2003 Progress Toward Enterprise GIS in the West Virginia Department of Environmental Protection

July 27, 2004

Information Technology Office
Technical Applications & GIS (TAGIS) Unit

*GIS for the Entire Organization …

Stop thinking **GIS details**		Start thinking **GIS enterprise**
Hardware/software platform		Integrating legacy multimedia data and spatial analysis processes to solve business problems
	Windows or UNIX	
	ESRI or Intergraph	
Data formats (.sid, .shp, etc.)		Long term archiving of both spatial and legacy business data to preserve the history of business decisions
Data compatibility (i.e., vector, raster, TIN, etc.)		

*What and Why of Farallon's Enterprise GIS Approach, 2004, "Unlocking GeoSpatial Data for use throughout the Enterprise"
http://www.fargeo.com/enterprise_gis/

What is an Enterprise GIS?

- Landrum's Definition*
  - Provides desktop access to all users (1)
  - Provides access to other information systems in the organization by using a map or application as the integrator of the organization's information (2)
  - Supports applications that are easy to use and understand (3)
  - Well organized and well managed (4)
  - Integrates geographic data across multiple departments and serves the entire organization (5)
  - GIS is supported by ALL departments and management (6)

*Landrum, Teri Boudreau, "Enterprise GIS-Building a Strong Foundation" Geospatial Information & Technology Association, 2001

  - Provides access to geospatial data regardless of user's geographic location (7) →

*Tangible Benefits of Enterprise GIS

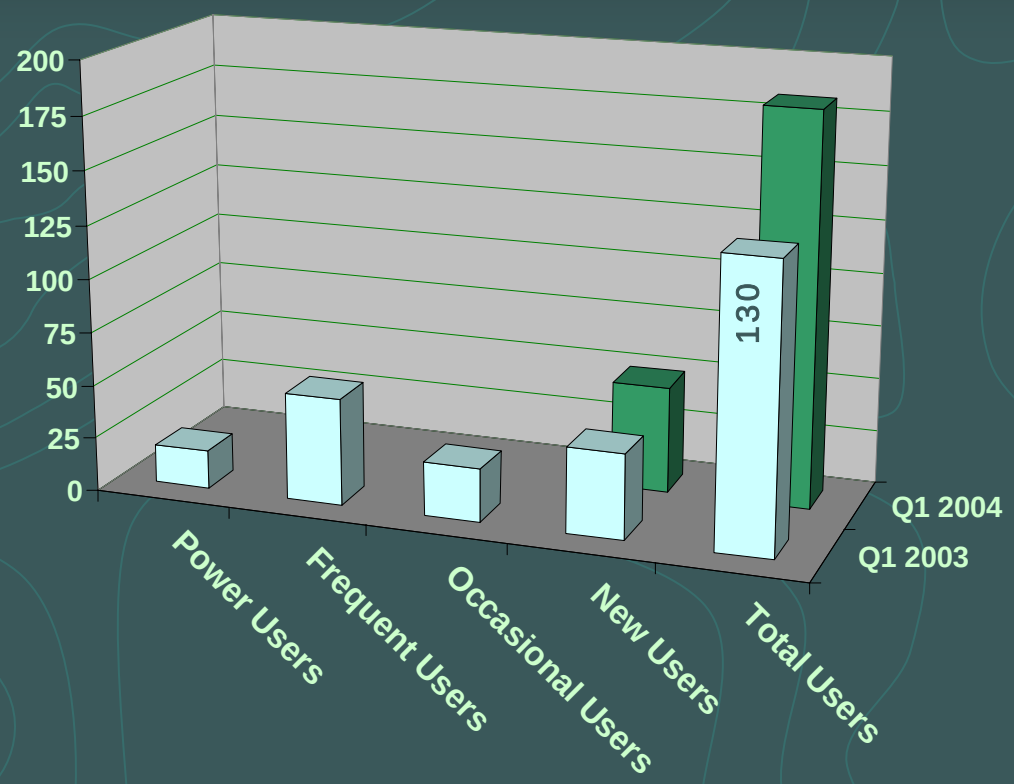
- Each department uses its preferred software and data types while working from a shared database - the best [right] tools for the job (A).
- Eliminates time wasted converting or translating data and eliminates out-of-sync data or errors - increases productivity (B).
- All users and key decision makers have quick access to the most accurate and up-to-date data - increases data accessibility (C).
- All independent systems communicate quickly and effectively, regardless of data format - improves communications among departments (D).
- Storing spatial data in a central database, your organization will maintain secure, high-quality data - increases data security (E).
- Enhances speed, reliability and uptime (F).
- Enables easy web-based access for data sharing and community participation (G).

*What and Why of Farallon's Enterprise GIS Approach, 2004, "Unlocking GeoSpatial Data for use throughout the Enterprise"
http://www.fargeo.com/enterprise_gis/

EGIS/ArcGIS Users in WVDEP Increased Significantly in 2003

Provides desktop access to all users (1)

Increases data accessibility (c)



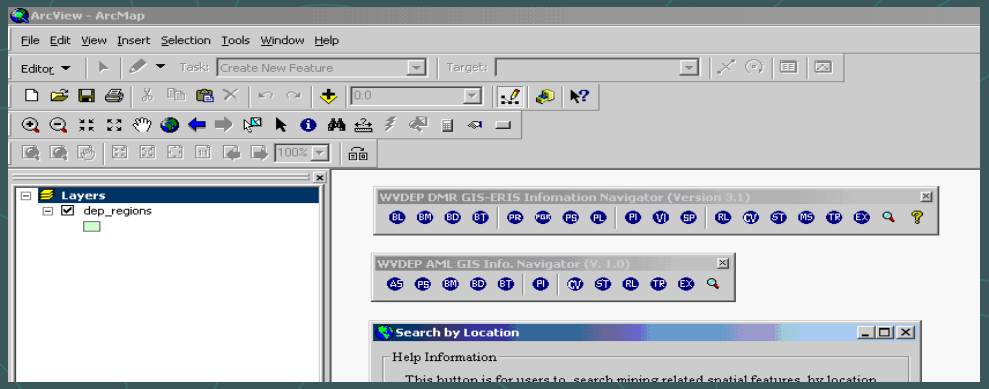
- Power and frequent users at the beginning of 2003 was ~ 65.
- During year we added about 65 occasional & new users → ~ 130
- Projected increase in users in 2004 is ~ 50 → ~ 180

Visual Basic /ArcObjects Customized Applications Development

Provides access to other information systems (2)

Applications easy to use and understand (3)

Right tools for the job (4)



ERIS

RIMS

EQuIS

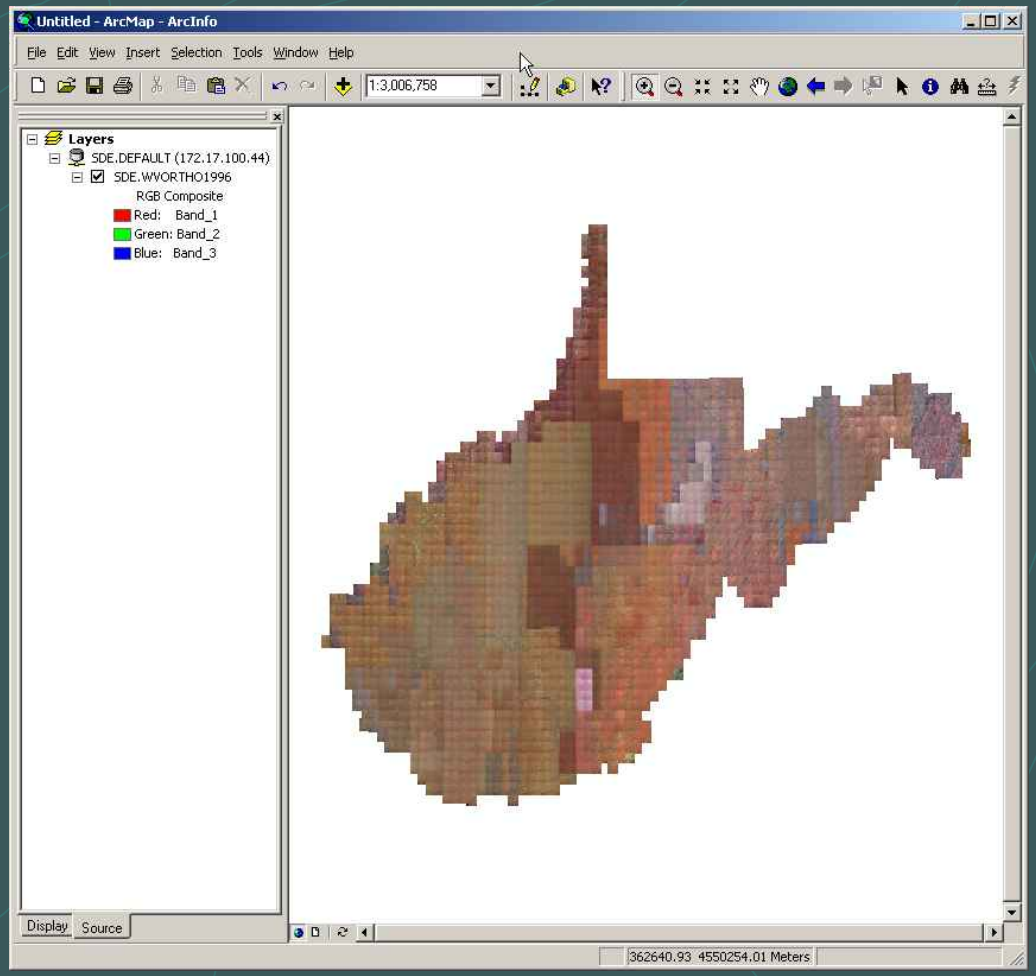
- Using Citrix technology WVDEP's first custom built spatial application was fielded for Division of Mining & Reclamation (DMR) in 2003.
  - Majority of new 2003 GIS users were DMR permitting staff
  - TIPS & TAGIS trained ~ 60 people to use DMR's new application
- Currently developing custom applications for Offices of Abandoned Mine Lands & Reclamation and Special Reclamation.
- Increased TAGIS' Spatial Applications Development Group from 1 to 2 people doing full time spatial development work in early '04.

