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CI125476-L

A Practical Guide to GIS in AutoCAD Civil 3D (Part 2)

Rick Ellis
CADapult Software Solutions

Learning Objectives

- Analyze Different types of GIS Data in Civil 3D
- Create Thematic Maps to Display Complex Data in ways that are Easy to Understand
- Export AutoCAD Geometry to Different GIS Formats
- Export Civil 3D Objects to Different GIS Formats

Description

If you took Part 1 of this class (today or a previous year at AU) and are ready to learn even more, this class takes the next step as we look at the GIS capability in Civil 3D and how it can benefit Civil Engineers and Surveyors. GIS data can be created directly in Civil 3D or imported from other programs. Now that you have access to that data the real fun begins. This class will explore ways to analyze, display and leverage this information to answer questions and automate common tasks. The request to provide design data to GIS departments is becoming more common every day. This class will explore the details of why just sending them a drawing is often not an adequate way to satisfy that request. You will learn ways to export Civil 3D objects to GIS formats that can be used easily and consistently by your GIS department.

Speaker(s)

Rick Ellis is the President of CADapult Software Solutions, Inc., where he provides training and consulting services to clients around the country, helping them get the most out of their design software investment. Rick specializes in AutoCAD® Civil 3D®, AutoCAD® Map 3D, Autodesk® InfraWorks™, AutoCAD® Raster Design, and AutoCAD®. He is a member of the Autodesk Developer Network, and author of several critically acclaimed books on AutoCAD Civil 3D, and AutoCAD Map 3D; including the Practical Guide series. Rick continues to use AutoCAD Civil 3D on projects in a production environment, in addition to teaching classes to organizations both large and small around the country. This practical background and approach has made him a sought-after instructor by organizations around the world.

rick@cadapult-software.com
@theRickEllis

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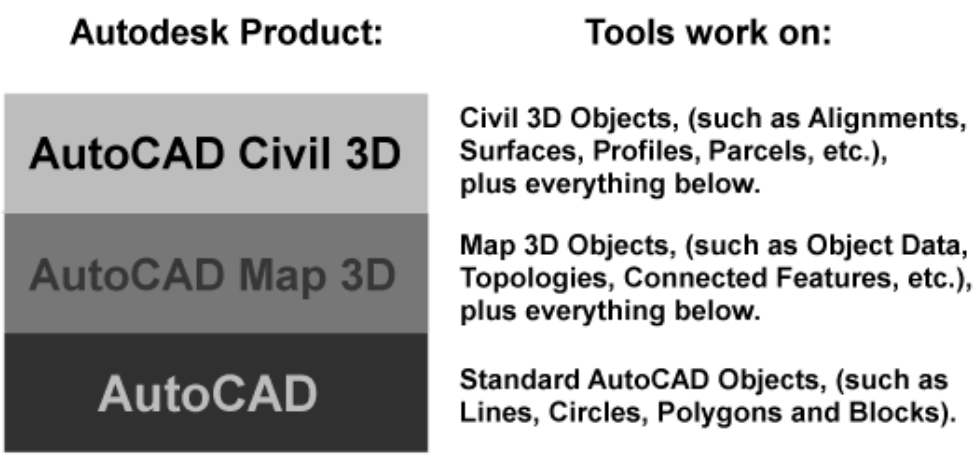
Introduction to GIS in Civil 3D

In addition to all of the tools built into Civil 3D for the civil engineering workflow, the software also includes many powerful tools for creating, editing, importing, displaying and utilizing a wide range of GIS and mapping data. For instance, aerial and satellite imagery can be displayed, geometric data that includes corresponding tabular data can be attached to existing AutoCAD objects, such as lines representing pipes and polygons representing tax lots. Geometry with corresponding tabular data can also be attached to, or displayed in Civil 3D drawing files, from a variety of GIS sources, such as ESRI Shapefiles and Autodesk SDF.

Many of these additional tools can be used alone, or in various combinations, and are not necessarily limited to GIS and mapping projects, or even civil design projects. Unlike most Civil 3D workflow processes, these tasks are typically not linear. For instance, for any given project you may use different combinations of these tools or processes, in different sequences.

AutoCAD Civil 3D is built on top of *AutoCAD Map 3D*, which is built on top of standard *AutoCAD*. Using the many tools found in *Civil 3D*, you can work with three types of objects: standard *AutoCAD* objects, (such as lines, arcs, circles, polylines and blocks); *Map 3D* objects, (such as *Object Data*, *Topologies* and connected *Features*); and Civil 3D objects, (such as alignments, profiles, parcels, surfaces, and pipe networks); and. These objects that are unique to the Map 3D tools in Civil 3D will be explained in the Lessons and exercises to follow.



I would encourage you to think of this as a toolbox that contains many related, yet separate tools. Each tool has its own function and purpose. As you learn and become proficient with these tools you become a skilled craftsman knowing what tool is best suited for each task you encounter during your project. I would encourage you not to limit yourself to simply the examples demonstrated here. Focus instead on the individual tools. There are many different applications for them and once you understand how to use these tools, not just blindly follow a series of predefined steps, then you will truly unlock the power and productivity that is available to you.

1 Analyze Different types of GIS Data in Civil 3D

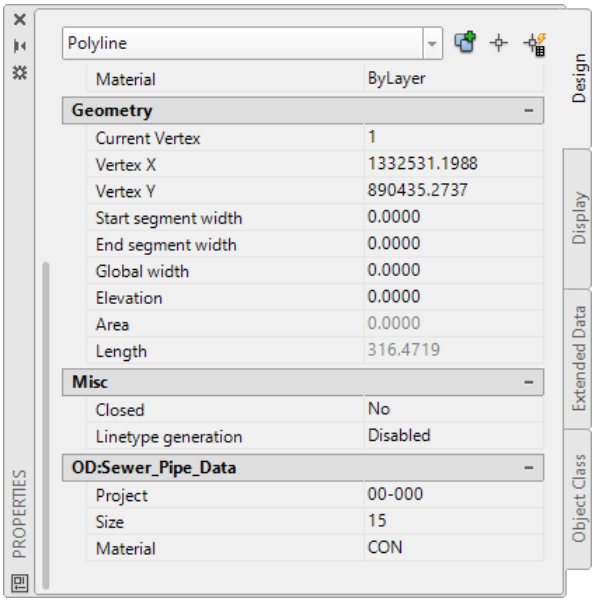
Once GIS data has been imported or created in Civil 3D there are a number of ways you can analyze and use that data. The commands you use depends on the format that the data is in. In this lesson you will first work with AutoCAD Objects that have Object Data attached. Then you will work with different commands to analyze attached GIS Features.

Analyzing AutoCAD Objects with Object Data

1.1 View Object Data on Existing Objects

For this exercise you should be in the *Planning and Analysis* workspace.

1. Open **Sewer.dwg** from the class dataset folder.
2. Pick one of the sewer lines, then right-click and select ⇒ **Properties**.
3. In the *Properties* palette, scroll to the bottom and notice the object data that is attached to that line.
4. You can view and edit any of the object data here as needed.



5. Close the Sewer drawing.

1.2 Query by Pipe Size from Object Data

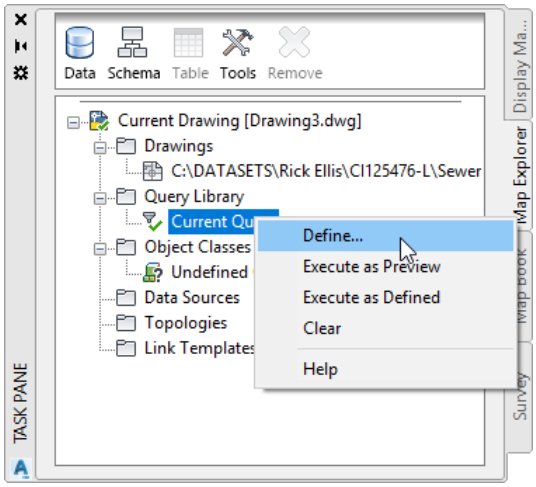
For this exercise you should be in the *Planning and Analysis* workspace.

In this exercise you will use a query to find all sewer pipes 10 inches or larger.

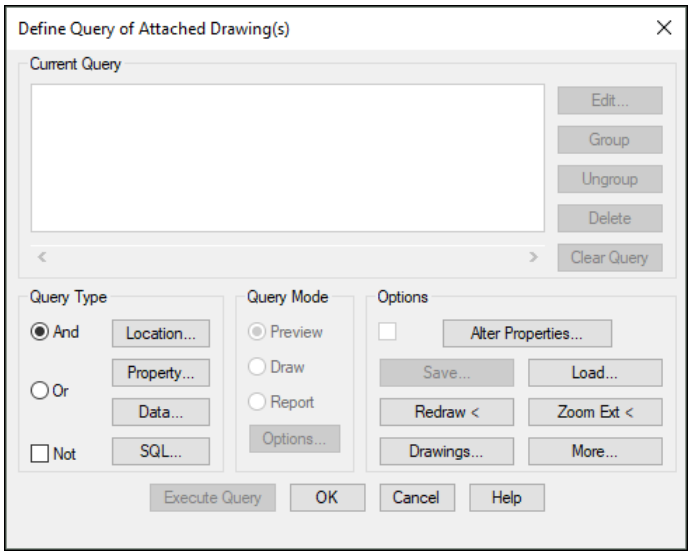
1. Start a new drawing using the ACAD.dwt template.
2. If the **Task Pane** is not visible, at the command line enter **MAPWSPACE**.
3. At the command line, enter **ON** to display the *Task Pane*, which includes the *Map Explorer*.
4. Select the **Map Explorer** tab of the *Task Pane*.
5. Drag and drop the drawing **Sewer.dwg** from the class dataset folder in *Windows Explorer* into the **Map Explorer** tab of the *Task Pane*.

This attaches the Sewer drawing to the current drawing and makes the data in it available for Queries.

6. In the *Map Explorer*, right-click on **Current Query** and select ⇒ **Define…**



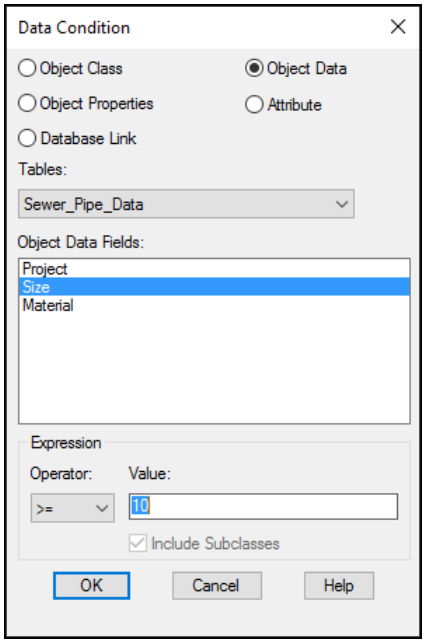
The *Define Query of Attached Drawing(s)* dialog box opens. Here, you set up the parameters of your query.



7. In the **Query Type** section, click **<<DATA>>**.

This opens *the Data Condition* dialog box.

8. Choose the **Object Data** option.
9. From the *Tables:* drop-down list, select **Sewer_Pipe_Data**.
10. From the *Object Data Fields:* list, select **Size**.
11. From the **Operator** drop-down list, select **Greater than or equal to (>=)**.
12. In the Expression section, for **Value:** enter **10**.
13. Click **<<OK>>.**



This returns you to the *Define Query of Attached Drawing(s)* dialog box.

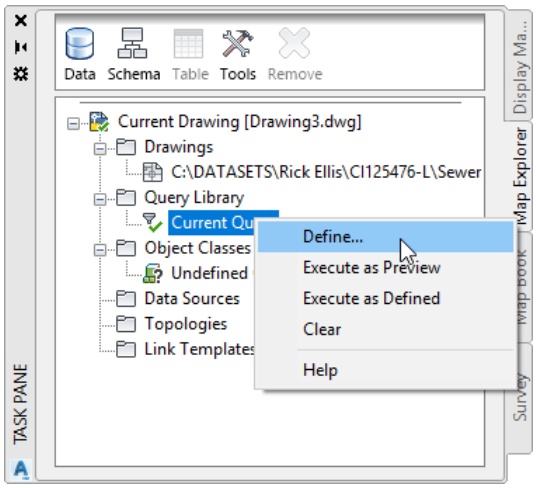
14. Confirm the **Preview** mode is chosen, and click **<<Execute Query>>**.
15. Zoom extents to see the pipes.

