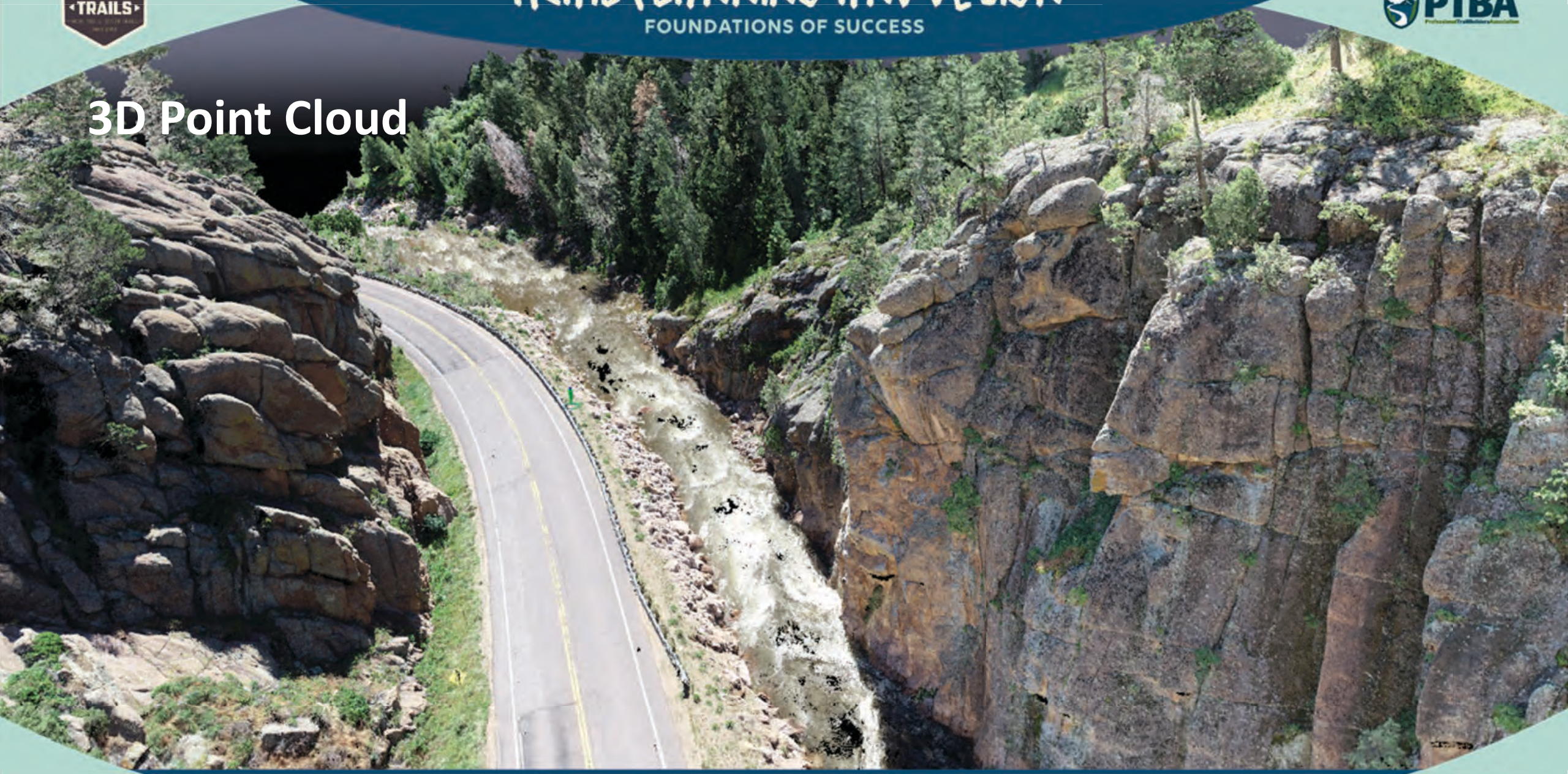
Filter/Remove Vegetation



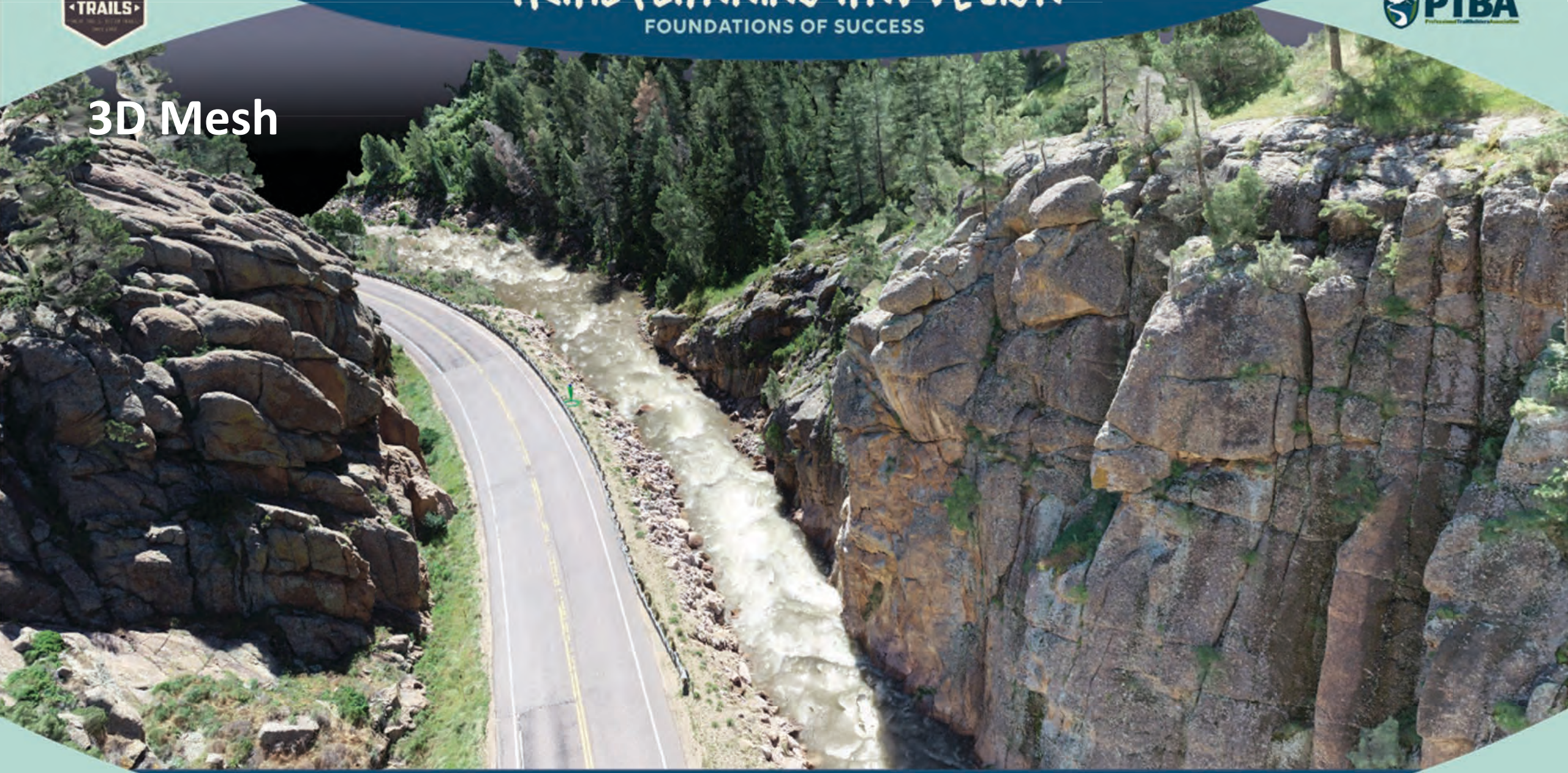
Contours



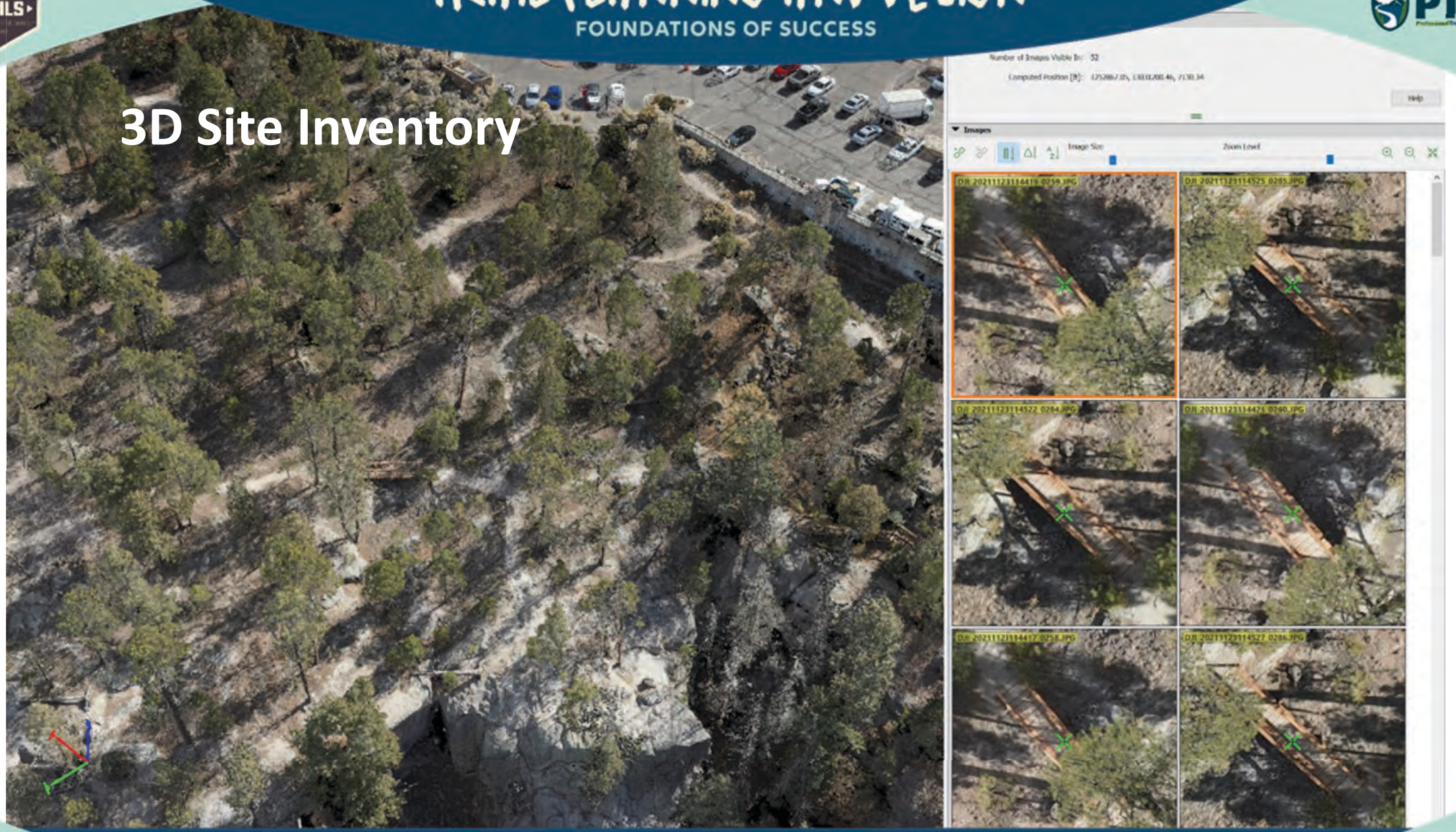
3D Point Cloud



3D Mesh

