



# APPLICATION OF UAV TECHNOLOGY FOR ENVIRONMENTAL LIFECYCLE MONITORING



**RemTech™ 2013**

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## **Unmanned Aerial Systems (UAV)**

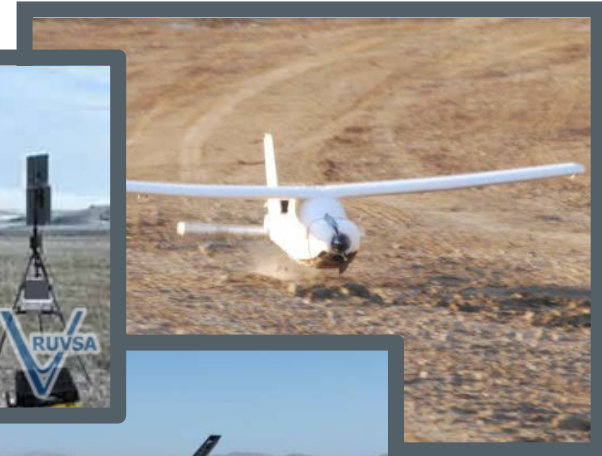
**Site Lifecycle Management**

**UAV Payload Sensors**



## Fixed wing

- Launch ramp or by hand
- Take-off and landing area required



## VTOL

- Designs have 4, 6, 8 rotors
- Small launching area
- Aeryon system designed for military use

# UAV SYSTEMS

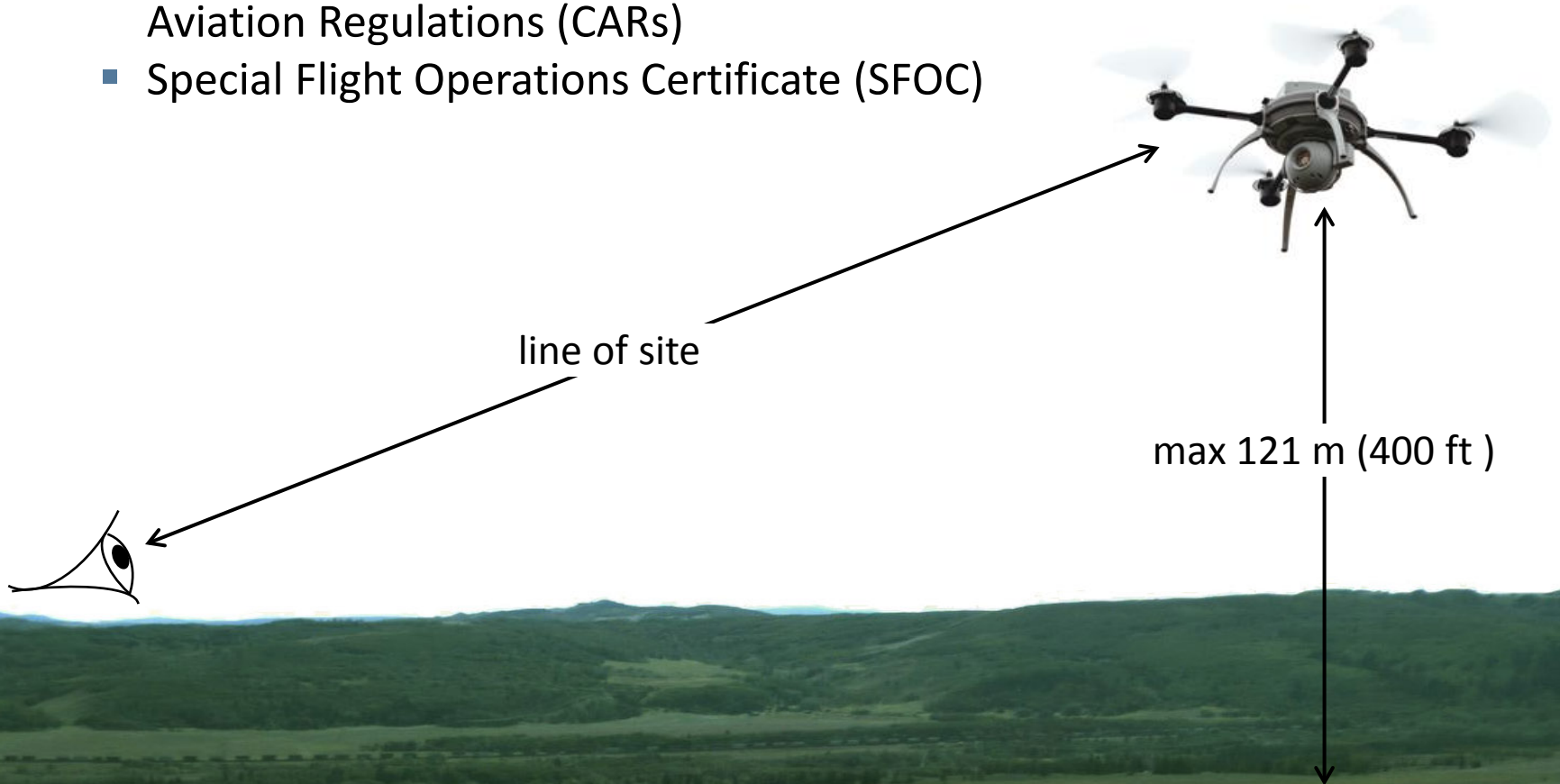


# COMMERCIAL OPERATION REGULATIONS



## Canada

- Controlled by Transport Canada under Canadian Aviation Regulations (CARs)
- Special Flight Operations Certificate (SFOC)