Only pipes 10 inches and larger are displayed in the preview.

16. Type **R to REDRAW** and clear the preview of the query.

Next you will refine the Query to find only the pipes that are greater than 10 inches and are concrete.

17. In the *Map Explorer*, right-click on **Current Query** and select ⇒ **Define…**

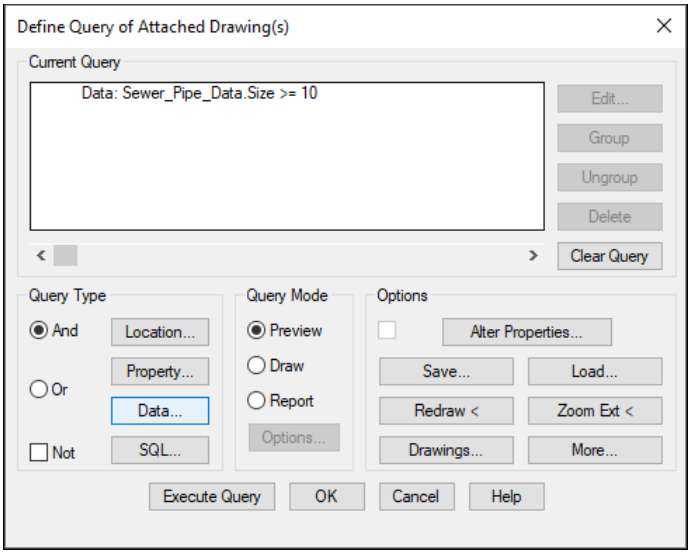


This returns you to the *Define Query of Attached Drawings* dialog box. Notice the *Data: Sewer_Pipe_Data.Size >=10* portion of the compound query is now defined.

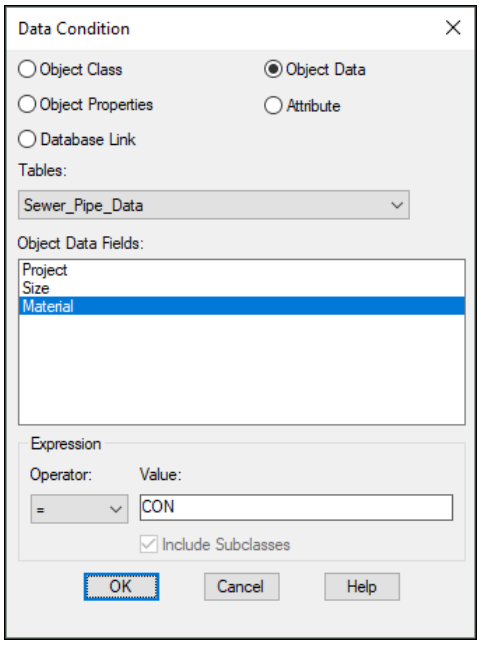
Next, you will define the *Material* portion of the query.

18. Confirm the **And** option is chosen in the **Query Type** section.

19. Click **<<Data>>**.



20. Choose the **Object Data** option.
21. From the *Tables:* drop-down list, select **Sewer_Pipe_Data**.
22. From the *Object Data Fields:* list, select **Materail**.
23. From the **Operator** drop-down list, select **Equal (=)**.
24. In the Expression section, for **Value:** enter **CON**.
25. Click **<<OK>>.**



This returns you to the *Define Query of Attached Drawing(s)* dialog box.

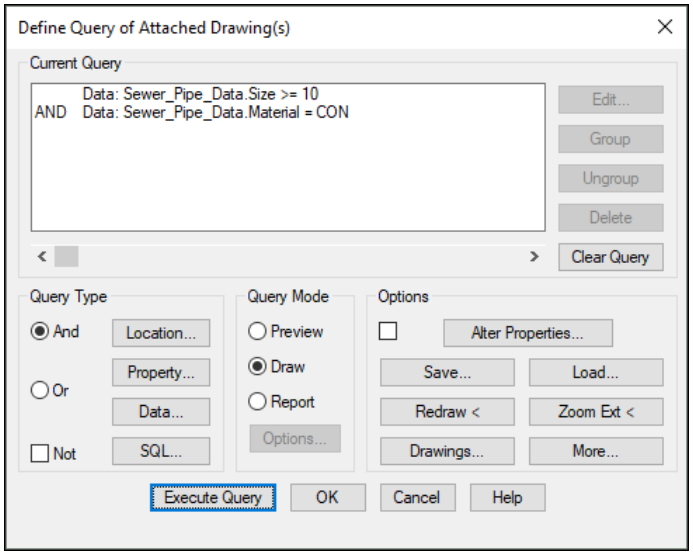
Notice the *Current Query* defined at the top of the dialog box filtering on both the *Size* and *Material* data.

26. In the *Query Mode* section, choose **Draw**.

This will copy all the objects that meet the query criteria into the current drawing.

27. Click **<<Execute Query>>**.

The sewer lines that are 10 inches or larger with a material of concrete are drawn into the current drawing.



28. Select one of the sewer lines, right-click and choose ⇒ **Properties**.

Notice that the Pipe Size and Material match our query.

29. Right-click on the attached drawing in the *Map Explorer* and select **Detach**.

Detaching the drawing breaks the link from the queried objects to their source drawing. If this link is maintained you can edit the objects and save them back.

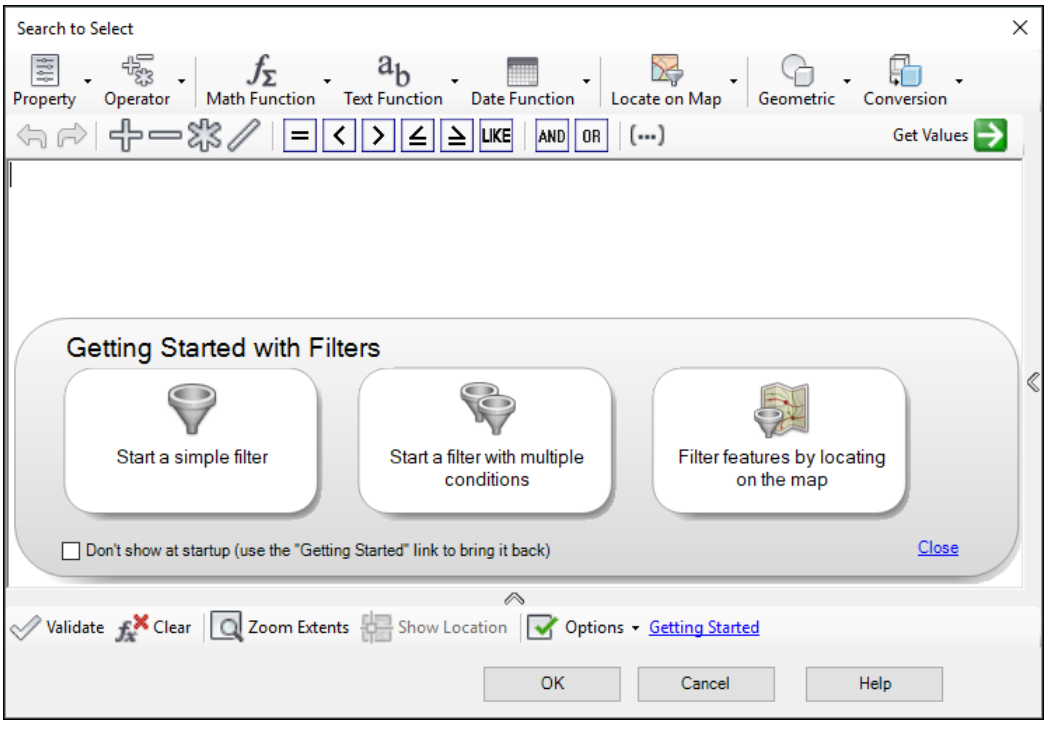
Analyzing GIS Features

There are a different set of tools to work with attached GIS feature data. These are not AutoCAD Objects and this lesson will explore ways to view and analyze their data.

The Expression Builder

This lesson introduces you to the basics of using the Expression Builder. This feature is a dialog that is used throughout Civil 3D, and the same interface is used in other Autodesk products. The advantage of this commonality is that once you understand and can effectively use the Expression Builder, your knowledge transfers to the other products.

You launch the Expression Builder from various commands that are contextually correct for that particular purpose, such as Create Query, Add to Map with Query, or Search to Select. The actual functions within the Expression Builder remain the same regardless of where you launched it.



When you first launch the Expression Builder, three options are presented to assist you in getting started:

- Start a simple filter.
- Start a filter with multiple conditions.
- Filter features by locating on the map.
- Once you become familiar with using the Expression Builder, you can dismiss the Getting Started guides.

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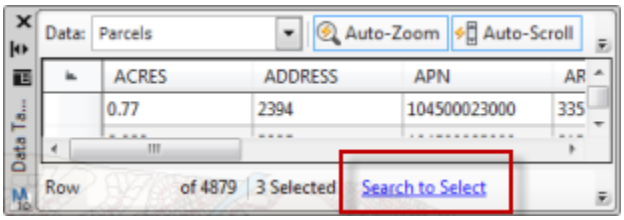
Expression Builder Process

The following is an example of how an expression is created in the Expression Builder. This example selects parcels on Dwayne CT which have an improved value below $100,000. Following is the final expression that is built in this example.

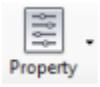
```
STNAME = 'DWAYNE CT' AND IMP_VALUE < 100000
```

1. The first step in creating an expression is to select the data upon which the expression is built. In this example, since the expression is based on parcel data, Search to Select is launched from the Parcels Data Table.

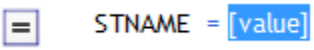


   Notice the expression that is built after each entry.

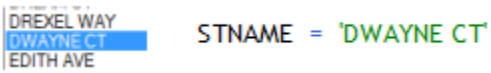
2. Select the STNAME value.



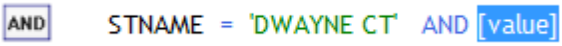
3. Select the Equals operator.



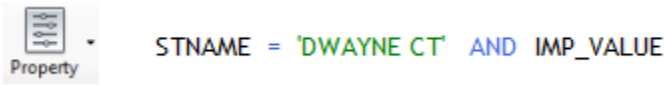
4. Select the DWAYNE CT value.



5. Select the And Boolean operator.



6. Select the IMP_VALUE value.



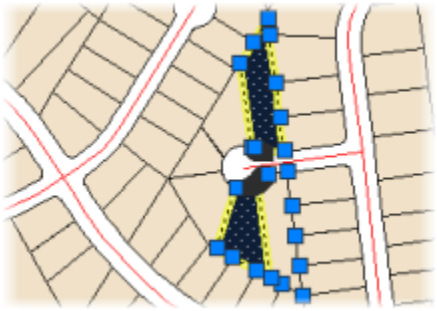
7. Select the Less Than operator.

   STNAME = 'DWAYNE CT' AND IMP_VALUE < [value]

8. Enter 100000 value.

   STNAME = 'DWAYNE CT' AND IMP_VALUE < 100000

The result of this expression is that all parcels on DWAYNE CT that have an improved value of less than $100,000 are selected in the drawing.



Feature Query and Filter to Select Defined

Queries and Filter to Select expressions are built the same way. The main difference between the two functions is that queries limit the features in the map and Data Table, and Filter to Select selects the features in the map.

Exercises: Create a Query, and Filter to Select Expression

In these exercises you begin in a map with streets, parcels and a flood zone polygon. You first create a *Filter to Select* expression to select all the private road segments in the city. You then create a query to identify all parcels that intersect with a flood zone.

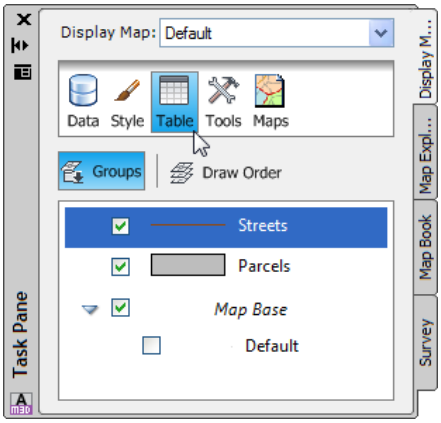
You do the following:

- Create a filter
- Create a query

1.3 Preforming a Filter to Select

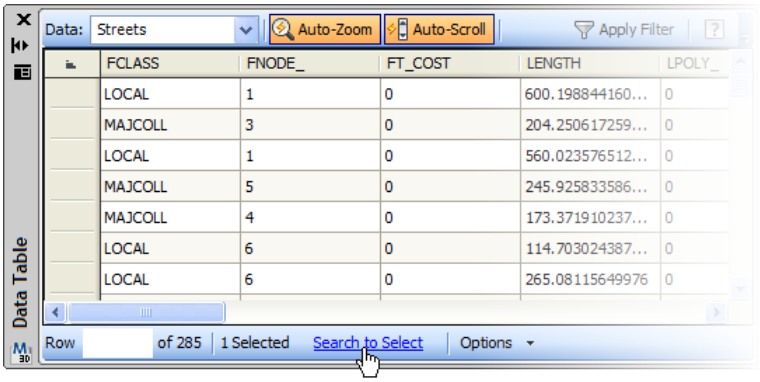
For this exercise you should be in the *Planning and Analysis* workspace.

