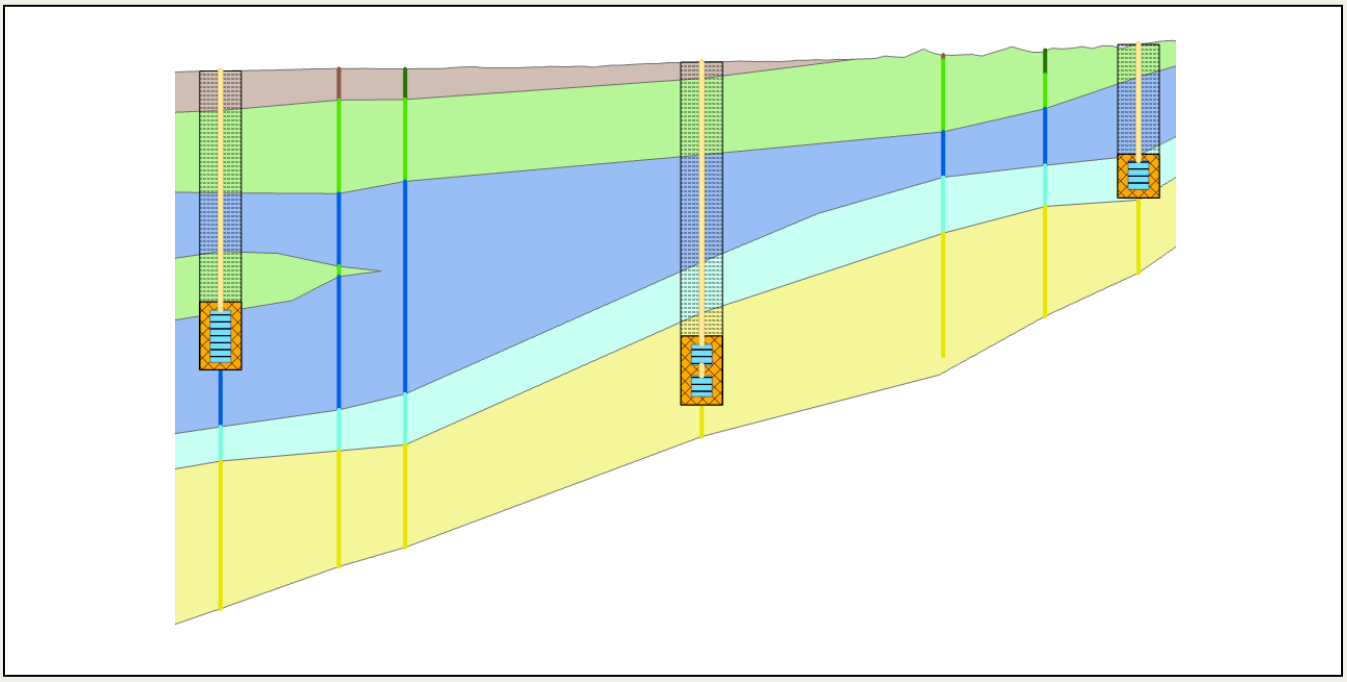
*AHGW Pro 1.0 Tutorial*

# *Subsurface Analyst – Adding Well Construction Details to Cross Sections*

Representing wells adjacent to the cross section



## Objectives

Learn how to use Arc Hydro Groundwater Pro tools to add 2D cross sections plots representing construction details for wells adjacent to the cross section.

### Prerequisite Tutorials

- Subsurface Analyst – Adding XS2D Points to Cross Sections

### Required Components

- ArcGIS Pro
- Subsurface Analyst

### Time

- 30–50 minutes

# 1 Introduction

Arc Hydro Groundwater Pro (AHGW Pro) is a geodatabase design for representing groundwater datasets within ArcGIS Pro. The data model helps to archive, display, and analyze multi-dimensional groundwater data, and includes several components to represent different types of datasets, including representations of aquifers and wells/boreholes, 3D hydrogeologic models, temporal information, and data from simulation models.

The Arc Hydro Groundwater Pro Tools help to import, edit, and manage groundwater data stored in an AHGW Pro geodatabase. Subsurface Analyst is a subset of the AHGW Pro Tools that is used to manage 2D and 3D hydrogeologic data, and create subsurface models including generation of borehole representations, cross sections, surfaces, and volumes. 2D cross sections can be sketched interactively using information from surficial geology maps, adjacent boreholes, and lines representing the intersection with rasters. This process is illustrated in the “Subsurface Analyst – Creating 2D Cross Sections” tutorial.

This tutorial demonstrates how to add to 2D cross sections plots representing construction details (screen, filter pack, riser, etc.) for wells adjacent to the cross section. This tutorial should be completed after going through the “Adding XS2D Points to Cross Sections” tutorial.

## 1.1 Background

Data used in this tutorial are part of a project for developing a groundwater simulation model: The Sacramento Regional Model (SRM), which encompasses an area of approximately 1,360 square miles (871,000 acres), overlying the North American sub-basins of the Sacramento Valley Groundwater Basin, and the Cosumnes sub-basin of the San Joaquin Groundwater Basin. The model is bounded by the Bear River and Feather River to the north, the Mokelumne River to the south, the Sacramento River to the west and by bedrock of the Sierra Nevada to the east (Figure 1). The well construction data used in this tutorial is fictitious.