Migrated Agency Spatial Data to an ArcSDE/Oracle Environment

Well organized & managed (A)

Enhances speed, reliability and uptime (F)

- Most Agency data sets now reside in ArcSDE/Oracle
- Huge rasters created
  - 1996-98 DOQQs → DOQs → DO layer
  - USGS DRGs → DRG

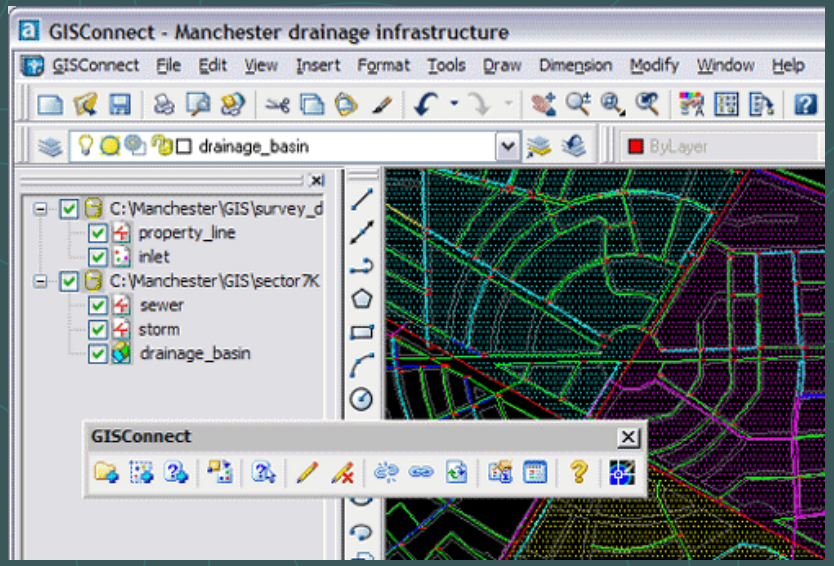


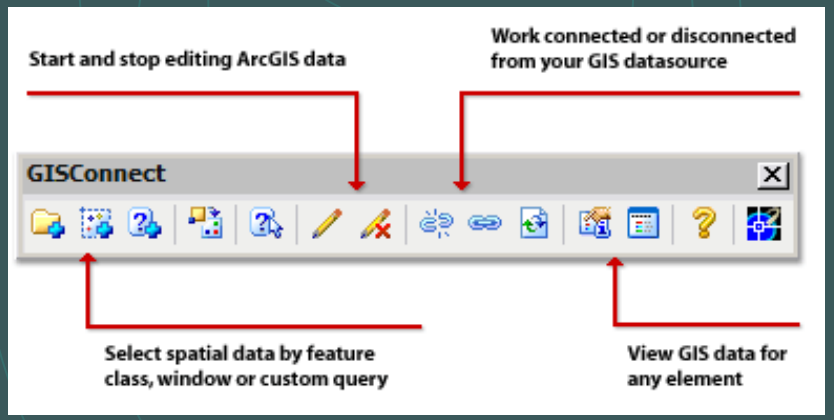
Statewide 1 meter resolution Digital Ortho ArcSDE layer

Egsan Integrating CAD and GIS Users Using GISConnect

Integrates geographic data across multiple departments (5)

Improves communications among departments (D)



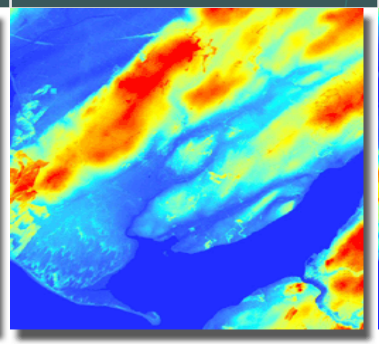
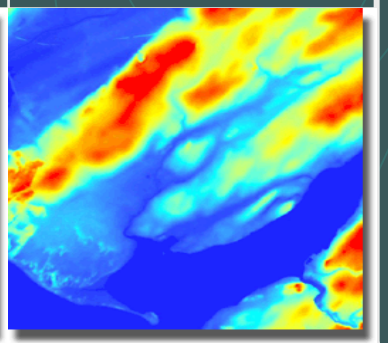


- GISConnect Works in AutoCAD®.
- CAD user can work with any GIS feature datasets or feature class.
- CAD users can convert any GIS point feature class to an AutoCAD block...or map blocks and attributes to GIS point data.
- CAD user has complete control over GIS data editing.
- Works connected or disconnected to the GIS data source.
- User can view all info about any GIS element with one click of the mouse.
- Fully supports vector data including geodatabases, shapefiles, coverages and feature classes.
- Allows access to ArcSDE data across WVDEP directly from AutoCAD.

AVDMR Funded IFSAR (NEXTMap) High Resolution Elevation Data Acquisition

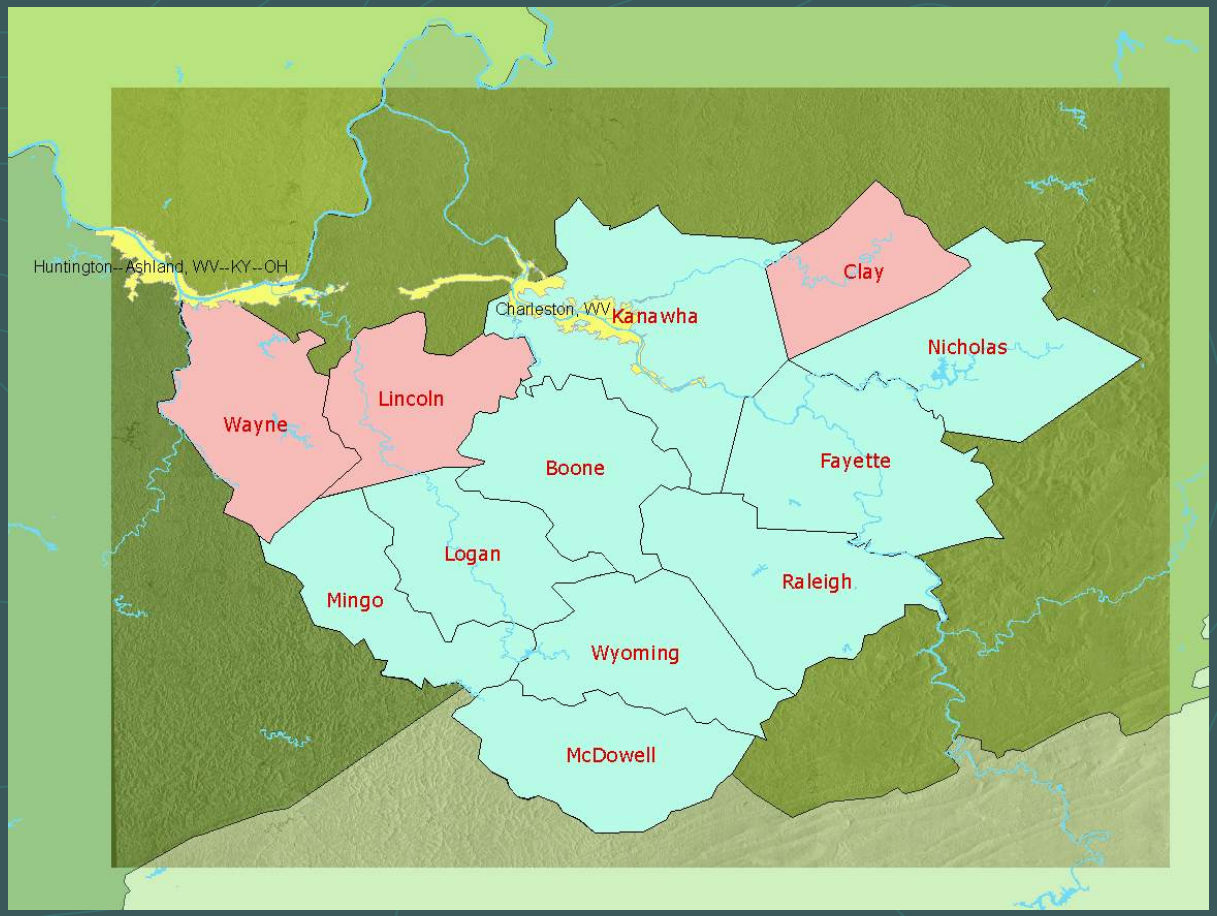
New organized & managed (4)

