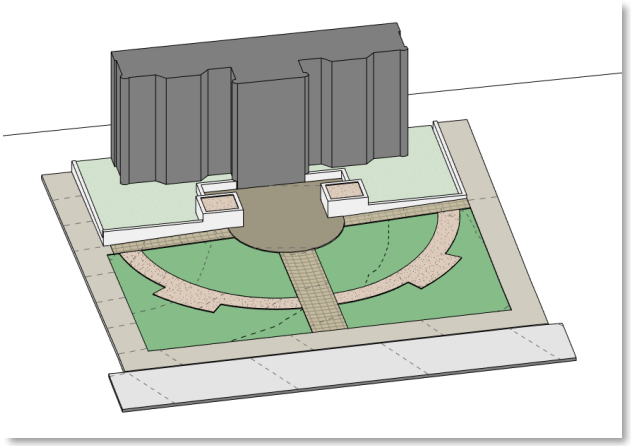
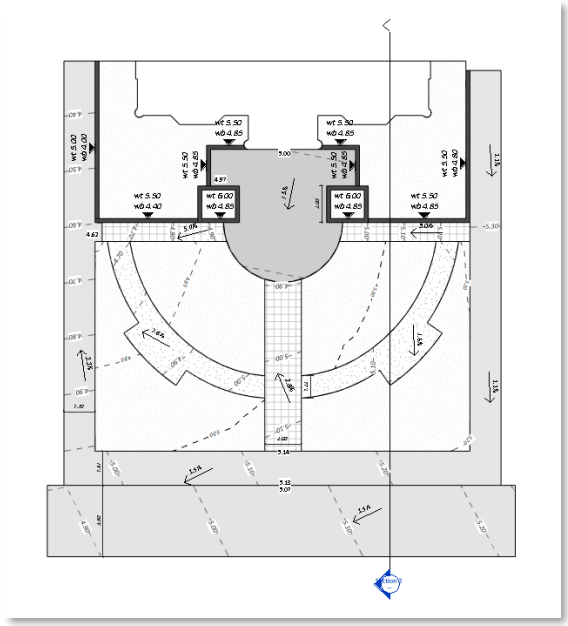
Module 3 – Grading Workflow and Methods

Note: This module was created with the assumption that both students and teachers have a basic understanding of site engineering, and working with contour lines to design a site's grading.





Module 3 – Grading Workflow and Methods

Part 1 – Creating a Topography from Model Lines

- Assigning elevations to **Model Lines** - **Set Elevation**
- **Model Line settings** in '**Environment**' tools
- Checking and labeling **Model Line** elevation - **Check Elevation**
- Creating a topography from **Model Lines** - **Create Surface**

Part 2 – Sloping a Floor according to a 'help surface'

- Shaping (grading) a **Floor** by a topography - **Shape by Topography**
- Hiding and revealing elements in a specific **View** - **Hide in View by Element/by Category**
- Getting to know the **Visibility Graphics Overrides** settings for a specific **View**

Part 3 – Implementing all of the different methods for creating sloped surfaces

- Completing the slope design of simple paths using **Modify Sub Elements**
- Manually changing points and snaping to model elements
- Sloping curved paths using **Shape by Topography**

Part 4 – Floor contours, Floor patterns and secondary surfaces

- Adding contour lines and contour labels to **Floors** - **Floor Contours + Check elevation**
- Modeling secondary surfaces with topographies using - **Surface from Edge**
- Splitting a **Toposurface** - **Split Surface**
- Correcting a deformation in a **Floor's** pattern in a specific **View** - **Object Outline**

Part 5 – Creating a section and editing graphic settings

- Create a new section **View** – **Section**
- Hide or reveal a section symbol on a plan **View** - **Hide at Scale Coarser Than**
- Changing a section's **View** depth – **Far Clipping / Far Clip Offset**
- Changing a section's **View Scale**
- Hiding helper surfaces in a cross-section - **Hide in View > By Element**
- Smart annotating - **Spot Elevation**
- Showing a topography cut profile in a section **View** - **Surface Profile**

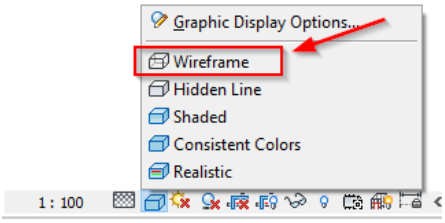
Exercise 3

Part 1 – Creating a Topography from Model Lines

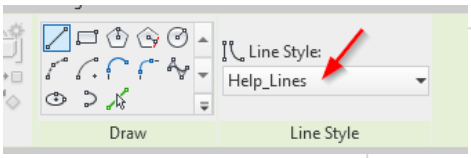
In this exercise, we will use **Model Lines** as contours from which we will create a Topography.

