MGISAC
MISSOURI GEOGRAPHIC INFORMATION SYSTEMS ADVISORY COUNCIL

How the Federal Government Uses GIS to Solve Problems

Mark McCart
GeoBase Program Administrator – Whiteman AFB

L3
National Security Solutions

Northeast Regional GIS Workshop | Hannibal, Missouri
22-MAY-2014

UNITED STATES AIR FORCE
GEOBASE

Items to be Covered

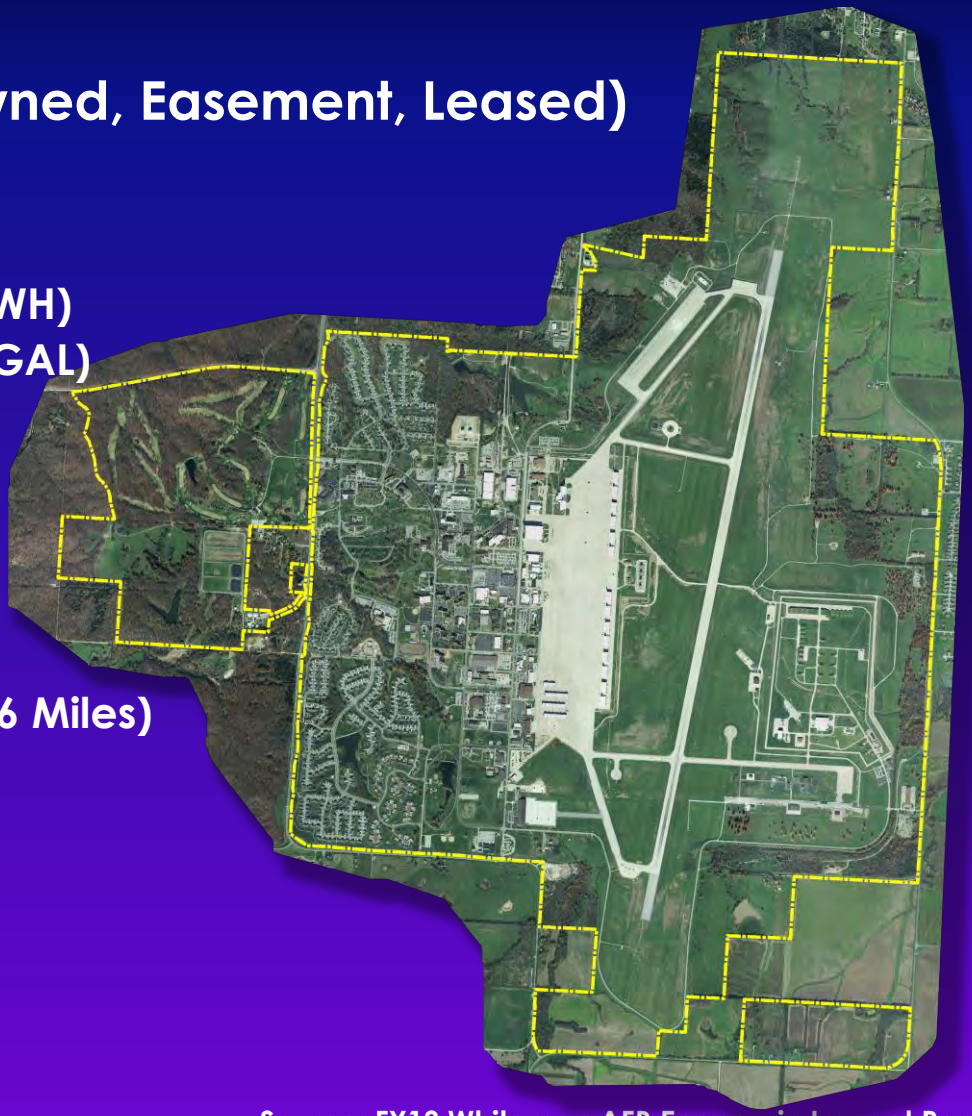
- GeoBase Program Overview
- Whiteman AFB: Just another small town in Missouri
- The basics of a robust GIS program
- Problems solved with GIS:
  - Pavement
  - Utilities
  - Planning and design
  - Space utilization for offices
  - Environmental
  - Tobacco Use Areas
  - Security Forces/Emergency Management
  - Other Solutions
- Web services
- Other GIS Solutions used by the federal government
- Questions & Answers Session

The GeoBase Program

- Started by the USAF in early 2000's
- Early Mission: One Installation…One Map
- Consolidate all maps, data, schematics into a single solution
- Major changes coming in the next 4 years

Whiteman AFB: A Small Town

- Area: 6,025 acres (Fee Owned, Easement, Leased)
- Population: 13,292
- Utility Info:
  - Electrical Lines: 3.6M LF (86KWH)
  - Water Mains: 400K LF (195M GAL)
  - Sanitary Sewer: 270K LF
  - Storm: 395K LF
  - Natural Gas: 393K MBTU
  - Fire Hydrants: 550
- Pavement Info:
  - Roads: 980K SQYD (Paved: 46 Miles)
  - Driveways: 400K SQYD
  - Sidewalks: 157K SQYD
- Buildings: 353 (4M SQFT)
- Houses: 920



-Source: FY13 Whiteman AFB Economic Impact Report

In the Beginning…

- A long standing culture at the base that GeoBase had incorrect data
- Utility shops weren't willing to share information
- Base was never surveyed
- Complete and accurate as-builts not provided by contractors

Garbage In = Garbage Out

- As of January 2011, the base had never been fully surveyed
- Without a spatially accurate dataset, can't use it for analytics
- GIS data was frowned upon for planning purposes due to inaccurate or missing data

The Basics for Engineering GIS

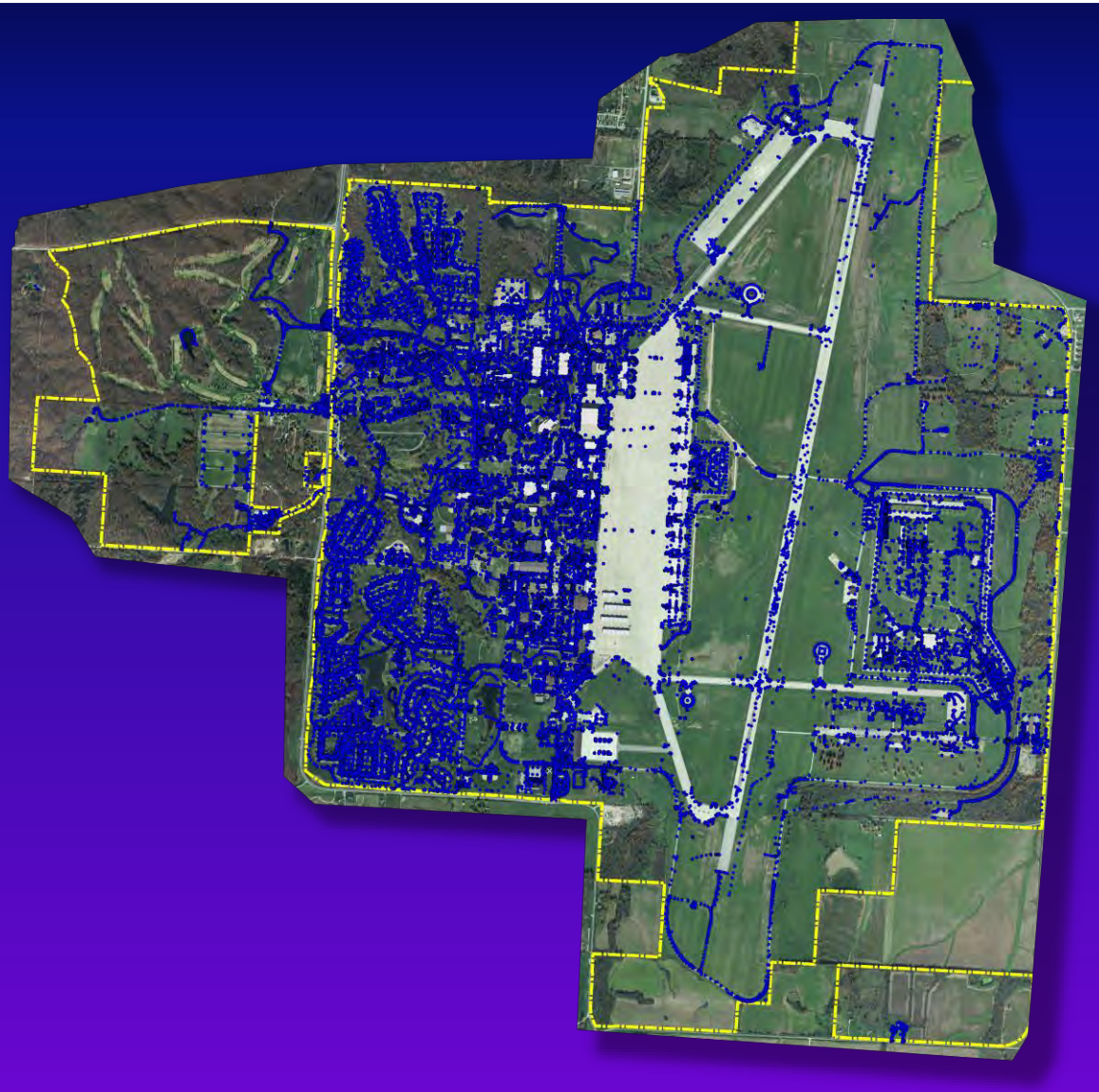
- Accurate spatial location and geometry
- Complete and accurate as-builts
- Complete attributes
- Accurate floorplans
- Once these items are complete the fun begins!

How We Are Fixing the Data

- We set up the base station to pick up GNSS which allowed us to double our available satellites

How We Are Fixing the Data

- Since October 2011, the GeoBase shop has surveyed over 115K points using R7, R8 and 5600 RTK surveys



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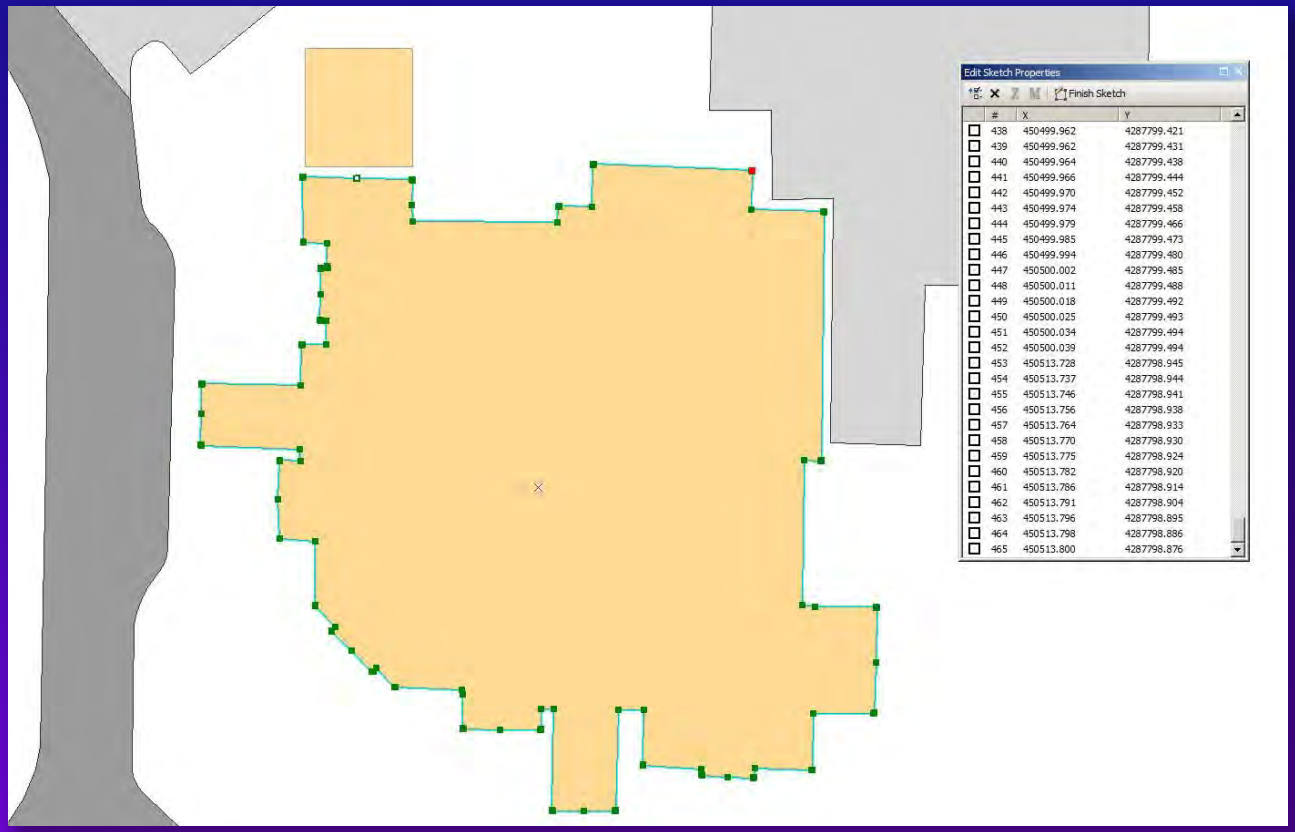

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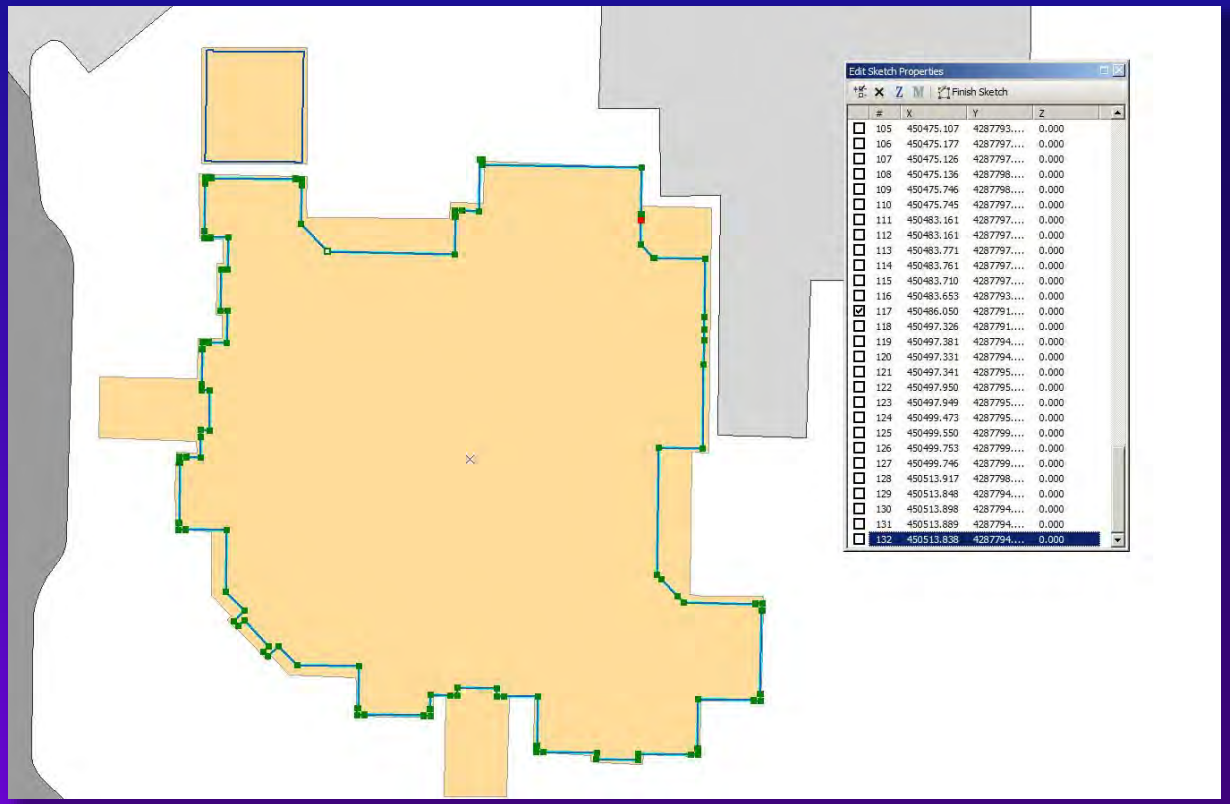

