

CES317787

Connecting ESRI and Autodesk Using the Connector for ArcGIS

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Boswell Engineering

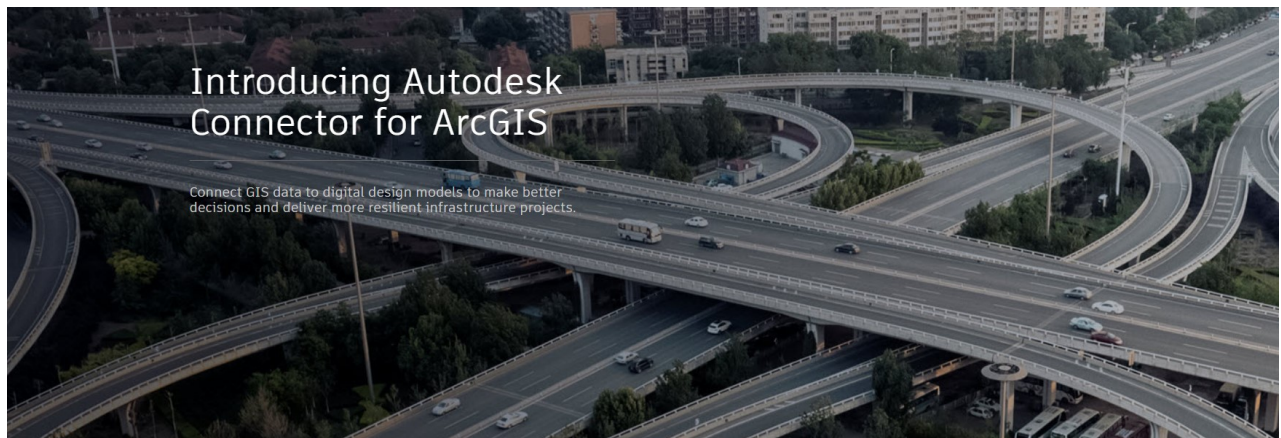
Ramesh Sridharan, Product Manager
Autodesk

Learning Objectives

- Learn how to import GIS data from your ArcGIS Portal to Inroadworks
- Learn how to import GIS data from your ArcGIS Portal to Civil 3D
- Learn how to publish data back to your ArcGIS Portal
- Learn how to export this data from Inroadworks and Civil 3D to an external ESRI database.

Description

See a Demonstration of how the Connector for ArcGIS can save time migrating GIS data from an ESRI ArcGIS Online Portal into Inroadworks and Civil 3D for use in your infrastructure workflows. See how the GIS data can be modified and published back to an ArcGIS Portal and how to export this data to an external GIS Database. Join Autodesk Expert Elite member John Mayo and Autodesk Product Manager Ramesh Sridharan as they show how this new technology can save time working with GIS data in Autodesk products.



Speaker(s)

John Mayo, PE, CFM

Boswell Engineering, Project Manager.

NJIT, Adjunct Professor

Autodesk Expert Elite

Autodesk University Speaker 2010 and 2018.

Civil 3D Associate Certification 2010. Civil 3D Professional Certification 2013, 2015, 2017.

AutoCAD R9-2019, Softdesk 7 and 7.5, Land Desktop R13-2009, Civil 3D 2004 Demo-2019

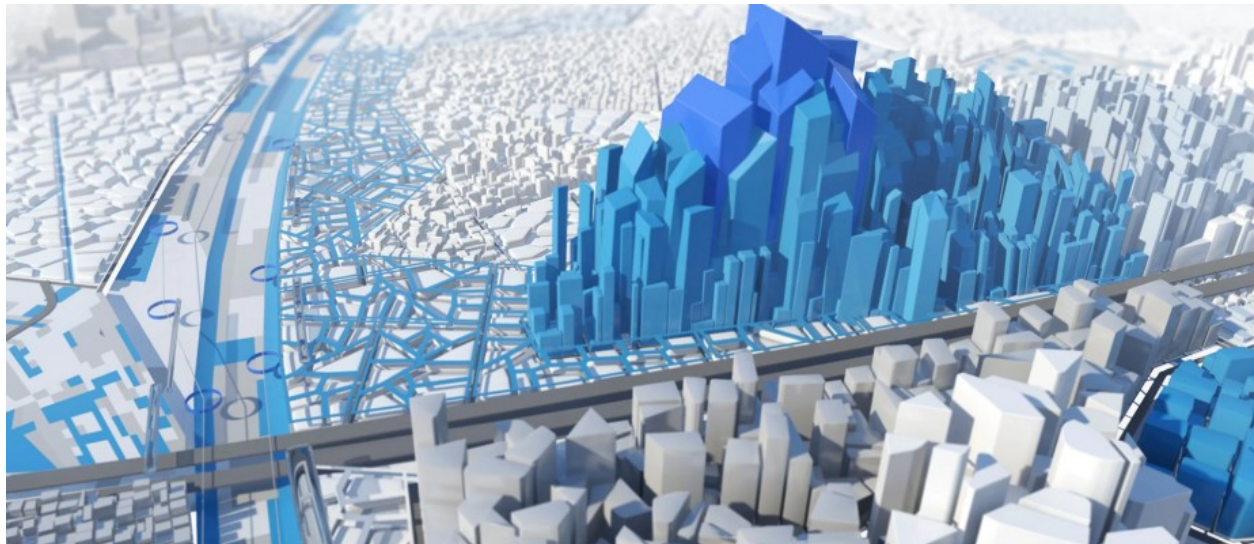
Ramesh Sridharan

20 years of experience in product development, technical sales, partner marketing, and customer analysis working with customers to understand and set industry workflows that drive the technology forward.

One of the pioneers in the field of reality capture point cloud product feature extraction that can handle and extract information from a large number of 3D data.

Autodesk Product Manager, InfraWorks

Post-graduate from the Indian Institute of Technology - machine learning, image processing, and artificial intelligence.



Connecting BIM & GIS

“The Autodesk Connector for ArcGIS is the first step toward realizing the vision of the partnership between Autodesk and Esri to integrate BIM and GIS workflows. This new feature in Autodesk InfraWorks, Civil 3D and Map 3D allows you to connect GIS data in a more seamless manner to your BIM design model in InfraWorks. With this capability, all attributes of the GIS data are added to the InfraWorks model, making the 3D context model much more intelligent, robust and accurate.” Autodesk

Introduction

GIS data has been used in infrastructure workflows for decades. From planning to design this data is critical in many infrastructure projects and workflows. Unfortunately many of the current workflows we use for our projects often have us waiting for data, converting data and/or downloading data. This of course wastes time and often leads to redundant data in our projects and on our company servers. Many of the infrastructure software solutions we have are filled with convoluted workflows that take time to teach new users. Do you recall learning how to perform a Map Query for the first time? I would bet that most professionals working with GIS data in BIM and CAD workflows believe this should be easier and faster. Well it is.

Thanks to a landmark agreement between ESRI and Autodesk in 2017 we now have the Connector for ArcGIS, or the Connector as it will often be referred to in this document. The Connector for ArcGIS will allow you to access GIS data posted to an ESRI ArcGIS Online Portal directly in your Infraworks, Map 3D and Civil 3D models. It will allow you to create data in Civil 3D and publish it to ArcGIS Online. You can connect to data, edit it, add to it and save it back to the portal. You can also create external geodatabases that can be used in your GIS workflows.

An ESRI ArcGIS Online account is a cloud solution used by firms and government agencies to create and manage their GIS datasets and maps. This service can be used to share this data with the public, clients, team members and anyone else they decide to share it with. This data is now readily available for use directly in Map 3D, Civil 3D and Infraworks.

The Connector for ArcGIS can provide your company with faster access to GIS data in your infrastructure workflows. The data shared in ArcGIS Online is managed and controlled by your company. This reduces data redundancies and saves time previously spent downloading, converting or waiting for the company GIS team to get you the information you need. GIS data imported into your Infraworks models can be stylized based on feature attribute classifications much easier than in the past. Data imported into Civil 3D will become native Civil 3D objects (points, parcels, feature lines and gravity networks).