Increases data availability (c)

Product	Orthorectified Radar Imagery	Digital Surface Model	Digital Terrain Model
Abbreviation	ORI	DSM	DTM
Pixel size	1.25 meters		
Product type		II	II
Root mean square error (RMSE)	2.0 meters	1.0 meter	1.0 meter
95%		2.0	2.0
Mean & standard deviation		0.7	0.7
Samples			

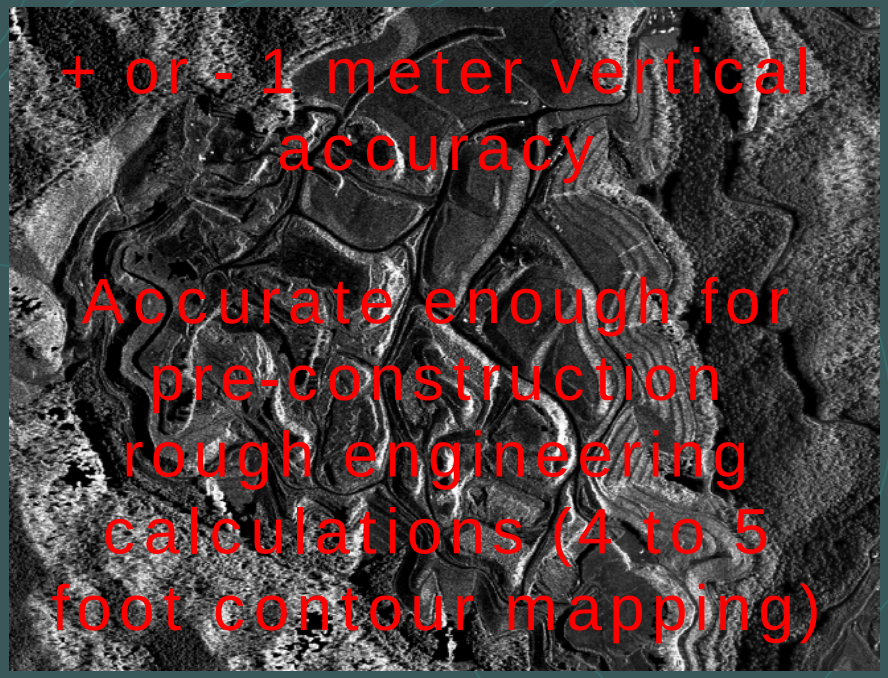
PECA/DMR Funded IFSAR High Resolution Elevation Data Acquisition [p. 2]

- Purchased data for 9 counties in southern coal field:
  - Boone
  - Fayette
  - Kanawha
  - Logan
  - McDowell
  - Mingo
  - Nicholas
  - Raleigh
  - Wyoming
  - Clay provided gratis by InterMAP



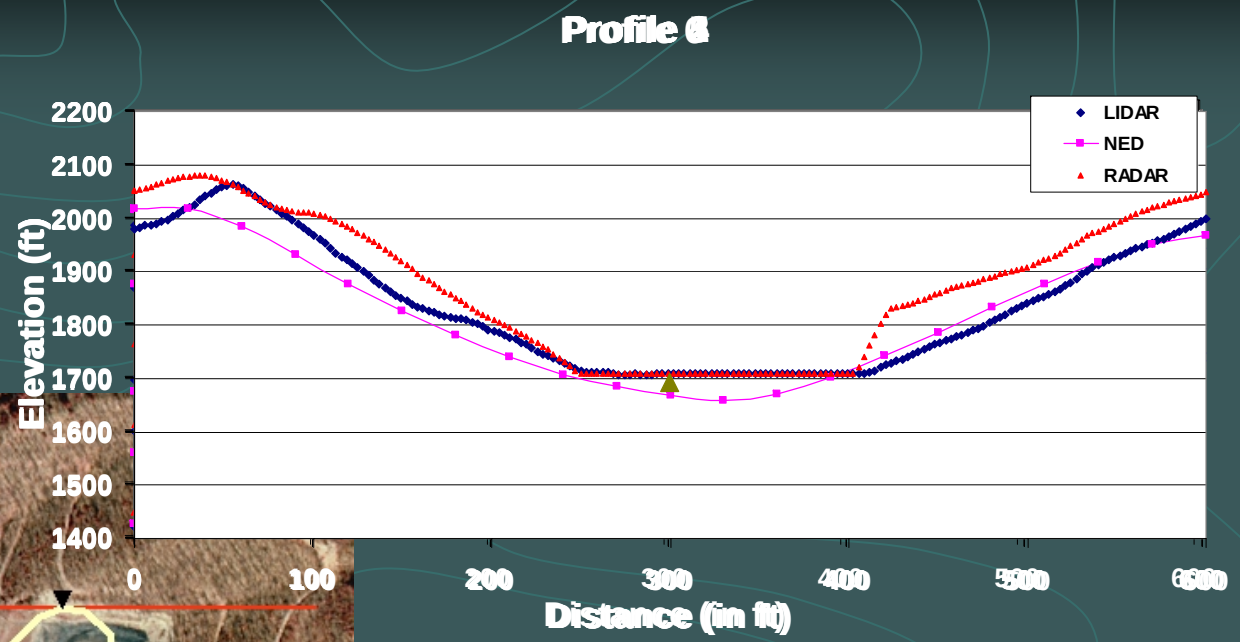
PECA/DMR Funded IFSAR High Resolution Elevation Data Acquisition [p. 3]

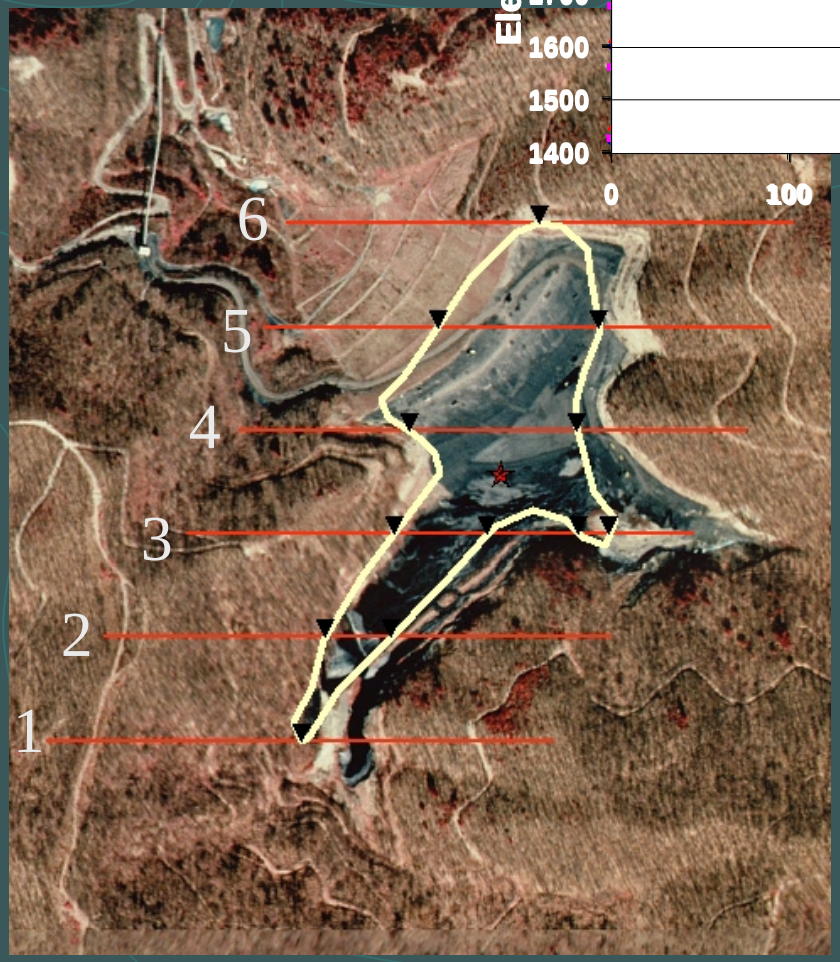
Part of Williams Mountain, WV Quadrangle



