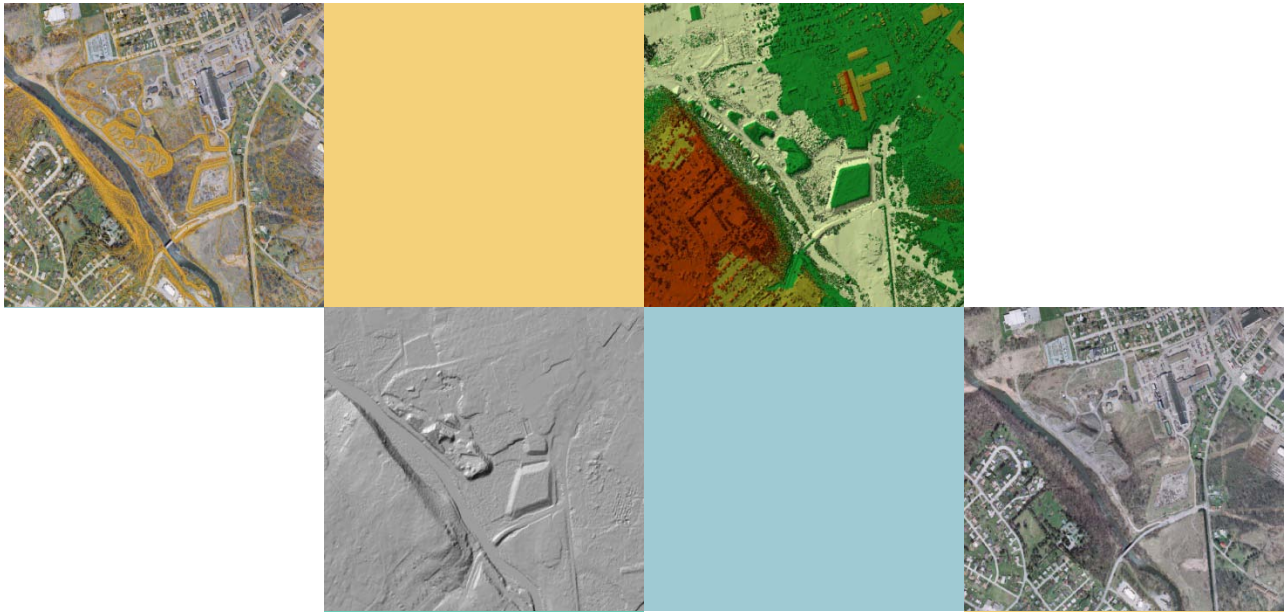
New Technology Initiatives in West Virginia

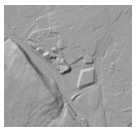


TIPS Steering Committee Meeting

May 13, 2010

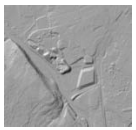
Tech Transfer

- Approaches used in FY'09
  - Dealing with future mining & AOC
  - Building an *"Isolated Computing Island"*
  - Moving field photos into the information enterprise
- Technologies utilized in FY'09
  - ArcGIS Server/Flex 4/ESRI Flex API V2.0
  - CORS & geodetic quality GPS rovers
  - Ricoh 500SE cameras
  - LiDAR

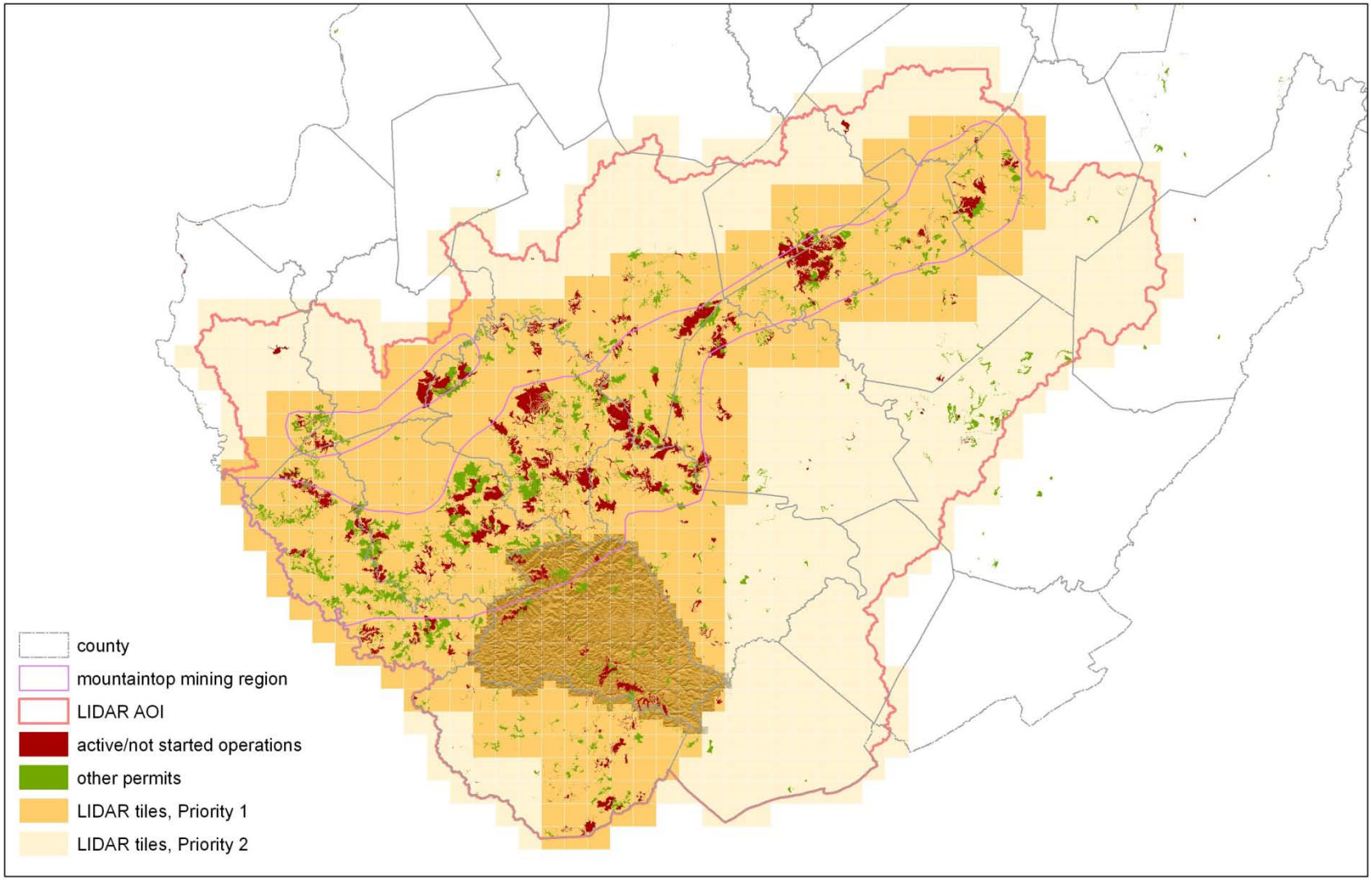



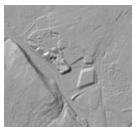

Hodgepodge

- The importance of mobile smartphones
- NGS CORS
- Engineering a fix to lousy geospatial data
  - Check data BEFORE it goes in databases
  - Using cheap receivers to full advantage
  - Uploading spreadsheet data automatically

