

SITKA LANDSLIDES INVESTIGATION AND ASSESMENT



Thursday, May 12, 2016
Sitka, Alaska

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DGGS LANDSLIDE WORK

August 18, 2015

Over 40 slides on Baranof
and Chichagof Islands

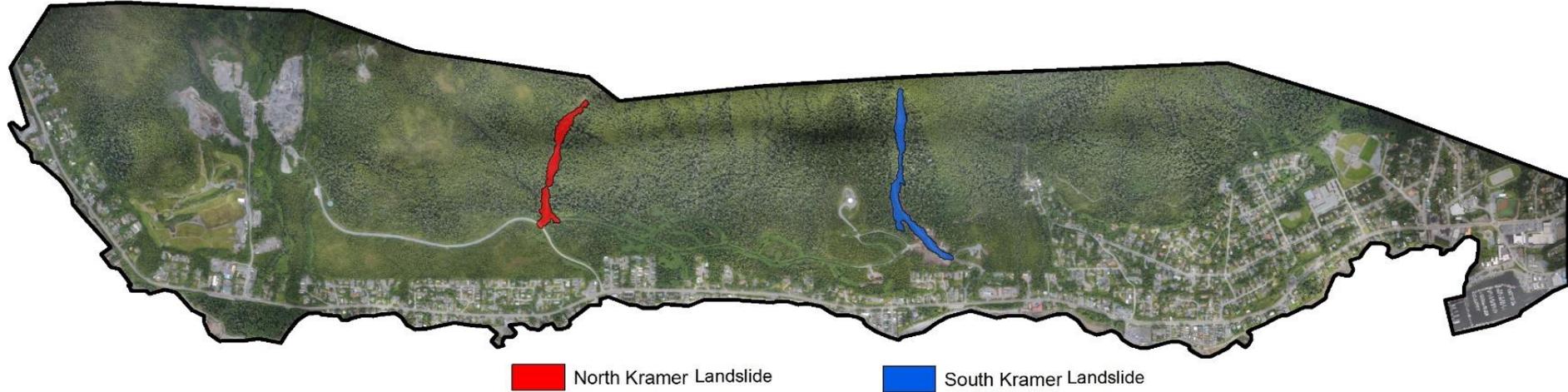
Harbor Mountain landslide
1200 ft long





August 2015 Kramer Landslides

Orthophoto



North Kramer Landslide

South Kramer Landslide

Digital Surface Model (DSM)

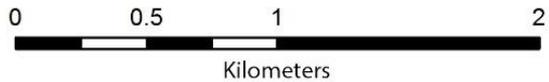
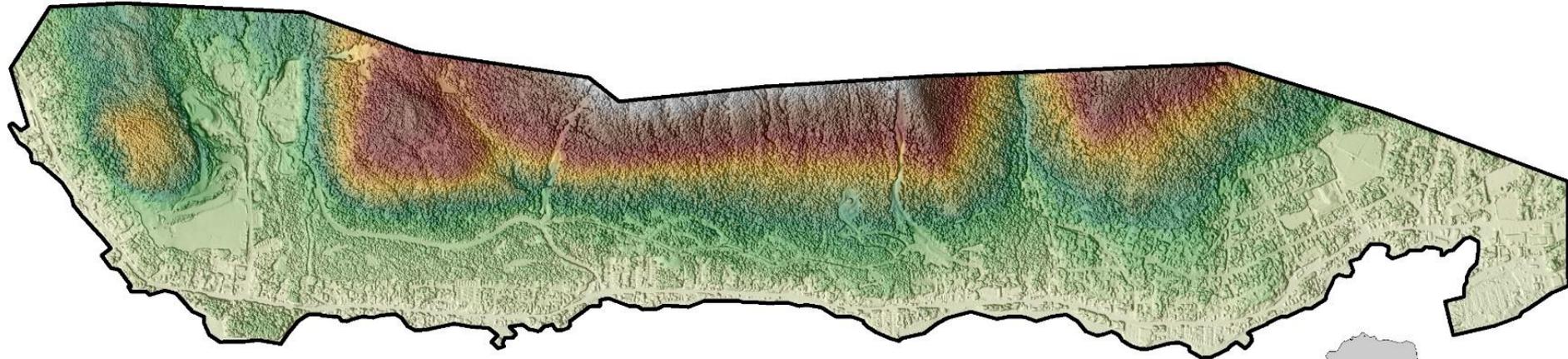
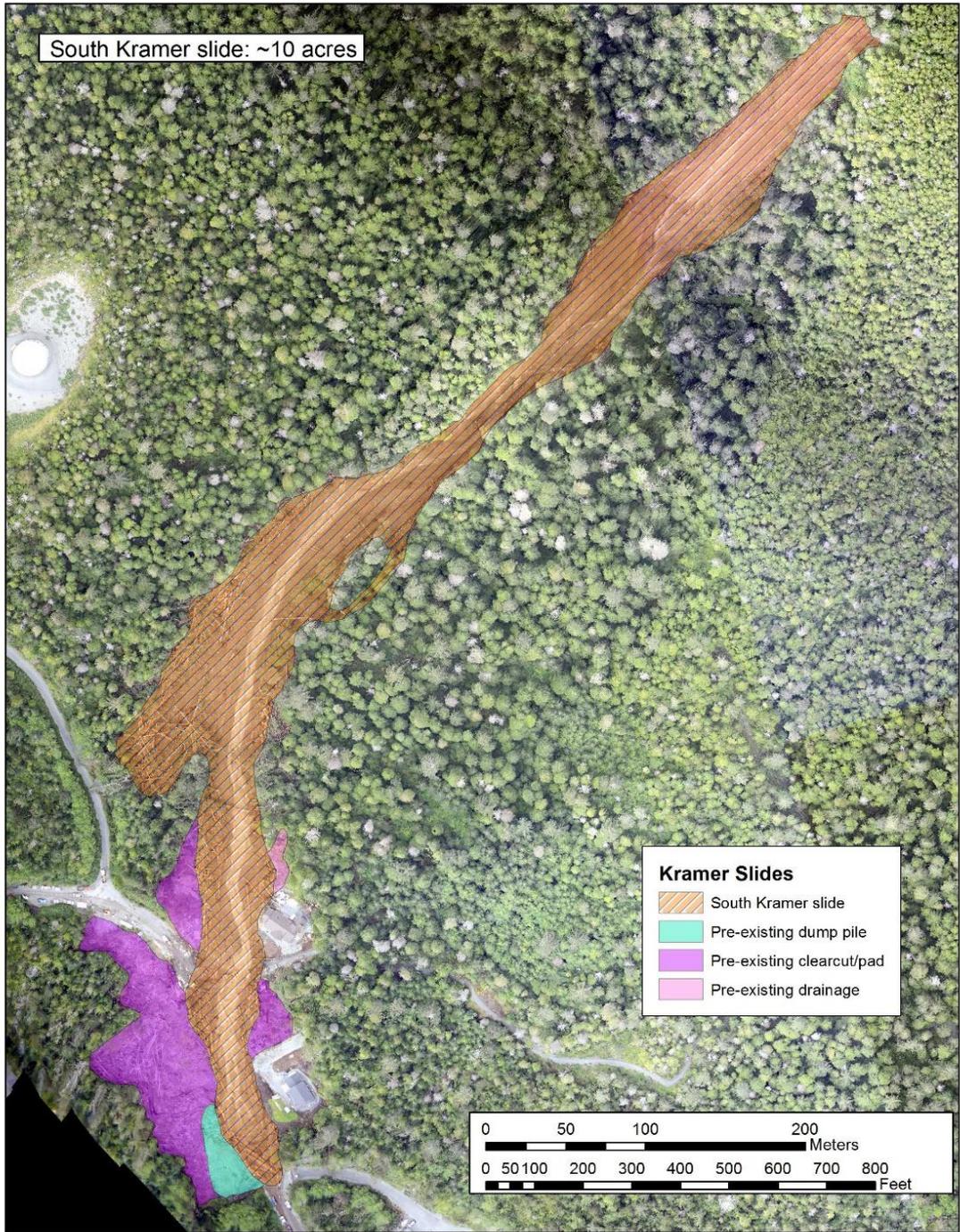


Figure 1. Orthophoto and DSM of the August 2015 Kramer landslides produced through structure from motion photogrammetry . This aerial survey was collected by Alaska Division of Geological & Geophysical Surveys two days following the event in partnership with the US Coast Guard.