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- As we fixed floorplans and footprints, we discovered that buildings were either larger or smaller than what was loaded into the real property record

How We Are Fixing the Data

- Surveyed and re-drew every road, parking lot, driveway, curb, shoulder and airfield pavement feature

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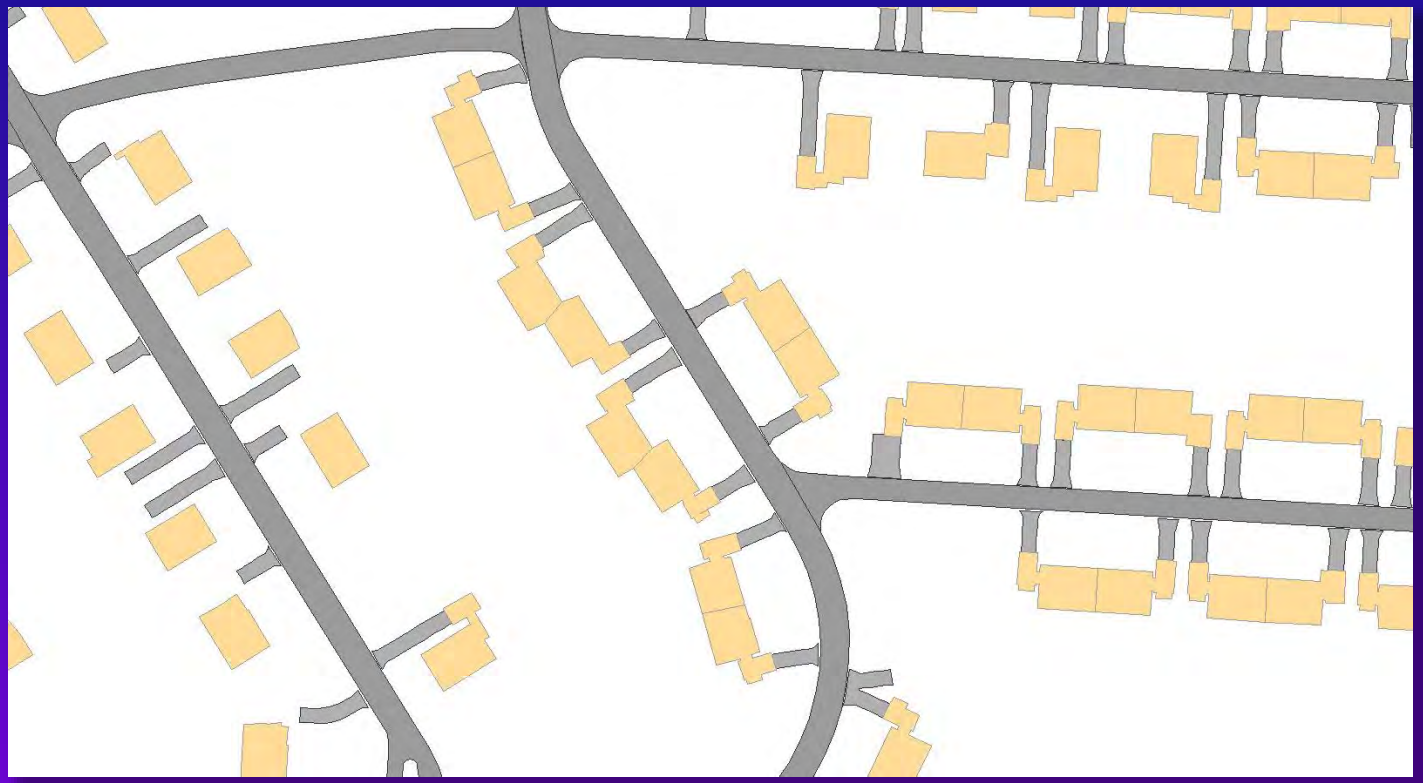

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How We Are Fixing the Data

- As we corrected the pavement data, we discovered that the airfield pavement area was smaller than what was in real property
- We had to document our process to change the permanent real property record

How We Are Fixing the Data

- Surveyed all utility slabs and other non-natural items so we can accurately calculate non-permeable surfaces and mowing acreage

How We Are Fixing the Data

- Re-wrote statement of work for new projects to provide more language for as-built deliverable requirements
- We've been re-building relationships with utility shops by surveying open utility lines quickly
- We survey all new construction as the feature is built/installed

Not Done

- Finally, we are currently correcting utility, sidewalk and fence features
- We are planning on completing all surveying this summer
- Everything except utilities will be corrected by December 2014
- Utilities will be completed by December 2016, if not sooner
- Currently developing solution to handle privatized utilities and housing

Now to the Fun Stuff….

- Once we get everything accurately drawn and attributed, we can really do some fun things.

Pavement

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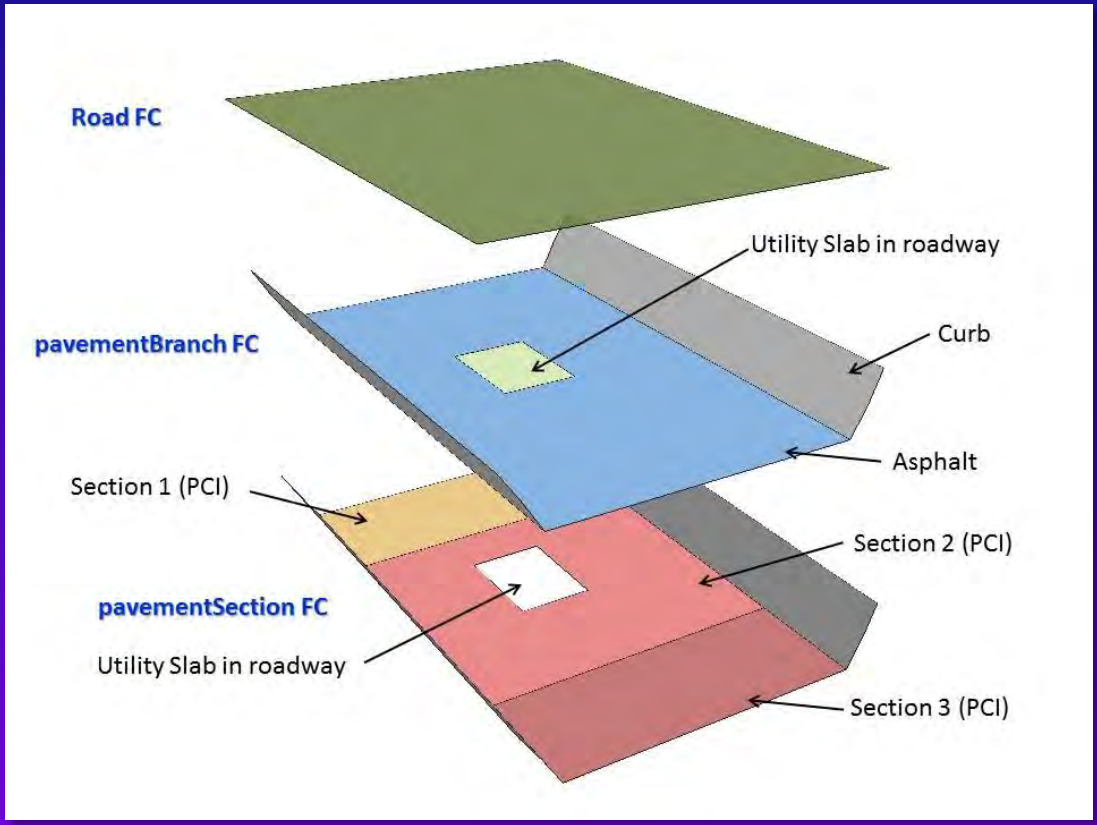

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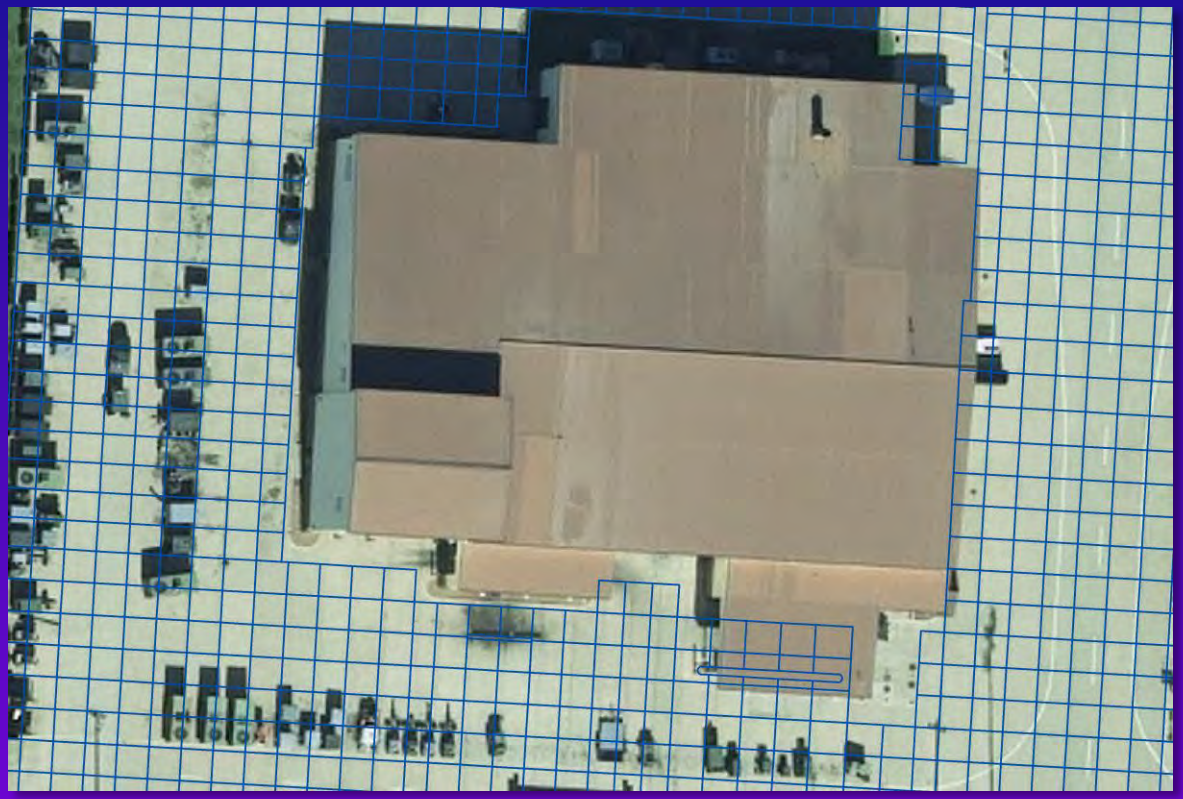

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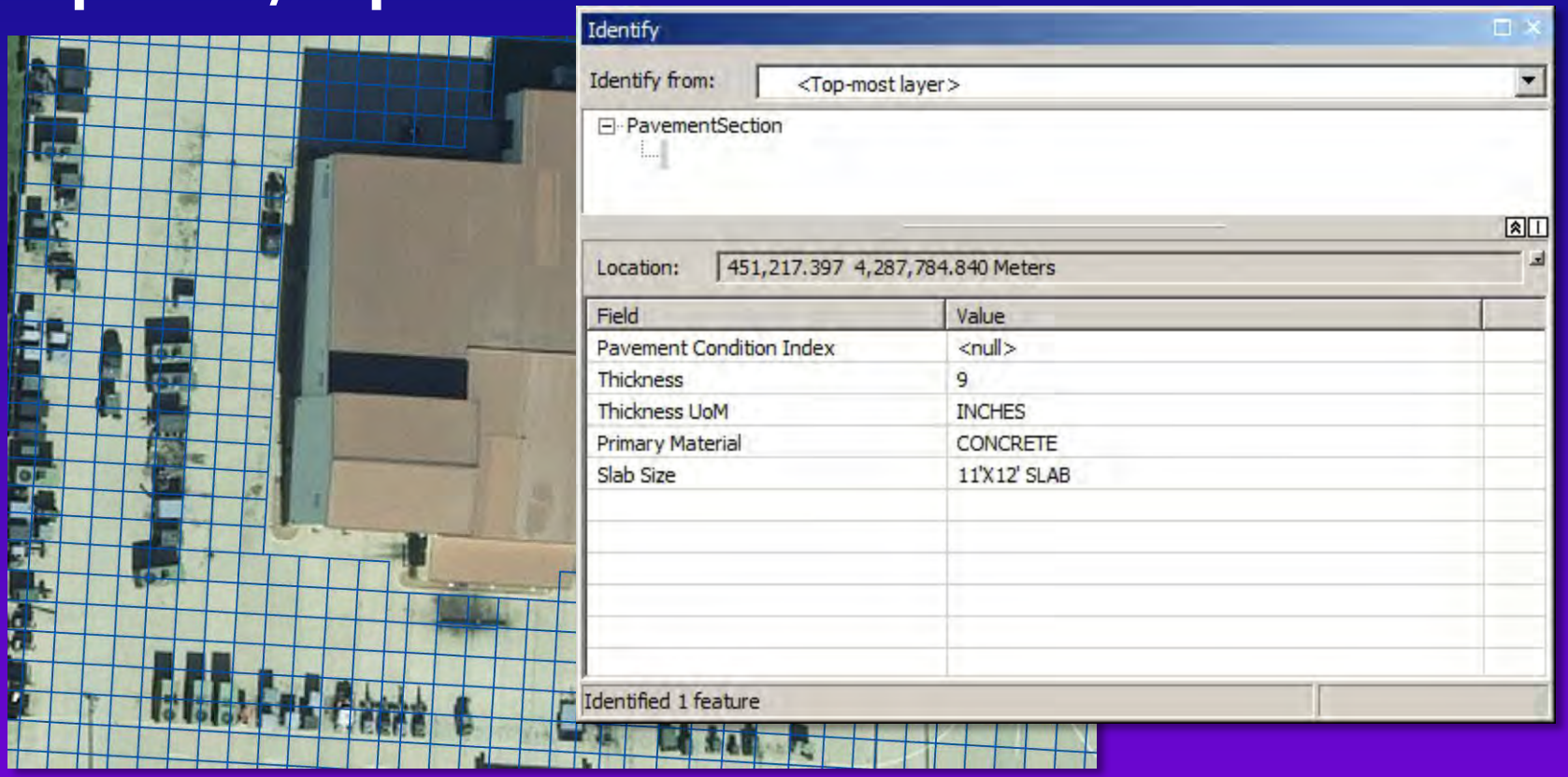