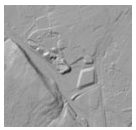

AOC and future mining → LiDAR





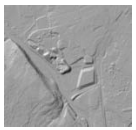
LiDAR collection specifications

- Horizontal postings: 1 meter
- Vertical accuracy: 15 centimeters
- Additional derived data products include:
  - ESRI elevation grid
  - Hillshade
  - 2 foot contours used in AML program
  - Intensity image → useful in QCing LiDAR data
- ~ 2 TB of data before derived products

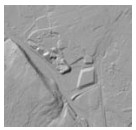

Building an ICI (=isolated computing island)

- Isolates one or more VERY high performance computers from central IT C&C during VERY long compute jobs:
  - No pushes of server OS upgrades
  - … followed by the requisite reboots
  - Isolate from dependence for TIPS licenses via pool of WVDEP licenses → network outages
  - Enough local storage to create a peer-to-peer within-the-room network
  - UPS on each PC

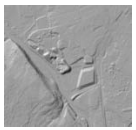

PC specs

- HP800 workstations with 64 bit OSes → super modular.
- Single quad core CPUs → 5th fastest on the planet when we purchased the boxes
- 16 GB RAM & 6 TB each local storage
- 4 megapixel displays + CUDA card
- Isolated peer-2-peer network when working off the net
- Gigabit network connections for on Net
- Local licenses of all core apps


Qcing LiDAR and LiDAR software

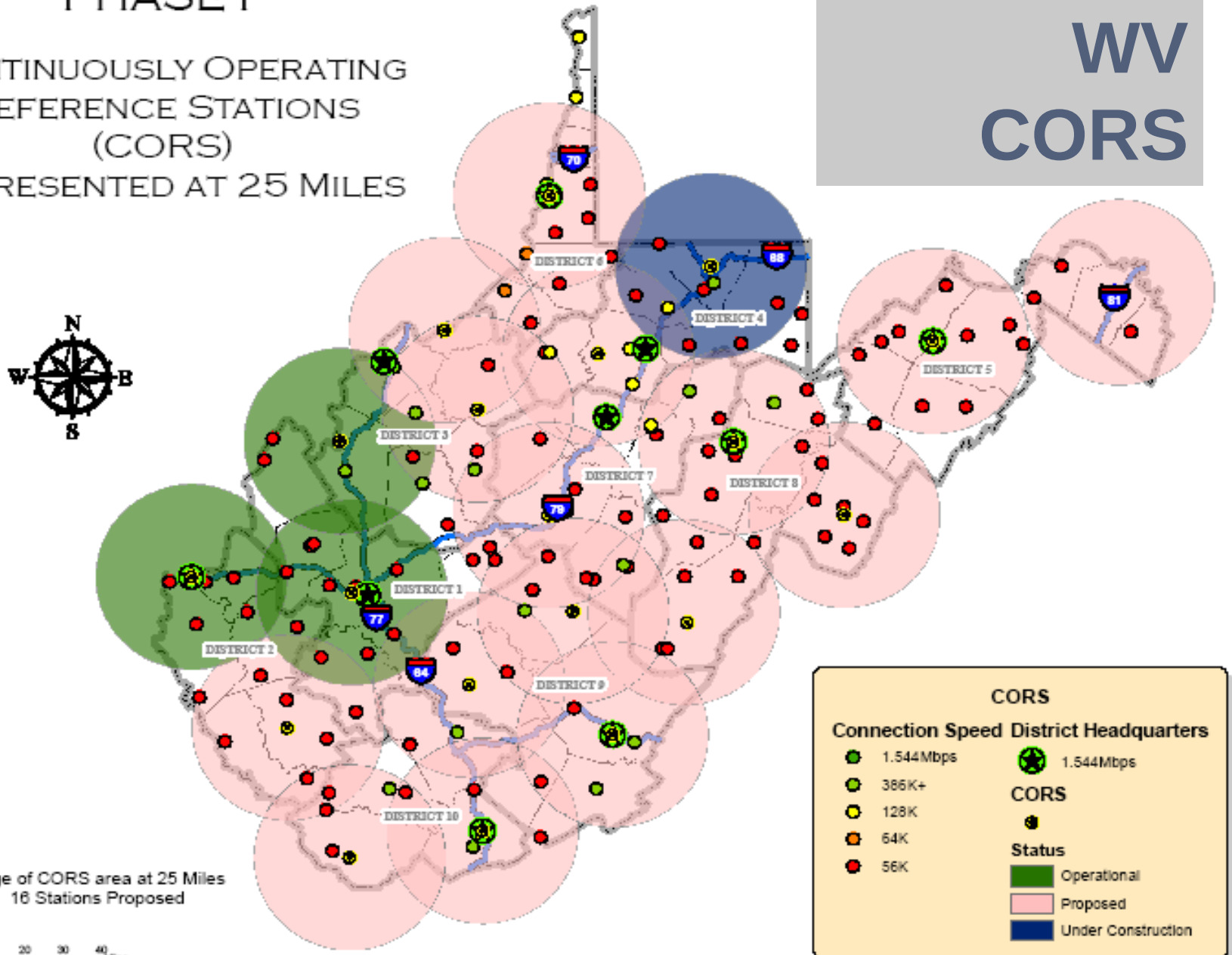
- QCing LiDAR deliverables
  - 2003 Statewide GCPs file
  - Multiple LiDAR datasets that overlap → difference grid calculation
  - Trimble R8 GNSS receivers for spot checks
  - Outsource via FEMA monies
- Software → 64 bit, use multicores
  - Virtual Geomatics
  - Applied Imagery's Quick Terrain Modeler



PHASE I

CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) REPRESENTED AT 25 MILES

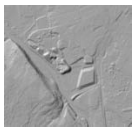
WV CORS



What do you do when you get THE call?

"Just wanted to let you know we're upping the number of Ricoh 500SEs we're buying from 24 to a total of 124. We need you TAGIS guys to come up with a geotagged photo

You brainstorm ... allot!


Documentation for each photo …

Category	What will be documented	IT solution
Who	Collected and uploaded the photo	Require input of user ID once a year
What	Keywords specific to what the users does → flavor based on logon data	Build database of keywords → become GIS attributes
	Date and time stored in each photo's EXIF header	Ricoh camera
	Compass orientation of person taking the photo and area of coverage of each photo	Mine camera's digital compass data written in each photo's EXIF header
Where	GPSed coordinates	Ricoh Capito 500SE camera's GPS stores coordinates in each photo's EXIF header
	Geoprocessing based on coordinates → quad, watershed	
	Geospatial analysis based on coordinates and logon data → an GIS layer	
When	Date and time photo was taken	Ricoh camera stores in each photo's EXIF header

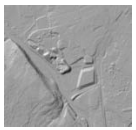
Queries → Person taking photograph's WVDEP affiliation

- DMR → SMCRA permit number where EVERY photo is taken.
- OOG → API number nearest photo
- DWW → WAP number
- OAML&R → PAD number

EXAMPLES:

Find all the photos taken on SMCRA permit number XXXXXXX

Find photos take within 5 miles of API number YYYYYYYY

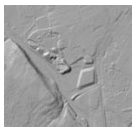




Queries → ArcGIS Server geoprocessing done automatically based on GPS location

- What is the quadrangle on which the photo was taken?
- What is the watershed in which the photo was taken?
- What WVDEP permitted facility is closest to where the photo was taken?

EXAMPLES:

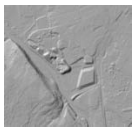
Find all the photos taken on the Williams Mountain quadrangle
Find photos taken on the Williams Mountain quadrangle within 5 miles of the town of .....


