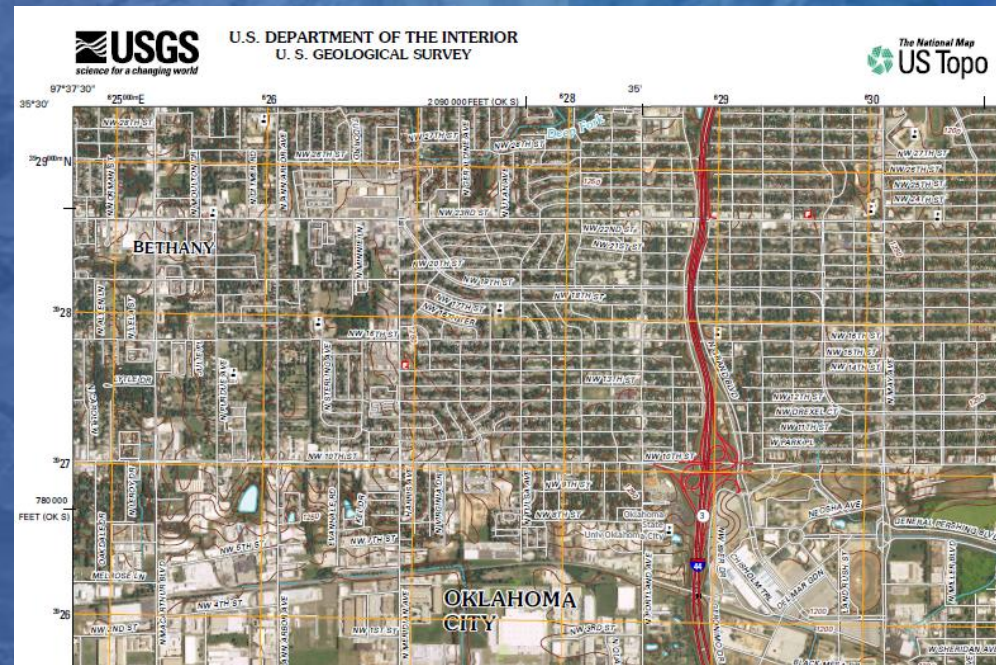


USGS National Geospatial Program Update



17th Annual OKSCAUG Conference
September 23, 2014

Ingrid M. Landgraf, Cartographer
U.S. Geological Survey

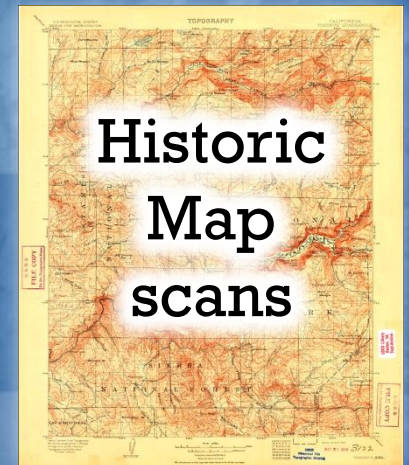
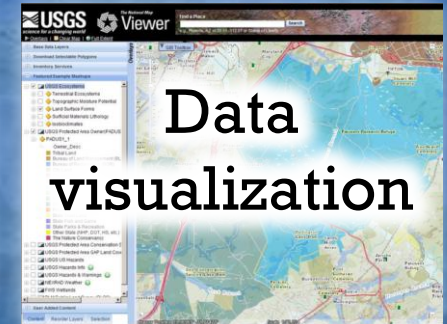


Topics

- ***The National Map (TNM):*** <http://nationalmap.gov/>
 - 3-D Elevation Program Initiative – Planned Nationwide Hi-Resolution Elevation Data
 - National Enhanced Elevation Assessment (Oklahoma's input)
 - On-line Elevation Inventory
 - Broad Agency Announcement for LIDAR
 - Proposed changes to LIDAR specifications and products
 - National Hydrography Dataset Future Directions
 - Map Services from *The National Map*
 - US Topo evolution

National Geospatial Program Mission

- Organize, maintain, publish, and disseminate the geospatial baseline of the Nation's topography through *The National Map*
- *The National Map* is a nationally consistent , continuously maintained platform for public domain geographic base data and services



3D Elevation Program (3DEP)

[The National Map Home](#) >> 3D Elevation Program (3DEP)

3DEP Resources

3DEP Plan - [The 3D Elevation Program Initiative - A Call for Action](#)
(USGS Circular 1399)

[The 3DEP Elevation Program - Summary of Program Direction](#)
(USGS Fact Sheet 2012-3089)

[National Enhanced Elevation Assessment \(NEEA\)](#)

[3DEP Executive Forum](#)

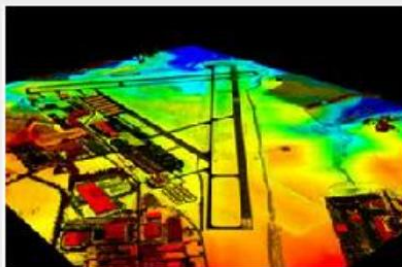
[Alaska Mapping Roundtable](#)

3DEP 'In the News'

[How Lasers and 3-D Maps Can Help the U.S. Prepare for Climate Change](#)

[Safer Communities, Stronger](#)

Introduction and Goals



Lidar is used to detect potential obstacles that present hazards to air navigation.

The 3D Elevation Program (3DEP) initiative is being developed to respond to growing needs for high-quality topographic data and for a wide range of other three-dimensional representations of the Nation's natural and constructed features. The primary goal of 3DEP is to systematically collect enhanced elevation data in the form of high-quality light detection and ranging (lidar) data over the conterminous United States, Hawaii, and the U.S. territories, with data acquired over an 8-year period. Interferometric synthetic aperture radar (ifsar) data will be collected over Alaska, where cloud cover and remote locations preclude the use of lidar over much of the State. The 3DEP initiative is based on the results of the [National Enhanced Elevation Assessment](#).

Announcing Instructions for 3DEP Partnerships

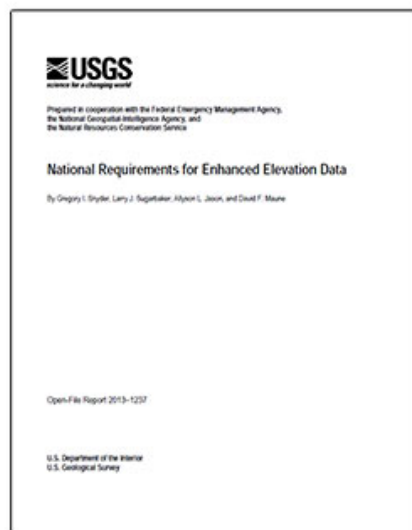
As outlined in the [White House FACT SHEET: Taking Action to Support State, Local, and Tribal Leaders as They Prepare Communities for the Impacts of Climate Change](#) (July 16, 2014), The Department of the Interior's U.S. Geological Survey and other Federal agencies are launching a 3D Elevation Program (3DEP) partnership designed to bring Federal agencies, academia, corporate entities, states, tribes, and communities

<http://nationalmap.gov/3dep/index.html>

Prepared in cooperation with the Federal Emergency Management Agency,
the National Geospatial-Intelligence Agency, and
the Natural Resources Conservation Service

National Requirements for Enhanced Elevation Data

By Gregory I. Snyder, Larry J. Sugarbaker, Allyson L. Jason, and David F. Maune



Introduction

This report presents the results of surveys, structured interviews, and workshops conducted to identify key national requirements for improved elevation data for the United States and its territories, including coastlines. Organizations also identified and reported the expected economic benefits that would be realized if their requirements for improved elevation were met (appendixes 1–3). This report describes the data collection methodology and summarizes the findings. Participating organizations included 34 Federal agencies, 50 States and two territories, and a sampling of local governments, tribes, and nongovernmental organizations. The nongovernmental organizations included The Nature Conservancy and a sampling of private sector businesses. These data were collected in 2010 and 2011 as part of the National Enhanced Elevation Assessment (NEEA), a study to identify program alternatives for better meeting the Nation's elevation data needs. NEEA tasks included the collection of national elevation requirements; analysis of the benefits and costs of meeting these requirements; assessment of emerging elevation technologies, lifecycle data management needs, and costs for managing and distributing a

national-scale dataset and derived products; and candidate national elevation program alternatives that balance costs and benefits in meeting the Nation's elevation requirements. The NEEA was sponsored by the National Digital Elevation Program (NDEP), a government coordination body with the U.S. Geological Survey (USGS) as managing partner and including the National Geospatial-Intelligence Agency (NGA), the Federal Emergency Management Agency (FEMA), the Natural Resources Conservation Service (NRCS), the U.S. Army Corps of Engineers (USACE), and the National Oceanic and Atmospheric Administration (NOAA), among the more than a dozen agencies and organizations. The term enhanced elevation data as used in this report refers broadly to three-dimensional measurements of land or submerged topography, built features, vegetation structure, and other landscape detail. Additional information about the NEEA and its later use in the development of a three-dimensional (3D) elevation program (3DEP) can be found at <http://nationalmap.gov/3DEP/index.html>.

First posted January 28, 2014

- [Report PDF \(188 KB\)](#)
- [Appendix 1 PDF \(8.25 MB\)](#)
- [Appendix 2 PDF \(3.68 MB\)](#)
- [Appendix 3 PDF \(1.59 MB\)](#)

These are links to appendixes 1 through 3 that contain results for requirements and high priorities of elevation data for government and nongovernmental organizations.

For additional information, contact:
Director, National Geospatial Program
U.S. Geological Survey
511 National Center
12201 Sunrise Valley Drive
Reston, VA 20192
<http://nationalmap.gov/3DEP/>

Part or all of this report is presented in Portable Document Format (PDF). For best results viewing and printing PDF documents, it is recommended that you download the documents to your computer and open them with Adobe Reader. PDF documents

Lidar Quality Levels

Elevation QLs ¹	Horizontal resolution terms			Vertical accuracy terms		Principal source ⁷
	Nominal point density ² , in pts/m ²	Nominal pulse spacing ³ , in meters	DEM post spacing ⁴ , in meters	Vertical RMSE ⁵ , in centimeters	Equivalent contour accuracy ⁶ , in feet	
QL1	8	0.35	~1	9.25	1	Lidar.
QL2	2	0.7	~1	9.25	1	Lidar.
QL3	1–0.25	1–2	~3	≤18.5	2	Lidar.
QL4	0.04	5	~10	46.3–139	5–15	Aerial imagery.
QL5	0.04	5	~10	92.7–185	10–20	IFSAR.

¹QL, quality level.

²Point density estimates the number of first-return lidar pulses per square meter; it is the inverse of nominal pulse spacing (NPS) and is typically used when the NPS is equal to or less than 1 meter.



³NPS, an alternative measure of the density of a lidar dataset, is the typical or average lateral distance between irregularly-spaced points in a lidar dataset, most simply calculated and expressed as the square root of the average area per elevation point.

⁴Digital elevation model (DEM) post spacing refers to the regularly spaced distance between centroids of individual pixels in a raster DEM.


⁵Vertical root mean square error (RMSE), the square root of the mean of squared elevation errors for a sample, is a statistical term used to estimate elevation errors at different confidence levels when elevation errors approximate a normal error distribution. For example, vertical accuracy at the 90 percent confidence level is calculated as $RMSE \times 1.6449$, and vertical accuracy at the 95 percent confidence level is calculated as $RMSE \times 1.9600$.