Utilities

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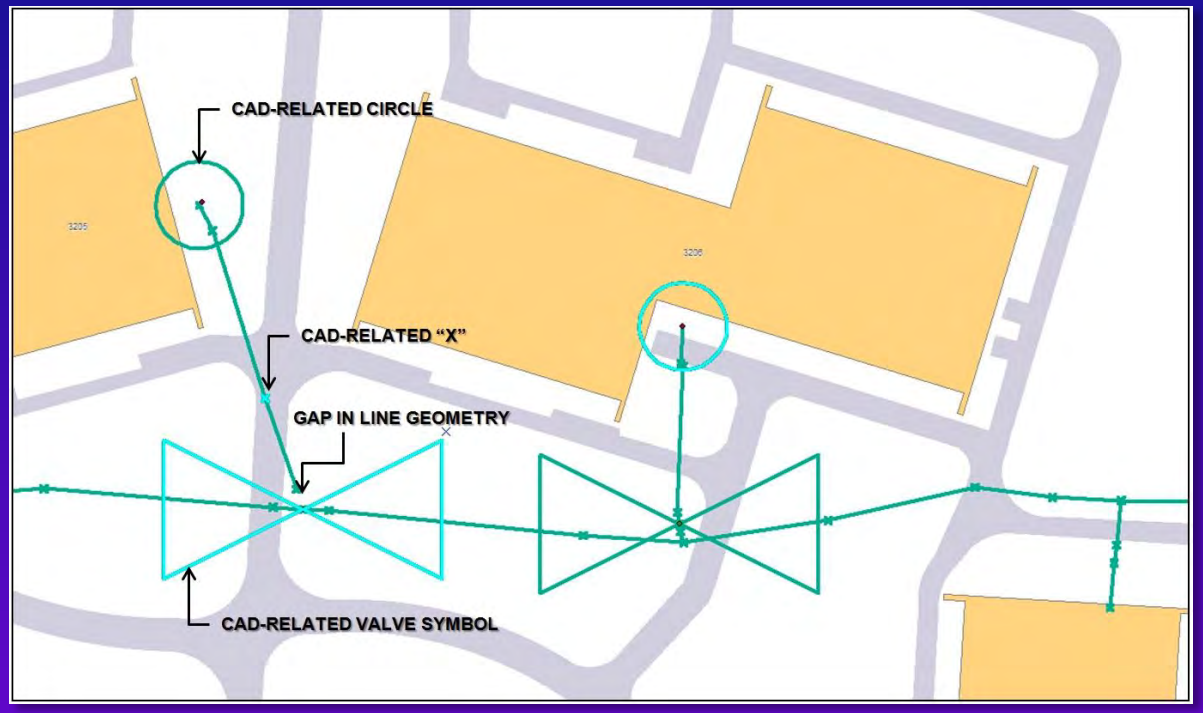

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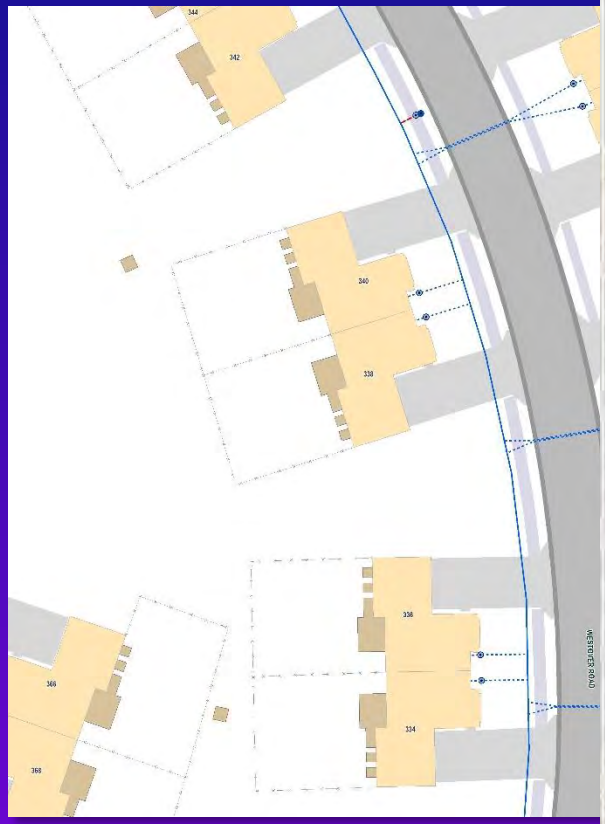

Identify

Identify from: Valves

Valves
A-97

Location: 450,136.710 4,288,496.993 Meters

Field	Value
Valve ID	A-97
Description	VALVE FOR FIRE HYDRANT
GIS Confirm Date	23APR2014 MGM
Control Type	Manual actuation
Valve Type	Gate
Plumbing Zone	ZONE A
In Diameter	6
Out Diameter	6
Installation Date	2012
LASTEDITDATE	20140423
Motorized (Y/N)	No.
Operation Status	The feature is in service.
Regulation Type	Flow
Survey Info	23APR2014 R8 MM

Identified 1 feature

Utility Data Stewardship

- Data Steward Program Developed for each system
- Subject Matter Experts (SMEs) are accountable for incorrect/missing data
- Each shop has resource-grade GPS units
- Editable Web Services

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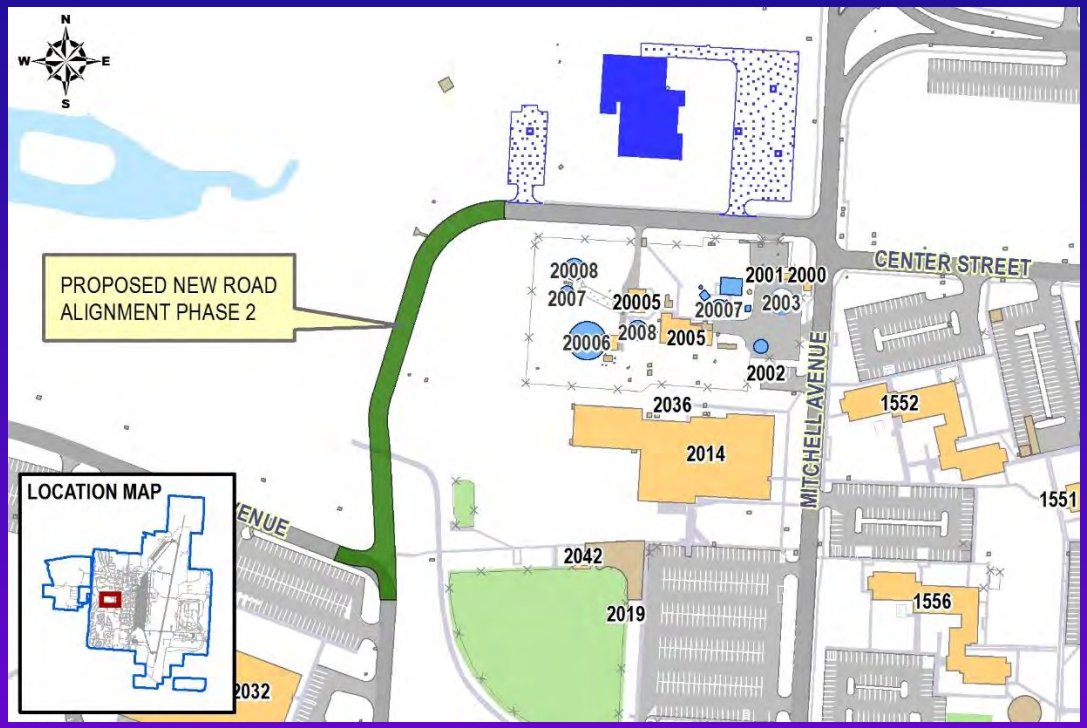
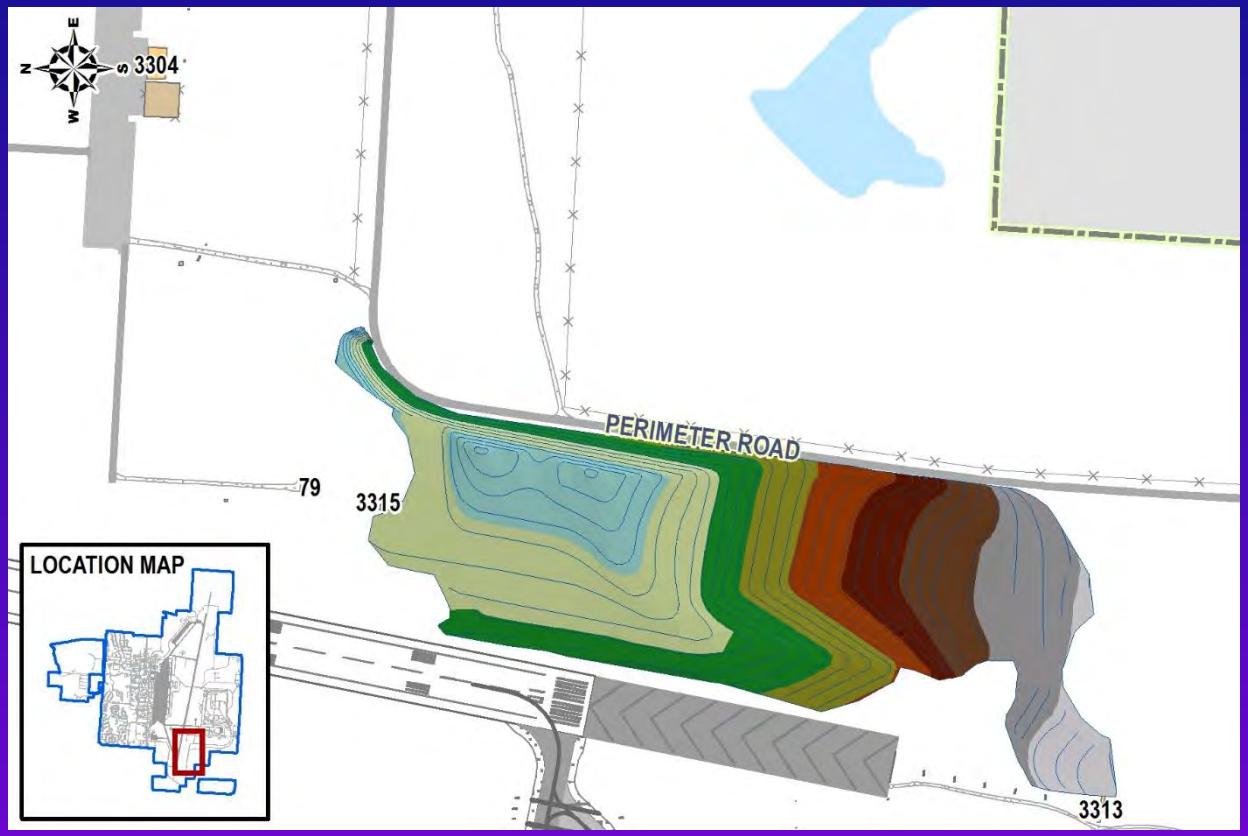


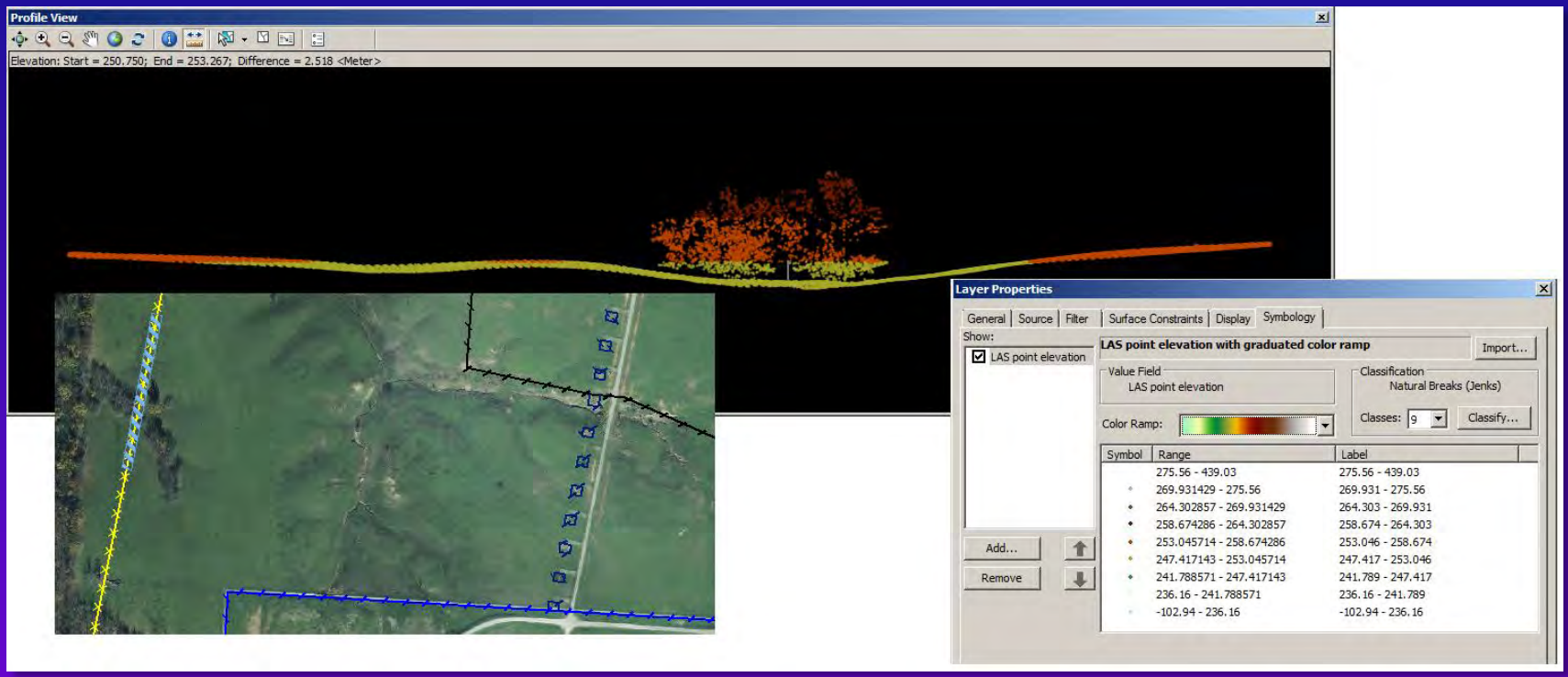
Planning & Design

- It also provides a great tool to brief leadership on proposed actions



Planning & Design

- LiDAR acquisition in 2012 has greatly increased our productivity and reduced costs for project design and programming