Queries → Keywords entered by person uploading the photo

- DMR → valley fill, refuse impoundment, violation, fly rock, etc.
- OOG → complaint, tank, reclamation, etc.
- DWW → discharge, AMD, etc.
- OAML&R → subsidence, underground fire.

EXAMPLES:
Find all the photos taken on SMCRA permit number WVXXXXX showing valley fills
Find photos take in the Guyandotte River watershed of OOG storage tanks → water
Find photos of acid seeps taken between May of 2010 and May of 2015.

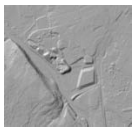




The automated workflow for GPSed cameras

(... AND GPSed cell phones)

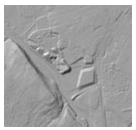
DAM

DEMO

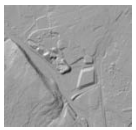

Current design criteria for the app

- Upload multiple photos straight from camera at the same time
- Automatically strip out EXIF header info
  - Get coordinates
  - Get compass data for photo orientation
  - Get GPS fix quality data → PDOP
- Create an ArcSDE point layer on-the-fly
- Allow user to select keywords to merge with point data attributes.

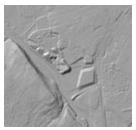

Planned V2.0 design enhancements

- Automated geoprocessing
  - What quad, county, watershed, etc.
  - Nearest cemetery, school, violation, etc.
- Baskin Robbins the app → permitting vs. I&E vs. AML flavors via login.
- Engineer a new Adobe Flex 4/ESRI API 2.0 *"query my photos"* widget.
- Integrate Ricoh 500SE sound files, AVIs.
- On-the-fly viewshed analysis → camera location, camera viewing angle & topography.

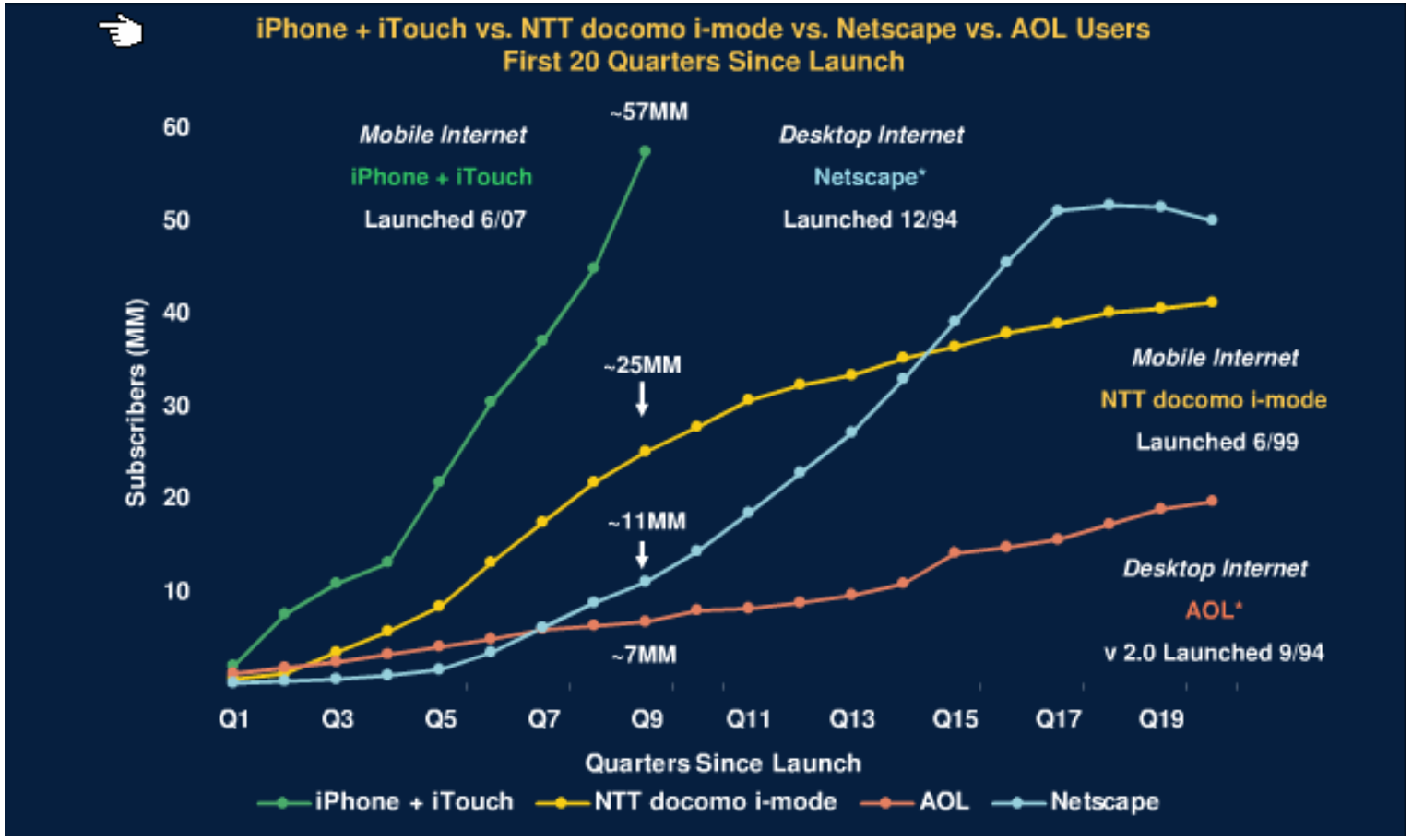




Why did we include smartphones?

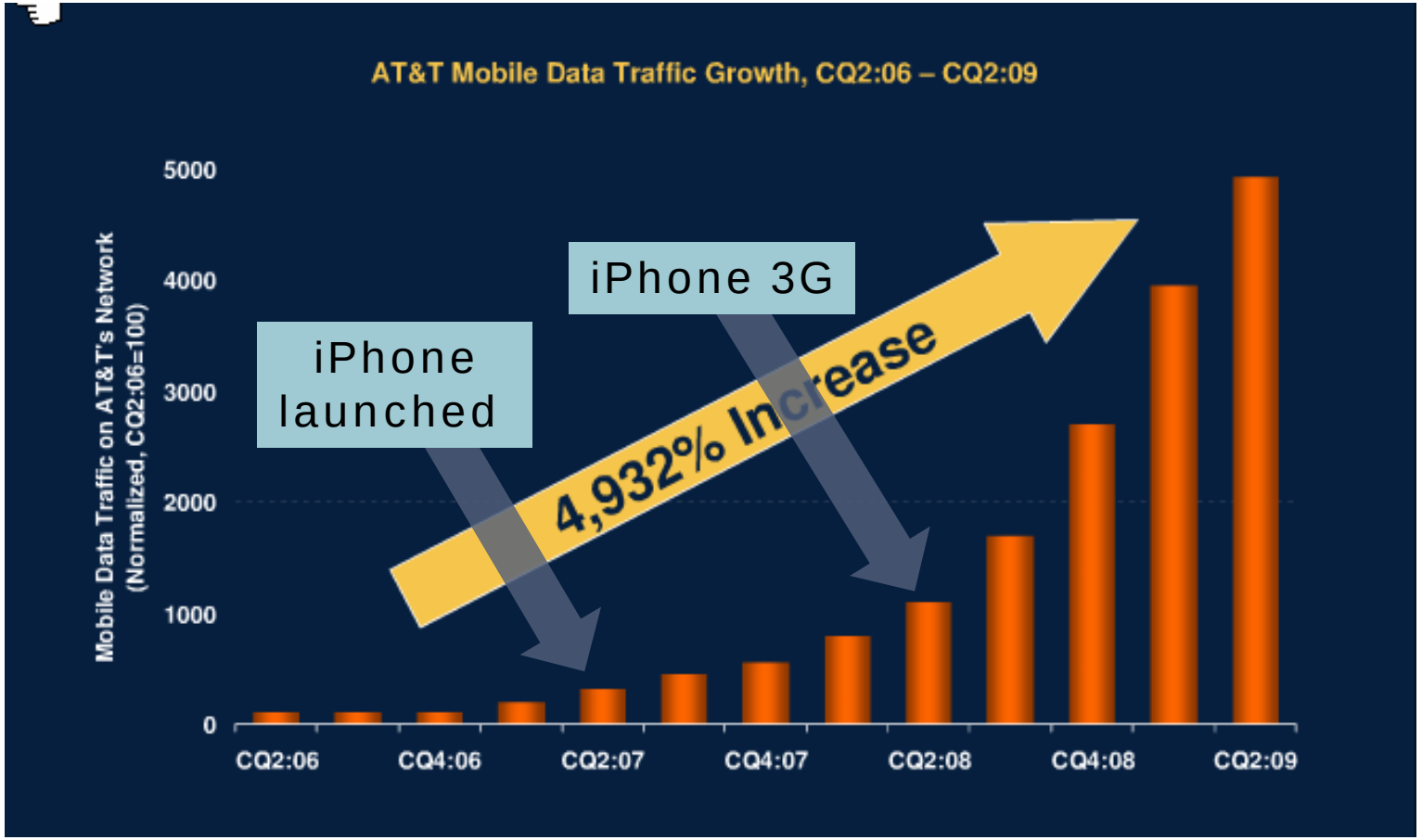
- Five megapixel or > cameras
- Internet data capable
- A-GPS + integrated GPS chips
- Electronic compass
- ESRI's new beta iPhone API