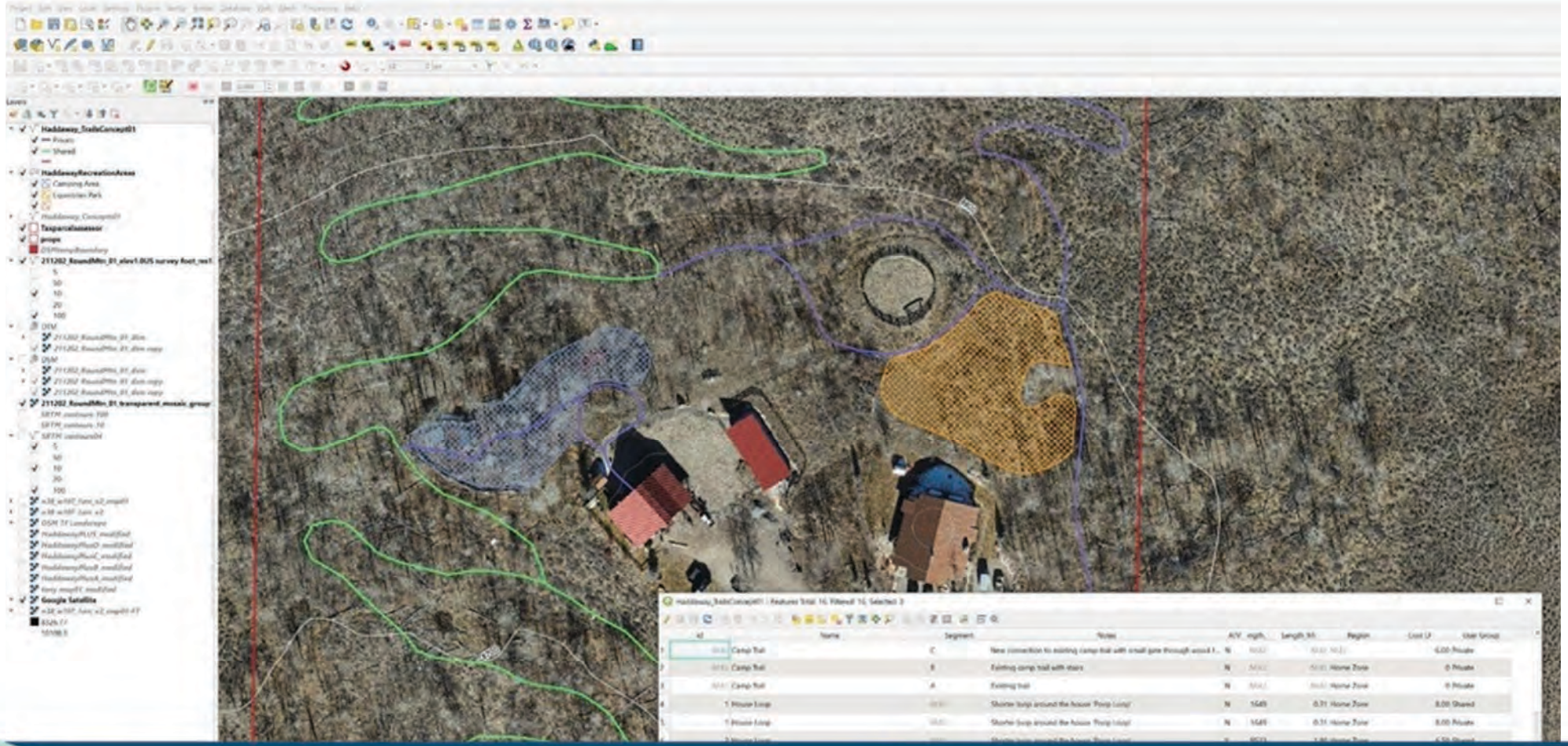


3D Site Inventory



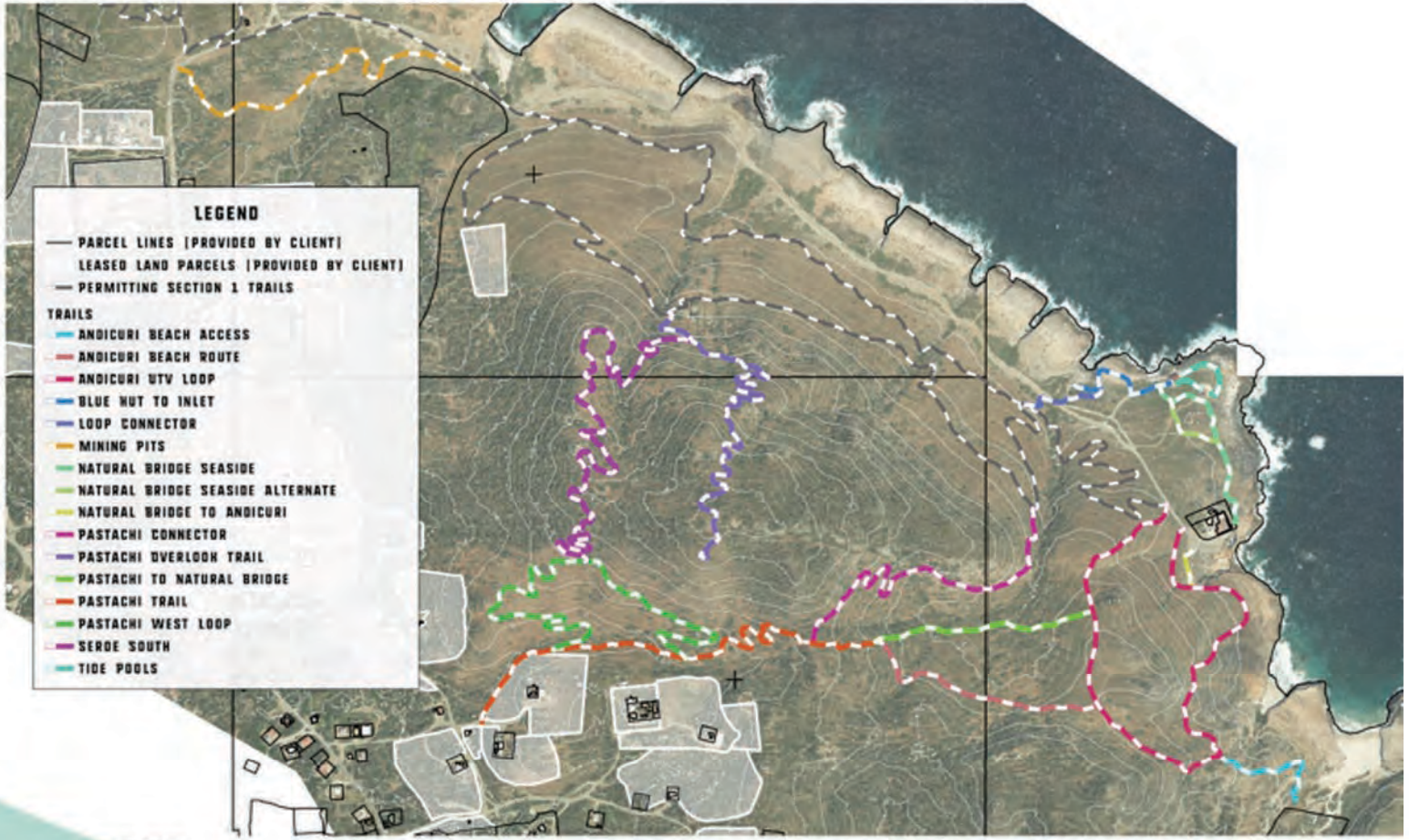
Category II: Design and Planning Tools

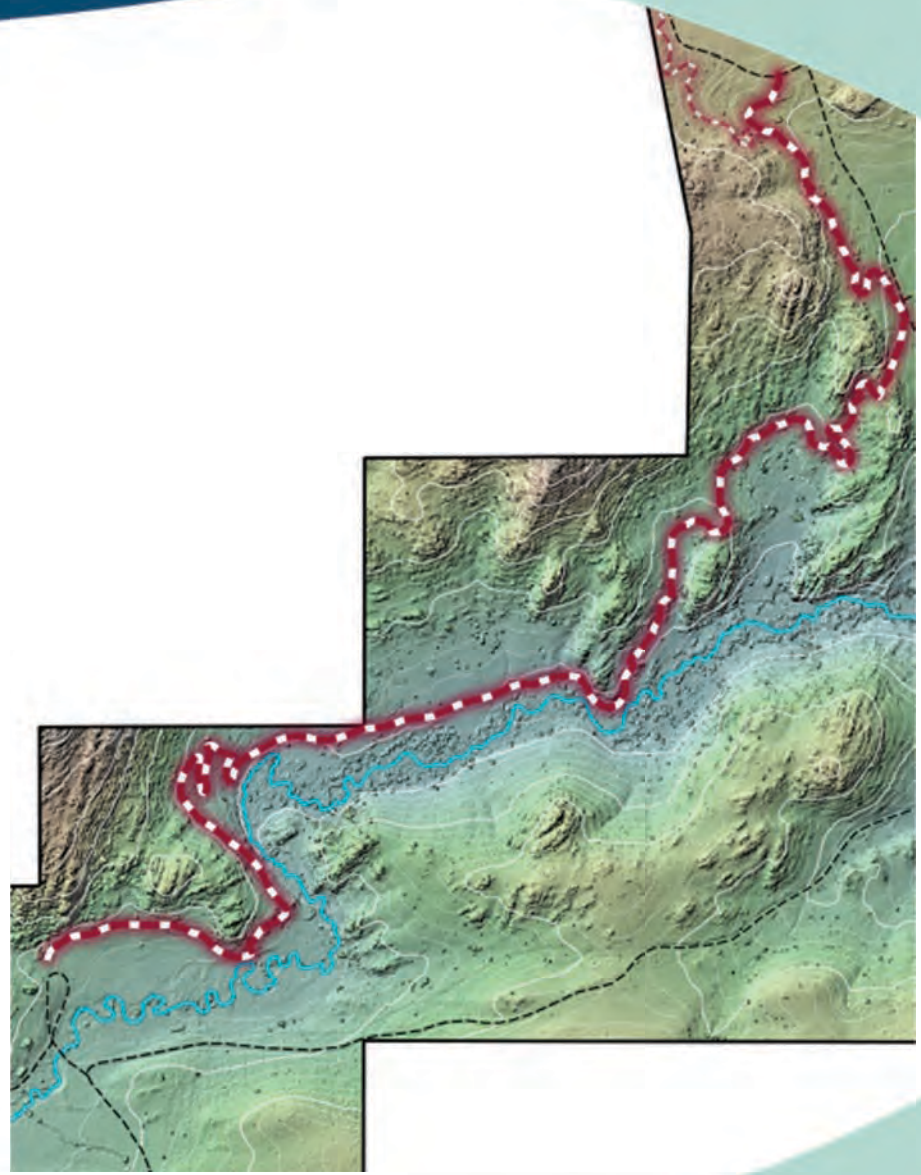
How to use the Category I data in the office

