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Introduction

Services are a growing technology for sharing, accessing, using, and even extracting spatial data. Map, image, and feature services allow you to add data hosted on someone else's GIS server resources into your web map or desktop map. As functionality changes are made in geospatial data storage and sharing, there can be a bit of a learning curve. Using services and downloading data from feature services can be different from how many people learned GIS, where the emphasis was on "downloading the data" and working with it locally.

The purpose of this document is to smooth out these learning curves by providing an overview of terms, technical tips for accessing VGIN data, and documenting the steps of connecting to services and copying features out of feature services in both ArcGIS Pro and ArcGIS Desktop ArcMap.

Overview of GIS Web Services

For several years the Virginia Geographic Information Network (VGIN) [Virginia GIS Clearinghouse](https://vgin.vdem.virginia.gov) (<https://vgin.vdem.virginia.gov>) has made available data not only as downloads, but also as services. There are several types of services, map services, image services, feature services, and geoprocessing services. Each of these serves a different purpose and is a different online data type. Regardless of the source or type, as you pull data from map, image, or feature services into your maps or analyses, they stay up-to-date as the host makes changes to the dataset.



Home

VGIN Board ▾

Clearinghouse ▾

Orthoimagery

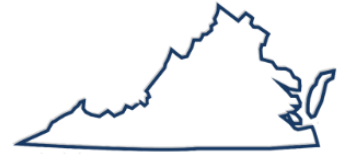
Base Mapping

NG9-1-1 GIS

Contact ▾

Virginia GIS Clearinghouse

VGIN coordinates the development and maintenance of a GIS Clearinghouse for the Commonwealth of Virginia, serving as a central location to share, plan, and coordinate all things geospatial to include data, services, maps, apps, and more.


 Search Entire Virginia GIS Clearinghouse
Data Download
By CategoryExplore REST
ServicesExplore Apps
& MapsStandards
& Resources

Map services, like traditional cached basemaps and imagery, only allow you to access and view spatial data. This allows the creator to control the data & symbology while sharing it publicly with others. This data can be helpful to the end user to provide context in their own maps without having to recreate a wheel. Raster or basemap versions of these services are often cached to display at certain pre-set scales. A VGIN example is the Most Recent Imagery service.

Image services allow users to not only view imagery, but filter, symbolize, and analyze hosted raster data. Image services involve a server extension and are not as common but are a powerful way to make the full capability of imagery widely available. Esri's Living Atlas (<https://livingatlas.arcgis.com/en/home/>) contains services of this type.

Feature services, depending on security and options set when they are published, can allow you to query or perform analysis on the data and symbolize them to work with your other map layers or your own data. VGIN generally makes their feature services open access, however you can't edit the data on our servers. Using "copy feature layers" geoprocessing functionality, offers a way to make local copies of data that may change frequently. VGIN examples include address points, road centerlines, and much of the boundary 9-1-1 data.

Geoprocessing services are GIS tools that are built and published as services. Some of these are part of the standard ArcGIS Server installation, such as geometry and print services. However, the possibilities are endless for what tools you can publish and make available. A VGIN example is the geocoding service.

Beyond traditional ArcGIS servers, you can also host, publish, and access many of these types of services from ArcGIS Online. The Open Geospatial Consortium (<https://www.ogc.org/>) supports WMS, WCS, and WFS services that function like the Esri versions. They may also be used in ArcGIS Desktop and ArcGIS Pro, but sometimes require a different workflow to add to a project.

VGIN's Clearinghouse Services page (<https://vgin.vdem.virginia.gov/pages/cl-restservices>) describes the services available, linking to the services on VGIN's ArcGIS Server (<https://vginmaps.vdem.virginia.gov/arcgis/rest/services>).


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Virginia GIS Clearinghouse

VGIN REST Services

VGIN REST services can be pulled into web and desktop mapping applications as well as many other open source mapping solutions for spatial utilization as well as many non-spatial applications to perform data analysis and development. From private citizens to casual mappers, GIS Analysts, Web Developers, to GIS Managers, the data can be utilized by many different applications in many different ways. Browse categories below to find more information.



Imagery

On average, 90% of the half billion annual hits to VGIN REST services are attributed to accurate and up to date imagery.



Base Map

VGIN Base Mapping efforts drive the ability to showcase additional high resolution vector datasets with local accuracy.



Geocoding

Locate a Virginia address or place with the highest resolution of geospatial data accuracy with numerous cascading sources.



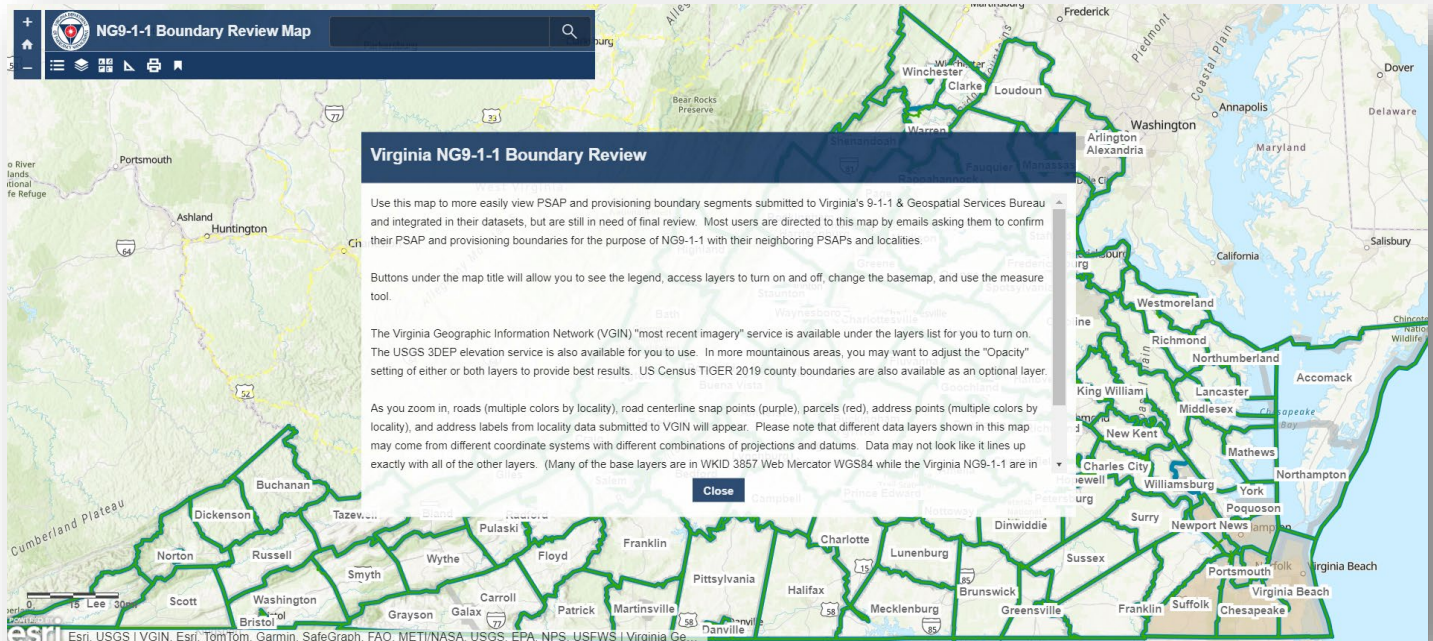
NG9-1-1

VGIN maintains numerous 9-1-1 and Next Generation 9-1-1 mission critical services, thus strengthening bases.

Feature Services and NG9-1-1 (An Example)

The examples describe feature services related to Virginia's NG9-1-1 deployment, but the steps apply to connecting to any GIS publishing services and copying features from feature services which have this functionality enabled.

As part of the NG9-1-1 Deployment, VGIN receives line segment data from 9-1-1 Public Safety Answering Points (PSAPs) and localities across the commonwealth. These data reflect mutual agreement with neighbors about boundaries for geospatial call routing to PSAPs and boundaries for "provisioning" GIS data into the NG9-1-1 spatial interface. VGIN reviews these lines for mutual agreement, attribution, geometry, and fit within lines received from others. These are updated weekly and are used to create the PSAP polygon and provisioning polygons for Virginia, the same geometry you see on the *NG9-1-1 Boundary Review Map*, the *Virginia Next Generation 9-1-1 Dashboard*, and other applications referenced at <https://vgin.vdem.virginia.gov/pages/ng9-1-1-gis>. The example below shows the completed PSAP line geometry from a feature service as a green line. This development method insures PSAP and GIS coverage will be complete with no gaps or overlaps.



To efficiently distribute one version of the data, VGIN shares these NG9-1-1 layers as feature services from an ArcGIS Server. The full listing of Virginia NG9-1-1 services is shown in the image below.

ArcGIS REST Services Directory

[Home](#) > [services](#) > [NG911](#)

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

Folder: NG911

Current Version: 11.3

Services:

- [NG911/NG911_Deployment](#) (FeatureServer)
- [NG911/NG911_Deployment](#) (MapServer)
- [NG911/NG911_Locality_Profile](#) (FeatureServer)
- [NG911/NG911_Locality_Profile](#) (MapServer)
- [NG911/NG911_Provisioning_Line_Geometry](#) (FeatureServer)
- [NG911/NG911_Provisioning_Line_Geometry](#) (MapServer)
- [NG911/NG911_Provisioning_Line_Junction](#) (FeatureServer)
- [NG911/NG911_Provisioning_Line_Junction](#) (MapServer)
- [NG911/NG911_PSAP_Line_Geometry](#) (FeatureServer)
- [NG911/NG911_PSAP_Line_Geometry](#) (MapServer)
- [NG911/NG911_PSAP_Line_Junction](#) (FeatureServer)
- [NG911/NG911_PSAP_Line_Junction](#) (MapServer)
- [NG911/NG911_PSAP_Telco](#) (MapServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_Provisioning_Polygon](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_Provisioning_Polygon](#) (MapServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_PSAP_Polygon](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_PSAP_Polygon](#) (MapServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_RCLSnapToPoint](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneNorth_NAD83_RCLSnapToPoint](#) (MapServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_Provisioning_Polygon](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_Provisioning_Polygon](#) (MapServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_PSAP_Polygon](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_PSAP_Polygon](#) (MapServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_RCLSnapToPoint](#) (FeatureServer)
- [NG911/NG911_VA_StatePlaneSouth_NAD83_RCLSnapToPoint](#) (MapServer)

Supported Interfaces: [REST](#) [SOAP](#) [Sitemap](#) [Geo Sitemap](#)

This guide uses the NG9-1-1 project as an example of how to connect to VGIN's ArcGIS Server (<https://vginmaps.vdem.virginia.gov/arcgis/rest/services>) and download copies of these data to your local environment in ArcGIS Desktop and ArcGIS Pro.

