Creating Value …

… Providing Solutions

Mobile LiDAR for Flood Risk Reduction and Risk Assessments

IAFSM Annual Conference
March 15, 2012

Bob Murdock, P.E.,CFM
Michael Baker Jr.

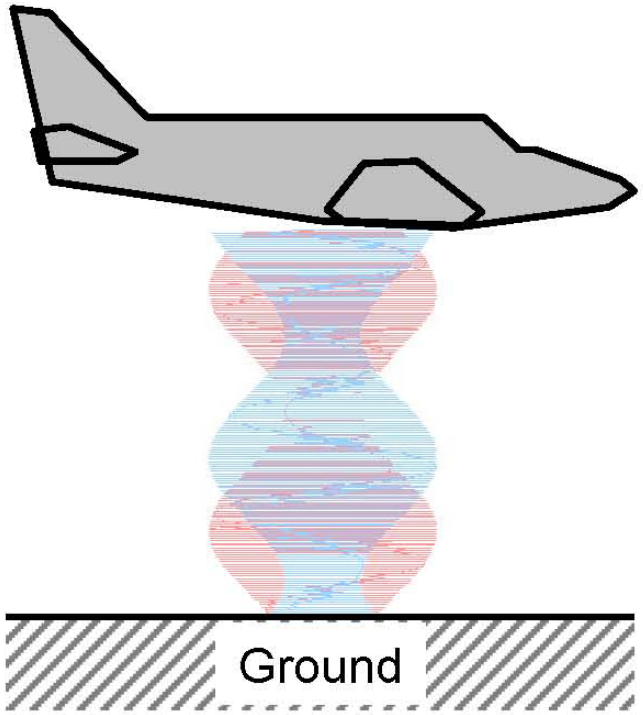
Baker

What is LIDAR

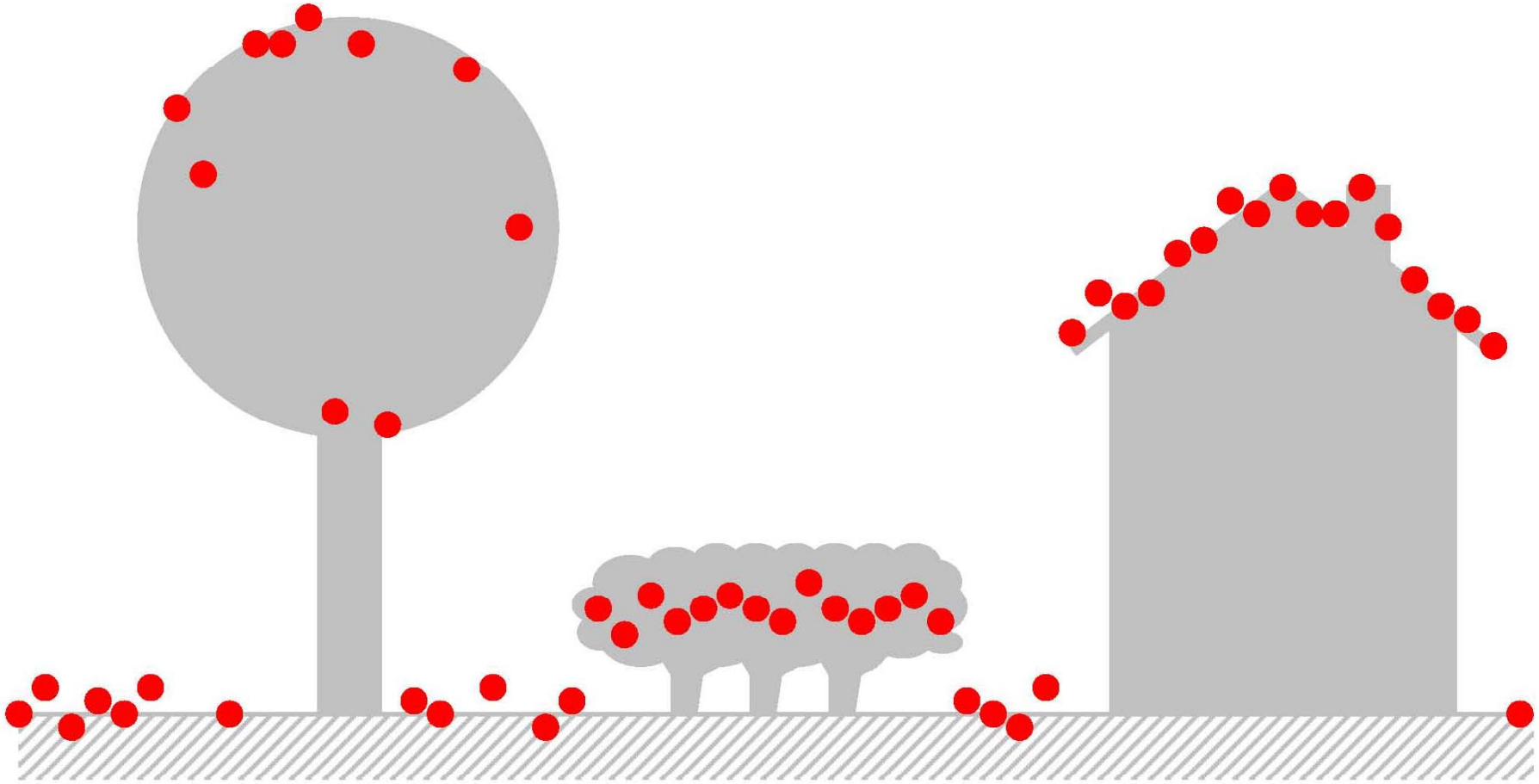
LIDAR (Light Detection And Ranging)

LiDAR is an optical technology that measures the properties of scattered light to determine range, elevations and other info.

Typical Ground LIDAR Collection



Point Reflection



Overview

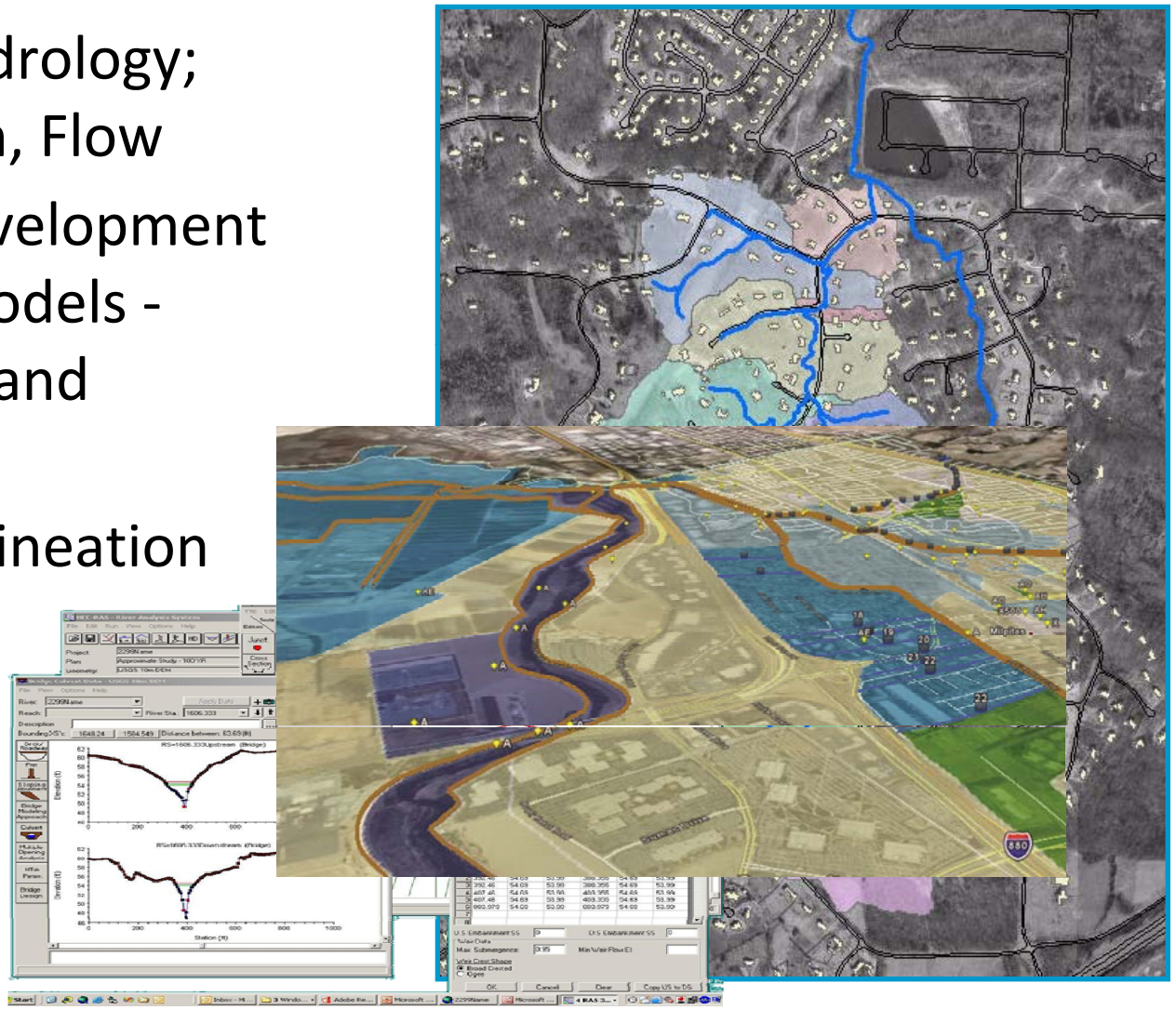
- **Optech LYNX Mobile Mapper™**

Specifications

- Accuracy: ± 3cm
- Vertical Accuracies: < 0.1’
- Precision: ≤ 7mm
- Range: 200m (235m corridor)
- Field of View: 360º
- Laser rotates: 9-15,000 RPM
- Measurement Rate: 200Khz
- Returns per Shot: 4 (1st, 2nd, 3rd, Last)
- Simultaneous LiDAR & imagery capture
- Digital Cameras: 2, 5 Mega-pixel
- Images Capture: ≤ 3 frames/sec.