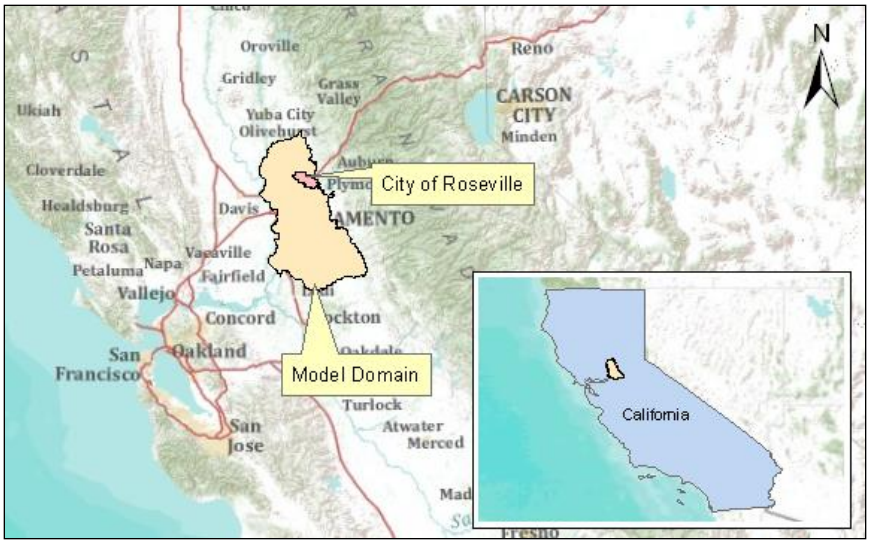



*Figure 1 Location of the Sacramento Regional Model.*

## 1.2 Outline

This tutorial introduces the basic workflow and tools for creating 2D well construction features. Well construction refers to the elements making up the well string and the materials used to fill a borehole.

The following tasks are demonstrated and discussed:

1. Review the structure of the data model classes needed for working with 2D cross sections.
2. Create XS2D lines representing well details at specified locations.
3. Create XS2D polygons representing well details at specified locations.

## 1.3 Required Modules/Interfaces

The following components must be enabled in order to complete this tutorial:

- ArcGIS Pro license
- Arc Hydro Groundwater Pro (AHGW Pro) Tools
- AHGW Pro Tutorial Files

The AHGW Pro Tools require a compatible ArcGIS Pro service pack installed. Feel free to check the AHGW Pro Tools documentation to find the appropriate service pack for the version of the tools being used.

# 2 Getting Started

To start, open the project file for this tutorial.

1. If necessary, launch *ArcGIS Pro*.
2. If on the *ArcGIS Pro* start page, select **Open another project** in the bottom-right corner of the window to open the *Open Project* dialog.

3. If already in the user interface, use the **Open** macro to open the *Open Project* dialog.
4. Browse to the location with tutorial files for this tutorial.
5. Select the file "well_construction.aprx" located in the *SubsurfaceAnalystPro\well_construction* folder.
6. Click **OK** to import the project.

Once the file has loaded, two maps should appear, one labeled *Map* and the other labeled *Section A-A'*. They contain a map of the model area in the California Central Valley (Figure 2). The map includes a boundary of the model domain, a polygon of the city of Roseville, layers representing streams, lakes, surface geology, wells, and section lines.

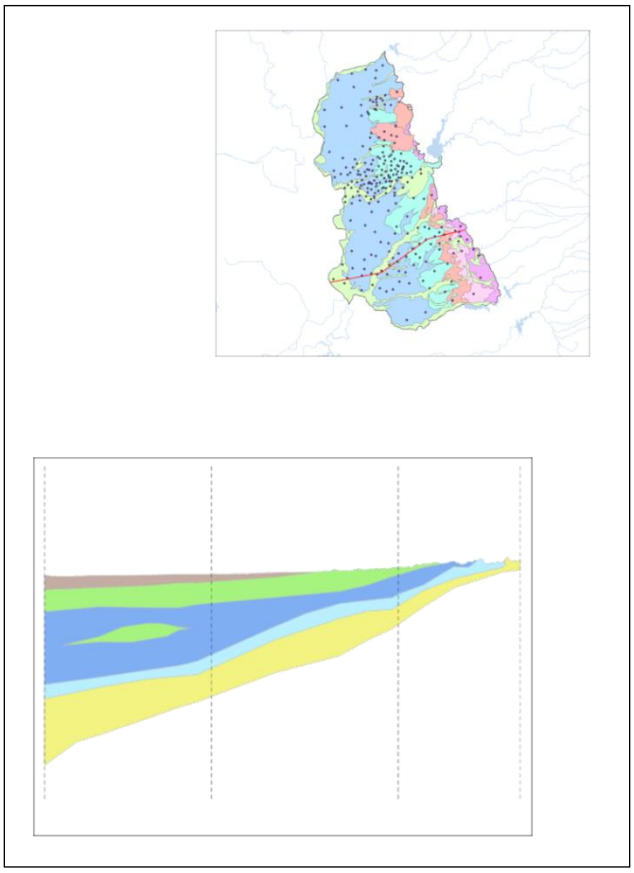


*Figure 2 Initial model appearance*

Next, ensure that the AHGW Pro tools are correctly configured.

7. Expand the *Toolboxes* list in the *Catalog* pane. Check if "ArcHydroGroundwater.pyt" is there. If it is not there, follow steps 8-10.
8. In the *Catalog* pane, right-click on *Toolboxes* and use the **Add Toolbox** command to open the *Add Toolbox* dialog.
9. In the *Add Toolbox* dialog, browse to the location where the Arc Hydro Groundwater Toolbox files were saved.
10. Select "ArcHydroGroundwater.pyt" and click **OK**.

"ArcHydroGroundwater.pyt" now appears in the *Toolboxes* list. When using geoprocessing tools, it's possible to set the tools to overwrite outputs by default, and automatically add results to the map/scene. To set these options:

11. On the ribbon, select the *Project* tab.
12. From the list on the left, select **Options** to open the *Options* dialog.
13. In the list on the left of the dialog, under *Application,* select *Geoprocessing*.
14. Ensure that *Allow geoprocessing tools to overwrite existing datasets* and *Add output datasets to an open map* are turned on.
15. Select **OK** to exit the *Options* dialog.
16. Using the arrow in the upper-left corner, return to the main user interface.