- 30 meter resolution DEM (NED)
- Data shown in model was collected in the 1970s
- Undisturbed forested area

- 1.25 meter resolution ORI
- X-band radar-based data collected Sept.' 2003
- Large area surface mine





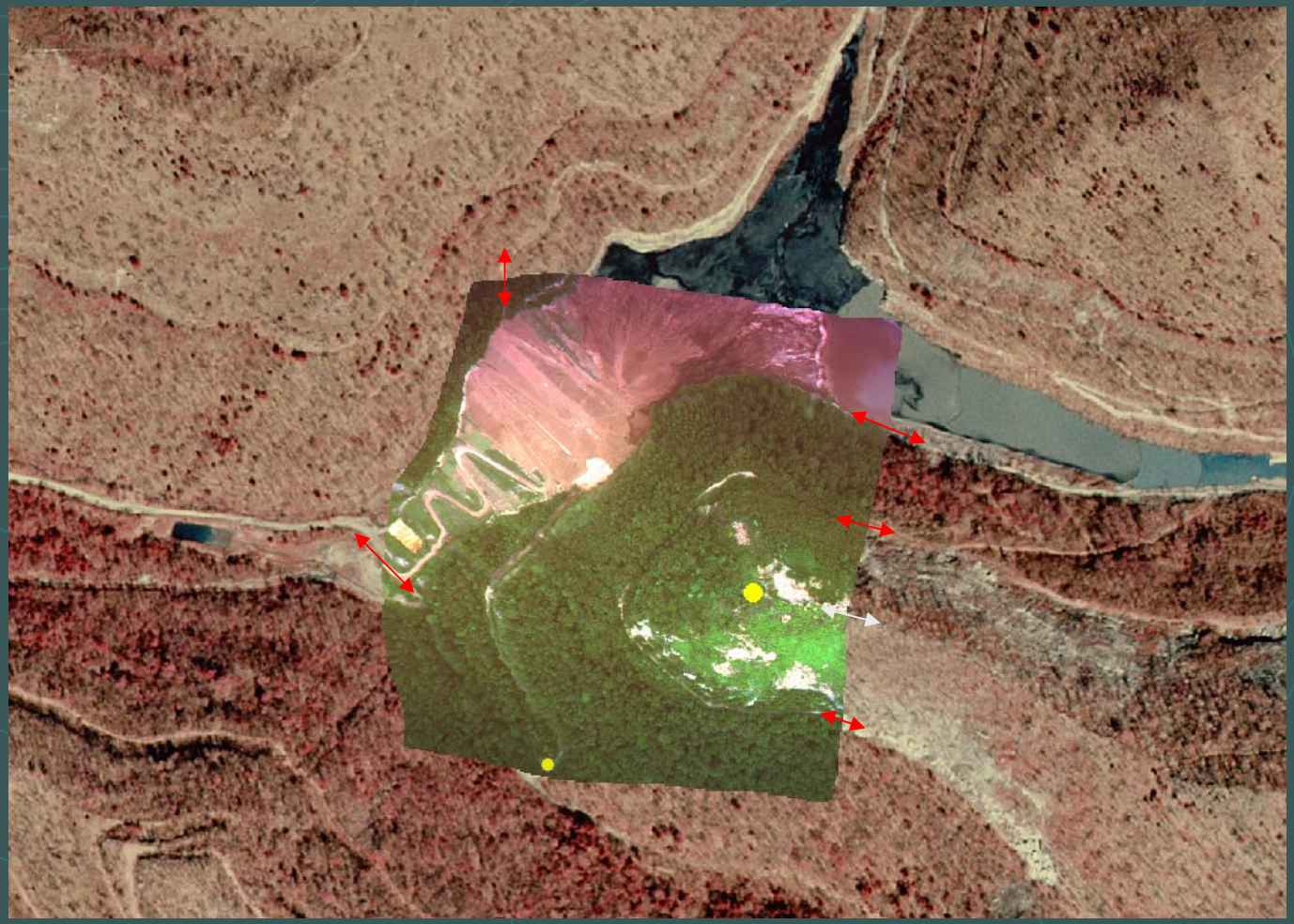
NED, Lidar & IFSAR Elevations at a Refuse Impoundment in Wyoming County, West Virginia

Recent Airborne Imaging of Active Mining and Abandoned Mine Lands Sites

Reorganizes managed GIS (a)

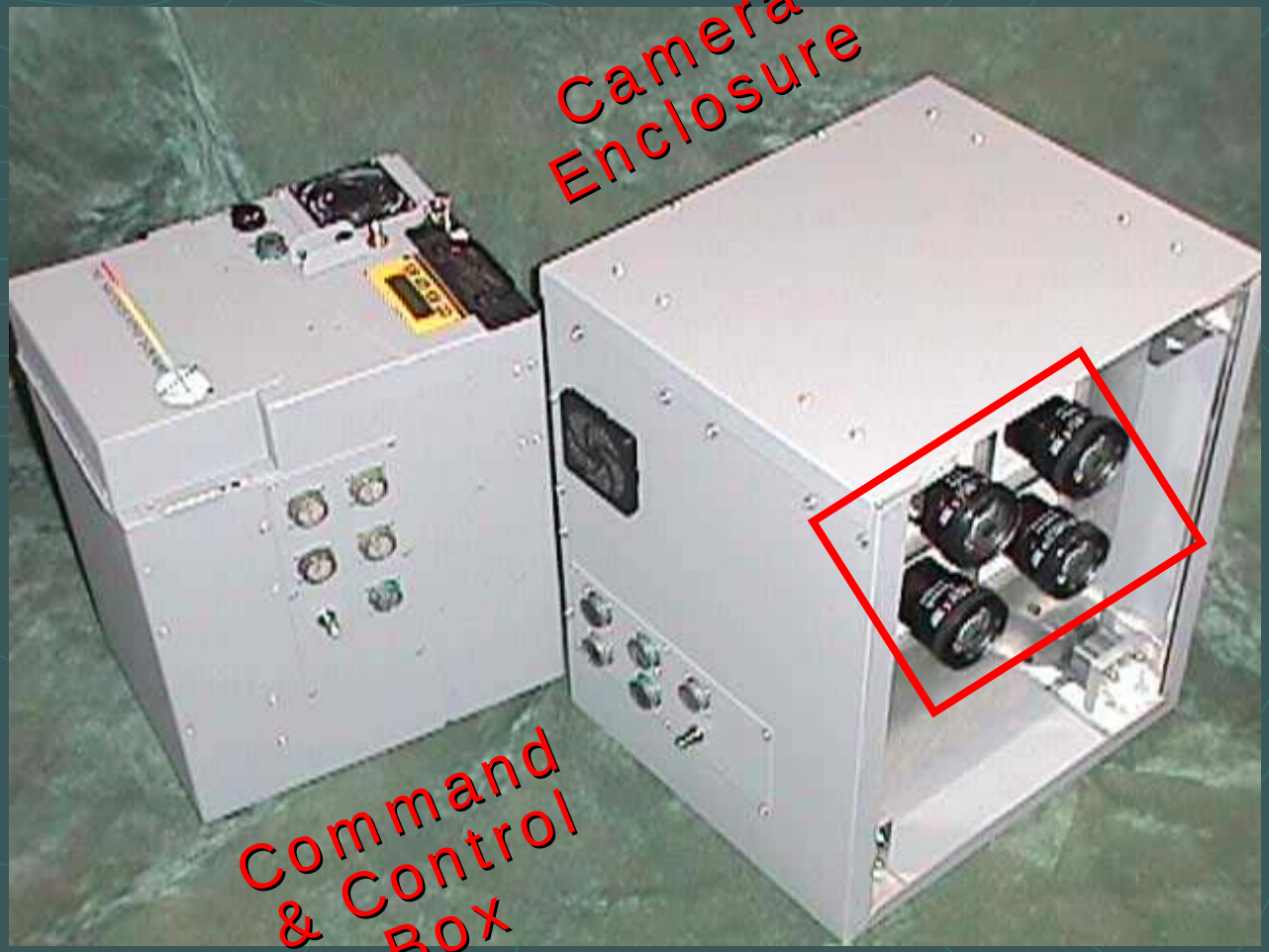
Increases data availability (c)

- Color ortho image (red, blue, and green channels) from WVDEP's airborne imaging system over 96-98 DOQQ.