This handout contains four demonstrations. One demonstration to meet each of the class objectives. The demonstrations will use only data included in this course's downloadable dataset and public domain data from ArcGIS Online. This is done so the steps can be recreated with any ESRI ArcGIS Online account including a free or trial account. The public data in ArcGIS Online is limited but you may find free datasets from respected publishers in some areas. Typically more data is available in densely populated areas. Many firms have ArcGIS Online portals set up to share project data and maps with department teams, field crews, and/or for sharing with client and team members. The data you find in your online portal will depend on what your company has published or what you have published to your own account. If you are starting with a free ArcGIS Online account you will only have public domain data available until you publish maps to your account portal.

Demo 1 - Import GIS data from your ArcGIS Portal to Infraworks

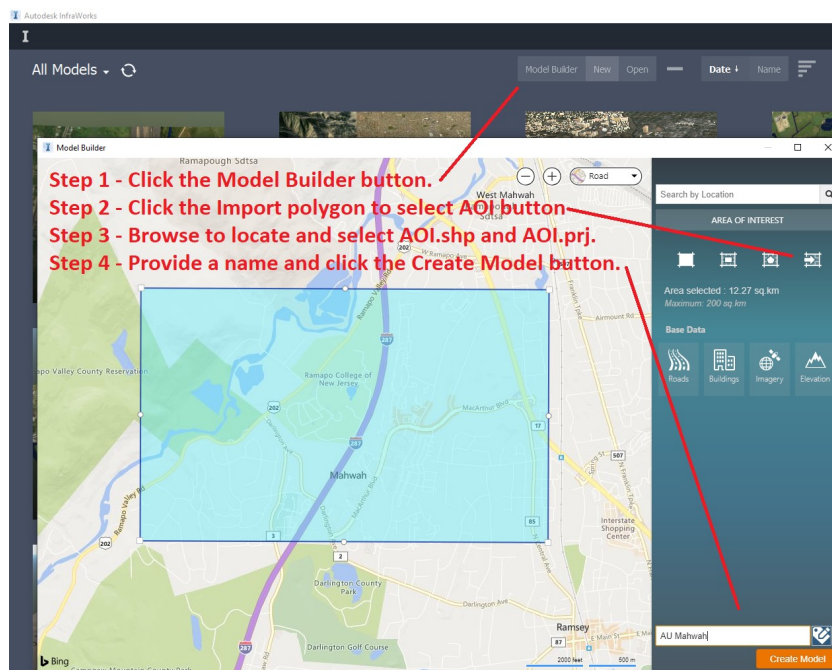
In this first Demonstration we will simply import some GIS based flood data into a new Infraworks model. The first step will be creating a new model in Infraworks using the Model Builder. The dataset for the class contains a polygon to define the Area of Interest (AOI). The

polygon is saved in a shp file format so it can be imported into any of the Infracore or Civil 3D files you need to complete this session.

Tip: Search, “CES317787 - Demo 1” in the Autodesk Knowledge Network for the video demonstrating the following procedure.

1. Open Infracore and click the Model Builder button.
2. Click the “Import polygon to select AOI” button.
3. Browse to the folder that contains your class files and select both the AOI.shp and the AOI.prj files.

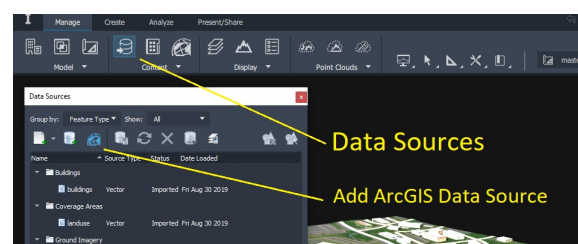
Tip: Note that Model Builder requires users to select both the shp and prj files to define the AOI polygon. If you use the ArcGIS Connector in Civil 3D you will need to place the entire shp file dataset into one zip file and select the zip file to define an AOI



4. Provide a name for the model and click the Create Model button at the bottom.
5. Close the Model builder and open the Infracore Model you just created once it appears in the Infracore Home screen. You may be prompted to choose between saving the file to your local hard drive or your BIM360 account. Choose the option that you want.
6. From the Manage tab, click the Data Sources icon to open the Data Sources dialog.

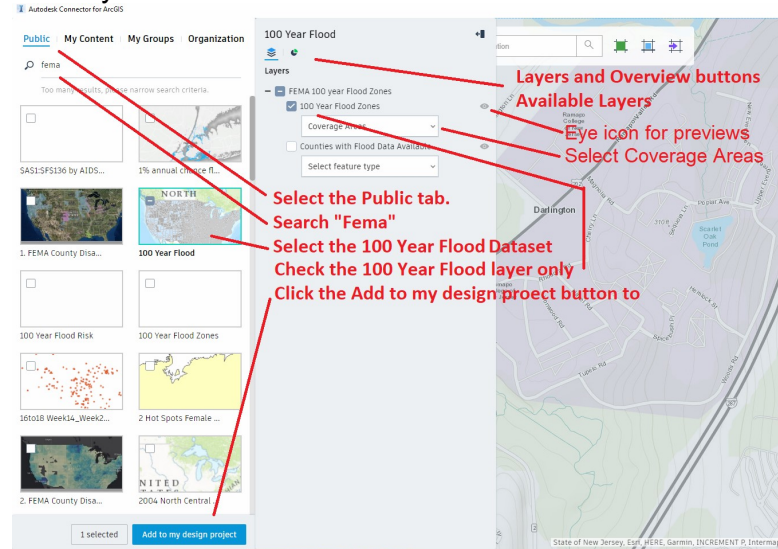
Tip: Use the keyboard shortcut ALT+1 to open the Data Sources dialog.

7. Click the Add ArcGIS Data Source button.
8. Connect to your ArcGIS Online account or create a new free account if you do not already have one.



9. After logging on, the ArcGIS Connector appears. Notice how the connector automatically zooms to your AOI and you are ready to search for GIS data.

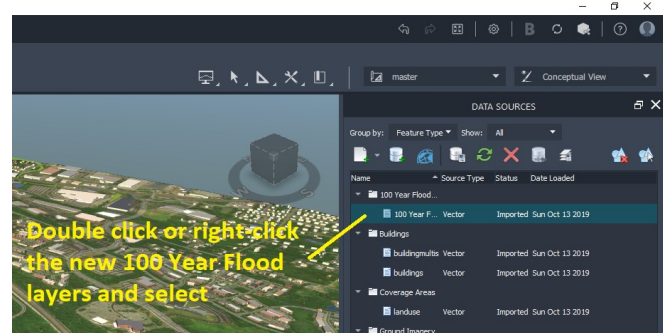
10. The Connector for ArcGIS opens with three tabs. Public, My Content, My Groups and Organization. Click the Public tab if it is not current. Here you can find data in the ArcGIS Online public portal. The My Content, My Groups and Organization are linked to your active ArcGIS Online account. These three tabs need to be populated with data from your ArcGIS Online account. Many firms have portals set up with data that can be shared with project teams, other professionals and clients



11. Search, "FEMA " in the Public tab.

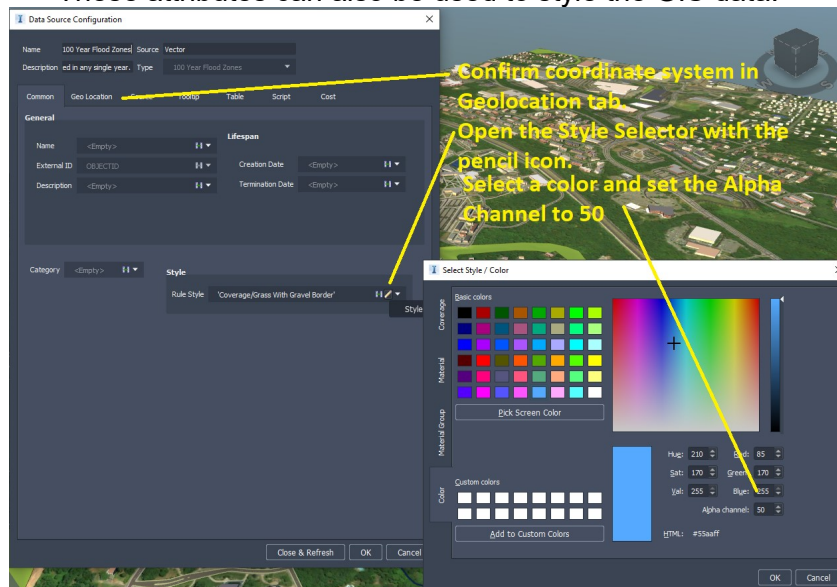
Tip: Place a space after FEMA in the search to better filter the results.