1. Open **Feature Filter.dwg** from the class dataset folder.
2. If the **Task Pane** is not visible, at the command line enter MAPWSPACE.
3. At the command line, enter **ON** to display the *Task Pane*, which includes the *Display Manager*.
4. **On the** *Task Pane* **select the Display Manager tab.**
5. In the *Display Manager*, select the **Streets** feature layer, and then click the **Table** button.



The *Streets Data Table* is displayed.

6. In *the Streets Data Table*, click **Search to Select**.



The *Search to Select* dialog box is displayed.

7. In the *Search to Select* dialog box, click **Property**.
8. From the drop-down list of properties, select **OWNER**.

The *OWNER* property is added to the *Expression Builder*.

9. Click the **=** button.

The equal operator is added, and the value prompt appears.

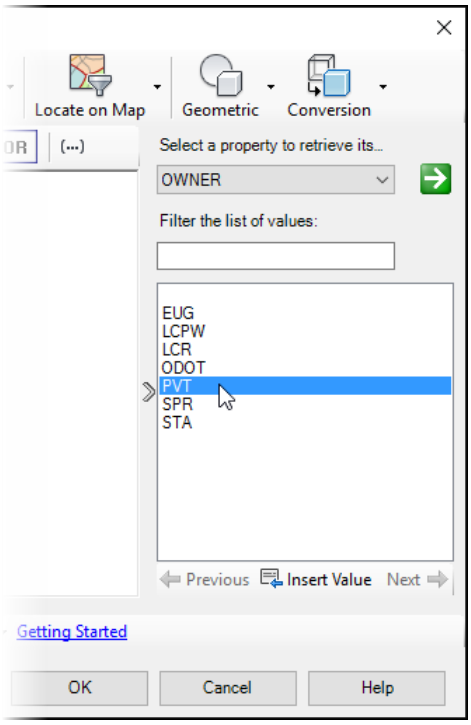
10. In the upper right portion of the *Search to Select* dialog box, click **Get Values**.

11. For *Select Property* to retrieve, confirm **OWNER** is displayed.

12. Click the green arrow button  .

13. From the list of values, select **PVT**.

14. Click **Insert Value**.



The statement is added to the Expression Builder.

```
OWNER = 'PVT'
```

15. Click **<<OK>>**.

All privately owned street segments are selected in the drawing, and the table highlights the 27 corresponding records, filtered from the total.

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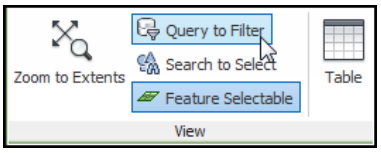
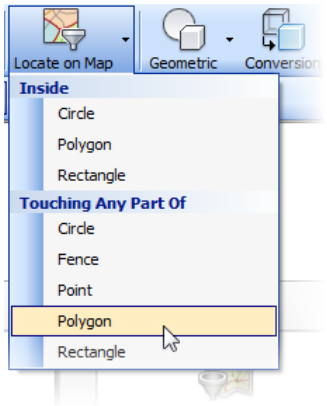
1.4 Preforming a Feature Query

For this exercise you should be in the *Planning and Analysis* workspace.

1. Open **Feature Query.dwg** from the class dataset folder.
2. In the *Task Pane Display Manager* tab, select the **Parcels** feature layer.
3. Select **Ribbon: Vector Layer ⇒ View ⇒ Query to Filter.**



4. In the Create Query dialog, click **Locate on Map**.
5. From the drop-down list, select **Polygon under Touching Any Part Of**.



6. At the command line, enter **S** to select an existing polygon.
7. Press **Enter**.
8. Select the blue polygon representing the flood zone.

The condition is added to the *Expression Builder*.

9. In the *Create Query* dialog box, click the **AND** button.
10. Click the **Property** button, and select **IMPVAL** from the *Numeric Values* section near the bottom of the drop-down list.
11. Click the **>** (greater than) symbol.

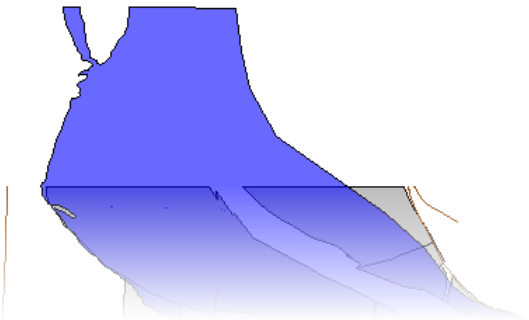
The expression prompts for the value.

12. Enter **0** (zero).
13. At the lower-left portion of the *Create Query* dialog, click **Validate**.

The expression should validate, and look like the illustration.

14. In the *Create Query* dialog box, click **<<OK>>.**

Only those parcels that intersect the flood zone, and have an improved value greater than zero are displayed in the drawing editor.



15. Open the Parcels feature layer data table and examine the tabular results of the query.

Lesson Review

In this lesson, you accurately selected and identified all the private roads in the city. This selection can then be used to modify these road segments for further analysis. You also identified all parcels that intersect with a flood zone. In addition to this intersection, you narrowed the query to identify only parcels that had an improved value greater than zero. This eliminated all city-owned properties during the query.

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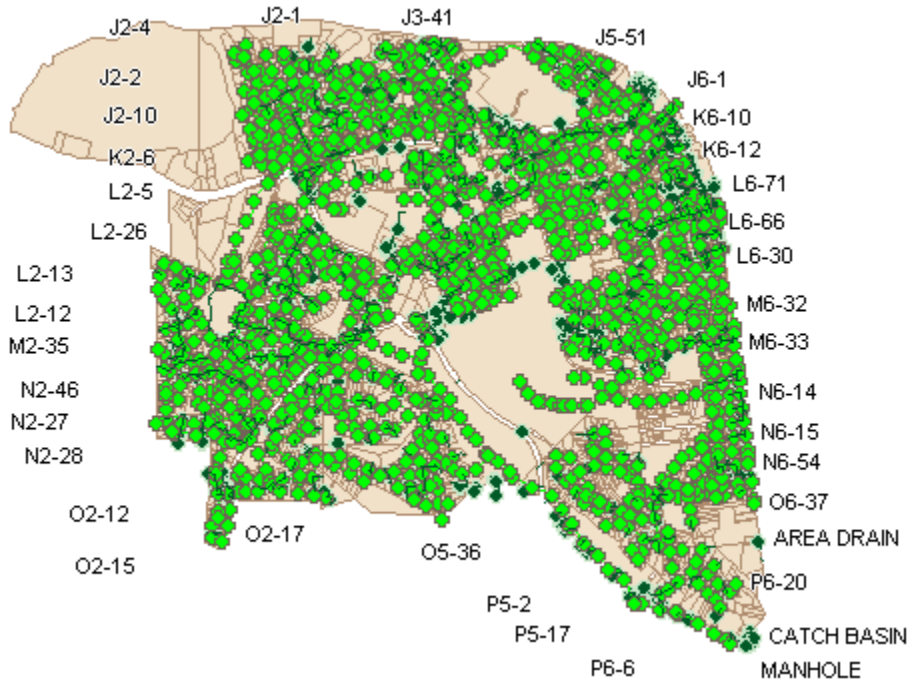
2 Create Thematic Maps to Display Complex Data

About Scale Dependent Styles

When working with drawings that are dense in geometry, you can make styles scale-dependent to establish display behaviors based on the scale at which you view the drawing. When working with hardcopy maps, or plotted drawing sheets, this scenario is built into the creation of the drawing. When the drawing is produced, the creator must determine the theme of the intended map; what is important, and what is not when producing the drawing. Working with drawings in Civil 3D or any other mapping application, the challenge is to create a display that is meaningful when an overwhelming amount of data is available.

In the following example, a drawing contains all the geometry for the storm and sewer infrastructure of a city. Obviously, this data is not usable and is distracting when it is displayed at this scale.



When scale dependent styles are applied to the same drawing, the data displays in a manner that enables you to see only the data that is required as you zoom in and out of the drawing. In this example, no infrastructure is displayed beyond a specific scale threshold. As you zoom into the drawing, at a determined scale the infrastructure appears. Zooming further, labels appear.

Methods of Scale Ranges

Applying scale dependent styles to feature layers is the same as applying normal styles. The only difference is that you establish multiple scale ranges for the feature layer, and assign styles to each range. As you zoom in and out of the drawing, the corresponding style is displayed for that feature layer depending on the scale range.

There are two main approaches to applying scale ranges in a drawing.

- No Display
- Change Display Style

You can use one or a combination of both methods for a feature layer.

No Display

This condition is common. In many cases, the detail of mapping features requires that they not be displayed at all beyond a certain scale. In this case, a single style can be applied to a single range beyond which they do not display.

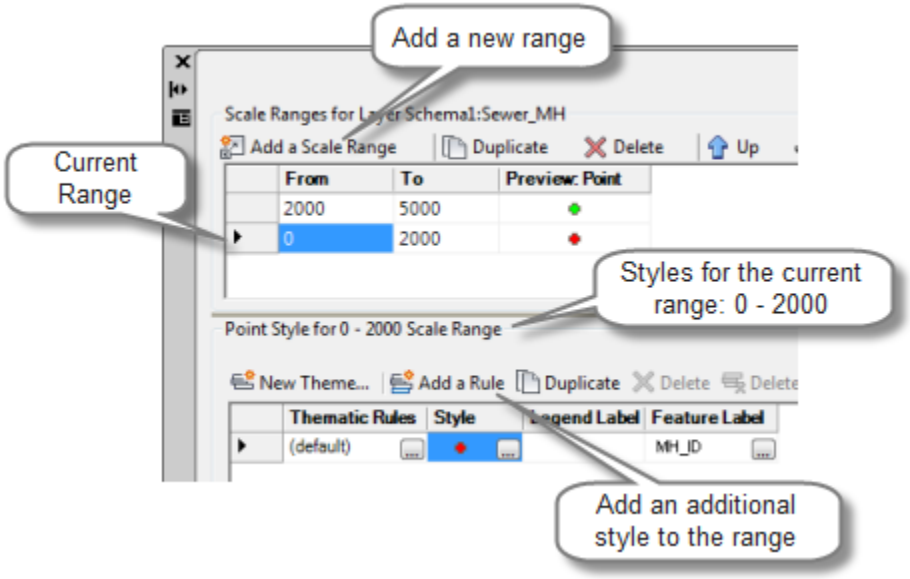
Change Display Style

In some cases, map features are useful at smaller scales, but benefit from being displayed differently at larger scales. An example of this situation is a road network. When viewed at a small scale, thin road lines serve to assist map viewers to geographically orient themselves. When zoomed in and viewing the same road network at a larger scale, more detail such as road name labels and thicker line weights can be displayed.

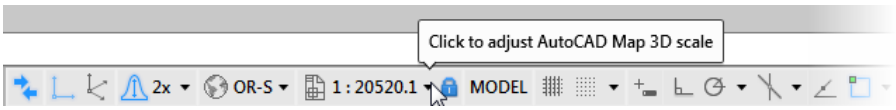
Working with Ranges and Styles

By default, all styles have a 0 to Infinity range. This range means that whatever style is applied, it will display regardless of scale. Ranges can be added to a feature layer with custom scale thresholds, and styles can be applied to each range.

In the following example, there are two ranges. Since the 0 – 2000 range is selected, all styles in the point style section apply only to this range. Ranges can be added, and additional styles can be added to each range. The critical point to understand when working in the Style Editor is that whichever range is selected in the upper portion of the palette, it corresponds to the styles in the lower part of the palette.



Once ranges are created in a drawing, they can be selected and zoomed to by selecting the zoom scale in the *Map Status Bar* portion of the *Drawing Status Bar*. As you zoom in the drawing, the scale shown on the Status Bar updates dynamically. This scale is a model space representation of how the map would plot at that particular scale.