# 3 Representing 2D Cross Sections in the AHGW Pro Data Model

Before starting to create cross sections, it is helpful to review the components of the AHGW Pro Data Model being used. The Hydrostratigraphy component includes data structures for representing 2D and 3D hydrostratigraphy, including the creation of 2D cross sections (Figure 3).

SectionLine is the central feature class used to manage cross sections. Each SectionLine represents the location of a cross section in map view. SectionLine features are indexed with a HydroID, which uniquely identifies them within the geodatabase. To create a vertical (profile) view of the cross section along the SectionLine, each SectionLine feature is associated with multiple feature classes representing the two-dimensional cross section, and these are given the "XS2D" prefix.

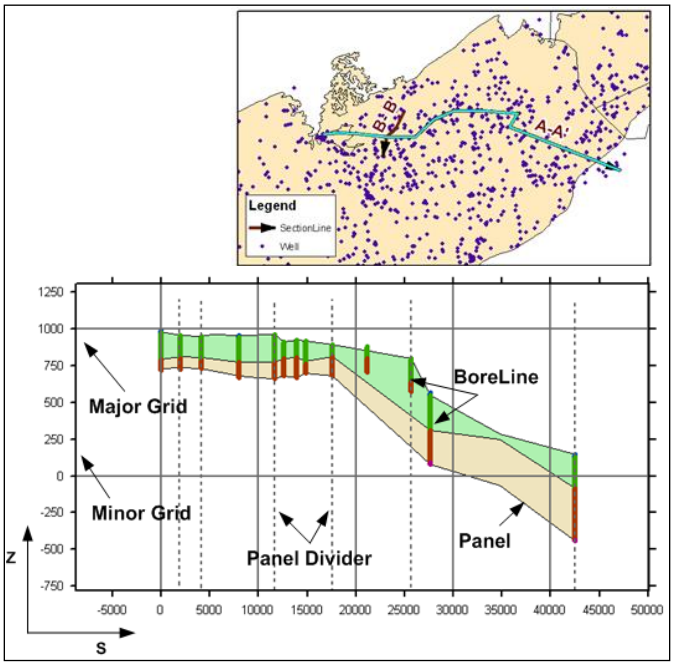



*Figure 3 Datasets used for creating 2D cross sections*

Common XS2D feature classes are:

- XS2D_Panel – polygon features representing cross section "panels".

- XS2D_BoreLine – vertical lines representing hydrostratigraphy along selected boreholes adjacent to the SectionLine.
- XS2D_PanelDivider – vertical guides showing the beginning and ending points of a SectionLine and where a SectionLine changes direction.
- XS2D_MajorGrid and XS2D_MinorGrid – grid lines showing the vertical and horizontal scales in an XS2D data frame.

Additional feature classes can be added to represent items such as land surface elevation, water table, faults, etc.

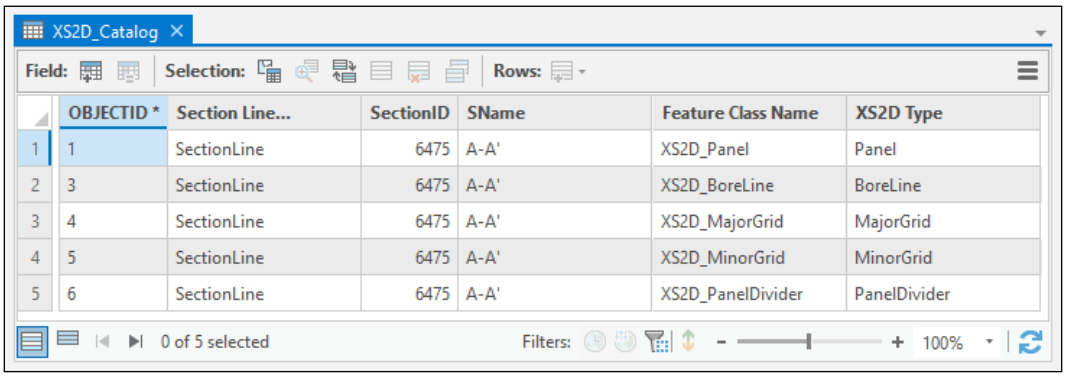
Each of the 2D cross sections is generated in a separate data frame. In ArcGIS Pro, this means they are visualized in a separate view. The XS2D feature classes are created in an {S, Z} coordinate system that is unique for each cross section. The S coordinate represents the length along the SectionLine (equivalent to the x-direction in the XS2D data frame) and the Z coordinate represents the vertical dimension (the y-direction in the XS2D data frame). In addition, XS2D features can be scaled (exaggerated) in the Z dimension for better visualization. *Subsurface Analyst* includes a number of tools for transforming features between a "real" coordinate system (X, Y, and Z) and a 2D coordinate system (S, Z), and for scaling features.

The XS2D_Catalog table is used for managing XS2D feature classes. The Catalog lists the XS2D feature classes related with each SectionLine feature. The SectionID field in the XS2D_Catalog references a HydroID of a SectionLine feature, thus creating a relationship between SectionLines (defined in real world coordinates) and XS2D feature classes.

To bring up the *XS2D_Catalog* table view, do the following:

1. Ensure that the *Map* view is displayed.
2. In the *Contents* pane, switch to **List By Data Source** .
3. Right-click on "XS2D_Catalog" and select **Open** to bring up the *XS2D_Catalog* table view.