Virginia's 9-1-1 & Geospatial Services Bureau recommends uploading your required NG9-1-1 GIS data layers stack in your local coordinate system (projection and datum). As such, polygon features are available in:

- Virginia State Plane North NAD 1983 (WKID 2283; EPSG) FIPS 4501 Feet
- Virginia State Plane South NAD 1983 (WKID 2284; EPSG) FIPS 4502 Feet

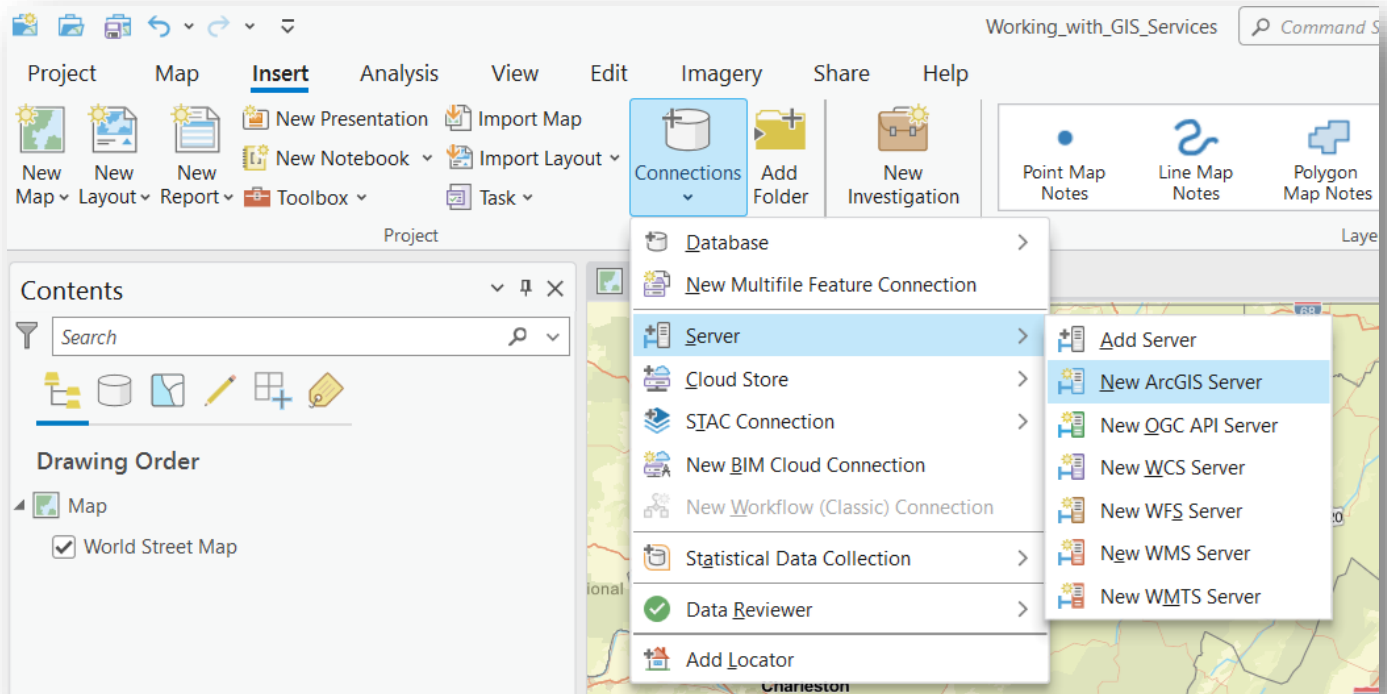
NG9-1-1 systems require all of the GIS data layers you upload to be submitted in the same coordinate system and will transform it to match the WGS 1984 required by NG9-1-1 systems.

(Note to Data Uploaders for NG911: If you locally use a datum other than NAD 1983, such as NAD 1983 (2011) or NAD 1983 HARN, please let us know by contacting us at: NG911GIS@vdem.virginia.gov.)

As the VGIN-hosted provisioning boundary is built from the submitted and mutually agreed to lines from all Virginia localities, your best provisioning boundary polygon when uploading to a NG9-1-1 spatial interface, is the polygon from the appropriate coordinate system feature service. You should use this polygon as the cookie cutter to clip the PSAP polygons that fall within your provisioning boundary. See the discussion in part 2 of the [GIS Recommendations](#) document for more detail and discussion of these workflows. Contact NG911GIS@vdem.virginia.gov for assistance or support.

Connecting to Services in ArcGIS Pro

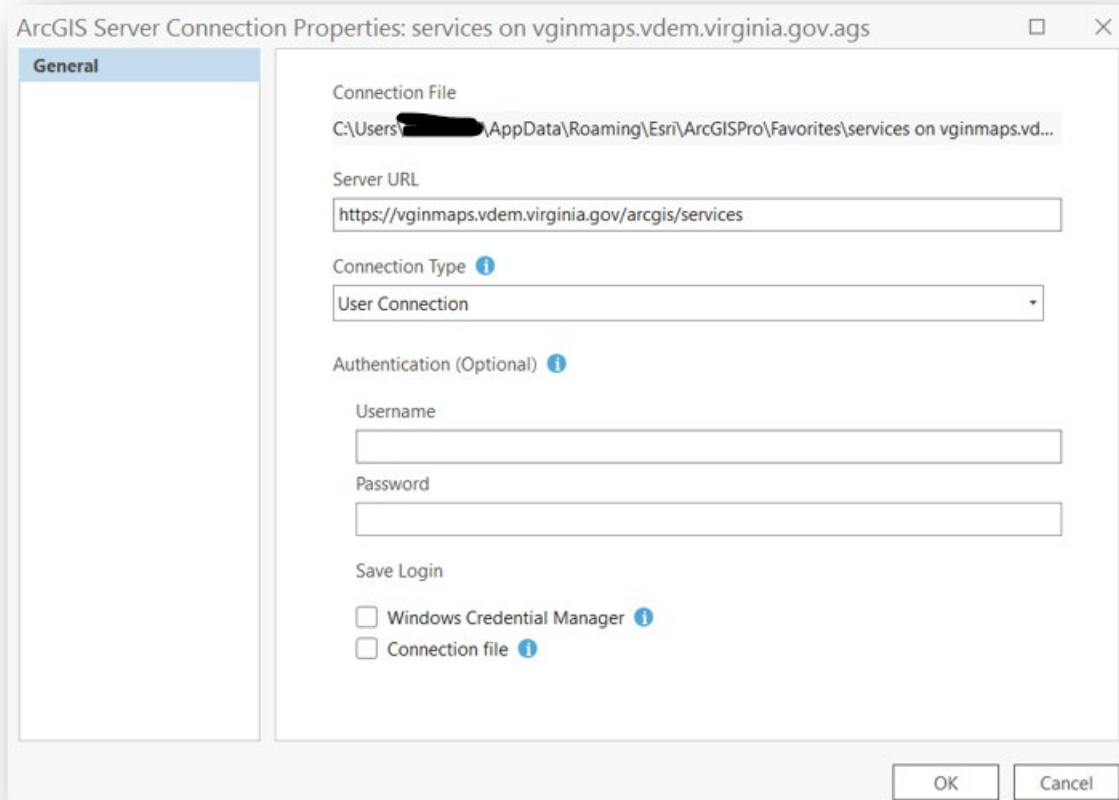
1. Open ArcGIS Pro and begin a project.
2. On the Insert tab, select the Connections drop-down, hover over Server, and select New ArcGIS Server.



3. In the next box, enter/copy and paste in the VGIN rest services url for Server URL: <https://vginmaps.vdem.virginia.gov/arcgis/rest/services>

As this is a public-facing server, no authentication is needed.

Click Ok



The screenshot shows the 'ArcGIS Server Connection Properties: services on vginmaps.vdem.virginia.gov.ags' dialog box. The 'General' tab is selected. The 'Connection File' field shows a path: 'C:\Users\...AppData\Roaming\Esrri\ArcGISPro\Favorites\services on vginmaps.vd...'. The 'Server URL' field contains 'https://vginmaps.vdem.virginia.gov/arcgis/services'. The 'Connection Type' dropdown is set to 'User Connection'. Under 'Authentication (Optional)', the 'Username' and 'Password' fields are empty. The 'Save Login' section has two unchecked checkboxes: 'Windows Credential Manager' and 'Connection file'. The 'OK' and 'Cancel' buttons are at the bottom right.

ArcGIS Server Connection Properties: services on vginmaps.vdem.virginia.gov.ags

General

Connection File
C:\Users\...AppData\Roaming\Esrri\ArcGISPro\Favorites\services on vginmaps.vd...