**Unmanned Aerial Systems (UAV)**  
**Site Lifecycle Management**  
**UAV Payload Sensors**



# SITE LIFECYCLE MANAGEMENT



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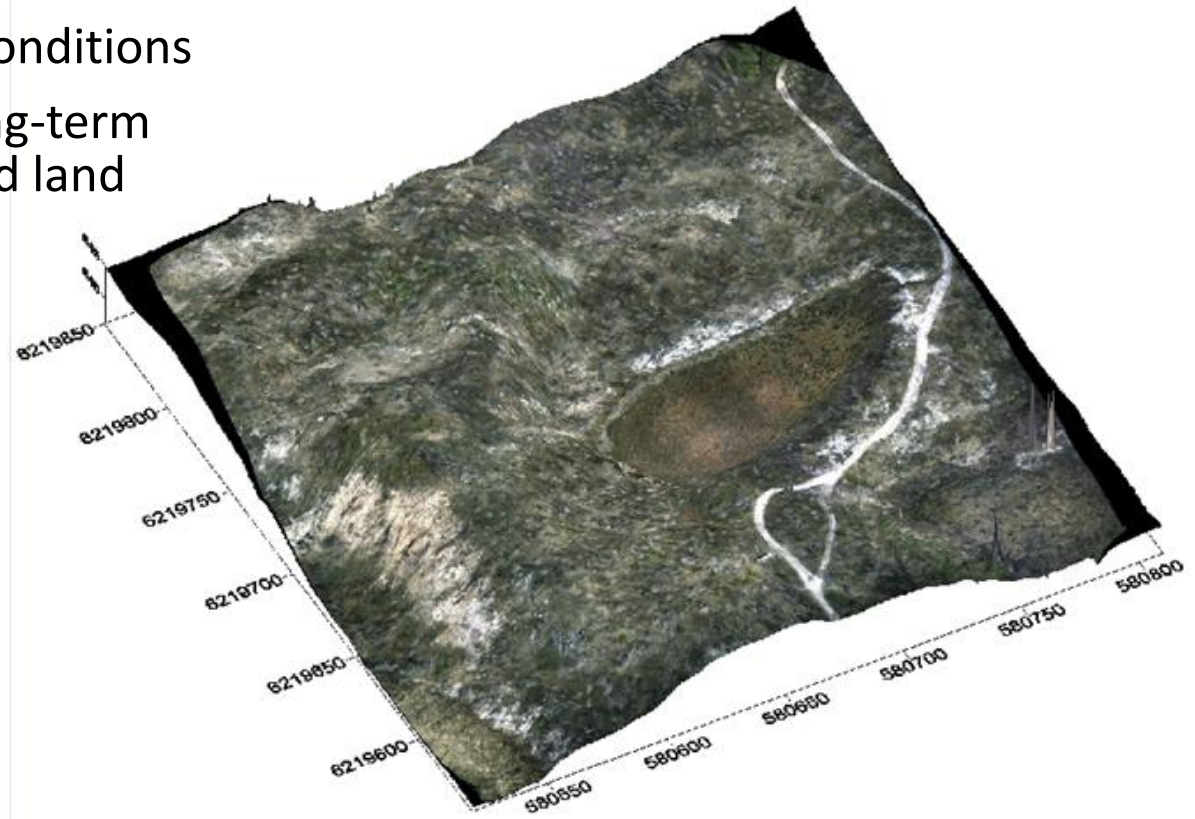