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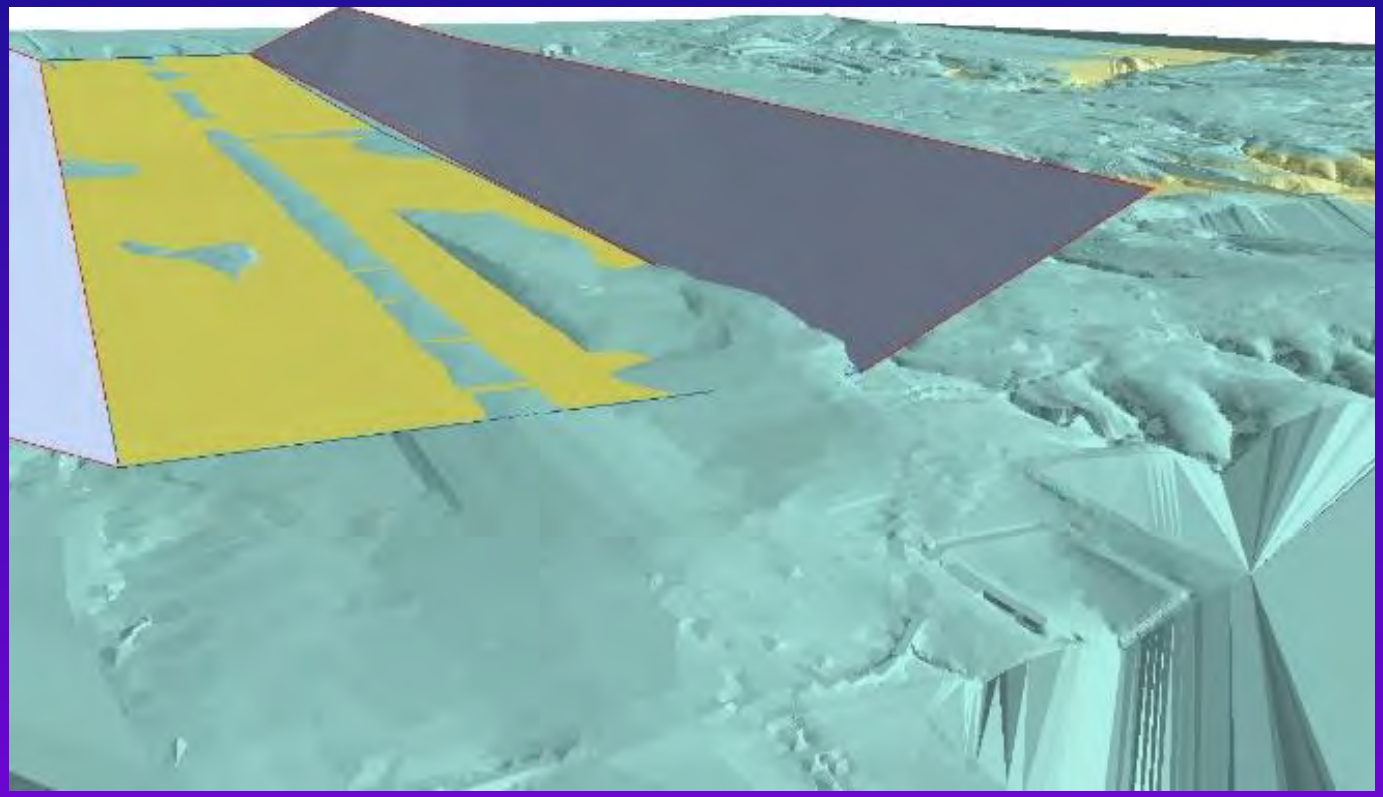
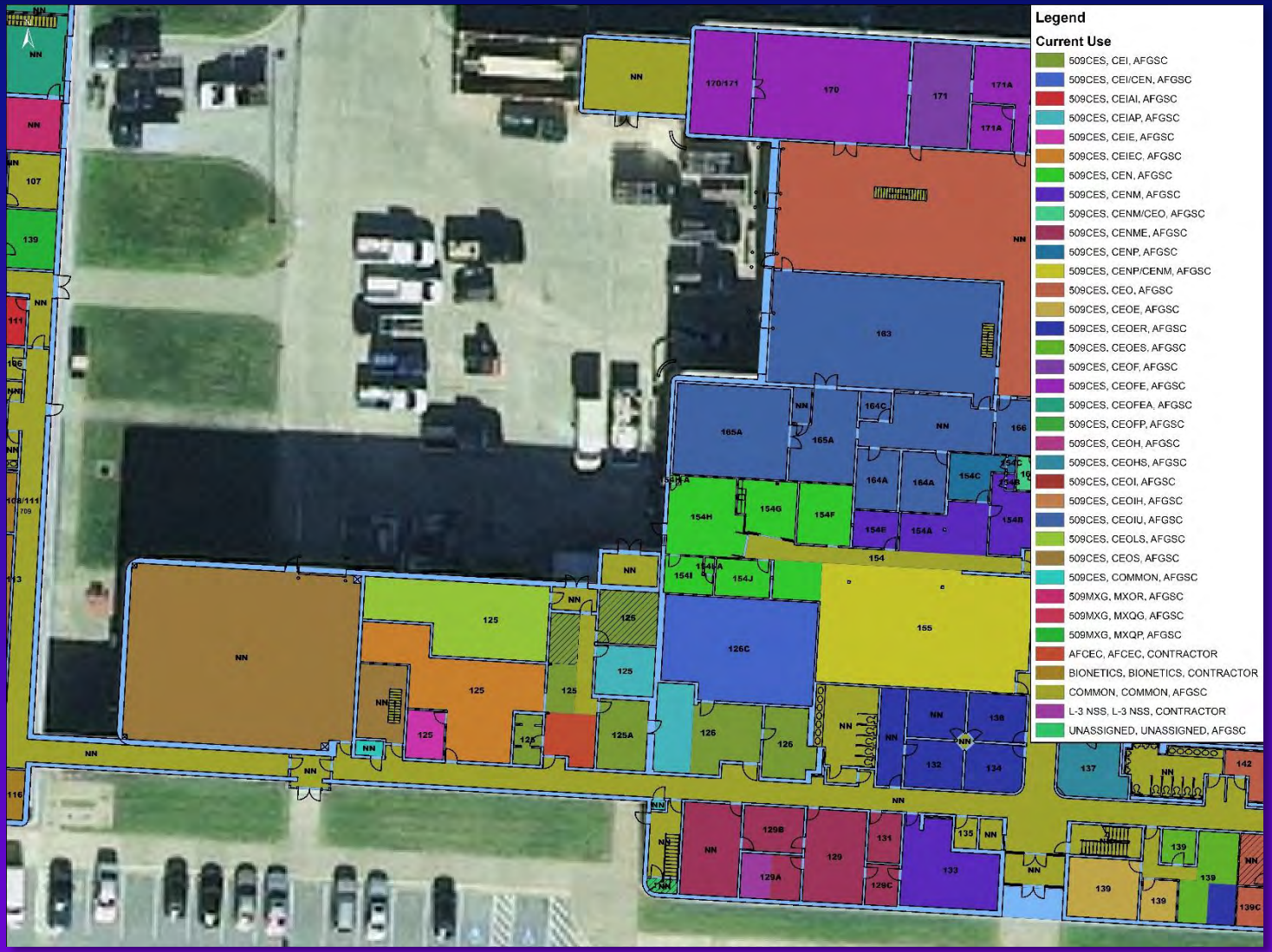


Office Space Utilization

- The USAF requires a maximum amount of square-footage based on job title/job function
- With accurate floorplans, we can track who sits where on base

Office Space Utilization



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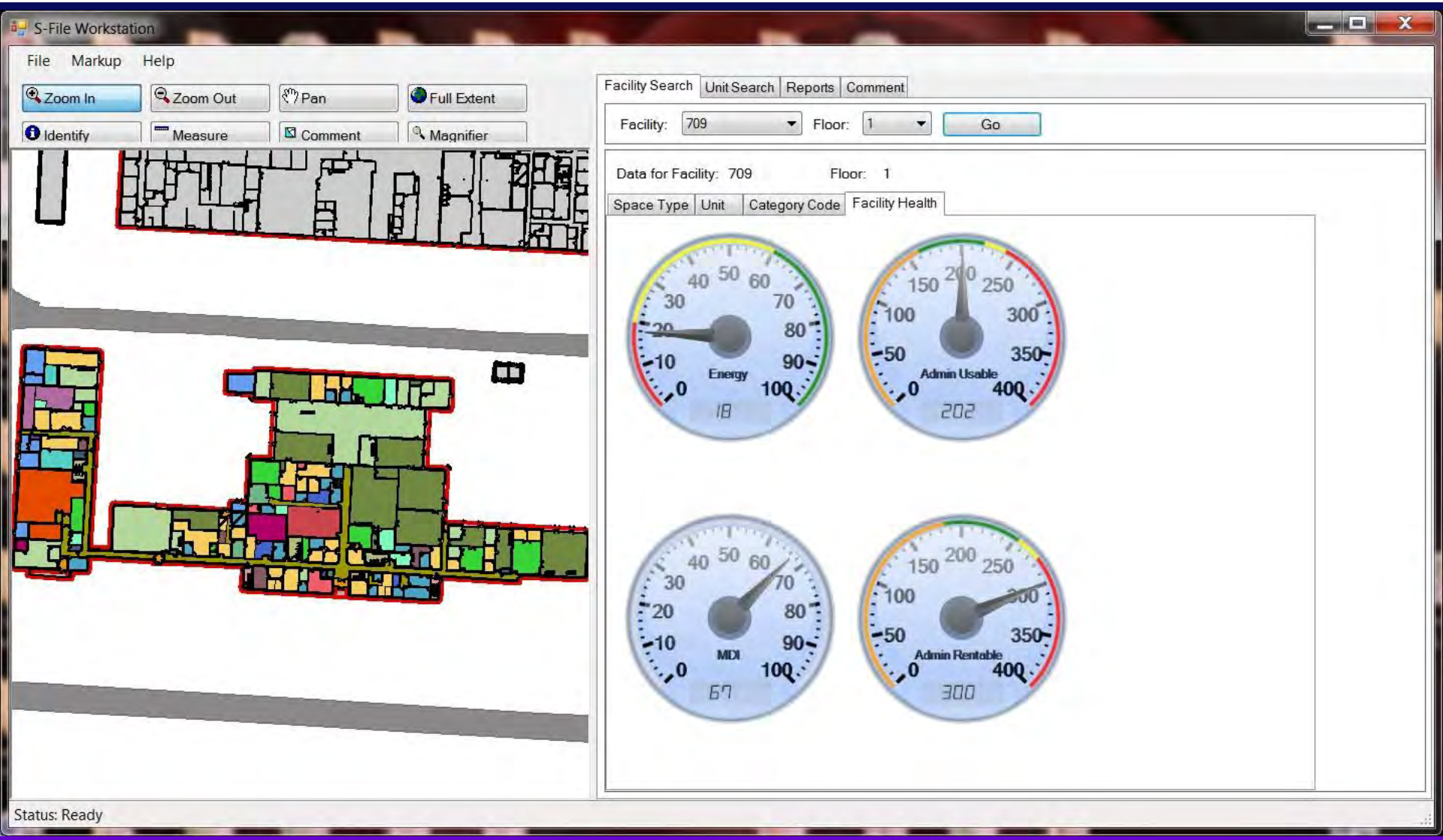
- We can also track unutilized space or vacant offices

Office Space Utilization



Office Space Utilization

S-File Workstation

File Markup Help

Zoom In | Zoom Out | Pan | Full Extent

Identify | Measure | Comment | Magnifier

Facility Search | Unit Search | Reports | Comment

Comments | Energy

Functional User | Facility | CATCODE | OSCRE L3 Space Type | Vacancy | Position Standard vs Actual | Installation Summary

Facility: FI:

100% Find | Next

Facility		FAC Code	Primary CATCODE	Exterior Gross (SF)	Admin Usable Area (SF)	Admin Usable (SF/P) 200 SF/P	Admin Rentable (SF)
1553	Zoom	7220	722351	24,864	894	149	
1556	Zoom	7210	721312	48,743	166		1
1559	Zoom	7210	721312	53,138	161		
1560	Zoom	7210	721312	47,595	140		1
1561	Zoom	7210	721312	47,471	588	147	1
1570	Zoom	7234	723392	190			
1621	Zoom	7447	740672	1,381			
1631	Zoom	7234	723392	496			
1704	Zoom	1498	730839	132			
1705	Zoom	1498	730839	285			
1706	Zoom	1498	730839	3,399	545	68	
1708	Zoom	8910	841169	182			
1720	Zoom	2111	211111	83,597	9,505	257	1
1730	Zoom	1445	730841	5,480	981	196	
1732	Zoom	5304	740270	3,116	606	202	
1750	Zoom	1714	171445	39,285	12,616	76	1

Status: Ready

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Unit filter

100% Find Next

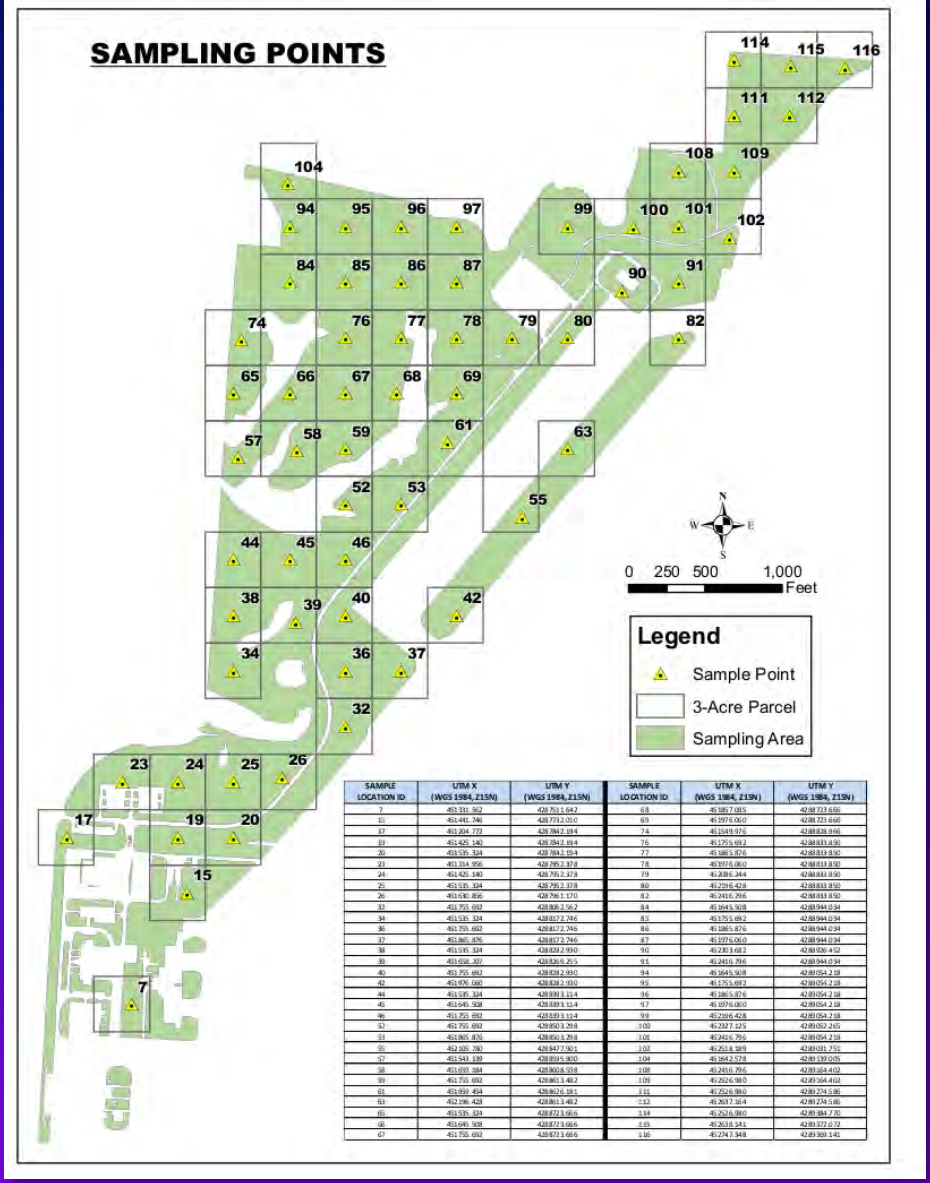
Job Function	Number of Personnel	Office Area (SF)	Authorized Standard (SF)
Wing Commander	3	420	350
Deputy Wing Commander	2	302	350
Group Commander	11	309	250
Deputy Group Commander	7	149	250
Squadron Commander	42	228	200
Deputy Squadron Commander	8	177	150
Flight Commander	137	136	150
First Sergeant	35	132	120
Superintendent	150	140	120
NCOIC	610	109	120
Secretary	21	257	120
Worker/Administrative	2,460	92	100
Student	3	154	25
Contractor	252	150	100
Civilian Volunteer	2	86	60
Total SF		**397,830**	**405,715**

Status: Ready

Environmental Support

- BioEnvironmental Shop asked GeoBase for help developing base-wide sampling program based on specific criteria
- 3-acre plots generated on all natural surfaces (excluded pavement, buildings, etc.)
- Randomly choose ½ available sample points