Server URL

Connection Type ⓘ
User Connection ▼

Authentication (Optional) ⓘ

Username

Password

Save Login

☐ Windows Credential Manager ⓘ

☐ Connection file ⓘ

OK Cancel

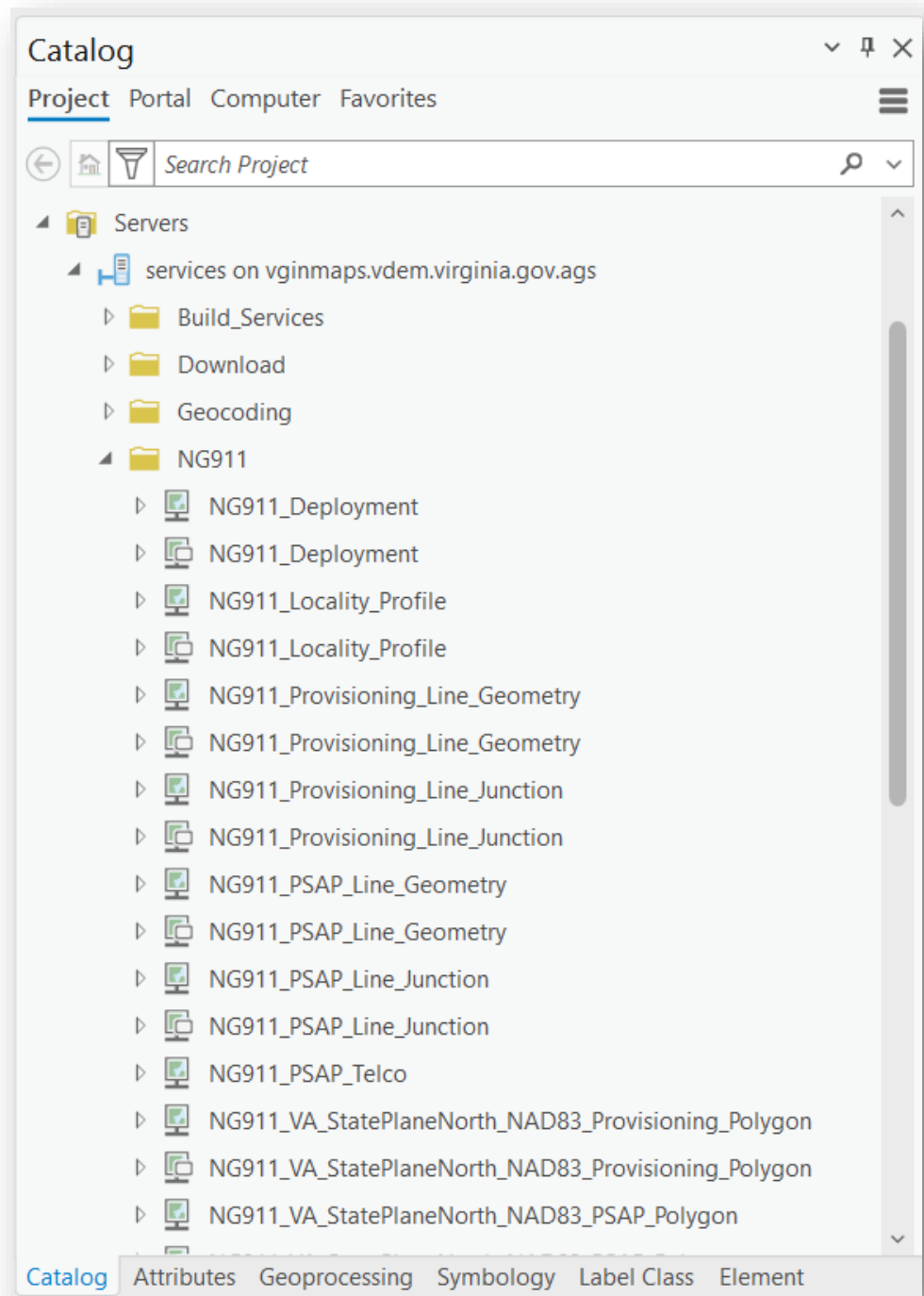
Open the Catalog pane and expand the new Servers folder that is now in your project. The new connection will show as an ArcGIS server with the path name and you can expand and navigate the services offered.

Let's examine the NG911 folder.

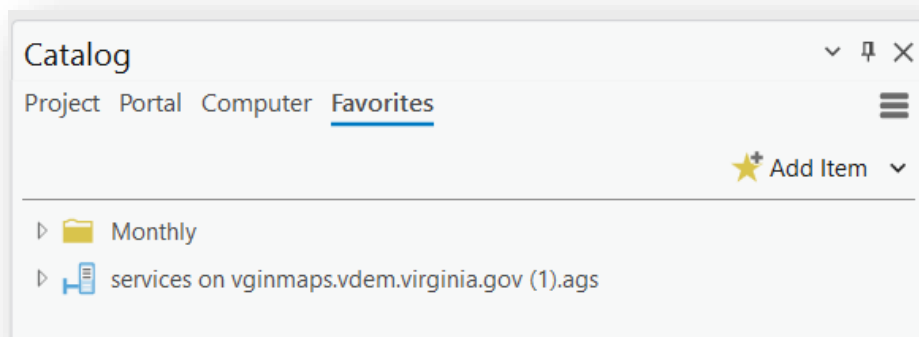
The "feature services" are denoted in the contents section under file type or if you click on one in the catalog tree you will see in the Contents pane the file type of "Feature Service." This means that you can select them, add them to your map, use them in geoprocessing tools, and change how they appear through symbology. The feature service icon has the small white box.

A matching "Map service" also appears in the Catalog Tree or Contents. Map services tend to load more quickly into desktop environments. However, you cannot select map service elements, use them in tools, or change how they appear but you can do an identify. The map service icon does not have the small white box.

Once you are connected, you can drag and drop services into your map, right-click and add them to the current or a new map or add them through the Map → Add Data button.

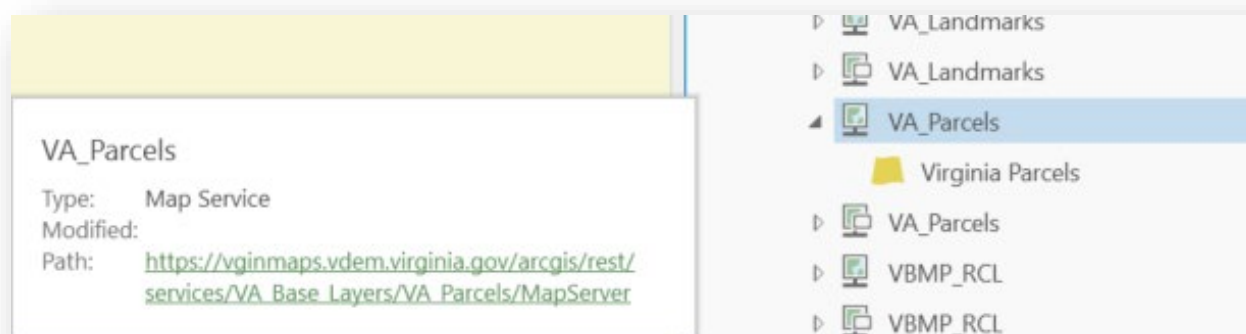


You can also right click on the main services connection and either select to “Add to new projects” or “Add to Favorites” so this server connection may be quickly added to other Projects in ArcGIS Pro without having to repeat the steps above.



Adding Map Services in ArcGIS Pro

When using map services in ArcGIS Pro, it is best to add the entire service (“VA_Parcels” in the example below) rather than the layer (“Virginia Parcels” with the yellow icon). When hovering over the URL in the Catalog pane of ArcGIS Pro the URL should end with “/MapServer” rather than “/Mapserver/0” or any other number.” Working with the entire service in Pro gives you the best performance in your project and helps the GIS server work with your requests more effectively.

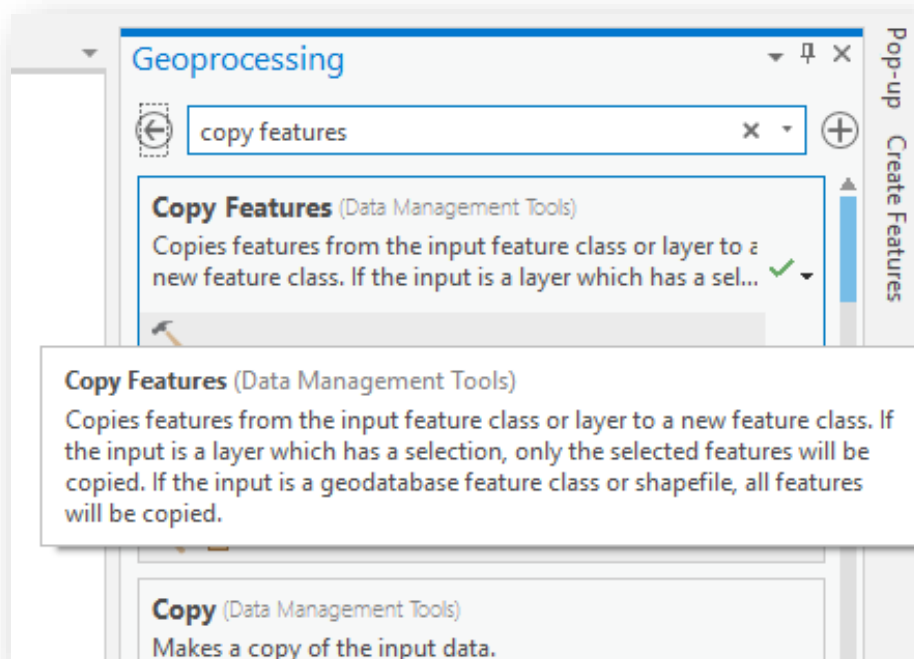
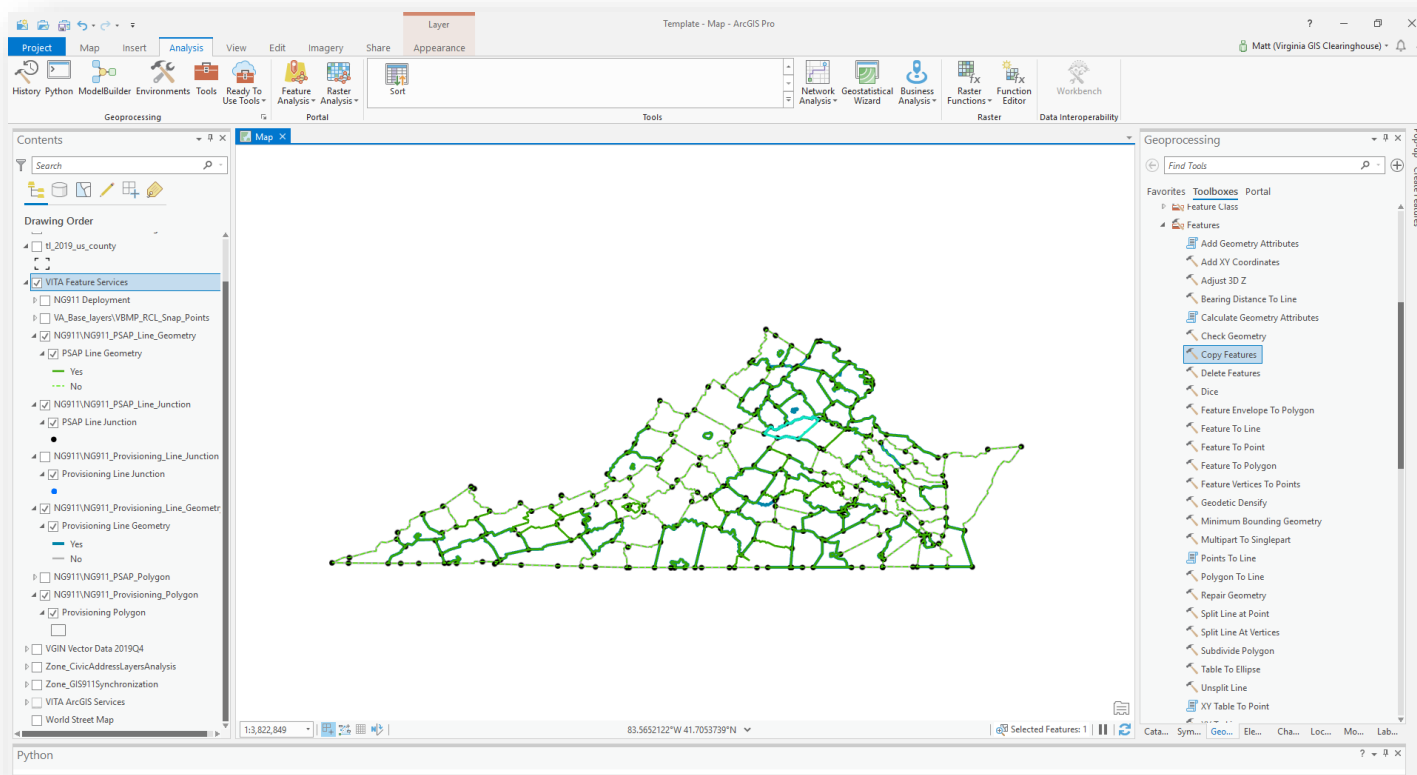


Copying Data from a Feature Services using ArcGIS Pro

Using geoprocessing tools is the primary way to turn feature services into a locally stored feature class in a file geodatabase or shapefile copy on your C:\ drive or network drive using ArcGIS Pro, as the “right-click → Data → Export Data” method is not supported for Feature services.