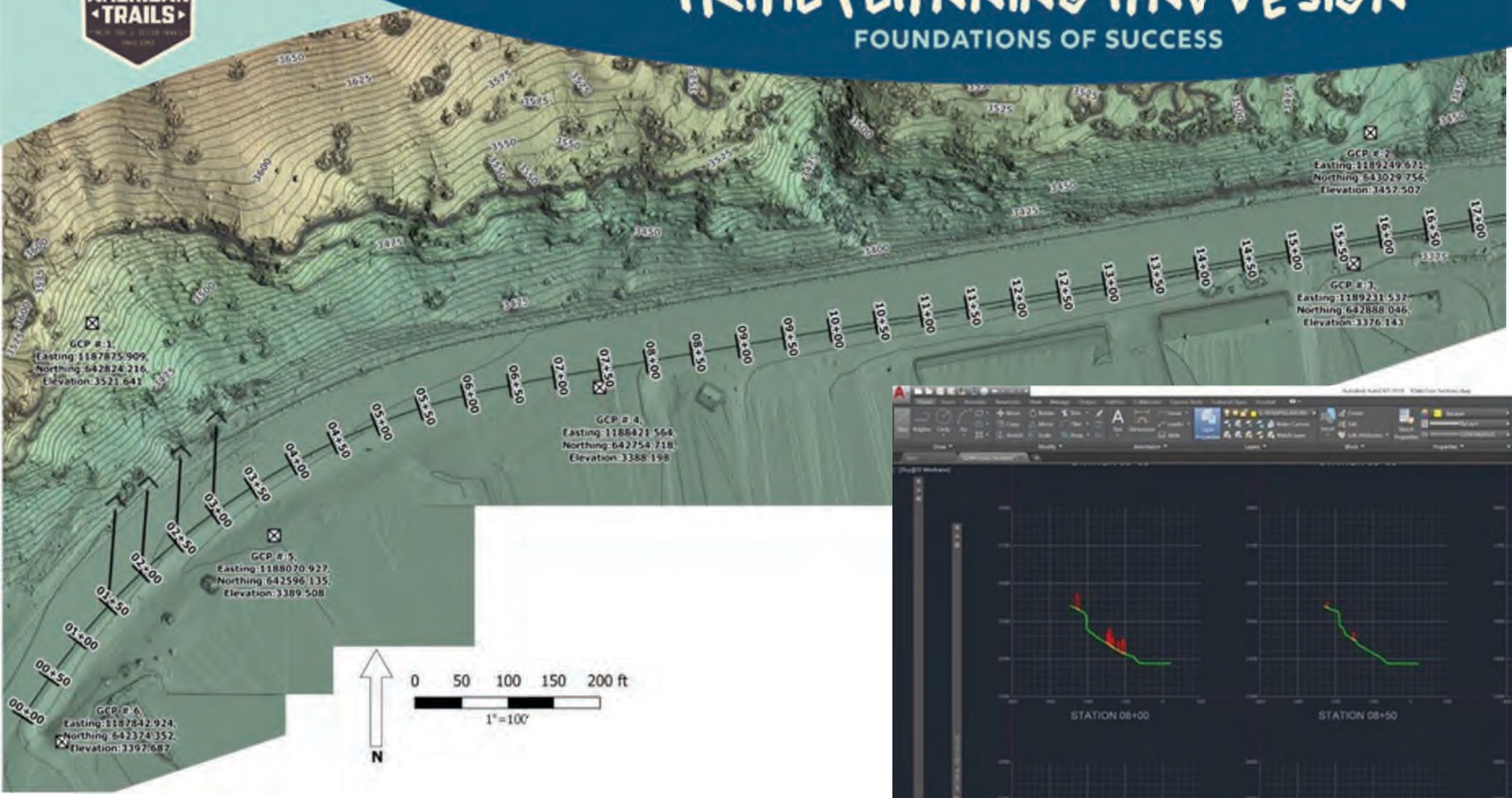


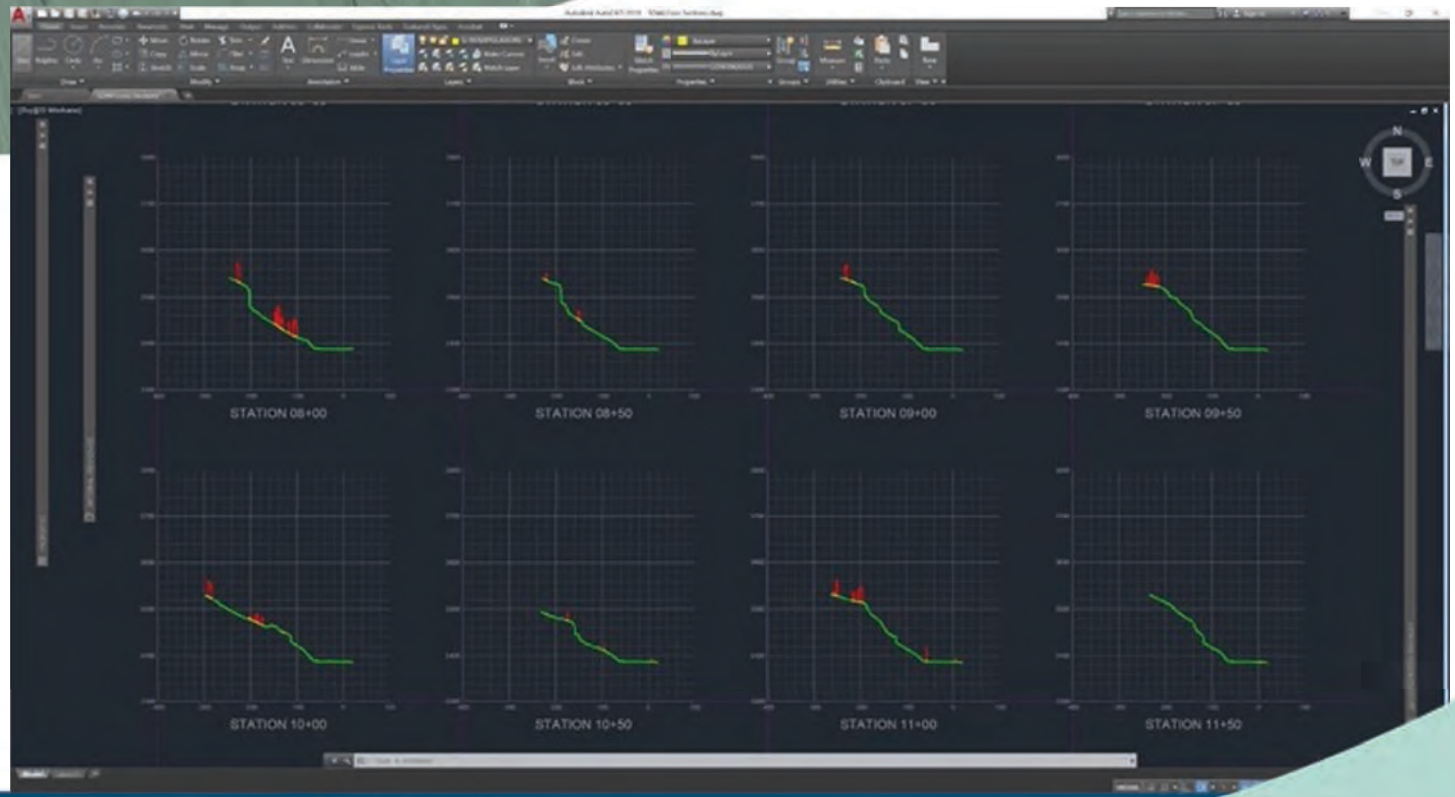
GIS Applications

QGIS and ArcGIS (ESRI)