Major Airborne Imaging Components

- Four 2Kx2K digital cameras mounted in their enclosure ready for installation on DEP's Bell Jet Ranger helicopter



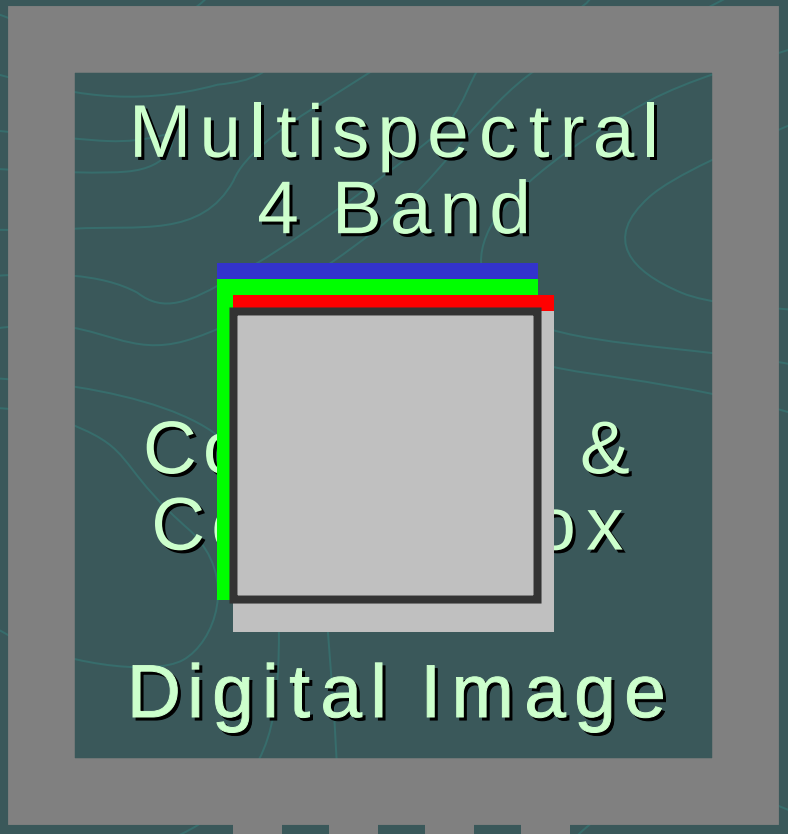
Ready for a Mission

- Quick-on/quick-off mounting bracket for the camera pod needed FAA approval

Cockpit Command and Control

- Data logging station where a TAGIS remote sensing specialist captures & reviews data in the air

How Airborne Imaging Works



Band 1
0.44-0.52 µm.
Blue Camera

Band 2
0.51-0.62 µm.
Green Camera

Band 3
0.61-0.71 µm.
Red Camera

Band 4
0.65-1.07 µm.
Near IR Camera

How Our System Compares

Units are µm.	*WVDEP's Airborne Imaging System	Space Imaging's Ikonos Satellite		SPOT-6		Landsat ETM+	
	Range	Min	Max	Min	Max	Min	Max
Blue	0.44-0.52	+0.01	0.00	-0.01	-0.05	+0.01	0.00
Green	0.51-0.62	0.00	-0.02	-0.01	-0.03	+0.01	-0.02
Red	0.61-0.71	+0.02	-0.01	0.00	-0.03	+0.02	-0.02
Near-IR	0.65-1.07	+0.11	-0.22	+0.14	-0.18	+0.11	-0.17
Mid-IR	N/A	N/A		1.58-1.75		1.55-1.75 2.08-2.35	
Thermal	**8-12	N/A		N/A		+2.40	+0.50

*Custom wavelength filters can be ordered

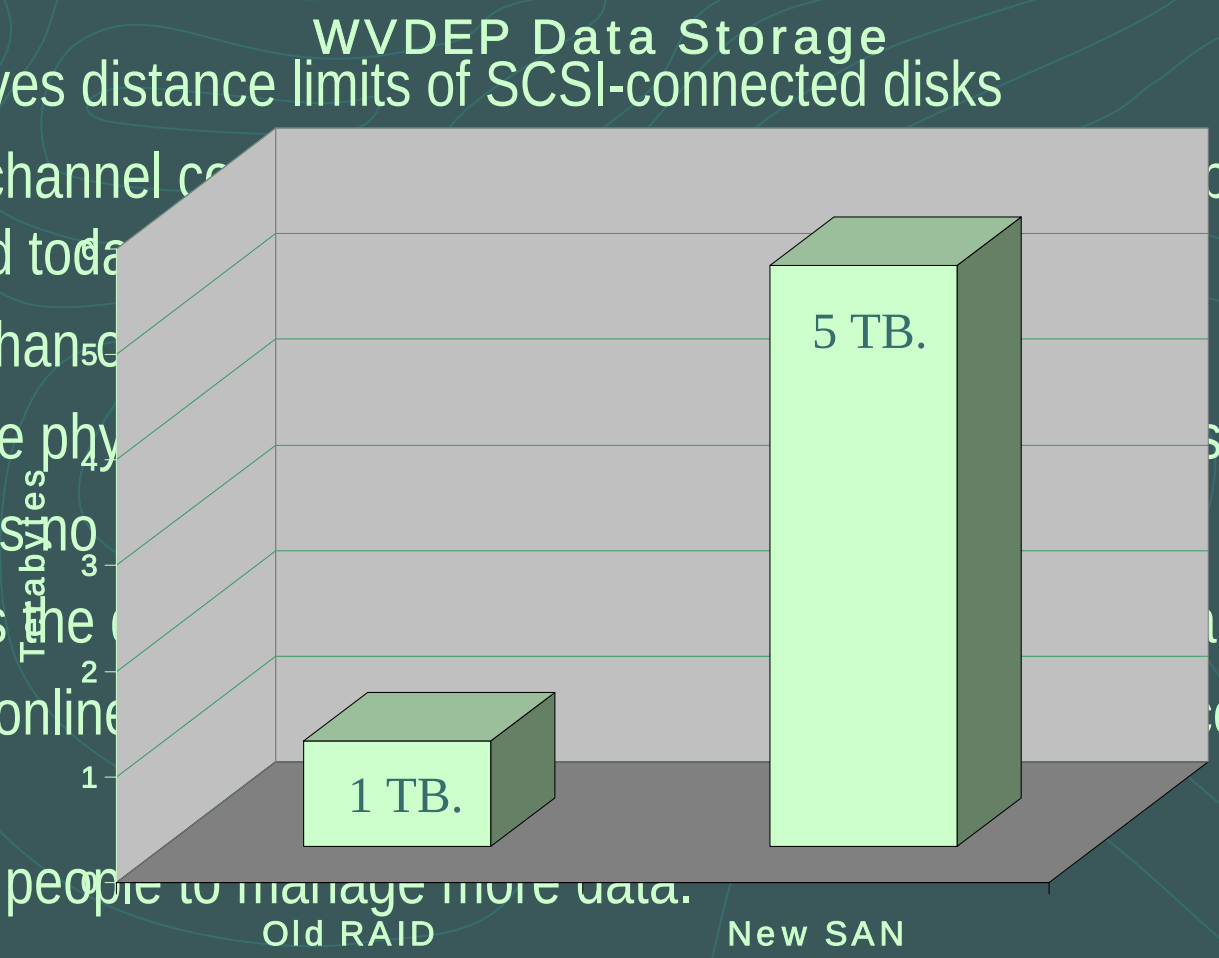
** Thermal can be added at a future date

Migrating WVDEP's GIS Data Archive to Storage Area Network (SAN) Technology

Provides comparable access to geospatial data regardless of user's geographic location (7)

Increases data security (E)

- Removes distance limits of SCSI-connected disks
- Fibre channel c[illegible] per second toda[illegible]
- More than [illegible]
- Multiple phy[illegible]s
- Servers no [illegible]
- Mirrors the [illegible] backup)
- Using online [illegible] corrupted data.
- Fewer people to manage more data.