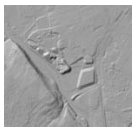




Mobile Internet outpaces desktop Internet adoption



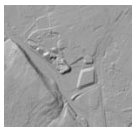
AT&T's 50x growth in mobile data traffic in three years



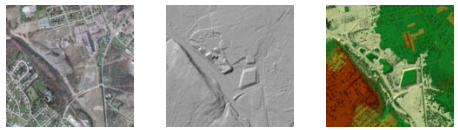

GPS … the largest mobile Internet winner?

- As of December 2009, estimates are that GPS chips are now in 300 to 500 million mobile phones.
- In the last three years, more GPS chips have been put into mobile phones than the cumulative number of all other GPS receivers built in the last 30 years
  - smart-bombs, boat, plane, hiking, survey, precision farming, GIS, Bluetooth-puck, personal digital assistant, and PNDs.

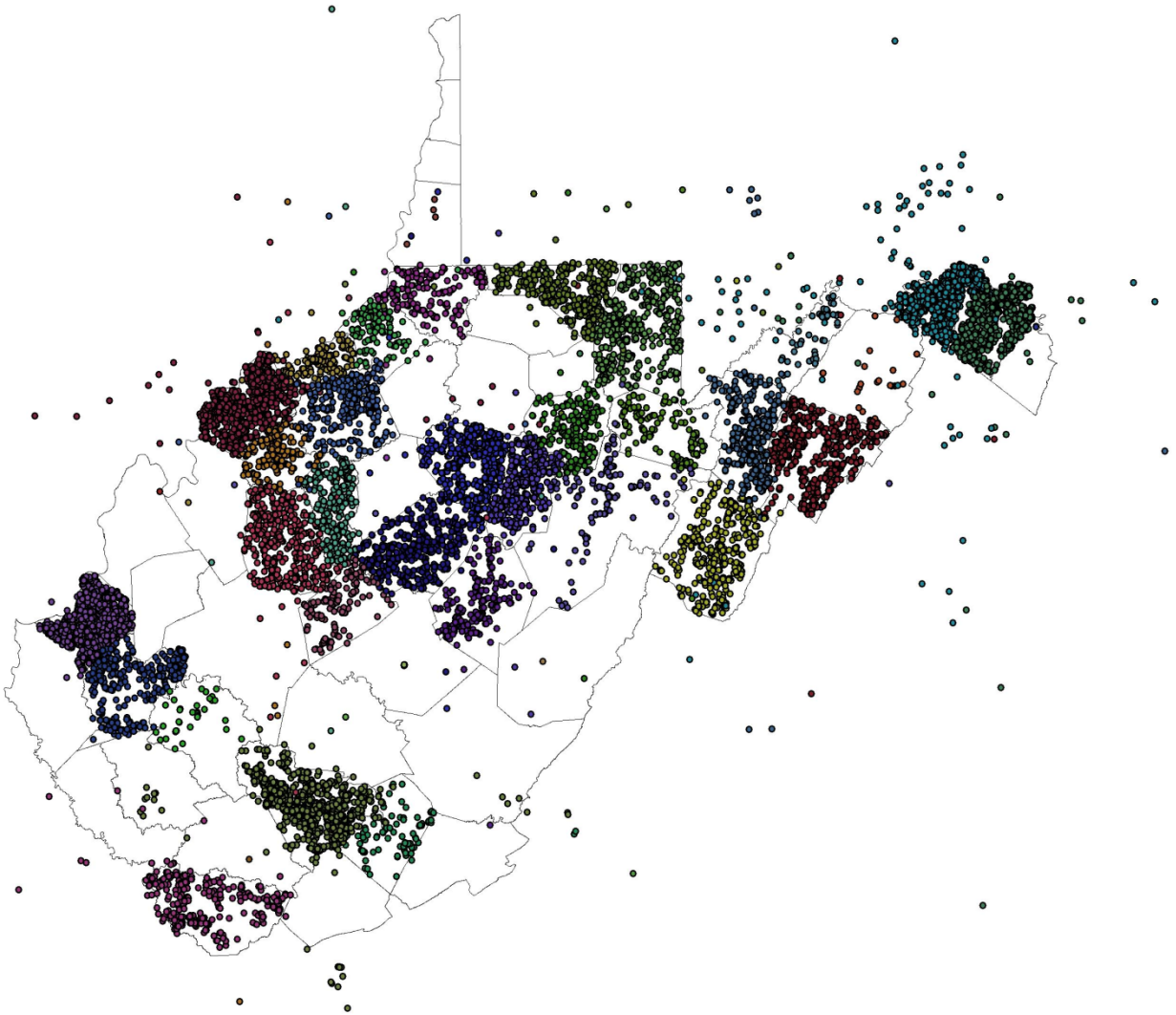

Why legacy data is ALWAYS hosed

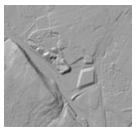
Current workflow

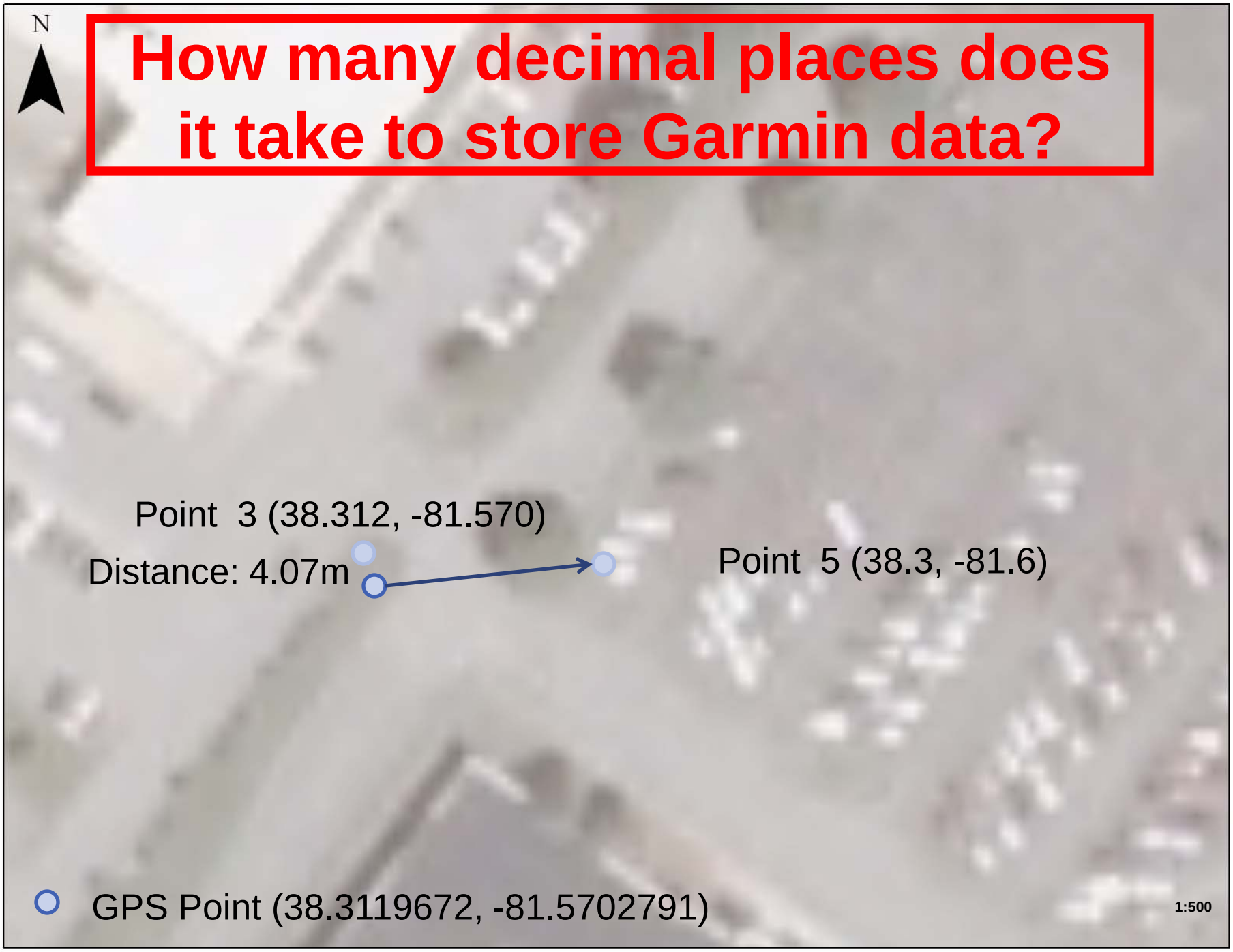


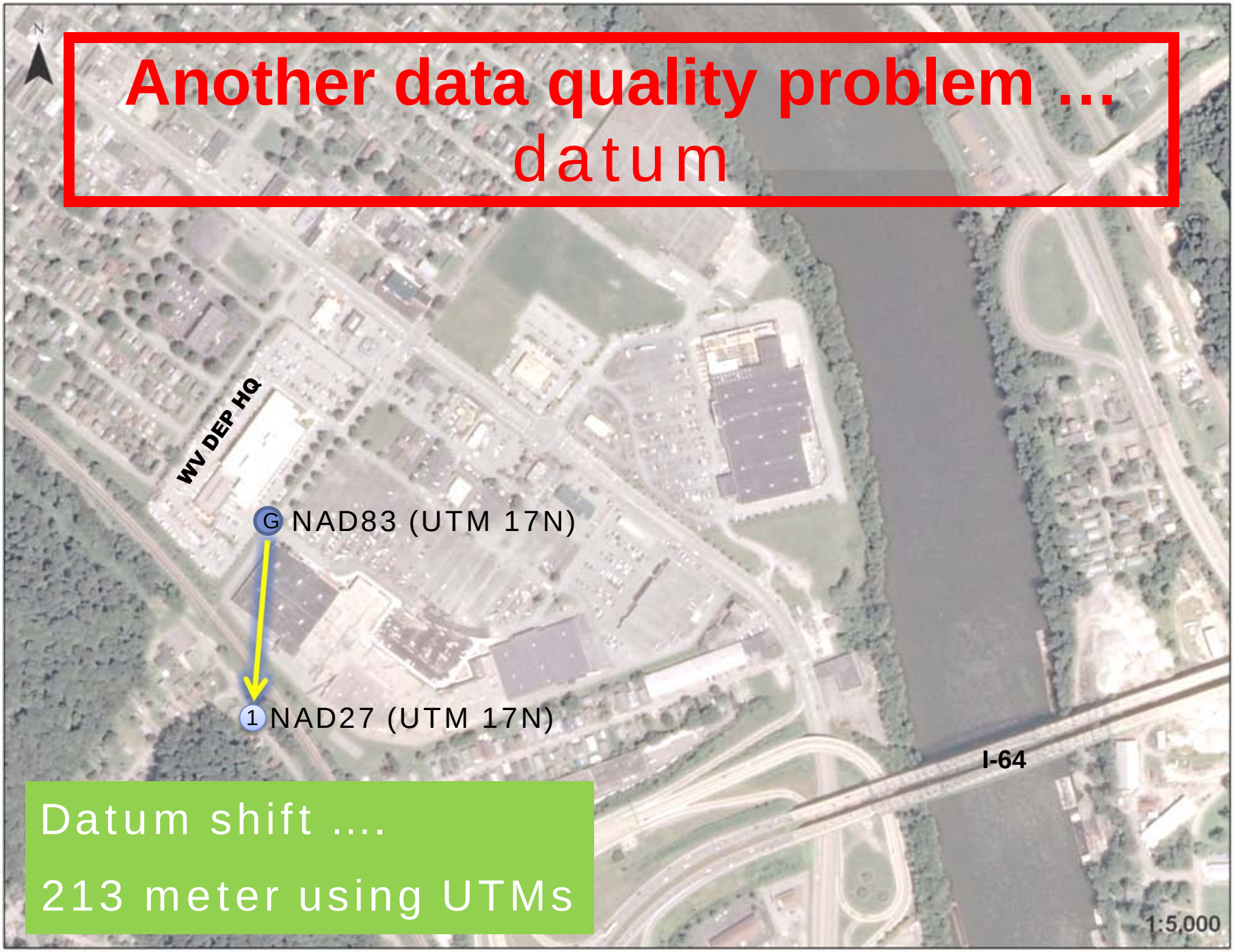
Coordinate accuracy … garbage in, garbage out

- Typical ERIS dataset the first time we look at it via GIS





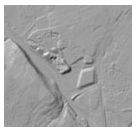

N
How many decimal places does it take to store Garmin data?
Point 3 (38.312, -81.570)
Distance: 4.07m
Point 5 (38.3, -81.6)
GPS Point (38.3119672, -81.5702791)
1:500


Another data quality problem ...
datum
WV DEP HQ
G NAD83 (UTM 17N)
1 NAD27 (UTM 17N)
I-64
Datum shift ....
213 meter using UTMs
1:5,000