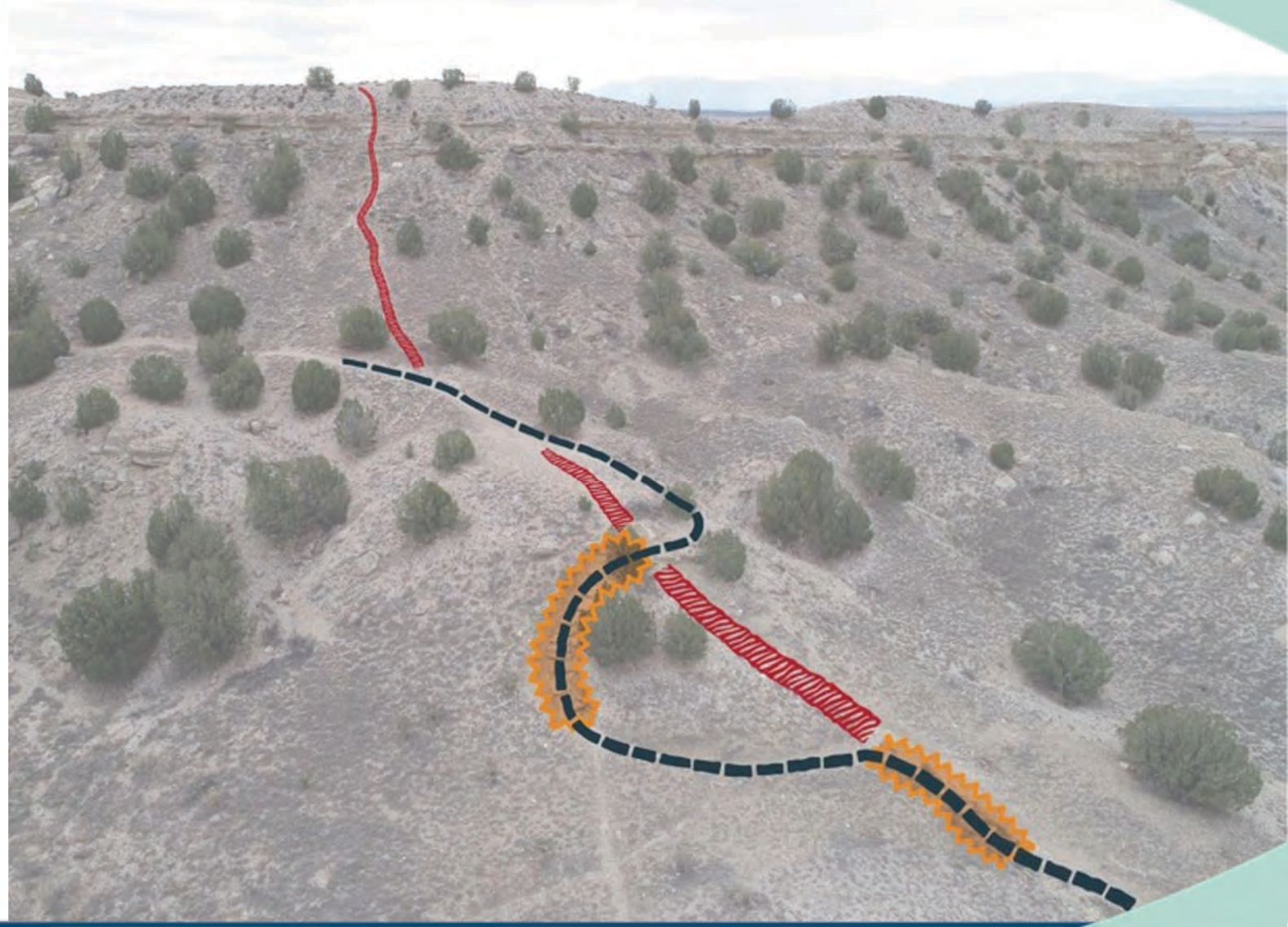




CAD Software

Adobe Products

Photoshop, Illustrator, InDesign, Premiere

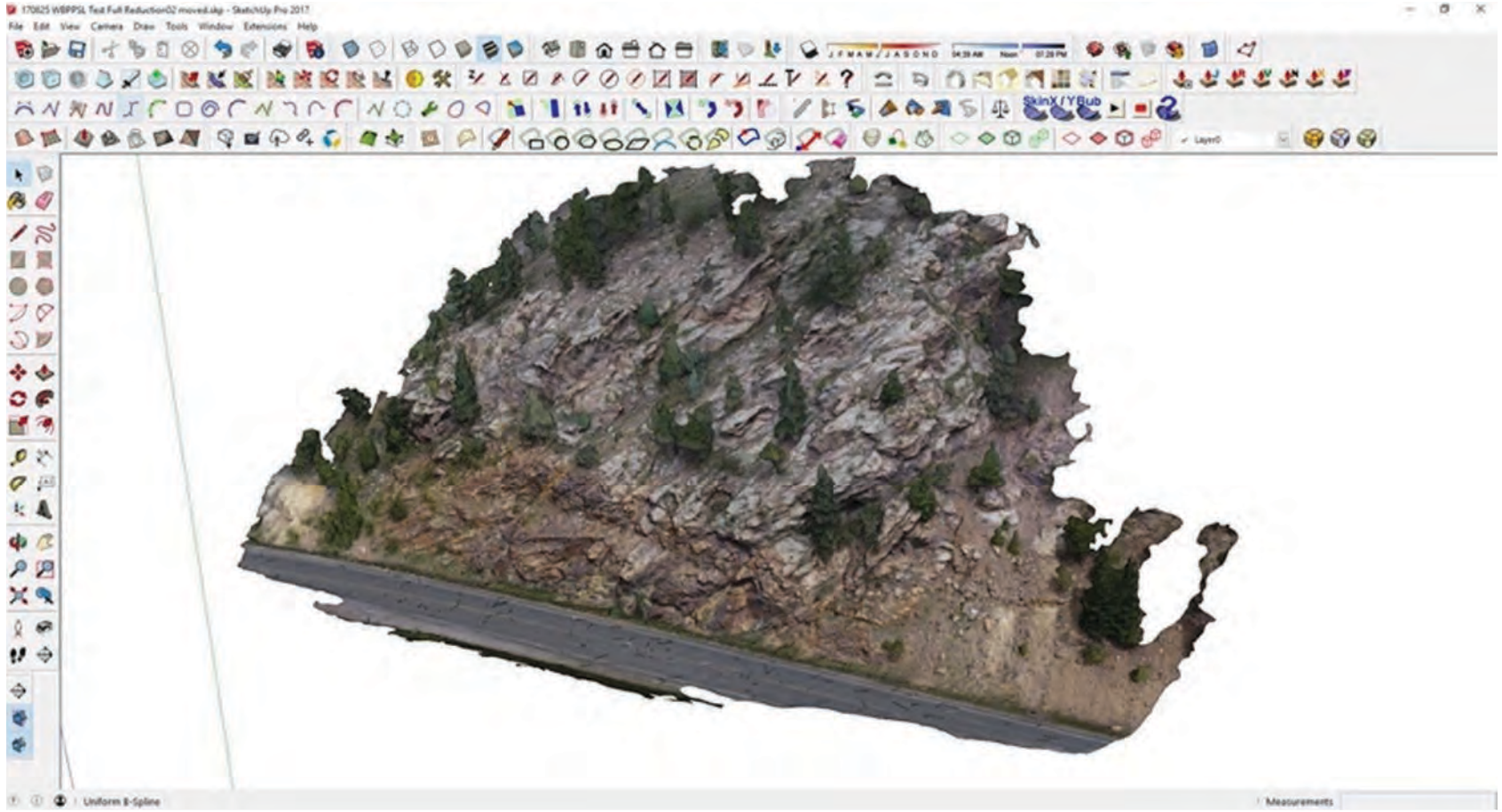


3D Modeling

SketchUp and Lumion

3D Modeling - SketchUp, Lumion, Photoshop

Photogrammetry model can be exported to SketchUp, or shared online for collaboration



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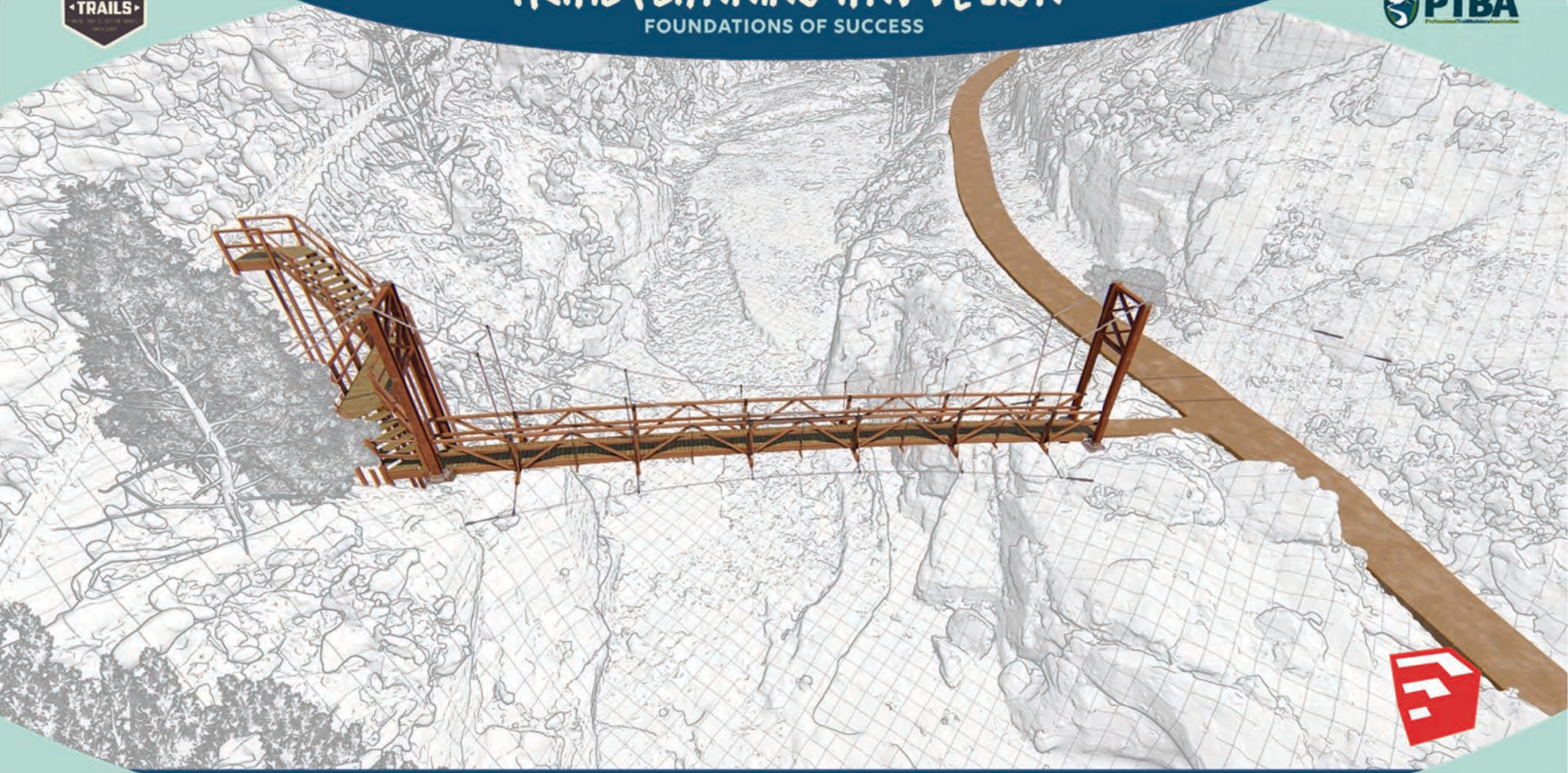

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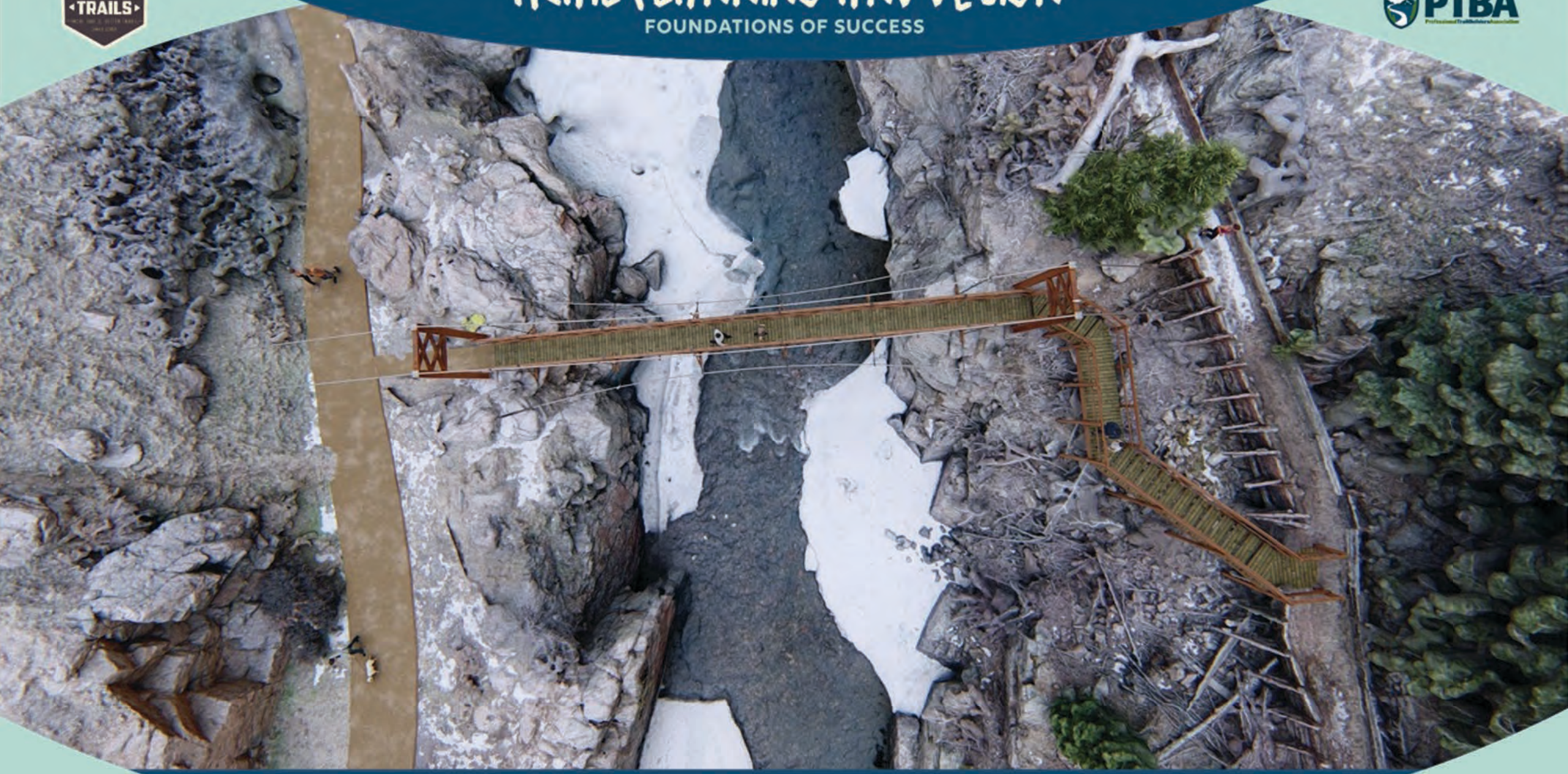
TRAIL PLANNING AND DESIGN