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Exercise: Apply Scale Ranges to a Drawing

In this exercise, you begin in a drawing that has several feature layers including parcels, sewer lines, and sewer manholes. The sanitary sewer manholes already have scale ranges applied. You create ranges and styles to display the sewer lines above a scale threshold, and place labels.

You do the following:

- Examine the behavior of an existing style.
- Create scale ranges for the sanitary sewer lines.
- Assign a label to the sewer lines.

2.1 Working with Scale Dependent Styles

 For this exercise you should be in the *Planning and Analysis* workspace.

1. Open the drawing **Scale Dependent Styles.dwg** from the class dataset folder.

2. If the **Task Pane** is not visible, at the command line enter **MAPWSPACE**.

3. At the command line, enter **ON** to display the *Task Pane*, which includes the *Display Manager*.

In the first step, you examine the behavior of scale dependent styles already defined.

The tools to change map scale views reside on the *Map Status Bar*. In the standard, out-of-the-box installation of Civil 3D, this status bar is not displayed by default.

4. If the *Map Status Bar* icons are not displayed, enter **MAPSTATUSBAR** on the *Command Line*, and select **<Show>**.

The *Drawing Status Bar* now shows additional tools for some *AutoCAD Map 3D* functions, such as 2D / 3D Viewing, Vertical Exaggeration, Coordinate Systems and View Scale

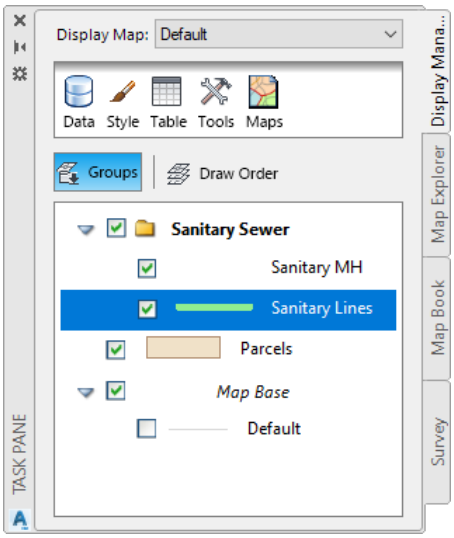
5. Using standard AutoCAD zoom methods, zoom in and out of the map observing the changes in how *Features* are displayed at different scales.

6. Notice that the manholes appear at scales below 1:5000, and that the labels for these *Features* appear at scales below 1:2000.

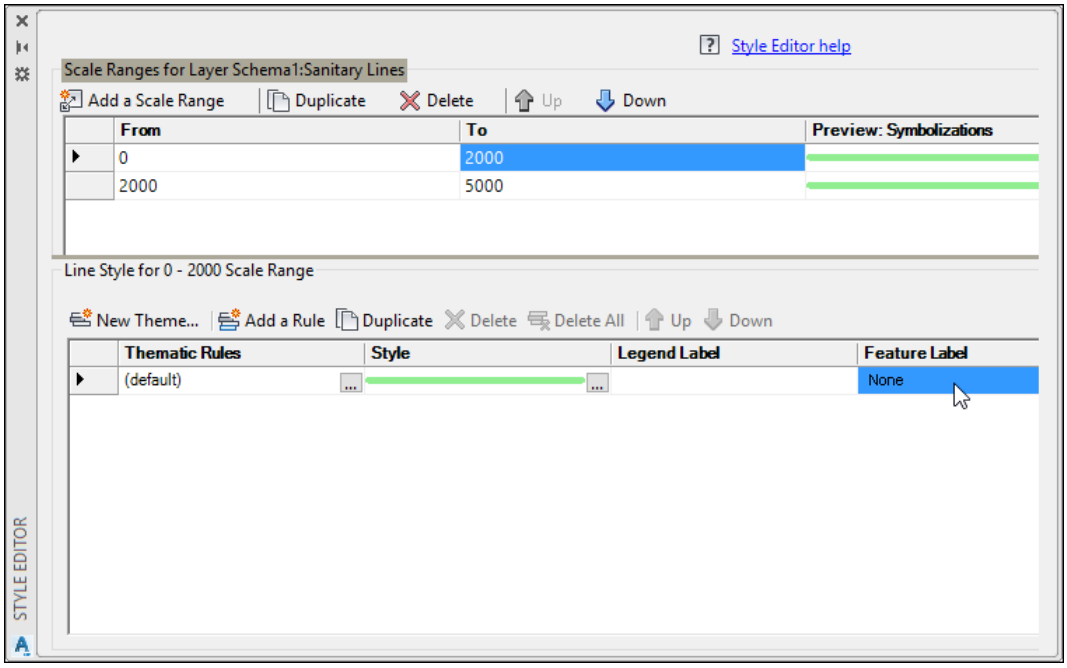
In the next series of steps, you create the same behavior for the sanitary sewer lines. You first create two scale ranges.

7. Zoom to the drawing extents.

8. In the *Display Manager*, select the feature layer **Sanitary Lines,** and then click the **Style** button.



This opens the *Style Editor* palette.



9. In the *Style Editor* palette, in the *Scale Ranges…* section, set the **From** and **To** scales for the existing range **to 0 - 2000**.

10. Click **<<Add a Scale Range>>**.

11. Set the scales for the new (second) second range to **2000 – 5000**.

The sanitary sewer lines will now display in both ranges but not above 1:5000.

12. Select the 0 – 2000 range.

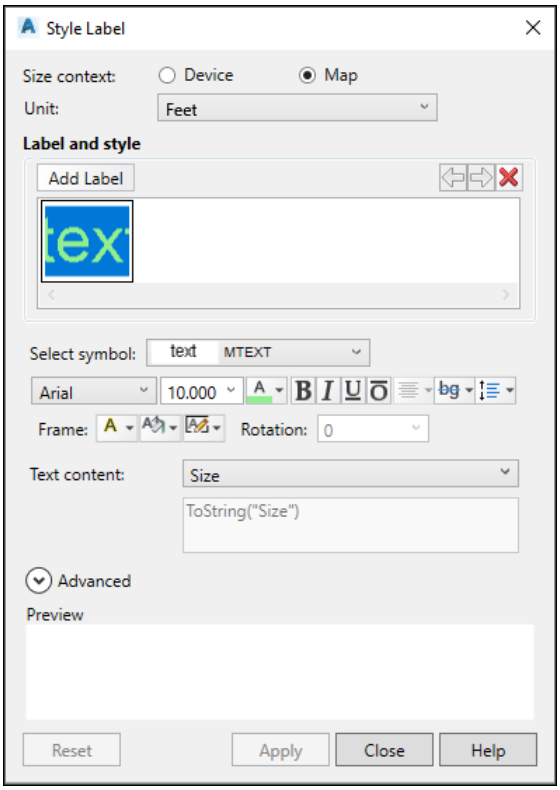
The arrow in the row's left-hand column indicates that it is selected.

In the next series of steps, you assign a label to display in the 0 – 2000 range style, verify the settings and examine the behavior of the new style.

13. In the *Line Style for 0 -2000* section of the *Style Editor*, click the cell under **Feature Label**.

The *Style Label* dialog is displayed.

14. In the *Style Label* dialog box, **for Size Context**, choose **Map**.
15. For **Units**, select **Feet**.
16. Click **<<Add Label>>.**
17. For **Size**, enter **10**.
18. Set the **text color** to **green**.
19. For **Text content** select **Size.**



This causes the *Size* data value to populate the label.

20. Click **<<Apply>>**
21. Click **<<Close>>**

Zoom into the drawing and examine the results of the changes to the styles.

There are now two styles. One is defined for the 2000 – 5000 scale range, which does not display labels, and another style is defined for the 0 – 2000 range, which does display labels. At scales above 1:5000 the sewer lines do not display at all.

22. Zoom into the drawing through the 1:5000, and 1:2000 scales. Notice that the labels appear for the sanitary sewer lines when zoomed below 1:2000.

Lesson Review

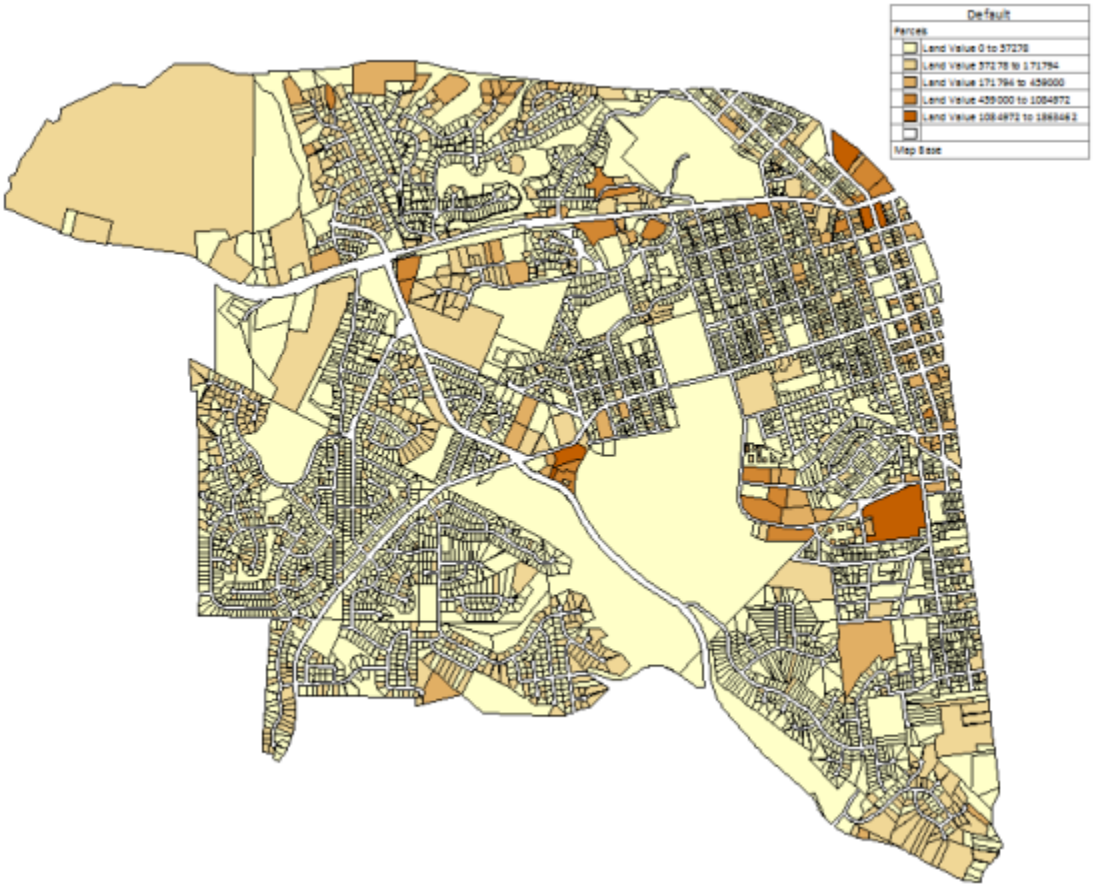
In this lesson by creating and applying scale ranges, you created a drawing that is useful for viewing the city sewer infrastructure.

About Feature Thematic Maps

Geographic information systems are as much a database application as they are a mapping application. Because there is so much data included in GIS, being able to present this data in a graphical manner is a powerful way to see data trends, distribution, and connections.

Thematic maps, in the most general terms, creates pictures based on the data.

A common example of thematic mapping is in the analysis and visualization of land values in a city. This type of theme reveals the distribution of land values in a way that a standard tabular database query and report could never produce. In the following example, parcels in a city are colored based on a range of values that they fall within. A legend is included to assist in the interpretation of the theme.