Environmental Support



SAMPLE LOCATION ID	UTM X (WGS 1984, Z15N)	UTM Y (WGS 1984, Z15N)	SAMPLE LOCATION ID	UTM X (WGS 1984, Z15N)	UTM Y (WGS 1984, Z15N)
7	451 331.562	428 753.1 642	68	453857.085	4288 723.666
11	451 441.746	428 773.2 10.0	69	453976.060	4288 723.666
17	451 204.772	428 784.2 194	74	451549.976	4288 826.866
19	451 425.140	428 784.2 194	76	451755.692	4288 833.850
20	451 535.324	428 784.2 194	77	451865.876	4288 833.850
23	451 314.956	428 795.2 378	78	453976.060	4288 833.850
24	451 425.140	428 795.2 378	79	452286.244	4288 833.850
25	451 535.324	428 795.2 378	80	452296.428	4288 833.850
26	451 630.856	428 796.1 170	82	452416.796	4288 833.850
32	451 755.692	428 808.2 562	84	451645.508	4288 944.034
34	451 535.324	428 817.2 746	85	451755.692	4288 944.034
36	451 755.692	428 817.2 746	86	451865.876	4288 944.034
37	451 865.876	428 817.2 746	87	451976.060	4288 944.034
38	451 535.324	428 839.2 930	90	452303.682	4288 936.452
39	451 658.201	428 826.9 255	91	452416.796	4288 944.034
40	451 755.692	428 828.2 930	94	451645.508	4289 054.218
42	451 976.060	428 828.2 930	95	451755.692	4289 054.218
44	451 535.324	428 839.1 114	96	451865.876	4289 054.218
45	451 645.508	428 839.1 114	97	451976.060	4289 054.218
46	451 755.692	428 839.1 114	99	452286.428	4289 054.218
52	451 755.692	428 850.1 298	100	452327.125	4289 052.265
53	451 865.876	428 850.1 298	101	452416.796	4289 054.218
55	452 103.780	428 847.7 301	102	452518.389	4289 031.751
57	451 543.139	428 859.5 300	104	451 642.578	4289 139.005
58	451 602.384	428 860.8 598	108	452416.796	4289 164.402
59	451 755.692	428 861.3 482	109	452526.980	4289 164.402
61	451 939.464	428 862.6 181	111	452526.980	4289 274.586
63	452 196.428	428 861.1 482	112	452637.164	4289 274.586
65	451 535.324	428 872.1 666	114	452526.980	4289 384.770
66	451 645.508	428 872.1 666	115	452618.141	4289 372.072
67	451 755.692	428 872.1 666	116	452747.348	4289 369.141

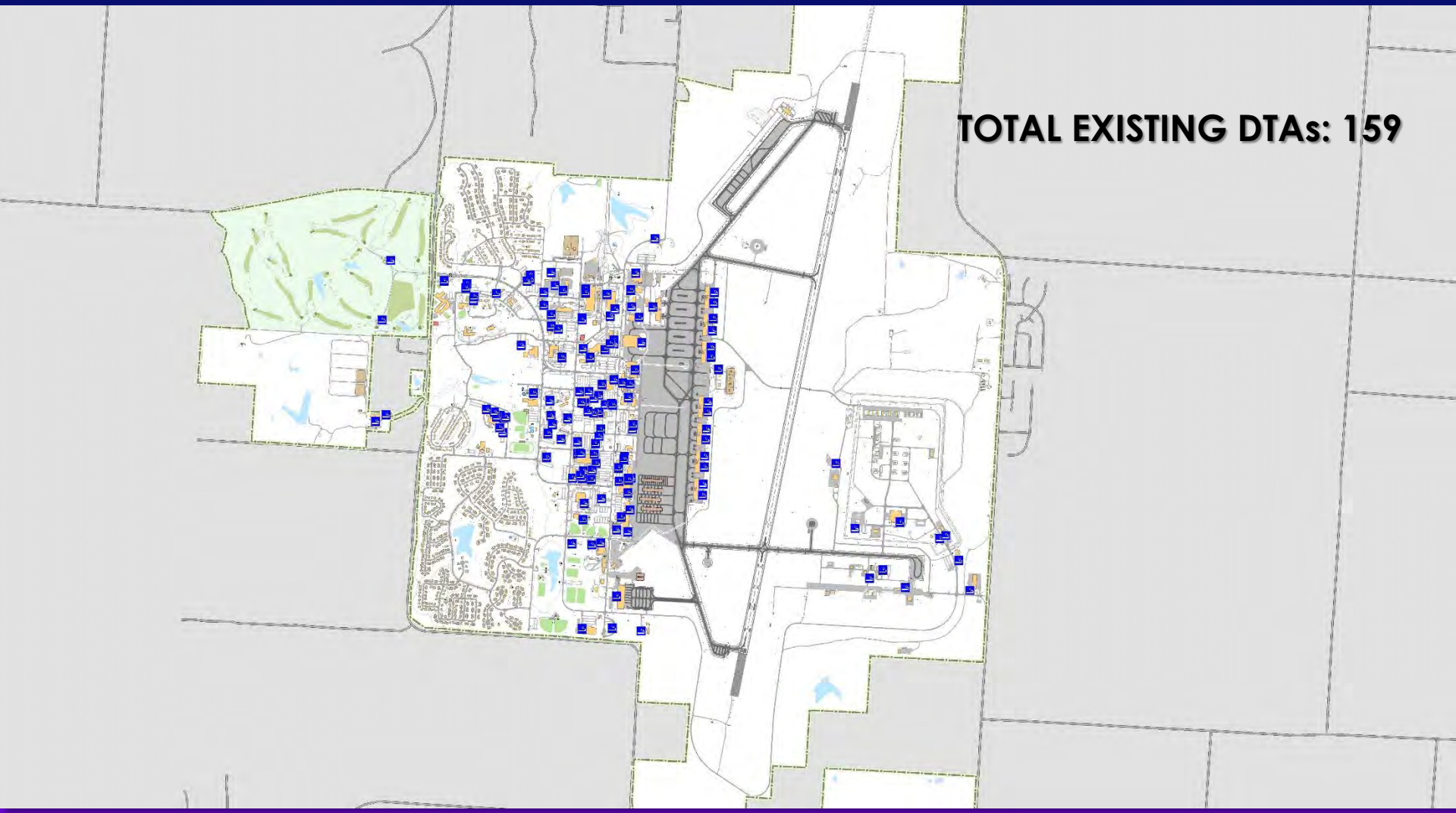
Tobacco Use Area Delineation

- In 2012, HQ USAF (HAF) sent out new guidance for creating Designated Tobacco Use Areas (DTAs)
- Med Group came to GeoBase to develop DTAs for base