Oklahoma Requirements and Benefits Data


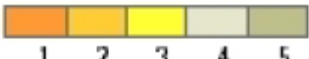
State Functional Activities

Program: Dam Safety Program	Business Use: 14. Flood Risk Management
 <p>Quality Level:</p>  <p>1 2 3 4 5</p>	<p>Dam Breach Analysis: Analyzing and modeling the potential breach of dams in high-hazard and non-high-hazard areas. The analysis includes potential damage assessment to structures and loss of life, property, and natural resources. Using enhanced digital elevation data allows rapid, remote analysis of dam breach areas and associated potential damage locations. The level of accuracy gives a much clearer picture of a breach event than even ground survey cross sections because of the sheer volume of accurate elevations. Even with surveyed cross sections, you still have to interpolate between them, and the enhanced elevation data do that for you on a more consistent and accurate basis.</p>
<p>Update Frequency: 6–10 years</p>	<p>Estimated Annual Operational Benefits: Major; \$3,762,500 Significant benefits are derived from not having to use survey crews to collect detailed elevation data for each dam site. Having enhanced elevation data statewide will expand the breach analysis program to include additional high-hazard and non-high-hazard dams being converted to high-hazard status due to population growth in rural areas.</p>
<p>Bathymetric Data: Yes</p>	<p>Estimated Annual Customer Service Benefits: Major; \$1,254,000 The State would be able to produce more and higher quality dam breach analyses for the same amount of money.</p>
<p>Tide-Coordinated: No</p>	<p>Estimated Strategic Benefits: Major Statewide expansion of the program gives all State residents a greater level of protection through emergency action plans and not limiting the better high accuracy information to only high priority areas.</p>
<p>Data Outside State Needed: No</p>	

Oklahoma Requirements and Benefits Data

Program: Flood Plain Management Programs		Business Use: 14. Flood Risk Management
 <p>Quality Level: 1 2 3 4 5</p>		<p>Flood Risk Mapping: Development of highly accurate flood plain maps to aid officials at various State agencies in conducting risk analysis for flooding events. There may be a need for some upstream elevation data that exist outside the State that are needed to develop accurate flood plain maps for areas downstream within the State.</p>
<p>Update Frequency: Event driven—Needs not met by a cyclic data acquisition program</p>		<p>Estimated Annual Operational Benefits: Major; \$1,400,000 Enhanced elevation data would greatly improve flood risk analysis results of various State agencies and reduce the amount of time required to create the analysis models. The availability of enhanced elevation data would also decrease the costs for counties and rural communities to update and improve flood plain mapping.</p>
<p>Bathymetric Data: Yes</p>		<p>Estimated Annual Customer Service Benefits: Major; \$1,050,000 Analysts would be able to produce more high-quality flood risk models leading to higher quality flood risk maps. Available enhanced elevations data would likely reduce the time to produce flood plain maps, making them more accessible sooner to the public and professionals in the field.</p>
<p>Tide-Coordinated: No</p>		<p>Estimated Strategic Benefits: Major The State could provide higher quality flood risk maps for low-hazard dams to cities, counties, developers, lenders, and insurance companies to discourage future development in these potential flood areas and allow for better decisionmaking where the public is concerned.</p>
<p>Data Outside State Needed: Yes; there may be a need for some upstream elevation data outside the State that are needed for developing flood plain maps downstream within Oklahoma</p>		

Oklahoma Requirements and Benefits Data

Program: Location Survey		Business Use: 21. Infrastructure and Construction Management	
 <p>Quality Level: </p>		Location Surveying and Highway Design: Location surveying for preliminary engineering for the design of highways and bridges.	
		Estimated Annual Operational Benefits: Moderate; \$15,000,000 Available enhanced elevation data will provide quality elevation data in areas where conventional survey access is limited or very expensive to acquire.	
		Estimated Annual Customer Service Benefits: Moderate; dollar value not reported More accurate elevation, structures, and land cover data provide better drainage information and allow service agencies to better serve the public with higher quality data and improved or better decisionmaking. The existence of high accuracy elevation data also aids in the generation of new datasets, which provide the ability to generate surface data in less time in areas where access is limited and data acquisition costs are nearly prohibitive.	
		Estimated Strategic Benefits: Moderate Geospatial data users can graphically illustrate a newer and more accurate representation of the Earth's surface and what is on it, by using the high-accuracy elevation data. The availability of this quality level of elevation data will significantly benefit users from all parts of society.	
Update Frequency: 2–3 years			
Bathymetric Data: Yes			
Tide-Coordinated: No			
Data Outside State Needed: Yes; cooperative work with departments of transportation of bordering States			

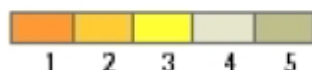
Oklahoma Requirements and Benefits Data

Program: Watershed Planning and Total Maximum Daily Load Development

Business Use: 2. Water Supply and Quality



Quality Level:



Update Frequency: 6–10 years

Bathymetric Data: Yes

Tide-Coordinated: No

Data Outside State Needed: No



Water Quality Modeling: Collect and interpret water quality data to determine the total daily maximum load for streams in Oklahoma. This activity is performed to meet regulatory requirements by the EPA.

Estimated Annual Operational Benefits: Minor; dollar value not reported
Most of the agency's watershed modeling was done with 30-m DEM data. Enhanced elevation data would significantly improve the outputs from the models. Using this type of enhanced data also improves the quality of graphs in reports created for projects.

Estimated Annual Customer Service Benefits: Do not know; dollar value not reported
Benefits description not reported.

Estimated Strategic Benefits: Do not know
Benefits description not reported.

Oklahoma Requirements and Benefits Data

Program: Oklahoma Natural Heritage Program		Business Use: 7. Wildlife and Habitat Management
 <p>Quality Level:  1 2 3 4 5</p>	<p>Species Distribution Modeling: Prediction of species distribution based on measured environmental variables. Accurate species distribution models are necessary for conservation planning, especially for endangered species protection and mitigation efforts.</p>	
	<p>Estimated Annual Operational Benefits: Moderate; \$500,000 State specialists would potentially be able to model currently unknown breeding grounds for lesser prairie chickens site locations with new enhanced elevation data due to the higher resolution of the data. State agency personnel may also be able to identify certain vegetation types not currently distinguishable with existing, lower quality elevation data.</p>	
	<p>Estimated Annual Customer Service Benefits: Moderate; \$500,000 Being able to produce basically enhanced species distribution models using the higher accuracy elevation data would allow resource planners better information on what to expect and how to manage the limited resources.</p>	
	<p>Estimated Strategic Benefits: Moderate Having access to better base elevation data means the State can make more accurate models and therefore give more precise recommendations to the public and private sector for natural resource management.</p>	
	<p>Update Frequency: 2–3 years</p>	
Bathymetric Data: No		
Tide-Coordinated: No		
Data Outside State Needed: No		

Oklahoma Requirements and Benefits Data

Local Functional Activities

City Government—City of Ardmore	
Program: Several programs	Business Use: 17. Homeland Security, Law Enforcement, and Disaster Response
Functional Activity: Municipal mapping	
Quality Level: QL1 elevation data from lidar	Estimated Annual Operational Benefits: Major; \$40,000 Existing elevation data are used in all aspects of maintenance, construction, and development for all municipal projects where elevation data have a role. The areas of data that are missing are bathymetric data of all city-owned lakes or elevation data or the waterlines coming from the lakes. These additional data would be invaluable in assessing current resources and planning for future growth in the region.
Update Frequency: Event driven—Needs not met by a cyclic data acquisition program	Estimated Annual Customer Service Benefits: Moderate; \$4,000 New customer service benefits from newly acquired elevation data would probably not be as critical as the data currently used because the bulk of the enhanced elevation data for the city and surrounding area have already been acquired. However, the new elevation data could easily point out issues that need to be addressed that are currently unknown. Having current elevation data in-house, elevation data do not have to be acquired every time a project needs to access elevation data. The ability of having a good elevation dataset on hand is invaluable to daily operations.
Bathymetric Data: Yes	Estimated Strategic Benefits: Moderate The additional data would definitely help in planning for future growth and hazard mitigation. Having one standard elevation dataset has helped the City of Ardmore tie all the projects together with all the elevation data matching on a citywide basis rather than on a project specific area.
Tide-Coordinated: No	

Regional Government—City of Oklahoma City and The Association of Central Oklahoma Governments

Program: Comprehensive planning

Business Use: 22. Urban and Regional Planning

Functional Activity: Municipal government operations

Quality Level: QL2 elevation data from lidar	<p>Estimated Annual Operational Benefits: Major; \$400,000</p> <p>Acquiring and possessing high-accuracy elevation data saves staff time by reducing field work, increases the ability to perform analyses, and increases the quality of program outputs. It also provides the ability to perform regionwide analyses that significantly reduces staff time acquiring and processing the data.</p>
Update Frequency: 4–5 years	<p>Estimated Annual Customer Service Benefits: Moderate; \$200,000</p> <p>If all enhanced data can be made available from one location, they can improve efficiency, lower customer and partner costs, and promote economic development. There is a much increased capability to provide customers and partners alike the data they require, through improvements to accuracy, broad coverage, and regular consistent acquisition of elevation data across the geographic region.</p>
Bathymetric Data: No	<p>Estimated Strategic Benefits: Major</p> <p>Greater accuracy in the data provides for better modeling, and higher resolution allows for better visualization for engineering and planning applications. Enhanced elevation data can be used for engineering and other high-accuracy tasks and projects, which would not be possible with lower accuracy levels of elevation data. Enhanced elevation data are often used for flood rate map production, hydrologic modeling for disaster preparedness, visualization for engineering and planning, while also improving business efficiency and promoting development.</p>
Tide-Coordinated: No	

Regional Government—City of Oklahoma City and The Association of Central Oklahoma Governments

Program: Storm Water Quality Management

Business Use: 3. River and Stream Resource Management

Functional Activity: Storm water quality management and regulatory compliance

Quality Level: QL2 elevation data from lidar	<p>Estimated Annual Operational Benefits: Major; \$400,000</p> <p>Improves ability to manage storm water quality regionwide by providing consistent elevation data. Higher resolution and consistent elevation data improves the city's ability to do storm water quality management throughout the system.</p>
Update Frequency: 4–5 years	<p>Estimated Annual Customer Service Benefits: Moderate; \$200,000</p> <p>Wider coverage, higher resolution data can provide better accuracy, centralized storage location for the data, and time savings through better decisionmaking. Storm water quality permitting and pollution control studies are produced from these data for customers.</p>
Bathymetric Data: No	<p>Estimated Strategic Benefits: Major</p> <p>Having all the data in one location makes it easier to share with customers, saving them time and money and promotes business. Pollution control protects environmental quality. Having enhanced elevation data for a larger area provides consistency that makes benefits possible regionwide.</p>
Tide-Coordinated: No	

Oklahoma Requirements and Benefits Data

Regional Government—City of Oklahoma City and The Association of Central Oklahoma Governments

Program: Transportation and Utility Infrastructure Management

Business Use: 21. Infrastructure and Construction Management

Functional Activity: Transportation and utility infrastructure management

Quality Level: QL2 elevation data from lidar

Estimated Annual Operational Benefits: Major; \$1,000,000

Accurate elevation data allow much better infrastructure project planning and modeling of existing assets. Having more accurate data for a wider area would allow new tasks to be performed using the enhanced elevation data, would increase the ability to collaborate and make it easier to provide required data to partner organizations.

Update Frequency: 2–3 years

Estimated Annual Customer Service Benefits: Major; \$1,000,000

Having the new data available would eliminate acquisition time and allow better validation of engineering work, as well as providing the ability to build better models for visualization and analysis. More accurate data for a larger area would improve the engineering and planning work associated with building and maintaining infrastructure.

Bathymetric Data: Not reported

Estimated Strategic Benefits: Major

Tide-Coordinated: Not reported

Enhanced data available in a consistent format that are acquired on a regular basis significantly reduce lag and startup times. Not having to dedicate city resources to the acquisition of high-accuracy elevation, this type of data allows the city to focus on the main planning and engineering goals. Highly accurate data expedite major construction projects, leading to cost savings, project efficiencies, better decisionmaking and overall better quality of life.

Oklahoma Requirements and Benefits Data

Tribal Functional Activities

Kickapoo Tribe of Oklahoma	
Program: Clean Water Act Section 106 Program	Business Use: 2. Water Supply and Quality
Functional Activity: Nonpoint source assessment	
Quality Level: QL3 elevation data from lidar	Estimated Annual Operational Benefits: Major; \$19,000 Any improvement to enhanced elevation data to show water quality results while comparing to the natural features would provide a better model and better results.
Update Frequency: 4–5 years	Estimated Annual Customer Service Benefits: Moderate; \$38,000 The customer benefits would be to the tribal community and its members regarding their water quality.
Bathymetric Data: Yes	Estimated Strategic Benefits: Major Benefits would demonstrate areas of concern with respect to nonpoint sources and aid in development for the future.
Tide-Coordinated: No	

Choctaw Nation of Oklahoma	
Program: Clean Water Act Section 106 Program	Business Use: 2. Water Supply and Quality
Functional Activity: Selection of water quality monitoring sites	
Quality Level: QL4 elevation data from imagery	Estimated Annual Operational Benefits: Moderate; \$10,000 Allow staff to visually see geography of drainage basins. Allow staff to select better sites for water quality monitors.
Update Frequency: 6–10 years	Estimated Annual Customer Service Benefits: Moderate; \$10,000 Allow staff to select monitor sites that are accessible and assess same for how well they would meet data collection criteria for turbidity and flow rate. Make maps convey 3D terrain of region.
Bathymetric Data: Yes	Estimated Strategic Benefits: Moderate Would show in more detail the terrain of the monitor sites and allow for better visualization and evaluation of same. Only used as map background to display 3D quality of terrain.
Tide-Coordinated: No	