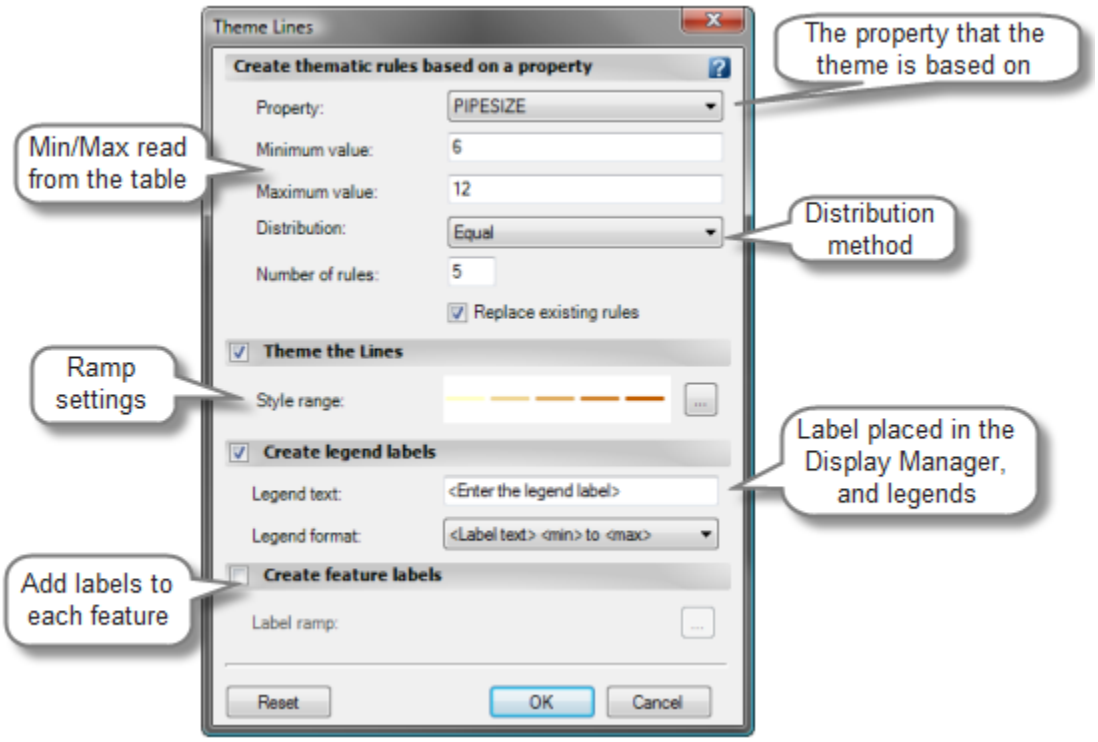


Feature thematic maps are really just a collection of styles that are applied to objects based on criteria you set in the theme. The following is an example of individual values which have been grouped for theme ranges.

Thematic Rules	Style	Legend Label
"PIPESIZE" = 6		Pipe Dia 6
"PIPESIZE" = 8		Pipe Dia 8
"PIPESIZE" = 10		Pipe Dia 10
"PIPESIZE" = 12		Pipe Dia 12
(default)		

Feature Thematic Map Tools and Functions

The interface provided in Civil 3D automates much of the creation of ranges and thematic representation of those ranges.



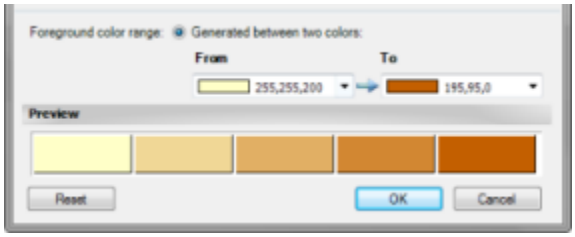
Methods

Most thematic maps create ranges which are divided in one of several different ways.

Method	Description
Equal	The difference in high and low values is the same for all ranges. You can narrow the range of each rule by increasing the number of rules.
Standard Deviation	Ranges are determined, and features are placed in the ranges based on their variance from the mean.
Quantile	Each range contains an equal number of entries.
Jenks (Natural Breaks)	Ranges are based on natural groupings of data values.
Individual Values	Features are placed in a group based on having the same value. This is a useful method if there are a small number of different specific values, such as the diameters of lines in a sewer collection system.

Ramps

You can assign individual values for the resulting colors that are assigned to ranges in a theme. More often, you use ramps which set the styles and colors for you based on a From – To color range. Civil 3D provides a default ramping as part of the theme creation, but you can change these values. This change is sometimes required based on existing colors in the map, or if you want a clearer delineation between ranges.

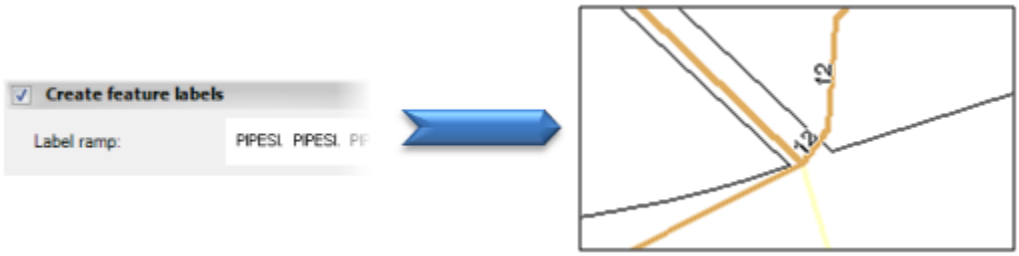


Legend Labels

Legend labels provide meaningful words and phrases in the resulting legend and in the Display Manager. The following example is a theme for pipe diameters. The term “Pipe Dia” is added to the legend text to provide context to the legend and Display Manager.

Feature Labels

In some cases, you want to include text in the map of the actual value the theme is based on. In the following example, pipe diameter labels have been added to the theme.



Exercises: Apply Themes to Feature Layers

In these exercises, you first create a thematic map to display the pipe diameters of the sewer lines. The sewer lines are AutoCAD objects but can be accessed through the *Display Manager* and themed similar to connected feature data. You then create a thematic map of the parcels based on land values, and insert a legend.

You will do the following:

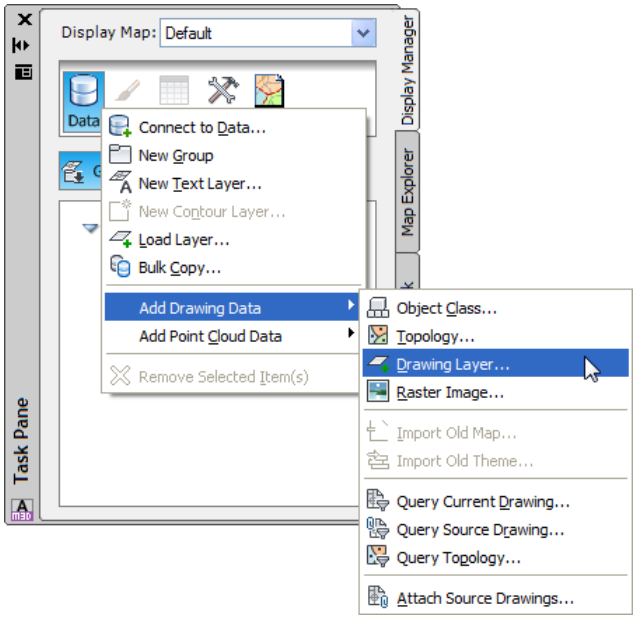
- Create a ramped theme.
- Create a theme for land values

2.2 Thematic Mapping of Linear Objects with Object Data

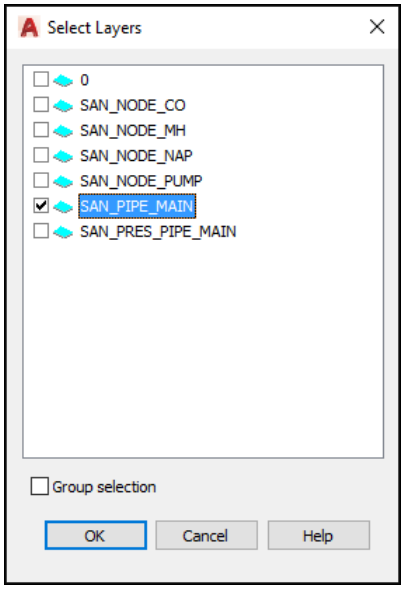
For this exercise you should be in the *Planning and Analysis* workspace.

In this exercise, you will display the sewer pipes in different colors according to the size field in the object data table.

1. Open **Sewer Theme.dwg** from the class dataset folder.
2. If the **Task Pane** is not visible, at the command line enter **MAPWSPACE**.
3. At the command line, enter **ON** to display the *Task Pane*, which includes the *Display Manager*.
4. In the *Display Manager*, click the **Data button, and select ⇒ Add Drawing Data ⇒ Drawing Layer**.

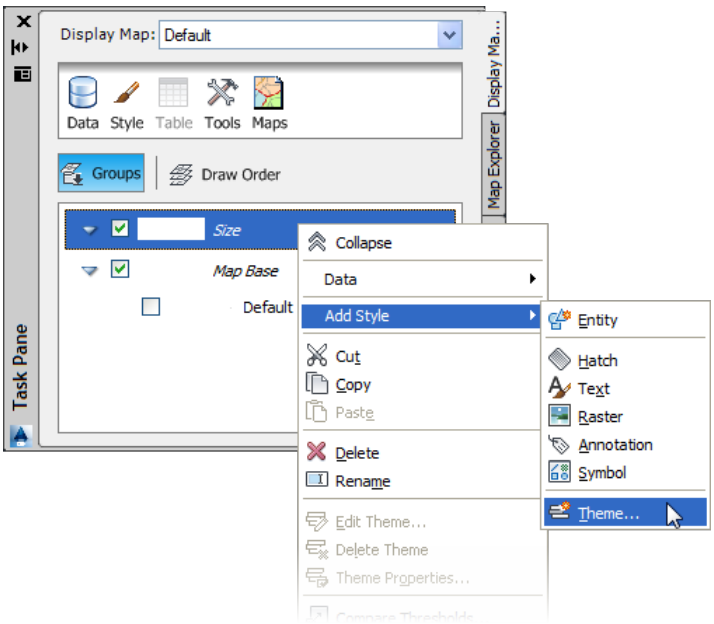


5. Enable the layer **SAN_PIPE_MAIN** in the *Select Layers* dialog box.
6. Click **<<OK>>**.



Notice data layer *San_Pipe_Main* now appears in the *Display Manager*.

A layer in the *Display Manager* is different than an *AutoCAD* layer; it is the name of a data source and where you manage its properties.



7. Click on the new feature layer and then click on the name *San_Pipe_Main*, and change it to **Size.**

8. In the *Display Manager*, right-click on the new feature layer **Size** and select ⇒ **Add Style** ⇒ **Theme**.

This opens the *Thematic Mapping* dialog box. Here you will set the criteria that control the display of the objects in the *Display Manager*. In this example, you will apply different colors to sewer pipe lines based on values found in the *Size* field of the *Object Data* table.

9. Confirm that **A set of specific values** is selected from the **Theme type***:* drop-down list.

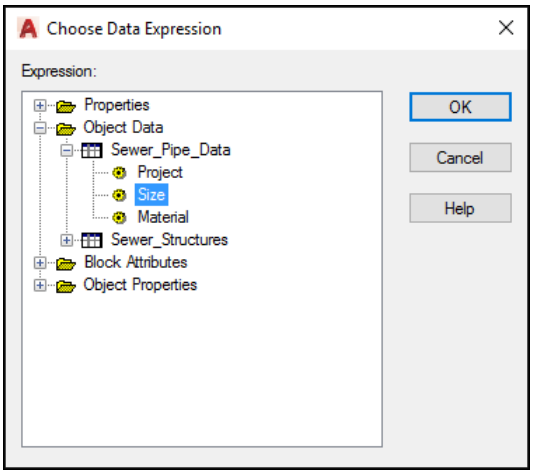
10. Click **<<Values…>>** to open the *Thematic Values* dialog box.

11. In the *Thematic Values* dialog box click the **More button <<…>>** to the right of the **Obtain from** field.

12. Expand **Object Data** in the *Choose Data Expression* dialog box**.**

13. Expand the **Sewer_Pipe_Data** object data table, and then select **Size**.

14. Click **<<OK>>** close the *Choose Data Expression* dialog box, and add the expression, *:Size@Sewer_Pipe_Data*, to the *Obtain From:* field in the *Thematic Values* dialog box.