LiDAR leads to Digital Terrain Models (DTMs) – Which lead to efficiency in Floodmapping

- Automated Hydrology; Basin, Subbasin, Flow
- Automated Development of Hydraulic Models - Cross Sections and Parameters
- Automated delineation



Risk Layers and Information Slide

Regional Flood Risk Reduction Analysis

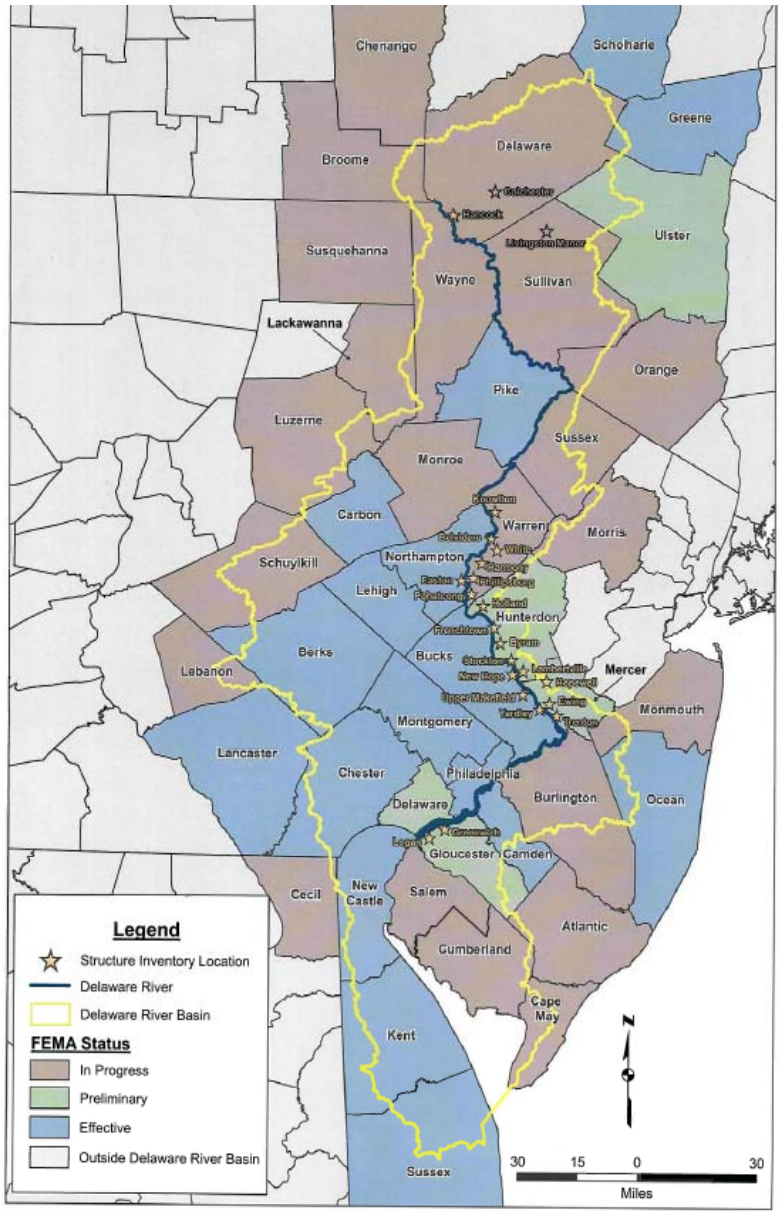
Delaware River Basin

- Delaware
- Pennsylvania
- New Jersey
- New York

Approximately 330 miles long

With a population of 7.5 million

15 million depend on the water for drinking



Baker

Structure Inventory

- Depreciated Replacement Cost
- Assumed Content to Structure Ratios

Hydraulic Data

- High Water Marks
- Gage Data
- Flood Protection
- HEC-RAS

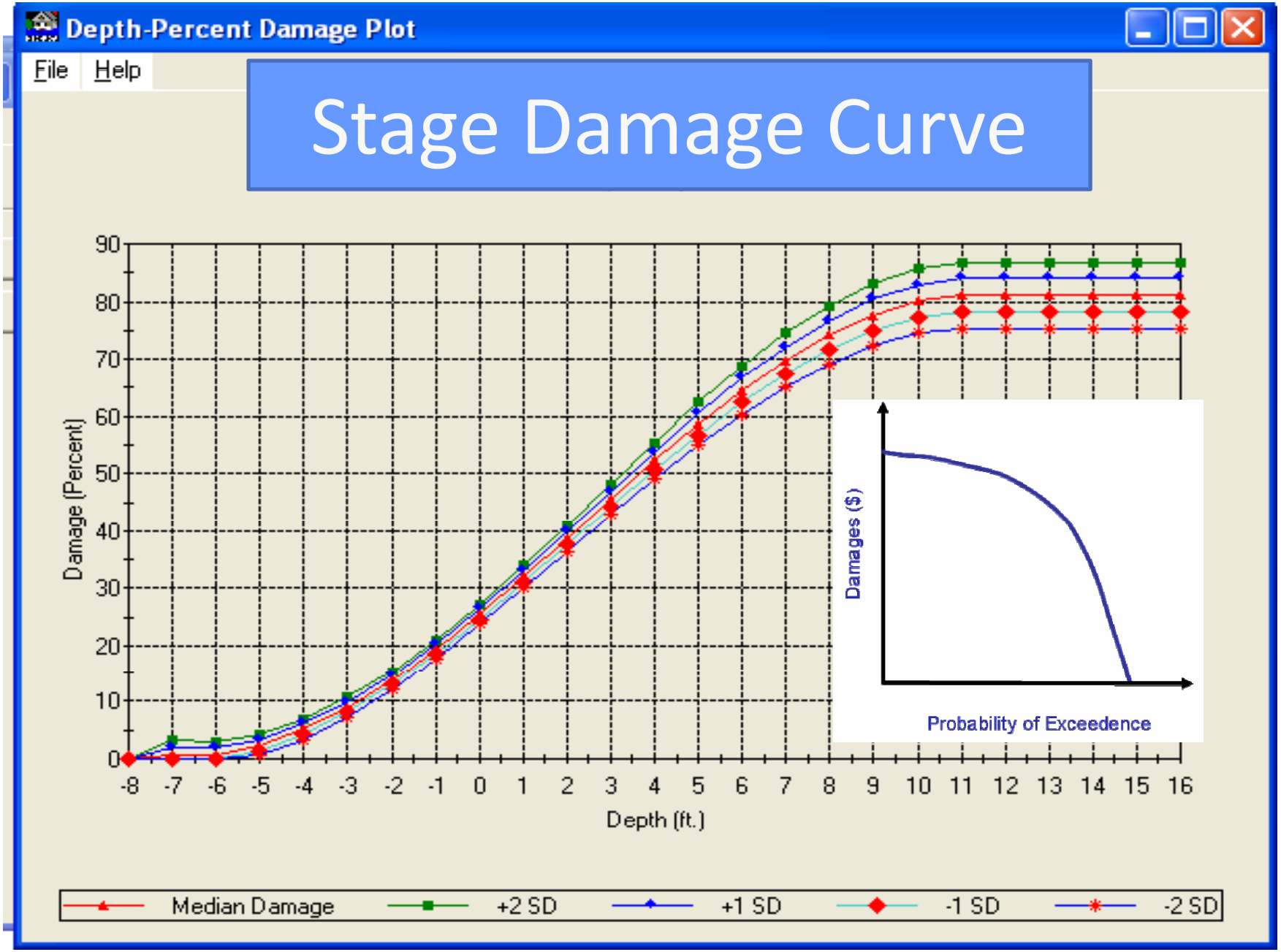
Economic Identifiers

- Stage Damage Curves
- Marshall & Swift Database

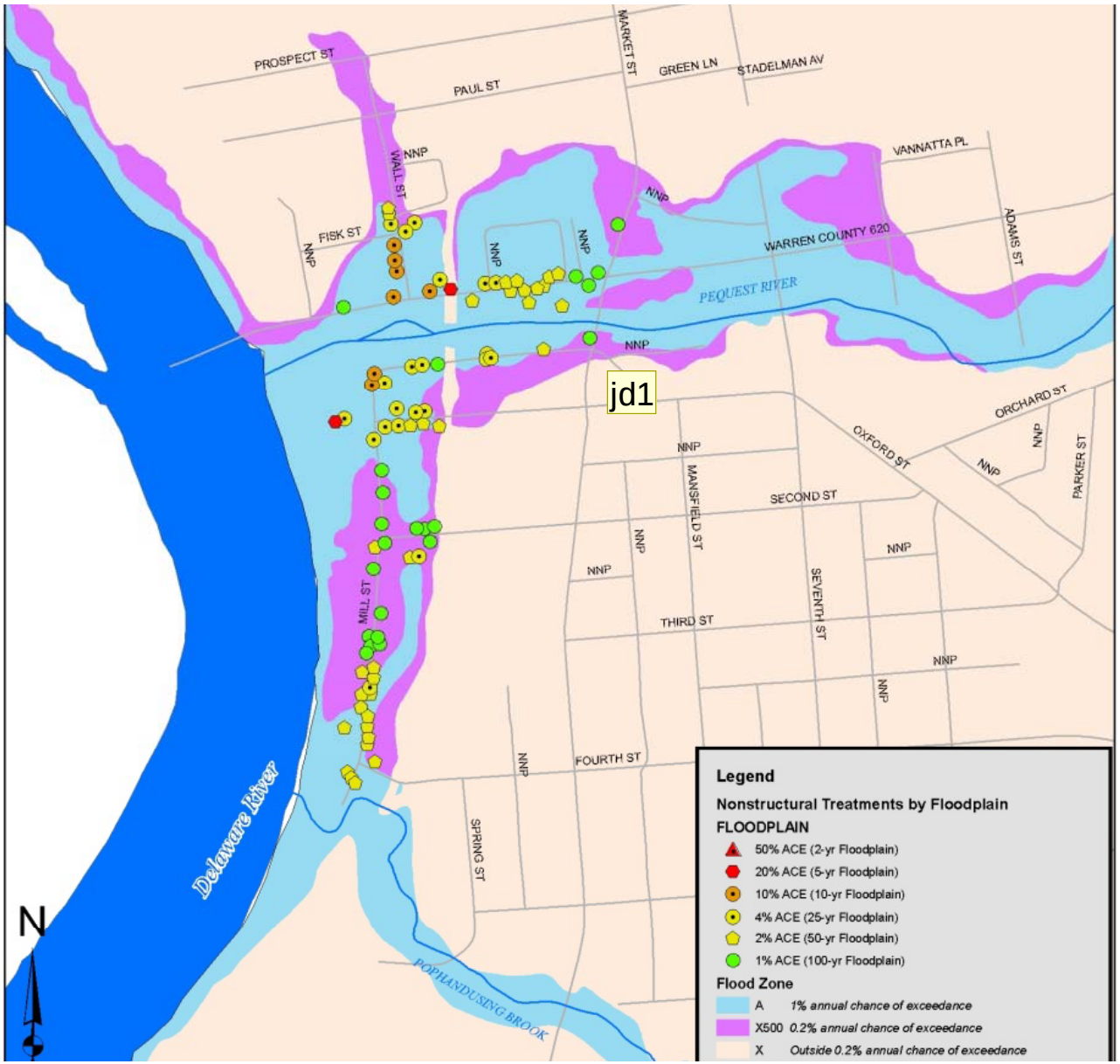
HEC FDA

- **Allows user to access the potential benefit of mitigation projects**
  - Import HEC RAS
  - Import structure data
  - Apply stage damage curves
  - Project area can be broken into reaches for detailed analysis