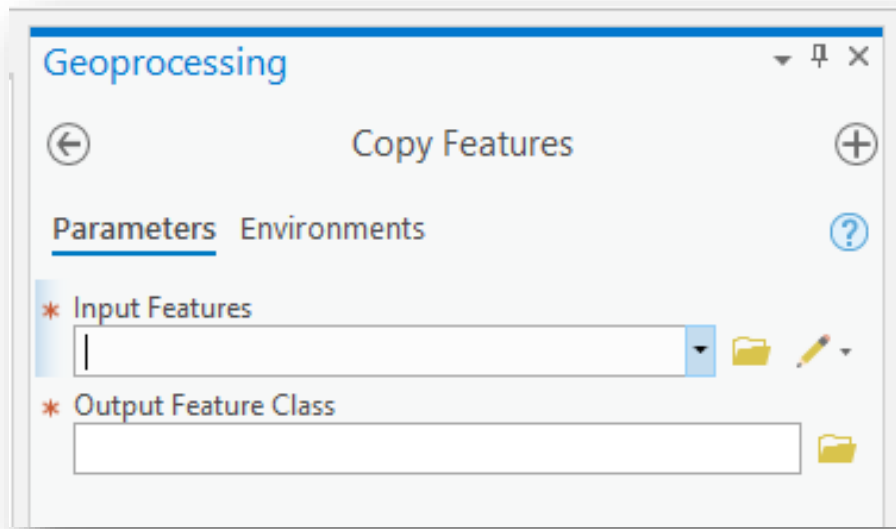
The following tool works best if you copy the entire dataset, then only work with the features that you need (i.e. select and export the ones you want to work with). It may work if you select one feature of interest interactively in the map, then run the tool to export only that feature to a local copy. Try it both ways and see what you are most comfortable with.

There are two ways to access the Copy Features geoprocessing tool. First, you can go to the Analysis tab and select Tools to open your Geoprocessing Toolboxes. Then, you search for “Copy Features”.

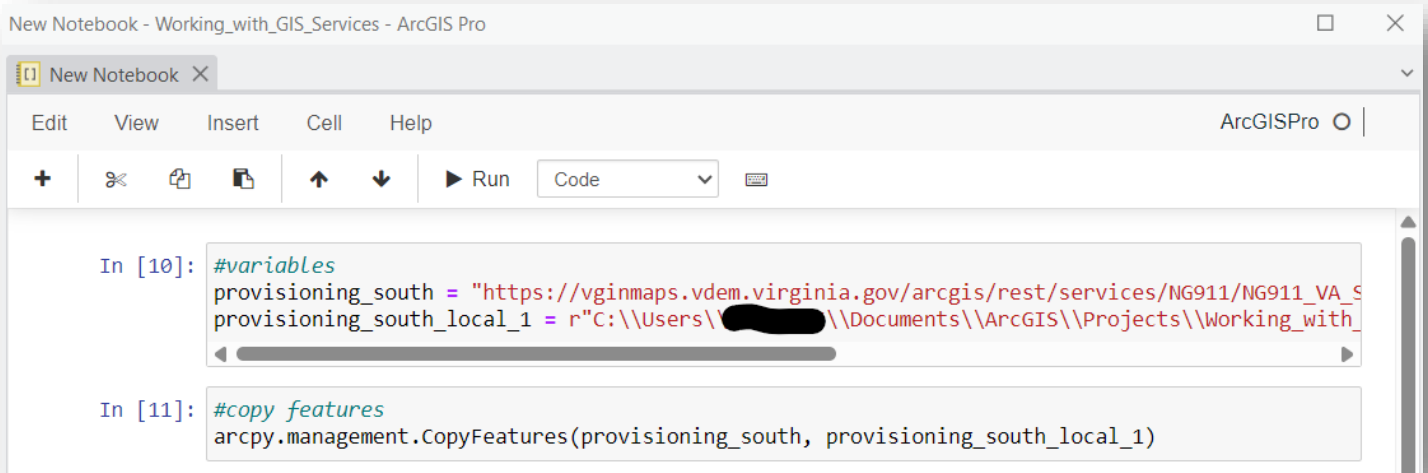
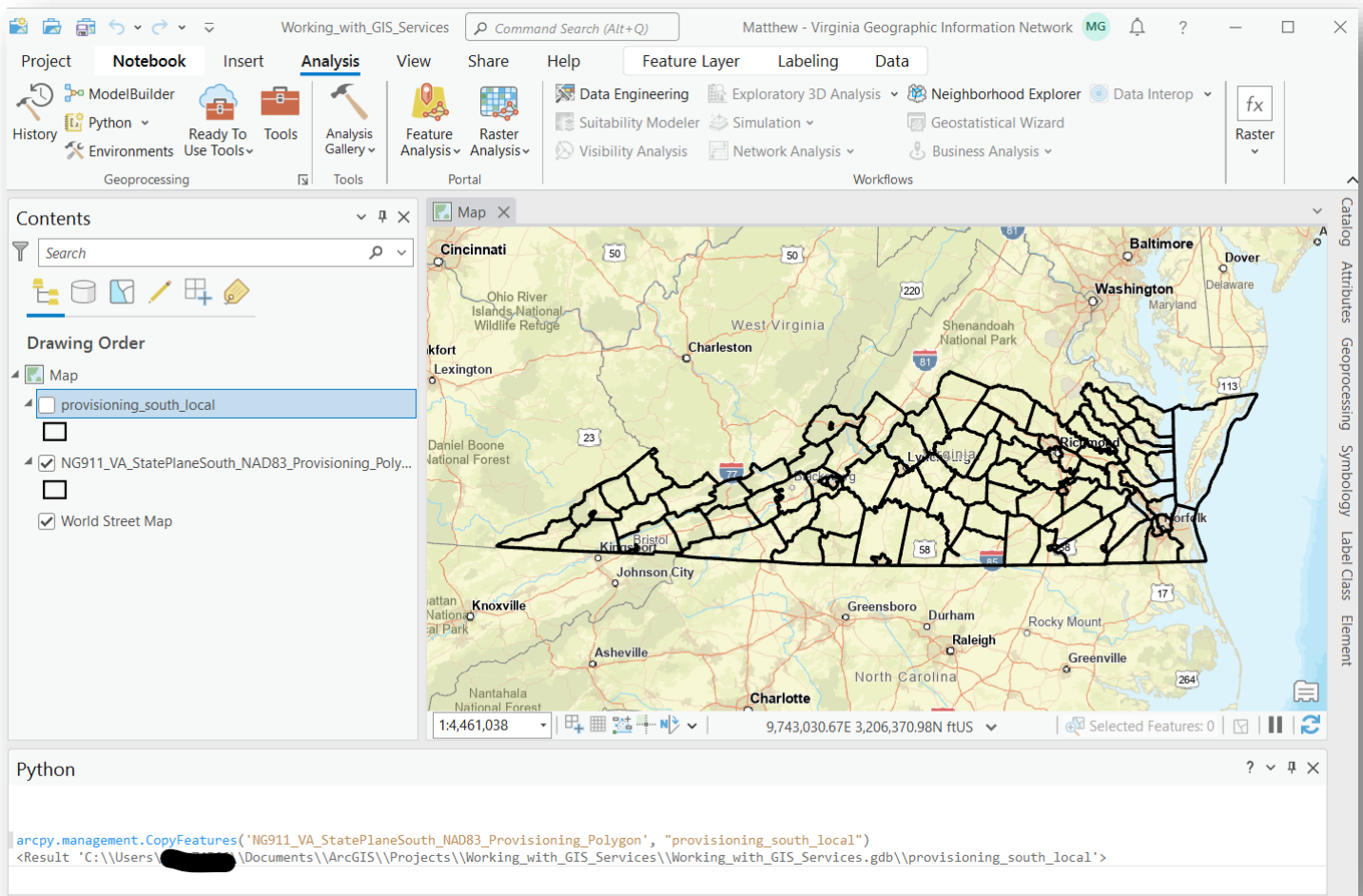


If your Toolbox Pane is already open, you can select Toolboxes, then navigate to Data Management → Features → Copy Features.

Either way, select the tool to open the dialog box. Then, select your input, specify your output, and run the tool.



For those who prefer Python, from the Python window or a Notebook, start with `arcpy.CopyFeatures_management`.

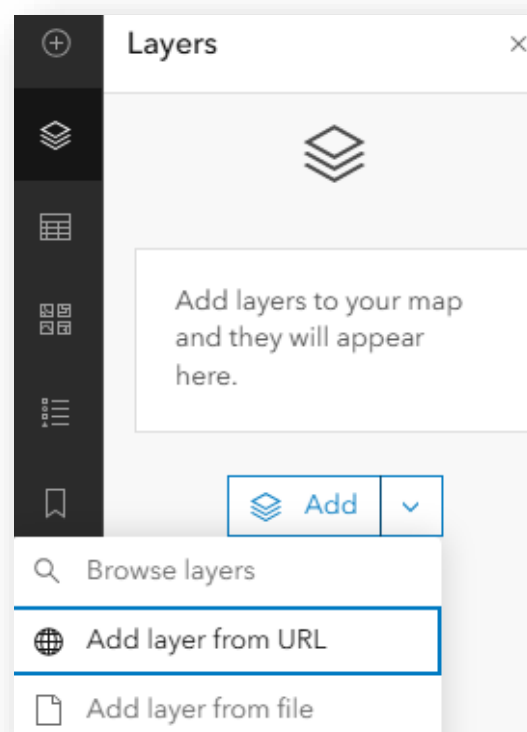


The Python method works easier if you have already loaded the feature services into your ArcGIS Pro map, but can also be leveraged using file paths or variables.