South Kramer slide: ~10 acres



Overview

PROJECT OBJECTIVES

- LiDAR Collection
- Landslide Inventory Mapping
- Landslide Susceptibility Mapping
- Landslide Modeling

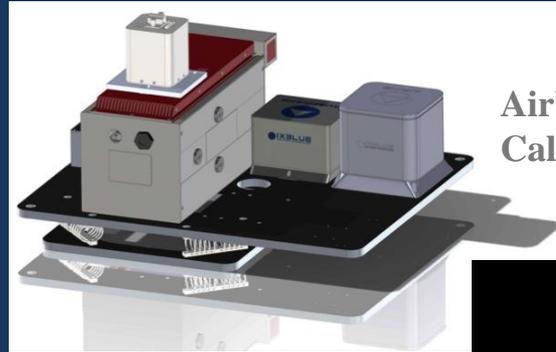
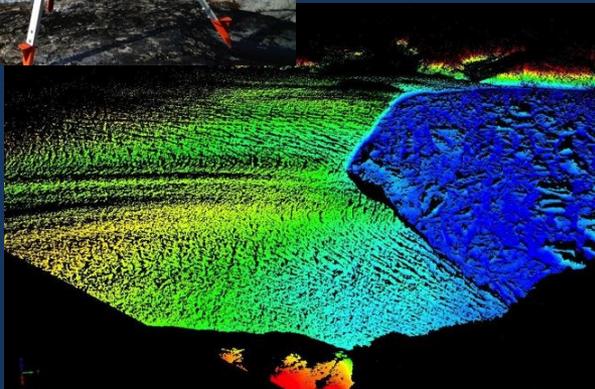
FIELD OBJECTIVES

- Characterize sediment
- Collect geophysical data

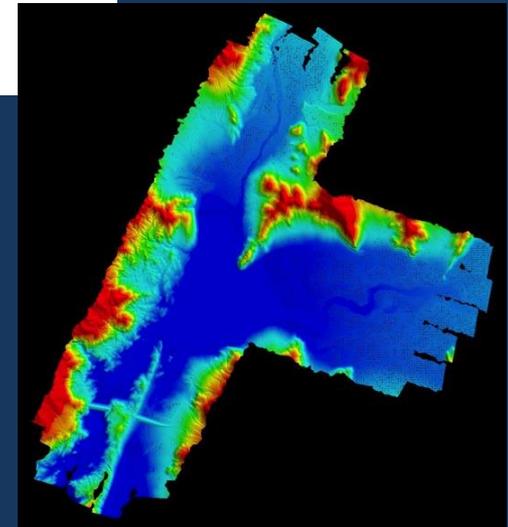
CRREL: Cold Regions Research & Engineering Lab

- Remote Sensing / GIS Center of Expertise for Army Corps of Engineers
- Specialize in Arctic, Antarctic, Alpine, and Cold Regions
- LiDAR Group: Army Corps experts in laser scanning (LiDAR)
- Partners with the National Center for Airborne Laser Mapping (NCALM)

Terrestrial Laser Scanning:
Helheim Glacier, Greenland



Airborne Laser Scanning:
California



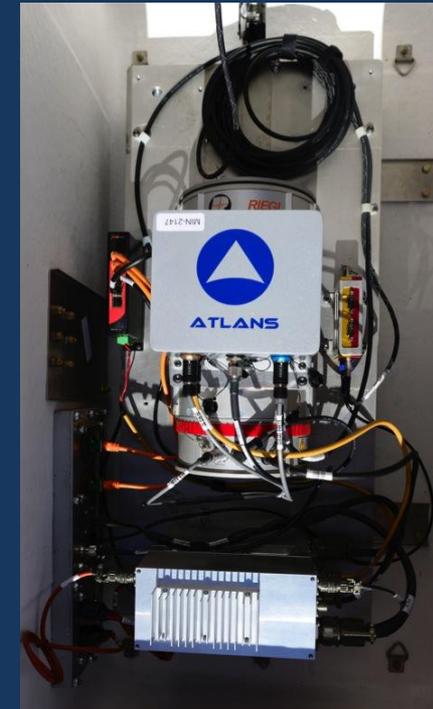
CRREL HeliPod Laser Scanning: Sitka, AK



US Army Corps
of Engineers.

CRREL HeliPod System

- Uses LiDAR technology: Light Detection and Ranging
 - Measure distances from sensor to surface
 - Very fast: Up to 1-million measurements per second (1MHz)
- Custom designed and built pod system for Robinson R44 Helicopter
- Able to fly **LOW** and **SLOW**: Purpose built for high-relief terrain



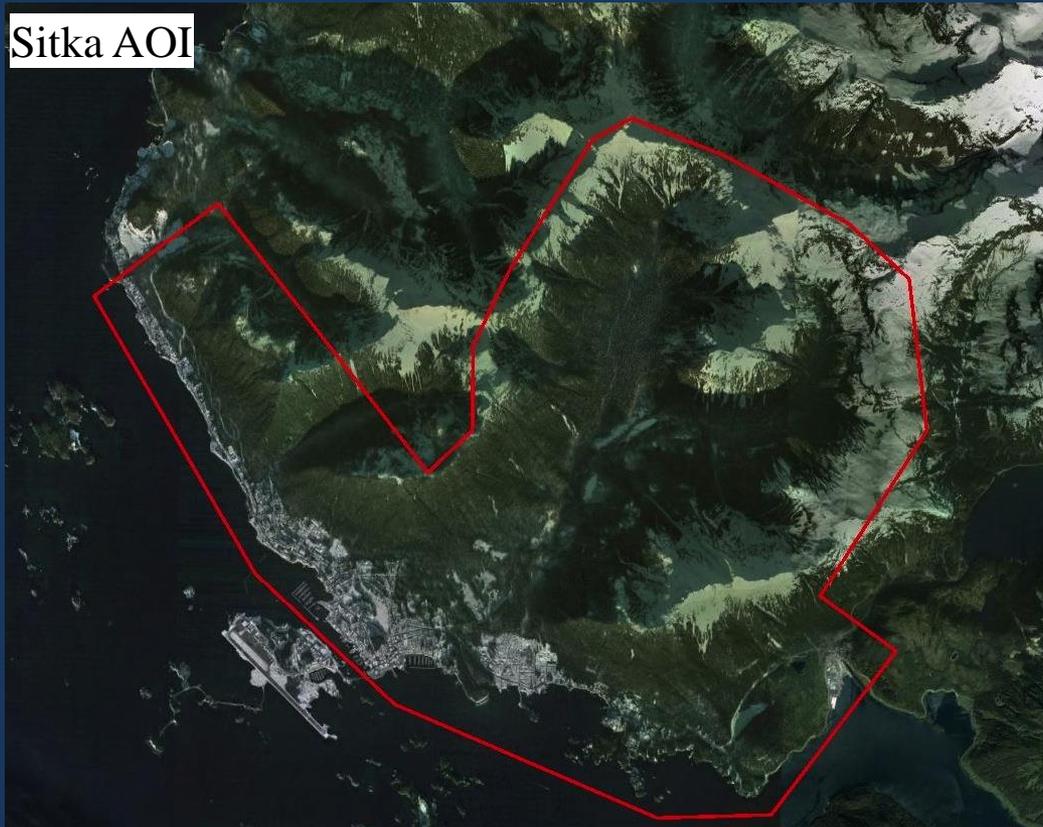
CRREL HeliPod Laser Scanning: Sitka, AK



US Army Corps
of Engineers.

Sitka HeliPod Data Collection

- Precise topographic measurements of an area = high resolution 3D map
- Penetrates thick vegetation (e.g. Sitka area forests!)
- Allows mapping of existing landslide areas and identification of landslide prone areas
- Follow pre-planned flight lines for full coverage of area