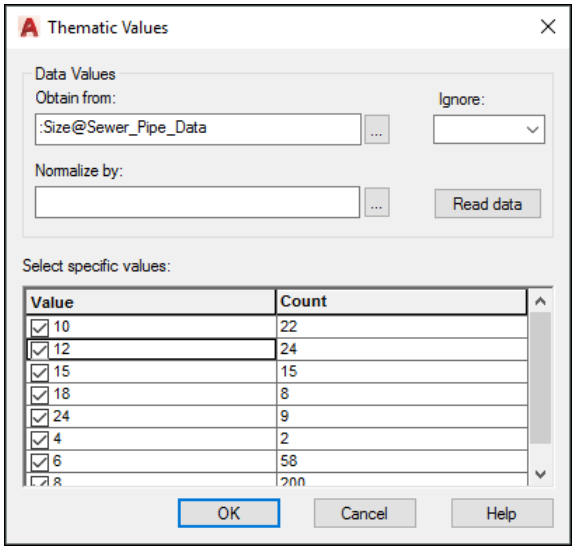


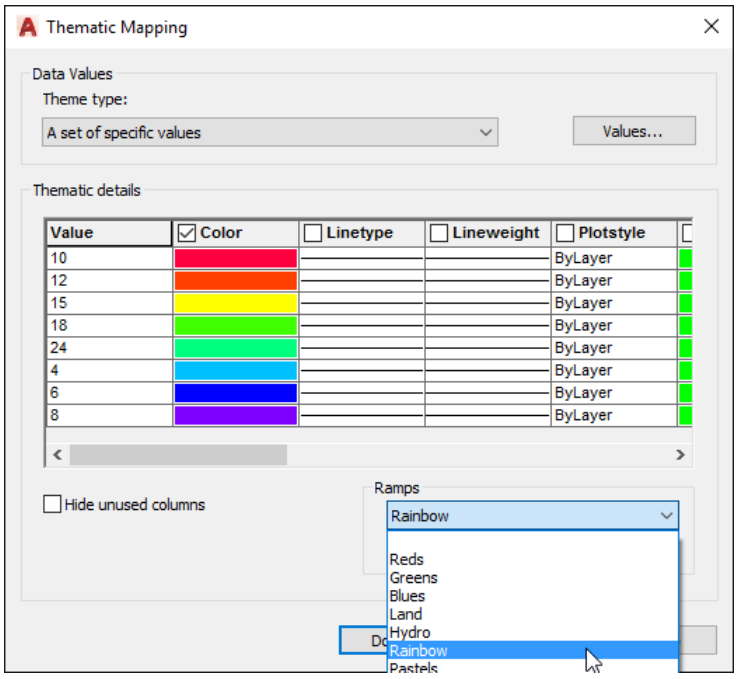
15. Click **<<Read Data>>** to display all the values found in the *Size* field of the Object Data table.

16. **Right-click** on one of the values and choose **Select All.**

17. Click **<<OK>>**.

This takes you back to the *Thematic Mapping dialog box*.





18. Enable the column **Color** to activate the *Ramps* section.

19. Select **Rainbow** from the **Ramps** drop-down list.

Color ramps are predefined sets of colors you can use to quickly assign a different color to each of a range of values. Once set, you can easily modify any color selection(s) to customize your map.

20. Click **<<Done>>**.

The drawing is now displayed showing the pipes colored according to their size.

Bonus Exercise:

Using the same drawing create a second Thematic Map of the pipes colored by Material.

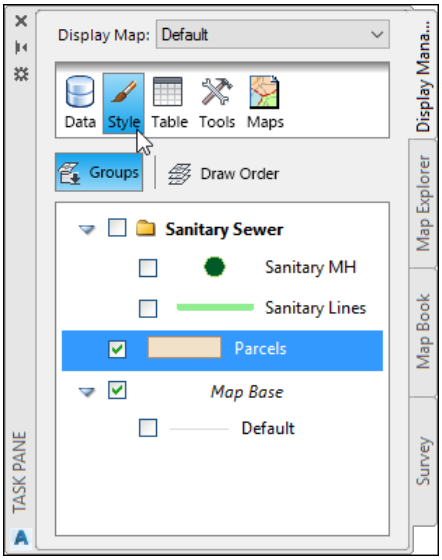
2.3 Thematic Mapping of Polygon Features

For this exercise you should be in the *Planning and Analysis* workspace.

In this exercise, you apply a theme to the Parcels feature class based on Land Values. You then insert a map legend in the drawing.

1. Open **Parcels Theme.dwg** from the class dataset folder.

2. In the *Display Manager*, select the feature layer **Parcels** and then click the **Style button**.



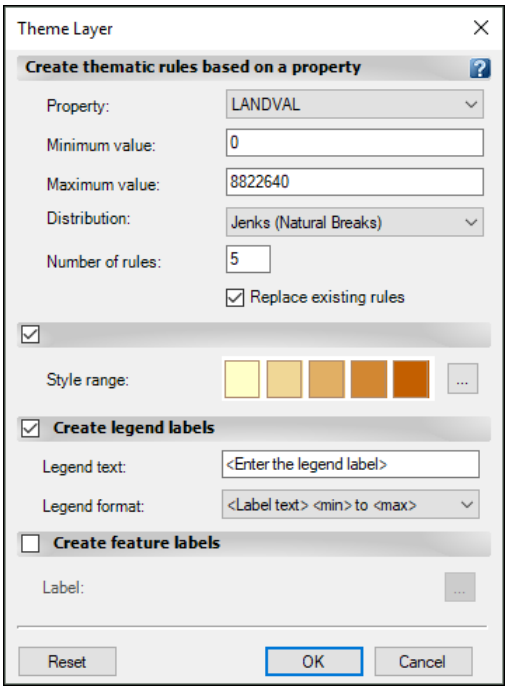
This opens the *Style Editor* palette.

3. In the Style Editor palette, click **<<New Theme>>**.

This opens the *Theme Polygons* dialog box, where you create a theme, such as applying a different color value to each range of land values, resulting in a thematic map.

4. Set the **Property** to **LANDVAL**.
5. Set the **Distribution** to **Jenks (Natural Breaks).**
6. Set the **Number of rules** to **5**.
7. For **Legend Text**, enter **Land Value**.
8. Click **<<OK>>.**
9. Close the Style Editor.

The parcels in the drawing are themed.



Lesson Review

In this lesson you created a theme to better visualize the pipe diameters in the sewer system. You then created a thematic map of the parcels based on land values. This drawing can now be printed and provided as a map to the Planning department, or used in City council meetings.

3 Export AutoCAD Geometry to Different GIS Formats

Exporting Data Concepts

Data exported from Civil 3D to other GIS formats includes standard AutoCAD geometry, attributes and coordinate systems. As with the import of GIS formats, Civil 3D attempts to maintain the integrity of the data as closely as possible within the target format and file.

Civil 3D objects such as alignments, profiles, parcels, etc., are not exported with this command.

The nature of GIS data is similar to databases even if the data is in a file format. The adherence of standards and classes is more stringent in GIS formats than is typically required in an AutoCAD drawing. AutoCAD, and Civil 3D allow objects to be incorrectly placed on different layers, attribute data entered without business rules and so on. The exception to this is Object Classes that do incorporate standards similar to a typical GIS format.

Because of the expectation of specific standards in other GIS formats, it is important to verify the standards and integrity of the outgoing Civil 3D file before performing the actual export.

Target File Types

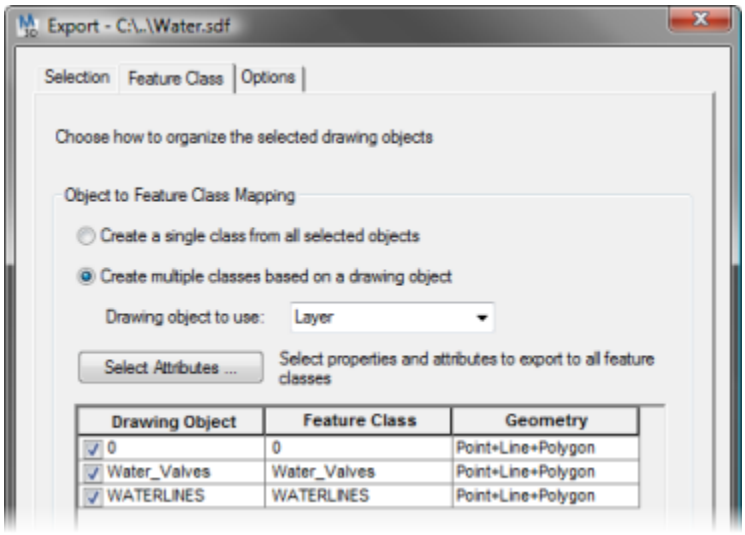
Target file types have different characteristics and the export is context-sensitive to the output type. For example, when exporting to ArcView Shapefile format, only one type of geometry and class is accepted by the target. On the other hand, the Autodesk SDF file allows multiple classes exported simultaneously and multiple geometry types included in each class.

ArcView Shapefile

The following illustration shows the object type attribute permitted when exporting to an ArcView Shapefile. Only one type of geometry type is allowed.

Autodesk SDF

The following illustration is an example of an Autodesk SDF file export. In this example, multiple classes are created and each can contain point, line, and polygon object types.



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Exercises: Export to an ArcView SHP file

In these exercises, you begin in a drawing with parcels and Object Data that contains the parcel data. You export the parcel map to ArcView SHP file format. During the export, you map Object Data fields to the .dbf file.

You do the following:

- Export polygons to a SHP file.

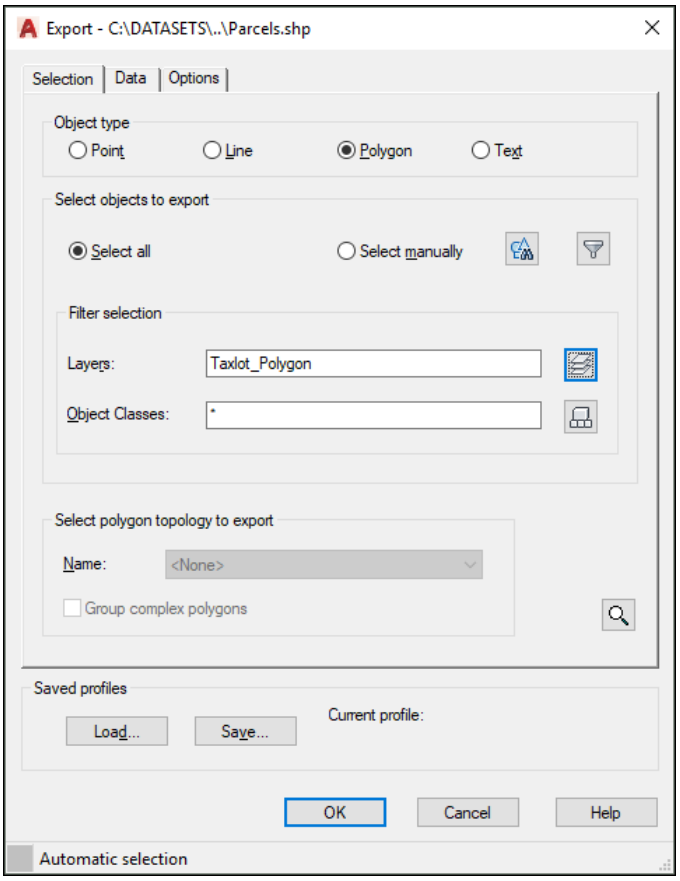
3.1 Exporting Polygons to a SHP file

 For this exercise you should be in the *Planning and Analysis* workspace.

In this exercise, you will export closed polygons with attribute data attached from an object data table. This is similar to exporting lines or points that have object data or external database data attached because the data is attached to the polygon instead of a centroid.

1. Open **Taxlot Polygons.dwg** from the class dataset folder.
2. Use the **Properties** command to view the *Object Data* attached to the parcels.
3. Notice the object is an MPolygon.
4. At the command line enter: Command: **MAPEXPORT**.
5. Navigate to the class dataset folder and open the folder called Export.
6. Select **ESRI Shapefile (*.SHP)** from the **Files of type:** list.
7. Enter **Parcels** for the **File name**.
8. Click **<<OK>>**.

The *Export* dialog box opens, where you select the types of object to export. In this exercise you will export the parcels represented by the polygon object type, and the linked data.