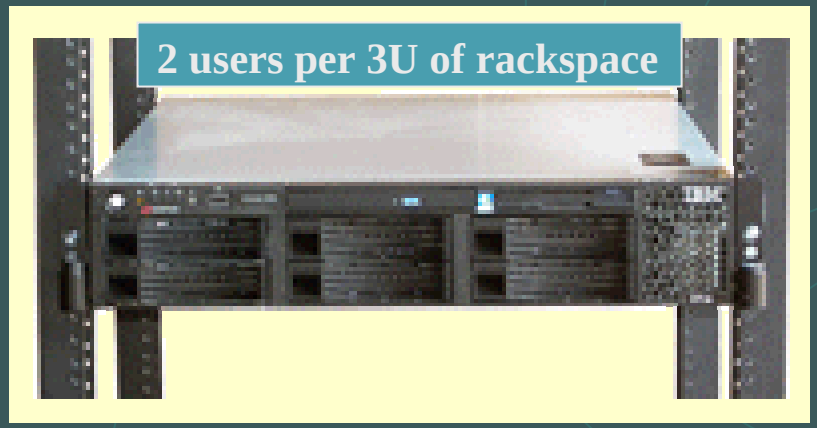


Moving Citrix Farm to Blade Servers with Fibre Channel Gigabit Connection to SAN

Provides comparable geospatial data regardless of user's geographic location (7)

Increases data security (E) & enhances speed, reliability and uptime (F)

- Blades share housing, redundant power, cooling and gigabit speed Ethernet backplane/ switching
- Much lower cost / CPU → lower cost per user

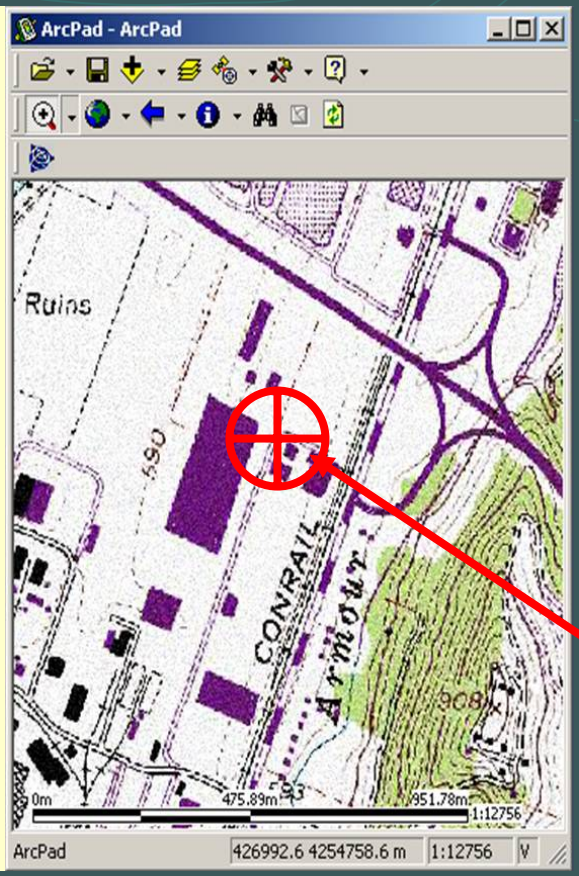


Beginning to Take GIS to the Field .: ArcGIS 8.X Data Check Out

Provides access to other information systems in the organization (2)

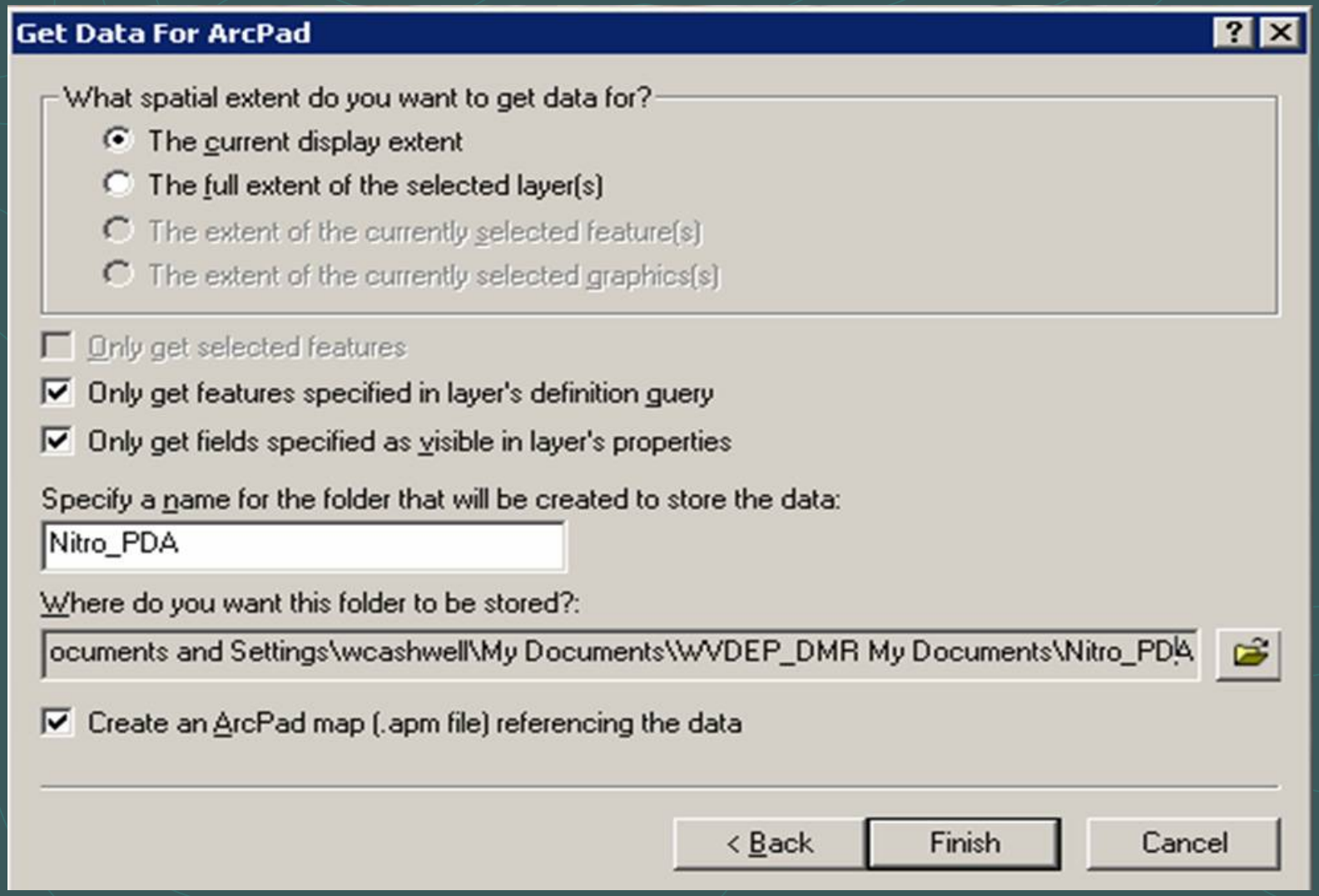
Provides comparable geospatial data regardless ofuser's geographic location (7)

Increases data accessibility (C)



- Fielded initial six HP iPAQs in Division of Mining & Reclamation (permitting staff) late in 2003.
- iPAQs are running ArcPAD
- Fourteen additional systems received but not yet deployed
- ArcPAD shape files combine spatial features with ERIS data
- Adding a GPS receive provides onscreen moving map layers with an indicator of one's exact location.