12. Select the dataset named, "100 Year Flood". A dialog appears displaying the dataset's layers. Note that this dataset has 2 layer sets that can be imported into Infraworks and/or Civil 3D.
13. Click the Overview button to reveal the author and other information for the dataset. Note that this data was not published by FEMA, is out dated and is only being used for Demonstration purposes in this exercise. Choose your data wisely. 😊.
14. Click the Layers button again.
15. Click one of the 'eye' icon buttons to the right of on of the layers to preview the data.
16. Change the layer to display as a Coverage Area.
17. Confirm the 100 Year Flood Zones layer is checked and the Counties with Flood Data Available is unchecked.
18. Click the Add to my Design Project button. The Connector for ArGIS will close and Infraworks comes back into focus. The 100 Year Flood layer is displayed. Note that the data comes in with a default style of grass and it is not transparent.
19. In the Data Sources dialog, double click the 100 Year Flood layer in the Data Sources dialog to configure the data. Note that you can also right click on the layer and select Configure to open the same Data Source Configuration dialog.
20. In the Common tab under the Style selection, click the pencil icon to open the Style Selector dialog.
21. Click the Color tab.
22. Choose any color you like and change the Alpha Channel from 255 to a value of 50. This will make the color transparent. Click the OK button to close the Style Selector.



Tip: Experiment with alpha channels less than 255 on all of your Infraworks styles to find transparency values that work best for any object in your models.

23. Back in the Data Source Configuration dialog click the Geolocation tab to confirm the dataset's coordinate system. Note that this data set uses the default Infraworks coordinate system, LL84 and the system does not need to be changed for correct projection.
24. Click the Close and Refresh button to display the flood plain with a transparency.
25. Select one of the Flood Zones. Right click and choose Properties to display the Properties dialog. Note that the data is imported into Infraworks with the GIS attributes. These attributes can also be used to style the GIS data.



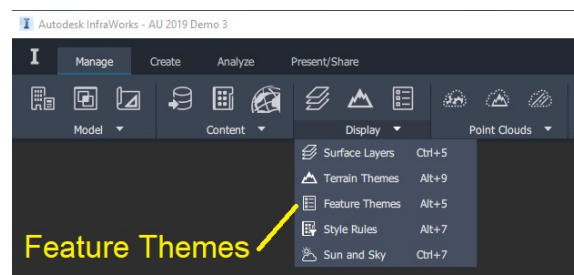
Demo 1 Bonus – Using Feature Themes

The GIS data imported with the Connector for ArcGIS will have feature classifications and attributes attached to it. These attributes can be used to stylize the data. These styles can be used to better visualize the data based on the feature classification. Users can easily differentiate municipal zone boundaries, soil types, and in this case flood zones.

Feature Themes are a new feature in Infraworks that can save you the time from coding Rule Styles to display data differently based on feature classification. In this bonus demo you can see how fast and easy it is to color the different flood zones without any Python coding that we may need using Rule styles.

Tip: Search, “CES317787 - Demo 1 Bonus” in the Autodesk Knowledge Network for the video demonstrating the following procedure.

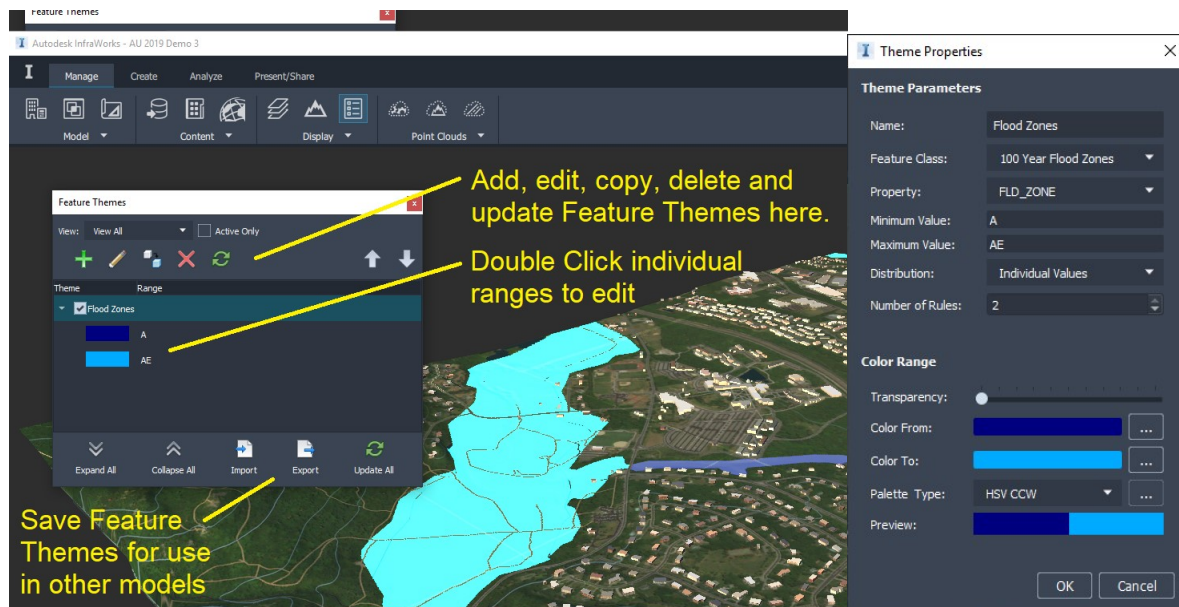
1. From the Manage tab, click the drop down arrow on the Display tab of the



- Infraworks menu
2. Select Feature Themes

Tip: Use the keyboard shortcut ALT+5 to open the Feature Themes dialog.

Bonus Tip: Note that all of the Infraworks Keyboard Shortcuts are displayed in the dropdown menus.



3. Click the green + button in the upper left of the Feature Themes dialog to create a new Feature Theme.
4. Provide a name of, 'Flood Zones'
5. Change the Property from 'ID' to 'FLD_ZONE'. Note that the min and max values appear. This dataset only has two flood zones so you cannot add more than two rules.
6. Choose a Quantile distribution. Note that you can also set individual styles based on each value or a set number of values.
7. Select your desired color and transparency values. Check the results with the preview.
8. Click the OK button when you are satisfied with the color configuration.

Theme Styles work great to easily control the display of GIS data with GIS attributes for flood zones, soil types, zoning districts, land use and any other GIS attribute attached to your data. Note in the image above that these Themes can also be exported to external files so they can be quickly reproduced in your other Infraworks models.

Demo 2 - Import GIS data from your ArcGIS Portal to Civil 3D

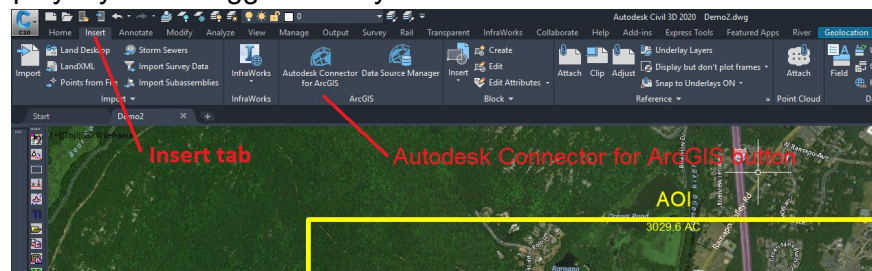
The Connector for ArcGIS also works in Civil 3D. Providing a more streamlined workflow to working with GIS data compared to previous methods. Not only is it faster to access GIS data from our ArcGIS Online Portals but the Connector will create native Civil 3D objects from the data. You can import Civil 3D Points, Alignments, Parcels, Feature Lines and Pipe Networks. As

with the Connector in Infraworks, you can edit the data and save it back to ArcGIS Online. You can also create new data and save it back. Let's begin by Using the Connector for ArcGIS to import the Demo 1 dataset into a Civil 3D file.