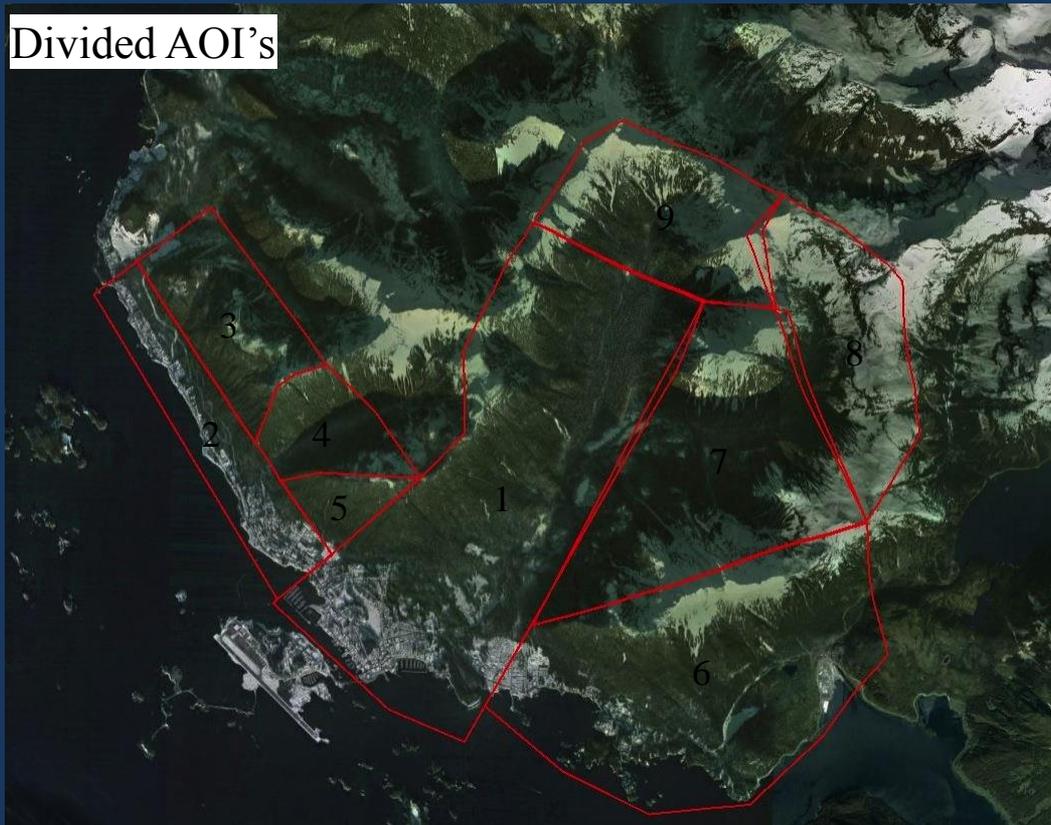
CRREL HeliPod Laser Scanning: Sitka, AK



US Army Corps
of Engineers.

Sitka HeliPod Data Collection

- Divide Area of Interest (AOI) into sections for flight line planning
- Group similar slopes and elevations



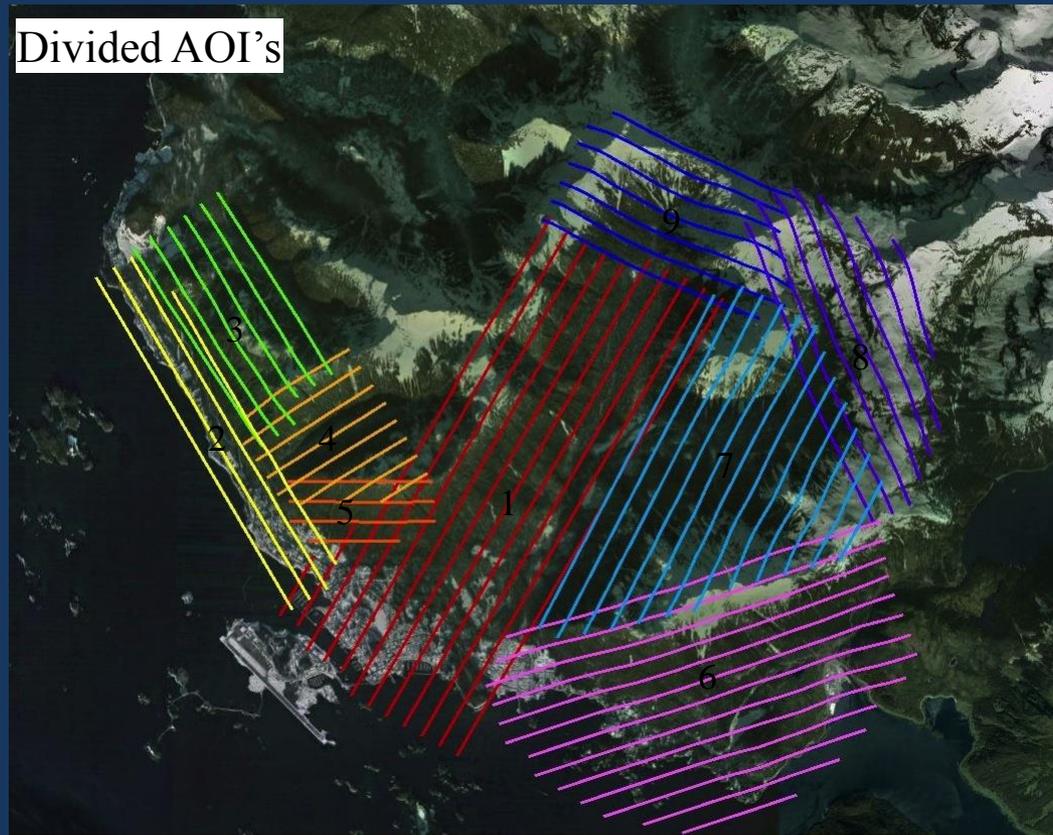
CRREL HeliPod Laser Scanning: Sitka, AK



US Army Corps
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Sitka HeliPod Data Collection

- Create flight lines for consistent spacing between lines and elevation above ground (AGL)



CRREL HeliPod Laser Scanning: Sitka, AK

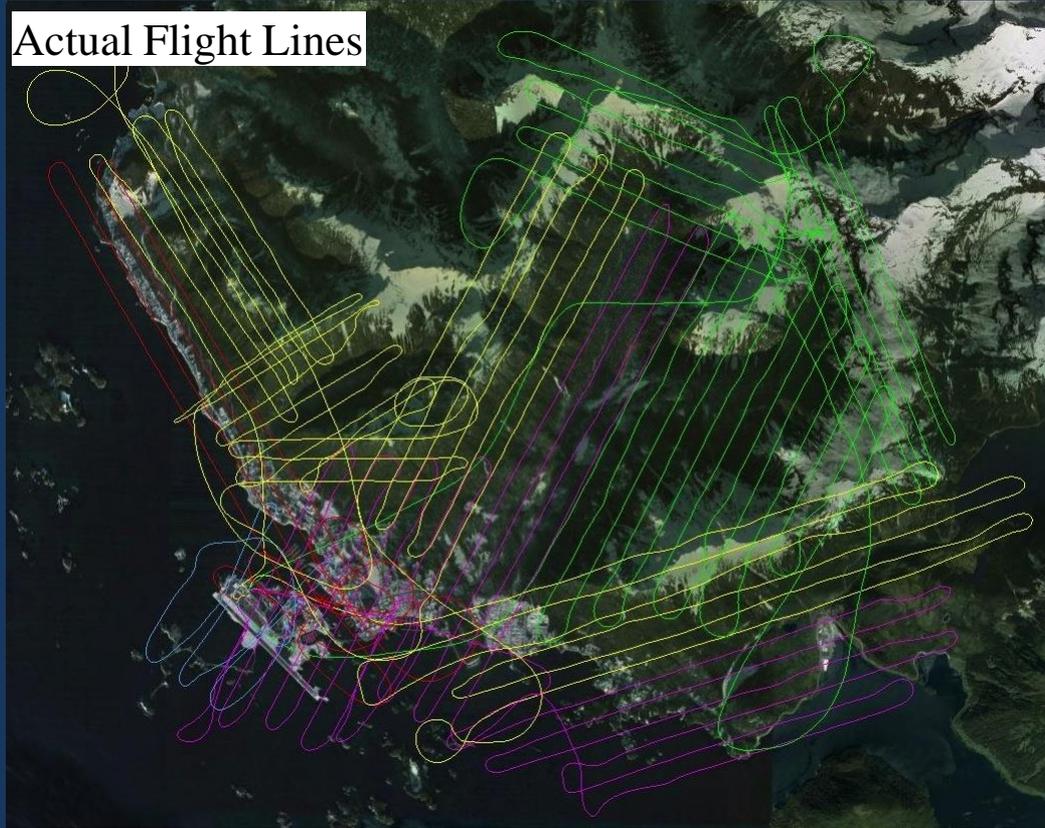


US Army Corps
of Engineers.