FOUNDATIONS OF SUCCESS



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LANDSCAPE ARCHITECTURE

TRAIL PLANNING AND DESIGN

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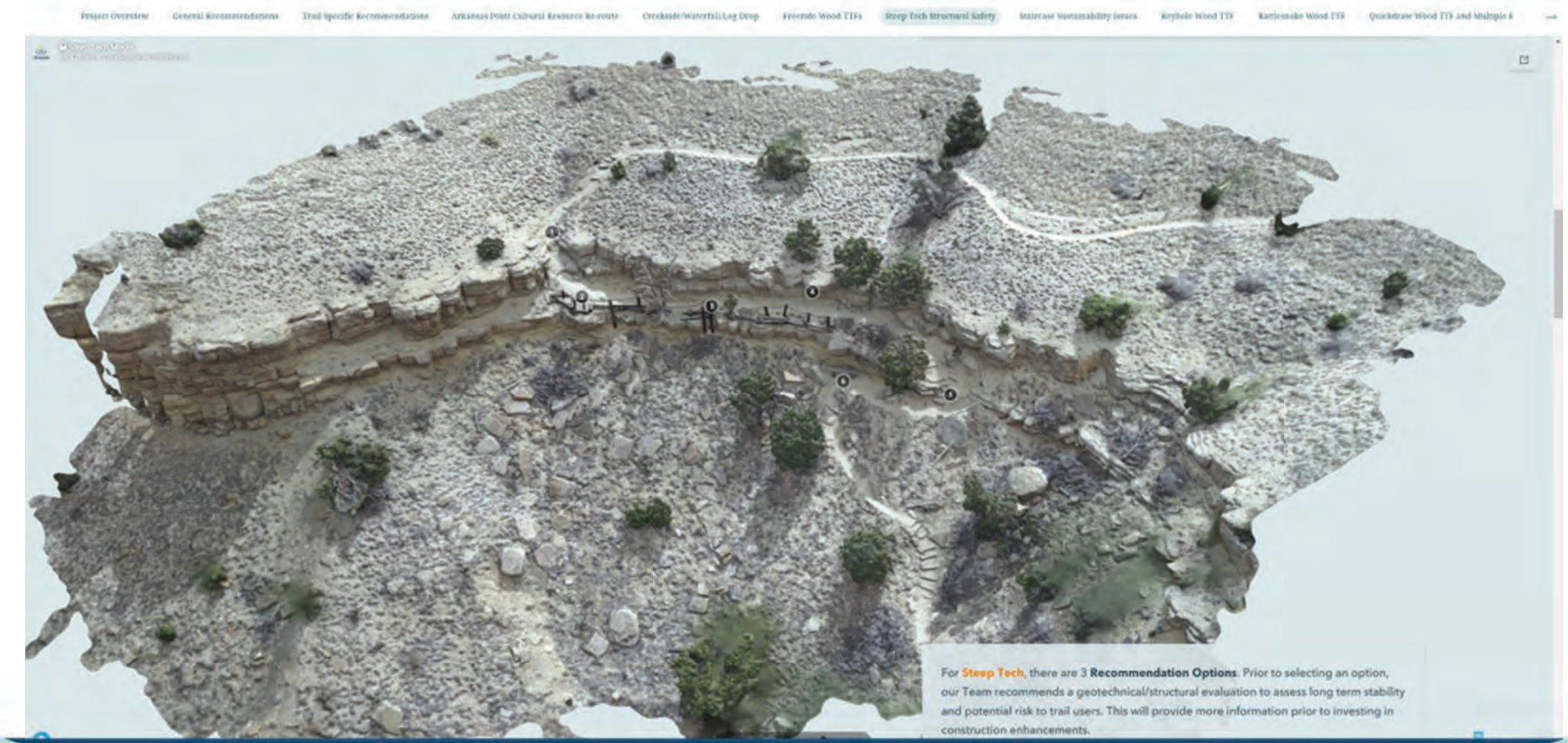
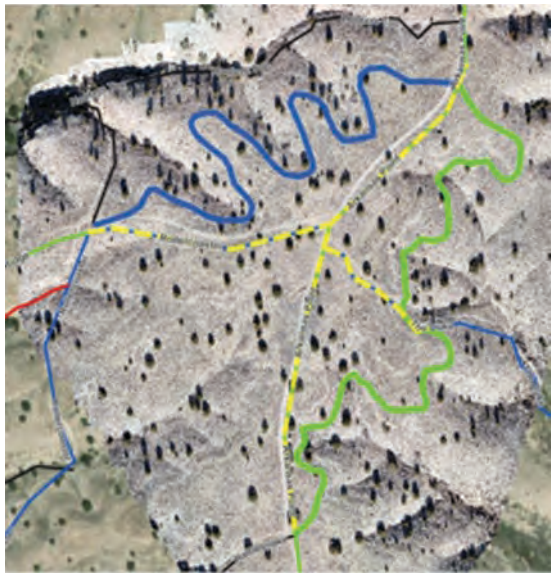
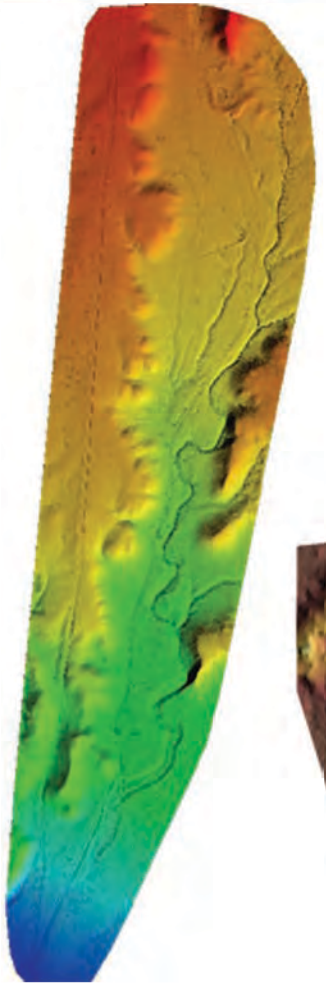
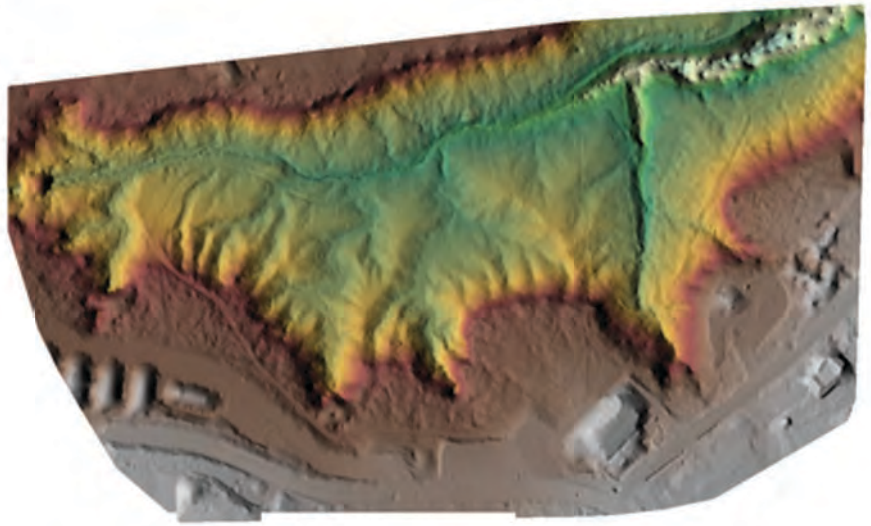
Category III: Presentation and Sharing Tools



Tons of Graphics…







…how do we share them with clients?