Search, “CES317787 - Demo 2” in the Autodesk Knowledge Network for the video demonstrating the following procedure.

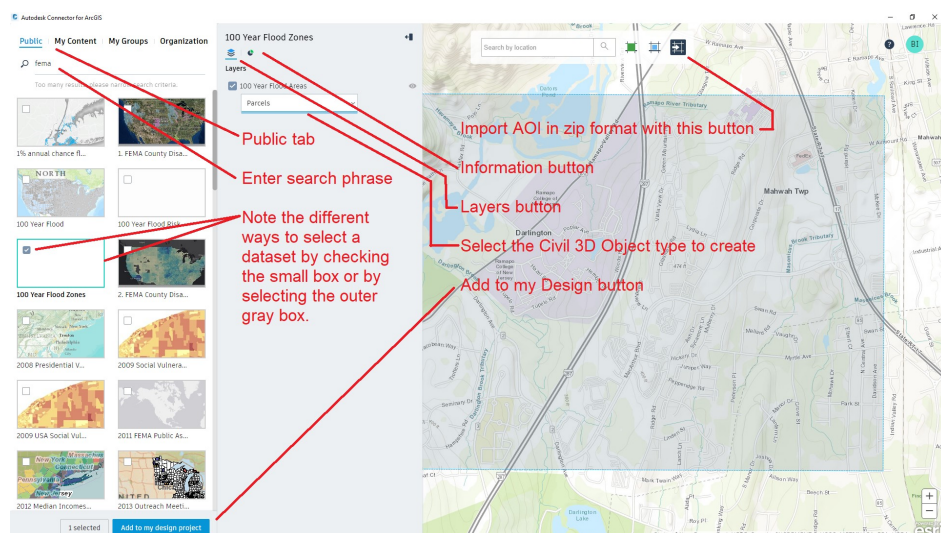
Tip: Before beginning make sure to close Infraworks if it is open. If it is open and a connection with the ArcGIS Connector is or was active, you may not be able to log on to ArcGIS Online in Civil 3D.

1. Launch Civil 3D and open the Demo2.dwg file. It will zoom to the same AOI from Demo1. The dwg file has a coordinate system assigned and the AOI is displayed. The Bing aerial photo will display if you are logged on to your Autodesk Account.
2. Click the Insert tab.
3. Click the Autodesk Connector for ArcGIS button.



4. The Connector opens. There are a couple of differences to note when compared to the Infraworks version. In the Civil 3D version the Connector will not automatically zoom to your site and if you want to use a shp file to import a polygon to define the AOI, the entire shp file dataset must be compressed into a zip file. There are a number of methods to locate your site so a shp file import is not required for all of your projects. You can also simply zoom to any site, type in an address, a name of a known place or import a polygon as we will do here to keep the data consistent.
5. Click the Import a Polygon to Select AOI button. Browse to the downloaded class files and select the AOI zip file.
6. The Connector now zooms to the same AOI that we used in Demo 1.

7. Click the Public tab
8. Enter “fema” into the search bar including the space after fema to narrow the filter.
9. Select the ‘100 Year Flood Zones’ dataset. Note that this is not the same

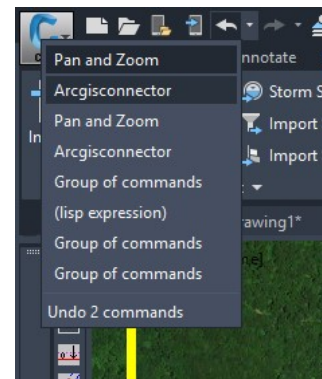


dataset used in Demo 1.

10. Note the different behavior if you select the large outer rectangle for any dataset versus clicking and placing a check in the small square in the upper right of any dataset. Selecting the large rectangle will display all of the layers unselected while the small box will display all of the layers as selected in the information panel.
11. Click the Info button to reveal the publisher. Again note that this set is not published by FEMA and is only being used for Demonstration purposes.
12. Click the Layers button and place a check in the 100 Year Flood Areas if it does not have one.
13. Select a feature type of Parcels
14. Click the Add to my design project button and you are returned to Civil 3D.

The flood areas are imported using the default Civil 3D Parcel and Parcel Label styles. We could have also imported the flood areas as feature lines or points. To see the data imported as other object types use the following steps.

1. Save your file and then save it again to a new name.
2. Click the dropdown menu (aka Drop down arrow) on the Undo button in Civil 3D's Quick Access toolbar.
3. Select the ArcGIS Connector entry to undo to that command.
4. Go back to the step 2 in Demo 2 where you launch the Connector. Repeat the steps (you can omit saving the file to a new name) but import the flood areas as feature lines. Repeat these 4 steps once more to see the data imported as Cogo points. Note that you must undo because the same dataset cannot be imported into the same model more than once.



As you can see the Autodesk Connector for ArcGIS provides a number of ways to migrate and display data between our BIM, CAD and GIS environments. The Autodesk Connector for ArcGIS is also capable of working with coverage areas, pipelines and points to better help you get your work done faster.

Note if this Demo was attempted using the '100 Year Flood' dataset that was used in Demo 1, the Civil 3D Autodesk Connector for ArcGIS may not work. I do not know why but I can say that all data is not created the same. Trust your publishers.

Civil 3D Performance with large datasets

The dataset used in the two Demonstrations were in part chosen because the data is much less dense than the data published by FEMA. By this I mean there are more flood areas (flood zone x was removed from the Demo datasets) and there are many, many more vertices in the FEMA data set. In the Demos The data in these demos was imported in about a minute on a 5-yr old laptop (core i5, 8GB ram). The FEMA data set is much larger and took about 15 minutes to import on the same laptop. The area imported was much larger and had flood zone x included adding to the data density. Users should plan time for very large datasets accordingly.

Demo 3 – Publish data back to your ArcGIS Portal

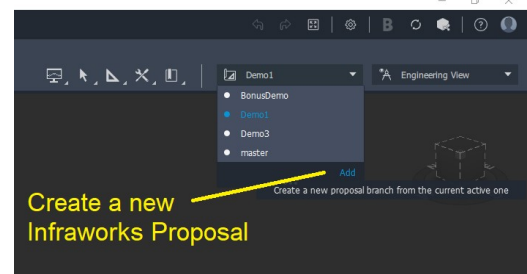
Infraworks

As mentioned before data created in, or imported to Infraworks and Civil 3D can also be published back to ArcGIS Online to help organizations with their GIS workflows. Pipelines, coverage areas, points of interest all can be sent to your ArcGIS Online Portal. The underlying data must be points, lines, polygons to meet GIS requirements. Attribute or feature data will carry through the publish process. The following Infraworks features can be published to an ArcGIS Online portal.

- | | |
|---|---|
| <ul style="list-style-type: none"> • Barriers • Buildings • City Furniture • Coverages • Culverts • Drainage End Structures • Easements • Land Areas • Parcels • Parking Areas • Parking Rows • Pipelines | <ul style="list-style-type: none"> • Pipe Connectors • Points of Interest (POIs) • Project Sites • Railways • Right of Ways • Roads • Streams • Traffic Study Areas • Trees • Water Areas • Watersheds |
|---|---|

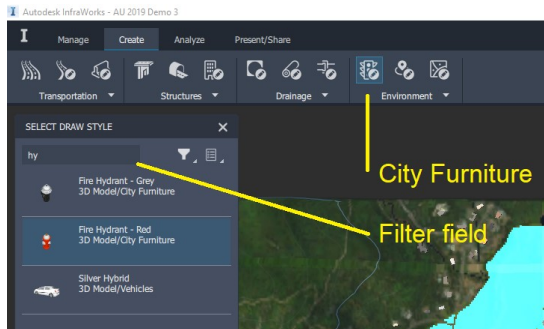
Tip: Search, “CES317787 - Demo 3” in the Autodesk Knowledge Network for the video demonstrating the following procedure.

In this Demo we will create some objects in our model and step through the process to publish the data back to ArcGIS Online. The Demonstration will remain very simple and general to highlight the workflow for getting new data back to your ArcGIS Online Portal.