**Pre-Disturbance**

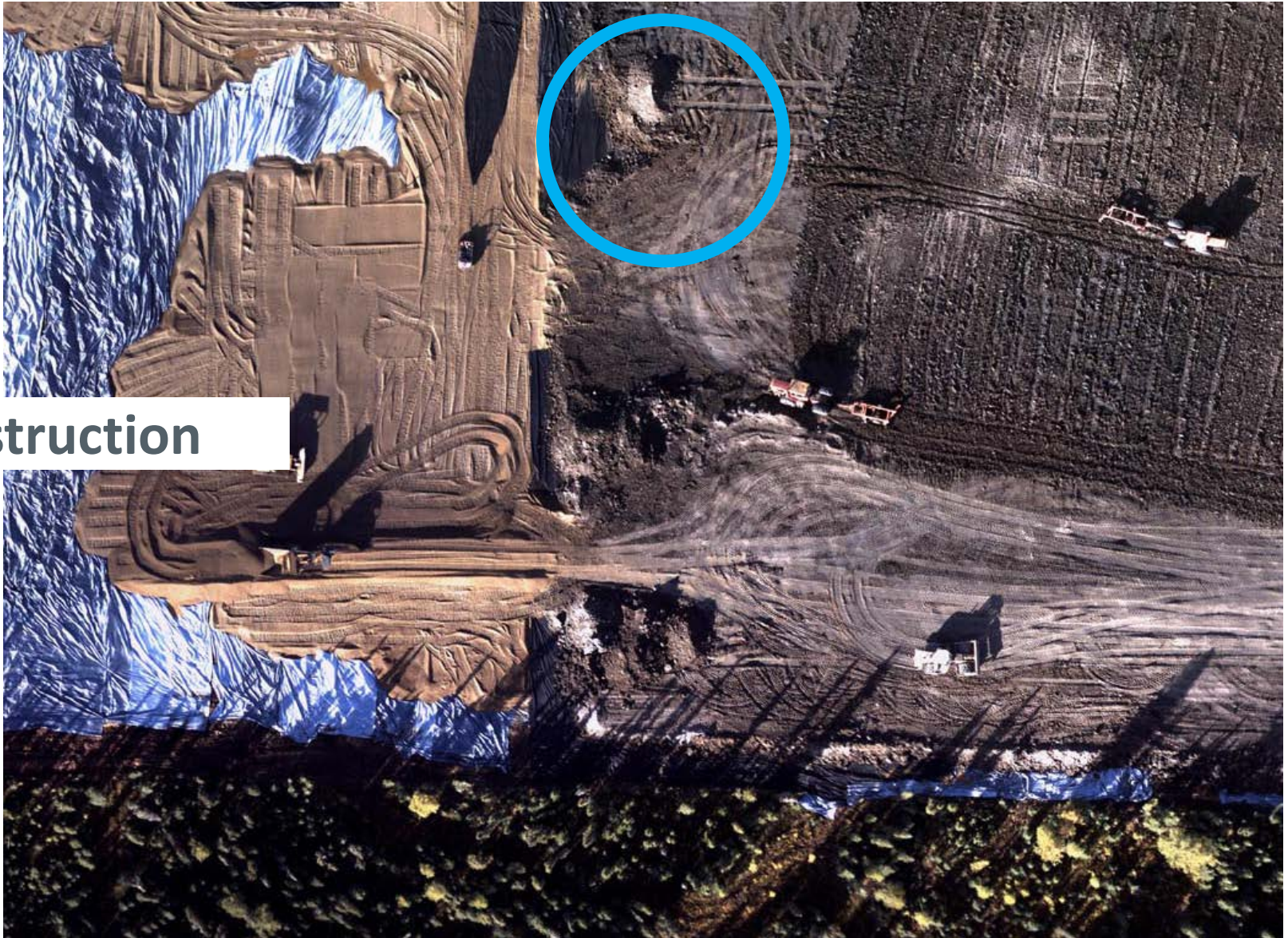


## Pre-disturbance data collection

- High resolution image mapping
- Document site conditions
- Metadata for long-term management and land stewardship