An example of a typical *XS2D_Catalog* table view is shown in Figure 4. This tutorial demonstrates the creation of two feature classes for well construction data (one for polygons and one for lines) and adding references to the classes in the XS2D_Catalog. For more information, see the "Creating 2D Cross Sections" tutorial.




| | OBJECTID * | Section Line... | SectionID | SName | Feature Class Name | XS2D Type |
|---|---|---|---|---|---|---|
| 1 | 1 | SectionLine | 6475 | A-A' | XS2D_Panel | Panel |
| 2 | 3 | SectionLine | 6475 | A-A' | XS2D_BoreLine | BoreLine |
| 3 | 4 | SectionLine | 6475 | A-A' | XS2D_MajorGrid | MajorGrid |
| 4 | 5 | SectionLine | 6475 | A-A' | XS2D_MinorGrid | MinorGrid |
| 5 | 6 | SectionLine | 6475 | A-A' | XS2D_PanelDivider | PanelDivider |

*Figure 4 Example XS2D_Catalog used for managing XS2D feature classes and establishing a relationship between the XS2D features and a SectionLine feature*

# 4 Storing Well Construction Data

Well construction data is referenced as depth along a borehole. To represent this type of data, each construction element has a WellID attribute that links it to a well feature. In addition, each element has attributes giving the top and bottom elevations of the construction element. These values are usually given as depths along the borehole (From Depth and To Depth) and measured from a reference point, either land elevation or top of casing, downwards (Figure 5).

There are different types of construction elements (e.g. risers, screens, filter pack, and grout) that can be managed within the geodatabase in a number of ways:

- All well construction elements are stored in a single table, and are differentiated by a “type” attribute.
- Elements are stored in a single table, but for each element type there are separate From Depth and To Depth fields.
- A separate table is created for each element type.

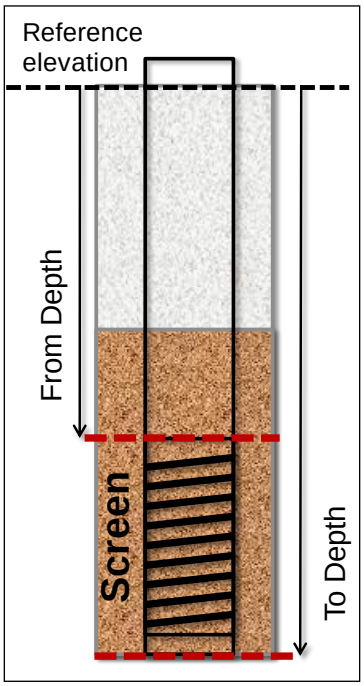
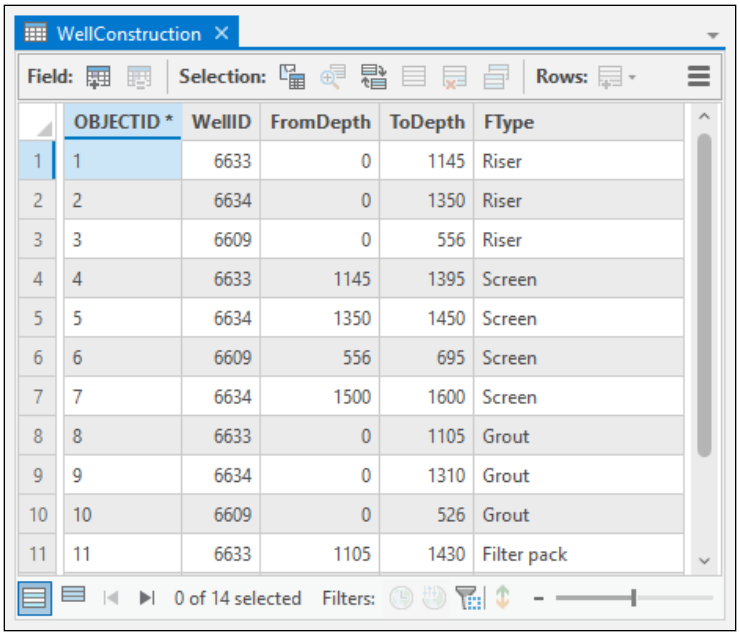



*Figure 5 Representing well construction elements using From Depth and To Depth attributes*

In this tutorial, well construction data are stored using the first option where all elements are stored in a single table, and are differentiated using a “type” field. Figure 6 shows the structure of the well construction table. The *WellID* field references a Well feature; *FromDepth* and *ToDepth* give the vertical elevations of the element; and *FType* gives its type.



WellConstruction

Field: Selection: Rows:

| | OBJECTID * | WellID | FromDepth | ToDepth | FType |
|---|---|---|---|---|---|
| 1 | 1 | 6633 | 0 | 1145 | Riser |
| 2 | 2 | 6634 | 0 | 1350 | Riser |
| 3 | 3 | 6609 | 0 | 556 | Riser |
| 4 | 4 | 6633 | 1145 | 1395 | Screen |
| 5 | 5 | 6634 | 1350 | 1450 | Screen |
| 6 | 6 | 6609 | 556 | 695 | Screen |
| 7 | 7 | 6634 | 1500 | 1600 | Screen |
| 8 | 8 | 6633 | 0 | 1105 | Grout |
| 9 | 9 | 6634 | 0 | 1310 | Grout |
| 10 | 10 | 6609 | 0 | 526 | Grout |
| 11 | 11 | 6633 | 1105 | 1430 | Filter pack |

0 of 14 selected Filters:

*Figure 6 Example of a well construction table for storing construction elements*

# 5 Adding Line Data from Well Construction Tables

Once a 2D cross section is constructed, it is often useful to plot well construction details for wells adjacent to the cross section. Subsurface Analyst contains tools to help add well construction diagrams to an XS2D data frame. Plots of the well screen and materials comprising the borehole can consist of lines, polygons, or some combination of both.