Tobacco Use Area Delineation

- First, we had to account for existing DTAs

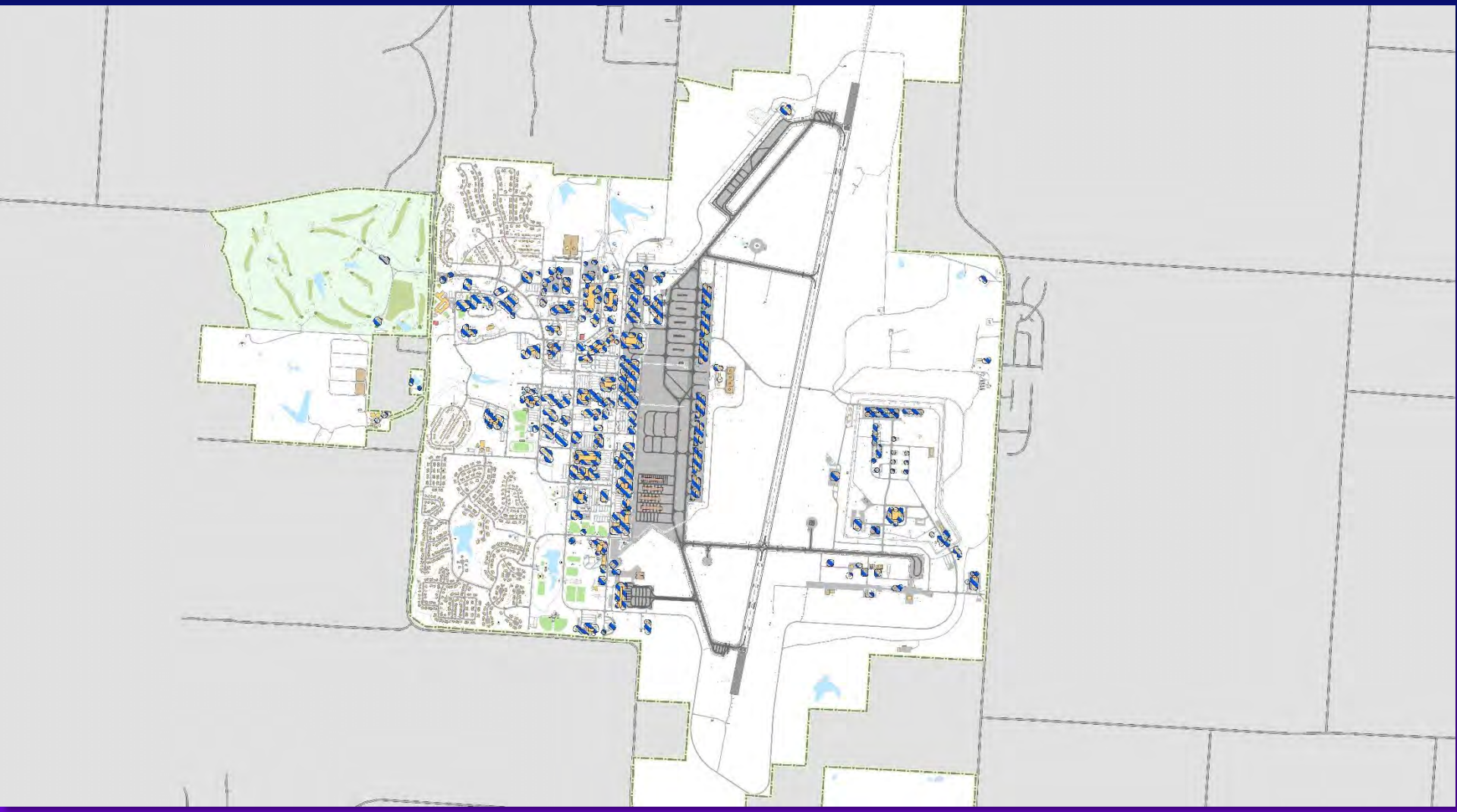
Tobacco Use Area Delineation



Tobacco Use Area Delineation

- Second, we had create 50FT buffers for all windows and doors

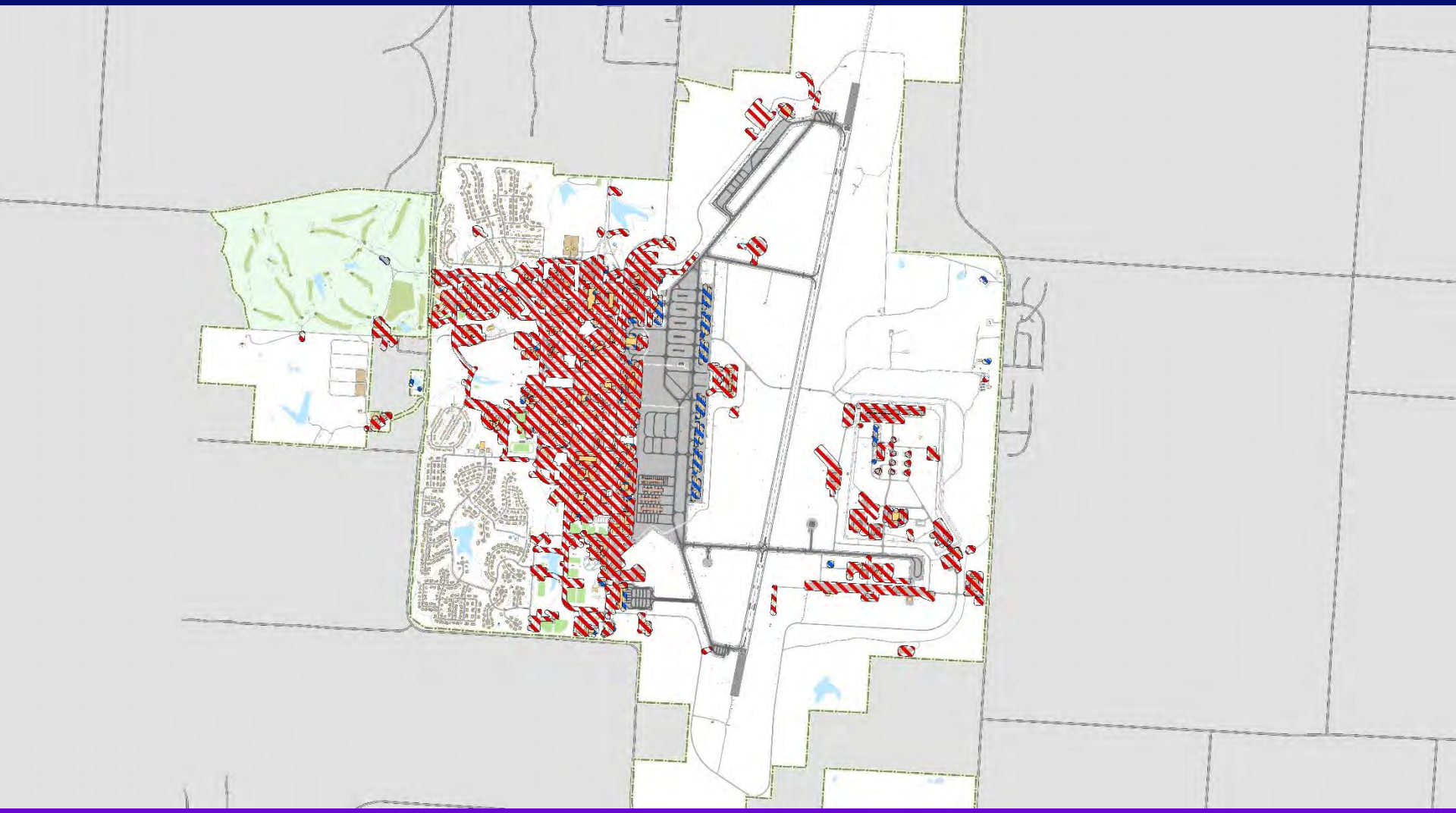
Tobacco Use Area Delineation



Tobacco Use Area Delineation

- Next, we had to create a 50FT buffer for all parking lots

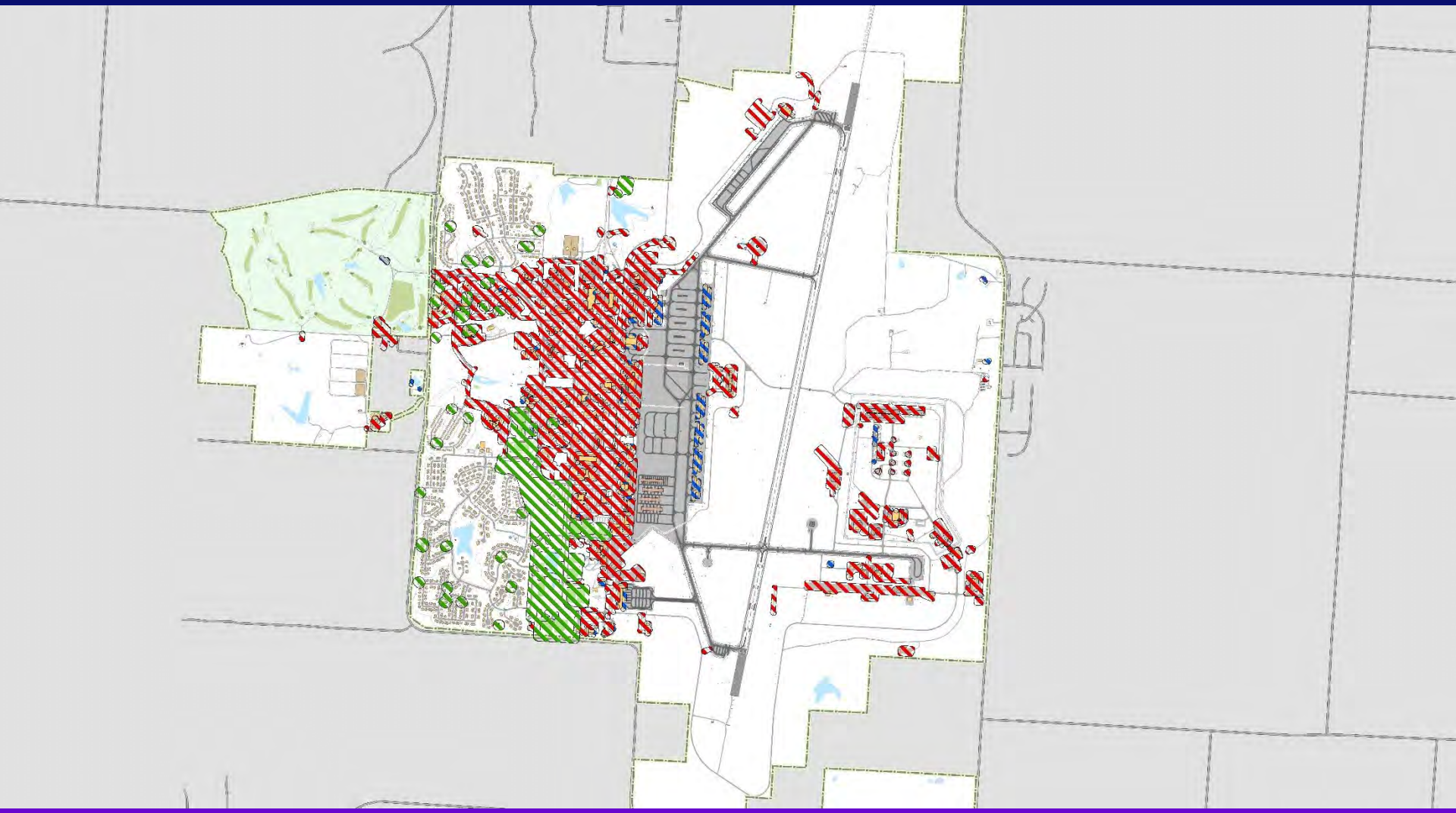
Tobacco Use Area Delineation



Tobacco Use Area Delineation

- Next, we had to create a 100FT buffer for all playgrounds and recreation areas

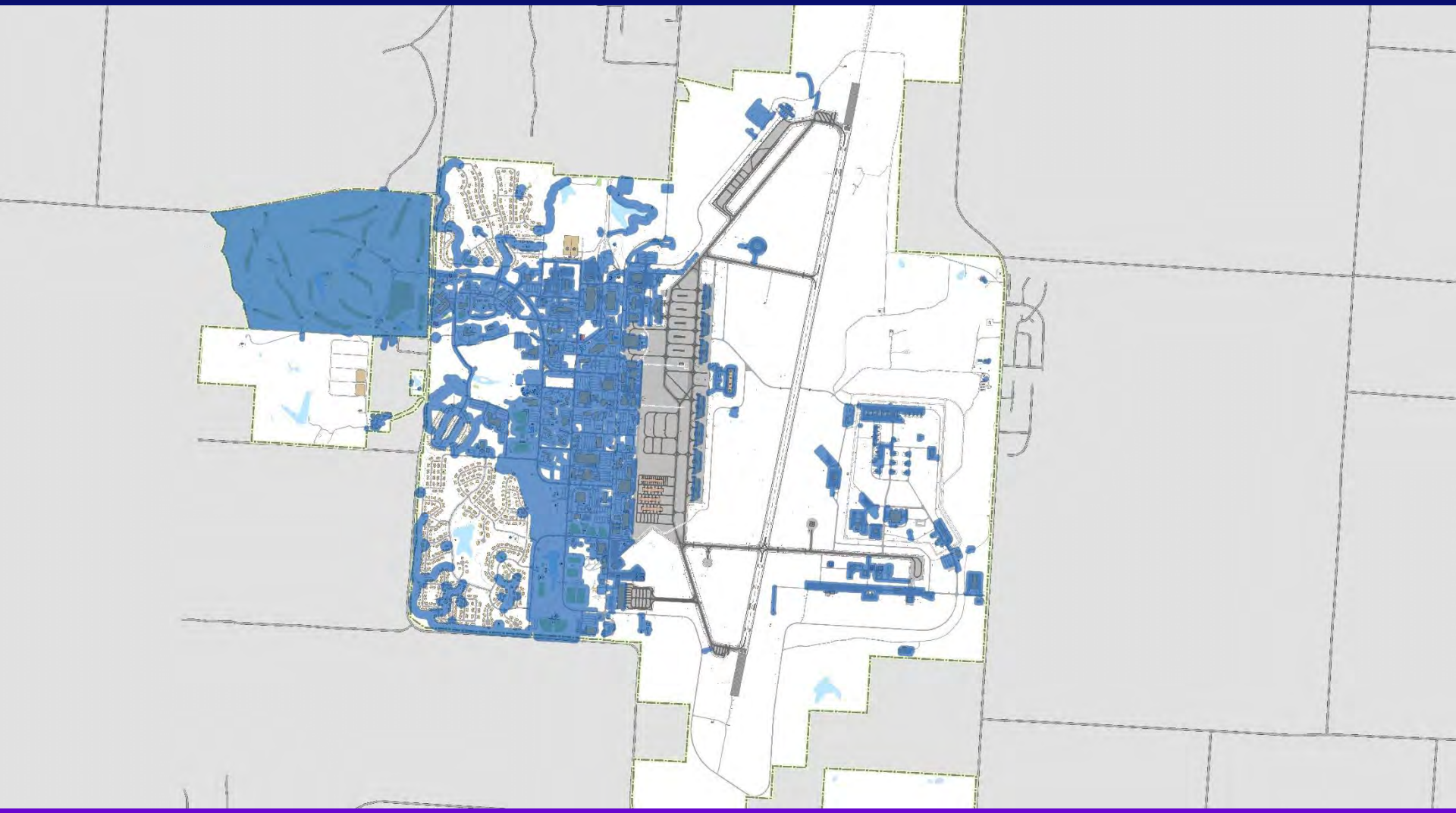
Tobacco Use Area Delineation



Tobacco Use Area Delineation

- Finally, we combined all the buffers and added all walking/running trails and the entire golf course and we ended up with this

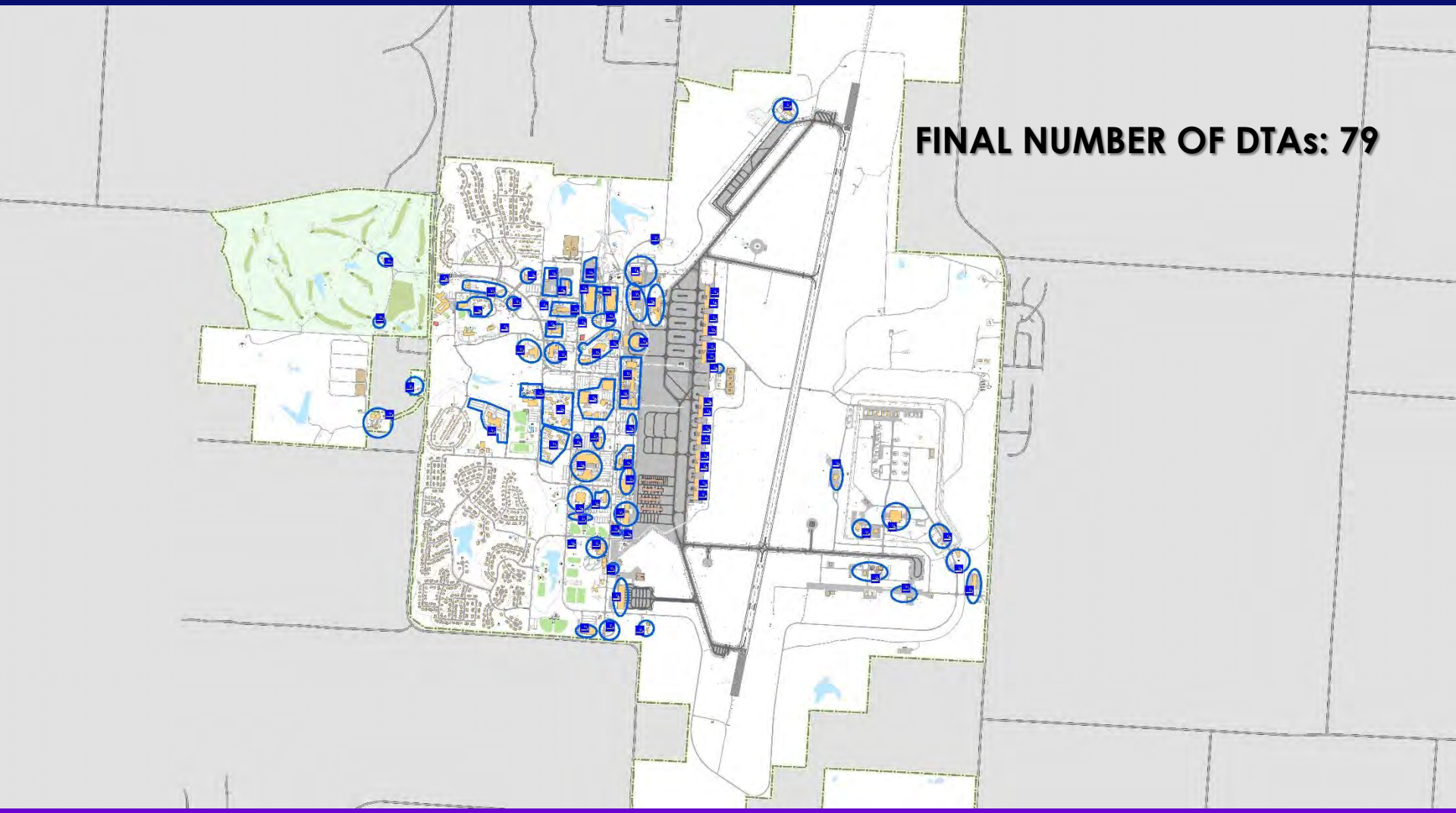
Tobacco Use Area Delineation



Tobacco Use Area Delineation

- After the requirements were mapped, we worked with Real Property Office and Med Group to define DTA campuses to reduce total number of DTAs

Tobacco Use Area Delineation



Security Forces

- Security Forces (SFS) asked us to develop a map-based solution for creating live, dynamic cordons for active incidents

Security Forces

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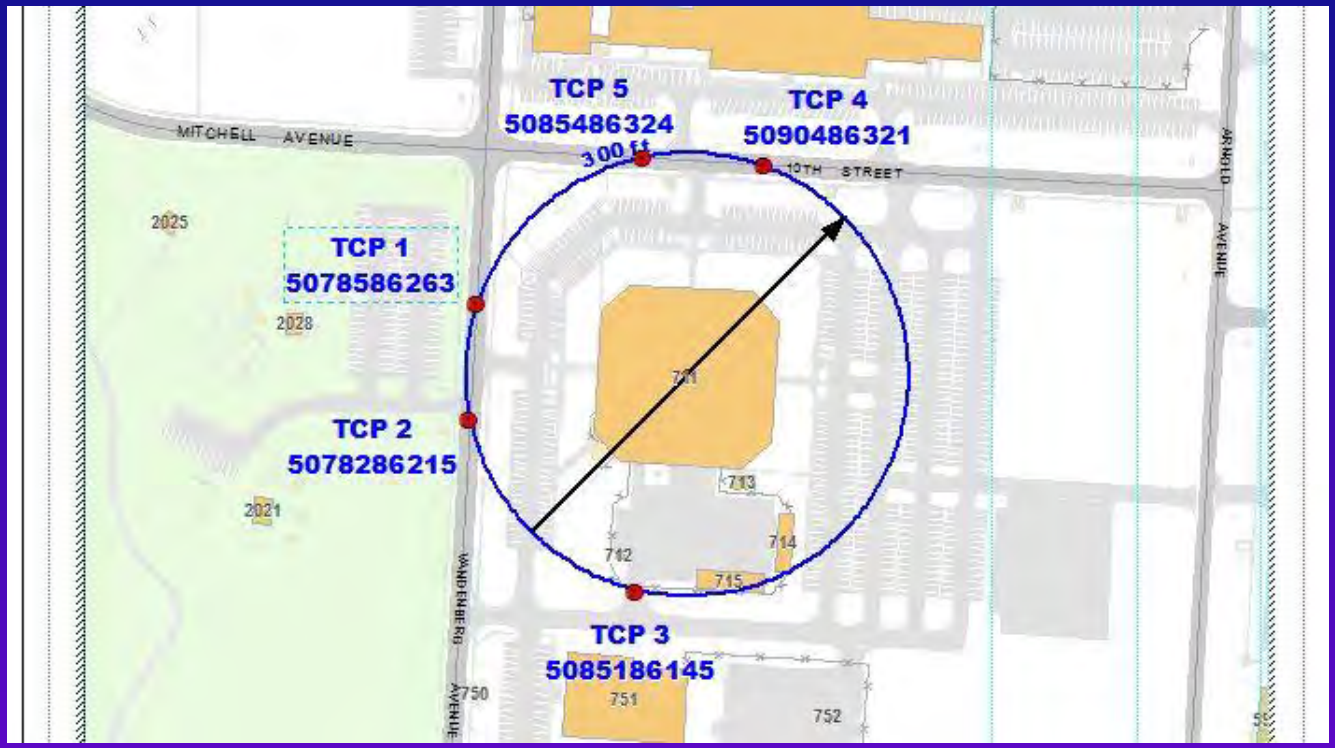
- We started with an ArcMap-based solution and are in the process to migrate to web-based mapping service

Security Forces



Readiness (Emergency Mngmt)

- During exercises (or actual event), Readiness requires the ability to plot damage to the base and surrounding areas in real-time

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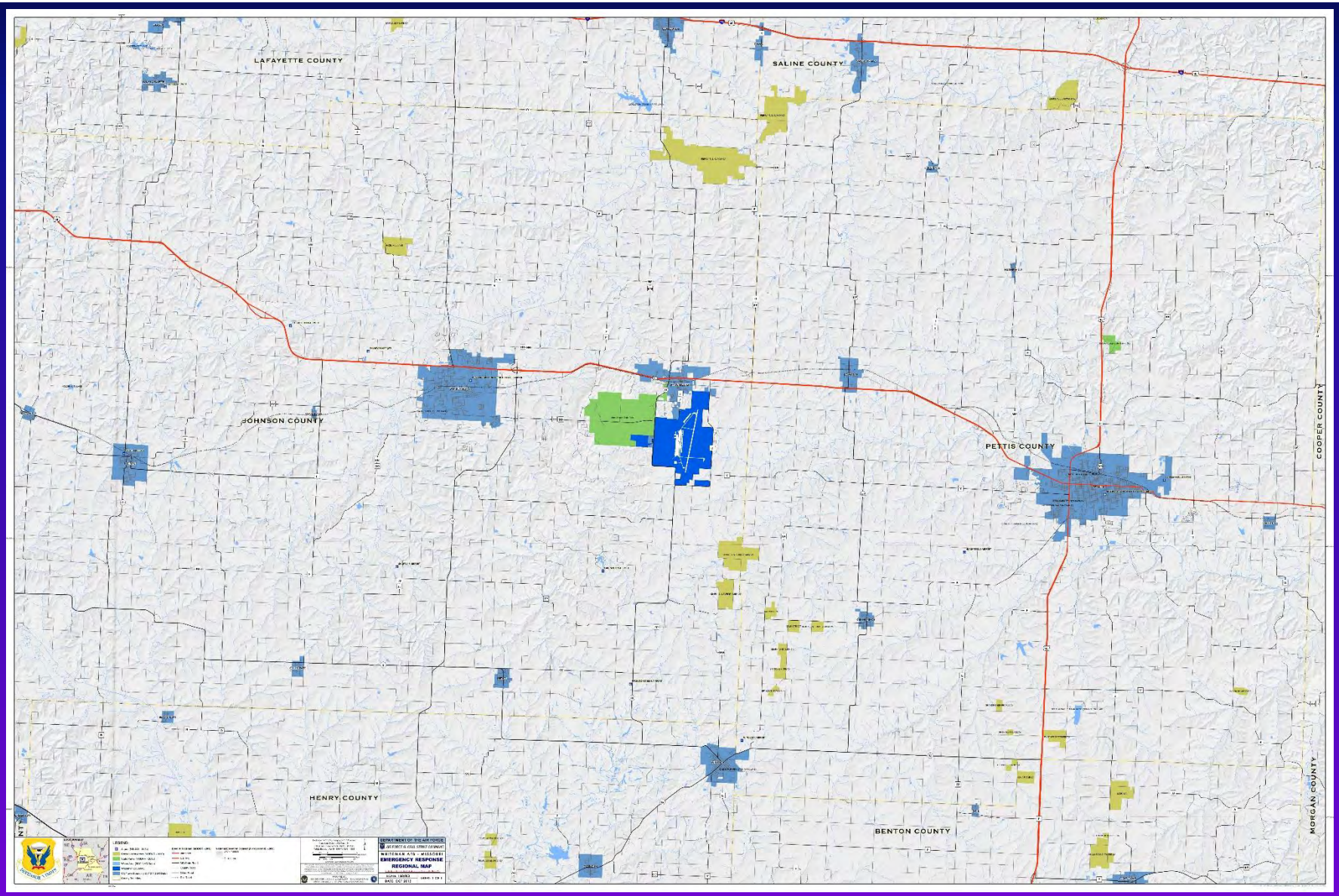
- We have a web-based service, but also created a large-scale paper version in case the network is unavailable