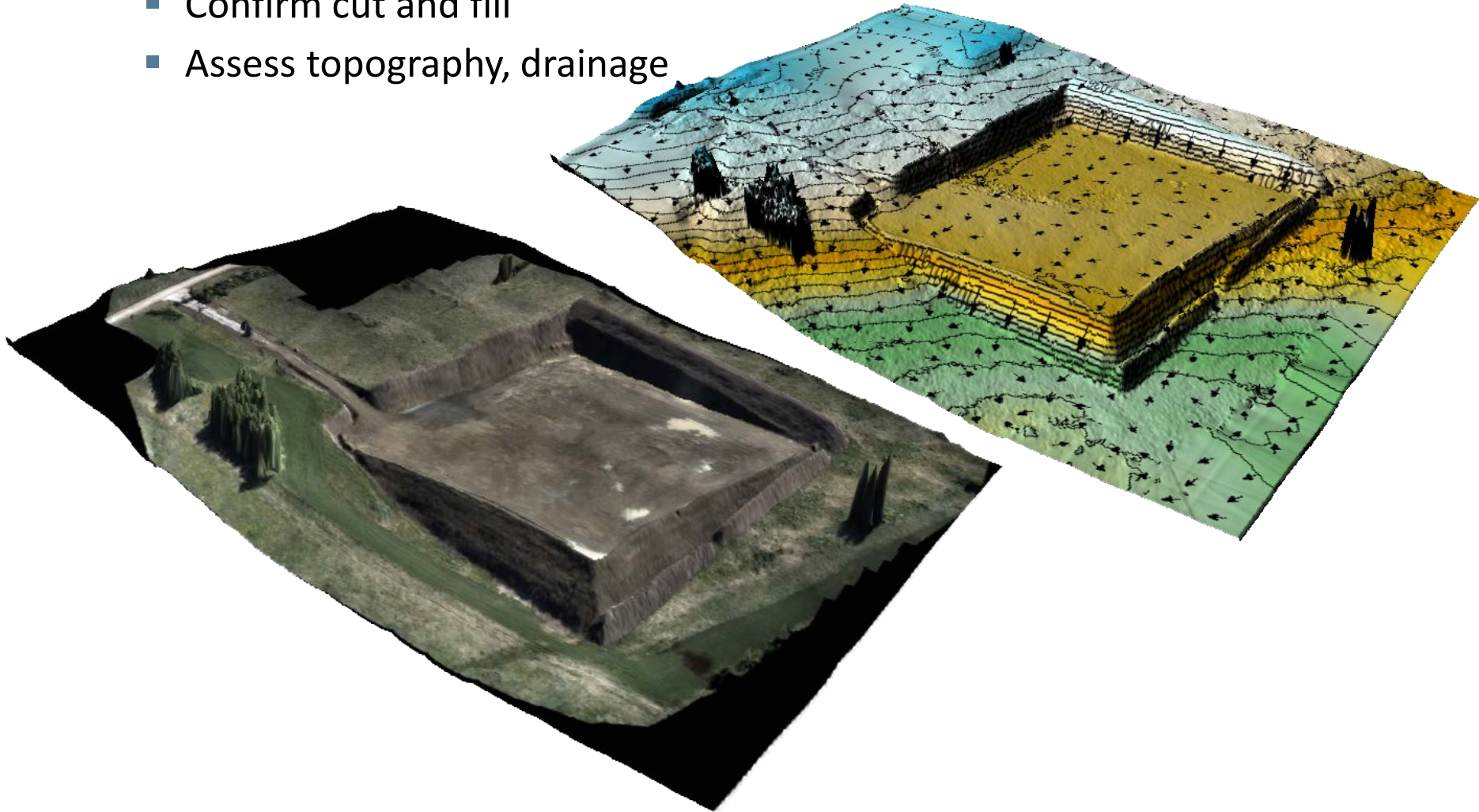
# SITE LIFECYCLE MANAGEMENT



**Construction**

## Site Construction

- Site mapping of constructed asset
- Confirm cut and fill
- Assess topography, drainage



# SITE LIFECYCLE MANAGEMENT

Operations

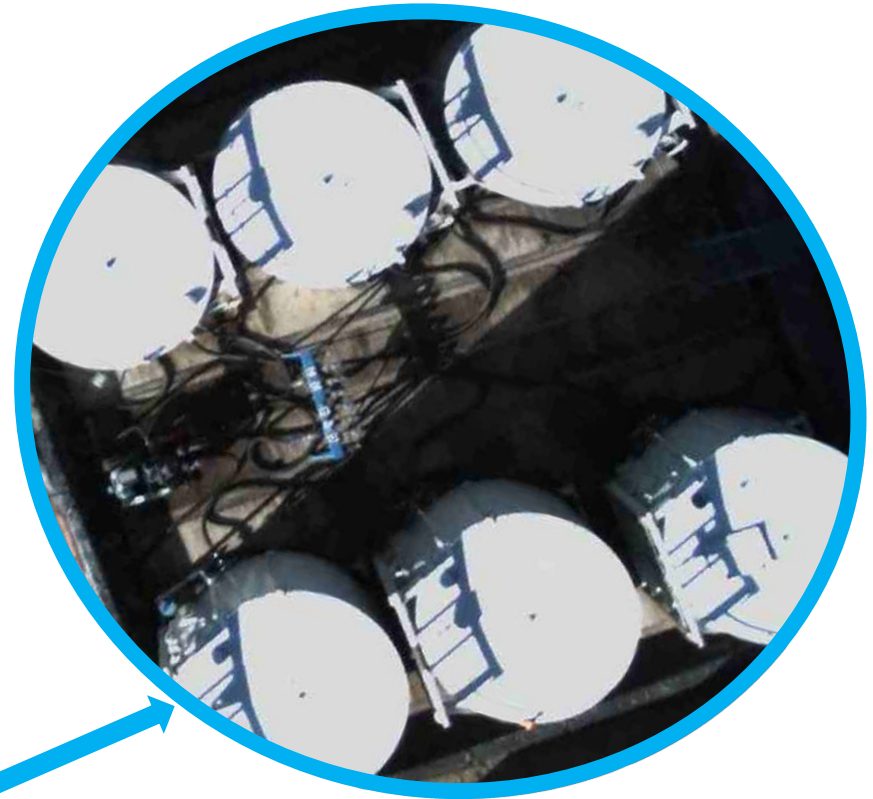


# SITE LIFECYCLE MANAGEMENT



## Operations

- Visual site records
- Detailed imaging
- Construction and as-built mapping
- Continuous monitoring