Sitka HeliPod Data Collection

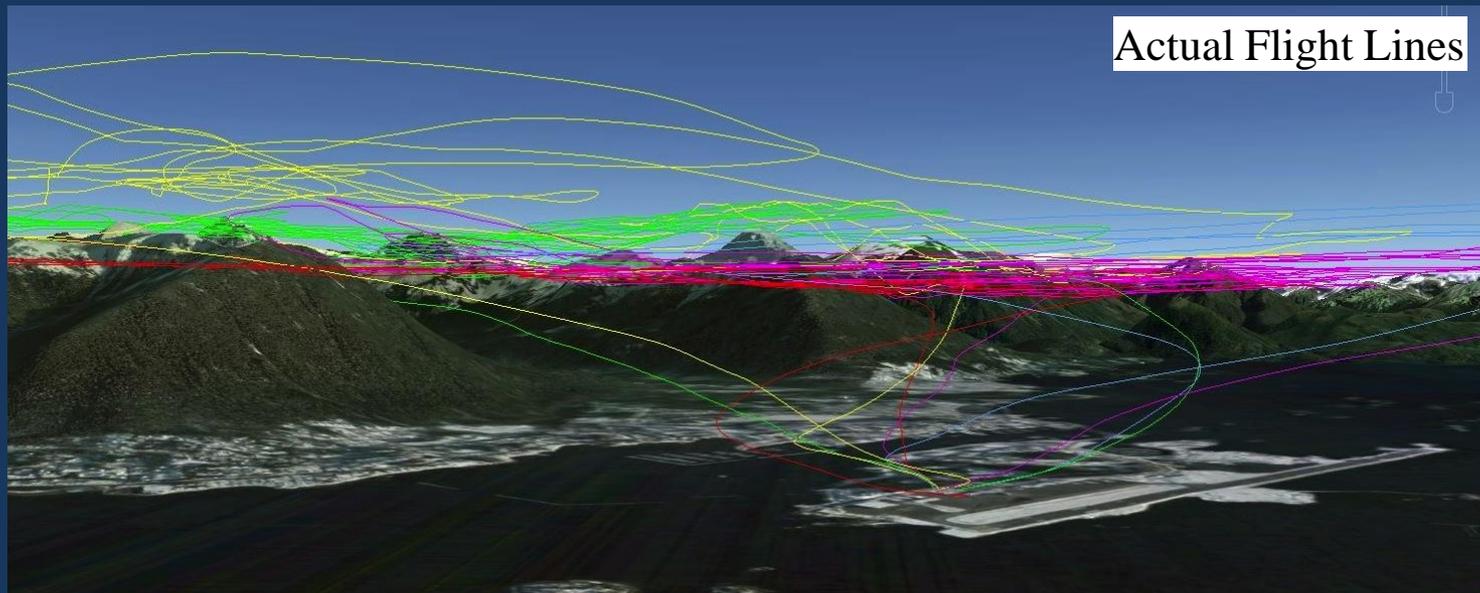
- Actual flight lines flown on May 2-3, 2016
- Pilot and operator must monitor heading and altitude above ground level
- Target was 50-knot airspeed @ 400m AGL
- Many fast ascents/descents in difficult terrain = Right job for a helicopter!

Actual Flight Lines



Sitka HeliPod Data Collection

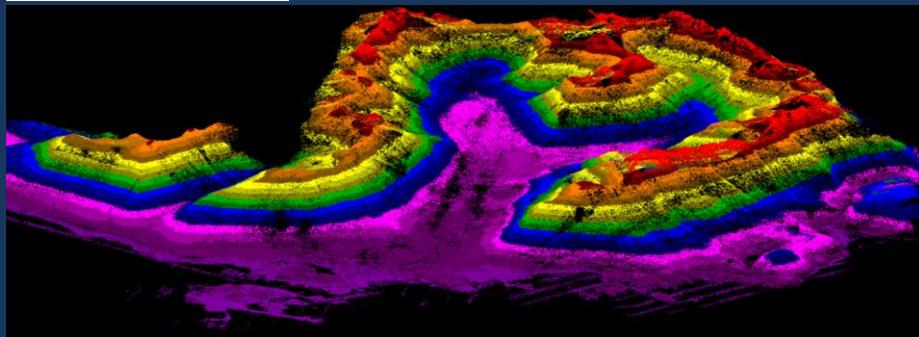
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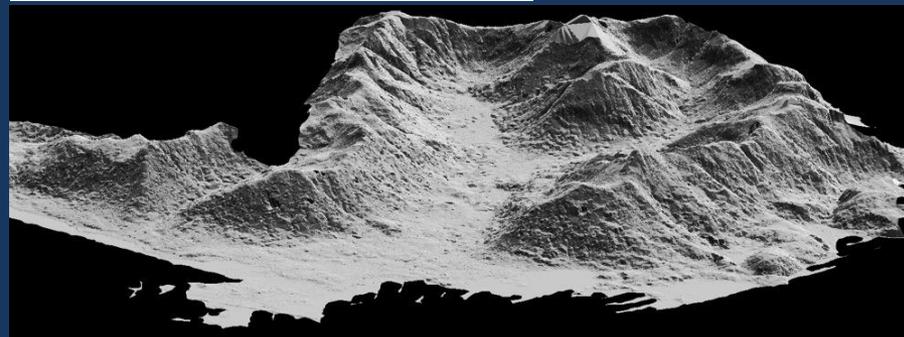
Sitka HeliPod Data Collection: Preliminary Results*

- Resulting data is a collection of billions of point measurements: Point cloud
- Can “remove” vegetation to get a bare earth model
- Create DEM from bare earth model

Height Colored



Shaded Relief 1-meter DEM

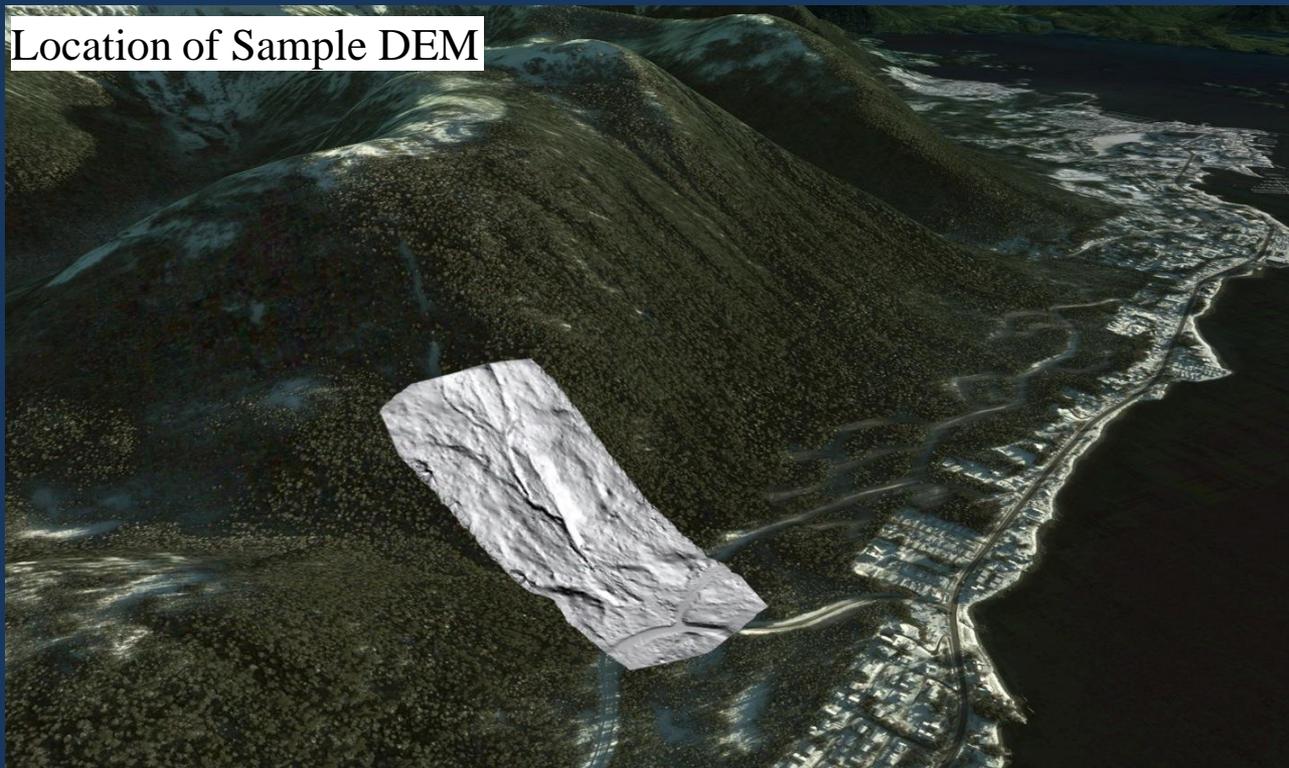


*NOTE: The above data is preliminary and only represents 1/1,000th of the actual point cloud



Sitka HeliPod Data Collection: Preliminary Results*

- Vegetation removal: Ability to “see through” thick vegetation
- Example of vegetation ON and OFF from Sitka