Baker

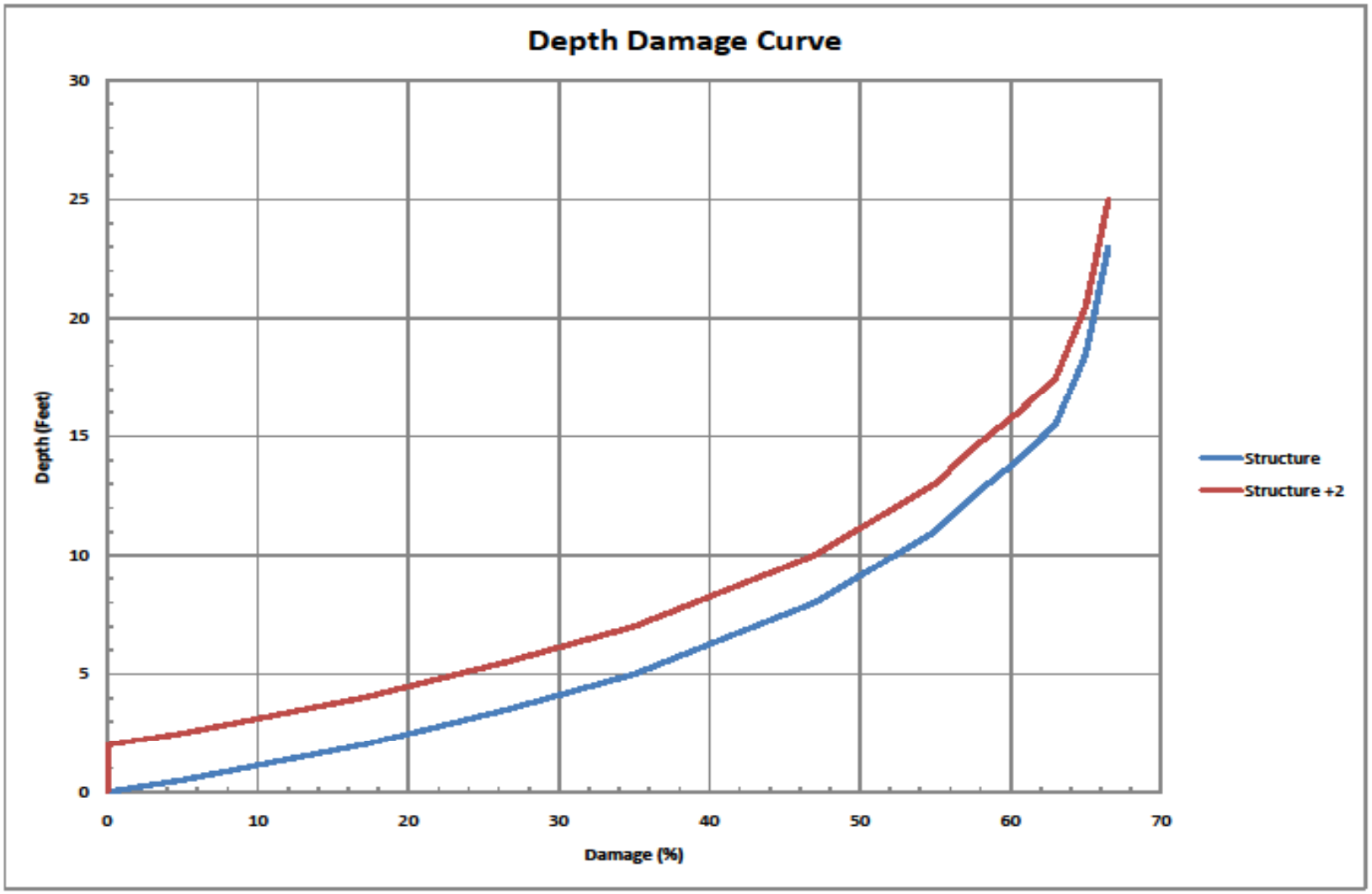

Depth-Percent Damage Plot
File
Help
Stage Damage Curve
Damage (Percent)
Depth (ft.)
Damages ($)
Probability of Exceedence
Median Damage
+2 SD
+1 SD
-1 SD
-2 SD

Evaluate Nonstructural Treatments



Slide 12

jd1 Change to summary, structural measures per community, community based options and results
jdeangelo, 9/1/2011

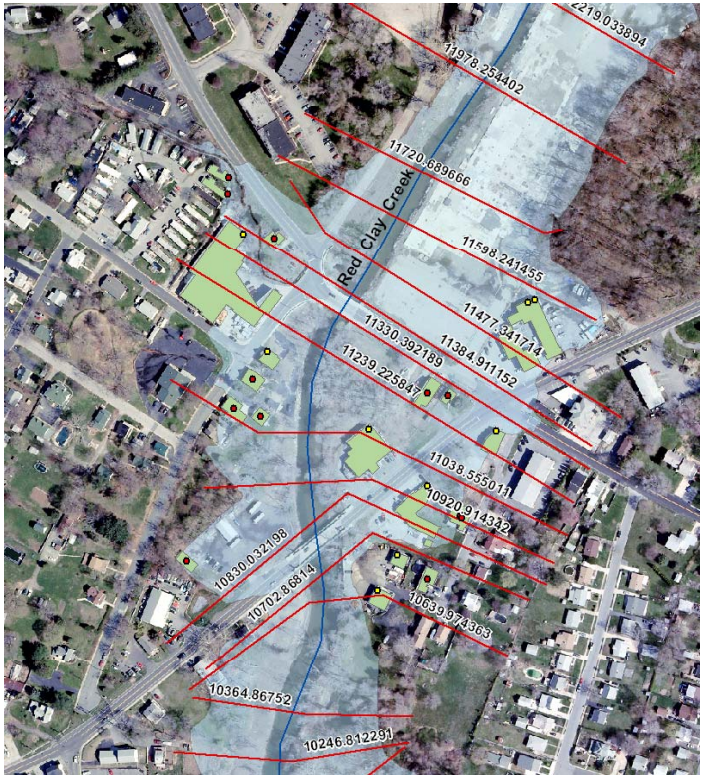

Depth Damage Curve
30
25
20
15
10
5
0
Depth (Feet)
0
10
20
30
40
50
60
70
Damage (%)
Structure
Structure +2

Pulling it all Together

- **Elevating structure 2 feet reduces damage cost significantly on the curve.**
- **Especially powerful in high frequency events.**
- **2 courses of block add less than 5 percent to construction costs; savings are almost immediately realized**

Outreach!

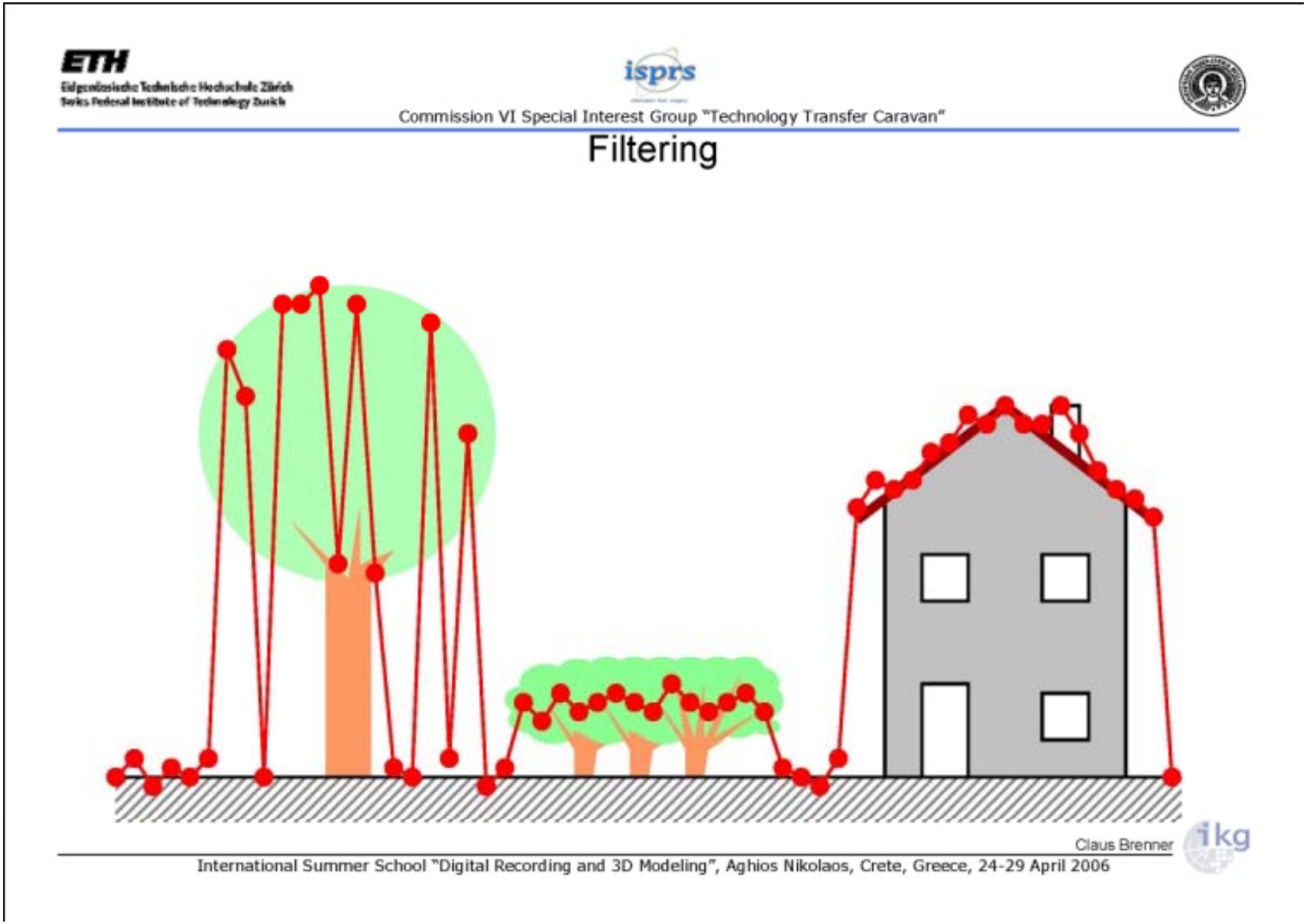
- **Show community were the danger is today and where the danger might be in the future**
- **Provide graphical and real examples ($) of the costs**
- **Work with the community to inform the residents and future residents of the risks**