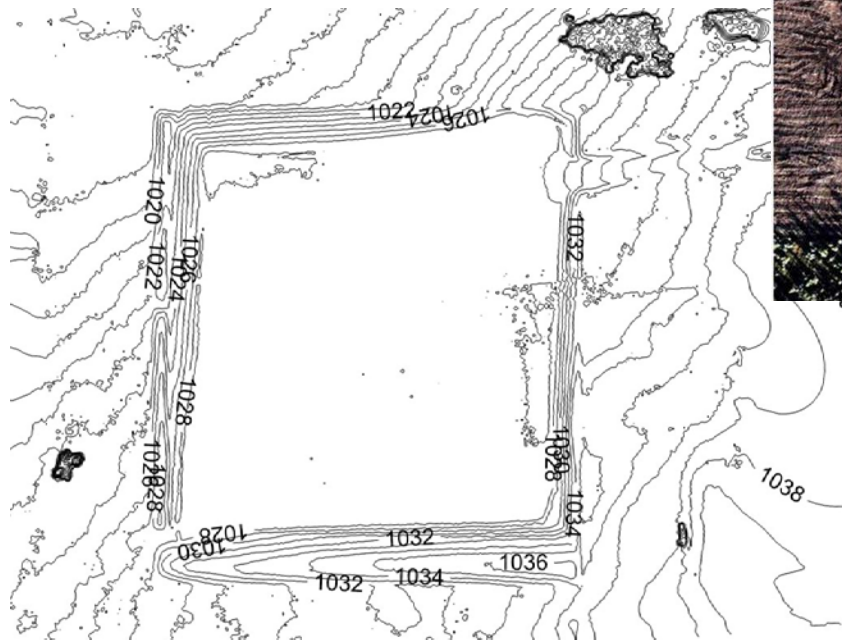
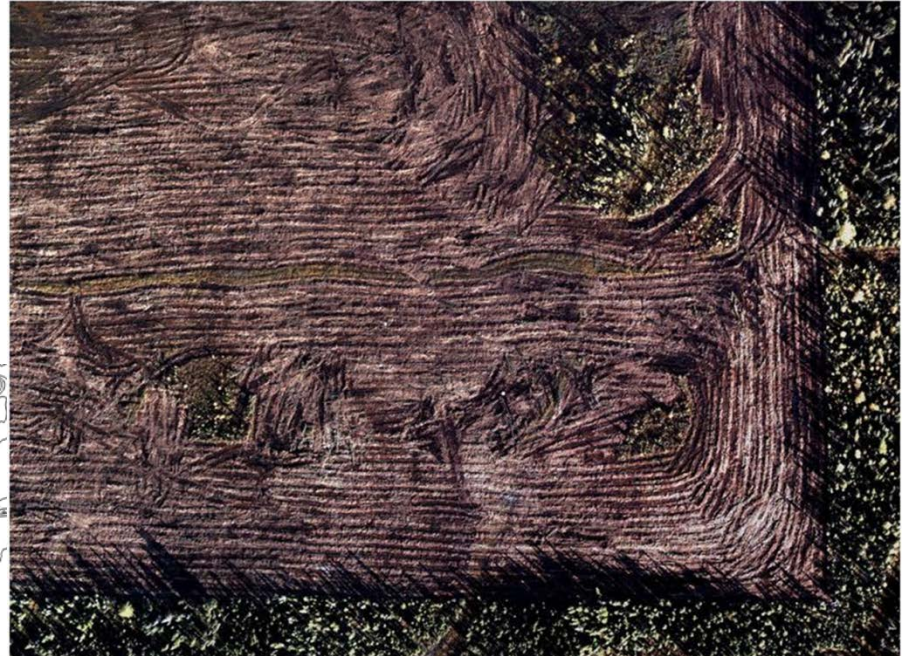
# SITE LIFECYCLE MANAGEMENT

Reclamation



## Reclamation

- Post reclamation mapping
- Assess topography
- Contour matching
- Seeding and transplanting



# SITE LIFECYCLE MANAGEMENT



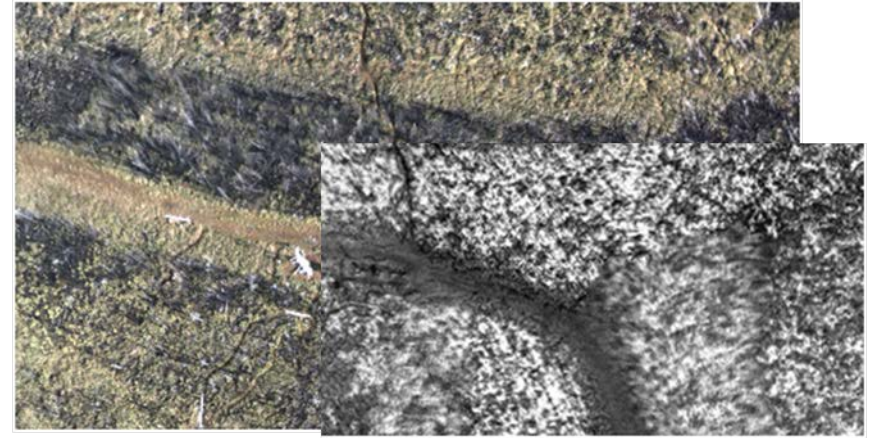
**Monitoring**





## Monitoring

- Optical, thermal, and multi-spectral imaging
- Vegetation health and growth
- Investigate potential residual damage