1. Launch Infraworks and open the Infraworks file created in Demo1.
2. Create a new Proposal and name it Demo 3.
3. Point your map with north to the top and locate Washington Lane as shown below.



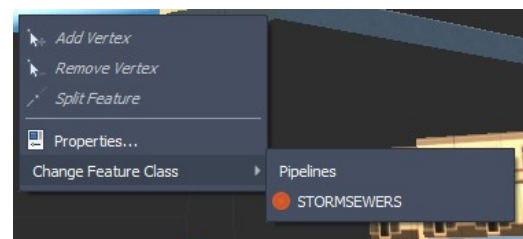
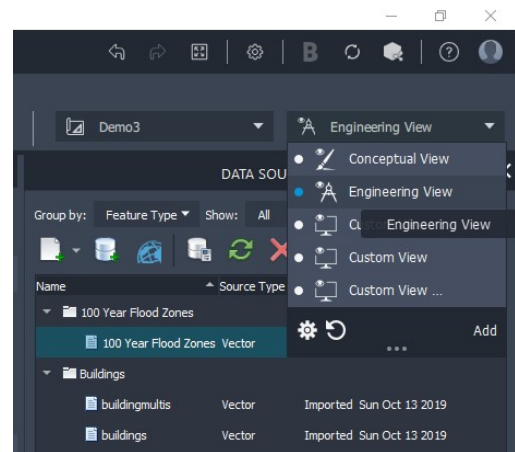
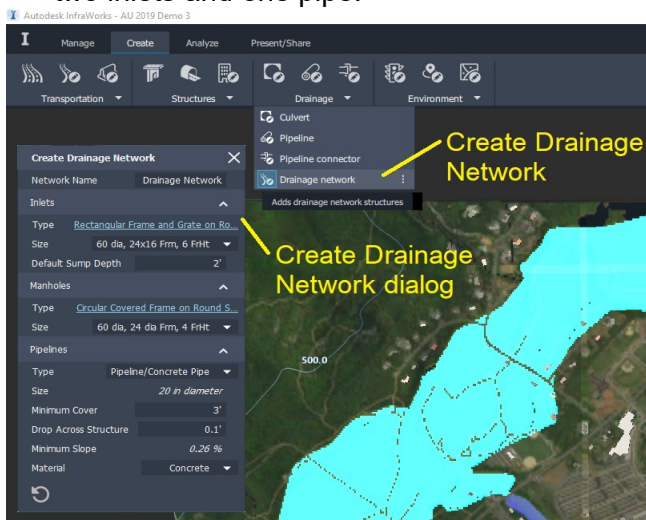


4. From the Environment panel on the Create tab, click the City Furniture icon to open the City Furniture dialog.
5. Type 'hy' into the filter field to quickly locate a fire hydrant.
6. Double click a point along Washington Lane to add a Hydrant to the model. Add a second along the same road.

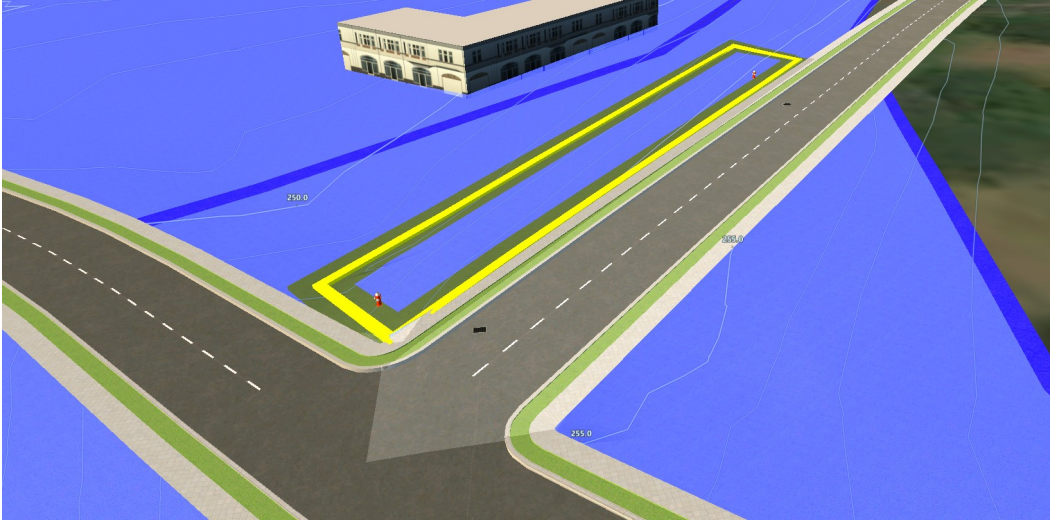
Tip: Use CTL+G to open the City Furniture dialog

Now let's create a small drainage network. Before we do this let's do a little preparation so we can better see our work.

7. In the upper right of Infraworks let's change the Conceptual View display to Engineering view so we can see below the surface.
8. From the Create tab, click the drop down arrow on the Drainage panel
9. Select Drainage Network.
10. Click to points within Washington Lane to create a small drainage network consisting of two inlets and one pipe.

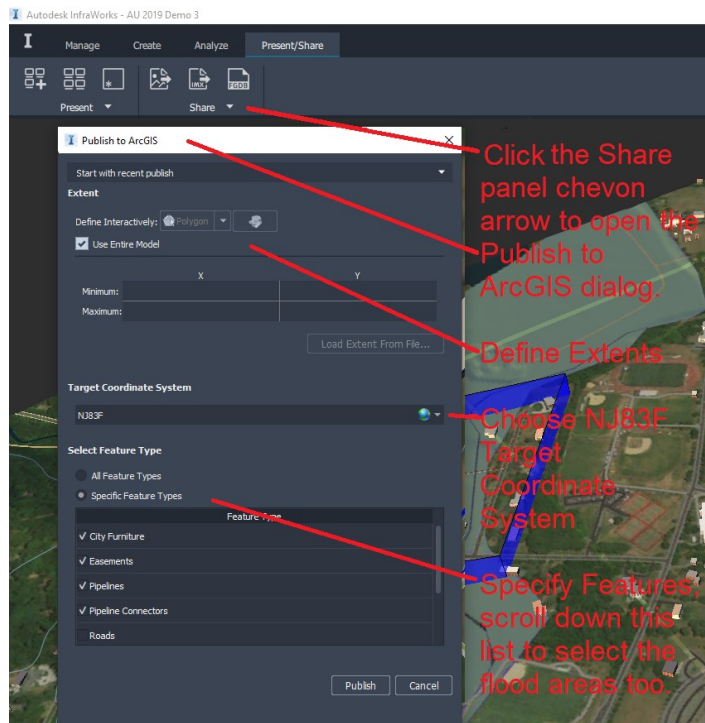


11. From the Create tab, Environment panel, click the drop down arrow to display the menu and choose Easement.
12. Draw a simple rectangle off to the side of the road.