Data Collection Team

Baker

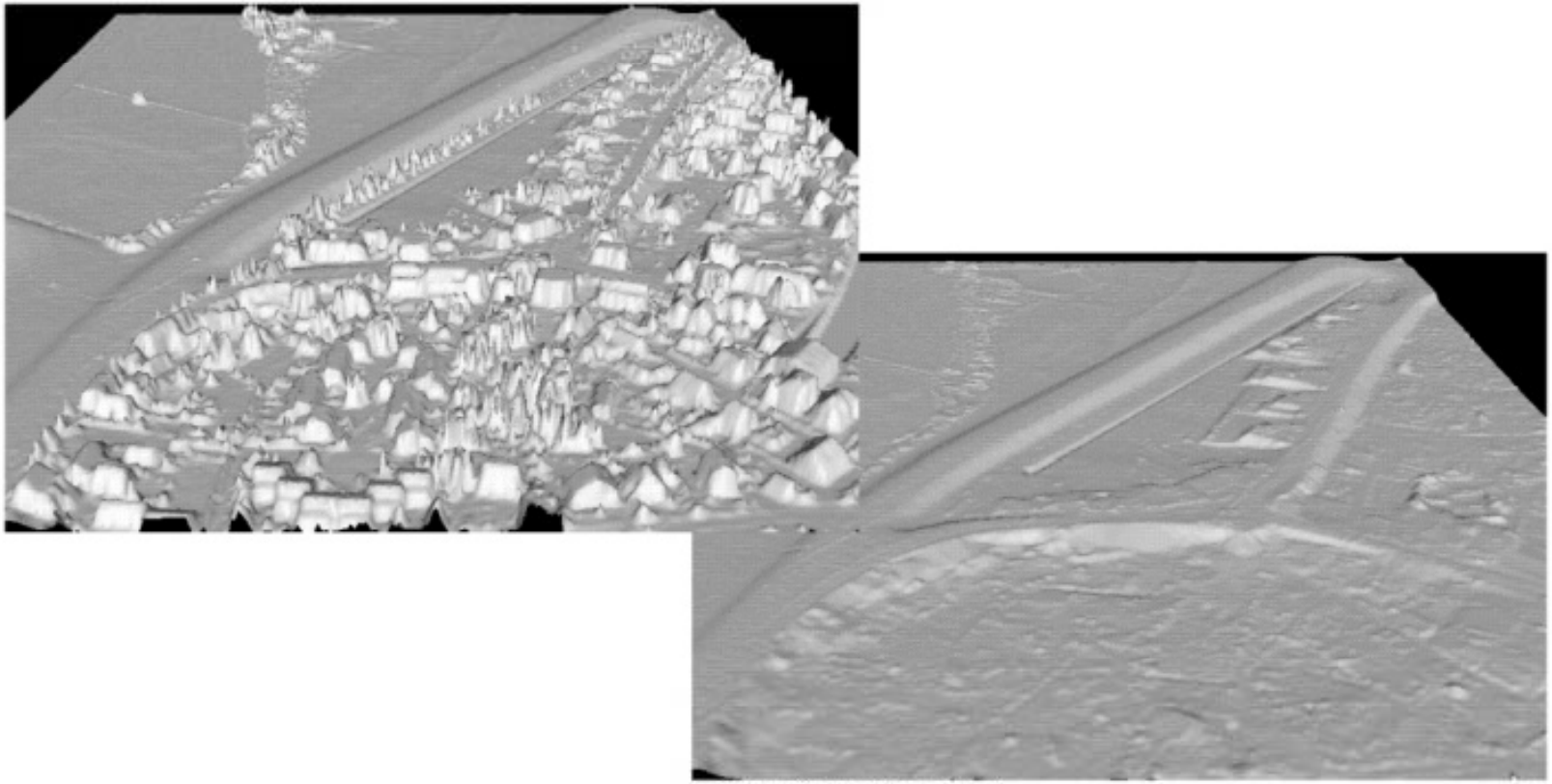
Point Capture from the Air



Baker

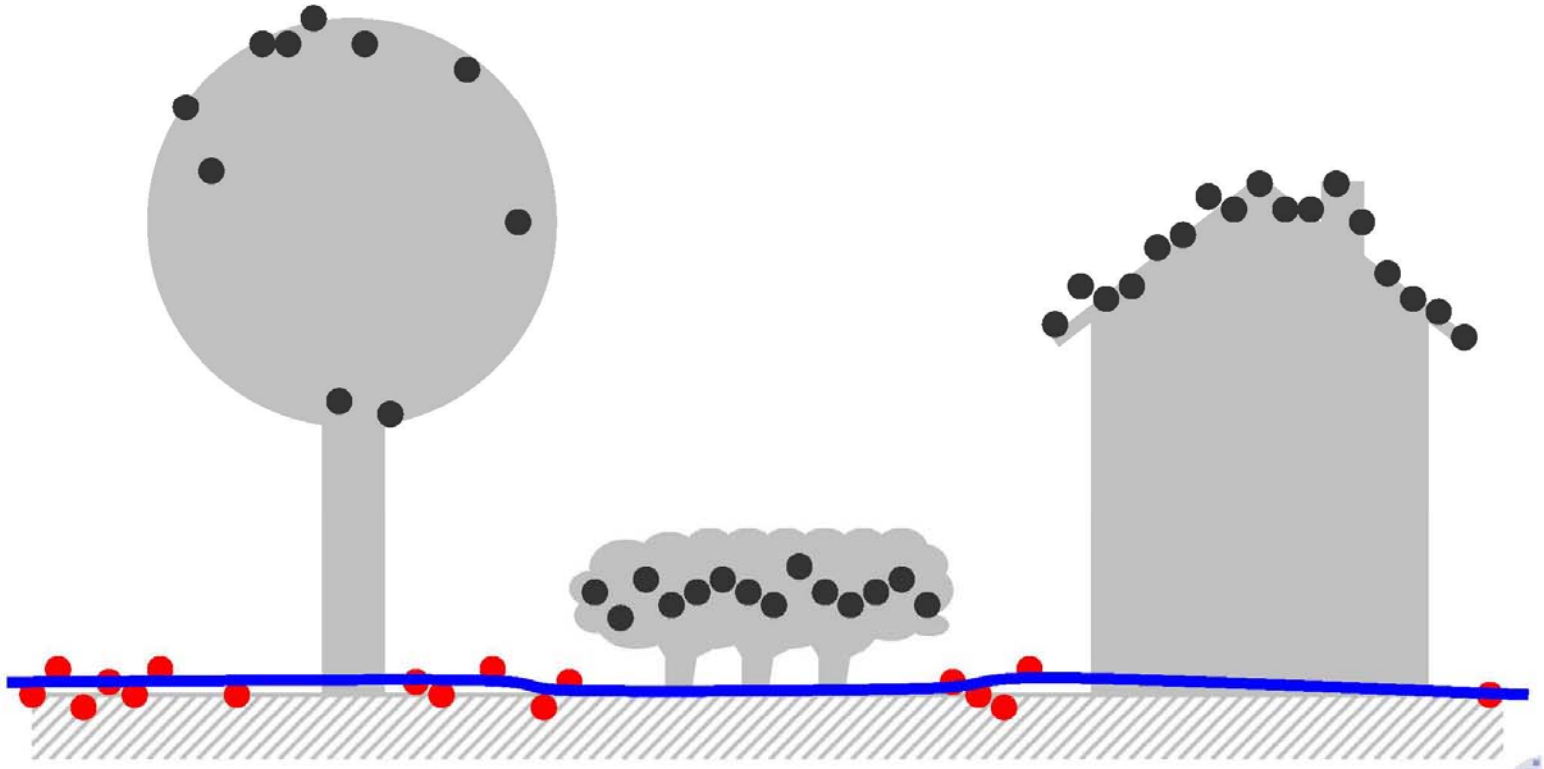
Aerial LIDAR Surfaces

Filtering



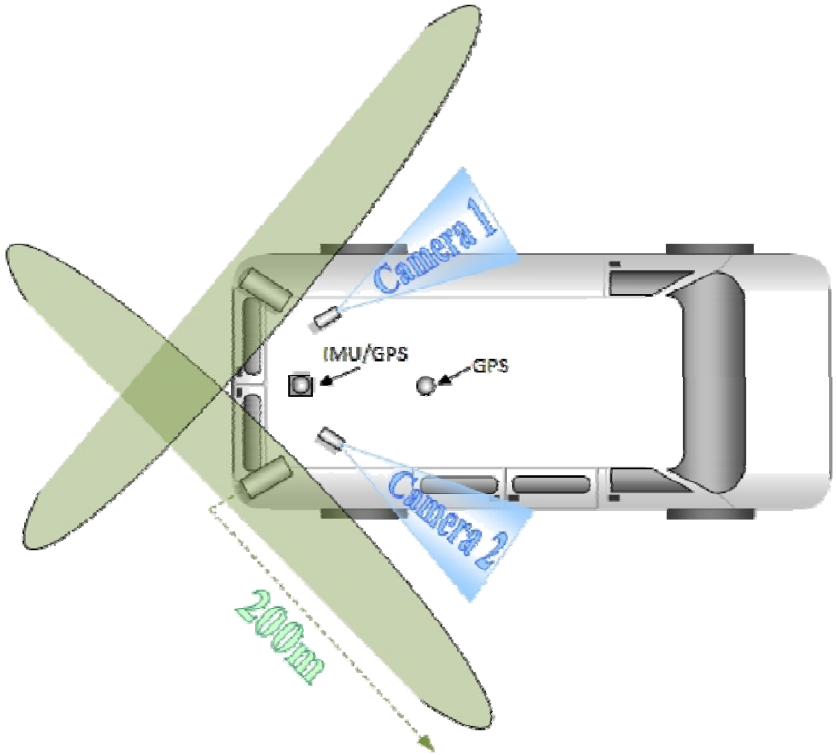
(Source: George Vosselman)