Readiness (Emergency Mngmt)



Other Fun Solutions

- Mowing Acreage Correction

Other Fun Solutions

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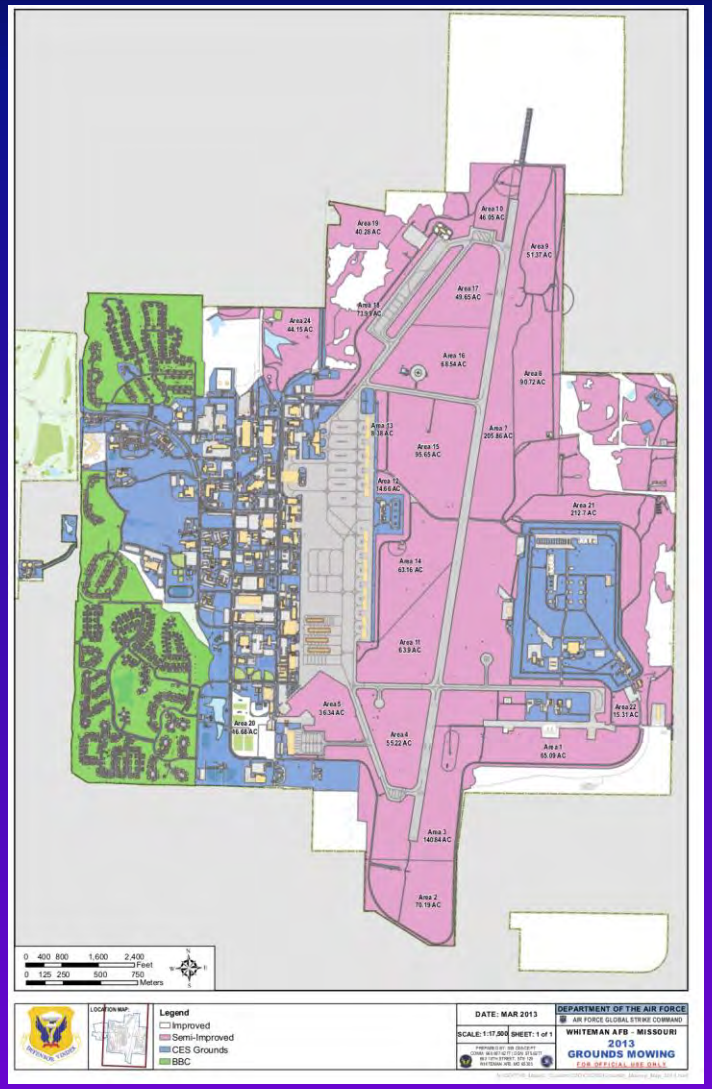
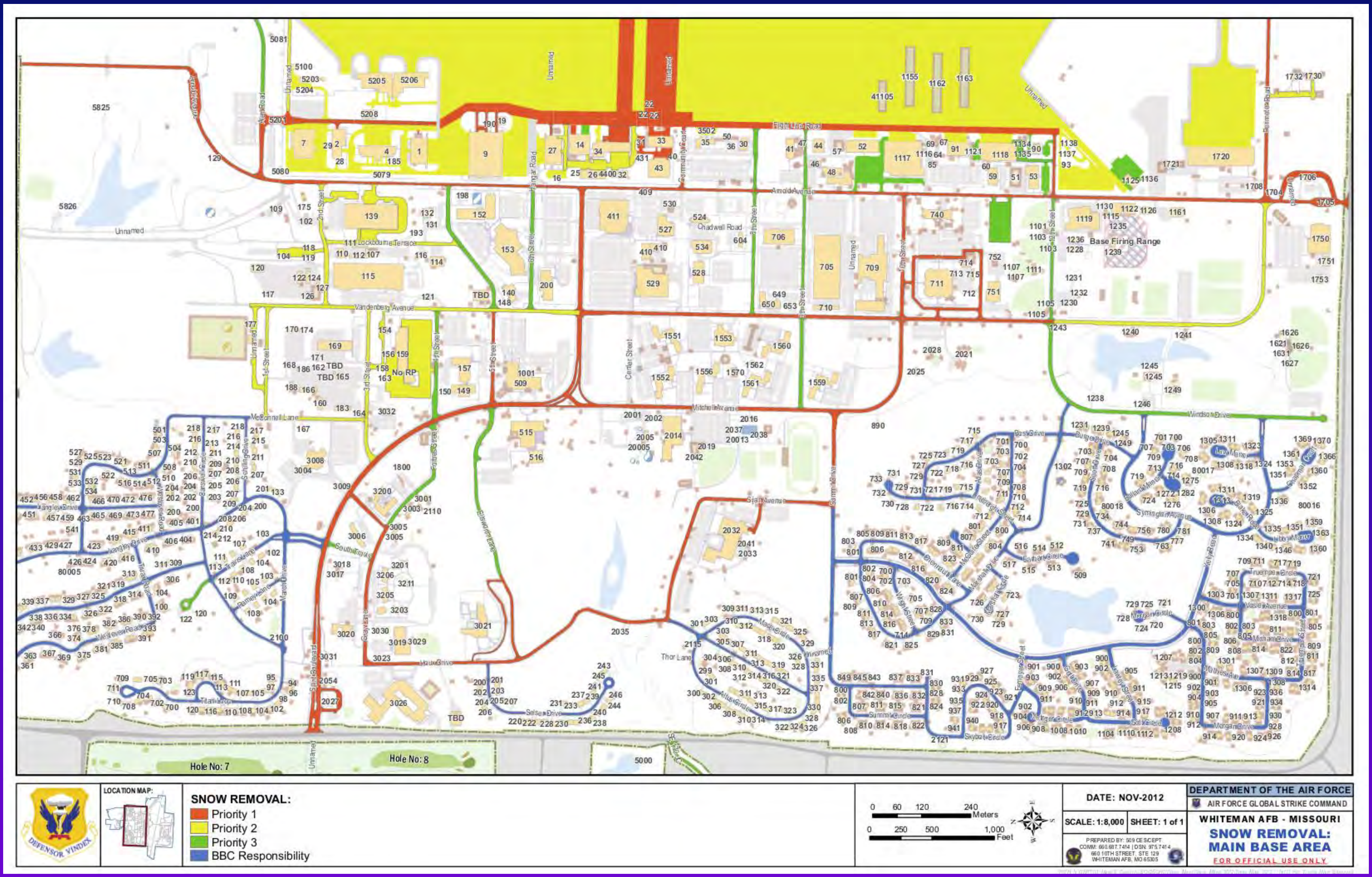


Other Fun Solutions

- Mowing Acreage Correction
- Snow Removal

Other Fun Solutions



Web Services

- Originally Silverlight, but moving over to Javascript API

Web Services

Command Viewer

GeoStriker, the AFGSC Map Viewer is the one source for visualization of installations' Common Installation Picture (CIP) and real-time US Weather and Hazard Information overlaid with aerial photopraphy and searchable, authoritative and comprehensive facilities and infrastructure information in order to expose the character of the installation for those with a need to know. It also provides on-screen draw, measure and other analytical tools. FOUO.

Status : Online

TCC & Weather Viewer

The AFGSC Transportation Control Center (TCC) Map Viewer displays open road condition, traffic, road cameras, hazards and construction area data for Air Force Global Strike Command (AFGSC) installations and local areas, exposing AFGSC GeoBase IGI&S, state DOT, and federal transportation and weather GIS services. FOUO.

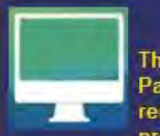
Status : Online

USAF GeoBase HAF Viewer

The US Air Force Installation Common Installation Picture (CIP) Map Viewer provides visualization of installation and infrastructure datasets across the Air Force. FOUO.

Status : Online

Online Requests



The AFGSC GeoBase Online Request Page is the one-stop, GeoBase work request site to order map and drawing products, surveys and other services tailored to your installation.

Status : Online

Utility & Pavement Viewer

The AFGSC Utility and Pavement Map Viewer provides visualization of a wide range of installation utilities infrastructure over high-resolution aerial photography, with searchable, authoritative and comprehensive infrastructure data and analytical tools, assembled for base operations for project planning & management, IDIQ, repair/replacement and hazard analysis. FOUO-sensitive. For CE/Ops use only.

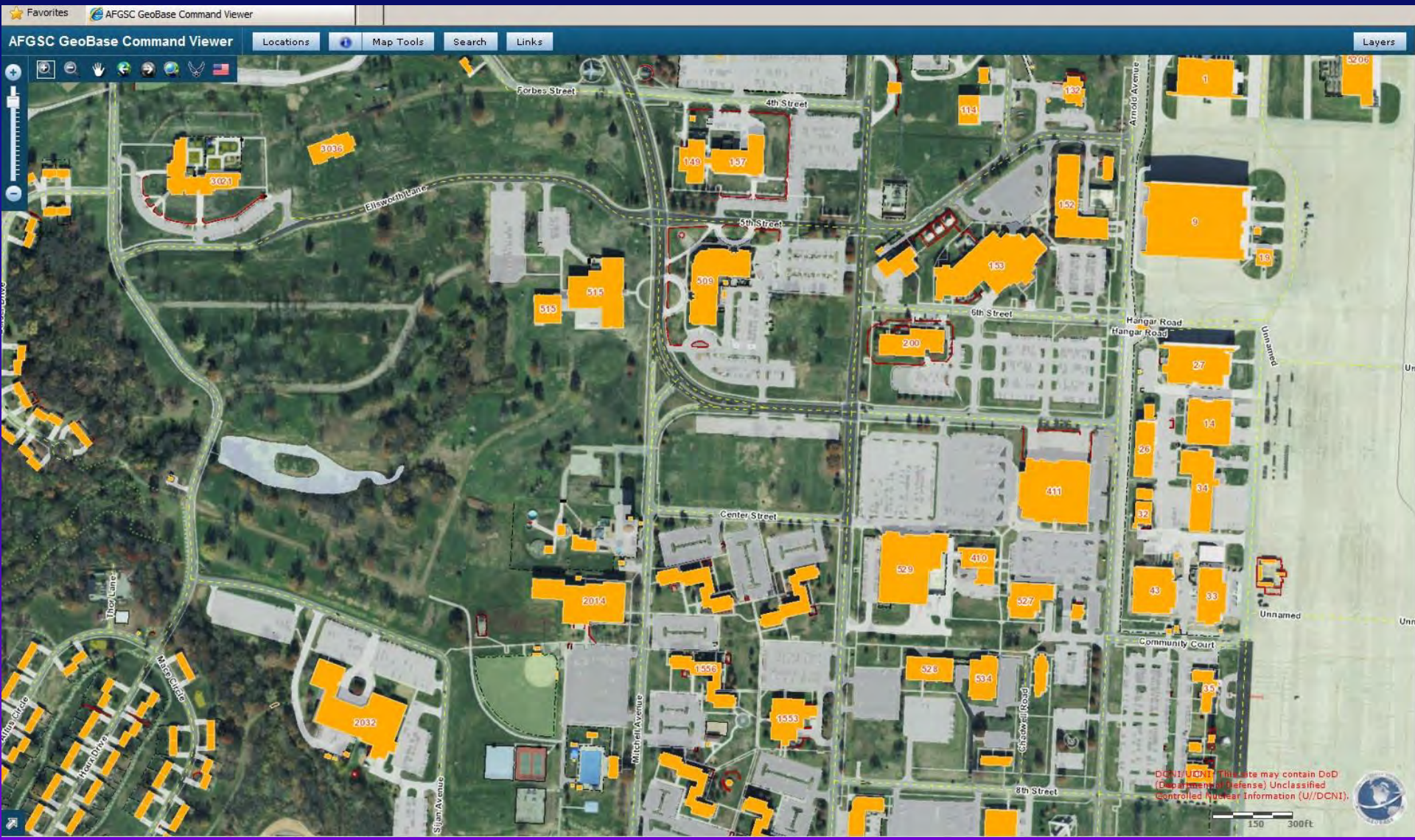
Status : Online

IDP Viewer

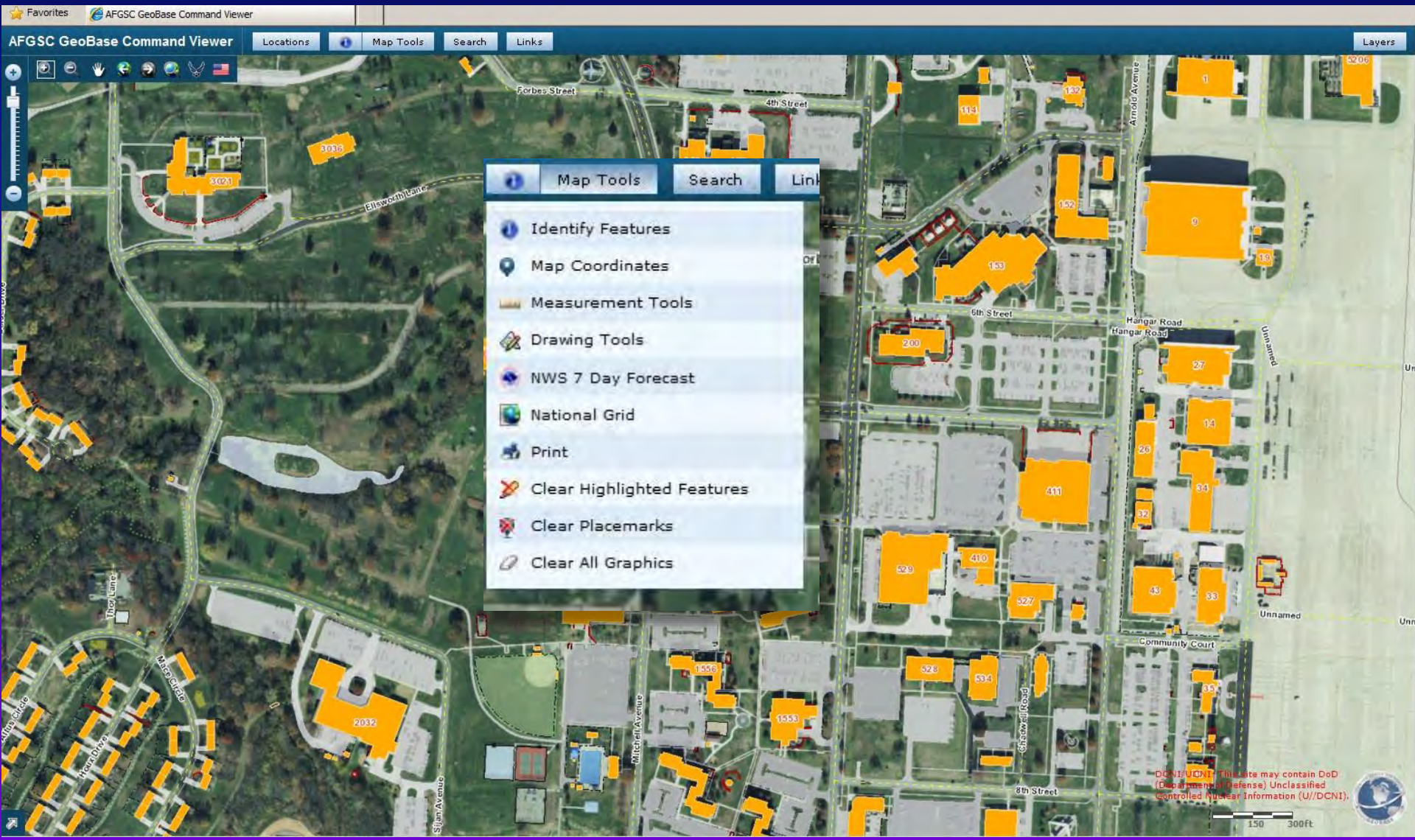
The AFGSC Installation Development Plan (IDP) Map Viewer provides for up-to-date visualization of your installation's Development Plan datasets maintained by the GeoBase office, and designd to mimic the map format of official AFGSC IDP maps. The site is for installations' planners increased situational awareness and export of common maps into slides and documents. FOUO-sensitive. For CE use only.