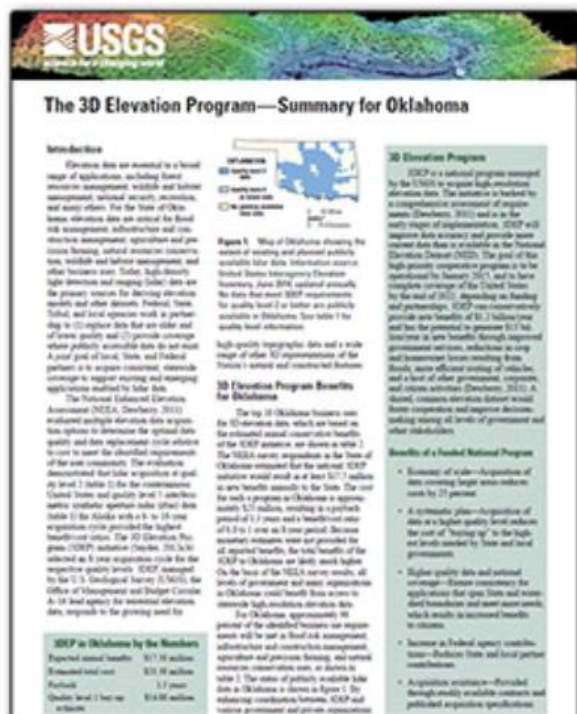
Choctaw Nation of Oklahoma	
Program: Agriculture	Business Use: 8. Agriculture and Precision Farming
Functional Activity: Lease agreements for tribal members	
Quality Level: QL4 elevation data from imagery	Estimated Annual Operational Benefits: Major; \$15,000 Allow preliminary assessments of tracts of land for suitability for leasing as pasture or recreational use. Allow detailed in-office assessments of tracts of land for suitability for leasing as pasture or recreational use and identification of fencing and other features used in determining lease value, such as pasture terrain and slopes, soil suitability, available water and type (stream, pond, and so on).
Update Frequency: 4–5 years	Estimated Annual Customer Service Benefits: Major; \$15,000 Improved detailed data would allow for much more accurate in office assessments of potential income-producing uses for tracts of individually owned native American land, therefore increasing the income of these individuals and possibly improving the quality of the land by inclusion of stipulations for same in the lease agreement. Examples would be additional fencing, weed control soil improvements, erosion control measures, addition of stock ponds, and other value-enhancing features. Currently available orthophotos with elevation and contours allow staff to calculate a preliminary acreage for suitability of pasture or recreational use only.
Bathymetric Data: Yes	Estimated Strategic Benefits: Major Would allow staff to show potential lessor and lessee, tribal leaders, and administrators how the tract of land up for lease “looks” now and what uses are proposed for that land. Should increase income potential for tribal members by allowing more cost effective evaluation of available land and better determination of best uses for same. Allow staff to locate land to evaluate in the field.
Tide-Coordinated: No	

Fact Sheet 2014-3053

>> Pubs Warehouse > FS 2014-3053

The 3D Elevation Program—Summary for Oklahoma

By William J. Carswell, Jr.



Abstract

Elevation data are essential to a broad range of applications, including forest resources management, wildlife and habitat management, national security, recreation, and many others. For the State of Oklahoma, elevation data are critical for flood risk management, infrastructure and construction management, agriculture and precision farming, natural resources conservation, wildlife and habitat management, and other business uses. Today, high-density light detection and

First posted June 19, 2014

- **Report PDF (302 KB)**

**For additional information,
contact:**

Director, National Geospatial
Program
U.S. Geological Survey
511 National Center
12201 Sunrise Valley Drive
Reston, VA 20192

<http://www.usgs.gov/ngpo/>
<http://nationalmap.gov/3DEP/>

Part or all of this report is presented in Portable Document Format (PDF). For best results viewing and printing

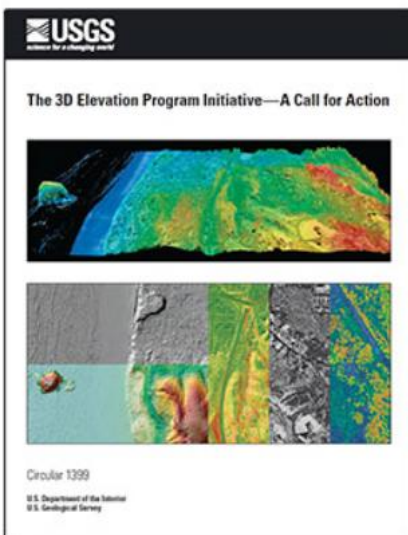


Circular 1399

>> Pubs Warehouse > CIRC 1399

The 3D Elevation Program Initiative—A Call for Action

By Larry J. Sugarbaker, Eric W. Constance, Hans Karl Heidemann, Allyson L. Jason, Vicki Lukas, David L. Saghy, and Jason M. Stoker



Abstract

The 3D Elevation Program (3DEP) initiative is accelerating the rate of three-dimensional (3D) elevation data collection in response to a call for action to address a wide range of urgent needs nationwide. It began in 2012 with the recommendation to collect (1) high-quality light detection and ranging (lidar) data for the conterminous United States (CONUS), Hawaii, and the U.S. territories and (2) interferometric synthetic aperture radar (ifsar) data for Alaska. Specifications were created for collecting 3D elevation data, and the data management and delivery systems are being modernized. The National Elevation Dataset (NED) will be completely refreshed with new elevation data products and services. The call for action requires broad support from a large partnership community committed to the achievement of national 3D elevation data coverage. The initiative is being led by the U.S. Geological Survey (USGS) and includes many partners—Federal agencies and State, Tribal, and local governments—who will work together to build on existing programs to complete the

national collection of 3D elevation data in 8 years. Private sector firms, under contract to the Government, will continue to collect the data and provide essential technology solutions for the Government to manage and deliver these data and services. The 3DEP governance structure includes (1) an executive forum established in May 2013 to have oversight functions and (2) a multiagency coordinating committee based upon the committee structure already in place under the National Digital Elevation Program (NDEP).

First posted September 15, 2014

- [Report PDF \(13.9 MB\)](#)

For additional information, contact:

Director, National Geospatial Program
U.S. Geological Survey
511 National Center
12201 Sunrise Valley Drive
Reston, VA 20192
Email: 3dep@usgs.gov
<http://www.usgs.gov/ngpo/>
<http://nationalmap.gov/3DEP/>

Part or all of this report is presented in Portable Document Format (PDF). For best results viewing and printing PDF documents, it is recommended that you download the documents to your computer and open them with Adobe Reader. PDF documents opened from your browser may not display or print correctly.

Latest Lidar Quality Levels

Quality level	Data source ¹	Vertical error (RMSE _z) ² (centimeters)	Nominal pulse spacing (NPS) ³ (meters)	Nominal pulse density (NPD) ⁴ (points per square meter)	Digital elevation model (DEM) cell size (meters)
QL1	Lidar	10	0.35	8	0.5
QL2	Lidar	10	0.7	2	1
QL3	Lidar	20	1.4	0.5	⁵ 2
QL4	Aerial imagery	139	n/a	n/a	5
QL5	Ifsar	185	n/a	n/a	5

¹Data sources: ifsar, interferometric synthetic aperture radar; lidar, light detection and ranging.

²RMSE_z is the root mean square error in the z (elevation) dimension.

³NPS is the typical or average lateral distance between irregularly spaced first-return points in a lidar dataset, most simply calculated and expressed as the square root of the average area per elevation point. It is the square root of the reciprocal of the NPD.

⁴NPD estimates the number of first-return lidar points per square meter. It is the square of the reciprocal of the NPS.

Select State/Territory ▼

Select County/Island ▼



Instructions

FAQ

Download Inventory

Metadata

Map Service

More Information

Contact Us

Data Type

- Topographic Lidar
- Topobathy Shoreline Lidar
- IfSAR Data
- Bathymetric Lidar
- NOAA Hydrographic Surveys
- Other Bathymetric Surveys
- USACE Dredge Surveys
- Trackline Bathymetry
- Multibeam Bathymetry

*Data inventory current as of June 2014



<http://www.csc.noaa.gov/inventory/#>

Select State/Territory ▼

Select County/Island ▼



Instructions

FAQ

Download Inventory

Metadata

Map Service

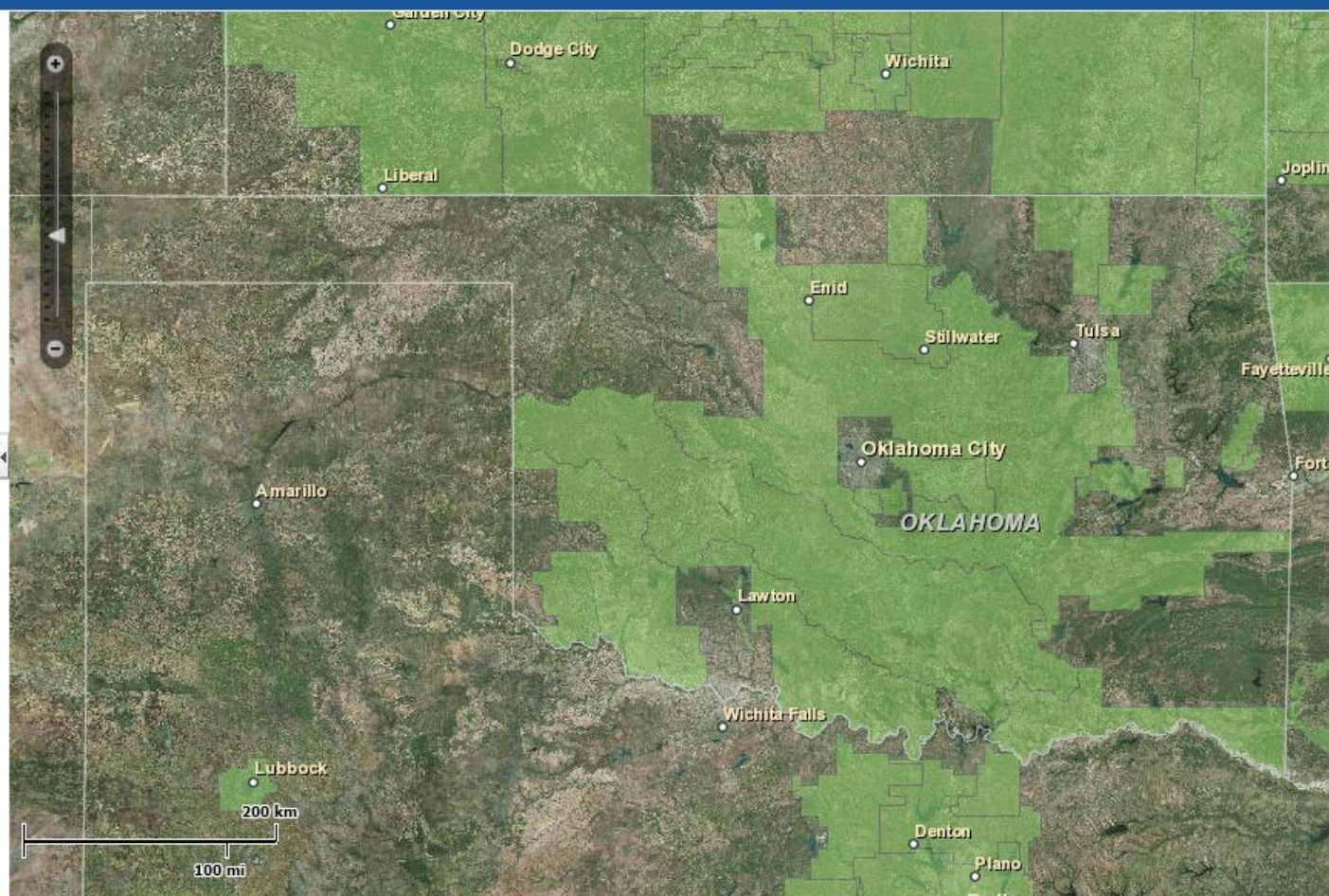
More Information

Contact Us

Data Type

-  Topographic Lidar
-  Topobathy Shoreline Lidar
-  IfSAR Data
-  Bathymetric Lidar
-  NOAA Hydrographic Surveys
-  Other Bathymetric Surveys
-  USACE Dredge Surveys
-  Trackline Bathymetry
-  Multibeam Bathymetry