Adding Map Services in ArcGIS Online Maps

If you are building a map in ArcGIS Online, many hosted feature layers are available through Esri and the Living Atlas. But you can also add in services from other ArcGIS Servers, like VGIN, to mix and match data from different sources to your purpose. To add other services to an ArcGIS Online map:

1. Open ArcGIS Online Maps.
2. In the Layers section of the map click the drop down beside Add and select "Add layer from URL".
3. On the Add Layer window for the section URL copy and paste a URL for the MapServer service to be added.



Add Layer

URL

`https://vginmaps.vdem.virginia.gov/arcgis/rest/services/VA_Base_Layers/VA_Parcels/MapServer`

Supported layer types are CSV, GeoJSON, OGC WFS web service, OGC WMS web service, WCS, OGC WMTS web service, OGC API - Features, ArcGIS Server web service, KML, GeoRSS, tile layer

Type

ArcGIS Server web service

An ArcGIS Server web service represents a GIS resource—such as a map or image—that is located on an ArcGIS Server site and is made available to client apps such as Map Viewer.

Custom parameters

Add parameters that need to be appended to requests to access this service. ⓘ

+ [Add custom parameter](#)

Use as basemap ☐

[Cancel](#) [Add to map](#)

Note that best practice for performance in your map and for server resources is to add the parent MapServer service rather than any child layer of the map service.

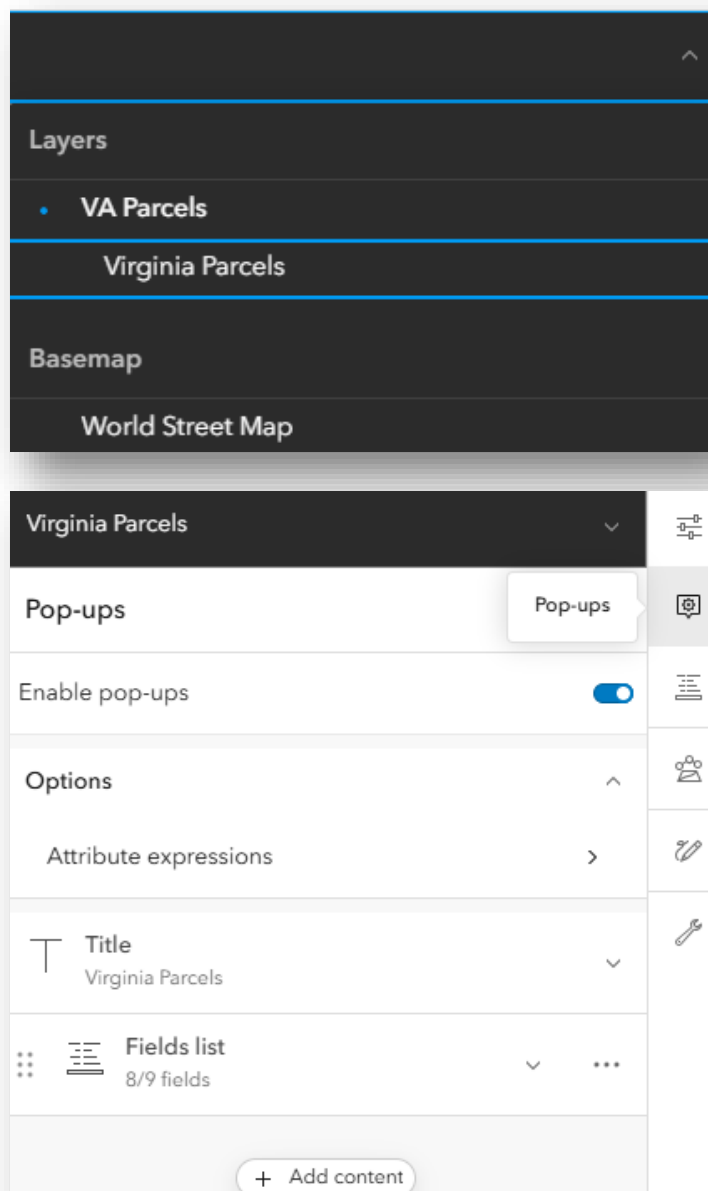
Correct URL that adds a Map service for best performance ends in "/MapServer".

https://vginmaps.vdem.virginia.gov/arcgis/rest/services/VA_Base_Layers/VA_Parcels/MapServer

Incorrect URL that adds a layer within a map service (note the 0 at the end of the URL). This will give poor performance for you and others in web maps.

https://vginmaps.vdem.virginia.gov/arcgis/rest/services/VA_Base_Layers/VA_Parcels/MapServer/0

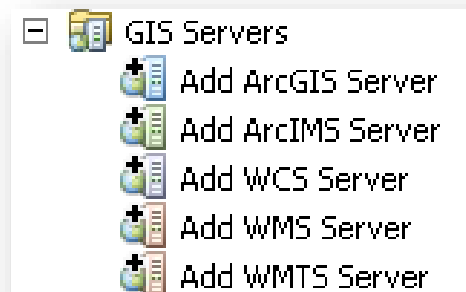
4. Click "Add to Map"
5. To configure Pop-ups and other settings for the service that was just added. On the right side of the map click the dropdown to the right of the map service that was just added. Then select the layer in that service to be configured for that service.
6. Once the layer is selected, click the Pop-ups button in the vertical menu on the right side of the window. Move the slider to "Enable pop-ups". You can now configure the pop-up as desired.



Connecting to Services in ArcCatalog

Please note that with the September 2024 switch to vginmaps, we have not updated the ArcGIS Desktop, ArcCatalog, and ArcMap screen shots which reflect gismaps. If you are still using these products, use the url in item 4 rather than what appears in the screenshots and everything will work.

1. Open ArcCatalog and go to the GIS Servers section of the Catalog Tree:
2. Double-click "Add ArcGIS Server"
3. In the new box, leave the option on "Use GIS Services" and click Next
4. In the next box, enter/copy and paste in this url for Server URL: <https://vginmaps.vdem.virginia.gov/arcgis/rest/services/>

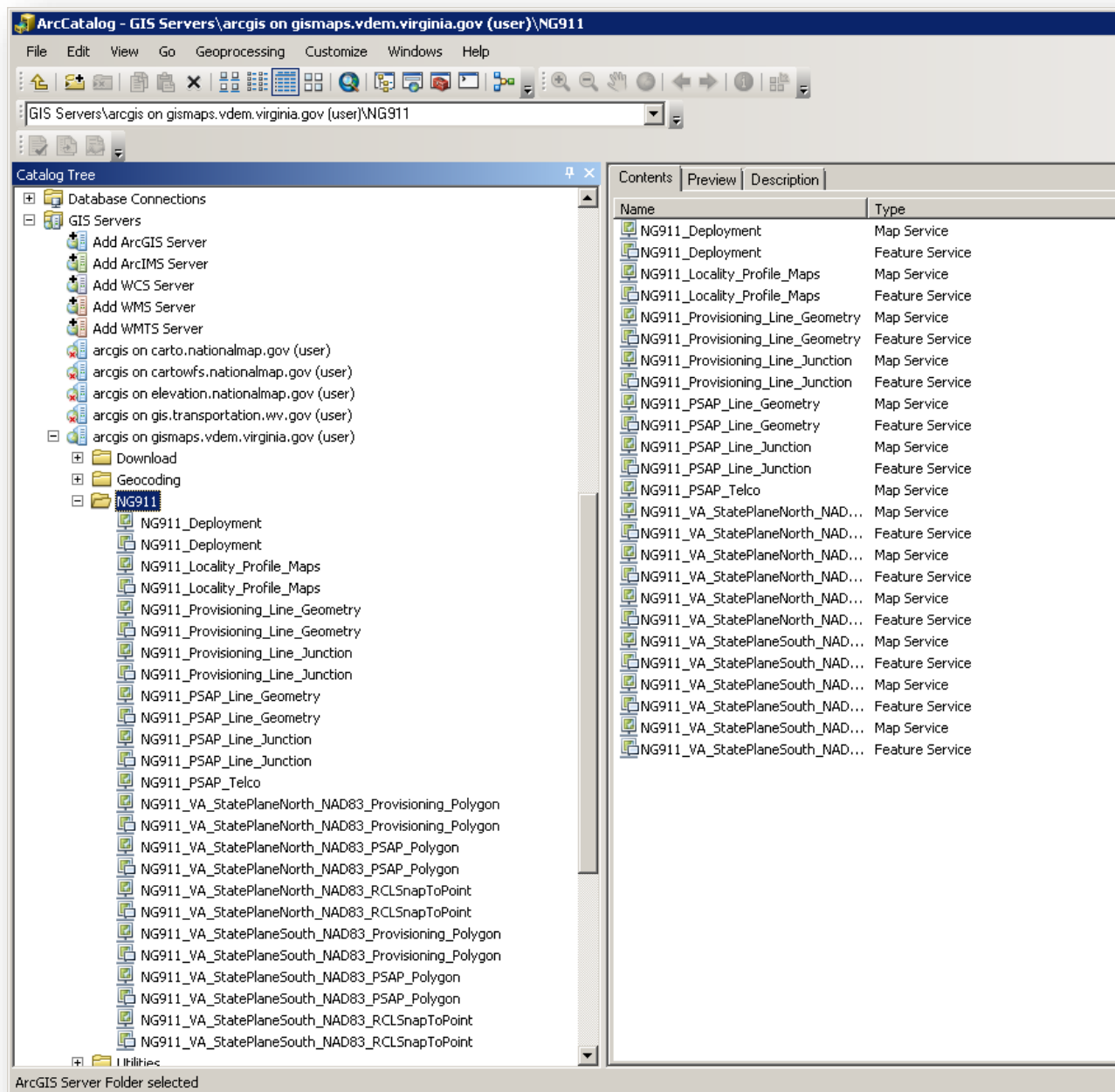


 A screenshot of the 'General' dialog box in ArcCatalog. The 'Server URL' field is populated with 'https://gismaps.vdem.virginia.gov/arcgis/rest/services/'. Below it, the 'ArcGIS Server' path is shown as 'http://gisserver.domain.com:6080/arcgis'. The 'Authentication (Optional)' section is expanded, showing 'User Name' and 'Password' input fields. The 'Save Username/Password' checkbox is checked. A link for 'About ArcGIS Server connections' is at the bottom left. At the bottom right are buttons for '< Back', 'Finish', and 'Cancel'.