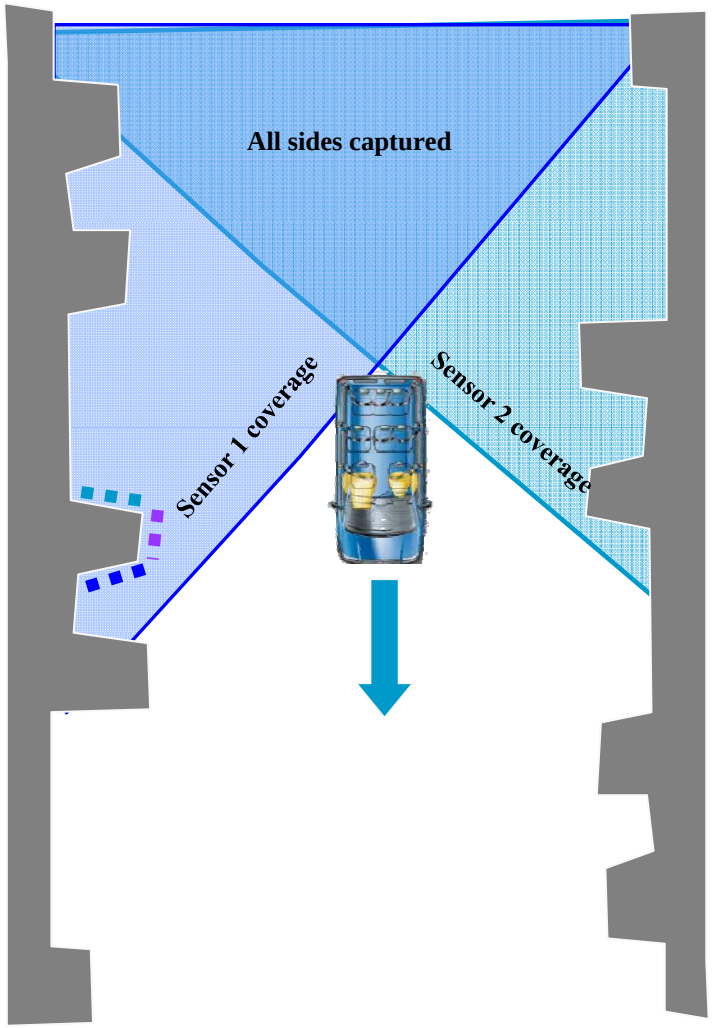
Filtering



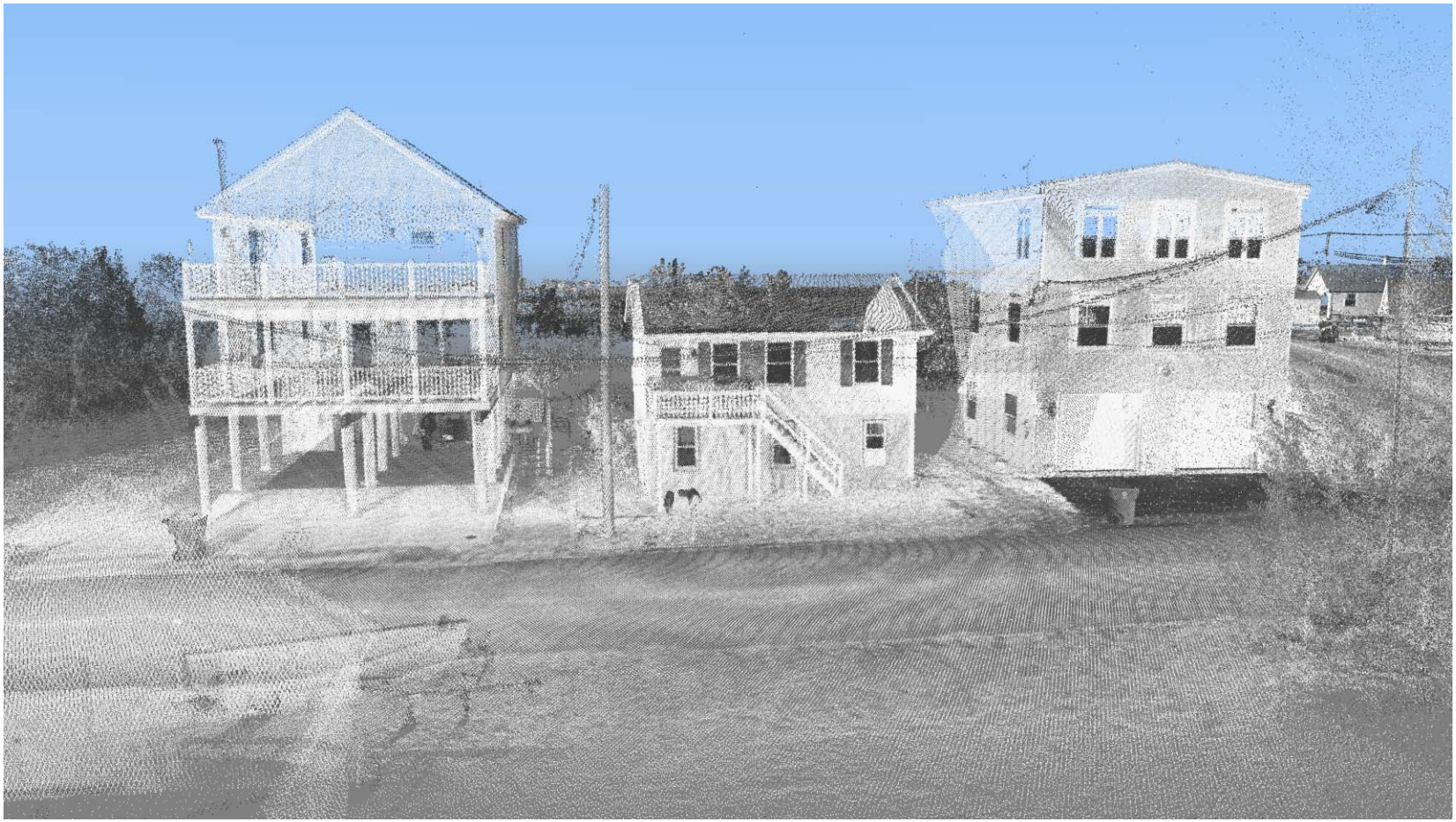
Dual Sensor System

- **Minimize laser shadowing**
- **Optimize Field of View (FOV)**
  - Sensor will see everything behind the vehicle
  - Sensor will see ~35º in front of vehicle
  - Full 360º area coverage