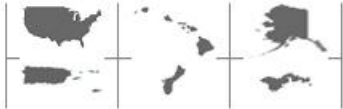
*Data inventory current as of June 2014



<http://www.csc.noaa.gov/inventory/#>

Select State/Territory ▼

Select County/Island ▼



Instructions

FAQ

Download Inventory

Metadata

Map Service

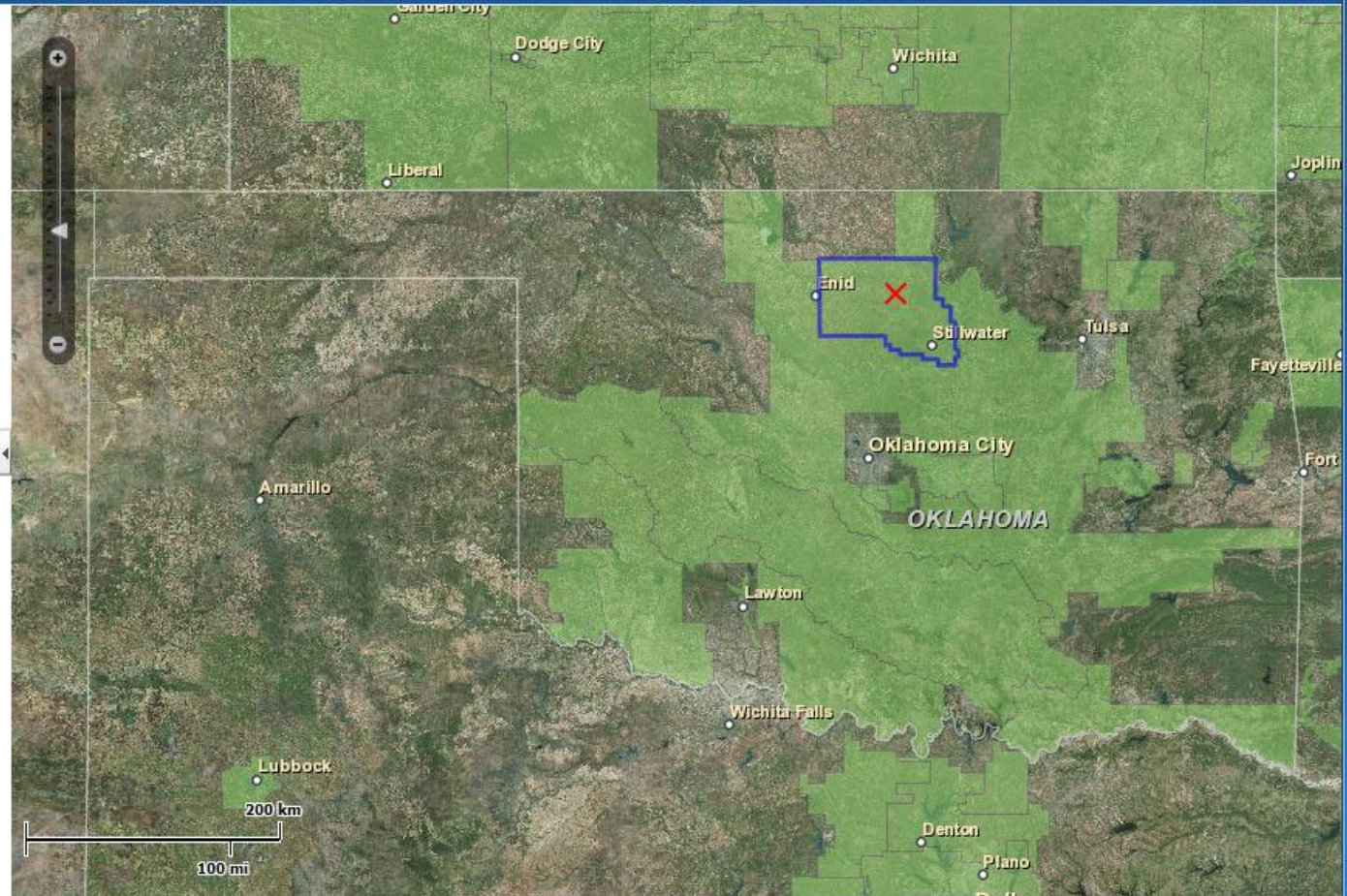
More Information

Contact Us

Data Type

- Topographic Lidar
- Topobathy Shoreline Lidar
- IfSAR Data
- Bathymetric Lidar
- NOAA Hydrographic Surveys
- Other Bathymetric Surveys
- USACE Dredge Surveys
- Trackline Bathymetry
- Multibeam Bathymetry

*Data inventory current as of June 2014



Topographic

Bathymetric

Clear Data

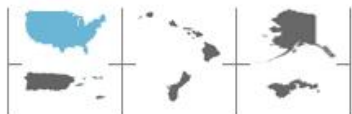
Current Location: 36.408309 , -97.314995

Print Report

Data Set Name	Data Access	Metadata Access	Collection Date	Project Status	Restrictions	Data Type	Vertical Accuracy	Horizontal Accuracy
2011 NRCS - Garfield, Noble, Payne	USGS EarthExplorer	Tile specific metadata	2011	Complete	Public	Lidar-Topo	18.5 cm	Not Provided

Select State/Territory ▼

Select County/Island ▼



Instructions

FAQ

Download Inventory

Metadata

Map Service

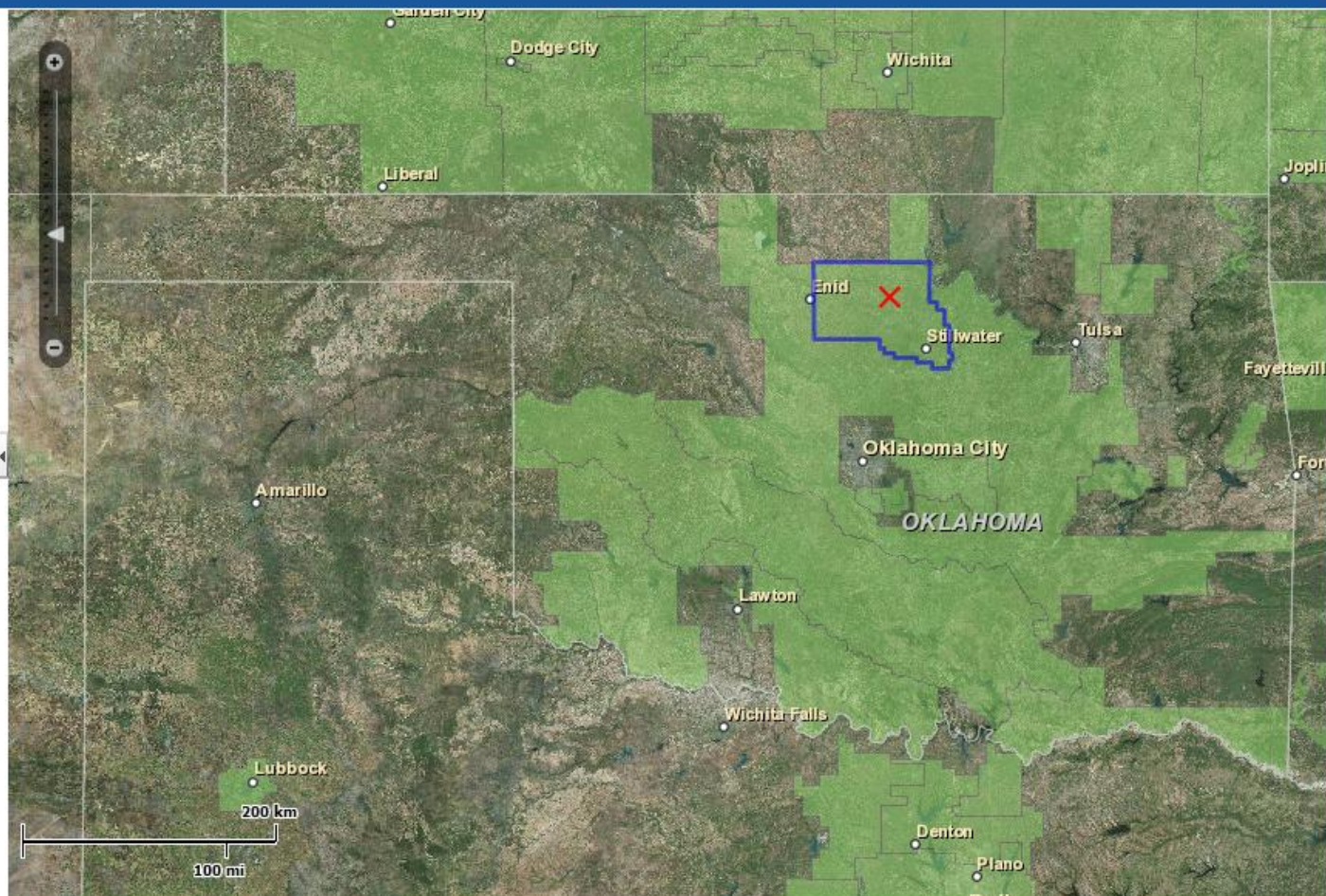
More Information

Contact Us

Data Type

- Topographic Lidar
- Topobathy Shoreline Lidar
- IfSAR Data
- Bathymetric Lidar
- NOAA Hydrographic Surveys
- Other Bathymetric Surveys
- USACE Dredge Surveys
- Trackline Bathymetry
- Multibeam Bathymetry

*Data inventory current as of June 2014



Topographic

Bathymetric

Clear Data

Current Location: 36.408309, -97.314995

Print Report

Data Set Name	Vertical Accuracy	Horizontal Accuracy	Point Spacing	Vertical Datum	Horizontal Datum	Products Available	Notes
2011 NRCS - Garfield, Noble, Payne	18.5 cm	Not Provided	1.4 m	NAVD88	NAD83	Classified LiDAR, bar	Per NMAS requirements, projec

Broad Agency Announcement for 3 D Elevation Program - G14PS00574

- Replaces partnership proposal process
- Pre-proposal due Sept 19, 2014
- Full Proposals due October 31, 2014
- USGS Lidar Specification Version 1.0 (revision in progress)
- Meet Quality Level 2 (QL2)
 - Classified lidar point cloud data, with a minimum point density of 2 points per square meter, nominal lidar pulse spacing of no greater than 0.7-meter, and relative vertical accuracy of no greater than 10-cm RMSEz

NOTICE

The USGS NGP Lidar Base Specification, Version 1.1
and
The ASPRS Accuracy Standards for Digital Geospatial Data
are both ***DRAFT*** documents at the present time.

Although both documents have been extensively reviewed



ALL descriptions and information provided in this
presentation *are proposed and are subject to change*,
pending final approval and official publication.



Lidar Specification Changes

- ☀ QL2 minimum for 3DEP lidar collections
- ☀ v1.0 Lidar metadata tags required
- ☀ Aggregate NPS(D) defined
- ☀ 2GB limit on LAS file size removed
- ☀ Overlap and Scan Angle requirements removed
- ☀ Required Datums and CRS
 - ☀ For CONUS,
 - ☀ NAD83(2011)(epoch 2010.00); NAVD88(GEOID12a)
 - ☀ EPSG registered: UTM, Stateplane, or other CRS (with prior approval)
 - ☀ For other areas, prior agreement



Lidar Specification Changes

- Classification: Two added required classifications

Classification Code	Description
1	Processed, but Unclassified
2	Bare-Earth Ground
7	Low Noise
9	Water
10	Ignored Ground (breakline proximity)
17	Bridge Decks
18	High Noise



ASPRS Accuracy Standard Alignment

- Alignment of QL Definitions to ASPRS Accuracy Classes

QL	NEEA (FVA) RMSE _z / ANPS	V1.1 (NVA) RMSE _z / ANPS	ASPRS Accuracy Class
QL0	na	5.0 cm / 8 <u>ppsm</u>	Class III
QL1	9.25 cm / 8 <u>ppsm</u>	10.0 cm / 8 <u>ppsm</u>	"Class IV+"
QL2	9.25 cm / 2 <u>ppsm</u>	10.0 cm / 2 <u>ppsm</u>	Class IV
QL3	18.5 cm / 0.7 <u>ppsm</u>	20.0 cm / 0.5 <u>ppsm</u>	Class VI

- NVA = Non-Vegetated Vertical Accuracy
- VVA = Vegetated Vertical Accuracy
- VVA Requirements are (1.5 * NVA)

"Class IV+" is a descriptive construct for Class IV accuracy with Class III density



ASPRS Accuracy Standard Alignment

- Alignment to ASPRS Accuracy Assessment Methodology

Land Cover Class	V1.0	V1.1
Clear/Open, bare-earth, low grass	FVA	NVA
Urban areas	SVA	
High grass, tall weeds, and crops	SVA	VVA
Brush lands and low trees	SVA	
Forested areas	SVA	

- NVA on point cloud assessed in single-return areas
- VVA must be met (excluding delineated Low Confidence areas)
- CVA is no longer reported

Control Points may NOT be used as Check Points



ASPRS Accuracy Standard Alignment

- ☀ Use of ASPRS recommended check point quantities:

Project Area [Sq Km]	Horizontal Accuracy Testing (Orthos and Planimetrics)	Horizontal and Vertical Testing (Elevation Data Sets)		
	Total Number of Static 2D/3D Check Points	Number of Static 3D Check Points for NVA	Number of Static 3D Check Points for VVA	Number of Static 3D Check Points, TOTAL
≤500	20	20	5	25
501-750	25	20	10	30
751-1000	30	25	15	40
1001-1250	35	30	20	50
1251-1500	40	35	25	60
1501-1750	45	40	30	70
1751-2000	50	45	35	80
2001-2250	55	50	40	90
2251-2500	60	55	45	100
Each add'l 500	as deemed necessary	3	2	5

Adapted from the **Draft** ASPRS Accuracy Standards for Digital Geospatial Data (2014, pending).
The values presented in the table are subject to change before final publication.