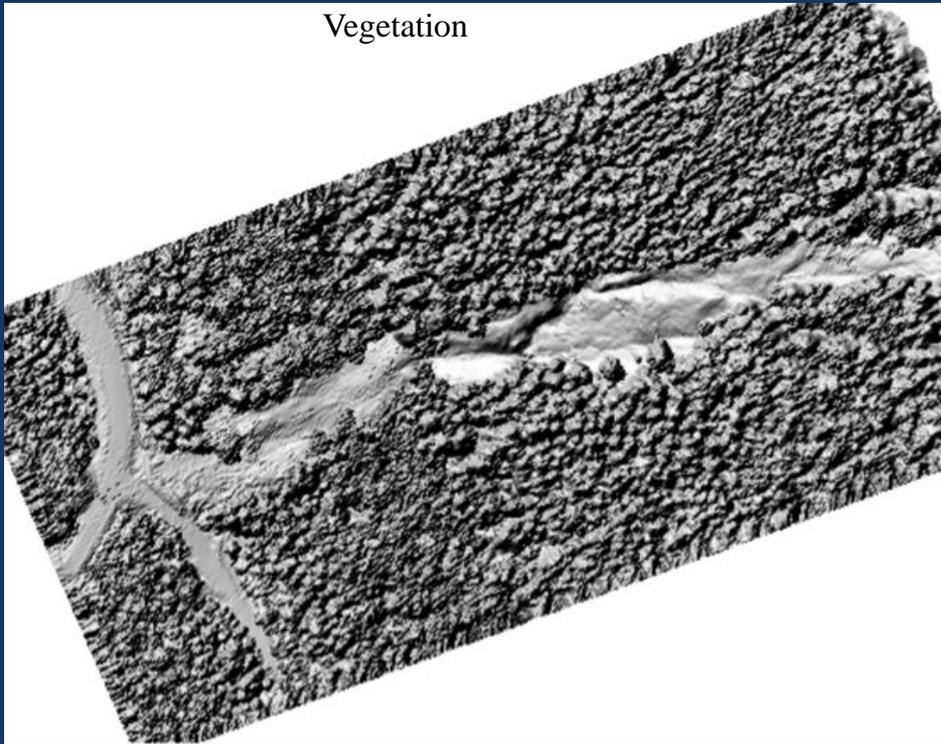
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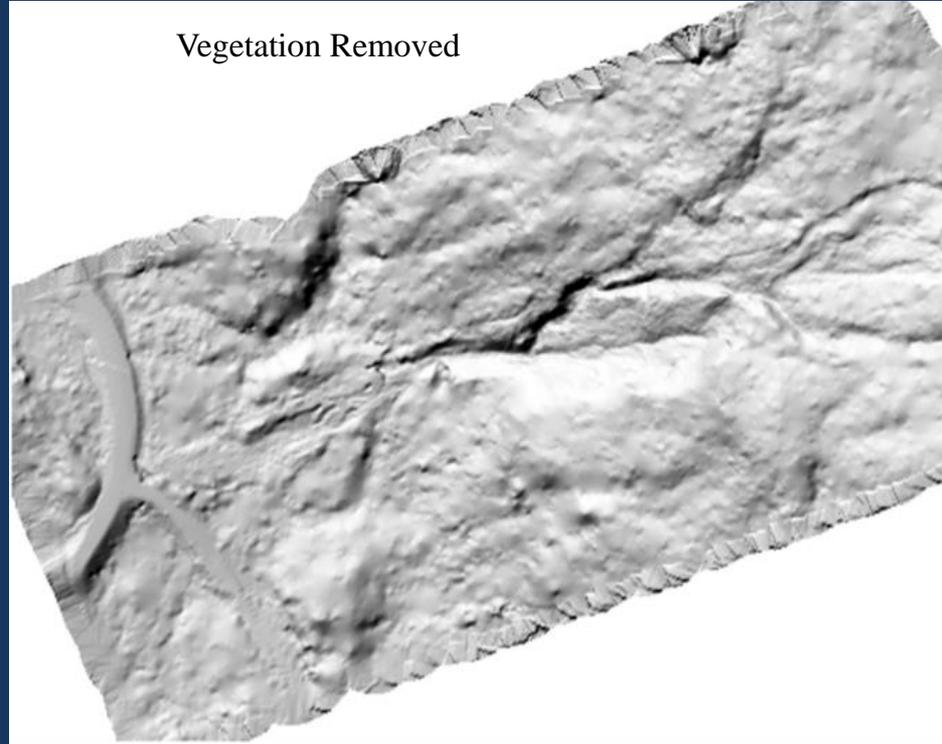
Sitka HeliPod Data Collection: Preliminary Results*

- Vegetation removal: Ability to “see through” thick vegetation
- Example of 1-meter DEM vegetation ON and OFF from Sitka

Vegetation



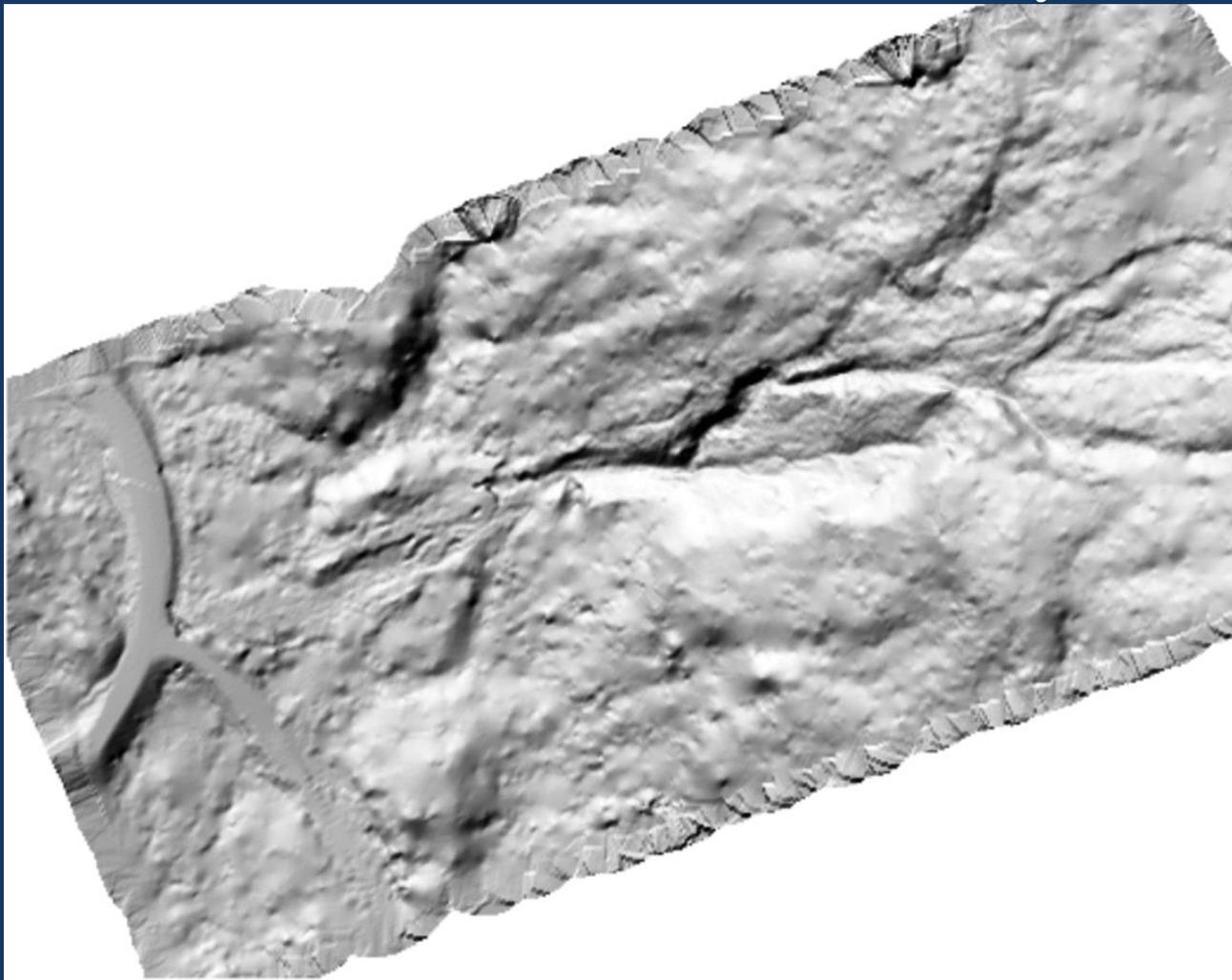
Vegetation Removed



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Sitka HeliPod Data Collection: Preliminary Results*



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CRREL HeliPod Laser Scanning: Sitka, AK