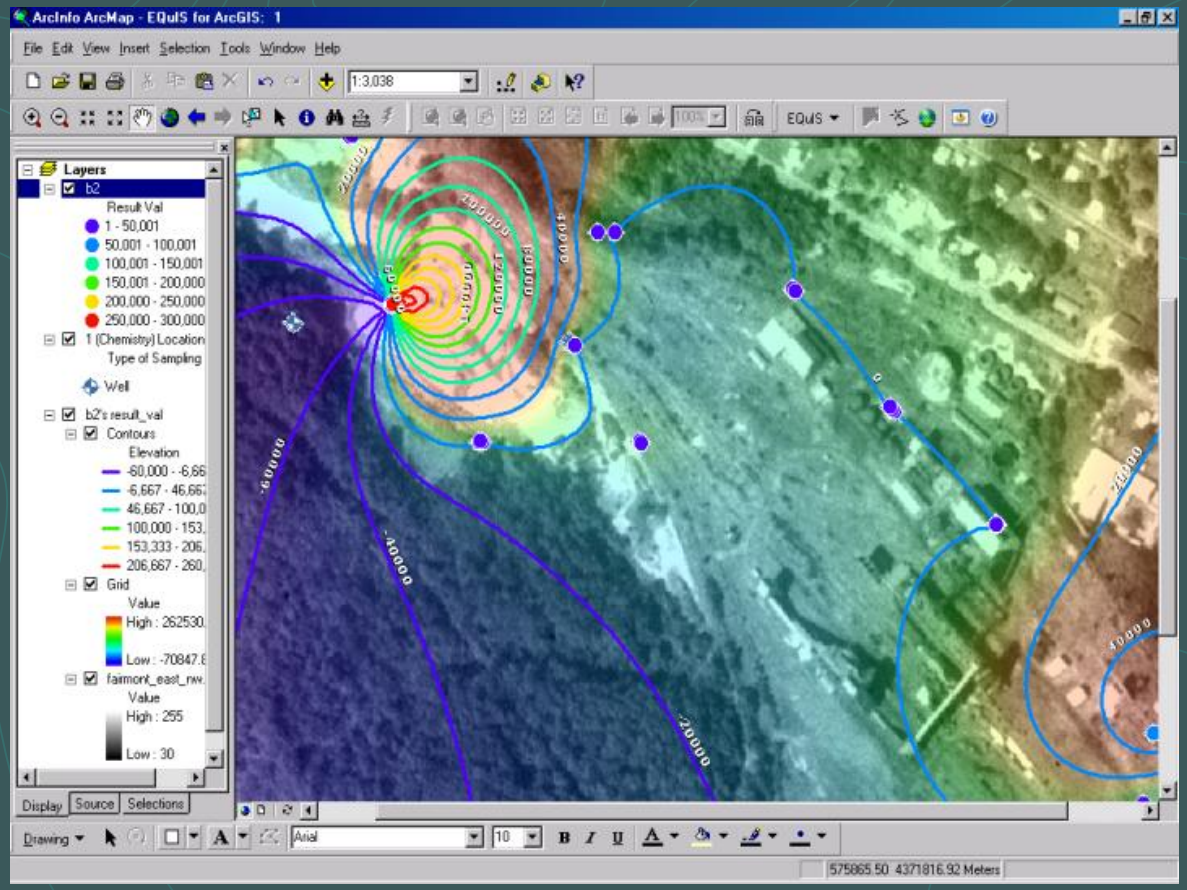
Taking GIS to the Field … ArcGIS data



Environmental Samples Archive … EQuIS

Provides access to other information systems in the organization (2)

Increases productivity (B) & data accessibility (C)



- It is an Oracle database system with tables containing environmental sampling results
  - Surface water samples
  - Groundwater samples
  - Geology samples

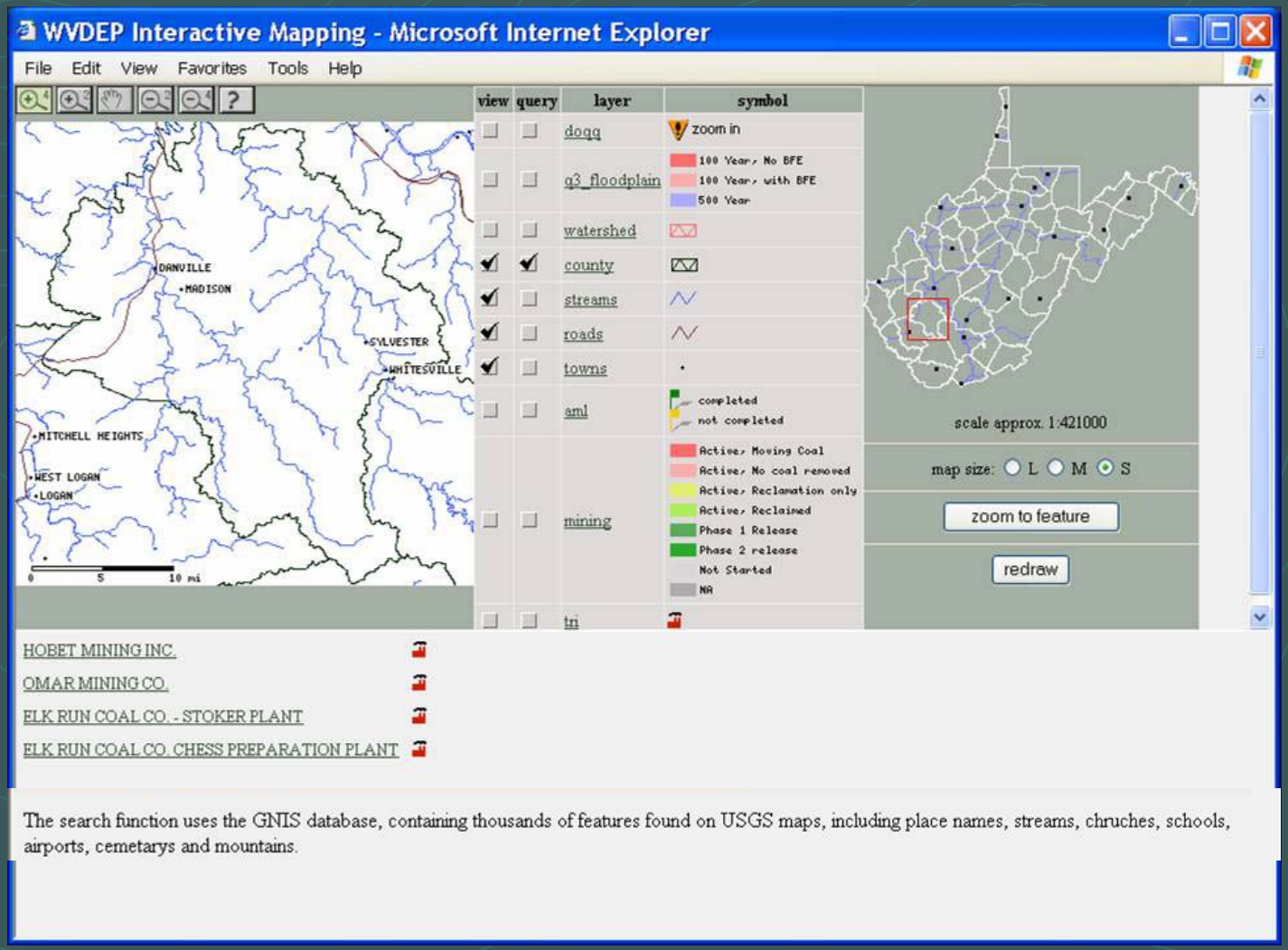
Groundwater pollutant concentration displayed in ArcGIS as colored contours