PDFs

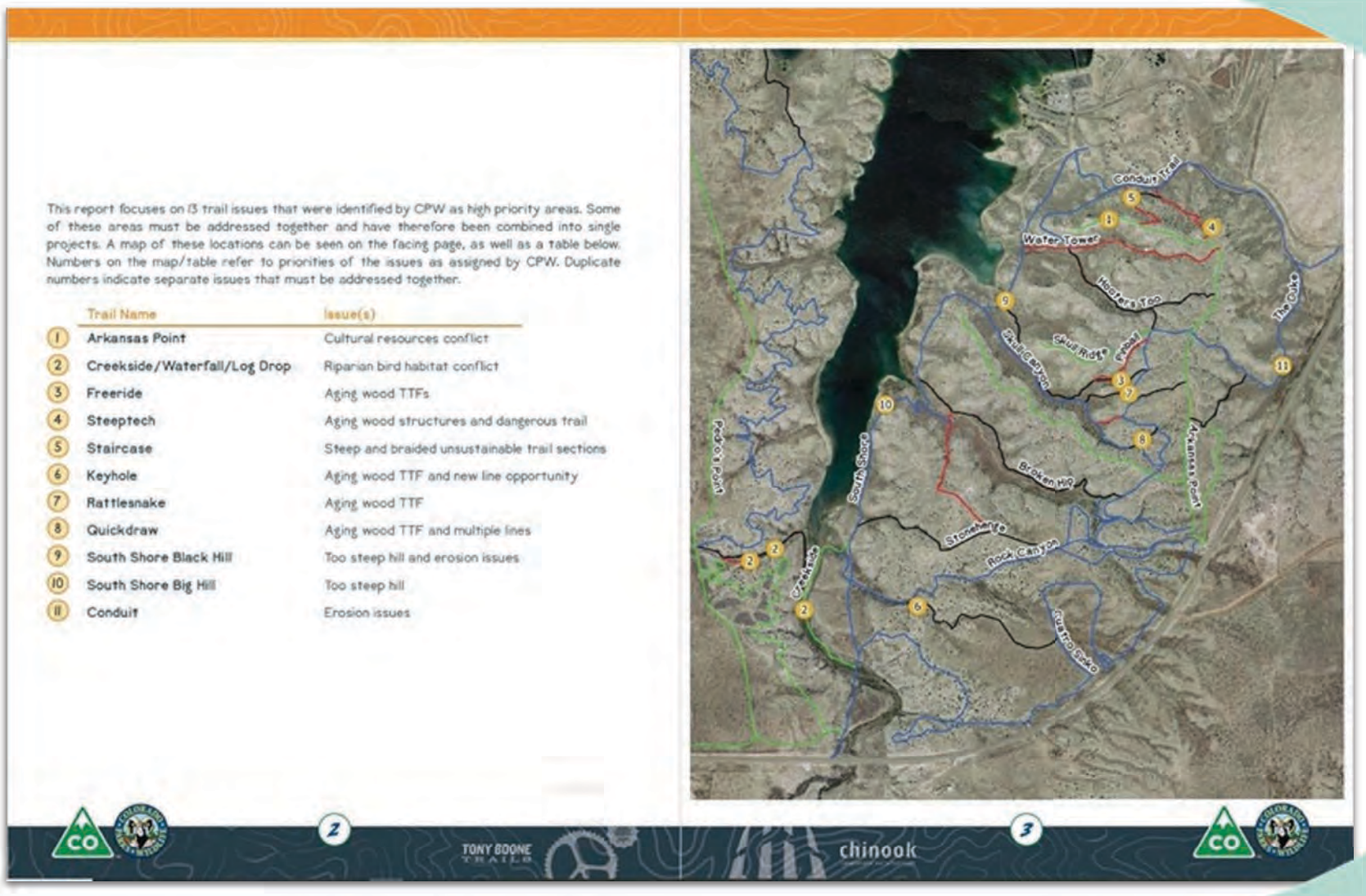
InDesign to dress them up

TTF Inspection and Routine Maintenance Schedule

Several trails at Lake Pueblo State Park include Technical Trail Features (TTFs), many of which are deteriorating wood and do not meet Best Management Practices. These aging TTFs urgently need to be removed and/or replaced. All TTFs, but especially wood ones, require regular documented maintenance inspections and repairs (based on industry standards) to effectively minimize injuries and manage risk. Understanding, inspecting, maintaining, and documenting the TTFs on the property is crucial to avoiding trail user injuries and property manager liability.

General Recommendation #3 is to develop a routine safety inspections and a maintenance schedule for all TTFs in the Park. International Mountain Bicycling Association (IMBA) guides and the Resort Municipality of Whistler's Trail Standards for Environmental and Technical Trail Features are both good resources for creating such a schedule.

These documents are commonly accepted as Best Management Practices and are frequently used in both construction and litigation as industry standards.

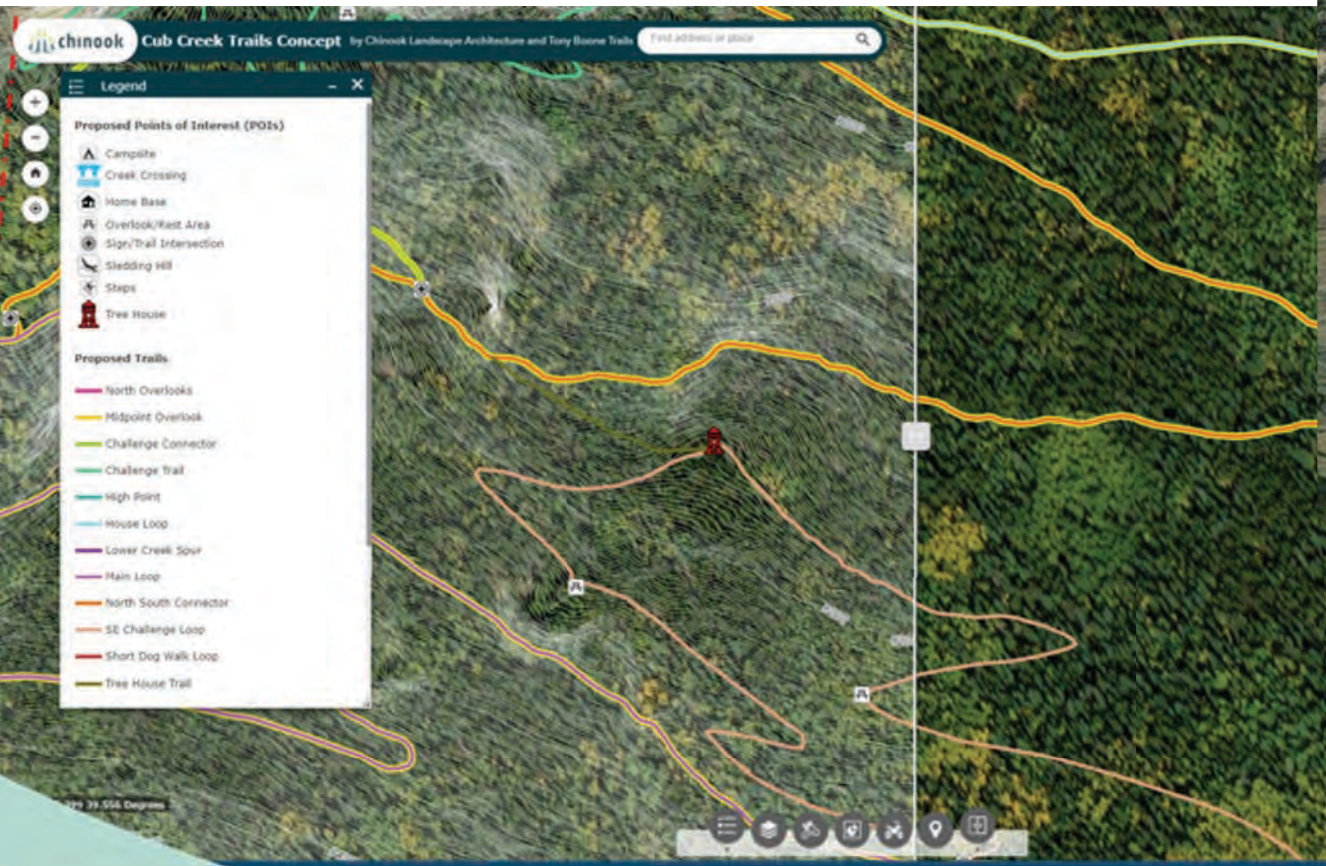


This report focuses on 13 trail issues that were identified by CPW as high priority areas. Some of these areas must be addressed together and have therefore been combined into single projects. A map of these locations can be seen on the facing page, as well as a table below. Numbers on the map/table refer to priorities of the issues as assigned by CPW. Duplicate numbers indicate separate issues that must be addressed together.

	Trail Name	Issue(s)
1	Arkansas Point	Cultural resources conflict
2	Creekside/Waterfall/Log Drop	Riparian bird habitat conflict
3	Freeride	Aging wood TTFs
4	Steeptech	Aging wood structures and dangerous trail
5	Staircase	Steep and braided unsustainable trail sections
6	Keyhole	Aging wood TTF and new line opportunity
7	Rattlesnake	Aging wood TTF
8	Quickdraw	Aging wood TTF and multiple lines
9	South Shore Black Hill	Too steep hill and erosion issues
10	South Shore Big Hill	Too steep hill
11	Conduit	Erosion issues

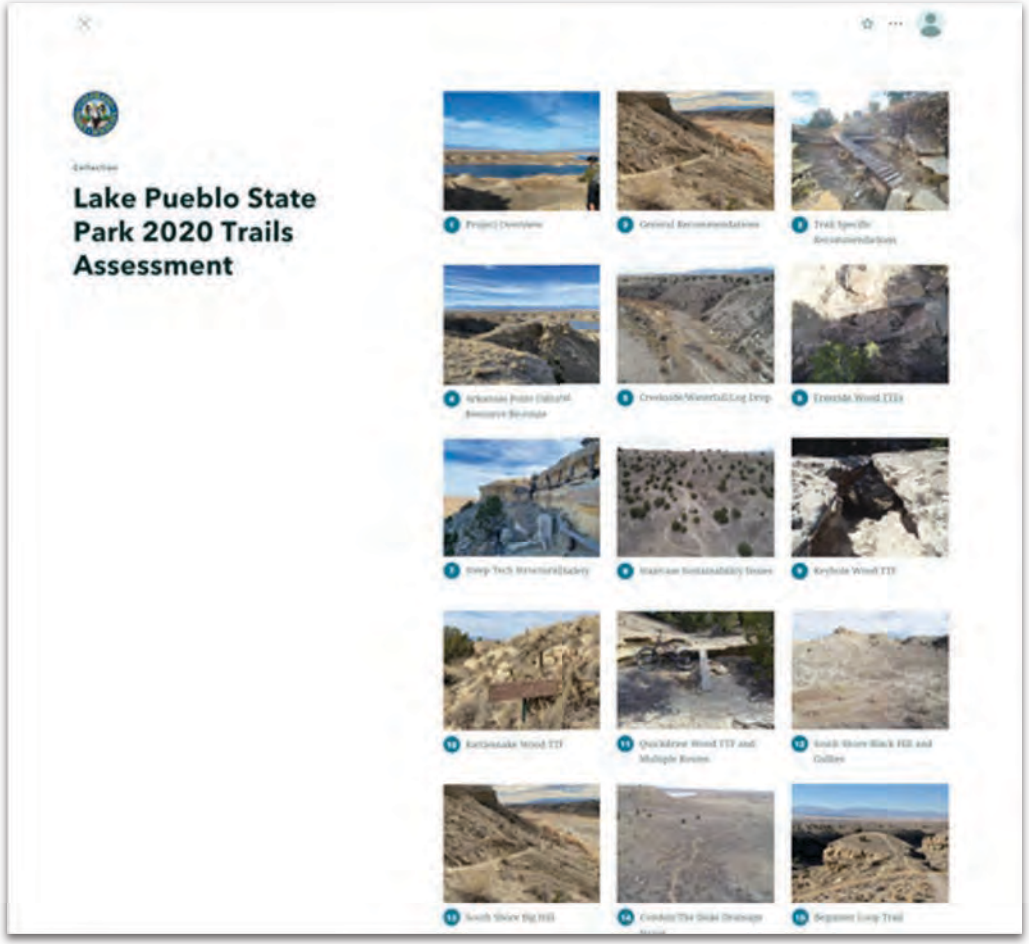
Sharing Maps ArcGIS Online

WebMaps and WebApps



Sharing an Entire Project and Narrative

[StoryMaps]