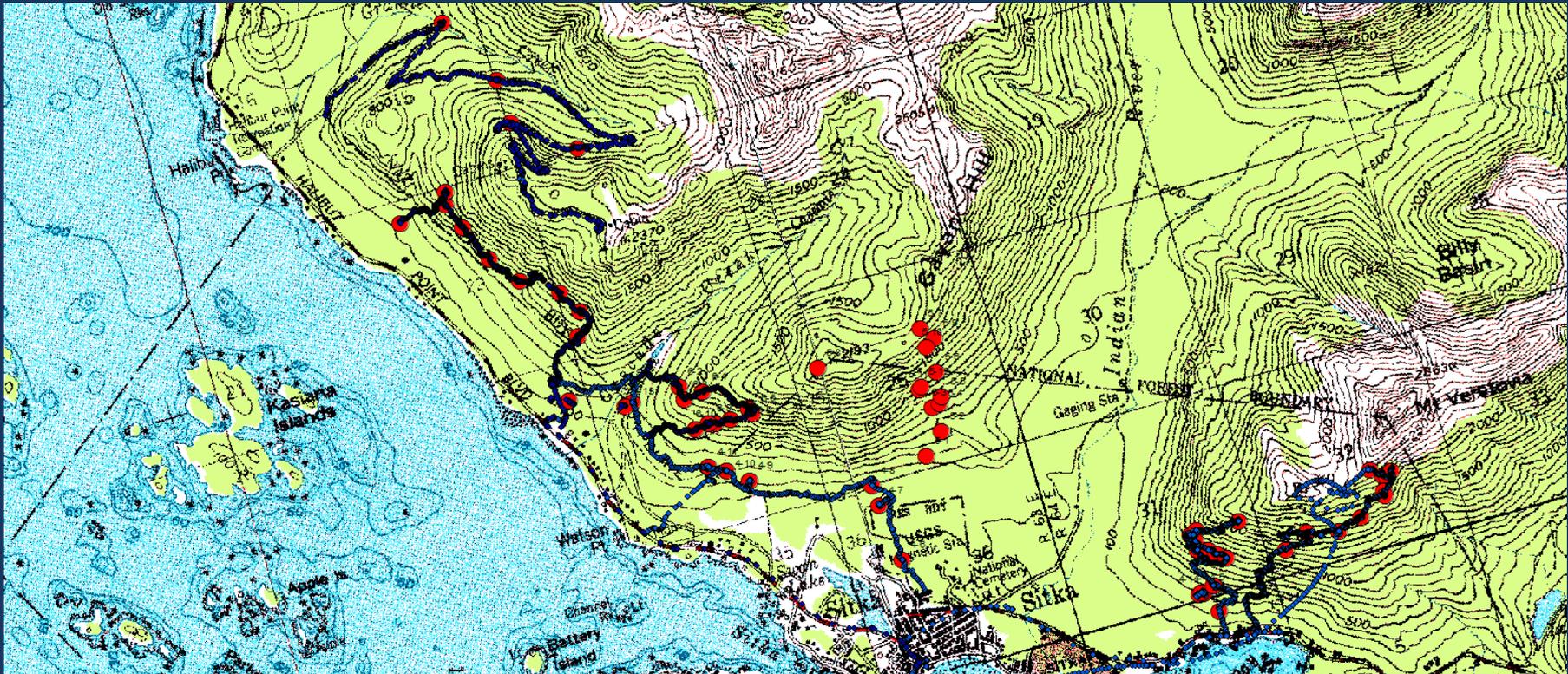


US Army Corps
of Engineers.