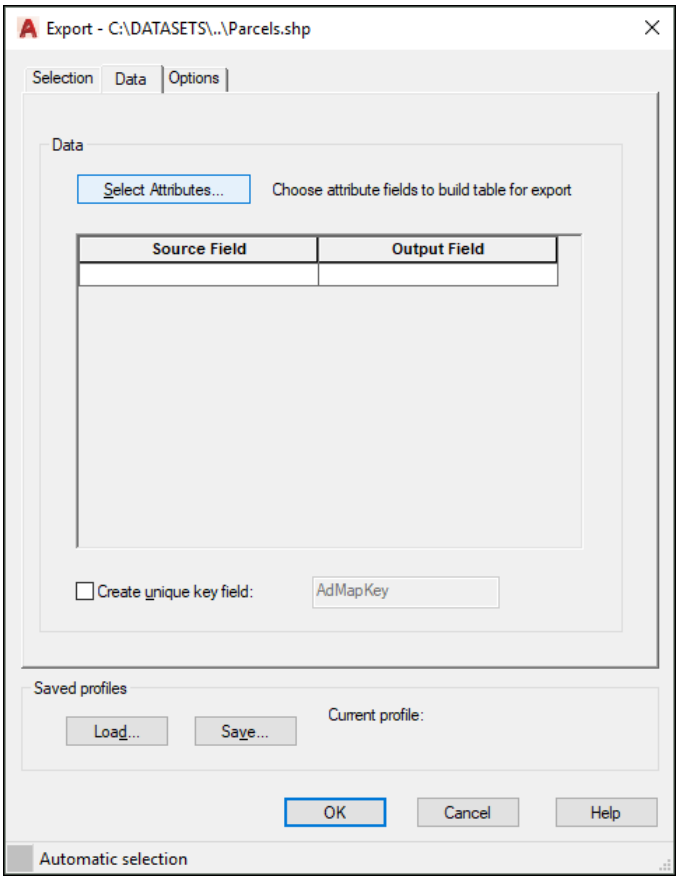
9. Choose the **Polygon** option in the **Object type section**.

10. Click the **Select Layers** button  in the **Filter selection** section, to select layers.

11. Select the **Taxlot_Polygon** layer to only export the parcel lines.

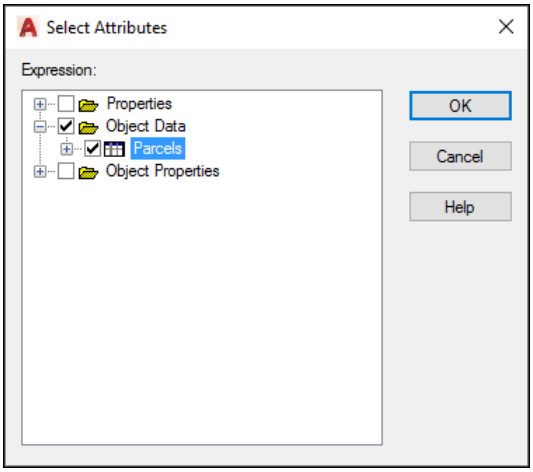
12. Select the **Data** tab.

13. Click **<<Select Attributes>>**.



14. In the *Select Attributes* dialog box, **expand** the **Object Data** option.

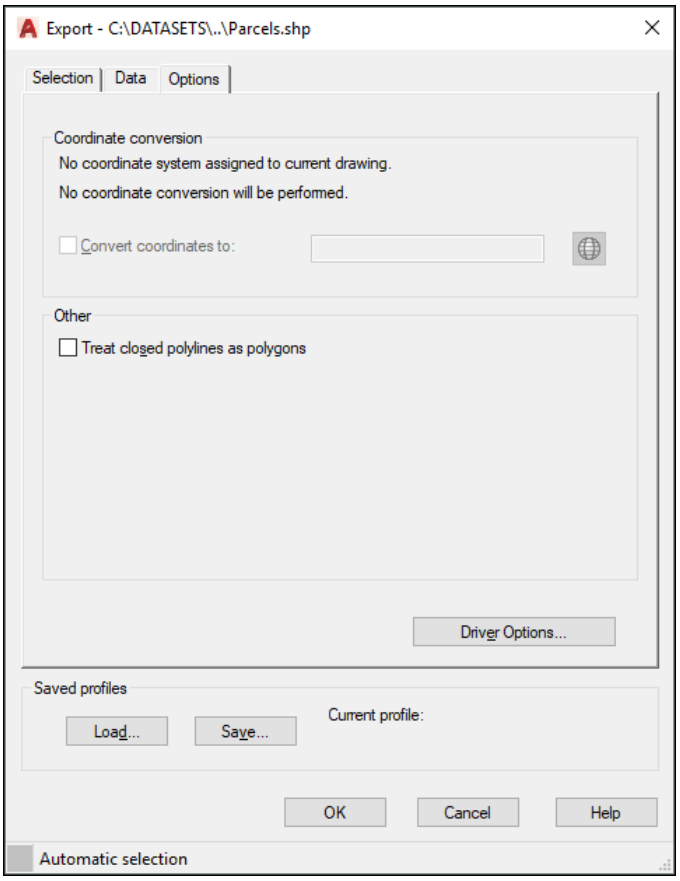
15. Select the **Parcels** object data table.



This will export all the fields in the *Parcels* object data table. This dialog box also allows you to drill down and only export selected attributes, but in this case you will export all of the fields.

16. Click **<<OK>>** to add this information to the *Data* tab of the *Export* dialog box.

17. Select the **Options** tab.



Here you have the option to assign a coordinate system to the exported data.

The option to *Treat closed polylines as polygons* is used if the polygons are closed polylines instead of MPolygon objects like you have in this exercise.

18. Click **<<OK>>** to export the data.

An *Export Progress* box opens to indicate progress as 1072 objects with associated data are exported.

19. Open *Windows Explorer* and navigate to the Export folder in the class dataset.

Notice that the SHP file and all associated files, including Parcels.dbf, have been created.

If you have a way to view shapefiles, such as ArcExplorer or ArcGIS, you can open the file and verify the export.

20. Close the drawing without saving any changes.

Lesson Review

In this lesson you exported AutoCAD drawing objects to a Shapefile. These files can now be used as a feature source in Civil 3D, and in many other applications.

4 Export Civil 3D Objects to Different GIS Formats

Exporting Civil 3D Objects as GIS Data Concepts

Types of Civil 3D objects that can be exported:

- Points
- Alignments
- Parcels
- Pipes
- Structures

All of the Civil 3D objects from the list above that are in your drawing will be exported, even those on frozen layers. There is no way to be selective with this command about what is exported.

The geometry of the Civil 3D objects will be exported along with all of the data created for those objects in Civil 3D.

When exporting Civil 3D objects to GIS data the only file format available is the Autodesk SDF file. If you need to provide the data to someone in a different format you can use the *Bulk Copy* command to convert it. The *Bulk Copy* command is covered in *Chapter 9*.

Exercises: Export Data from Other GIS Formats

In these exercises you will export Civil 3D objects and their associated data to an SDF file. This SDF file could then be used in other applications or converted to another format using the Bulk Copy command.

You do the following:

- Export Civil 3D objects to an SDF file.

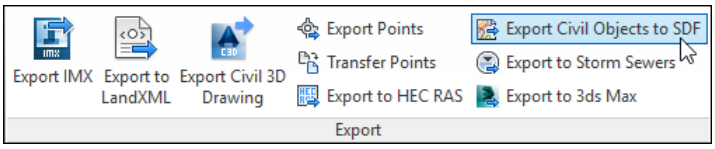
4.1 Exporting Civil 3D Objects to an SDF File

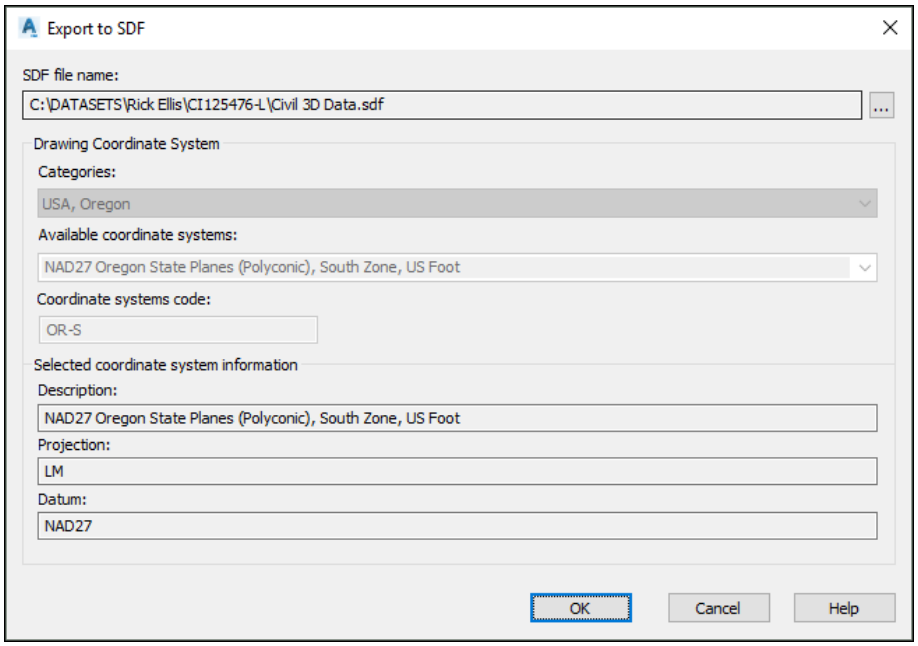
For this exercise you should be in the *Civil 3D* workspace.

1. Open **Civil 3D Data.dwg** from the class dataset folder.

This drawing contains Civil 3D Points, an Alignment, and Parcels.

2. Select **Ribbon: Output ⇒ Export ⇒ Export Civil Objects to SDF**.





3. Confirm the **SDF file name** is set to **Civil 3D Data.sdf** and it is located in the class dataset folder.

4. Notice the coordinate system of the drawing is included in the SDF file.

5. Click **<<OK>>** to export all of the available Civil 3D Objects in the drawing to the new SDF file.

The command line reports the quantity of each of the exported objects, by category. This command exports only the geometry of the Civil 3D objects and does not include labeling or stylization.

In this exercise you exported Civil 3D objects to an SDF file that includes both the geometry of those objects and the data that was created in Civil 3D. The SDF could be used in another program or even converted to a different file format using the Bulk Copy command.

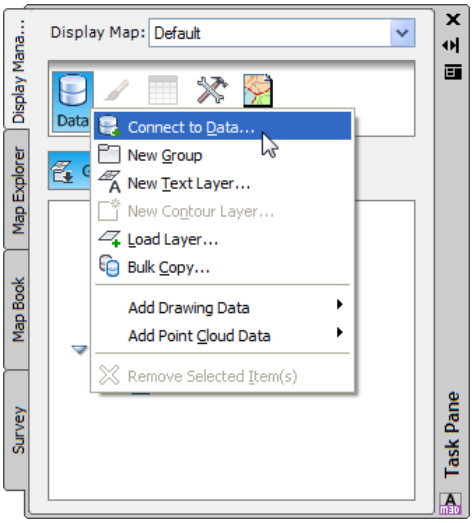
4.2 Bulk Copy from an SDF to an SHP

In this exercise you will use the Bulk Copy command to create a shape file from the parcels in the SDF file you just exported.

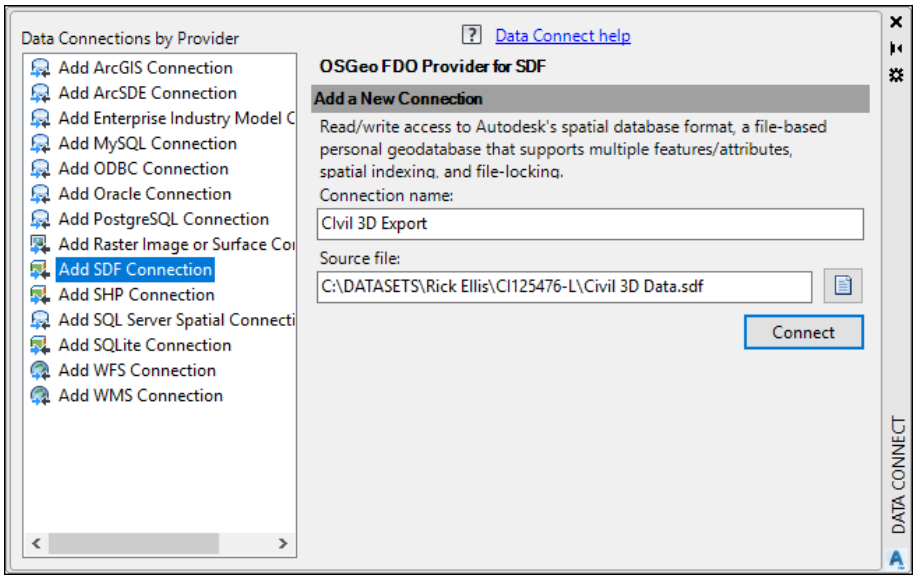
For this exercise you should be in the *Planning and Analysis* workspace.