3DEP/v1.1 Quality Levels

Definitions and Requirements Summary

QL	ANPS Max [m]	ANPD Min [ppsm]	Minimum DEM Cell Size [m] [(ft)]	Smooth Surface Repeatability Maximum [cm]	Swath Overlap Difference RMSD _z [cm]	Swath Overlap Difference Maximum [cm]	Vertical Error Non-Vegetated, RMSE _z [cm]	Vertical Accuracy NVA@95% Confidence [cm]	Vertical Accuracy VVA@95 th Percentile [cm]	Allowable Demonstrable Classification Error [%]
QL0	0.35	8.0	0.5 (1.0)	3	4	8	5.0	9.8	14.7	0.5
QL1	0.35	8.0	0.5 (1.0)	6	8	16	10.0	19.6	29.4	0.5
QL2	0.71	2.0	1.0 (2.0)	6	8	16	10.0	19.6	29.4	1.0
QL3	1.41	0.5	2.0 (5.0)	12	16	32	20.0	39.2	58.8	2.0
v1.0 (ref)	2.00	0.7	3.0 (10.0)	7	n/a	10	12.5	24.5 (FVA)	36.3 (SVA) 36.3 (CVA)	2.0



NHD Future Direction - Water Assessment Study

- **Water Assessment Study**
 - Re-evaluation of hydrography data based on user requirements
 - Oklahoma Conservation Commission
 - Oklahoma Department of Environmental Quality
 - Oklahoma Department of Transportation
 - Oklahoma Water Resources Board
 - Others?
 - Develop program recommendation based on cost benefit
- **Long-term future direction – better integration of hydrography and elevation data**

Map Services












viewer.nationalmap.gov/example/services/serviceList.html

USGS The National Map Viewer














The National Map - Service Endpoints

TNM Viewer NHD Viewer NED Viewer














Background Maps

Name	Type	URL	WMS	Legend
USGS Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSTopo/MapServer	Link	
USGS Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSTopoLarge/MapServer	Link	
USGS Imagery Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopo/MapServer	Link	
USGS Imagery Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopoLarge/MapServer	Link	
Imagery - Large Scale	image	http://raster.nationalmap.gov/arcgis/rest/services/Orthoimagery/USGS_EROS_Ortho_SCALE/ImageServer	Link	
USGS ImageryOnly Base Map	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryOnly/MapServer	Link	
NHD Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHD/MapServer	Link	
USGS NHD Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHDLarge/MapServer	Link	
USGS Shaded Relief - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefOnly/MapServer	Link	
Shaded Relief - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefLarge/MapServer	Link	
Base Map - Blank	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/TNM_Blank_US/MapServer	Link	






Map Services

viewer.nationalmap.gov/example/services/serviceList.html				
Base Data Layers				
Name	Type	URL	WMS	Legend
US Topo Availability	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/US_Topo_Availability/MapServer	Link	
Geographic Names (GNIS)	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/geonames/MapServer	Link	
Structures	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/structures/MapServer	Link	
Transportation	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/transportation/MapServer	Link	
Governmental Unit Boundaries	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/govunits/MapServer	Link	
Map Indices	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/map_indices/MapServer	Link	
Hydrography (NHD)	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/nhd/MapServer	Link	
National Land Cover Database (NLCD)	dynamic	http://raster.nationalmap.gov/arcgis/rest/services/LandCover/USGS_EROS_LandCover_NLCD/MapServer	Link	
Elevation Availability	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/ElevationAvailability/MapServer	Link	
Elevation Contours - Small Scale	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/TNM_Contours/MapServer	Link	
Imagery - 1 meter	image	http://raster.nationalmap.gov/arcgis/rest/services/Orthoimagery/USGS_EROS_Ortho_NAIP/ImageServer	Link	
Imagery - 1 foot	image	http://raster.nationalmap.gov/arcgis/rest/services/Orthoimagery/USGS_EROS_Ortho_1Foot/ImageServer	Link	
Reference Polygons	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/selectable_polygons/MapServer	Link	

Map Services

Natural Hazards				
Name	Type	URL	WMS	Legend
USGS US Hazards	dynamic	http://igems.doi.gov/ArcGIS/rest/services/igems_haz/MapServer	Link	
USGS Stream Flow, Weather & Tide Stations	dynamic	http://igems.doi.gov/ArcGIS/rest/services/igems_info/MapServer	Link	
FEMA National Flood Hazards	dynamic	https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer	Link	
NEXRAD Weather	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/NEXRAD_Weather/MapServer	Link	
NGA US National Grid	dynamic	http://maps1.arcgisonline.com/ArcGIS/rest/services/NGA_US_National_Grid/MapServer	Link	
Other Featured Data				
Name	Type	URL	WMS	Legend
Scanned Topo Maps from USA Topo	dynamic	http://services.arcgisonline.com/ArcGIS/rest/services/USA_Topo_Maps/MapServer		
USGS Ecosystems	dynamic	http://rmgsc.cr.usgs.gov/ArcGIS/rest/services/ecosys_US/MapServer	Link	
USGS Protected Area Owner (PADUS)	tiled	http://gis1.usgs.gov/arcgis/rest/services/gap/PADUS_Owner/MapServer	Link	
USGS Protected Area Conservation Status (PADUS)	tiled	http://gis1.usgs.gov/arcgis/rest/services/gap/PADUS_Status/MapServer	Link	
USGS GAP Land Cover	dynamic	http://gis1.usgs.gov/arcgis/rest/services/gap/GAP_Land_Cover_NVC_Formation_Landuse/MapServer	Link	
FWS Wetlands	dynamic	http://107.20.228.18/ArcGIS/rest/services/Wetlands/MapServer	Link	
BLM Public Land Survey System (PLSS)	dynamic	http://www.geocommunicator.gov/ArcGIS/rest/services/PLSS/MapServer	Link	
National Park Service (NPS) Boundaries	dynamic	http://mapservices.nps.gov/ArcGIS/rest/services/LandResourcesDivisionTractAndBoundaryService/MapServer	Link	

Map Services

viewer.nationalmap.gov/example/services/serviceList.html				
Web Feature Services (WFS)				
Name	Type	URL	WFS	Preview
WFS/geonames	MapServer	http://services.nationalmap.gov/arcgis/rest/services/WFS/geonames/MapServer	Link	
WFS/govunits	MapServer	http://services.nationalmap.gov/arcgis/rest/services/WFS/govunits/MapServer	Link	
WFS/selectable_polygons	MapServer	http://services.nationalmap.gov/arcgis/rest/services/WFS/selectable_polygons/MapServer	Link	
WFS/structures	MapServer	http://services.nationalmap.gov/arcgis/rest/services/WFS/structures/MapServer	Link	
WFS/transportation	MapServer	http://services.nationalmap.gov/arcgis/rest/services/WFS/transportation/MapServer	Link	
Other Services				
Name	Type	URL		
NLCD OGC-WCS service	Other	http://raster.nationalmap.gov/ArcGIS/services/LandCover/USGS_EROS_LandCover_NLCD/MapServer/WCSServer?request=GetCapabilities&service=WCS		
NED Point Query Service (PQS)	Other	http://ned.usgs.gov/epqs/		
Streamer	Other	http://nationalmap.gov/streamer/		
Direct FTP Access to Staged Products	Other	ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/		

Map Services

viewer.nationalmap.gov/example/services/serviceList.html

USGS The National Map Viewer

The National Map - Service Endpoints

TNM Viewer NHD Viewer NED Viewer

Background Maps

Name	Type	URL	WMS	Legend
USGS Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSTopo/MapServer	Link	
USGS Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSTopoLarge/MapServer	Link	
USGS Imagery Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopo/MapServer	Link	
USGS Imagery Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopoLarge/MapServer	Link	
Imagery - Large Scale	image	http://raster.nationalmap.gov/arcgis/rest/services/Orthoimagery/USGS_EROS_Ortho_SCALE/ImageServer	Link	
USGS ImageryOnly Base Map	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryOnly/MapServer	Link	
NHD Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHD/MapServer	Link	
USGS NHD Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHDLarge/MapServer	Link	
USGS Shaded Relief - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefOnly/MapServer	Link	
Shaded Relief - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefLarge/MapServer	Link	
Base Map - Blank	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/TNM_Blank_US/MapServer	Link	

Map Services – WMS Link

```
<?xml version="1.0" encoding="UTF-8"?>
- <WMS_Capabilities xsi:schemaLocation="http://www.opengis.net/wms http://schemas.opengis.net/wms/1.3.0/capabilities_1_3_0.xsd
  http://www.esri.com/wms http://services.nationalmap.gov/arcgis/services/USGSTopoLarge/MapServer/WMSServer?
  version=1.3.0&service=WMS&request=GetSchemaExtension" xmlns:esri_wms="http://www.esri.com/wms"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wms" version="1.3.0">
  - <Service>
    <Name>USGSTopoLarge</Name>
    <Title>USGSTopoLarge</Title>
    <Abstract>WMS</Abstract>
  - <KeywordList>
    <Keyword/>
  </KeywordList>
  <OnlineResource xlink:href="http://services.nationalmap.gov/arcgis/services/USGSTopoLarge/MapServer/WMSServer" xlink:type="simple"
    xmlns:xlink="http://www.w3.org/1999/xlink"/>
  - <ContactInformation>
    - <ContactPersonPrimary>
      <ContactPerson/>
      <ContactOrganization/>
    </ContactPersonPrimary>
    <ContactPosition/>
    - <ContactAddress>
      <AddressType/>
      <Address/>
      <City/>
      <StateOrProvince/>
      <PostCode/>
      <Country/>
    </ContactAddress>
    <ContactVoiceTelephone/>
    <ContactFacsimileTelephone/>
    <ContactElectronicMailAddress/>
  </ContactInformation>
  <Fees/>
  <AccessConstraints/>
  <MaxWidth>2048</MaxWidth>
```


Map Services












viewer.nationalmap.gov/example/services/serviceList.html

USGS The National Map Viewer

The National Map - Service Endpoints

TNM Viewer NHD Viewer NED Viewer

Background Maps

Name	Type	URL	WMS	Legend
USGS Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSTopo/MapServer	Link	
USGS Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSTopoLarge/MapServer	Link	
USGS Imagery Topo Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopo/MapServer	Link	
USGS Imagery Topo Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSImageryTopoLarge/MapServer	Link	
Imagery - Large Scale	image	http://raster.nationalmap.gov/arcgis/rest/services/Orthoimagery/USGS_EROS_Ortho_SCALE/ImageServer	Link	
USGS ImageryOnly Base Map	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSImageryOnly/MapServer	Link	
NHD Base Map - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHD/MapServer	Link	
USGS NHD Base Map - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSHydroNHDLarge/MapServer	Link	
USGS Shaded Relief - Primary Tile Cache	tiled	http://basemap.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefOnly/MapServer	Link	
Shaded Relief - Below 18K Scale Dynamic	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/USGSShadedReliefLarge/MapServer	Link	
Base Map - Blank	dynamic	http://services.nationalmap.gov/ArcGIS/rest/services/TNM_Blank_US/MapServer	Link	

USGSTopoLarge (MapServer)

View In: [ArcGIS JavaScript](#) [ArcGIS.com Map](#) [Google Earth](#) [ArcMap](#) [ArcGIS Explorer](#)

View Footprint In: [ArcGIS.com Map](#)

Service Description: See <http://viewer.nationalmap.gov/help> for assistance with The National Map viewer, services, or metadata.