As this is a public-facing server, no authentication is needed.

- Click Finish. The new connection will now be added to your Catalog Tree. You can expand and navigate the services offered.

Let's examine the NG911 folder. The "feature services" are denoted in the contents section under file type or if you click on one in the catalog tree you will see in the Contents pane the file type of "Feature Service". This means that you can select them, add them to your map, use them in geoprocessing tools, and change how they appear through symbology. Often a matching "Map service" also appears in the Catalog Tree or Contents. Map services tend to load more quickly into desktop environments. However, you cannot select map service elements, use them in tools, or change how they appear.



Once you are connected, you can drag and drop services into your map, or add them through the add data button.

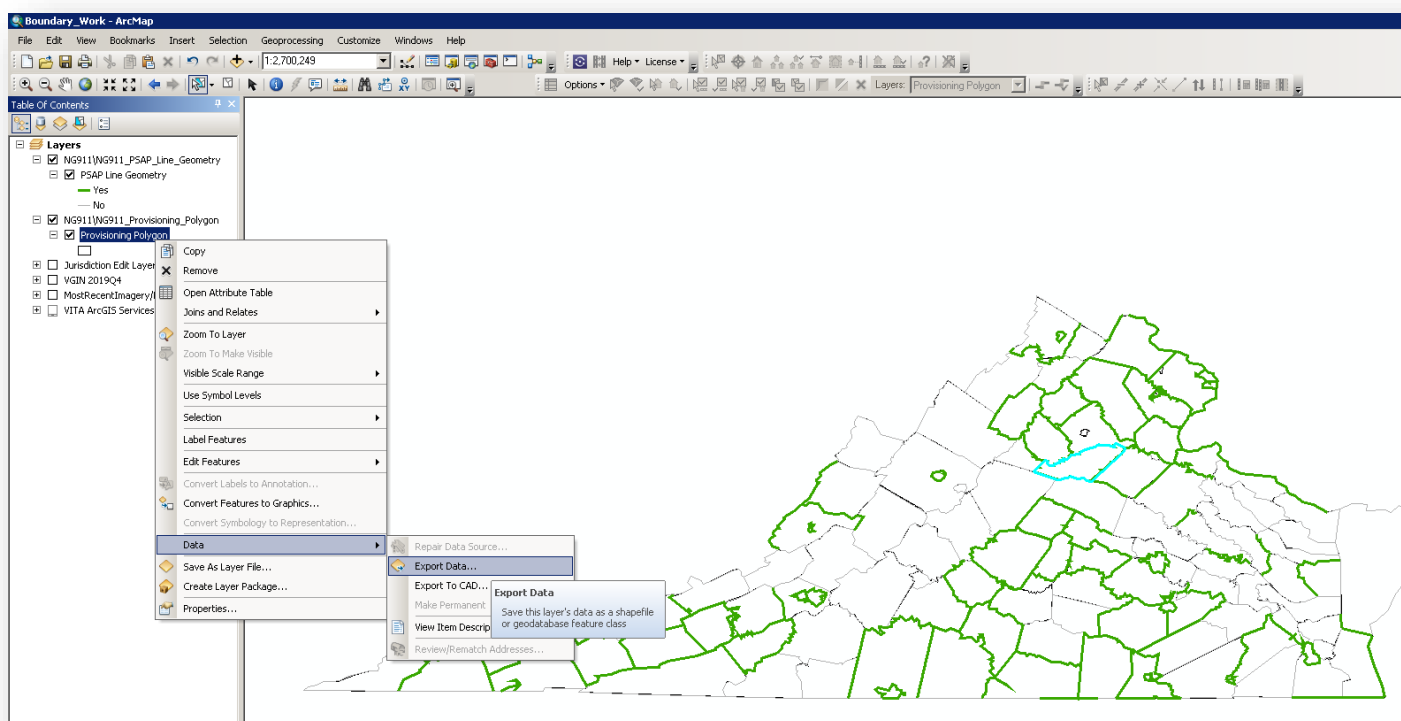
Copying Data from a Feature Service using ArcMap

Using ArcMap, there are two main ways to turn feature services into a locally stored feature class in a file geodatabase or a shapefile copy on your C:\ drive or network drive.

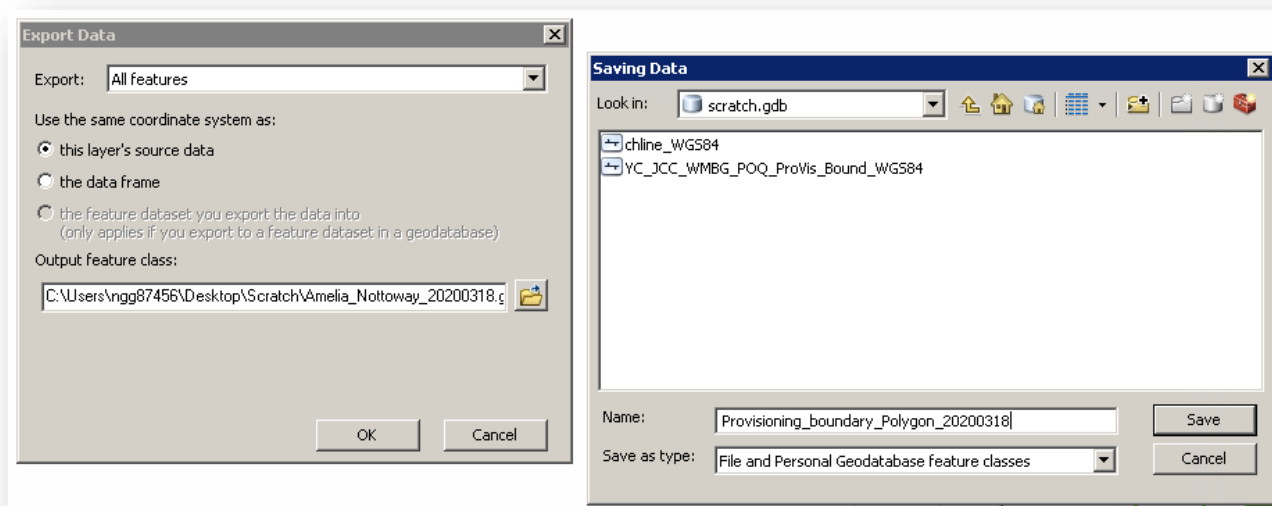
1. The first choice you have is if you want to extract the whole dataset, or only a selection of the dataset. If you want the whole dataset, skip to step 2.

If you only want a few features, select them interactively, select by attribute, or select by query or select based on another feature (selected features show up in bright blue on the map & in the table). When you move to the next steps, only these features will be copied.

2. For ArcMap users, the easiest way to make the copy locally may be the right-click on the feature service → Data → Select the Export Data option.