Maximizing utility of recreational grade GPS receivers

GPX

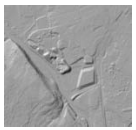
DEMO


Converting tabular data to geospatial datasets

Excel Upload

DEMO

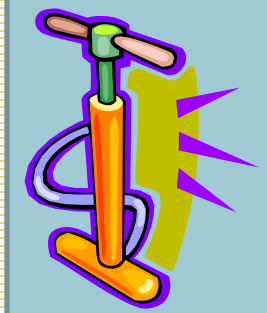



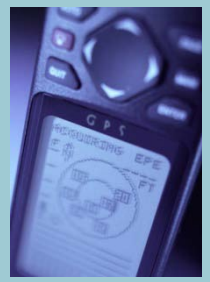

How GPX and Excel apps can help

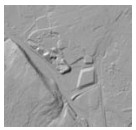
milliseconds pass

GIS QC Check

Automatically

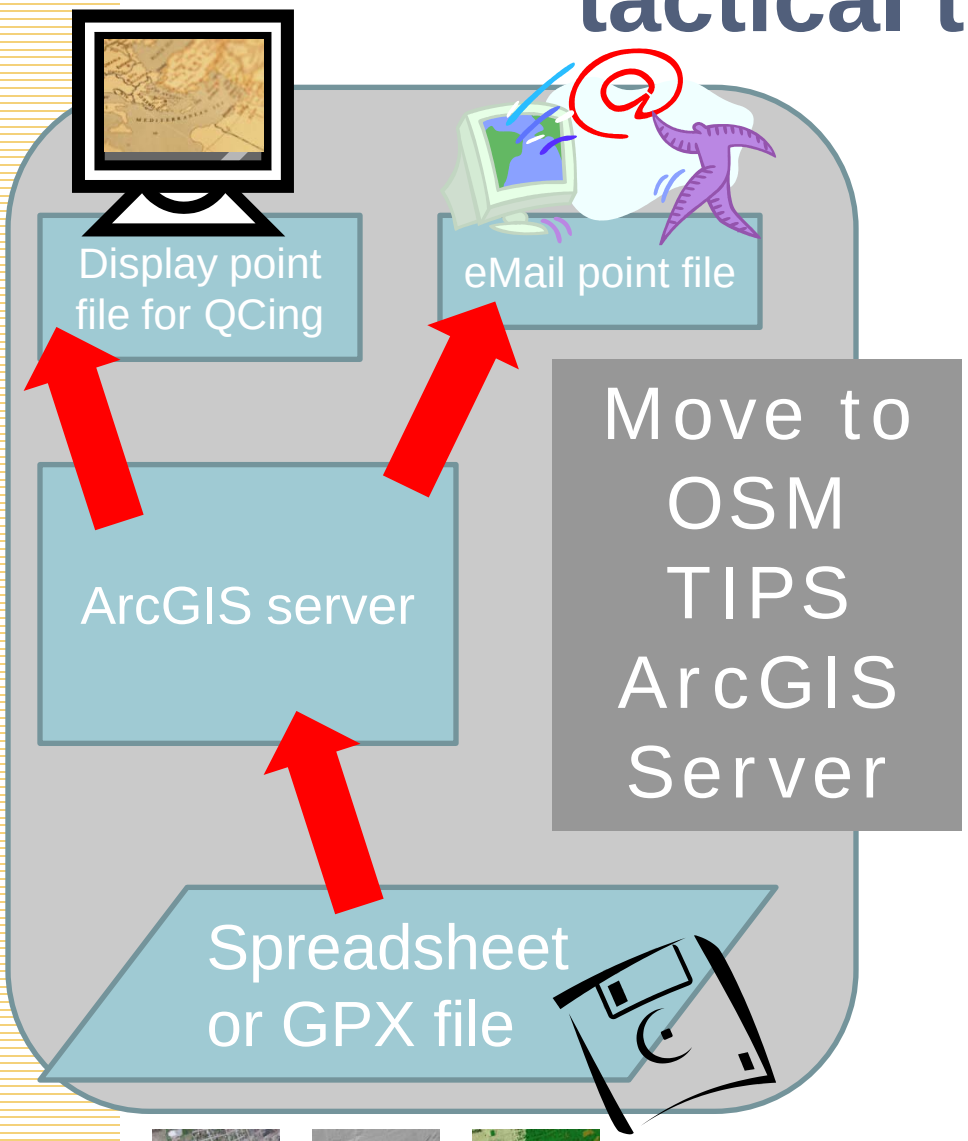






Build a gedatabase instead

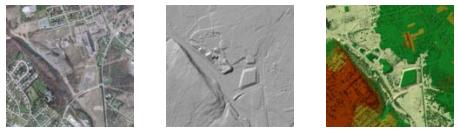
Spreadsheet & GPX strategic to tactical thinking



TIPS Tools GPX file

Use ArcGIS Server to implement a data dictionary

Might be possible to use lat/lon, date & time to back calculate PDOP??



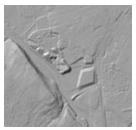
Three Distinct Programs Under Imagery for the Nation