Map Name: Layers

[Legend](#)

[All Layers and Tables](#)

Layers:

- [Level 16-19 - 1:9K and larger](#) (0)
 - [Geographic Name](#) (1)
 - [Landform Name](#) (2)
 - [Culture Name](#) (3)
 - [Hydrography Feature Name](#) (4)
 - [Locale Name](#) (5)
 - [Populated Place \(Cities/Towns\) Name](#) (6)
 - [Structure](#) (7)
 - [Structure](#) (8)
 - [Airport](#) (9)
 - [Airport Runway](#) (10)
 - [Transportation](#) (11)
 - [Interstate](#) (12)
 - [Interstate shield 2](#) (13)
 - [US Route](#) (14)
 - [State Route](#) (15)
 - [Railroad](#) (16)
 - [County Route](#) (17)
 - [Road Segment](#) (18)
 - [Boundary \(Outline\)](#) (19)
 - [International Boundary](#) (20)
 - [Native American Land](#) (21)
 - [National Forest](#) (22)
 - [County](#) (23)
 - [Federal Land](#) (24)
 - [Incorporated Place \(Cities and Towns\)](#) (25)



Layers:

- [Level 16-19 - 1:9K and larger](#) (0)
 - [Geographic Name](#) (1)
 - [Landform Name](#) (2)
 - [Culture Name](#) (3)
 - [Hydrography Feature Name](#) (4)
 - [Locale Name](#) (5)
 - [Populated Place \(Cities/Towns\) Name](#) (6)
 - [Structure](#) (7)
 - [Structure](#) (8)
 - [Airport](#) (9)
 - [Airport Runway](#) (10)
 - [Transportation](#) (11)
 - [Interstate](#) (12)
 - [Interstate shield 2](#) (13)
 - [US Route](#) (14)
 - [State Route](#) (15)
 - [Railroad](#) (16)
 - [County Route](#) (17)
 - [Road Segment](#) (18)

- [Incorporated Place \(Cities and Towns\)](#) (25)
 - [State](#) (26)
- [Hydrography \(Outline\)](#) (27)
 - [Gaging Station](#) (28)
 - [Water Point Feature](#) (29)
 - [Line: Stream, Canal, Pipeline and Shoreline Line Feature](#) (30)
 - [Miscellaneous Water Line Feature](#) (31)
 - [Lake, Reservoir and Swamp Areal Feature](#) (32)
 - [Area: Stream, Canal, Ocean and Miscellaneous Feature](#) (33)
- [Elevation \(Line\)](#) (34)
 - [Contour Label - 10 foot](#) (35)
 - [Contour Line - 10 foot](#) (36)
- [Boundary \(Fill\)](#) (37)
 - [Federal Boundary](#) (38)
 - [Native American Land](#) (39)
 - [Woodland](#) (40)
- [Hydrography \(Fill\)](#) (41)
 - [Lake, Reservoir and Swamp Areal Feature](#) (42)
 - [Area: Stream, Canal, Ocean and Miscellaneous Feature](#) (43)
- [Elevation \(Relief\)](#) (44)
 - [NED_13](#) (45)
 - [Boundary](#) (46)
 - [Footprint](#) (47)
 - [Image](#) (48)

Initial Extent:

XMin: -77.4094956224034
YMin: 37.507622474211246
XMax: -77.38889863576873
YMax: 37.51632715308661
Spatial Reference: 4326 (4326)

Full Extent:

XMin: -179.4680555999999
YMin: -19.865153419549415
XMax: 179.89472220000005
YMax: 71.49960662200004
Spatial Reference: 4326 (4326)

Units: esriDecimalDegrees

Supported Image Format Types: PNG32,PNG24,PNG,JPG,DIB,TIFF,EMF,PS,PDF,GIF,SVG,SVGZ,BMP

Document Info:

Title: USGS TNM Topo Base Map – Large Scale
Author: U. S. Geological Survey - National Geospatial Program
Comments: See <http://viewer.nationalmap.gov/help> for assistance with *The National Map* viewer, services, or metadata.
Subject: USGS TNM Topo Base Map – Large Scale
Category:
Keywords: base map,elevation,shaded relief,contour,hydrography,water,governmental unit,boundary,geographic name,land cover,structure,transportation,road,railroad,airport,runway
AntialiasingMode: Best
TextAntialiasingMode: Force

Supports Dynamic Layers: false

MaxRecordCount: 1000

MaxImageHeight: 4096

MaxImageWidth: 4096

Supported Query Formats: JSON, AMF

Min Scale: 13500

Max Scale: 1000

Child Resources: [Info](#)

Supported Operations: [Export Map](#) [Identify](#) [Find](#) [Return Updates](#) [Generate KML](#)



[JSON](#)

Layer: Level 16-19 - 1:9K and larger (ID: 0)

Sub Layers:

- Geographic Name
- Structure
- Transportation
- Boundary (Outline)
- Hydrography (Outline)
- Elevation (Line)
- Boundary (Fill)
- Hydrography (Fill)
- Elevation (Relief)

Name: Level 16-19 - 1:9K and larger

Display Field:

Type: Group Layer

Geometry Type: null

Description: U.S. City Block/Village View showing USGS The National Map (TNM) data for all U.S. and National Atlas data for North American Borders. TNM "vector" data includes all Boundaries, Structures, Transportation, and Hydrography data. This view will be comparable to the USGS Topographic Products being developed at 7.5 minute quadrangle using 1:24,000 scale data.

Definition Expression: N/A

Copyright Text: USGS TNM - National Structures Dataset, USGS TNM - National Transportation Dataset, TeleAtlas Commercial Roads, USGS TNM - Governmental Units Dataset, U.S. Census Bureau - TIGER/Line, USGS TNM - Geographic Names Information Systems (GNIS), USGS TNM - National Hydrography Dataset (NHD)

Default Visibility: true

MaxRecordCount: 0

[JSON](#) | [SOAP](#) | [WMS](#)

USGSTopoLarge (MapServer)

View In: [ArcGIS JavaScript](#) [ArcGIS.com Map](#) [Google Earth](#) [ArcMap](#) [ArcGIS Explorer](#)

View Footprint In: [ArcGIS.com Map](#)

Service Description: See <http://viewer.nationalmap.gov/help> for assistance with The National Map viewer, services, or metadata.

Map Name: Layers

[Legend](#)

Legend (USGSTopoLarge)

Landform Name (2)



Culture Name (3)



Hydrography Feature Name (4)

Locale Name (5)



Populated Place (Cities/Towns) Name (6)

Structure (8)



Ambulance Service



Cemetery



College / University



Fire Station / EMS Station



Hospital / Medical Center



Law Enforcement



Post Office



Prison / Correctional Facility

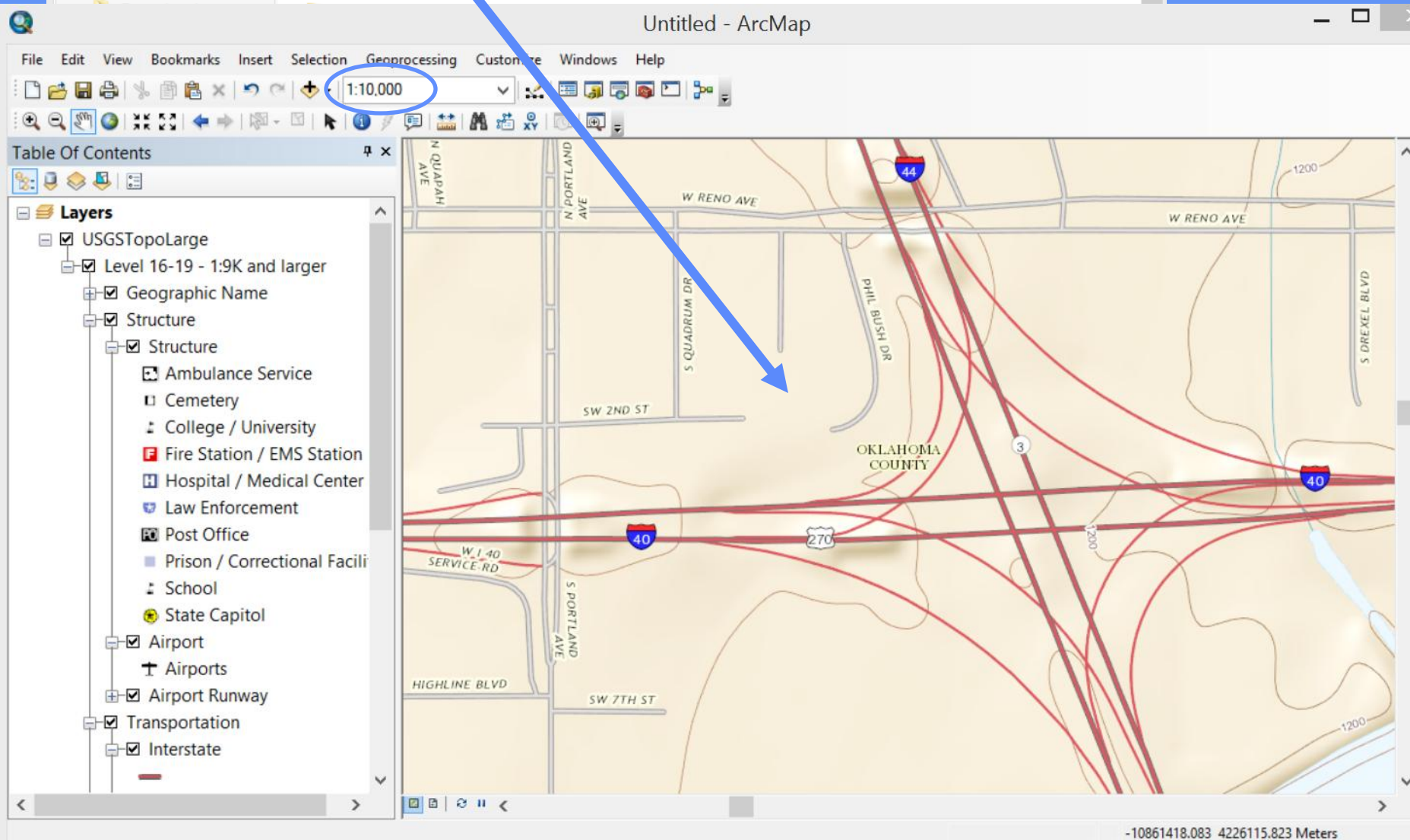
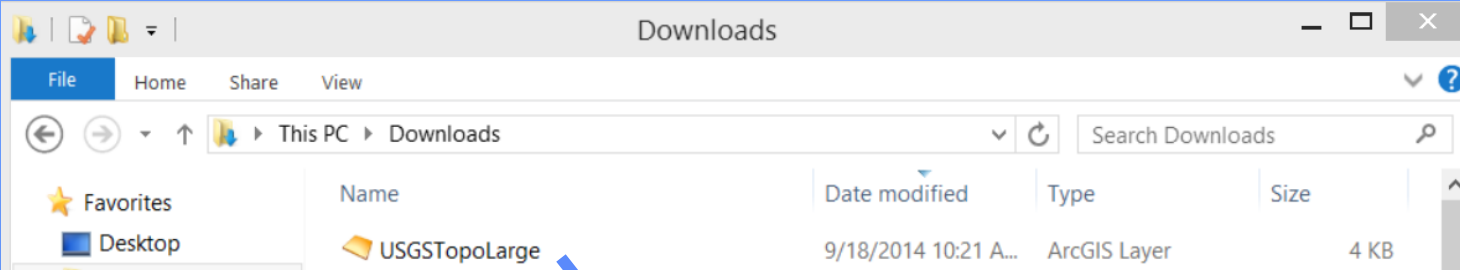


School



State Capitol

Airport (9)



Load a TNM service as an ArcGIS Server REST service into ArcMap

- Use ArcCatalog to add a *TNM* service as an ArcGIS Server REST service. Copy a URL from the Services List at <http://viewer.nationalmap.gov/example/services/serviceList.html>, but make sure to remove the "rest/" portion from the URL. Here is an abbreviated list to setup quickly:
- Base Map Services: <http://basemap.nationalmap.gov/ArcGIS/services>
- Vector Overlay Services: <http://services.nationalmap.gov/ArcGIS/services>
- Raster Overlay Services: <http://raster.nationalmap.gov/ArcGIS/services>
- Once you have added the service to ArcCatalog, expand the list, pick the service layer you seek, and you can drag and drop the service into the data frame of your ArcMap session.