Since well construction data can be stored in a variety of formats, the geoprocessing tools used to create the plots have been designed to be as flexible as possible. Each well construction detail is processed separately and is added to the map as either a line or rectangular polygon. The input to the tools is simply the top and bottom depths of the details and the table containing the data.

## 5.1 Creating a New Line Feature Class

Before continuing, create a new line feature class to which the output well construction polylines will be written.

1. If necessary, select the *Map* view tab.
2. Switch to **List by Drawing Order** in the *Contents* pane.

This data frame (view) needs to be active as the Well features are located in this data frame. Note them in the *Contents* pane at the top of the *Drawing Order* list.

3. In the *Catalog* pane, under *ArcHydroGroundwater.pyt* | *Subsurface Analyst* | *XS2D Editor*, double-click on **Create XS2D Line Feature Class** to bring up the *Create XS2D Line Feature Class* tool in the *Geoprocessing* pane.

This tool creates a new XS2DLine feature class for each of the selected SectionLine features. If no section line is selected it will create feature classes for all section lines in the SectionLine feature class.

4. Select “SectionLine” from the *Input SectionLine Features* drop-down.
5. Select “XS2D_Catalog” from the *Input XS2D_Catalog Table* drop-down.
6. Enter “Well Construction Line” as the *XS2DType value of the XS2D line features*.
7. Enter “WellConstructionLine” as the *Feature class name prefix*.

The feature classes created will include the prefix specified and the HydroID of the section line feature (e.g., “WellConstructionLine_6475”).

8. Click **Run** to run the *Create XS2D Line Feature Class* tool.

Now the “WellConstructionLine_6475” has been created. However, it is not yet visible in the *Contents* pane. It needs to be added from the geodatabase, which is where it was created.

9. Select the *Section A-A'* view tab.

Now, the new item will be added to the *Section A-A'* view.

10. On the ribbon, select the *Map* tab.
11. Click **Add Data** to open the *Add Data* dialog.
12. Under *Project* in the data tree on the left, browse to *Databases\Roseville.gdb.*
13. In the *Roseville.gdb* geodatabase, double-click on *Data*.
14. Select “WellConstructionLine_6475”.
15. Click **OK** to import “WellConstructionLine_6475” and close the *Add Data* dialog.

“WellConstructionLine_6475” now appears in the *Contents* pane under *Section A-A'.*

16. If necessary, select “WellConstructionLine_6475” and drag it to top of the *Contents* pane.

This is to put the item at the top of the drawing order. Note the display has not changed because well construction features have still not been added to the feature class.

## 5.2 Adding Well Construction Features

Next, add well construction features to the newly-created feature class. Each line in the feature class represents a part of the overall well or borehole, and can be classified by a feature type, such as riser, screen, filter pack, etc.

To add well construction data along the cross section, apply the *Transform Well Detail Line* tool. First select the wells to use. A subset of wells that have well construction information (the tool works on a selection set of wells) will be used. Select wells with well construction data:

1. Select the *Map* view tab.
2. On the ribbon, select the *Map* tab
3. Select **Select By Attributes** to bring up the *Select By Attributes* dialog.
4. Select “Well” from the *Input Rows* drop-down.
5. Select “New selection” from the *Selection type* drop-down.
6. In the *Where* text field, enter the values as follows:
   - Select “HasWellConstruction” from the first drop-down.
   - Select “is equal” from the second drop-down.

- Select “1” from the third drop-down.

7. Click **OK** to close the *Select By Attributes* dialog.

Three well features along the SectionLine should be selected (Figure 7).

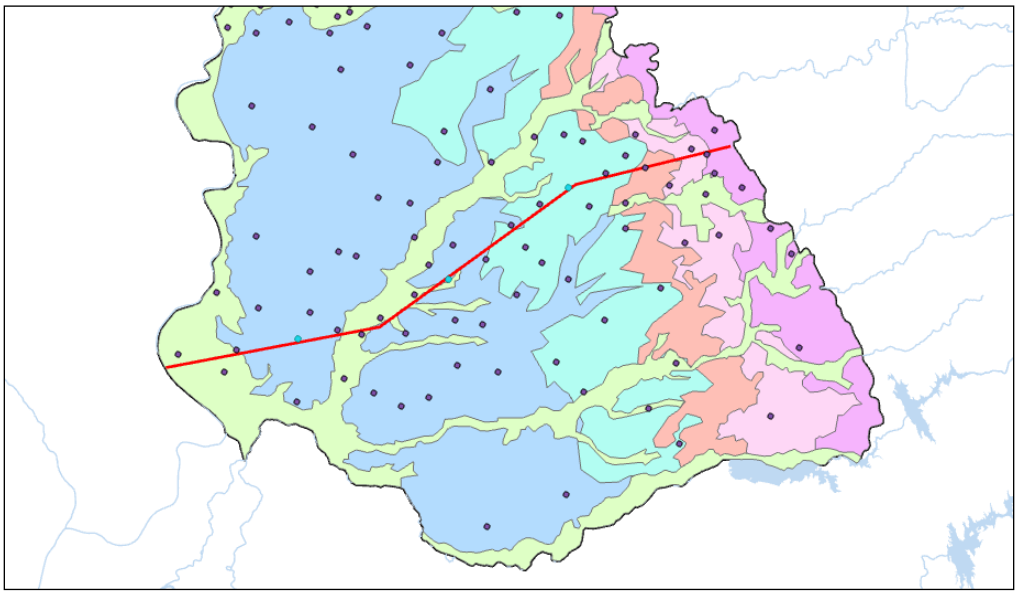


*Figure 7 Three selected wells*

## 5.3 Transforming and Creating the Line Features

Now that wells are selected, run the tool that transforms and creates the line features.