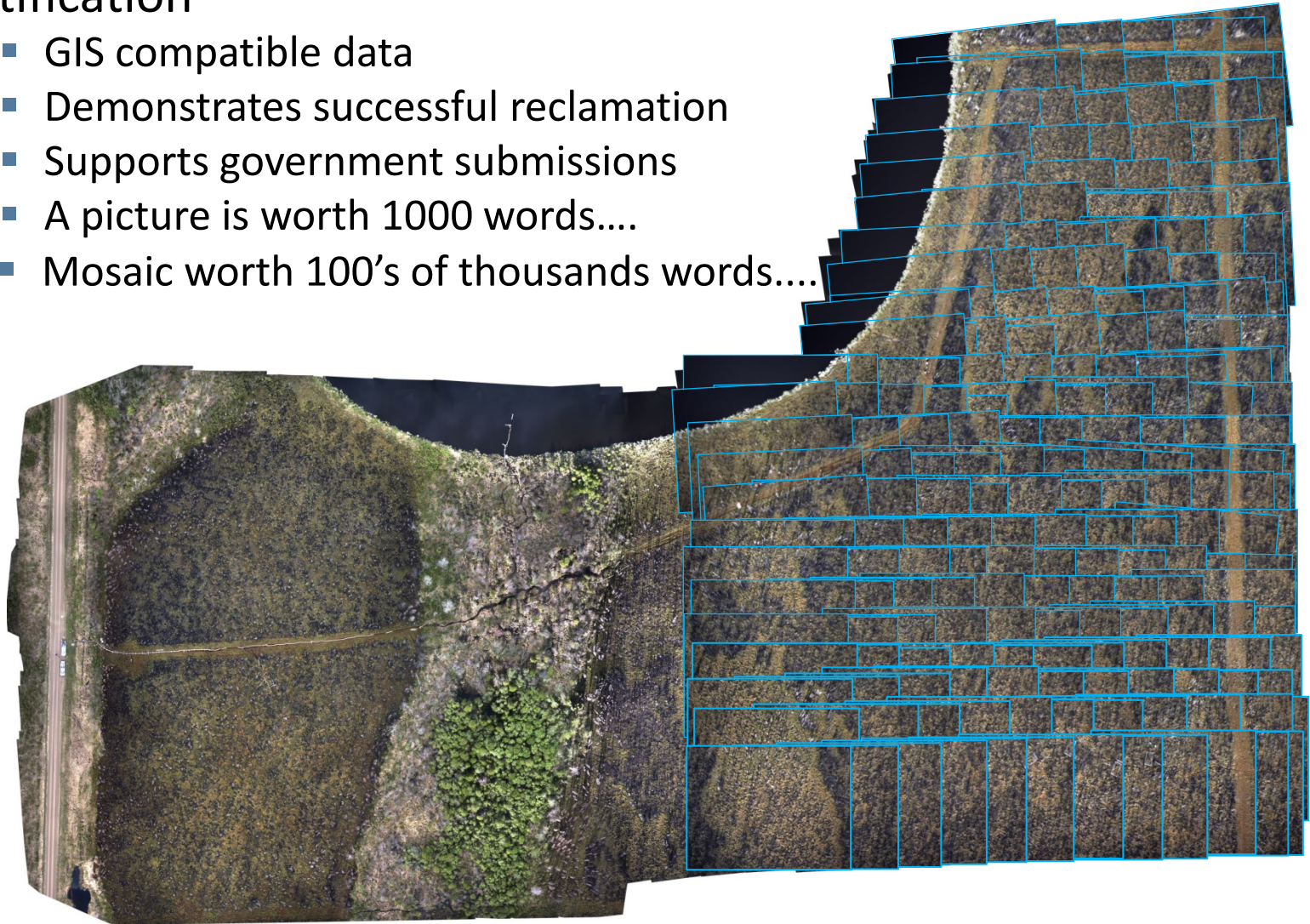
# SITE LIFECYCLE MANAGEMENT



**Certification**

## Certification

- GIS compatible data
- Demonstrates successful reclamation
- Supports government submissions
- A picture is worth 1000 words....
- Mosaic worth 100's of thousands words....