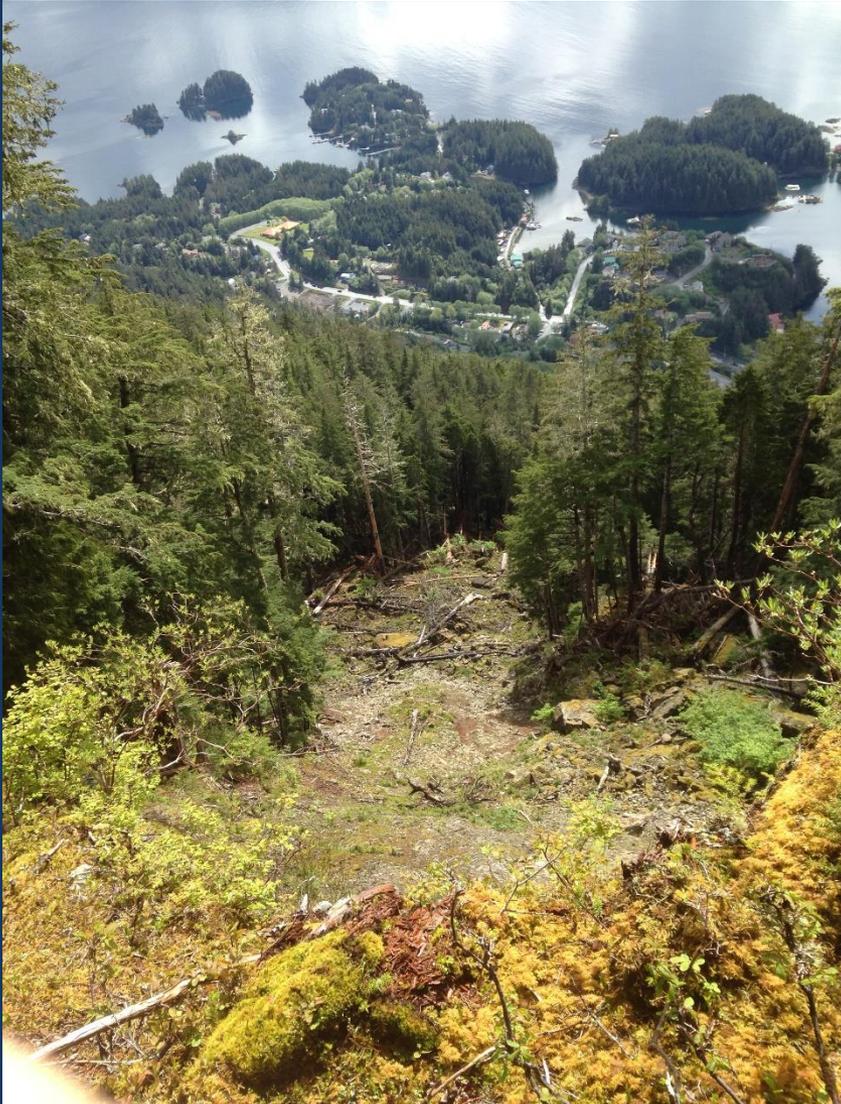
LIDAR COLLECTION



FIELDWORK



FIELDWORK



FIELDWORK



FIELDWORK



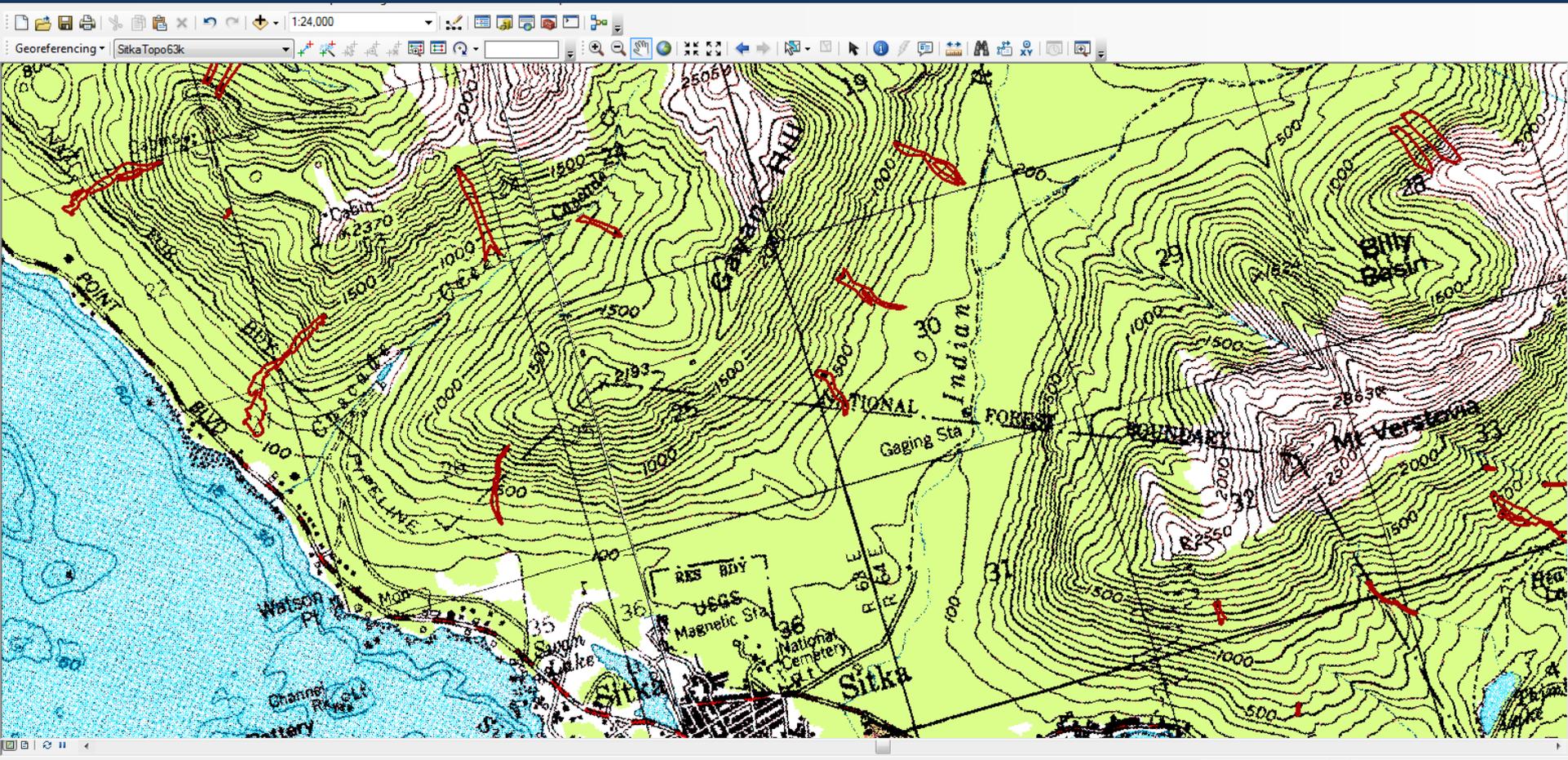
FIELDWORK



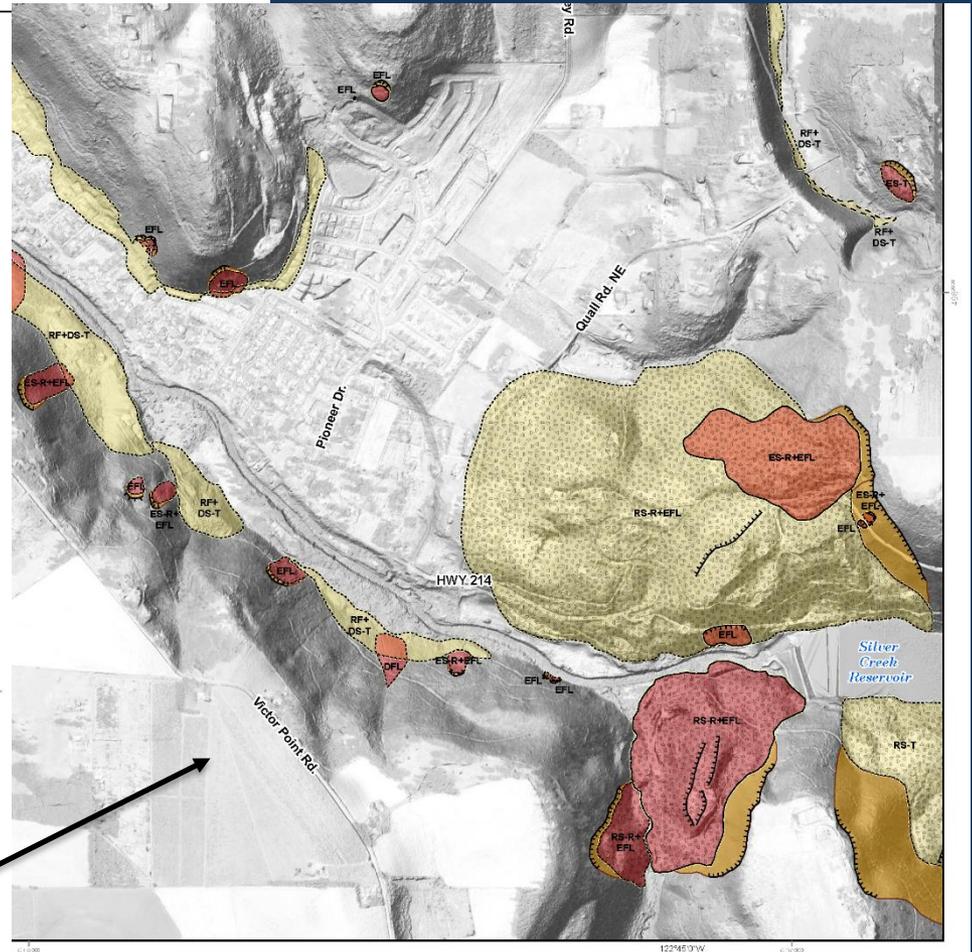
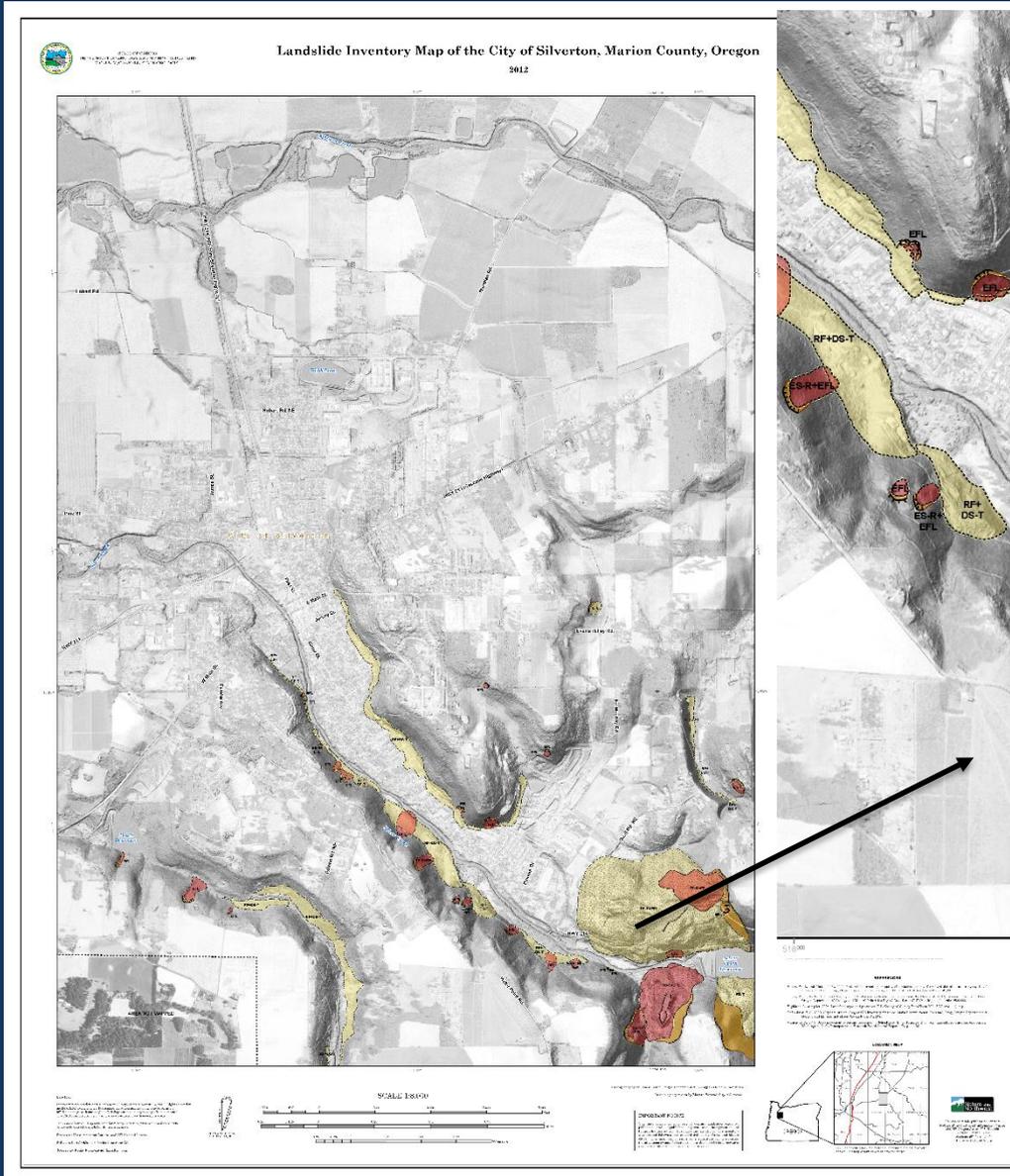
FIELDWORK