1. In the *Catalog* pane, under *ArcHydroGroundwater.pyt* | *Subsurface Analyst* | *XS2D Editor,* double-click on “ Transform XS2D Well Detail Line” to bring up the *Transform XS2D Well Detail Line* tool in the *Geoprocessing* pane.
2. Select “XS2D_Catalog” from the *Input XS2D_Catalog Table* drop-down.
3. Select “Well” from the *Input Well Features* drop-down.
4. Select “SectionLine” from the *Input SectionLine Features* drop-down.
5. Enter “6475” as the *SectionLine ID*.
6. Select “Well Construction Line” from the *XS2DType* drop-down.
7. Enter “Riser” as the *FType*.

This is the feature type attribute added to the feature class referenced in the XS2D_Catalog table.

8. Select “WellConstruction” from the *Input Well Construction Table* drop-down.
9. Select “WellID” from the *Well Construction WellID Field* drop-down.

This field contains the HydroID of the associated well.

10. Select “FromDepth” from the *Well Construction From Depth Field* drop-down.
11. Select “ToDepth” from the *Well Construction To Depth Field* drop-down.
12. Select “LandElev” from the *Well Ground Elevation (if not Z enabled)* drop-down.

This represents the field in the Well feature class containing the ground surface elevation. This is used by the tool to convert the depths associated with the well construction details to elevations.

13. Select “FType” from the *Data Type Field for filtering*.
14. Select “Riser” for the *Data Type value for filtering*.
15. Click **Run** to run the *Transform XS2D Well Detail Line* tool.
16. Select the *Section A-A'* view tab.

A new set of lines in the cross section representing the risers should be visible, extending from the ground surface to a point at about mid-depth in the cross section (Figure 8). If the line does not appear, ensure that the *WellConstructionLine_6475* feature class is listed first in the *Contents* pane of the *Section A-A*' view. If it still doesn’t appear, click **Refresh** in the bottom-right corner of the view.

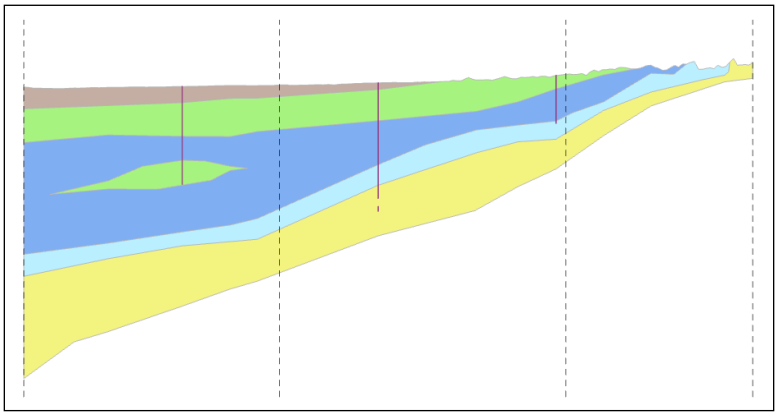


*Figure 8 Three risers visible in the cross section*

## 5.4 Symbolizing the Risers

The next step is to symbolize the risers. First, add the style file to be used for symbolizing the risers:

1. In the *Catalog* pane, right-click on *Styles* and select *Add* | **Add Style** to open the *Add a style file* dialog.
2. Under *Project* in the data tree on the left, navigate to *Folders\well_construction*.
3. Select the “WellConstruction” file.
4. Click **OK** to import the “WellConstruction.stylx” style file and close the *Add a style file* dialog.

Note that “WellConstruction” has been added to the *Catalog* pane under *Styles.*

5. In the *Contents* pane, right-click on “WellConstructionLine_6475”, and select **Symbology** to bring up the *Symbology* pane.
6. Select the *Symbol layer drawing* tab.
7. Turn on *Enable symbol layer drawing.*.
8. In the upper-right corner, click and select **Import symbology** to open the *Apply Symbology From Layer* tool in the *Geoprocessing* pane.

9. Ensure that *Input Layer* is set to “WellConstructionLine_6475”.
10. Click **Browse** to the right of *Symbology Layer* to open the *Symbology Layer* dialog.
11. In the data tree on the left, under *Project*, browse to *Folders\well_construction\symbology*.
12. Select “Riser.lyr”.
13. Click **OK** to select “Riser.lyr” and close the *Symbology Layer* dialog.
14. Click **Run** to run the *Apply Symbology from Layer* tool.

The risers should now appear similar to those in Figure 9.

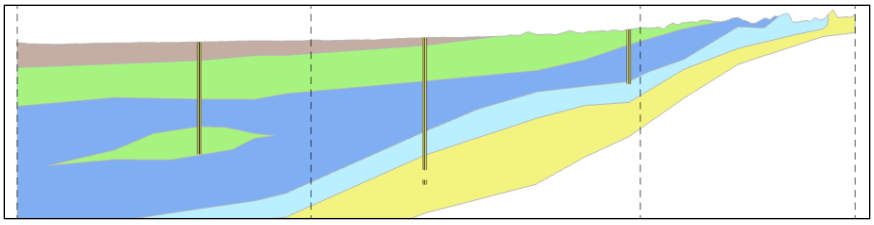


*Figure 9 Symbolized risers*

# 6 Adding Polygon Data from Well Construction Tables

In addition to creating well construction polyline features, the Subsurface Analyst toolset also has a tool for creating the same features as polygons instead. The tools work similarly. Using a polygon instead of a polyline can be preferable, depending on how the feature is symbolized. Each polygon created represents a part of the overall well or borehole, and can be classified by a feature type, such as riser, screen, filter pack, etc.