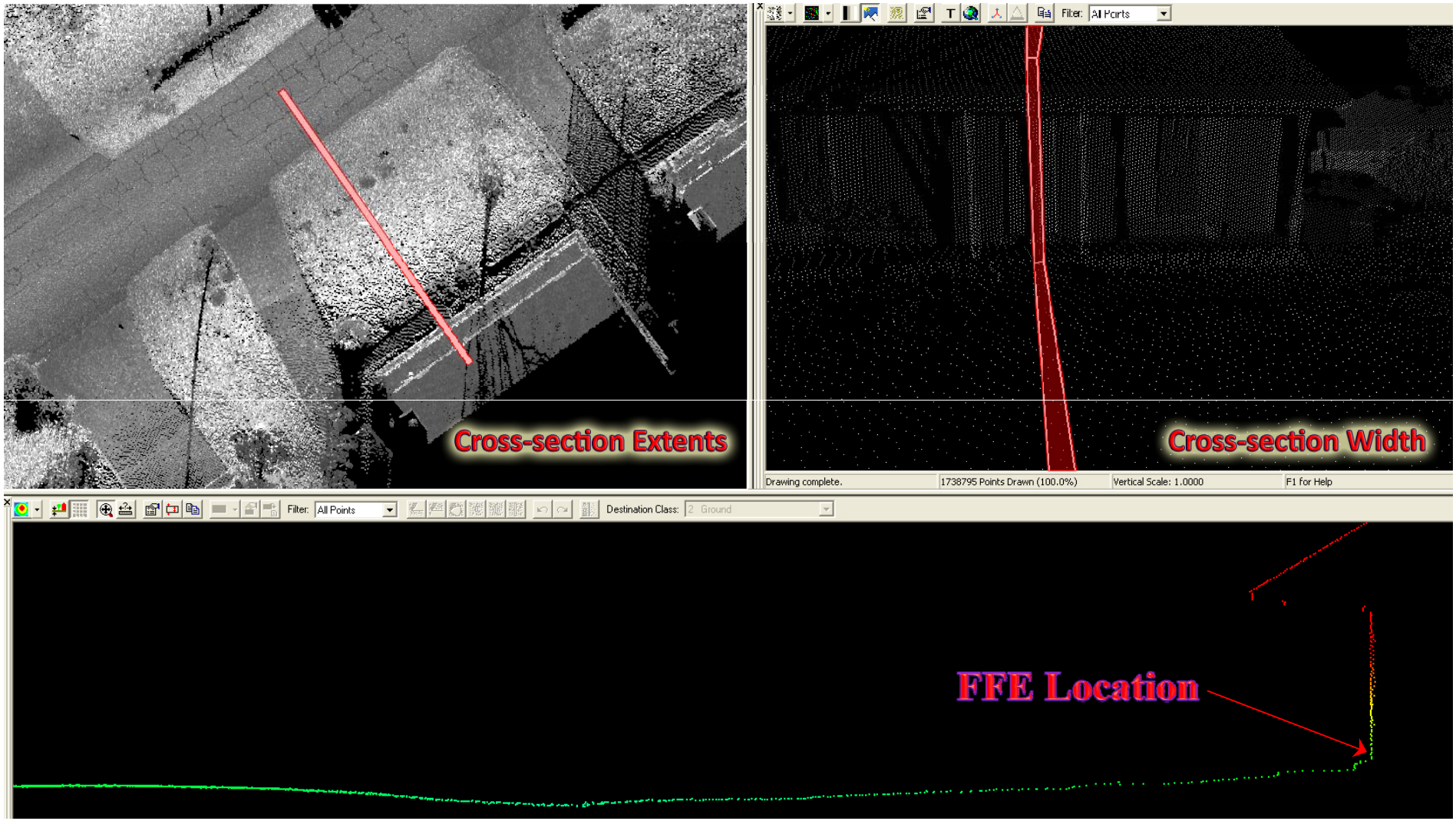


Baker



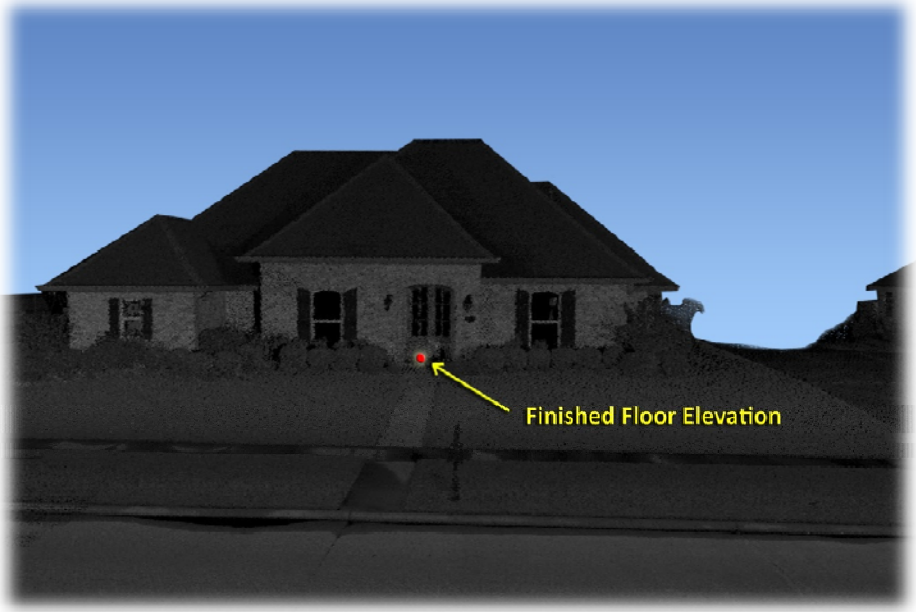
Baker

Cross-Sections



Finished Floor Elevations (FFE)

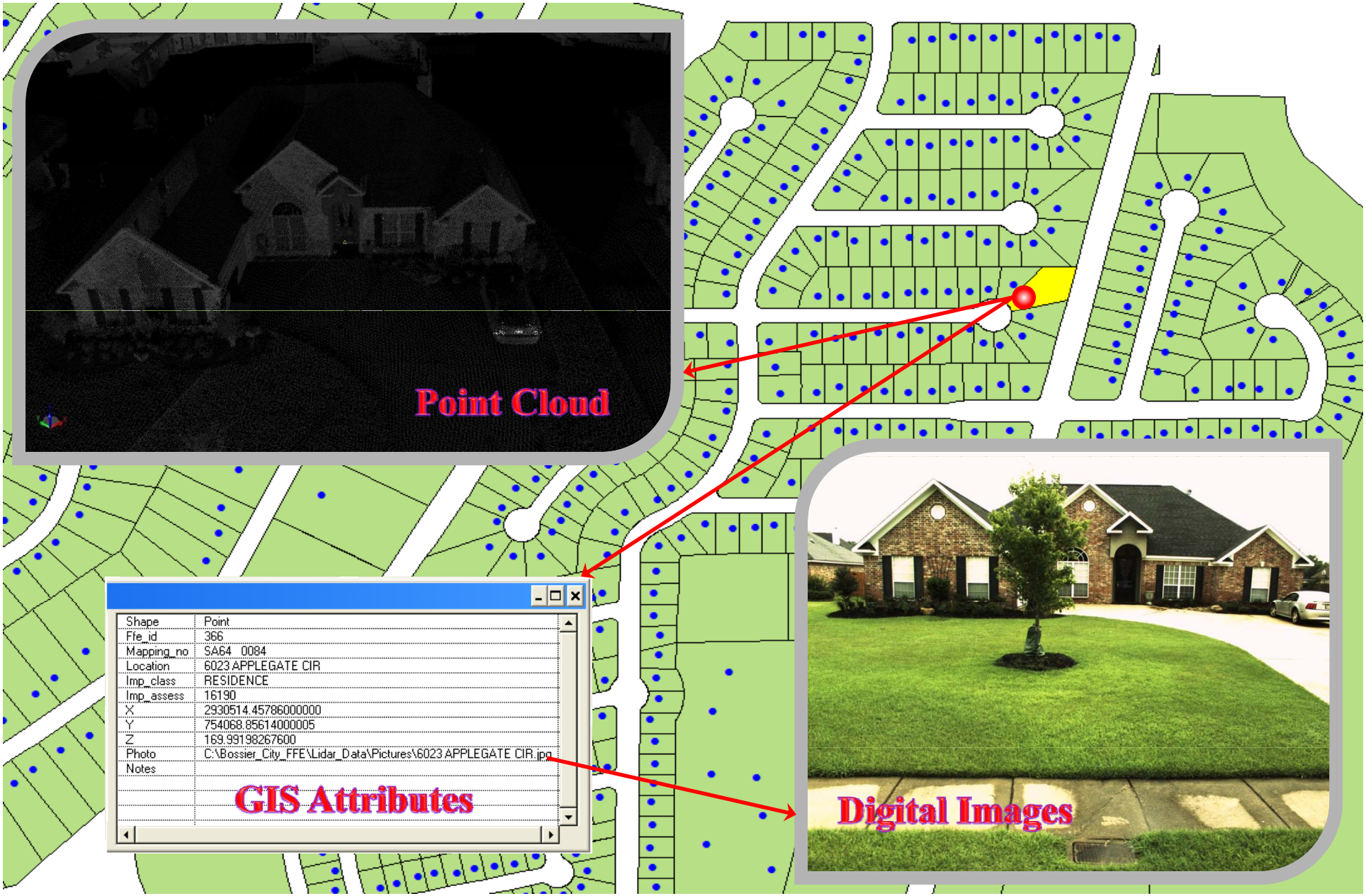
- **Quickly and Economically determine Finished Floor Elevations on a Regional Scale**
- **Minimize or Eliminate Right of Entry**



Bossier City FFE Stats

- **1,367 Identified Structures**
  - 267 more than previously known
  - 7 parcels had no information
  - 29 “Deductive Reasoning” Addresses
- **Field Collected in 2-Days**
  - 70+ ground-control points
- **150+ Gb of Raw Data**
- **64 Gb of Delivered Data**
  - Split into 117 LAS files

Bossier City FFE – GIS Ready



Risk Layers and Information Slide

North Carolina Floodplain Mapping Program

Integrated Hazard Risk Management (IHRM)

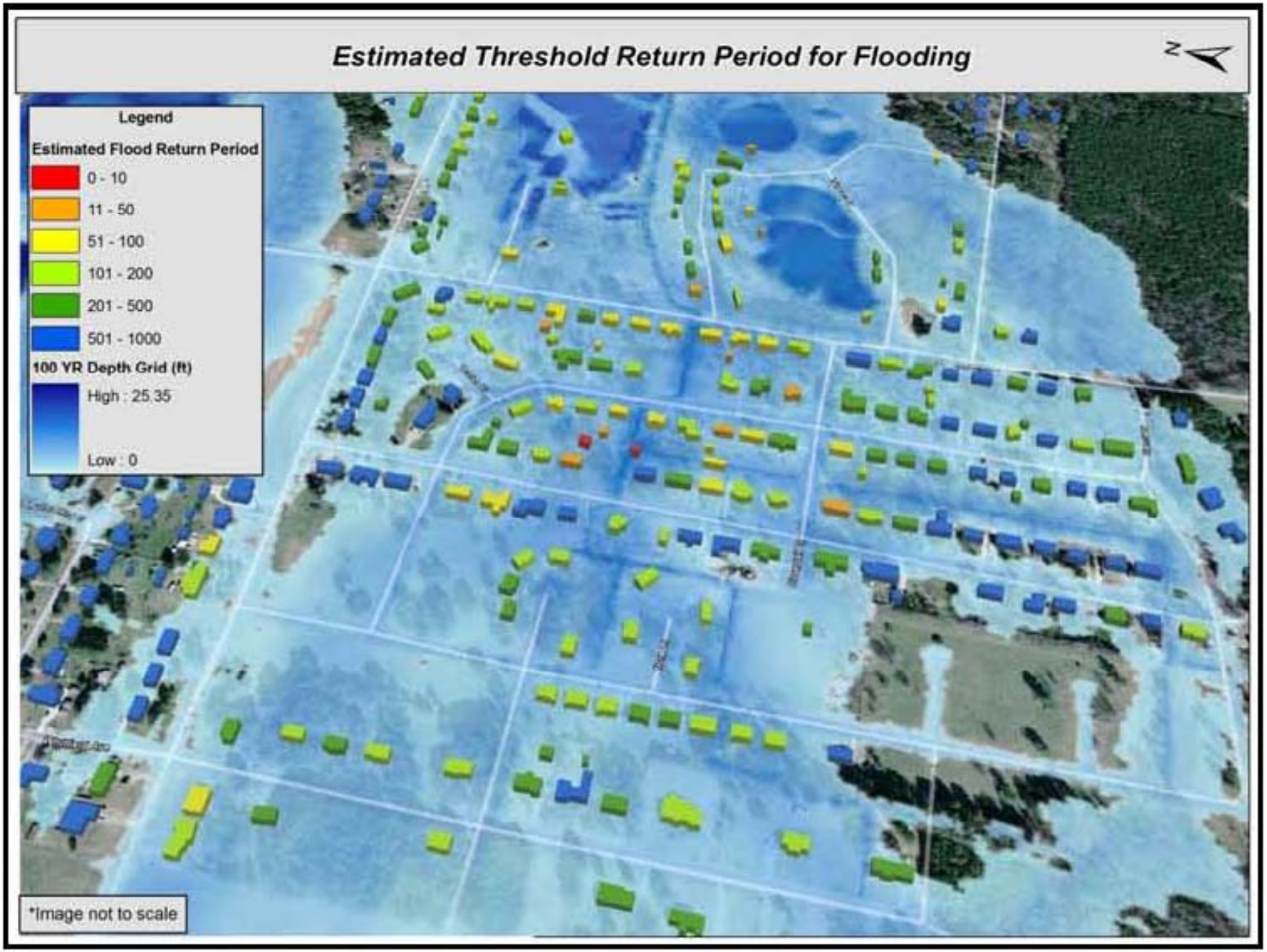
Fostering the transition from just “In or Out” flood management practices to “Graduated Flood Risk” management.