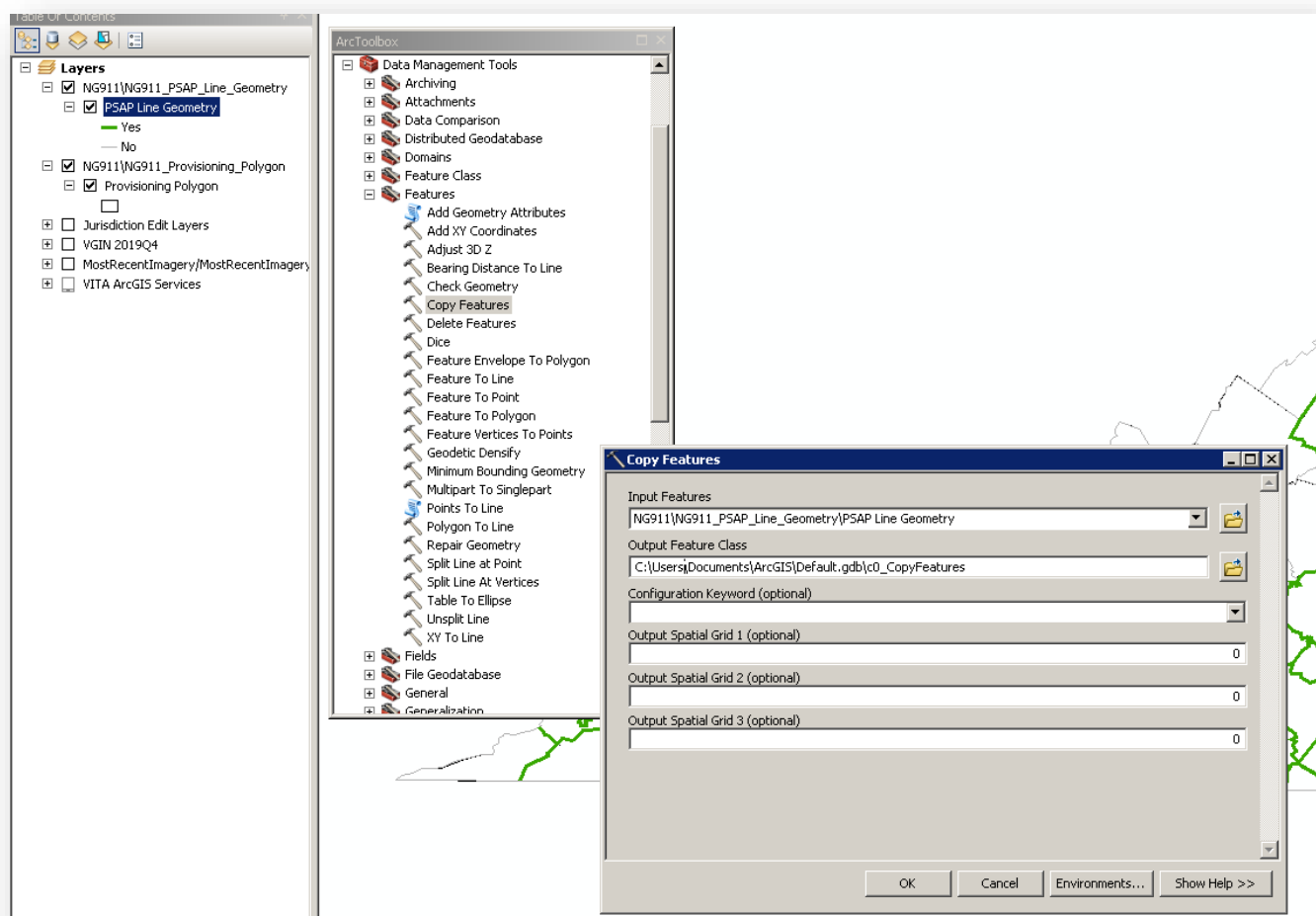


3. Then use the dialog box to choose to save selected or all features and specify the output file location and name.

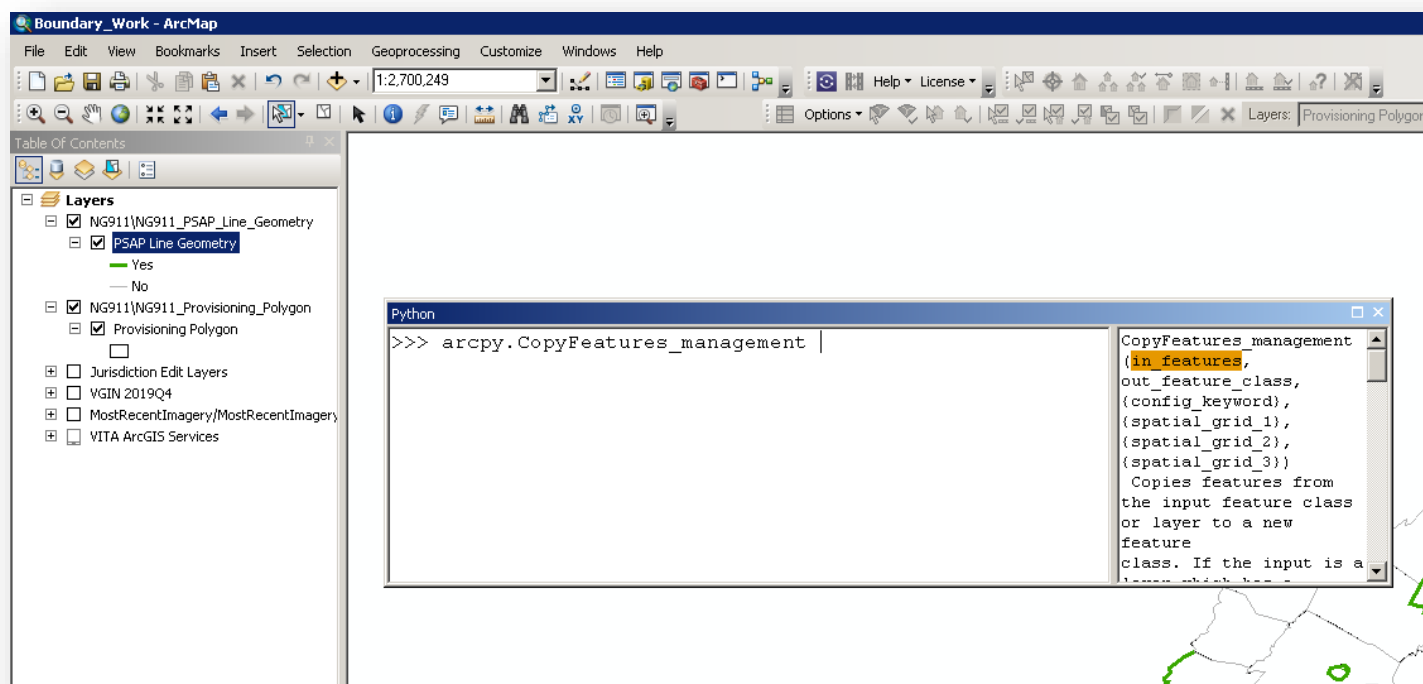


Another option is to use the CopyFeatures geoprocessing tool to make a local copy of the data from the Feature service.

In ArcToolbox, look under Data Management → Features → Copy Features. Run this tool like in the example above by selecting your input, specifying your output, and executing the tool.



For those users who use or want to improve their Python skills, from the Python window, start with `arcpy.CopyFeatures_management`.



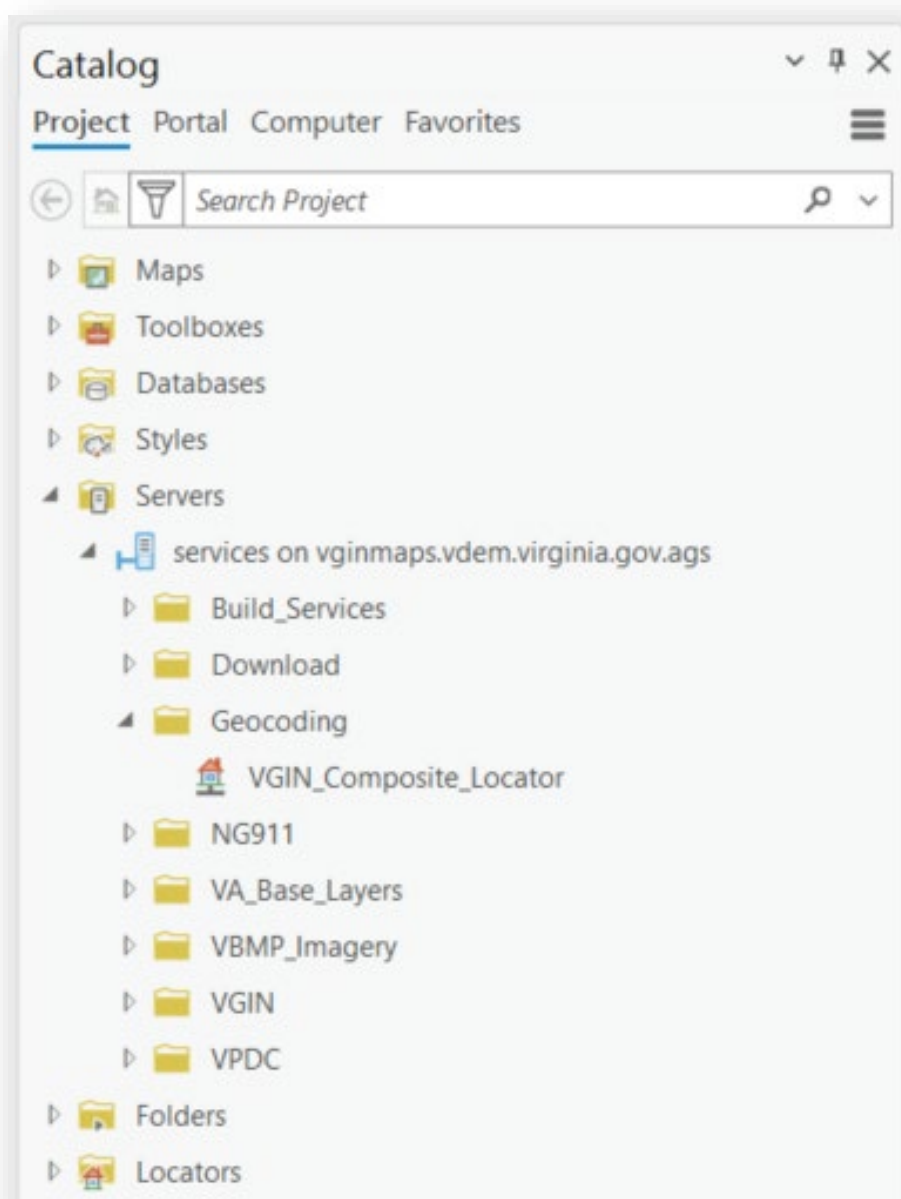
About the VGIN Geocoding Service

As VGIN processes its quarterly releases of road centerline and address point data with updates sourced from Virginia localities, it also updates the Geocoding Service available through the VGIN ArcGIS Server. Unlike the Esri World Geocoder or other geocoding services, this is relatively up to date for the Commonwealth as a whole to a known point in time. If you are geocoding Virginia addresses, this is a good resource to be aware of.

More details on the configuration and use of the geocoding service are available here:

<https://vgin.vdem.virginia.gov/documents/VGIN::about-the-vgin-composite-geocoding-service/explore>.

Once you connect to the VGIN ArcGIS Server in ArcGIS Pro, you will be able to see and interact with the geocoding service.



Next Steps for Working with Services

Many local, state, federal, and non-governmental agencies and organizations make vector and raster GIS data and tools available as map, feature, image, or geoprocessing services. As datasets get larger, like shaded relief models and imagery, or data changes quickly, like weather radar or hurricane forecast tracks, consider searching for and using data services to keep your storage needs low and data currency up. One of the best documented sites is the [USGS National Map Programs' services](https://apps.nationalmap.gov/services/) at <https://apps.nationalmap.gov/services/>.

The National Map - Service Endpoints

Subscribe to SNS messages to receive emails regarding changes to the status of TNM services - [Get Notifications about Changes to our Services](#)

Notice: Service URLs are case-sensitive. All USGS services are available through SSL connections by using the https protocol.

Expand All Collapse All Reset View Show Only These Categories Search by Keyword

USGS National Map publishes 40 services in the list below.

Base Maps (Cached)

Availability/Index Overlays (US Topo, 3DEP...)

Theme Overlays (NHD, Names, Elevation, Transportation...)

Natural Hazards

NGA US National Grid									
REST		ArcGIS.com	ArcMap		Thumbnail	Refreshed Date: See Copyright Text section of the service Refresh Cycle:	Spatial Reference: 102100 (3857) Min Scale: 0 Max Scale: 0		
NEXRAD Weather									
REST	WMS	ArcGIS.com	ArcMap	Legend	Thumbnail	Refreshed Date: See Copyright Text section of the service Refresh Cycle:	Spatial Reference: 102100 (3857) Min Scale: 0 Max Scale: 0		
FEMA National Flood Hazards									
REST		ArcGIS.com	ArcMap		Thumbnail	Refreshed Date: See Copyright Text section of the service Refresh Cycle:	Spatial Reference: 102100 (3857) Min Scale: 0 Max Scale: 0		

Other Featured Data

Web Feature Services (WFS)