File Edit View Go Geoprocessing Customize Windows Help

GIS Servers\Add ArcGIS Server

- Catalog Tree
- Folder Connections
 - Toolboxes
 - Database Servers
 - Database Connections
 - GIS Servers
 - Add ArcGIS Server
 - Add ArcIMS Server
 - Add WCS Server
 - Add WMS Server
 - Add WMTS Server
 - My Hosted Services
 - Interoperability Connections

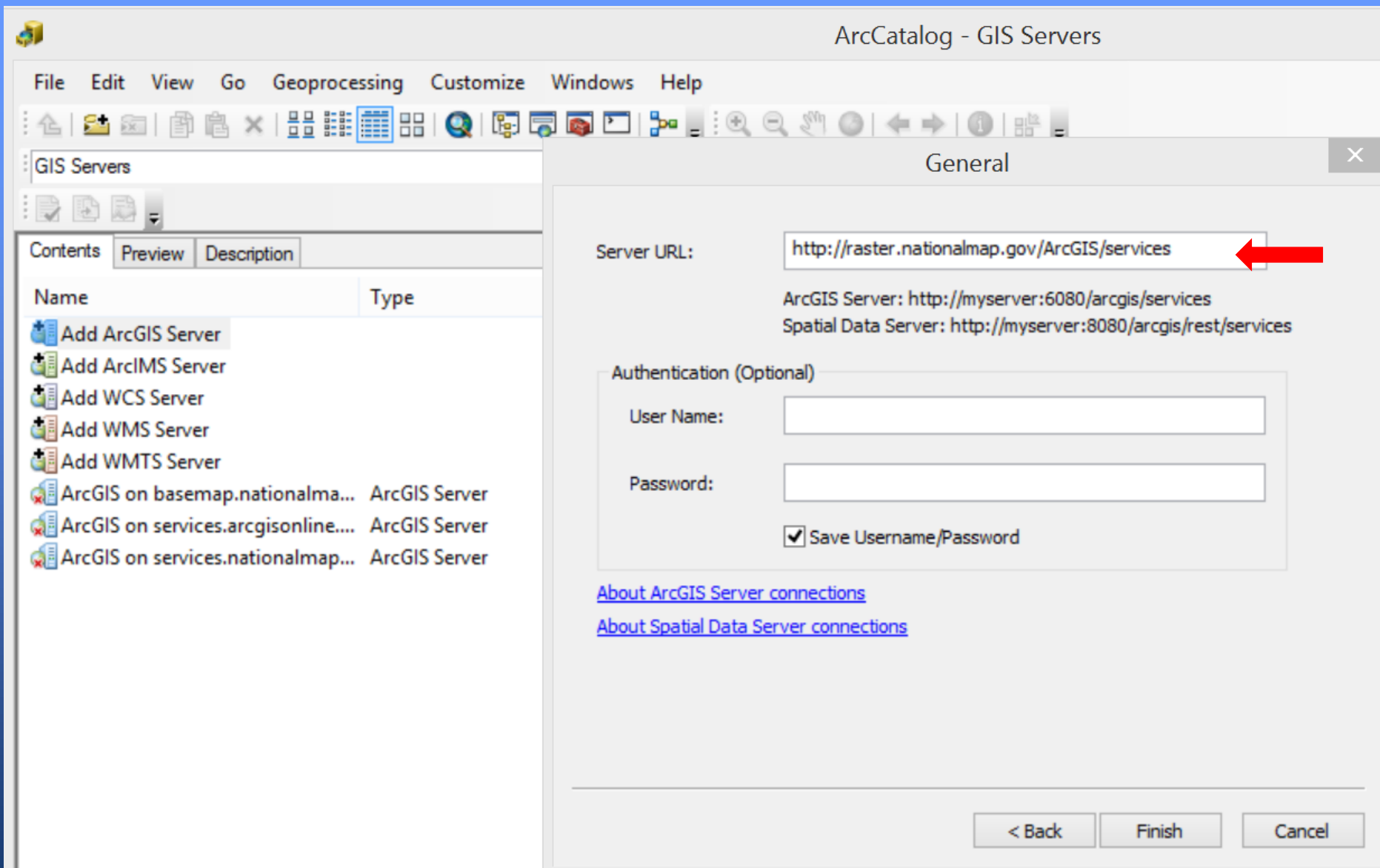
Add ArcGIS Server

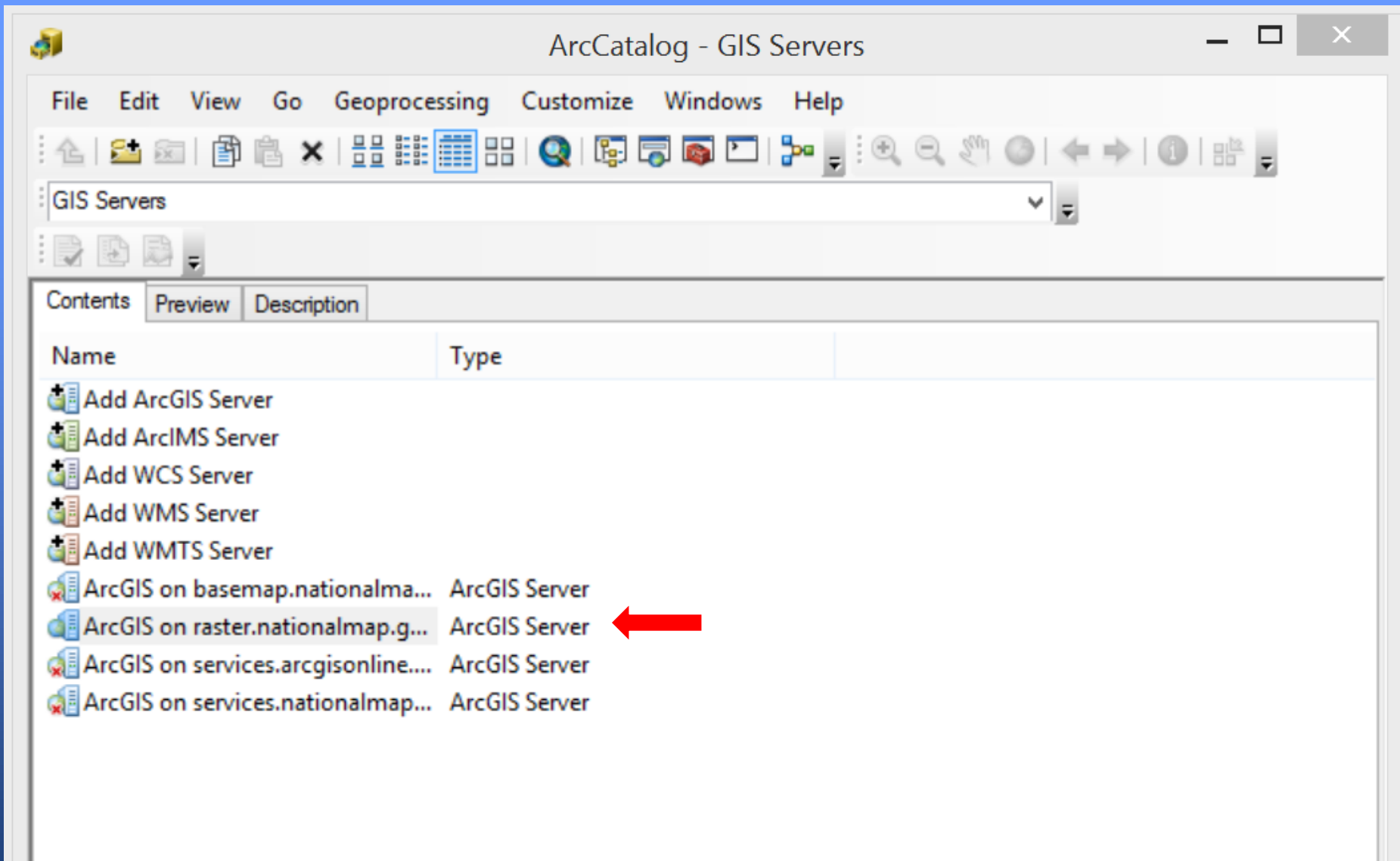
This wizard guides you through the process of making a connection to an ArcGIS Server. You can create a connection to use, publish, or administer GIS services.

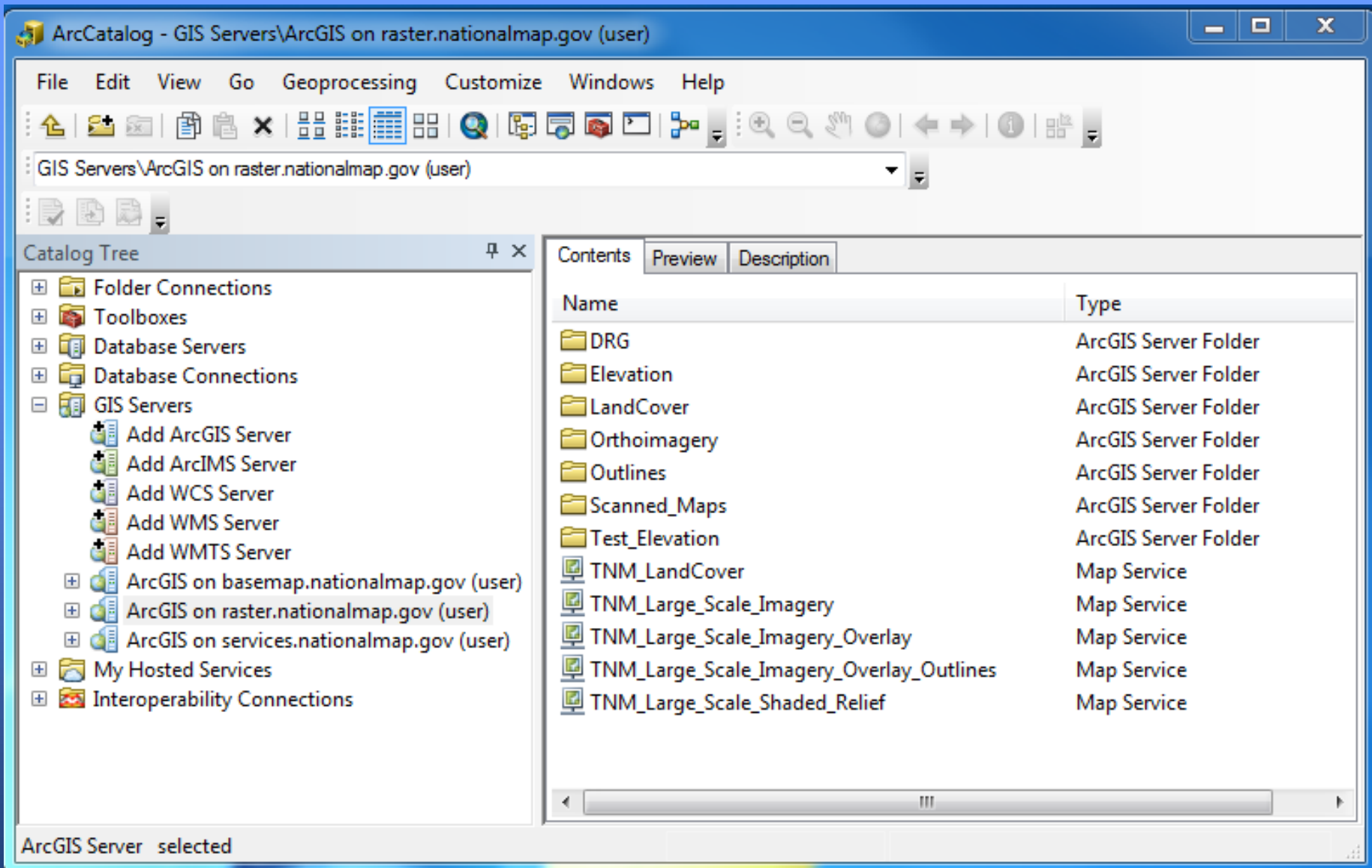
What would you like to do?