Expanded functionality of WVDEP's Interactive Mapper

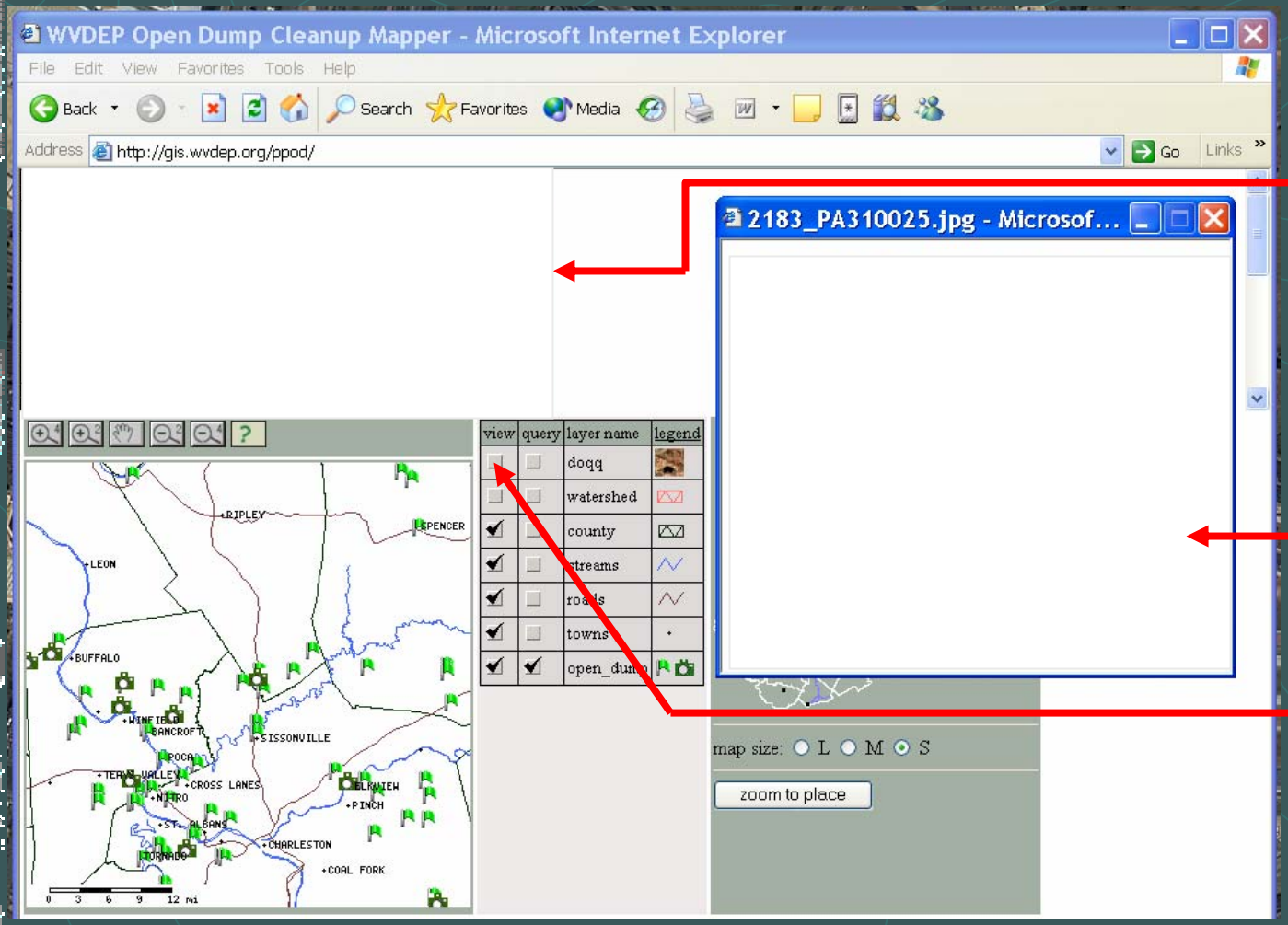
Provides desktop access to all users (1)

Community participation (4)

- Search via GNIS database
- Search by County (new)
- Search by Watershed (new)

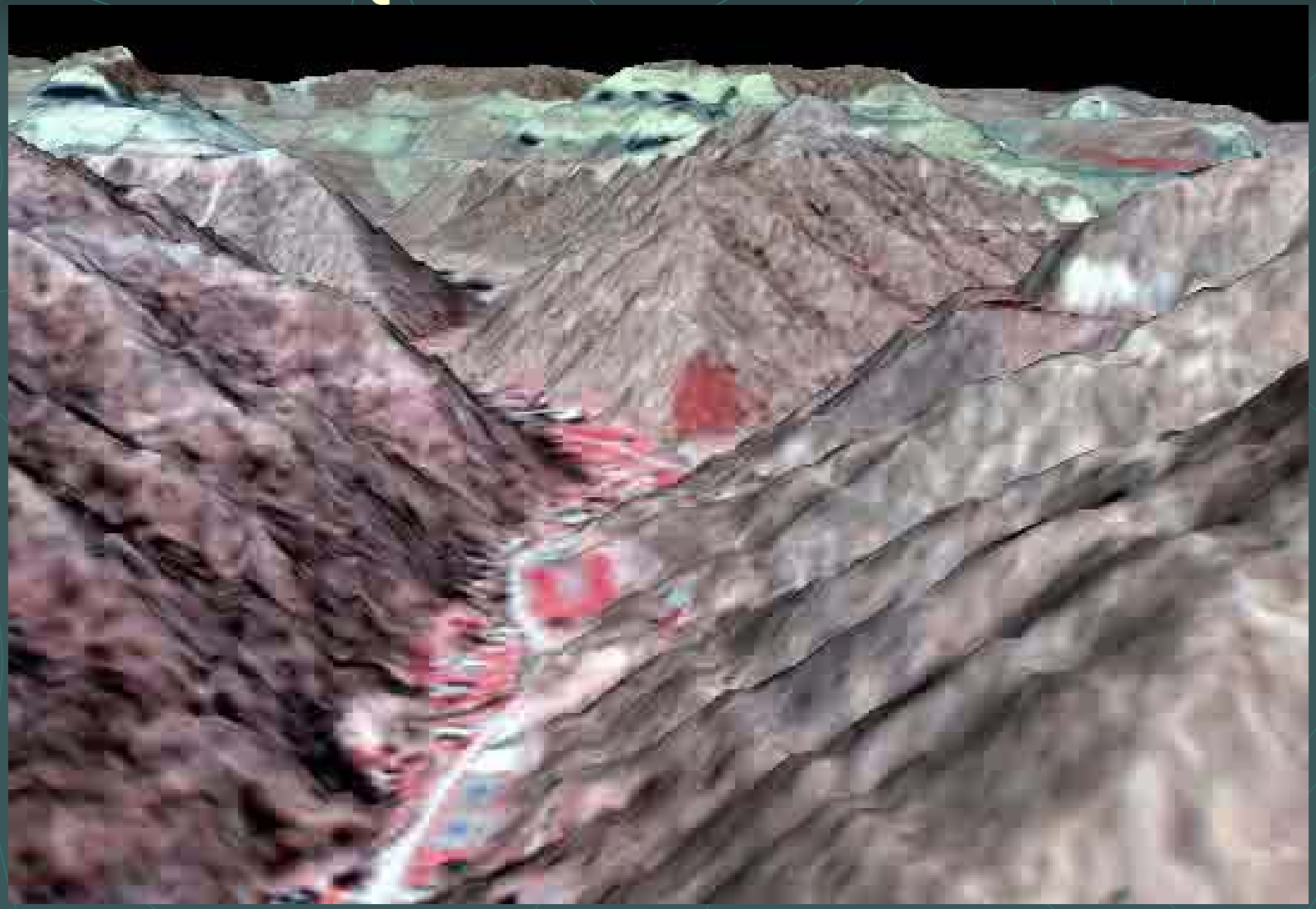


Open Dump Multimedia Custom Mapper Application Integrates Multiple Databases



- Open dump program mapper
  - Pulls data from Oracle client server RDBMS
  - Integrates field photos
  - Uses Statewide '96-'98 DOQQs as basemap

Questions ?



GIS Supported by All departments and management (6)?

TAGIS Unit Internal Structure

Remote Sensing Group

Airborne & Satellite-Based Imaging, Photogrammetry

GIS Remote Sensing Analyst I, II
(1) Doug Brown, GIS RS II
(2) GIS RSA I is an open position

Spatial Applications Development Group

Visual Basic/ArcObjects Apps
Visual Basic for Applications (VBA) Scripting
.NET Apps

GIS Programmer Analyst I, II, III, IV
(3) Dr. Yueming Wu
(4) Ms. Songmei Li

Spatial Analysis Group

Data Compilation, Networking, etc.

GIS Technician
GIS Programmer Analyst I, II, III, IV
(9) Mike Lamb, GIS Technician

Administration & Infrastructure Management Group

Citrix
GIS DBA, EQuIS Data Base Mgmt.
GIS Management

GIS Manager I, II
GIS Data Base Administrator I, II
GIS Technical Systems Administrator I, II
(5) Larry Evans, GIS Manager II
(6) Mike Shank, GIS DBA II
(7) Rob Grigsby, GIS Tech. Sys. Admin. I
(8) Eric Dannaway, EQuIS Gate Keeper