WCS Services

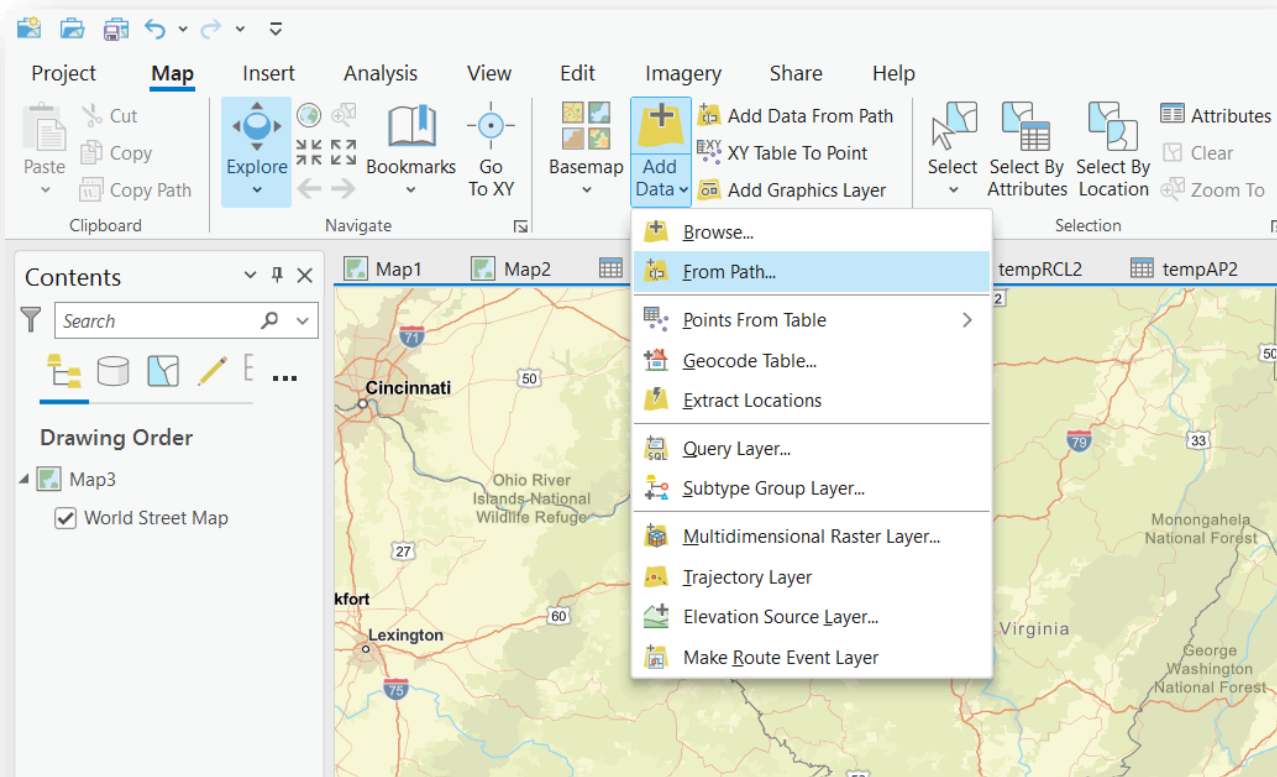
Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: <https://viewer.nationalmap.gov/services/> Page Last Modified: 26-Jun-20
Page Contact Information: [The National Map](#)

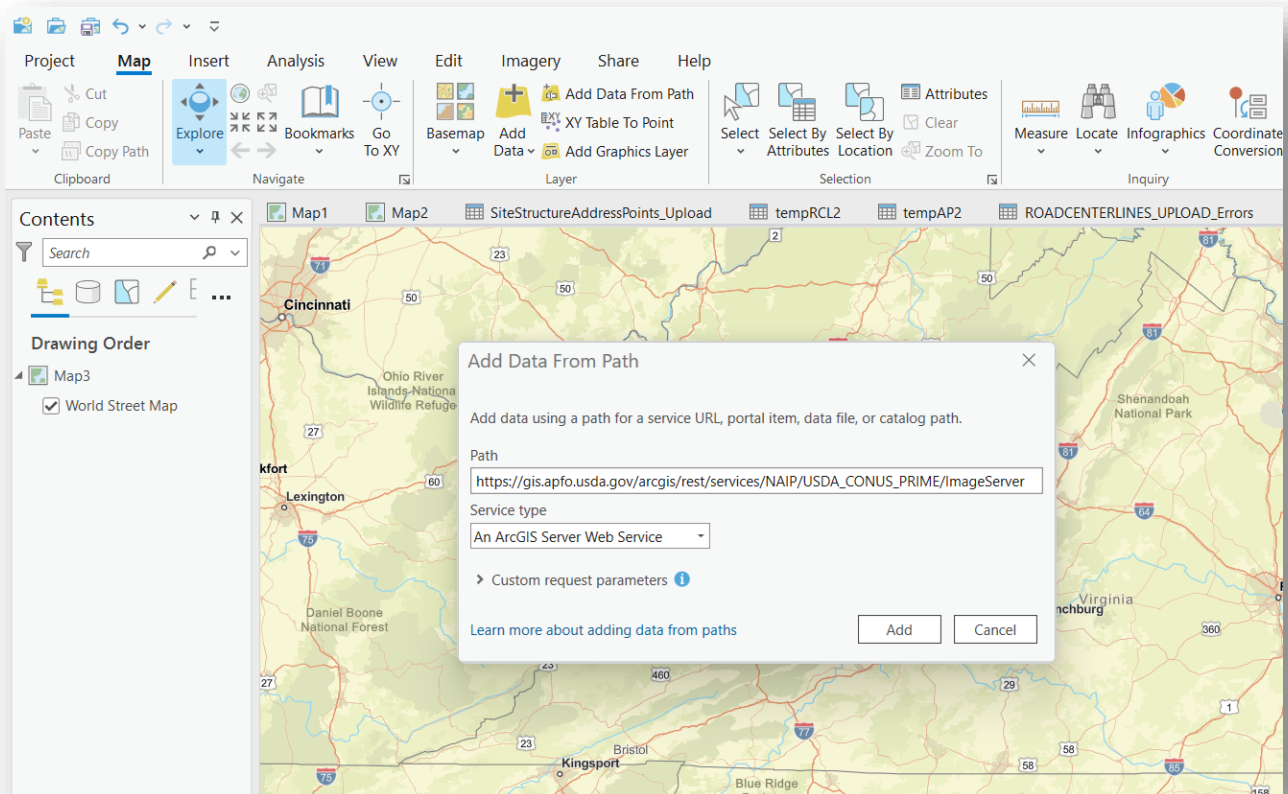
USA.gov

Not all agencies sharing data through REST services provide information for how to connect to their resources. However if you find a REST services directory or just a URL that looks like https://gis.apfo.usda.gov/arcgis/rest/services/NAIP/USDA_CONUS_PRIME/ImageServer for the United States Department of Agriculture's National Imagery Program, you can easily add it to ArcGIS Pro through Add Data:

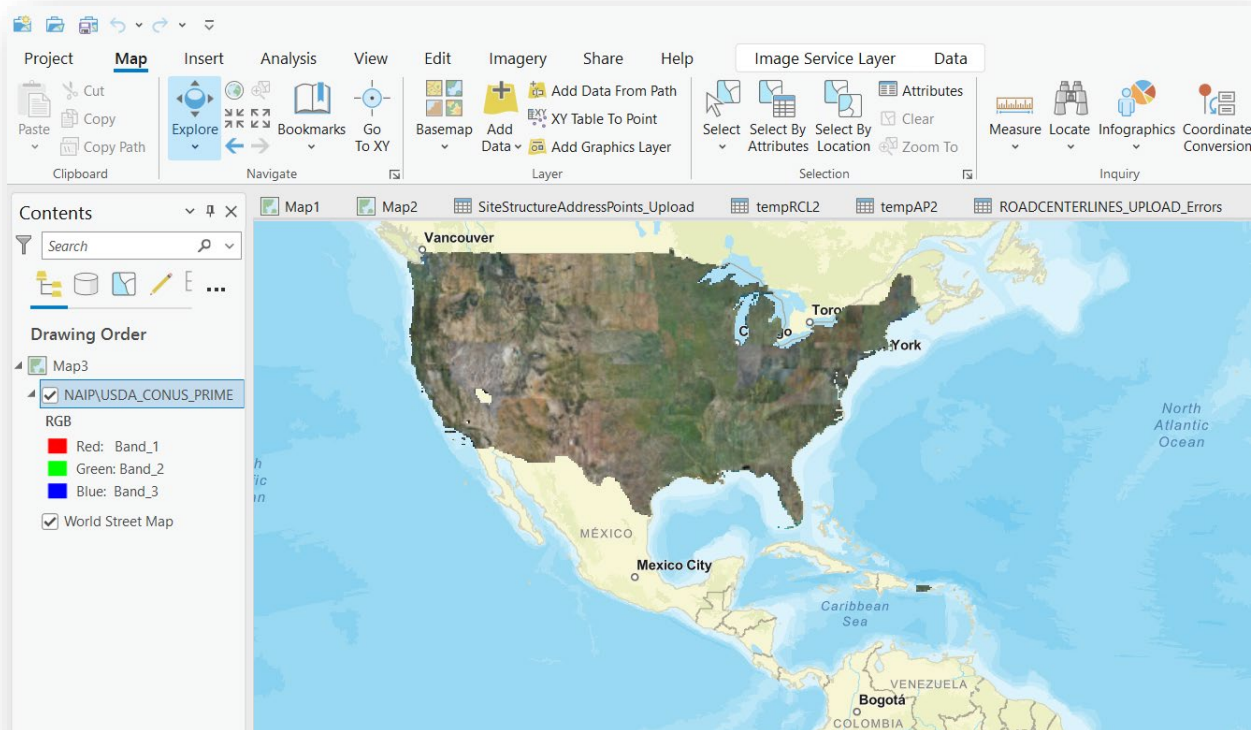
First, from the Map ribbon select the drop-down arrow on the Add Data button and select From Path...



A new box asking for a Path pops up. Copy and paste the URL into the Path box.



Clicking Add will read the service and add it to your Table of Contents, but will not add a Server Connection to the Catalog Pane.



Publication Version Control

The following table contains a history of revisions to this publication.

Documentation Version	Release Date	Revision Description
1.0	03/24/2020	Initial public release.
1.0	07/15/2020	Reformatted for VDEM.
1.1	01/21/2021	Updated link references and screen shots to use https://gismaps.vdem.virginia.gov/arcgis/rest/services/
1.2	10/17/2022	Updated link references to use https://vgin.vdem.virginia.gov
1.3	9/18/2024	Renamed from "Working with GIS Feature Services" to "Working with GIS Services." Updated links and ArcGIS Pro screen shots to use https://vginmaps.vdem.virginia.gov/arcgis/rest/services/ . Updated USGS links.
1.4	4/15/2025	Added "Adding Map Services in ArcGIS Pro" and "Adding Map Services in ArcGIS Online Maps" to document best practices for working with map services. Added an example of how to add data as a path in the "Next Steps for Working with Services" section.
		Future work: 1. Remove ArcGIS Desktop examples for ArcMap and ArcCatalog. 2. Add QGIS examples.

The most current version of this document is available at this stable url:

<https://vgin.maps.arcgis.com/home/item.html?id=fdd6163fa57a4064bd87f5dd8078fbb7>