Status : Online

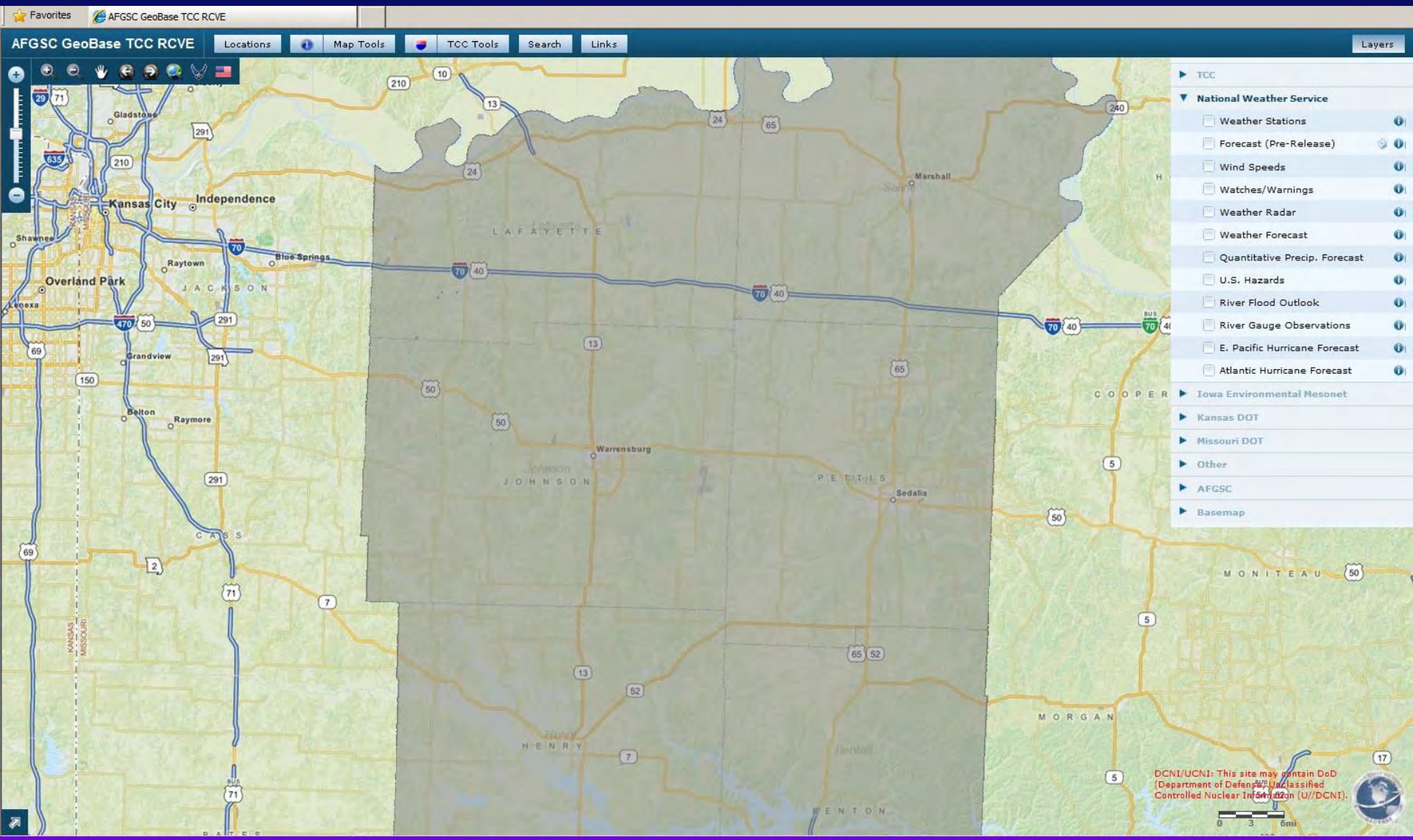
Web Services



Web Services



Web Services



Web Services

- We have challenges for robust services:
  - Constantly changing COMM requirements and lockdowns
  - Still using IE 8.x
  - Small bandwidth in/out of base can't handle connecting to services outside Whiteman's domain

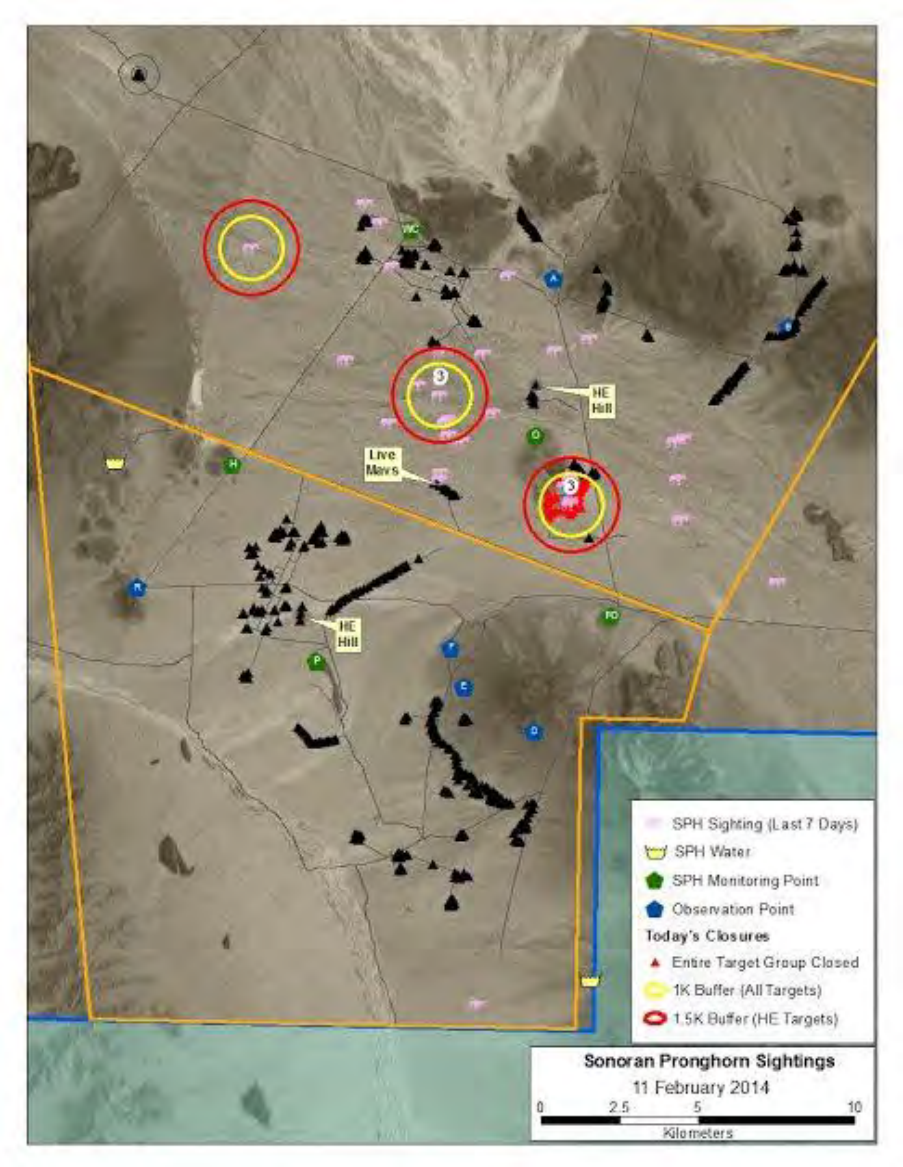
Web Services

- Moving forward, HAF is working with ESRI to develop ArcGIS Online completely behind the DoD firewall
- Centralized datasets and web services may provide more stability

Other Solutions Feds Are Using

- Sonoran Pronghorn & Live Target Closure – Barry M. Goldwater Range, Arizona

Other Solutions Feds Are Using



Courtesy Luke AFB, AZ 56TH Range Management Office

Other Solutions Feds Are Using

- **Weather Monitoring Southwest U.S.**

Precipitation interpolation in the Sonoran Desert: A multiagency effort to inform time sensitive land management decisions

Chris Black – USAF, Barry M. Goldwater Range East
Ami Pate - NPS, Organ Pipe Cactus National Monument
Kim Veverka – USFWS, Cabeza Prieta National Wildlife Refuge

RESULTS

The 2012 monsoon was much wetter than the 30-year normal - especially in Organ Pipe's eastern mountains and throughout the San Cristobal Valley (Figure 4). Total precipitation for 2012 was near the long term normals for much of the study area with several exceptions - the northwest corner received lower than normal amounts, while the area that received the highest percentages of monsoon rain ended the year with higher than normal amounts as well (Figure 6). With the exception of part of the Child's Valley, the rains from 1Jan-31Mar 2013 were generally less than the normals for that time period - particularly in the west side of the study area (Figure 8).

Courtesy Luke AFB, AZ 56TH Range Management Office

Other Solutions Feds Are Using

- **Weather Monitoring Southwest U.S.**

OVERVIEW

Precipitation is a driving factor behind the natural systems of the Sonoran Desert. Precipitation is highly variable across the region, especially during the summer monsoon. Knowing amounts and the spatial distribution of rainfall is of great value to a large number of time sensitive resource management questions that land managers are faced with in the region. This includes responding to stressors on Threatened & Endangered species (for example understanding when and where emergency feed and water stations are needed), better targeting the timing and location of control measures on invasive plants, and identifying cultural and other resources that may have been subjected to extreme erosional events.

METHOD

Three land managers in Southwest Arizona - USAF Barry M. Goldwater Range (BMGR) East, NPS Organ Pipe Cactus National Monument, and Cabeza Prieta National Wildlife Refuge are working together to gain a better understand near real time precipitation distribution. Multiple times per year precipitation data is being combined from a number of recording sites across these jurisdictions and from surrounding lands (including the El Pinacate y Gran Desierto de Altar Biosphere Reserve in Mexico, the Flood Control District of Maricopa County, and others). Some of these recording sites are weather stations that transmit the data in real time, others are manual download weather stations, and still others are plastic rain gages that are read periodically (mineral oil is used to eliminate evaporation from these gages). The data is then used to interpolate rainfall surfaces and those surfaces are compared with long term climate normals. Figure 1 shows the jurisdictions and stations involved.

Figure 1

The combined data is interpolated for each of the time periods using Inverse Distance Weighting (IDW), with a variable search radius, a power of 2, and the nearest 8 points. The IDW surfaces are then divided by PRISM Climate Group 30-year climate normal precipitation (1981-2010) surfaces for the same time period to get at percent of normal precipitation. PRISM surfaces end just beyond the US border, so the percent of normal precipitation surfaces end there as well.

PRISM also produces a precipitation surface for each month and year. However, the PRISM model typically only has 6 samples points within the study area (Figure 2 shows points used in Arizona). This scarcity of sample points is somewhat less of an issue for the 30 year average than it is for individual surfaces. By comparison the IDW surfaces (shown in Figures 3, 5, and 7) were based in 98 to 107 sample points.

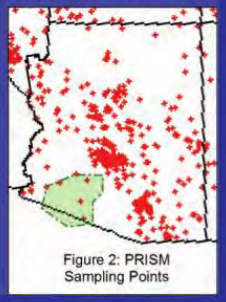
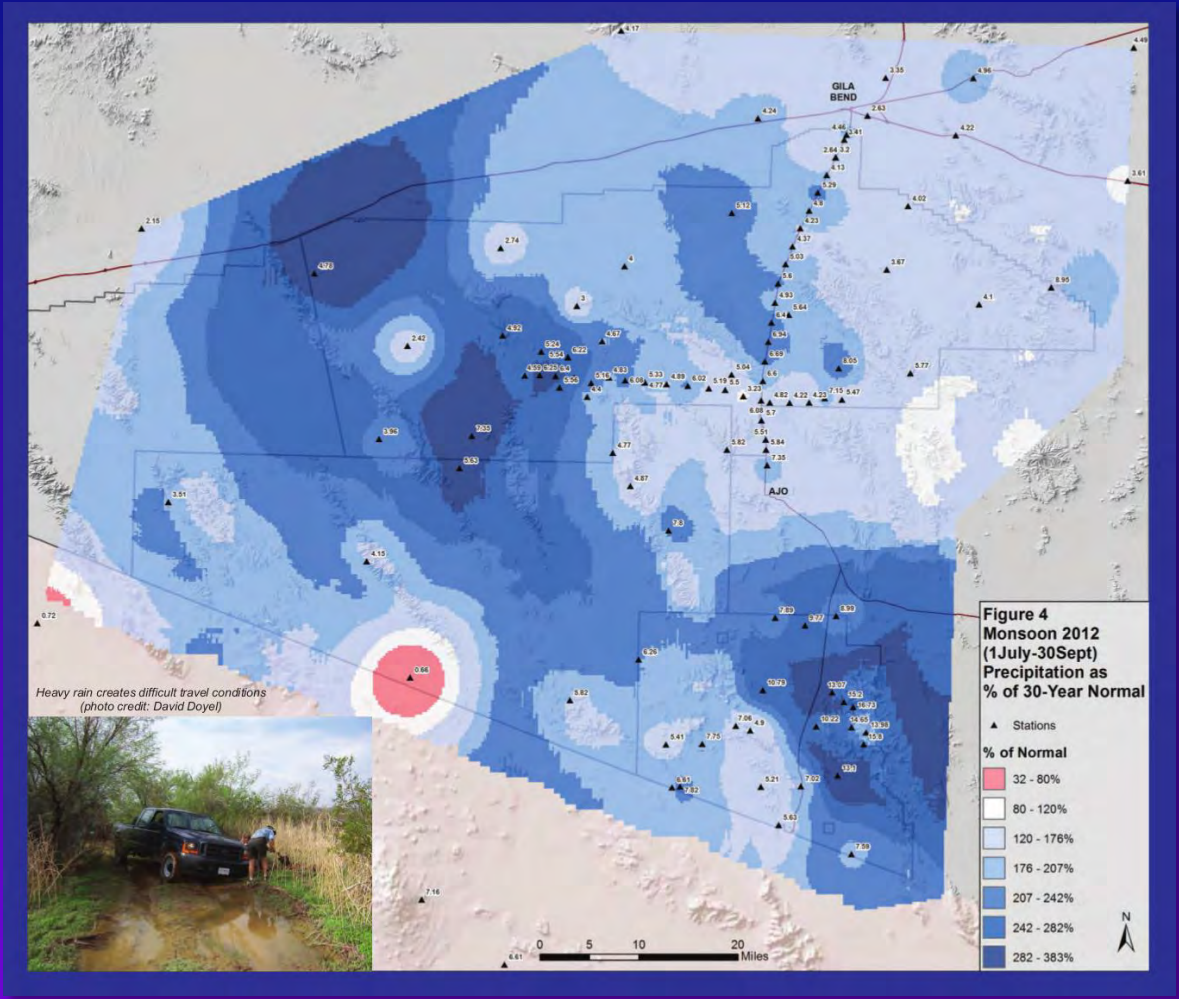


Figure 2: PRISM Sampling Points

Courtesy Luke AFB, AZ 56TH Range Management Office

Other Solutions Feds Are Using

- **Weather Monitoring Southwest U.S.**



Courtesy Luke AFB, AZ 56TH Range Management Office

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L3 National Security Solutions

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