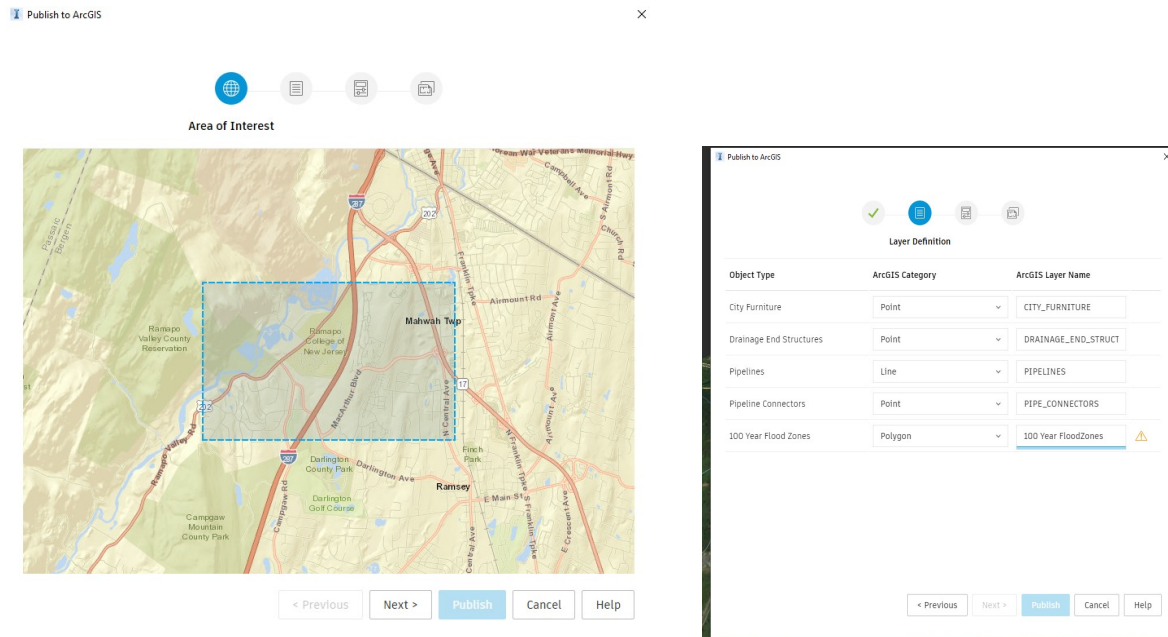
We now have some data that GIS applications work with. We have points from the hydrants and inlets. We have lines from the pipe and we have polygons with the flood areas and easement. The data in this model can now be published to your ArcGIS Online Portal.

1. Click the Present/Share tab.
2. Click the drop down arrow on the Share panel and select Publish to ArcGIS. The Infraworks Publish to ArcGIS dialog appears. Logon if required to connect.
3. Users can define the extent for the publish process by clicking the Define Interactively Polygon button and drawing a polygon or bounding box around the new features created above. Let's check the Use Entire Model button to use the model extents.
4. In the Target Coordinate System type NJ83F to set the coordinates to the Civil 3D drawing system.
5. In the Select Feature Type section, click Select Specific Feature so you can filter the data published. Place a check on 100 Year Flood Zones, City Furniture, Easements, Pipelines and Pipeline Connectors. Leave the other items unchecked but note that

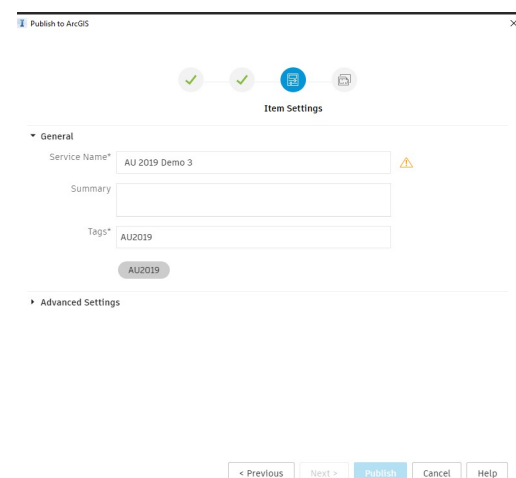


you can publish these items as well.

6. At the bottom of the dialog click the Publish button.
7. You are now presented with the ArcGIS Publish to ArcGIS dialog. This dialog has 4 pages to step you through the publishing process. Note that these same dialogs are used in the Civil 3D Connector for ArcGIS as well.
8. On the first page of this dialog your AOI is displayed for your confirmation.

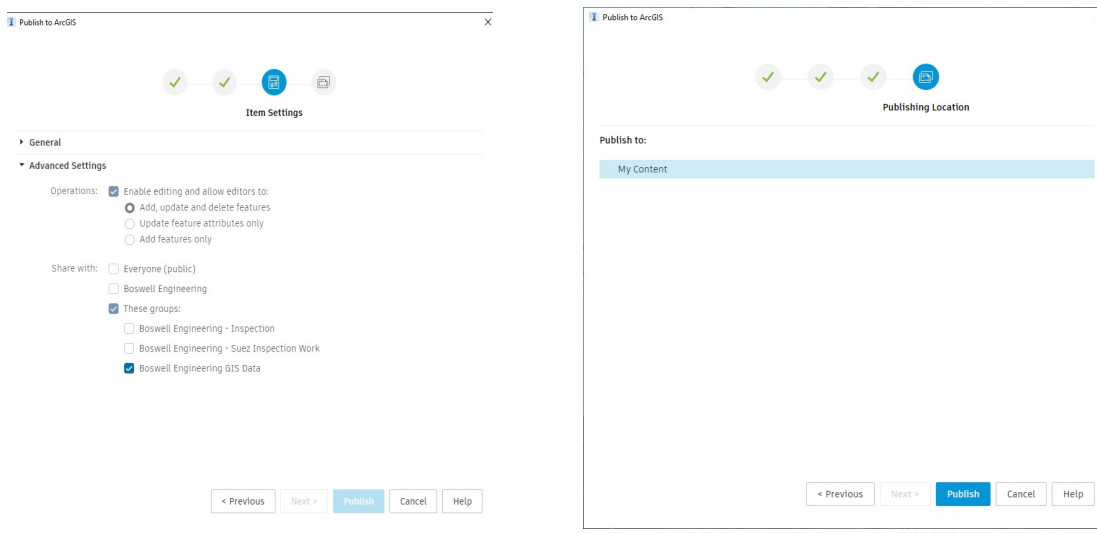


9. Click the Next button.
10. The second page allows you to configure the GIS categories and GIS Layer Names to be created. Note by the orange triangle icon that there is an issue with the flood zones. If you hover over the icon a message is displayed telling you that the Layer Names must begin with a letter and cannot have spaces or special characters except for an underscore. The Next button will not work unless the names are corrected.
11. Edit the 100 Year Flood Zones layer name to be Flood_Zones.
12. You can also change the type of data being exported in the ArcGIS Category column. The values shown are what we want so Click the Next button.
13. On the third page you specify your Item Settings.
14. Provide a name for the Service. This will be the name of the item you will see in your ArcGIS Online Portal. This name must also begin with a letter and may not contain spaces or special characters.
15. Provide a name for your Service.
16. Provide at least one tag as this is a required field.



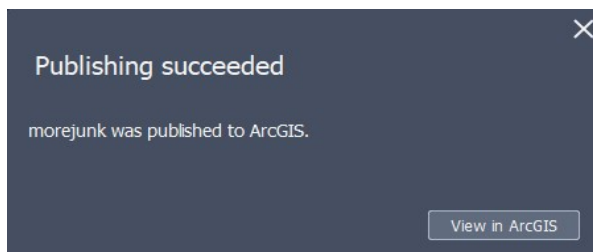
17. Click the Advanced Settings arrow and here you can provide instructions for the update.
You can choose from one of the following actions,
 - a. Add, update and delete.
 - b. Update Feature Attributes only or
 - c. Add Features Only.

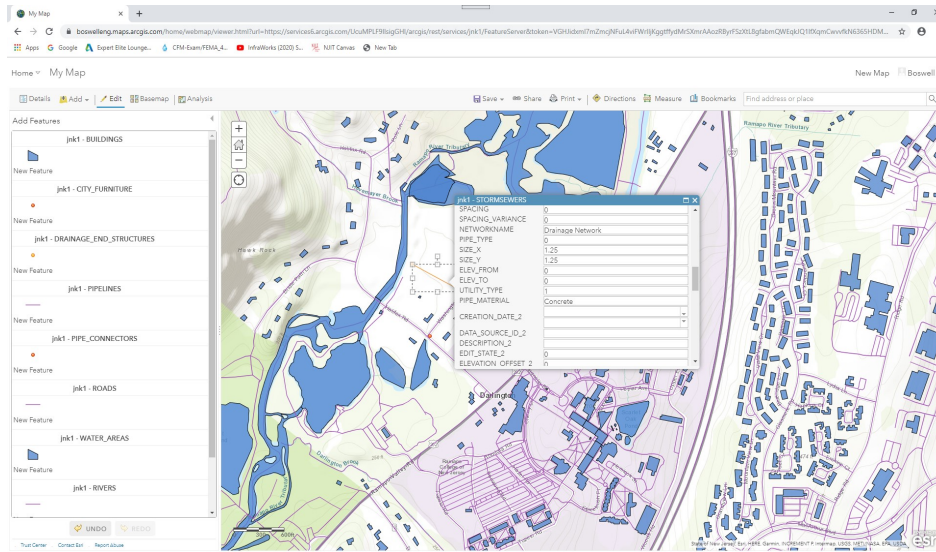
You can also specify who you will share the data with. Your ArcGIS Online Organization and Groups will appear in the list. Check the options you desire. Again the Next button will light up and become functional once all of the information is provided.