Develop data products – data, and tools targeted towards local government and private sector (CI/KR) decision makers.

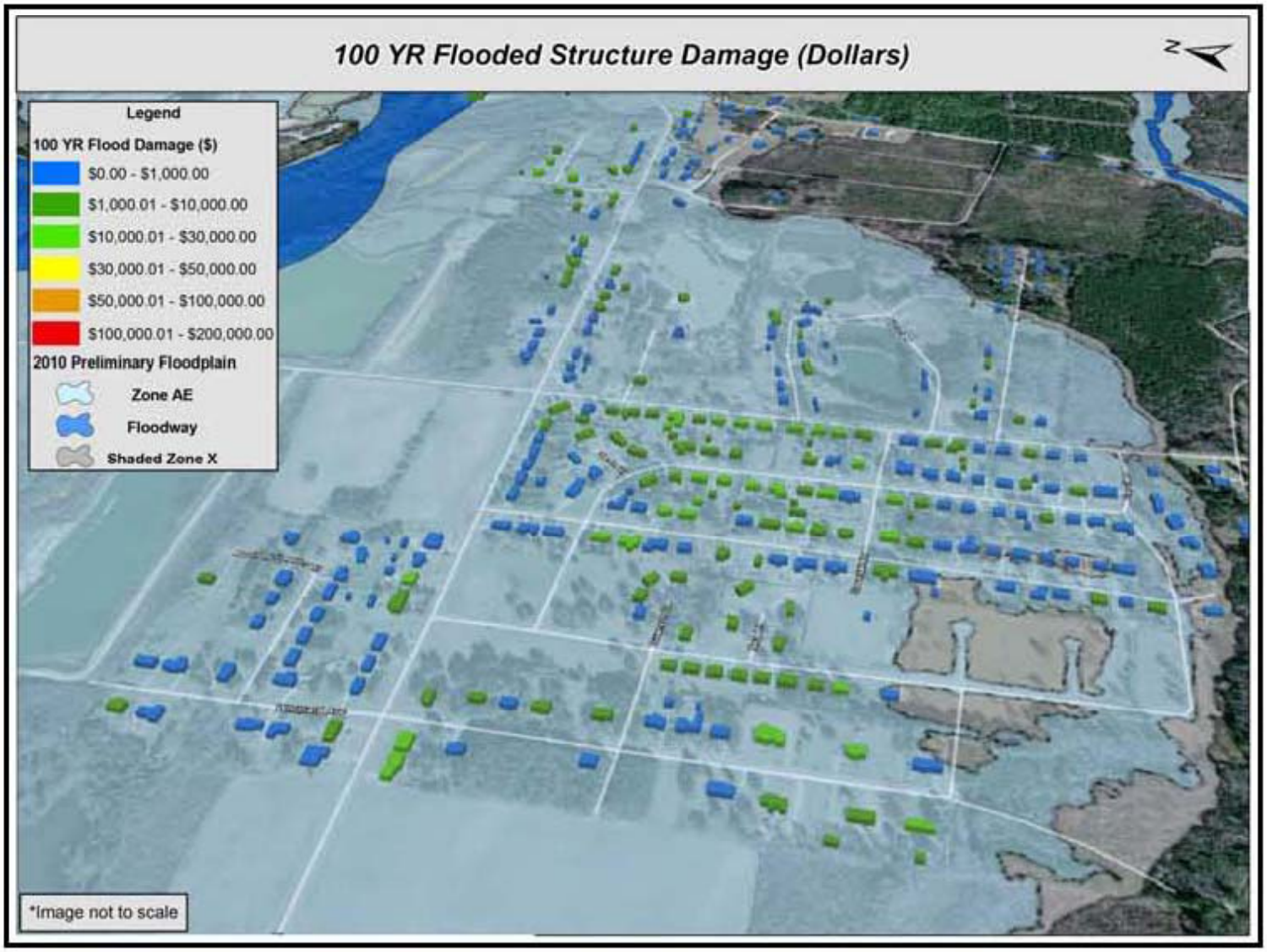
Questions to Answer:

- What is the overall risk (Annual Loss Estimate)?
- What are efficient and effective strategies that will mitigate or prevent the likelihood and/or consequences?
- What is the Return on Investment from implementing such strategies?