- One Meter

West Virginia statewide 1 meter aerial imagery layers
1996 – 98
2007
2009

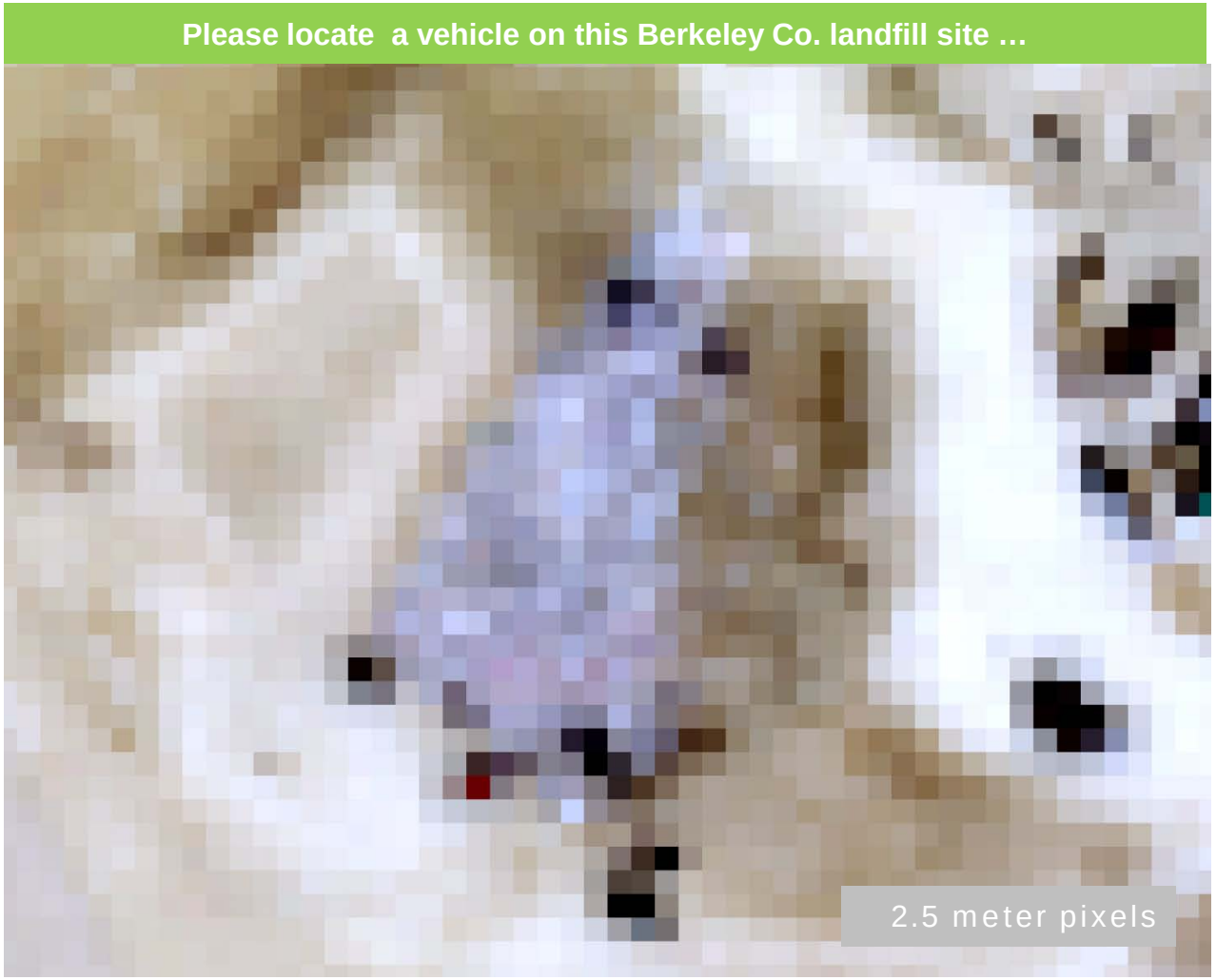
WVSAMB 2 foot pixel layer
2003

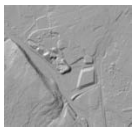
- One Foot
- Six Inch


Resolution and Perspective

- View at right shows permitted site via high resolution commercial satellite (QuickBird).

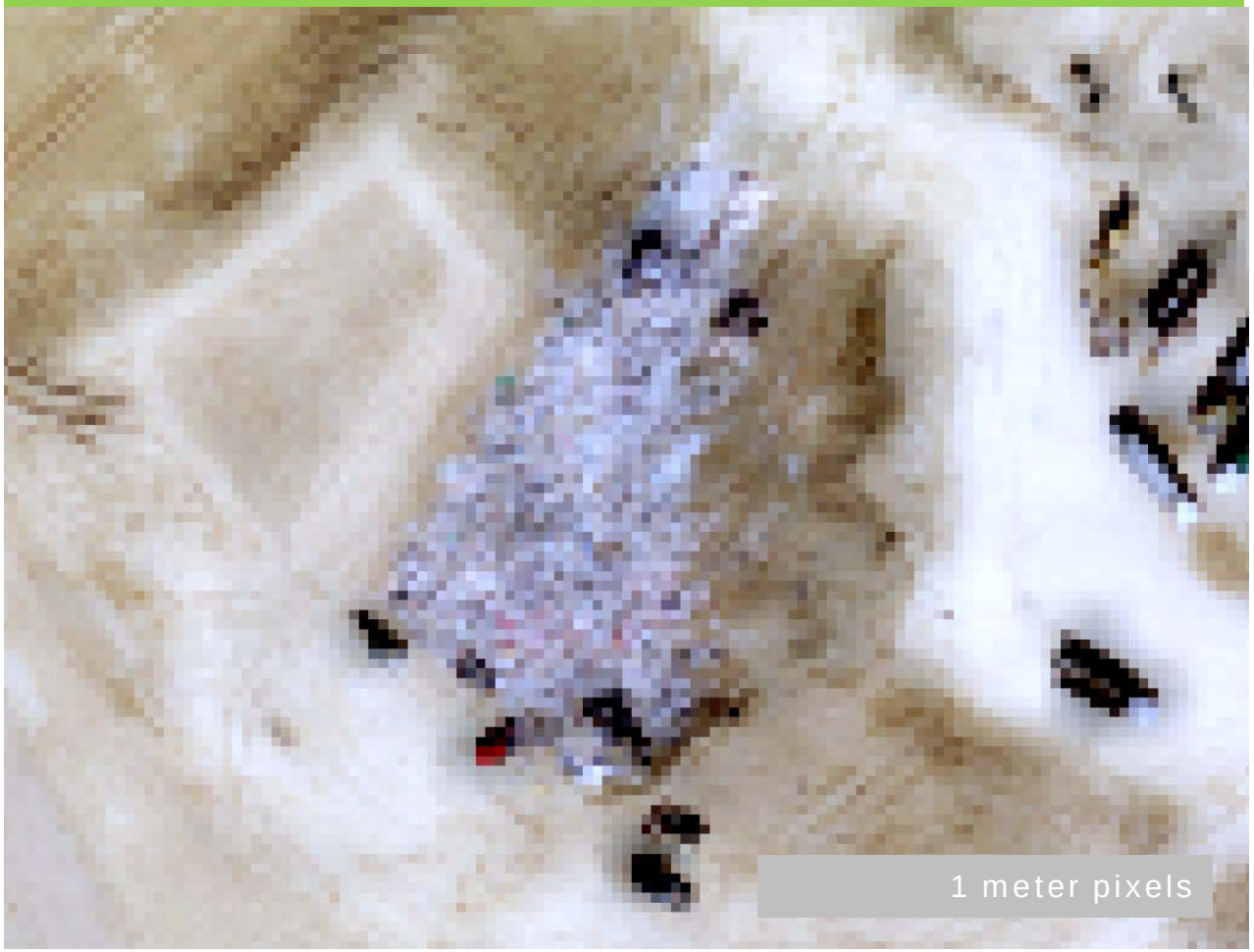


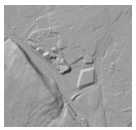


Resolution and Perspective (2)

- Same spatial extent as previous slide
- Most WV statewide imagery datasets are one meter resolution (1996, 2007 and 2009).

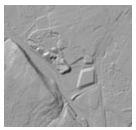
Ok now you sort of see vehicles … next identify trucks vs. bulldozers




Resolution and Perspective (3)

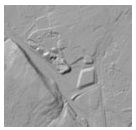
- Equivalent to best resolution imagery on Microsoft Virtual Earth.
- 1 foot pixel data, however, is only available via Virtual Earth in the Charleston area


Now you see truck vs. bulldozer … locate a tire on the site

Resolution and Perspective (4)