**Unmanned Aerial Systems (UAV)**  
**Site Lifecycle Management**  
**UAV Payload Sensors**



# PAYLOAD SENSORS

## Application specific sensors

### Optical

- Primarily mapping
- High resolution camera

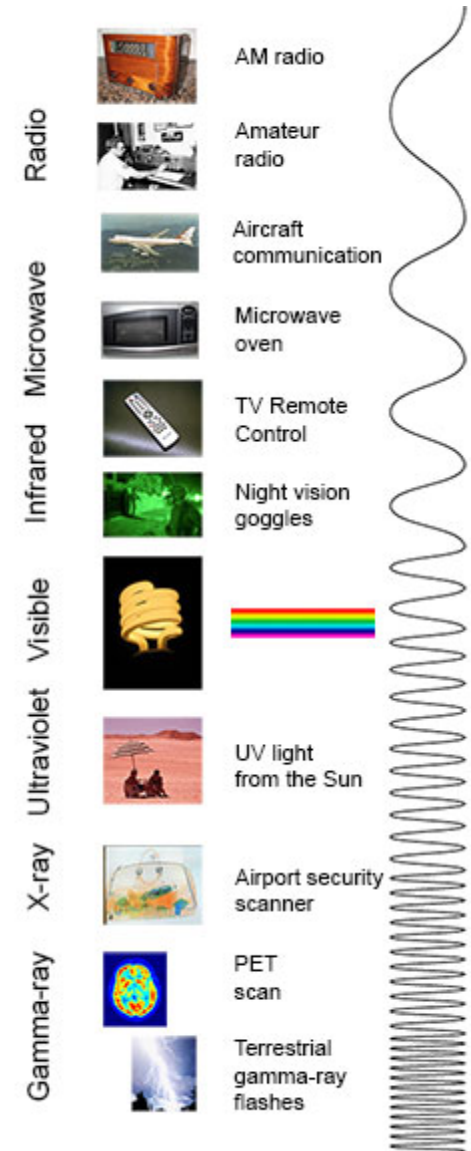


### Thermal Infra-red

- Thermal inspection
- Measures temperature variation within image

### Multi-spectral

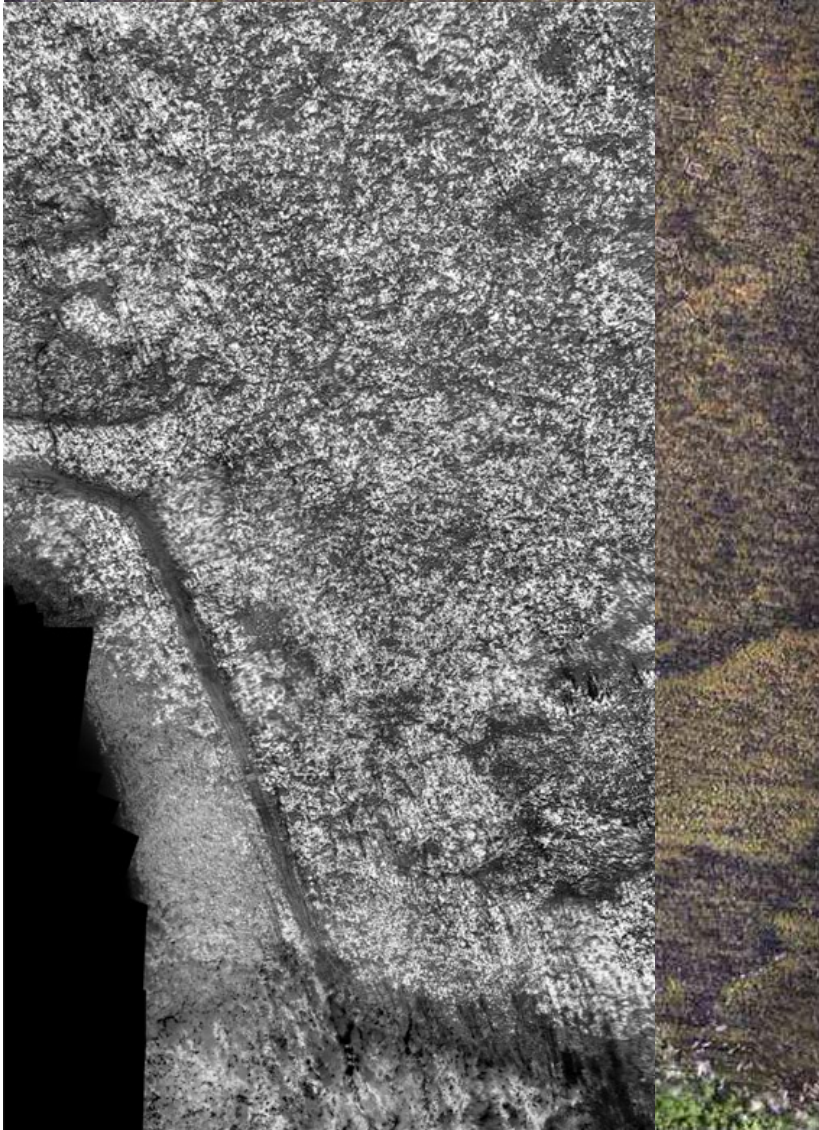
- Vegetation assessment
- Near-IR, Red, and Green bands (NDVI)