- ☒ Use GIS services
- ☐ Publish GIS services
- ☐ Administer GIS server

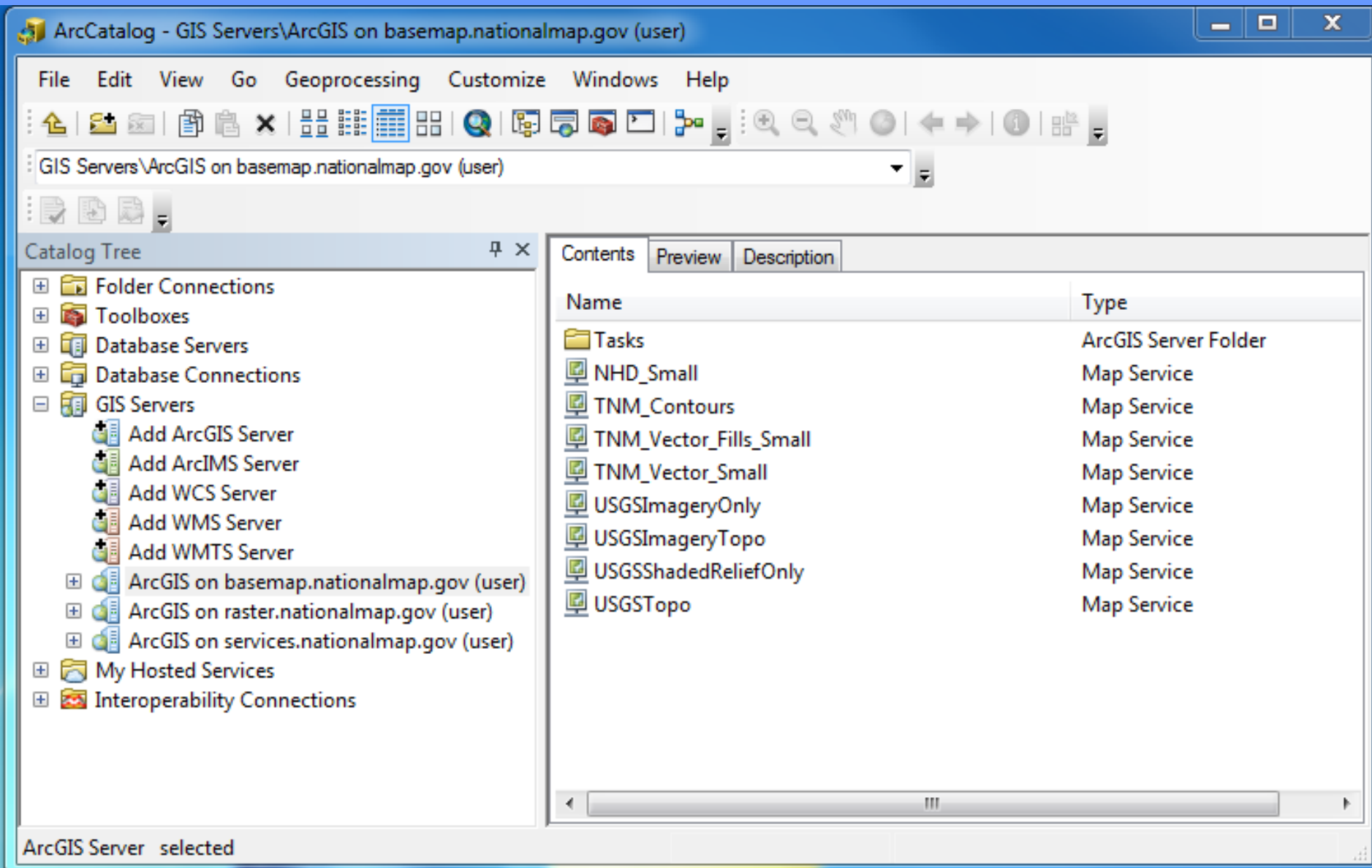
< Back Next > Cancel

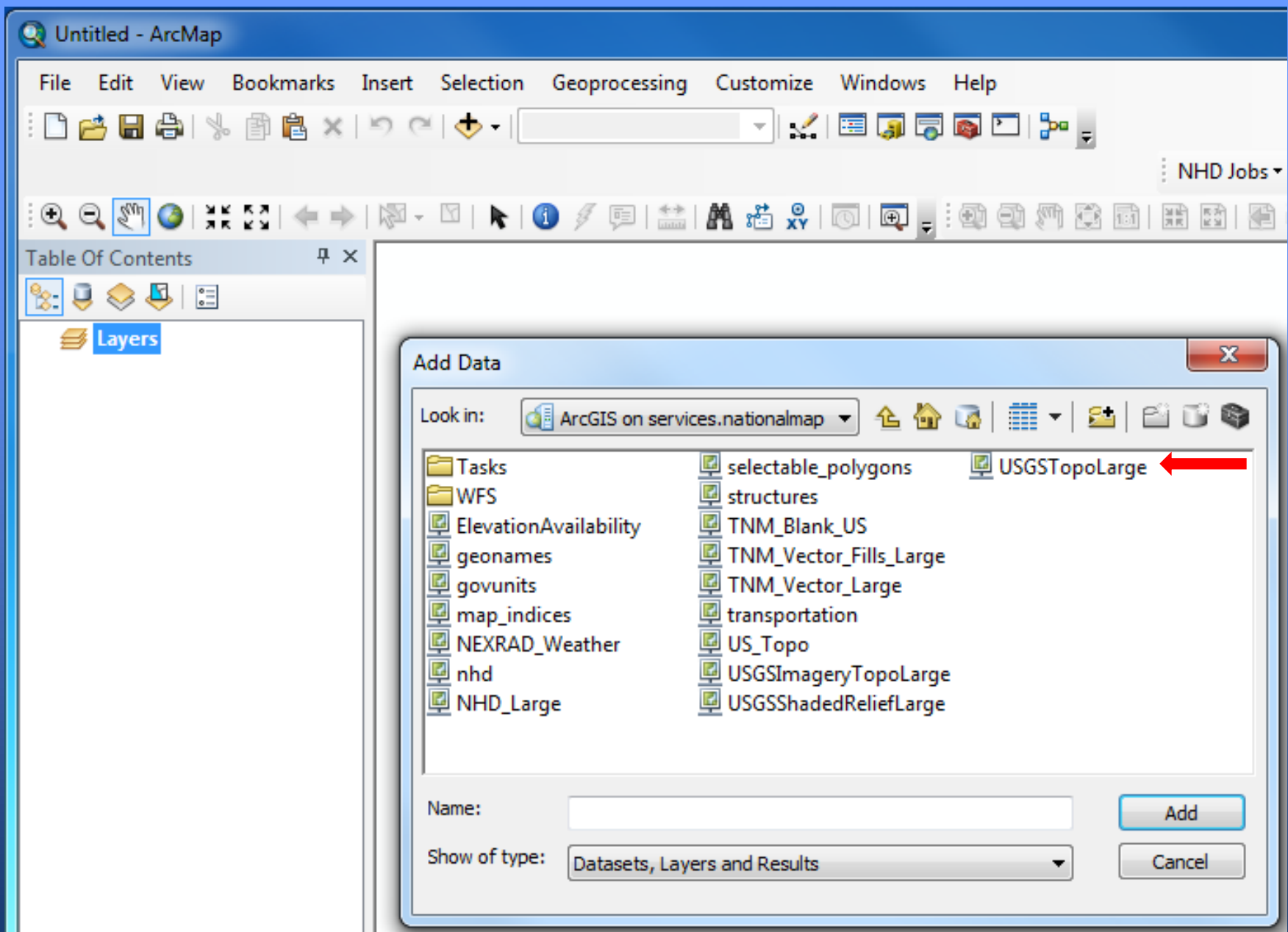




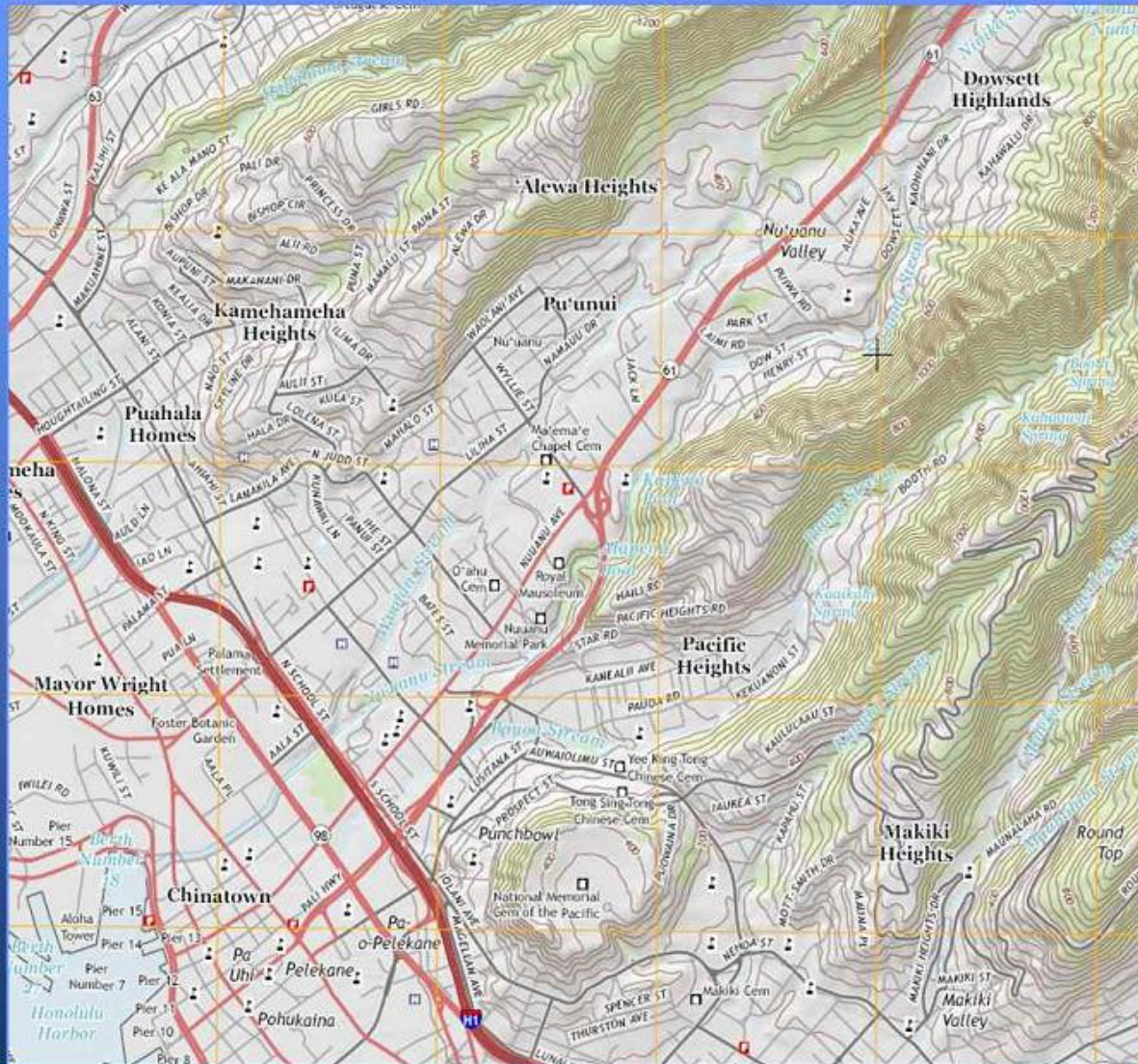


<http://raster.nationalmap.gov/ArcGIS/services>





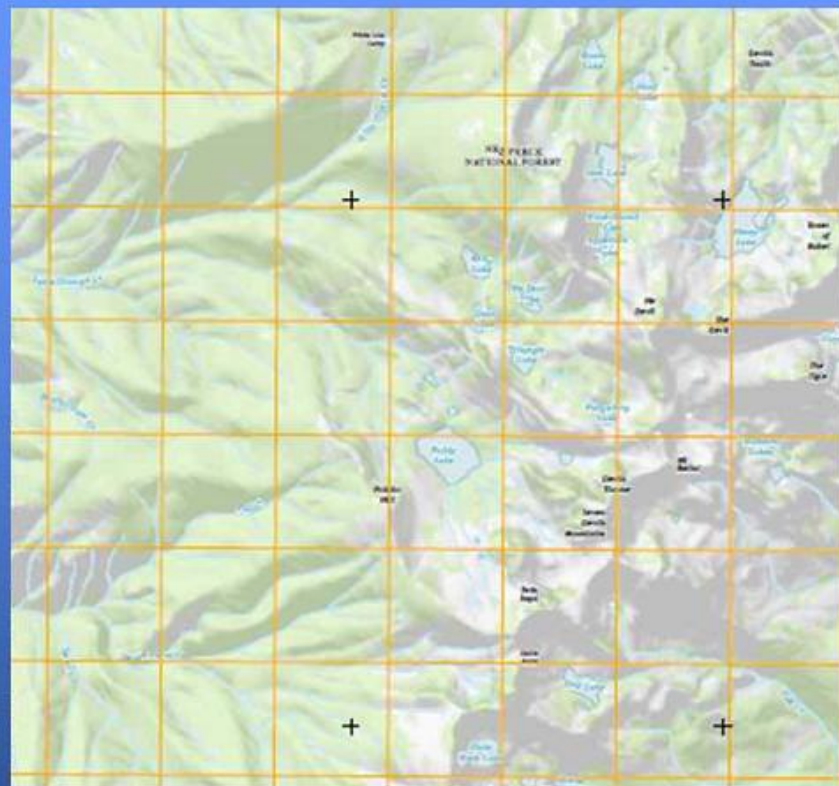
US Topo Feature Content: 2009, 2010, 2011, 2012, 2013, 2014



Ortho-rectified Aerial Imagery
Roads
Names
Elevation Contours
Hydrography
State/County/USFS Boundaries
Runways
Woodland
Railroads
PLSS
Fire Stations
Hospitals
Schools
Military Boundaries
Cemeteries
Post Offices
Shaded Relief
Selected Trails
FWS Boundaries
State Capitals
Police Stations
Correctional Facilities

US Topo Redesign

- **Feature additions**
 - Shaded relief
 - Land cover
 - Military installation boundaries
 - NPS boundaries
 - FWS boundaries
 - Schools
- **Display factors**
 - Functional road classification
 - Update existing vector symbology
 - Update layer orders and transparencies
- **Annotation**
 - Freely distributable fonts (Win and Mac OS)
 - Unicode to support diacritics
- **Expanded Legend**
 - Attached to GeoPDF



Questions?

Ingrid M Landgraf, Cartographer

U.S. Geological Survey

imlandgraf@usgs.gov

785-832-3566