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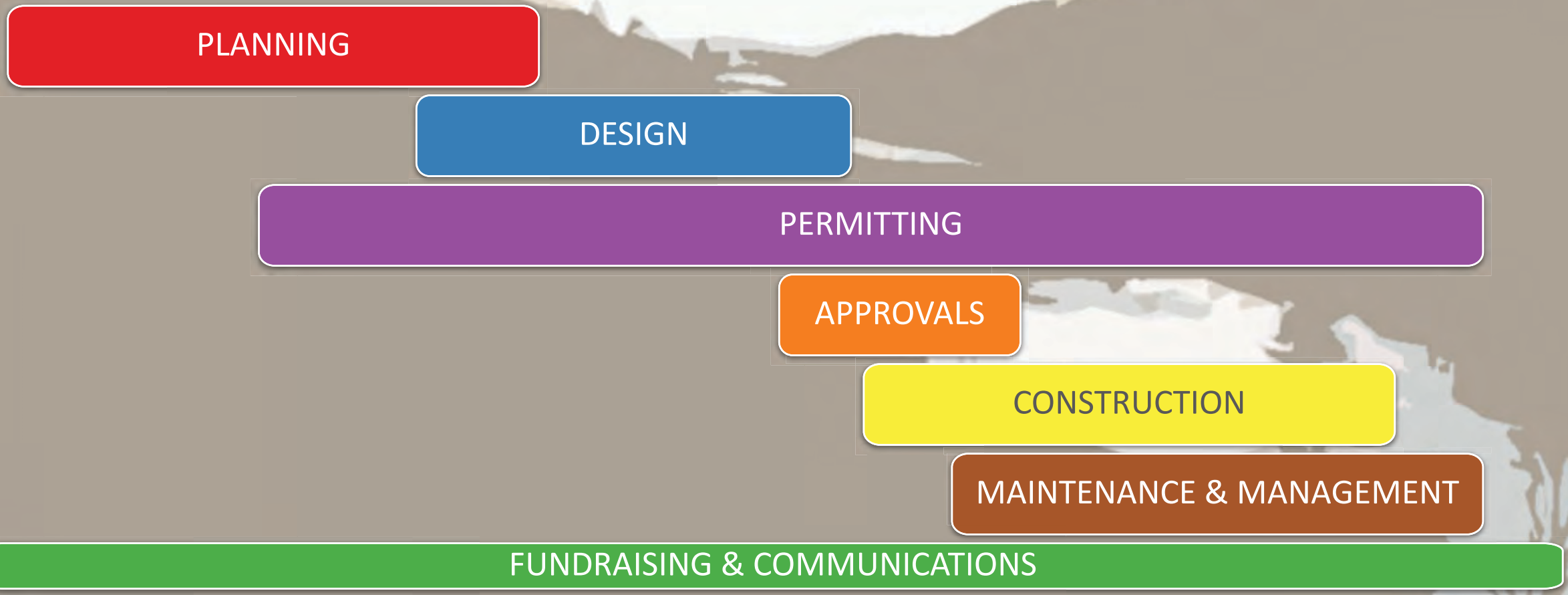
Trail Project Life Phases



Planning

- Master Plan (narrative, 30,000-foot view)
- Conceptual Plan (narrative, placeholders for budgeting, guides field work, opportunity for agency and partner review, permitting initiation)

DMH Bike Park	0.3	0.7	0.4	1.5
Glendale Park	0	0.25	0	0.25
Total	1.8	7.35	2.7	11.95

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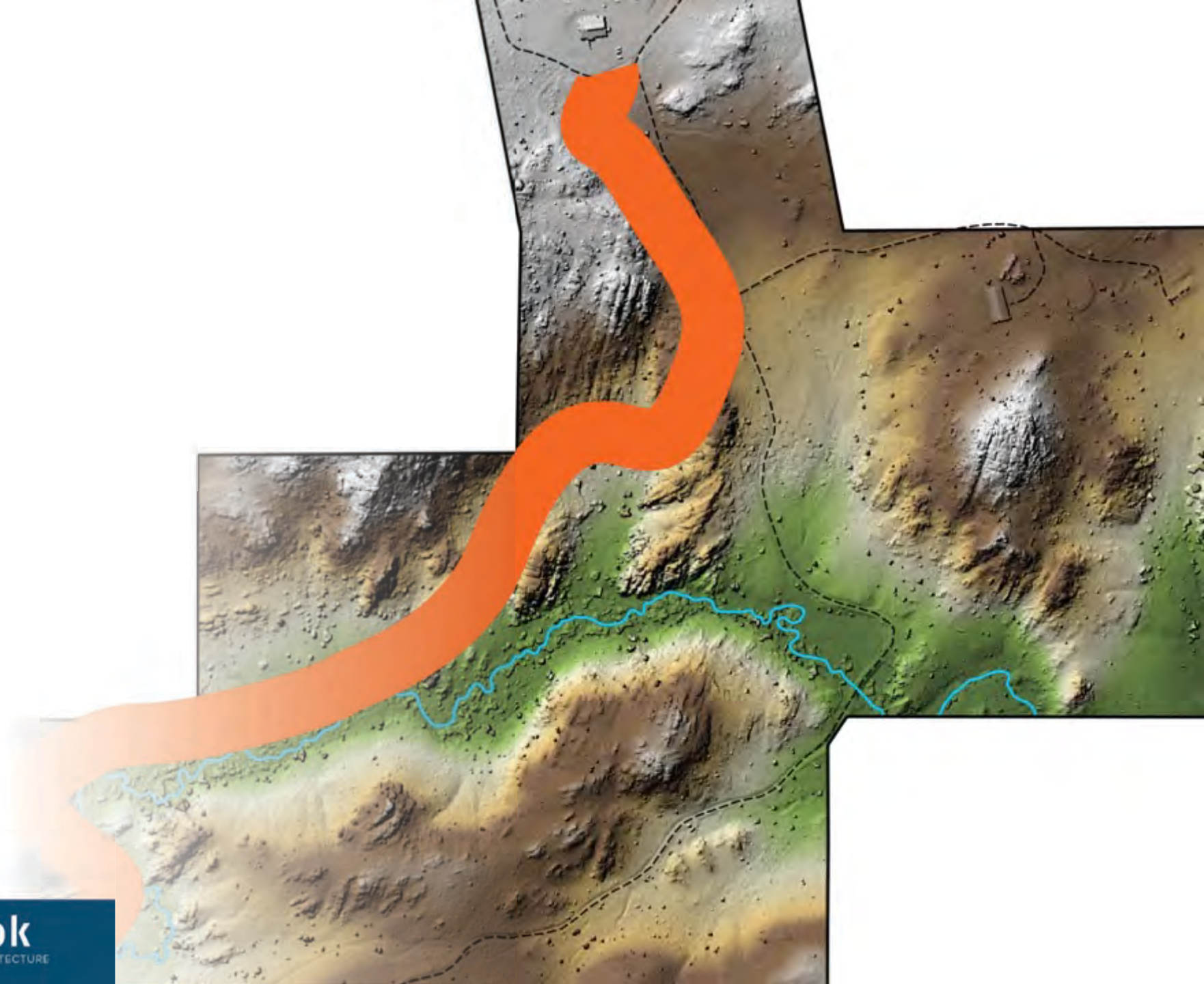
Design

- Conceptual Trail Plan
  - System Level
  - GIS/Digital Based w/limited scouting
- Field Design
  - Review and permit ready
  - Field designed and flagged
  - GPS
- Final Design
  - Construction ready



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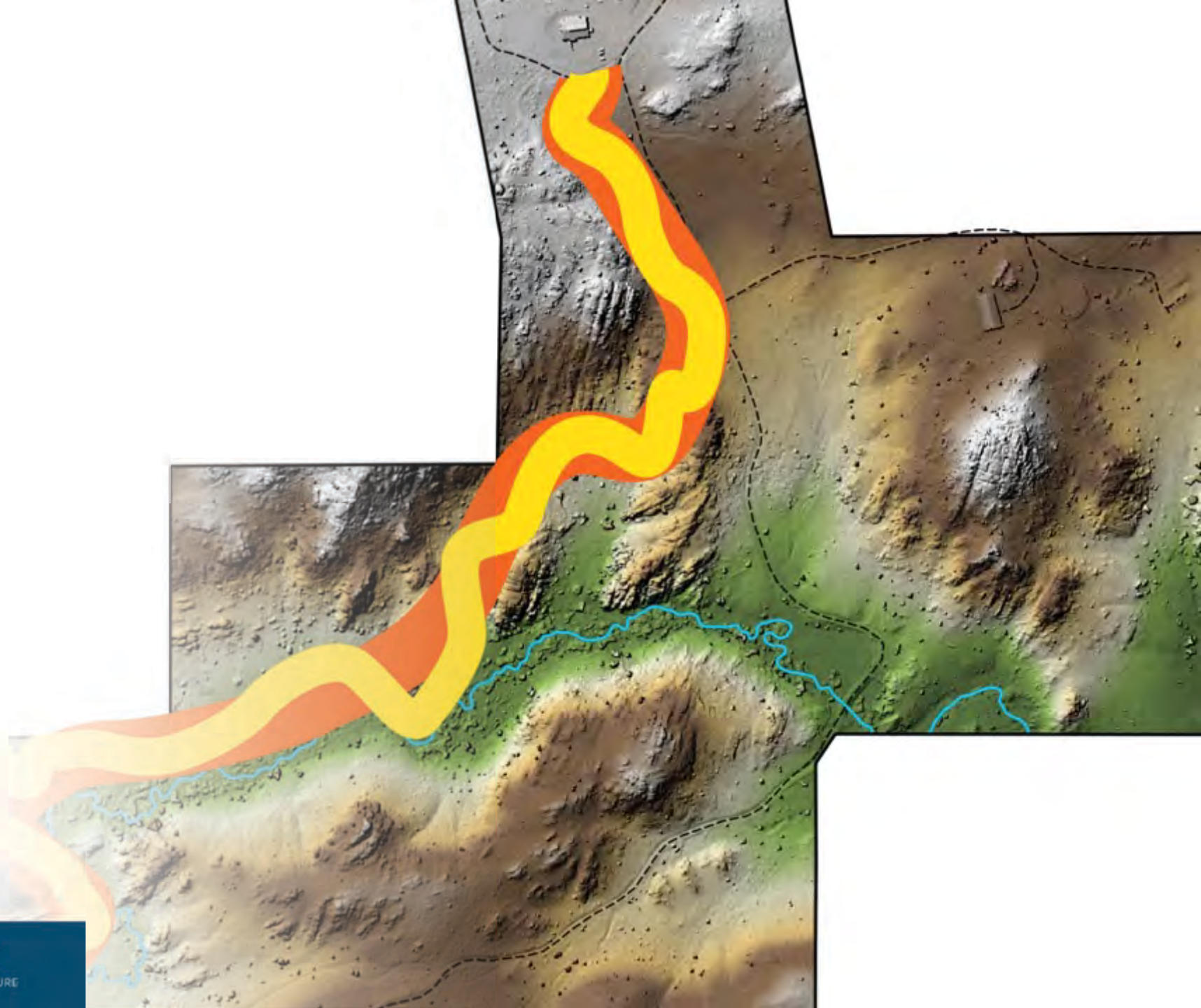