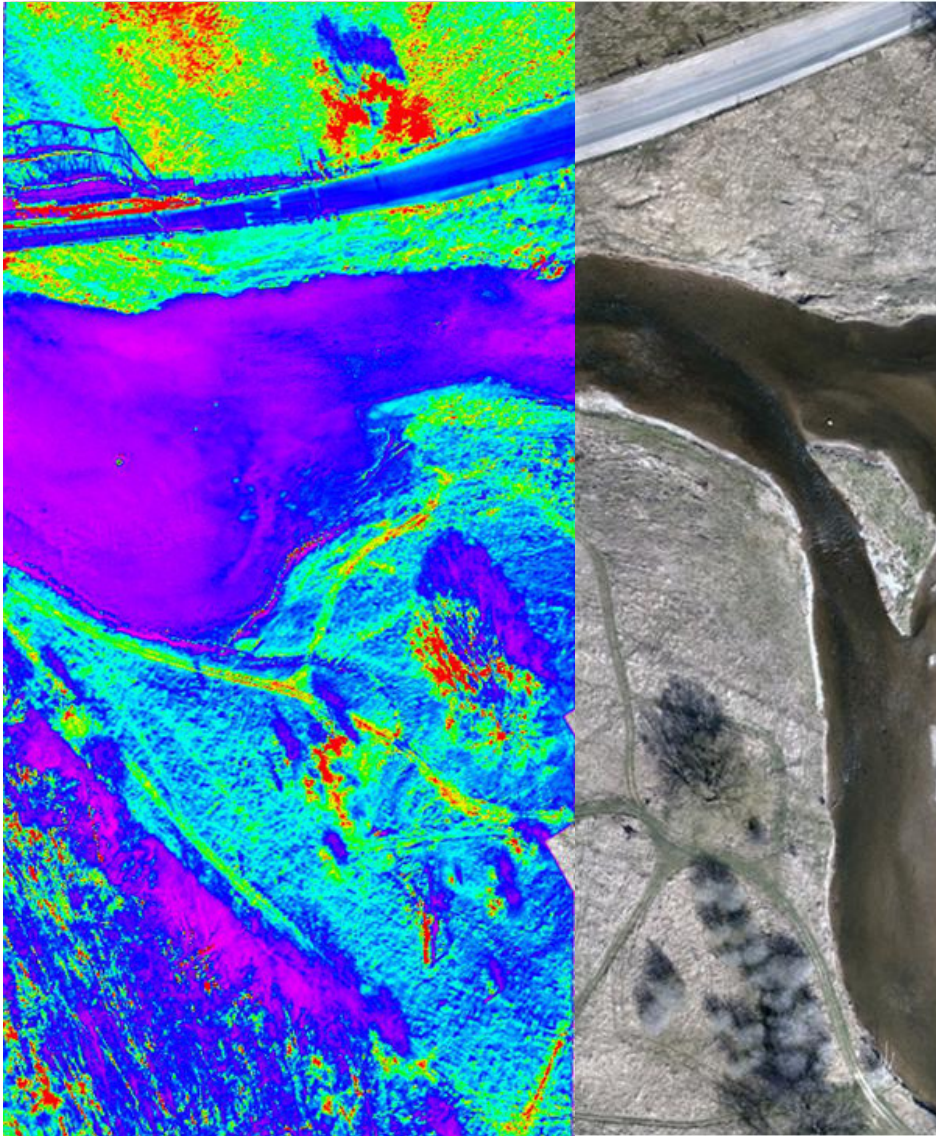
## Optical Sensor

- Map environmental conditions
- Comprehensive digital data



## Thermal IR

- Environmental applications
- Facility applications
- Geo-referenced for revisiting exact inspection location



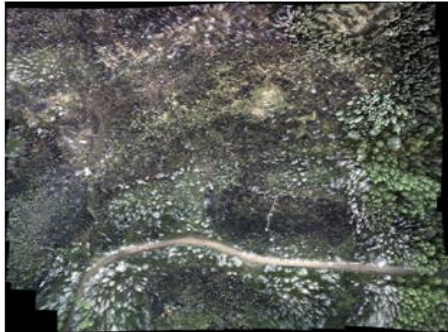
## Multi-Spectral

- Enhances data analysis
- Assessment at progressive growth stages
- Hydrology mapping
- Mining applications

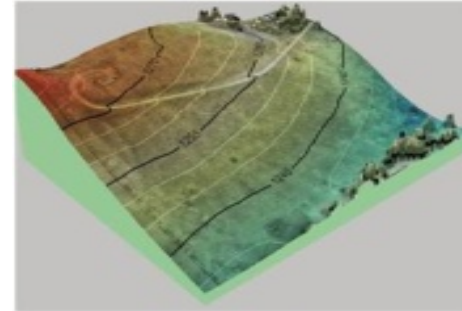


## Rapid turnaround

### Geo-referenced orthomosaic



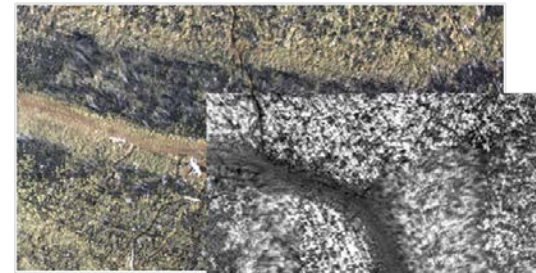
### Digital elevation model (DEM)



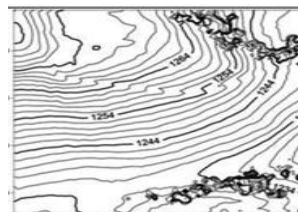
### Panoramic and oblique mosaics



### Custom products



### Digital files



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fov_y=0.555500  
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gps_lat=0.894324  
gps_lon=-2.002084
```

Two large, blue, curved lines that resemble the left side of a question mark, framing the central text.

QUESTIONS ?