Landslide Inventory



Landslide Inventory



LANDSLIDE INVENTORY

TYPE_MOVE	MOVE_CLASS	MOVE_CODE	CONFIDENCE	AGE
Flow	Debris Flow	DFL	High (=>30)	Historic (<150yrs)

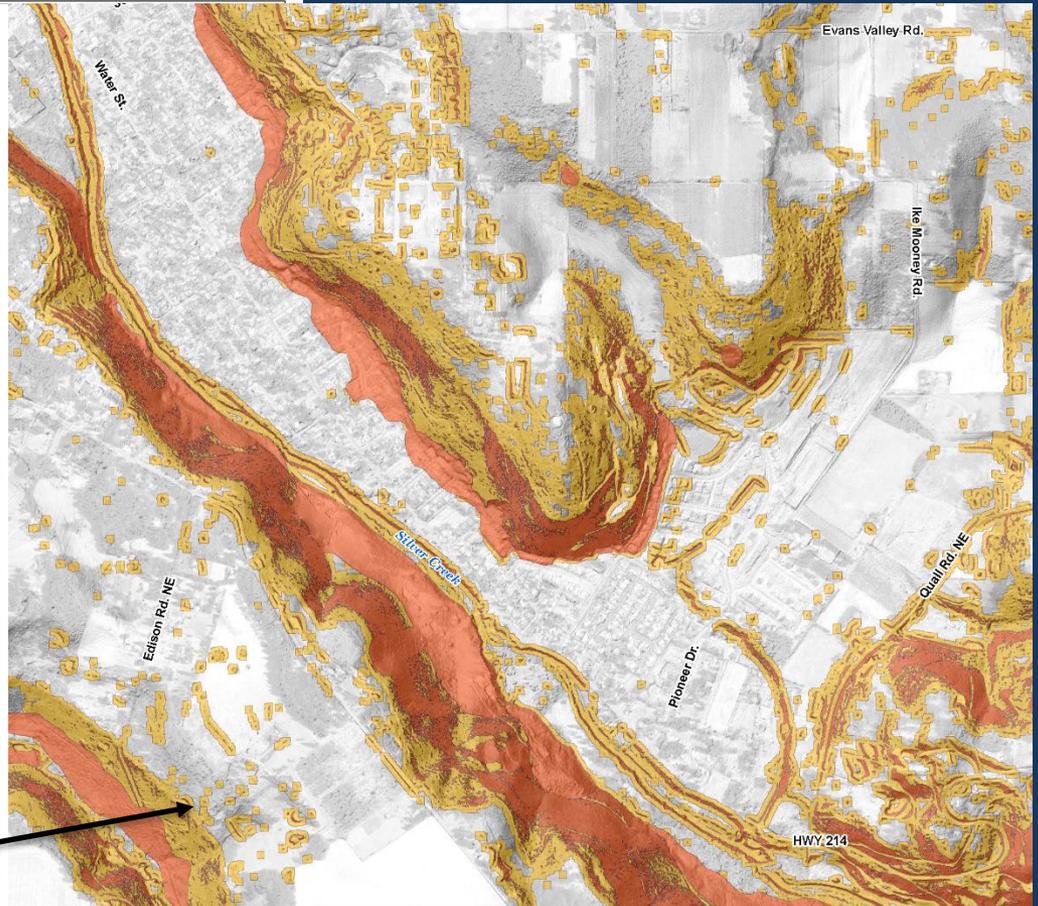
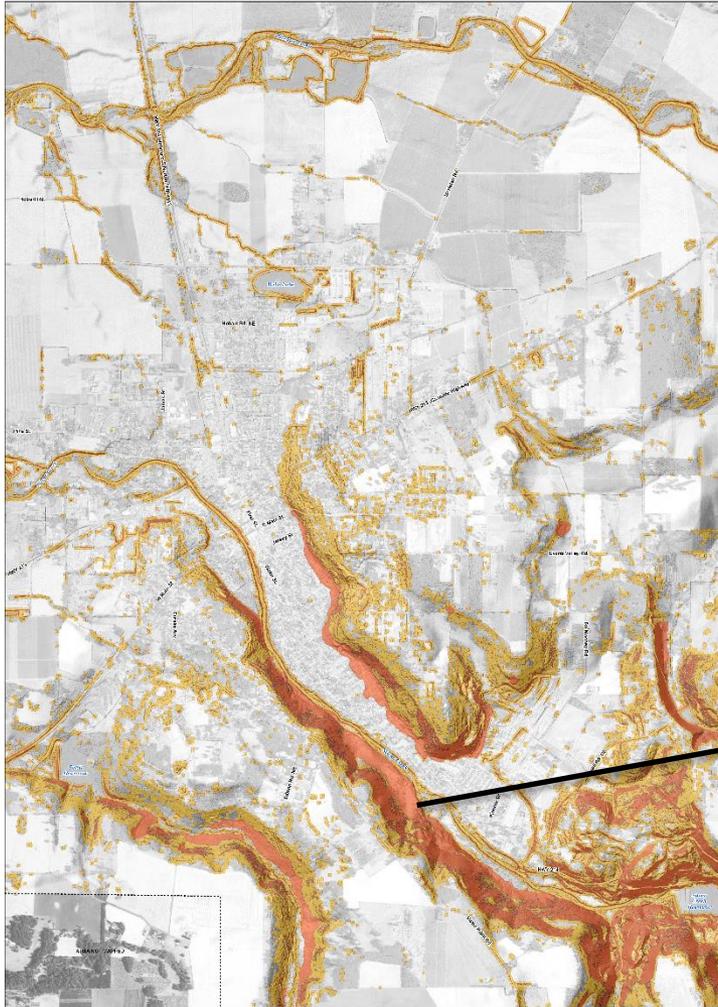
SLOPE	HS_HEIGHT	FAN_HEIGHT	FAIL_DEPTH	DEEP_SHAL

DIRECT	AREA	VOL	DATE_MOVE	NAME

Landslide Susceptibility



Shallow-Landslide Susceptibility Map of the City of Silverton,
Marion County, Oregon
2012



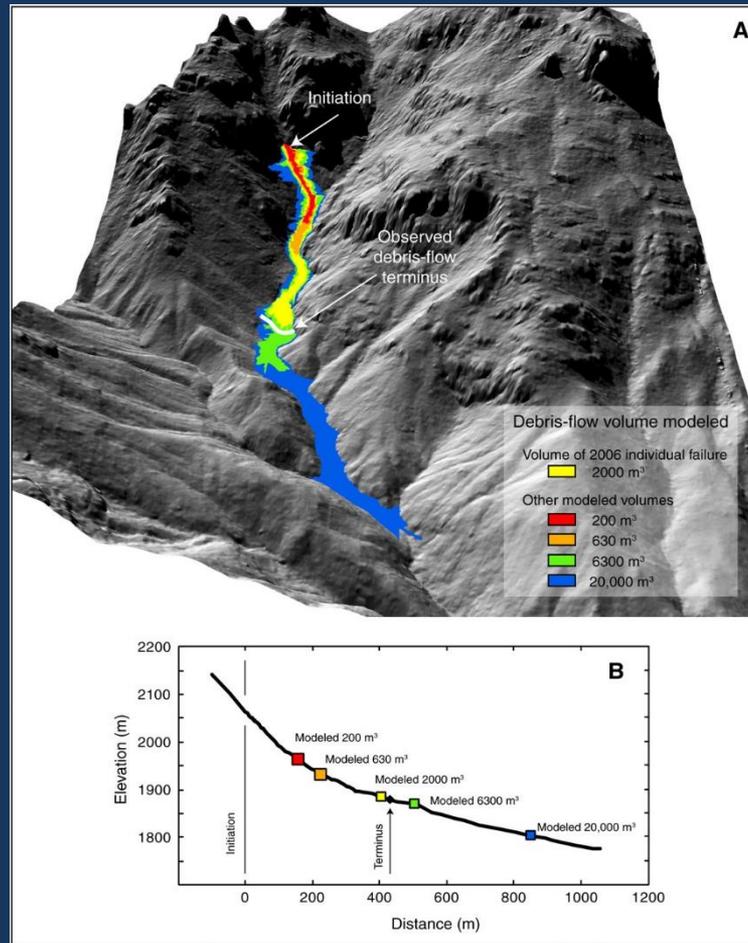
GENERAL NOTES:
 1. This map was prepared for the City of Silverton, Oregon, and is intended for informational purposes only. It is not intended to be used for engineering or other professional purposes.
 2. The data used in this map was obtained from the City of Silverton, Oregon, and is subject to change without notice.
 3. The City of Silverton, Oregon, is not responsible for any errors or omissions in this map.



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Landslide Modeling



Questions



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