1. Continue working in the drawing **Civil 3D Data.dwg** from the previous exercise**.**

2. In the *Display Manager*, click the **Data** button and select ⇒ **Connect to Data…** .



The *Data Connect* palette opens.

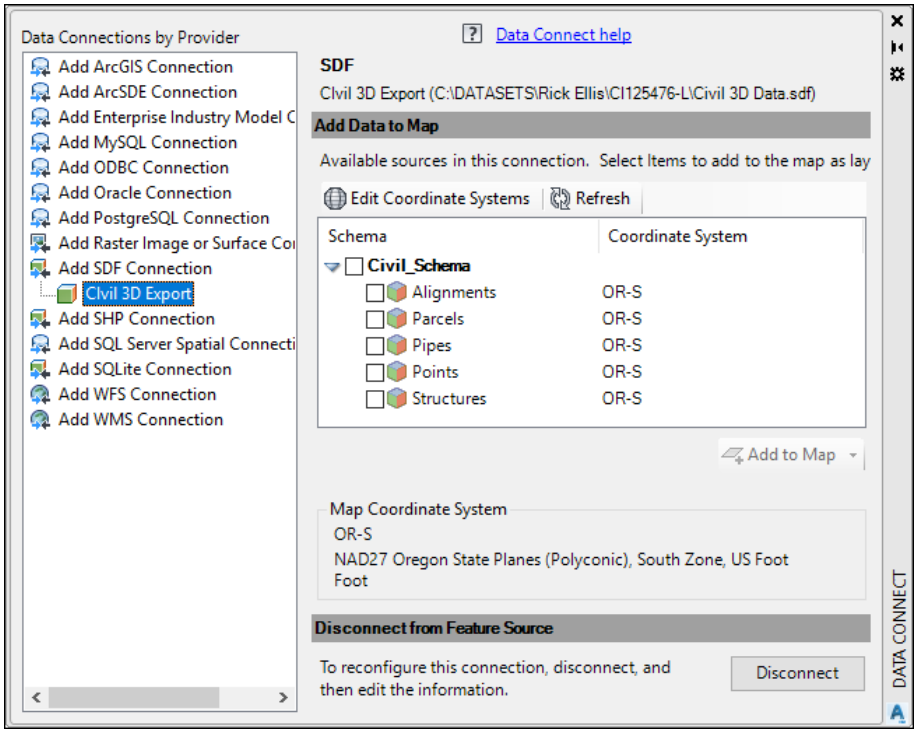


3. Select **Add SDF Connection**.

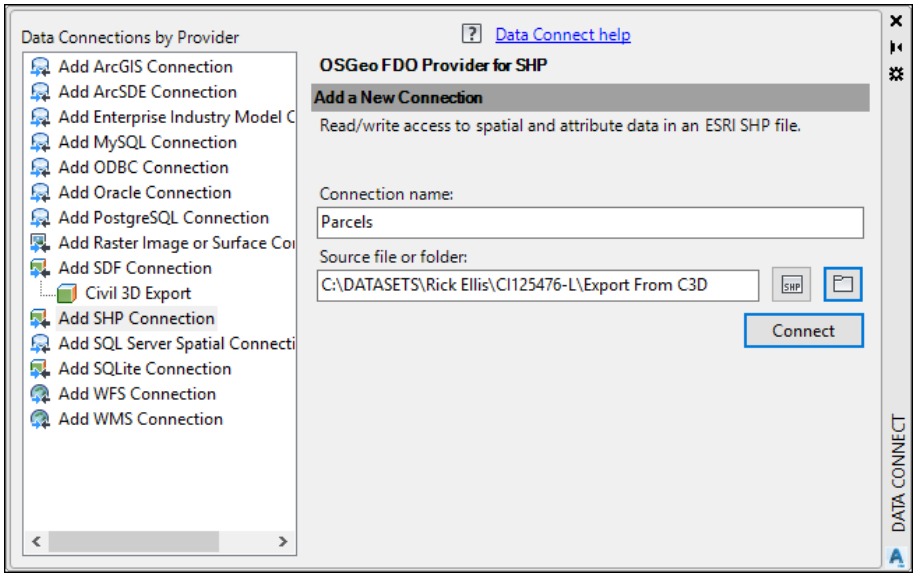
4. Change the *Connection name:* to **Civil 3D Export**.

5. Browse to the class dataset and select the file **Civil 3D Data.sdf** that you created in the previous exercise.

6. In the *Data Connect* palette, click **<<Connect>>**.



You will see the connection has been added and the list of objects it contains. There is no need to add them to the map as they will only be used as the source of the data in the *Bulk Copy* command.

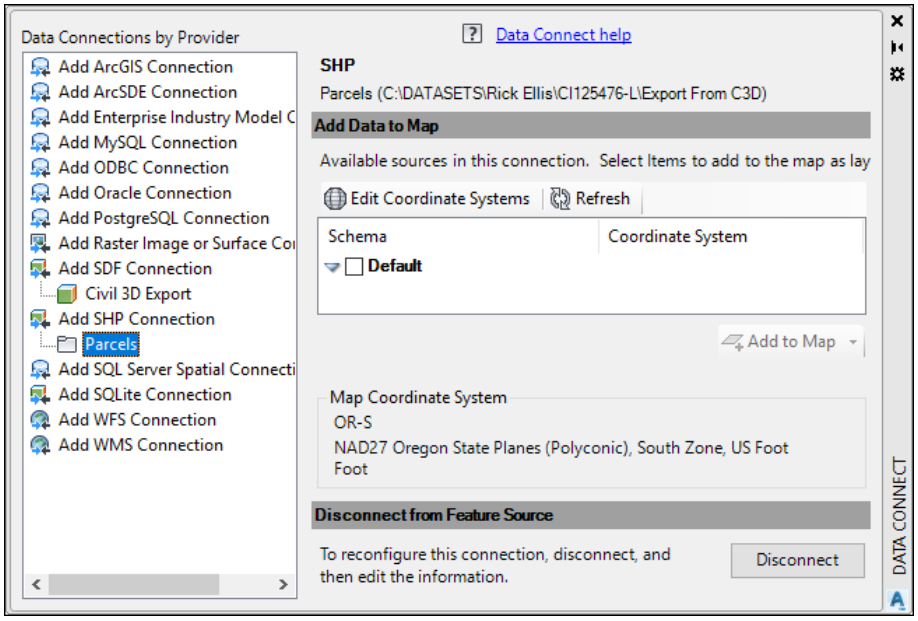


7. Select **Add SHP Connection**.

8. Change the *Connection name:* to **Parcels**.

Since you cannot directly create a new SHP file, you assign a folder that receives the new SHP when it is created with the bulk copy.

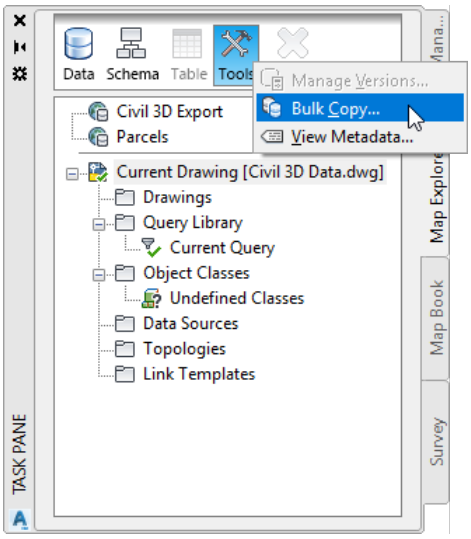
9. Click the folder button.
10. Browse to the **Export from C3D** folder in the class dataset.
11. Click **<<OK>>**.
12. In the *Data Connect* palette, click **<<Connect>>**.

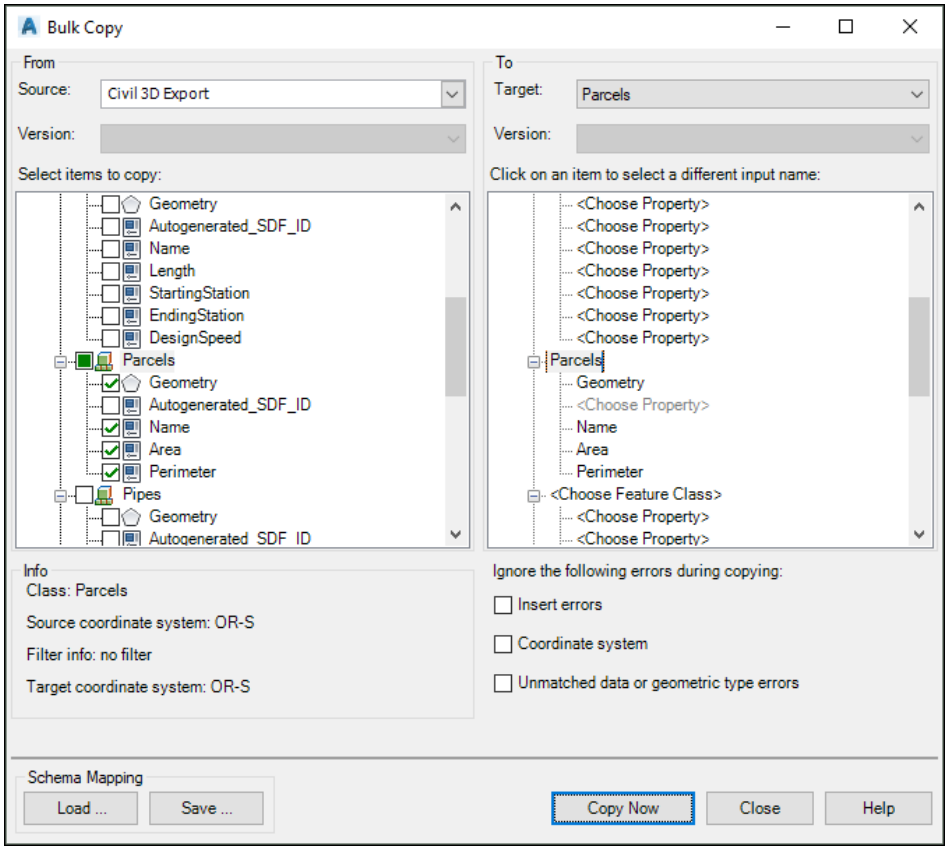


A folder icon appears under Add SHP Connection called Parcels.

13. Close the *Data Connect* palette.

14. In the *Map Explorer*, select the **Streets** connection, and then click the **Tools** button and select ⇒ **Bulk Copy…**





15. In the *Bulk Copy* dialog box, for **From**, select the **Civil 3D Export** feature source.

16. For the **Target**, select **Parcels**.

This is the empty folder connection you created for the shape file.

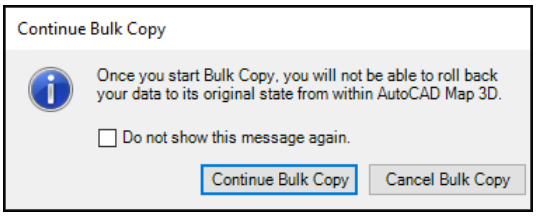
17. On the left side of the **Bulk Copy** dialog, under **Select Items to Copy**, select the **Parcels** feature class.

All of the properties are selected, and duplicated in the target feature class (SHP).

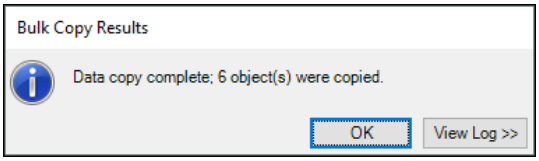
18. Disable the **Autogenerated_SDF_ID** property.

19. Click **<<Copy Now>>**.

20. In the *Continue Bulk Copy* dialog box, click **<<Continue Bulk Copy>>.**



21. Civil 3D confirms the number of objects that were copied and gives you an option to view a log.



22. Click **<<OK>>.**

23. Close the *Bulk Copy* dialog.

24. In *Windows Explorer,* navigate to the **Export from C3D** folder in the class dataset, to confirm the SHP and all related files were created.

Optionally, you can connect back to the new SHP file to verify the integrity of the data exported.

Lesson Review

In this lesson you exported Civil 3D objects to an SDF file that includes both the geometry of those objects and the data that was created in Civil 3D. The SDF could be used in another program or even converted to a different file format using the Bulk Copy command. Then you used the Bulk Copy command to create a new SHP file from the parcel data that you exported into the SDF. Another powerful aspect of this feature is that you can add new data to an existing SHP.

The material in this class is based on the book
A Practical Guide to GIS in AutoCAD Civil 3D 2018.
For more information go to www.cadapult-software.com/books