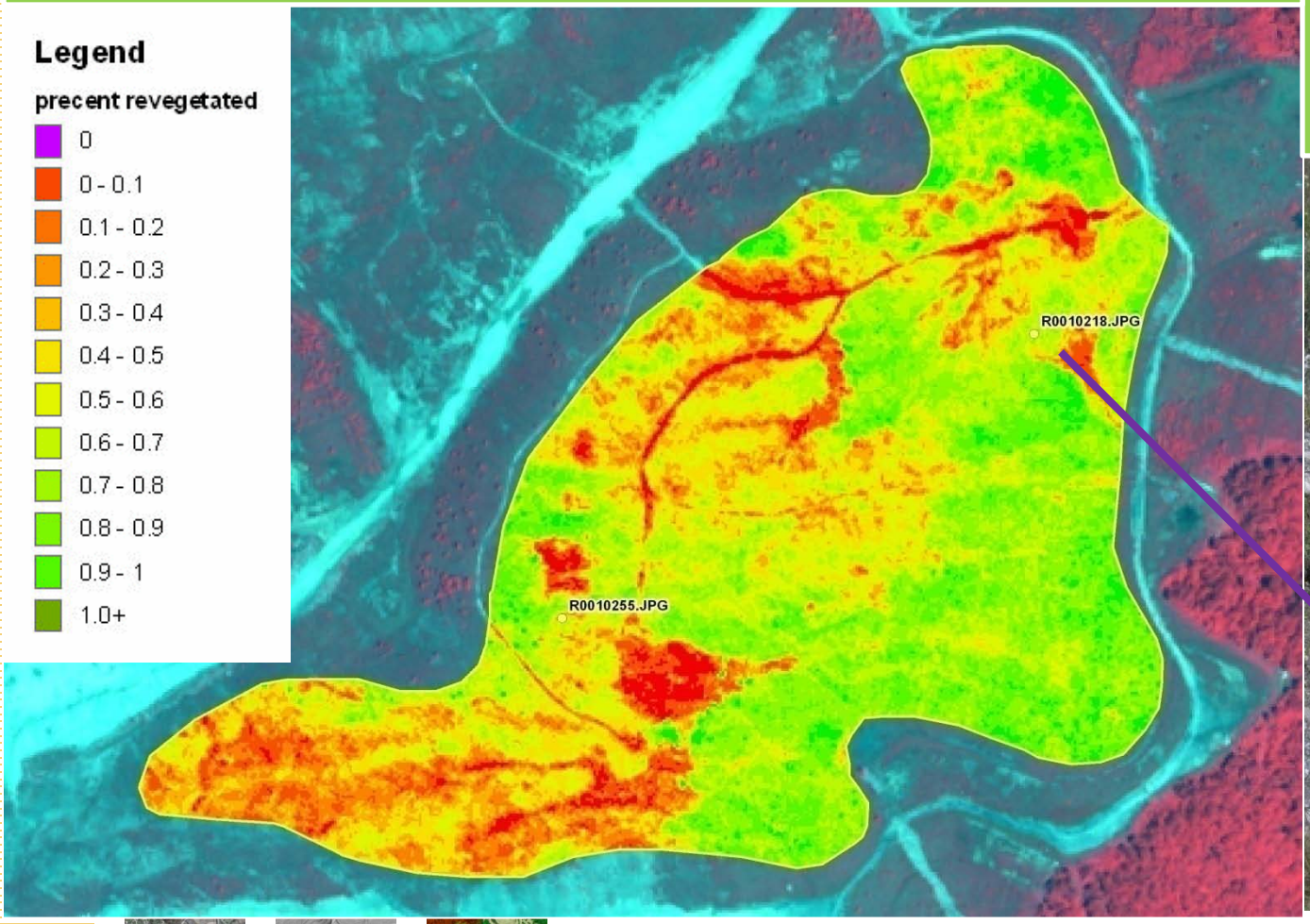
- Source of image at right was a 2007 flight paid for by Berkeley County


Comparing SMCRA Perspectives

- Percent Cover→ analysis → [illegible]

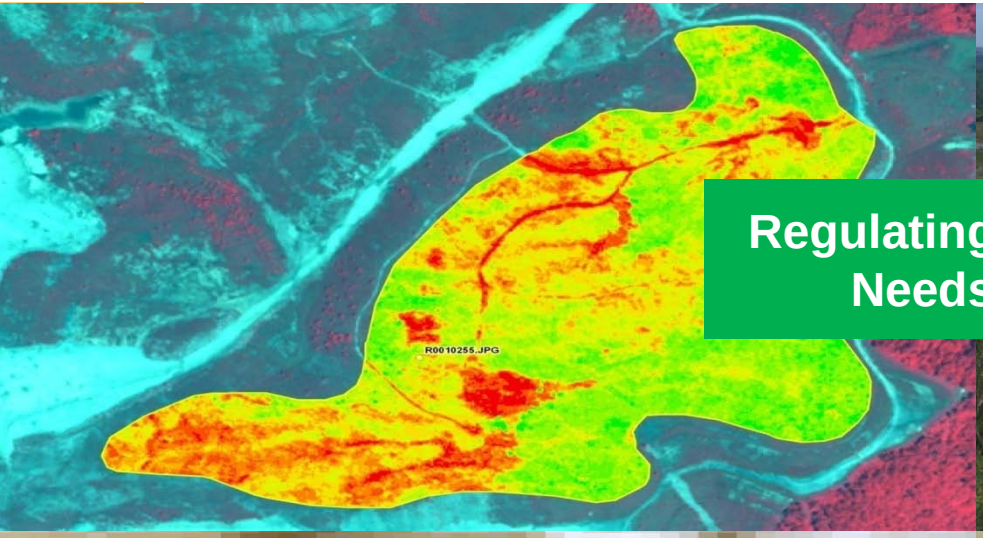
Aerial Camera Perspective

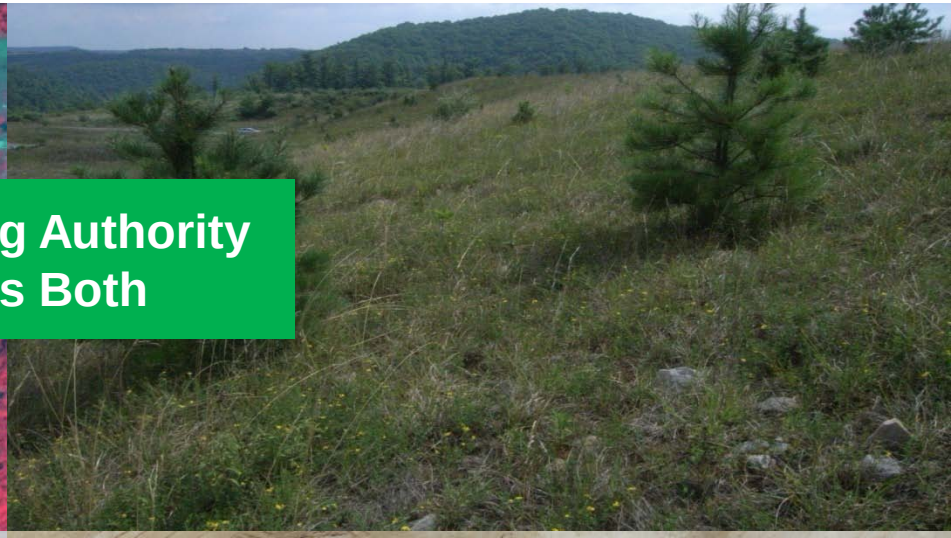


ATV Cell Phone Camera Perspective

Perspective & Resolution

How we see the permits we regulate & the emergencies to which we must respond

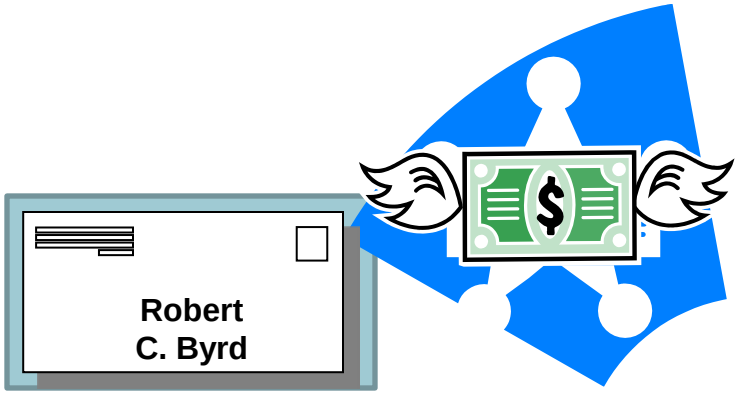


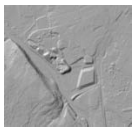


Regulating Authority Needs Both

Regulating Authority Needs Highest Resolution Affordable

Happenstance & 2010 … the stars align

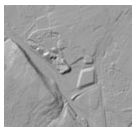




A new angle on SMCRA

Pictometry

DEMO


The end