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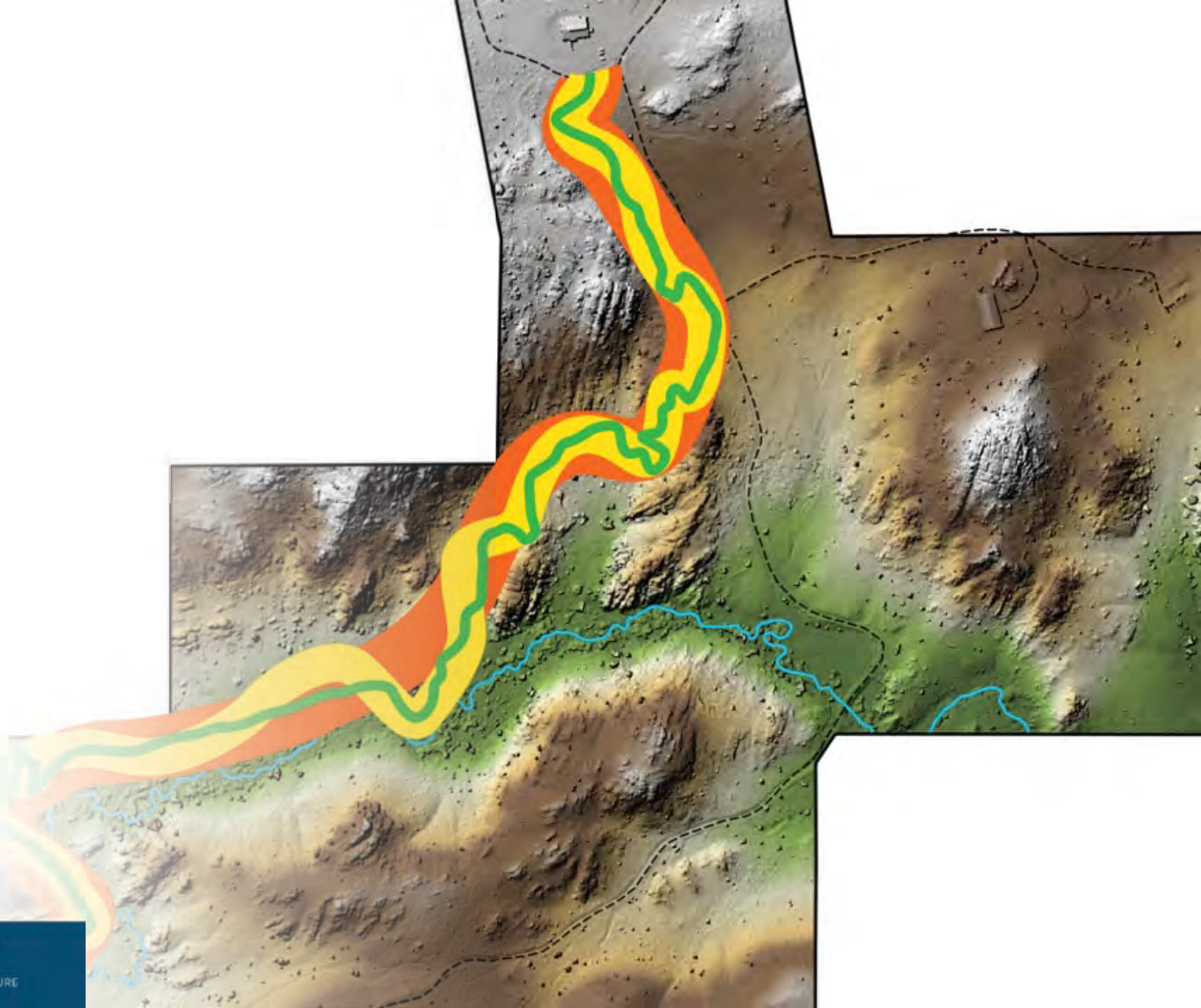

Permitting & Approvals

- See previous webinar
- Complexity and requirement scale with project size and components
- Federal, State and local coordination likely needed on projects >1 acre of disturbance

Construction

- Typical sequence:
  - Solicitation – bidding
  - Award – contracting
  - Construction management
    - Kick-off, coordination, inspections, approvals, payments
  - Closeout
    - As-built documentation
    - Grant and permit closure
  - Trail opening

Photo Credit: OBP Trailworks

Photo Credit: Trail Eyes, LLC

Maintenance & Management

- Manager and partner O&M of trails/systems
  - Inspections
  - Coordination on repair, closure, adaptation
  - Development of skills and capacity specific to system

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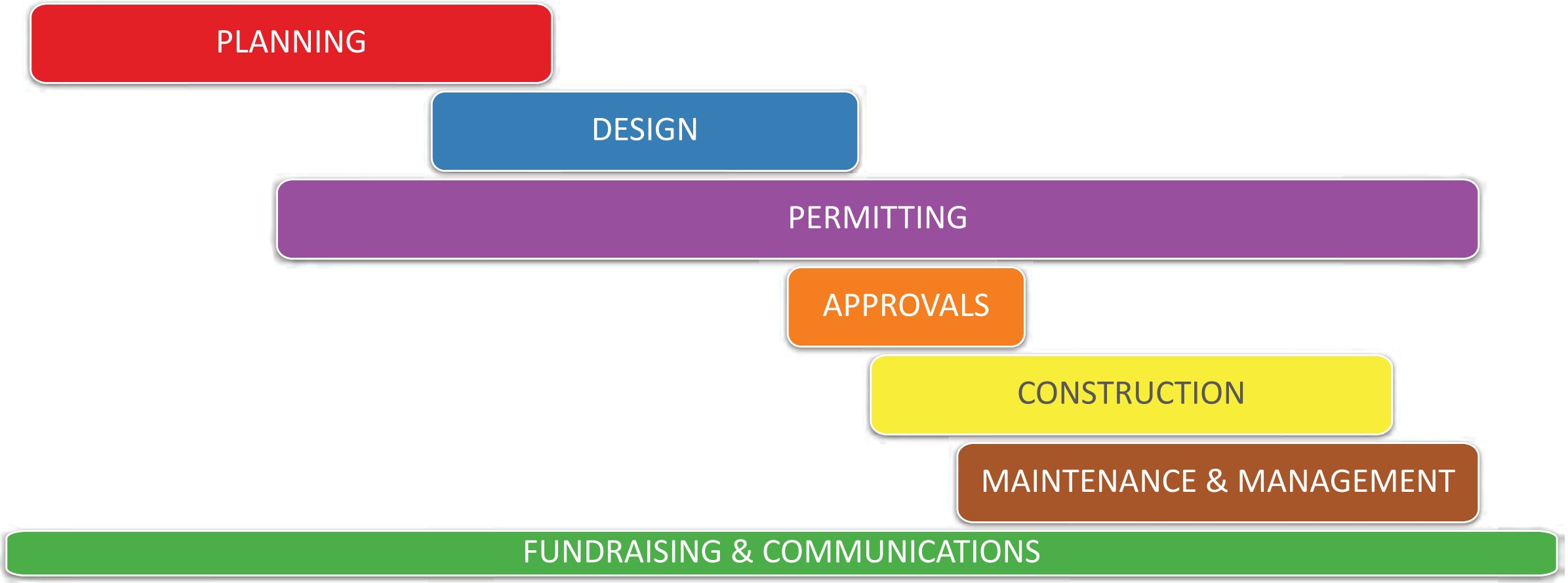
Trail Project Life Phases



MN Iron Range (https://www.ridetherange.com/)

- Year Round Recreation redevelopment on MN's Iron Range
  - 3 recently built trail systems
  - 1 Update trail system
  - 145+ miles of trail

RIDE THE RANGE

MN Iron Range (https://www.ridetherange.com/)

- Project Roots in regional efforts (5+ years)
- $5M+ Initial Funding 2018 → Field Design, Permitting Initiated
  - 2019-20 80 Miles constructed across 3 sites
  - 2023 announced an additional $2.25M for expansion of RedHead system

RIDE THE RANGE

University of Denver - Kennedy Mountain Campus Phase I Trails

Quick project turnaround required

Identified 3 trails (~3 miles)

Concept to Final Flagging in <2 months

Future Master Plan Guidance



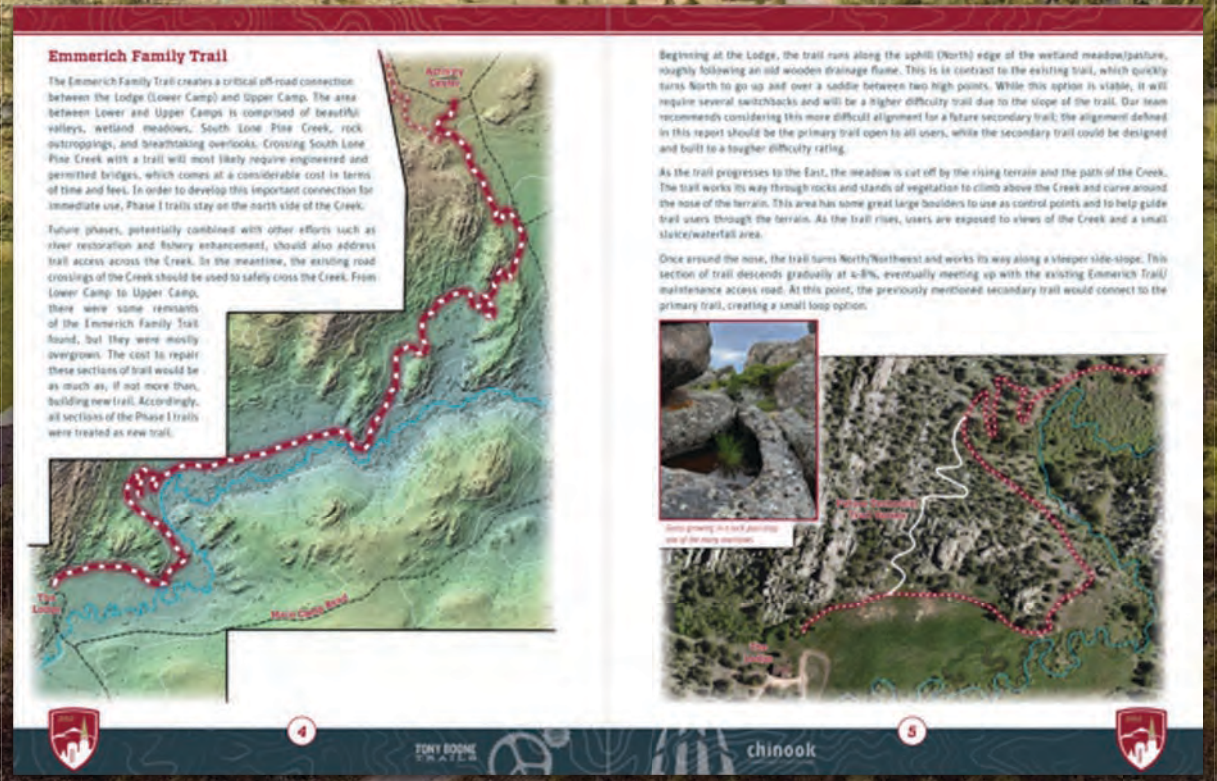



PLANNING

DESIGN

APPROVALS

- Project began with very specific direction
- Planning and Design was mostly on-site
- Quick approvals with private client



Questions & Discussion

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