18. Click the Next button.
19. The last screen allows you to choose a Publishing Location in your ArcGIS Online portal.
Depending on how your company's portal is setup you will see My Content by default and any custom locations your portal has defined.
20. Click the Publish button.

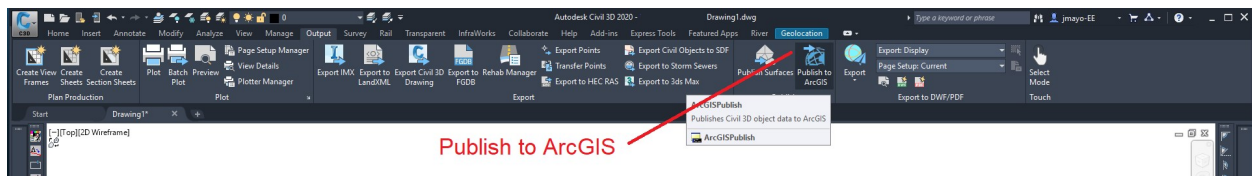
The data is written to you portal and you are prompted to view the data in ArcGIS. Click the button to view and confirm the data in ArcGIS. Sign in if prompted and the data you published is opened directly in ArcGIS Online.





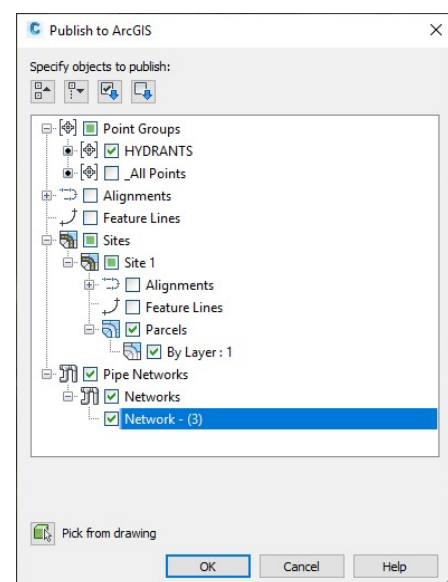
Now that the data is written to your ArcGIS Online portal you can access it and edit in your favorite ESRI application and Civil 3D. Civil 3D can be used to edit this data and save it back to the ESRI Portal. This edited data can be saved back to ArcGIS Online directly from Civil 3D using the Data Source Manager.

Civil 3D



Publishing in Civil 3D is very similar to the process above for InfraWorks. After creating new point, parcel, feature line or pipe network objects in Civil 3D click the Output tab to locate the Publish to ArcGIS feature.

You will be prompted to connect and the Civil 3D ArcGIS connector will open. The only real difference from the InfraWorks process is the first dialog you are presented with. This dialog should look very familiar to Civil 3D users as it is also used in xml import/export, data shortcuts and more. The dialog just lists all of the Civil 3D objects in the current file that are available to publish. Check your items and follow the instructions above from step 6 down. The 4 dialogs that follow this first are the exact same dialogs you used in the steps above and the workflow is the same.

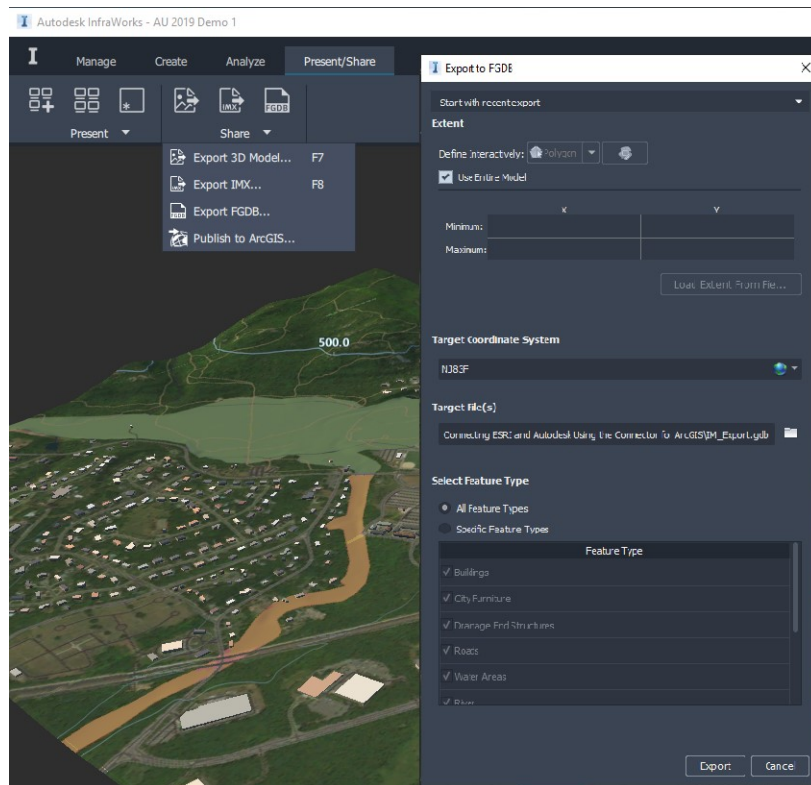


Demo 4 – Write to External Geodatabase

The ArcGIS Connector in Infraworks has the ability to create a new external geodatabase and upload it directly to your ESRI Portal.

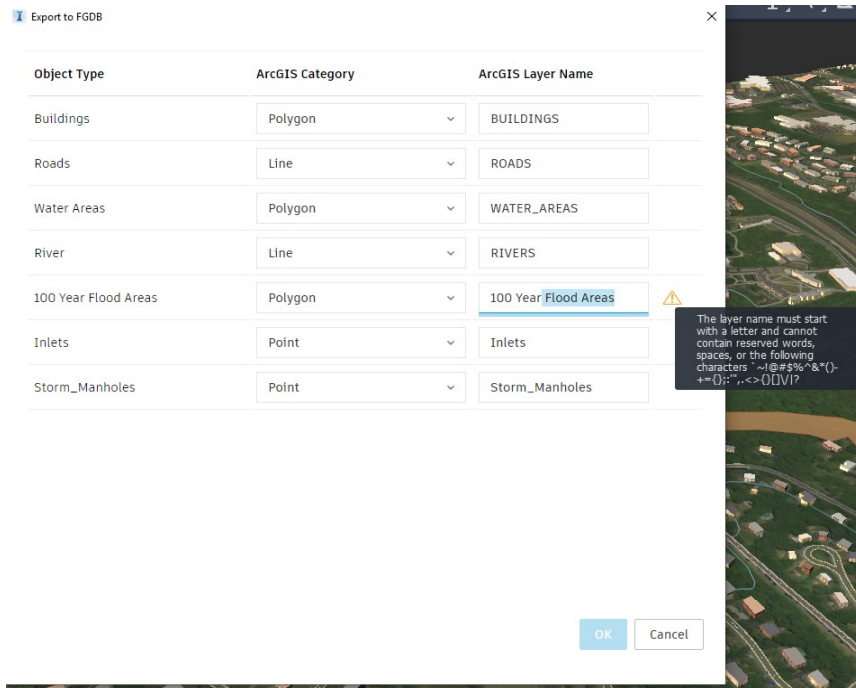
Infraworks

1. Open the file you created in Demo 3.
2. From the Present/Share tab, click the dropdown arrow on the Share panel.
3. Select Export FGDB and the Infraworks Export to FGDB dialog appears.
4. Under the Extents section place a check in the Use Entire Model box.
5. Select a Target Coordinate system of NJ83F.
6. Confirm that All Feature Types are selected or select the object types you would like to export by clicking the Specific Features button.



7. Click the Export button and the ArcGIS Online Export to FGDB dialog appears. Note the warning icon next to 100 Year Flood Zones. Hovering over the warning icon will inform you that the ArcGIS Layer Name cannot have spaces, must begin with a letter and cannot have special characters other than an underscore.
8. Rename the Layer to Flood_Zones.
9. Click the OK button and a new geodatabase is created in your ArcGIS Online Portal.