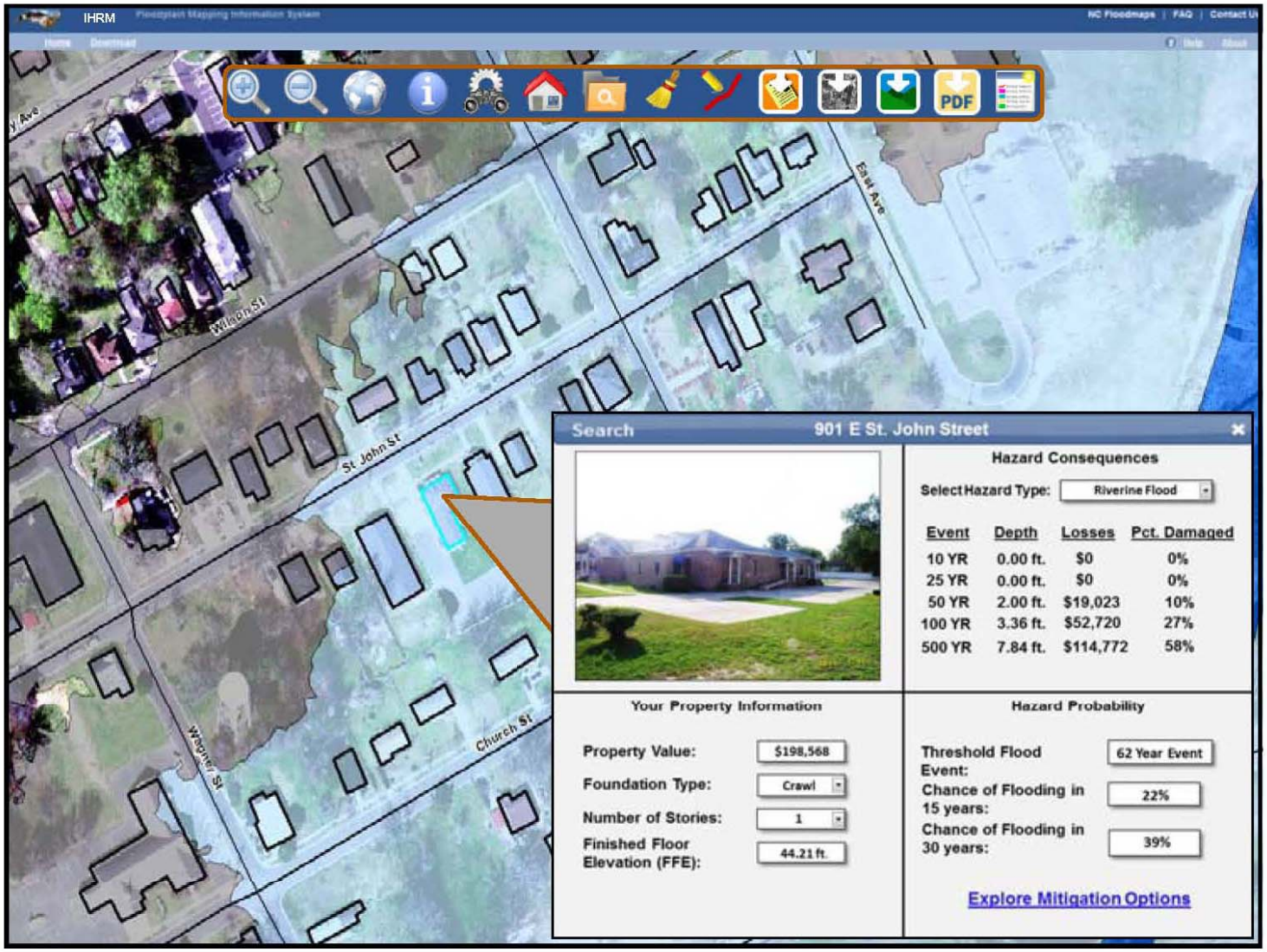
Graduated Flood Risk



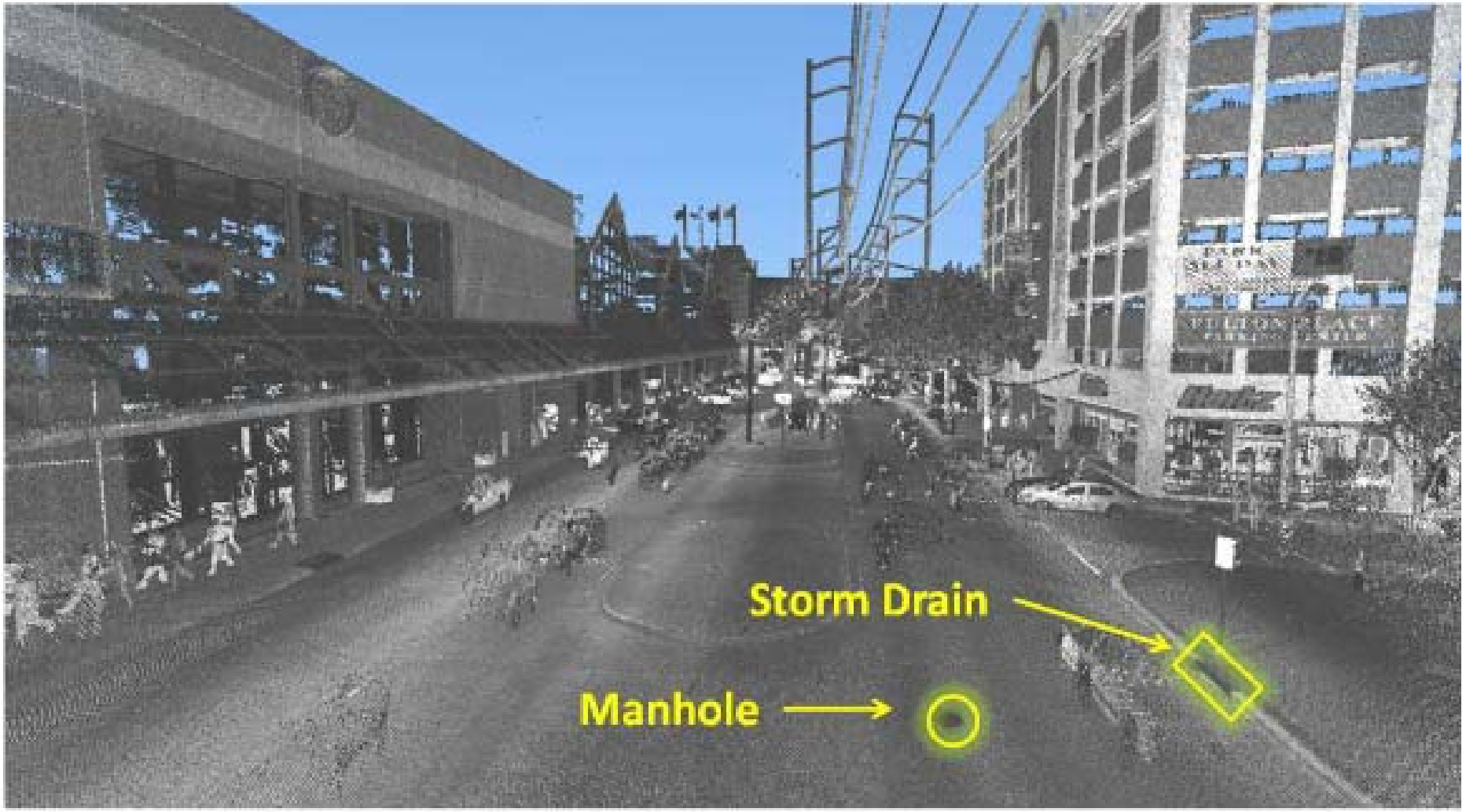
Damage Estimates per Return Period Event



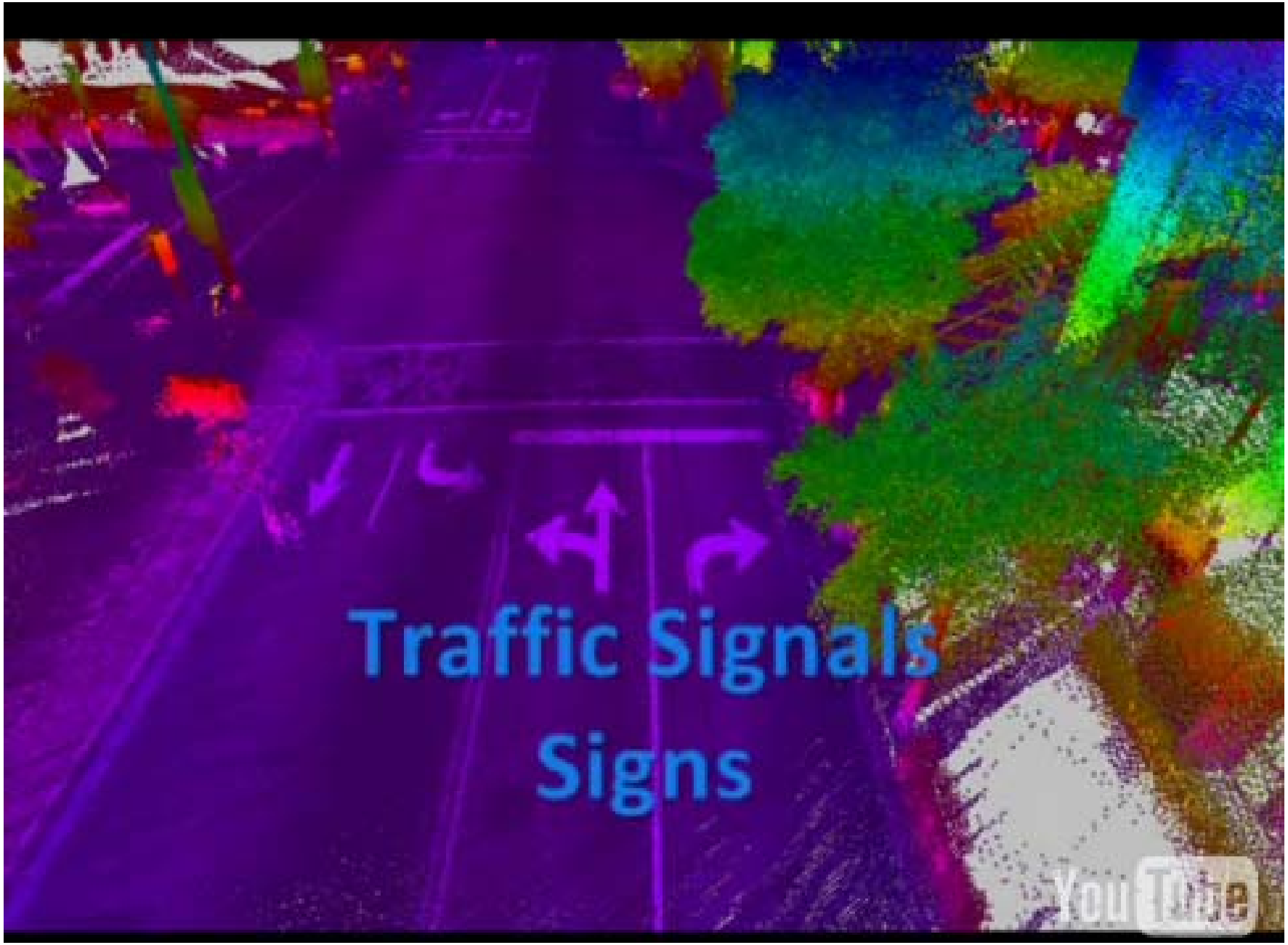
Website Hazard Risk Reports for Public



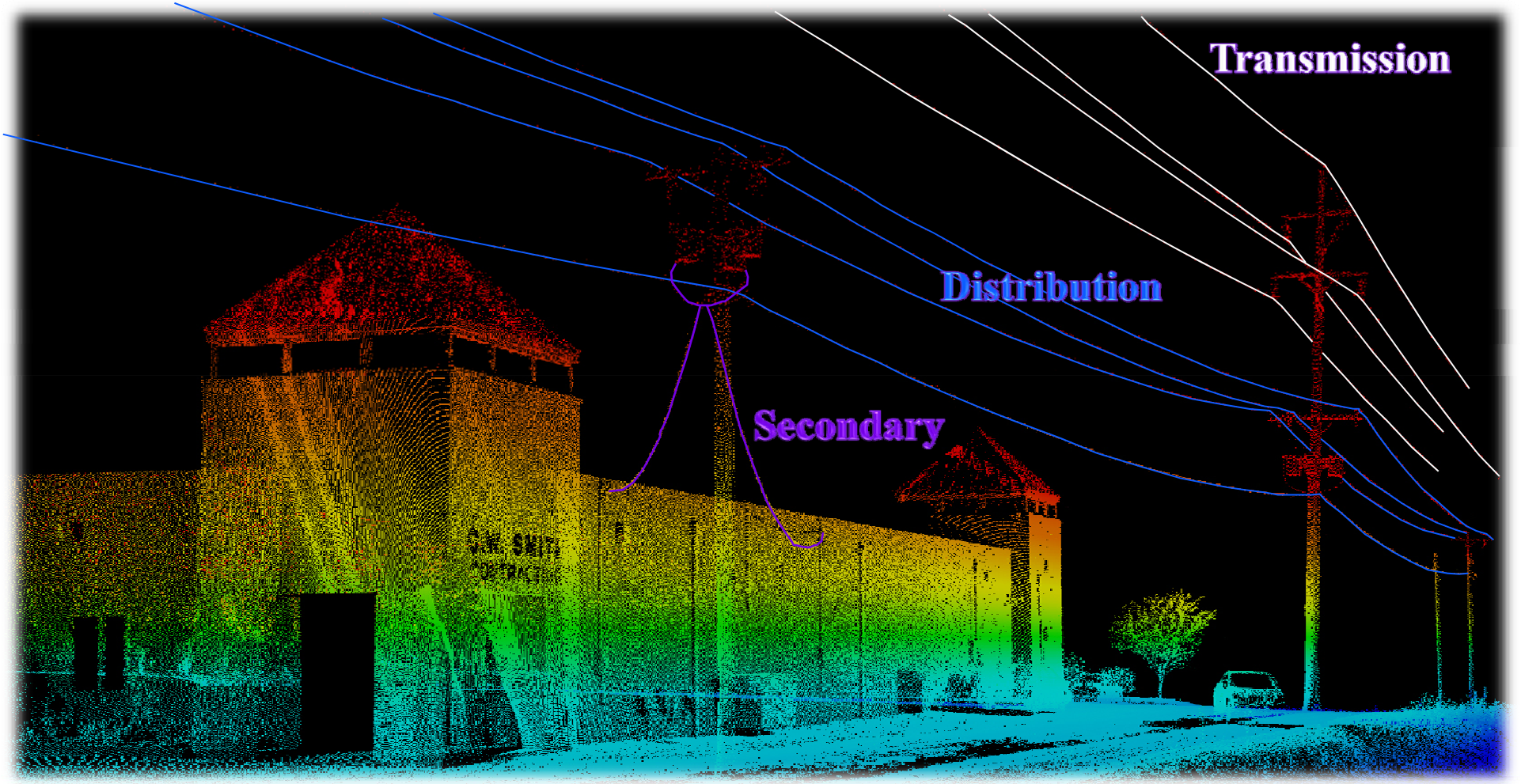
Citywide Manhole/Inlet/Outfall Surveys



Traffic Features, Pavement Condition



Utilities Systems




Baker
Thank You
rmurdock@mbakercorp.com
IAFSM
Illinois Association for
Floodplain and Stormwater Management

Export to Google Earth