## 6.1 Creating the XS2D Polygon Feature Class

The first step is to create the XS2D polygon feature class by doing the following:

1. Select the *Map* view tab.
2. In the *Catalog* pane, under *ArcHydroGroundwater.pyt* | *Subsurface Analyst* | *XS2D Editor*, double-click on “Create XS2D Polygon Feature Class” to open the *Create XS2D Polygon Feature Class* tool in the *Geoprocessing* pane.

This tool creates a new XS2DPolygon feature class for each of the selected SectionLine features. If no section line is selected it will create feature classes for all section lines in the SectionLine feature class.

3. Select “SectionLine” from the *Input SectionLine Features* drop-down.
4. Select “XS2D_Catalog” from the *Input XS2D_Catalog Table* drop-down.
5. Enter “Well Construction Polygon” as the *XS2DType value of the XS2D polygon features*.
6. Enter “WellConstructionPolygon” as the *Feature class name prefix*.

The feature classes created will include the prefix specified and the HydroID of the section line feature (e.g., “WellConstructionPolygon_6475”).

7. Click **Run** to run the *Create XS2D Polygon Feature Class* tool.

Now the "WellConstructionPolygon_6475" feature class has been created. However, it is not yet visible in the *Contents* pane. It needs to be added from the geodatabase, which is where it was created. First, make sure that it has appeared in the geodatabase:

8. In the *Catalog* pane, under *Folders\well_construction\Roseville.gdb\Data* check if the "WellConstructionPolygon_6475" item is there.
9. If it is not, right-click on *Folders* and select **Refresh**.

The "WellConstructionPolygon_6475" item should now appear if it hadn't already. Now, it can be added to Section A-A'. To do so:

10. Select the *Section A-A'* view tab.
11. On the ribbon, select the *Map* tab.
12. Select **Add Data** to open the *Add Data* dialog.
13. In the data tree on the left, under *Project*, browse to *Databases\Roseville.gdb\Data*.
14. Select "WellConstructionPolygon_6475".
15. Click **OK** to add "WellConstructionPolygon_6475" and close the *Add Data* dialog.

The "WellConstructionPolygon_6475" item now appears in the *Contents* pane.

16. If necessary, select "WellConstructionPolygon_6475" in the *Contents* pane and drag it to the position just below "WellConstructionLine_6475".

Now "WellConstructionPolygon_6475" is just below "WellConstructionPolygon_6475" in the drawing order. Note the display has not changed because well construction features have still not been added to the feature class.

## 6.2 Transforming the XS2D Well Detail Polygon

Do the following to transform the XS2D well detail polygon:

1. Select the *Map* view tab.
2. In the *Catalog* pane, under *ArcHydroGroundwater.pyt* | *Subsurface Analyst* | *XS2D Editor,* double-click on " Transform XS2D Well Detail Polygon" to open the *Transform XS2D Well Detail Polygon* tool in the *Geoprocessing* pane.
3. Select "XS2D_Catalog" from the *Input XS2D_Catalog Table* drop-down.
4. Select "Well" from the *Input Well Features* drop-down.
5. Select "SectionLine" from the *Input SectionLine Features* drop-down.
6. Enter "6475" as the *SectionLine ID*.
7. Select "Well Construction Polygon" from the *XS2DType* drop-down.
8. Enter "Screen" as the *FType*.

This is the feature type attribute added to the feature class referenced in the XS2D_Catalog table. This allows for identifying these features when doing queries or setting up symbology.

9. Select "WellConstruction" from the *Input Well Construction Table* drop-down.
10. Select "WellID" from the *Well Construction WellID Field* drop-down.
11. Select "FromDepth" from the *Well Construction From Depth Field* drop-down.
12. Select "ToDepth" for the *Well Construction To Depth Field* drop-down.

13. Enter “2000” as the *Display Width*.

This indicates that the polygons to be created are 2000 units wide in the linear unit of the target polygon feature class.

14. Select “LandElev” from the *Well Ground Elevation (if not Z enabled)* drop-down.
15. Select “FType” from the *Data Type Field for filtering* drop-down.
16. Select “Screen” from the *Data Type value for filtering* drop-down.
17. Click **Run** to run the *Transform XS2D Well Detail Polygon* tool.
18. Select the *Section A-A'* view tab.
19. Click **Refresh** in the bottom-right corner of the view.

Notice a new set of polygons in the cross section representing the well screen (Figure 10).

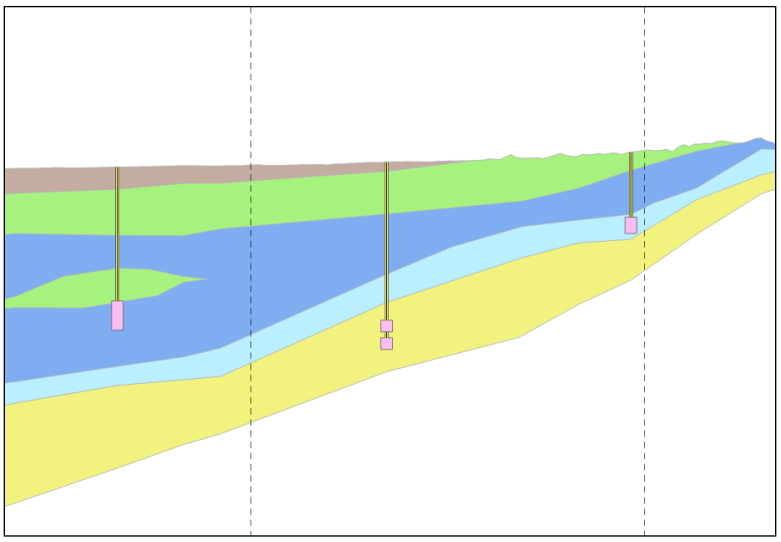


*Figure 10 Well screen polygons visible on the risers*

## 6.3 Symbolizing the Polygons

The next step is to symbolize the polygons by doing the following:

1. In the *Contents* pane, right-click on“WellConstructionPolygon_6475” and select **Symbology** to bring up the *Symbology* pane.
2. In the upper-right corner, click and select **Import symbology** to bring up the *Apply Symbology From Layer* tool in the *Geoprocessing* pane.
3. Select “WellConstructionPolygon_6475” from the *Input Layer* drop-down.
4. Click **Browse** to the right of the *Symbology Layer* drop-down to bring up the *Symbology Layer* dialog.
5. In the data tree on the left, under *Project*, browse to *Folders\well_construction\symbology*.
6. Select “WellPolygon.lyr” and click **OK** to select “WellPolygon.lyr” and exit the *Symbology Layer* dialog.
7. Click **Run** to run the *Import Symbology* tool.

The cross section should be similar to the one shown in Figure 11.

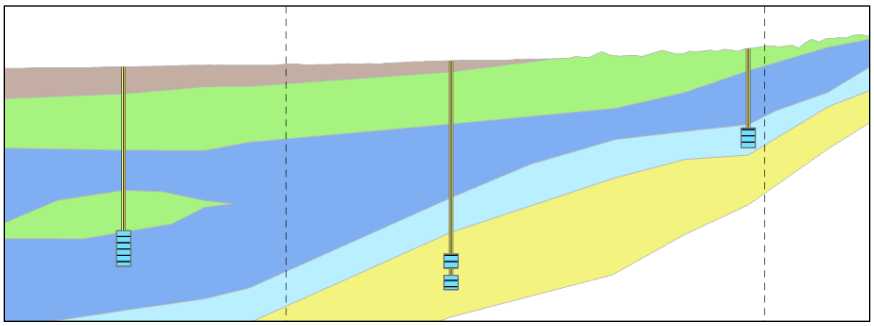


*Figure 11 Riser and screen well construction elements*

## 6.4 Adding Filter Pack

Next, add filter pack as polygons. Doing so will require the *Transform XS2D Well Detail Polygon* tool again. What's more, most of the desired settings for this second run are the same as the settings for the last run. ArcGIS Pro has a *History* pane that allows for opening up previous runs of Geoprocessing tools with all of the settings still saved. To do so:

1. Select the *Map* view.
2. On the ribbon, select the **Analysis** tab.
3. Select **History** to open the *History* pane.
4. On the *Geoprocessing* tab, double-click the most recent run of the *Transform XS2D Well Detail Polygon* tool to open the *Transform XS2D Well Detail Polygon* tool in the *Geoprocessing* pane.

Most of the settings are already as desired. Only a few adjustments are necessary to add filter pack as polygons.

5. Enter "Filter Pack" as the *FType*.

This is the feature type attribute added to the feature class referenced in the XS2D_Catalog table. This allows for identifying these features when doing queries or setting up symbology. Ensure that the "P" is capitalized to avoid confusion with the "Filter pack" in the *Data Type value for filtering* drop-down.

6. Enter "4000" as the *Display Width*.

This indicates that the polygons to be created are 4000 units wide in the linear unit of the target polygon feature class.

7. Select "Filter pack" from the *Data Type value for filtering* drop-down.
8. Click **Run** to run the *Transform XS2D Well Detail Polygon* tool.
9. Select the *Section A-A'* view.
10. Click **Refresh** in the bottom-right corner of the view.

Note the polygons representing the filter pack.

## 6.5 Adding Grout Elements

Next, add the grout elements as polygons. Doing so will require the *Transform XS2D Well Detail Polygon* tool again. What's more, most of the desired settings for this third run are the same as the settings for the last run. If the *Geoprocessing* pane is still open to the *Transform XS2D Well Detail Polygon* tool, there is no need to open it from the *History* pane. If the *Geoprocessing* pane has been closed, use the *History* pane to load the tool with the desired settings. To do so:

1. Select the *Map* view.
2. On the ribbon, select the **Analysis** tab.
3. Select **History** to open the *History* pane.
4. In the *History* pane, on the *Geoprocessing* tab, double-click the most recent run of the *Transform XS2D Well Detail Polygon* tool to open the *Transform XS2D Well Detail Polygon* tool.

Most of the settings are already as desired. Only a few adjustments are necessary to add grout elements.

5. Enter "Grout" as the *FType*.

This is the feature type attribute added to the feature class referenced in the XS2D_Catalog table. This allows for identifying these features when doing queries or setting up symbology.

6. If necessary, enter "4000" as the *Display Width*.

This indicates that the polygons to be created are 4000 units wide in the linear unit of the target polygon feature class.

7. Select "Grout" from the *Data Type value for filtering* drop-down.
8. Click **Run** to run the *Transform XS2D Well Detail Polygon* tool.
9. Select the *Section A-A'* view tab.
10. Click **Refresh** in the bottom-right corner of the view.

Note the grout elements.

# 7 Conclusion

This concludes the "Adding well construction details to cross sections" tutorial. The following key concepts were discussed and demonstrated:

- The Arc Hydro Groundwater data model includes XS2D feature classes that provide the framework for working with 2D cross sections in ArcGIS Pro.
- The *Transform XS2D Well Detail Line* geoprocessing tool can be used to create line data associated with well features along a 2D cross section.
- Similarly, the *Transform XS2D Well Detail Polygon* geoprocessing tool can be used to create polygon data associated with well features along a 2D cross section.