10. Open ArcGIS Online to view and edit the geodatabase.



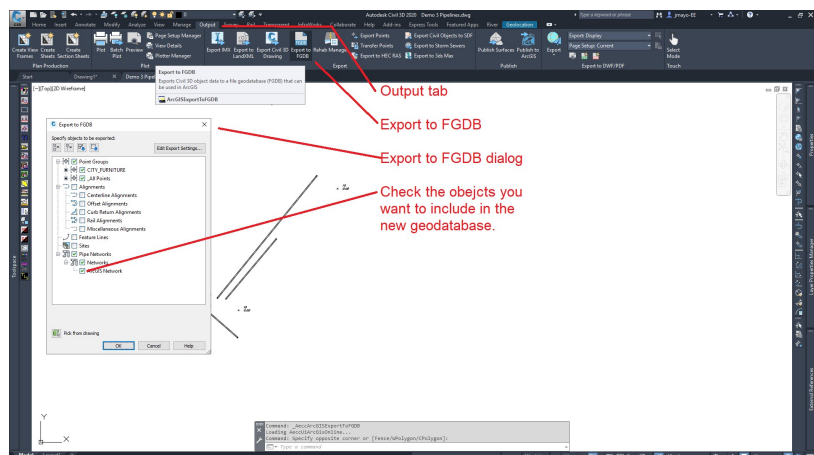
Civil 3D

In civil 3D, a geodatabase can be exported and saved to your PC, network or external storage device.

1. Open any file that contains Civil 3D objects (points, alignments, gravity pipe networks, parcels and or feature lines).
2. From the Export panel of the Output tab select, Export to FGDB
3. The Export to FGDB dialog appears. Place a check beside each Civil 3D object type to include in the geodatabase.
4. Provide a file name and path before clicking the OK button to save the file.

To sum it all up...

The features provided in the Connector for ArcGIS provide powerful tools in Infraworks, Civil 3D and Map 3D that allow us to quickly access, edit and create GIS data in our infrastructure workflows. We hope this handout and the demonstrations help you get



off to a fast start implementing these new tools in your current BIM, CAD and GIS workflows.

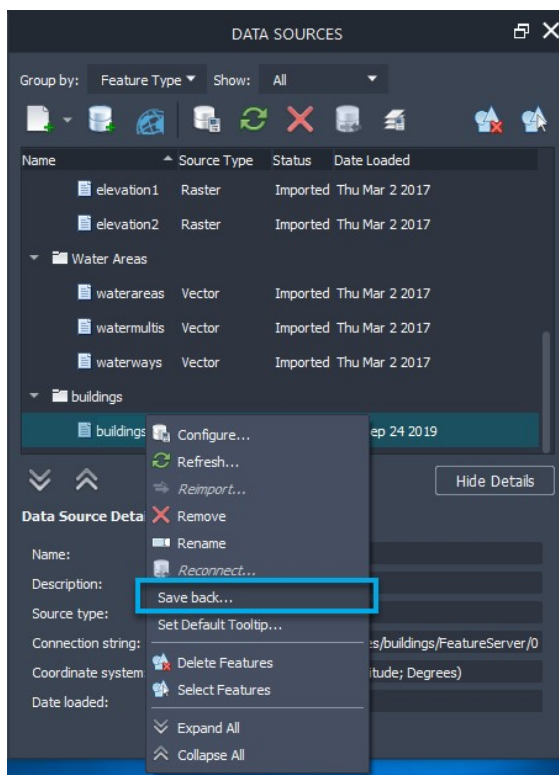
John and Ramesh

Bonus Feature Review - Save Back Feature

The Save back feature is another very easy tool you use. Saving data back to ArcGIS Online is a simple task once you have imported GIS data from ArcGIS. Do note that you must have editing privileges assigned to your ESRI account to use the save back feature. You also cannot publish data, edit it and save it back. You can work around this by publishing data to ArcGIS Online, remove the data you published from your Infraworks model and then import the data you published. You will then be able to edit and back the edits you make.

Save Back - Infraworks.

1. Open the Data Sources dialog from the Manage tab.
2. Select an ArcGIS feature from the Data Sources panel. Again a reminder that this must be an ArcGIS dataset that was imported into your model using the Autodesk Connector for ArcGIS. It cannot be a dataset you published and still exists in your model.
3. Right-click.
4. Click Save back.



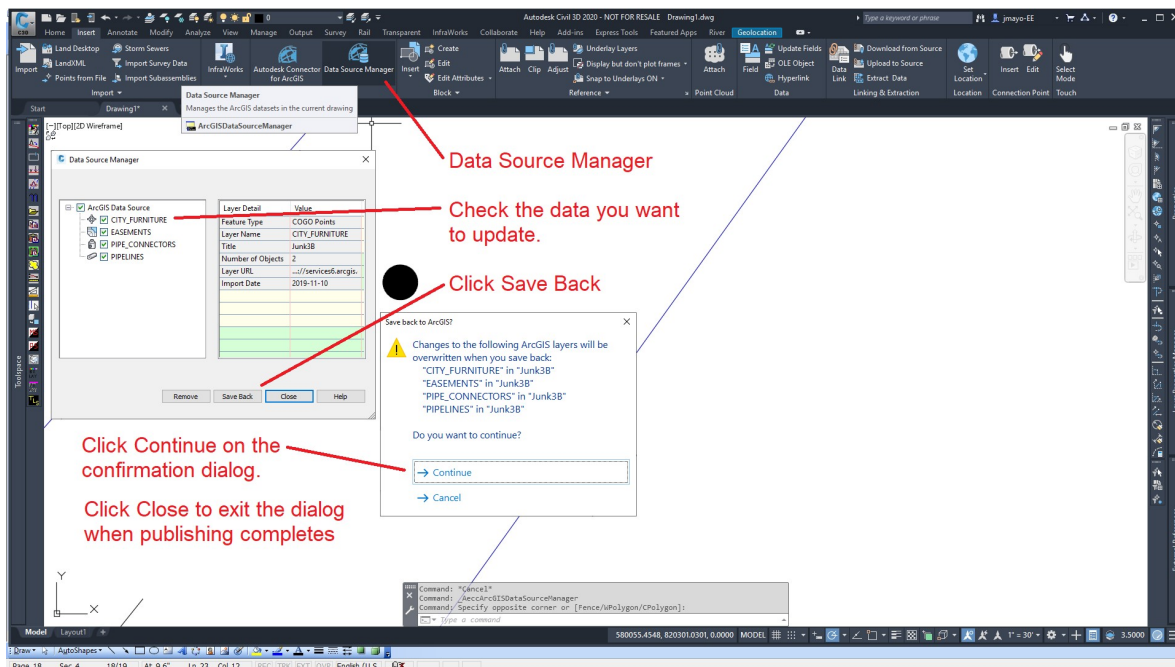
Save Back – Civil 3D

The Save back feature in Civil 3D is just as simple to use and it is accessed from the Insert tab of the Ribbon. This feature will again require you to have data imported into your model and not contain data you published. You must also have editing privileges assigned to your ArcGIS Online account.

To save back data begin by importing data from ArcGIS Online.

Edit the data you imported.

From the Insert tab click the Data Source Manager button.



The Connector for ArcGIS has many features designed to help you save time working with GIS data in your infrastructure workflows. This new feature can significantly enhance many current BIM, CAD and GIS workflows by providing fast access to native GIS datasets within Map 3D, Civil 3D and InfraWorks. We hope these demonstrations get you off to a fast start using the Autodesk Connector for ArcGIS.

Learn More About the Autodesk Connector for ArcGIS

<https://knowledge.autodesk.com/support/infraworks/learn-explore/caas/CloudHelp/cloudhelp/ENU/InfraWorks-UserHelp/files/GUID-AFF4B76A-F6C1-455C-805C-95DF98189806-hm.html>

Tip: Search the internet with, "Infraworks Extended Schema" to learn more about creating, assigning and editing objects to contain the data you need for your GIS feature classes and attributes.