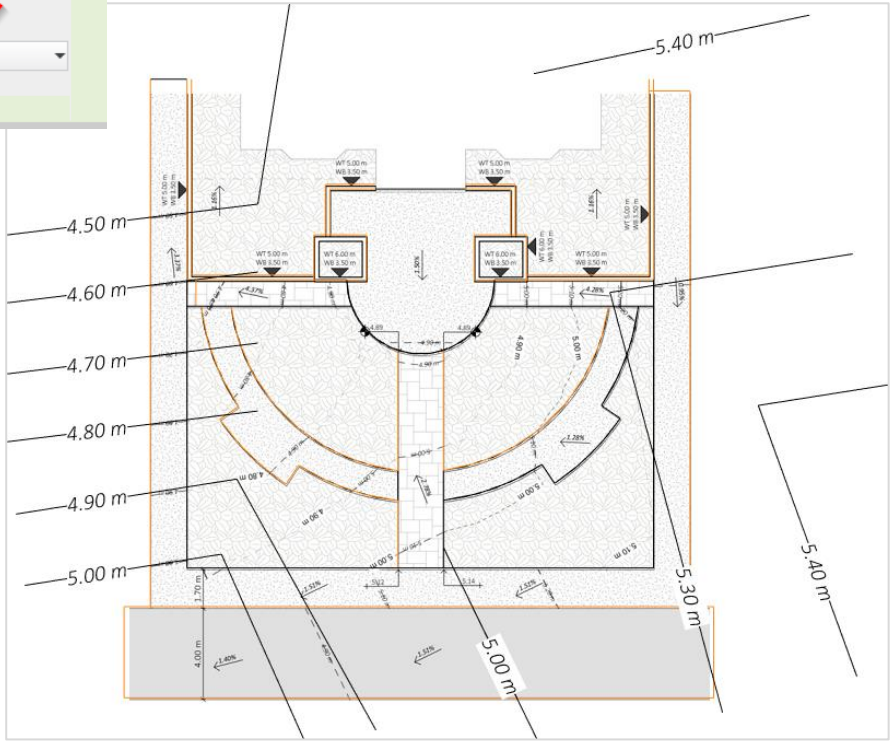
Creating a helper surface from Model Lines to grade the Floors:

- Open the attached **Module 03_Ex 01** file.
- Switch to 'Site General Plan' **View** from the project browser.
- Switch to the **Wireframe** display on the "**View Control Bar**" – This makes all model surfaces transparent, allowing you to see the reference picture we inserted for guidance.



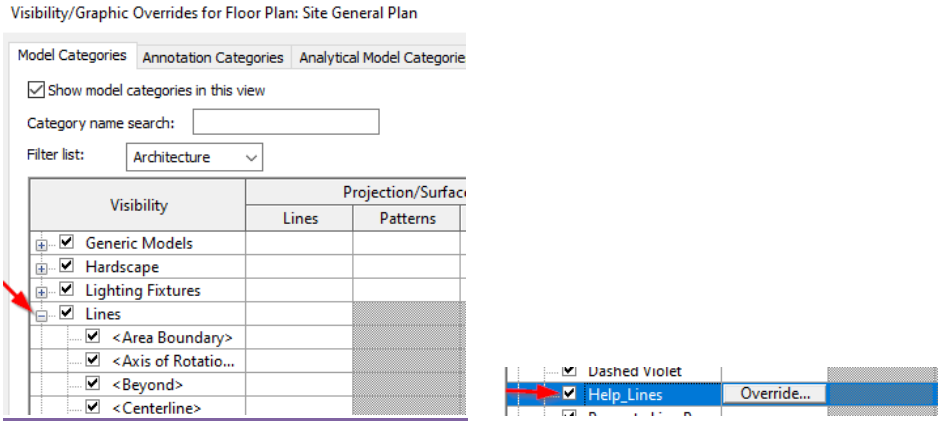
- Draw **Model Lines** to match the elevations in the reference image. You can draw them ruffly similar to the example below: (Remember these are only help lines for grading purposes).



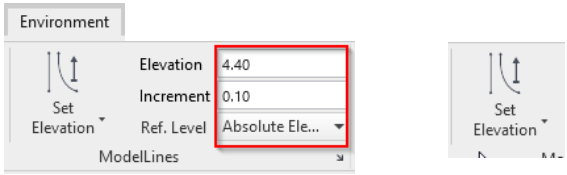


***Tip**: Use the **Help Lines** line **Type**. We created this line style especially for creating helper lines. These lines are meant to aid in the design but should not be included in the project documents.*

*If this line style is not currently visible in the **View**, open the **Visibility Graphics Overrides** window and turn on the "Help Lines" Sub-Category under the **Lines Category**.*



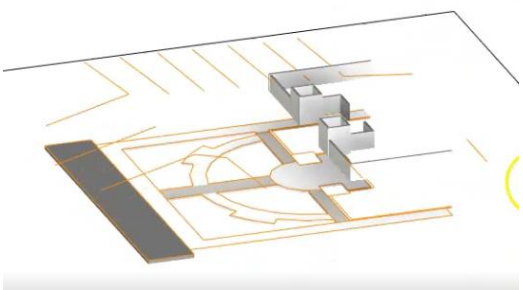
- Define an elevation for each line according to the reference plan, using the **Set Elevation** command under the **Environment** ribbon (don't forget to hit the Enter key to actually set the elevation). Click on **Set Elevation** to execute the command.



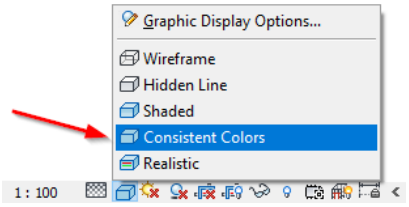
***Tip**: To set the elevation of a series of related lines, for example, the lines of an even slope, you can select the **Set Elevation by Crossing** option, under the **Set Elevation** command:*

- *Enter the elevation of the bottom-most line (in reference to sea-level) in the "Elevation" field.**
- *Enter the desired vertical increment between each line in the "Increment" field.**
- *Draw a line across the contour lines whose elevation you would like to set.*
- *Executing the command will set the elevation of the desired contour lines at the desired increments.*

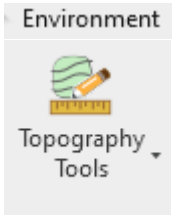
*How can we know if the command was successful? The Model Line we selected will change its color (in this specific **View** only). We can also go to the 3D **View** and see the change in elevation.*

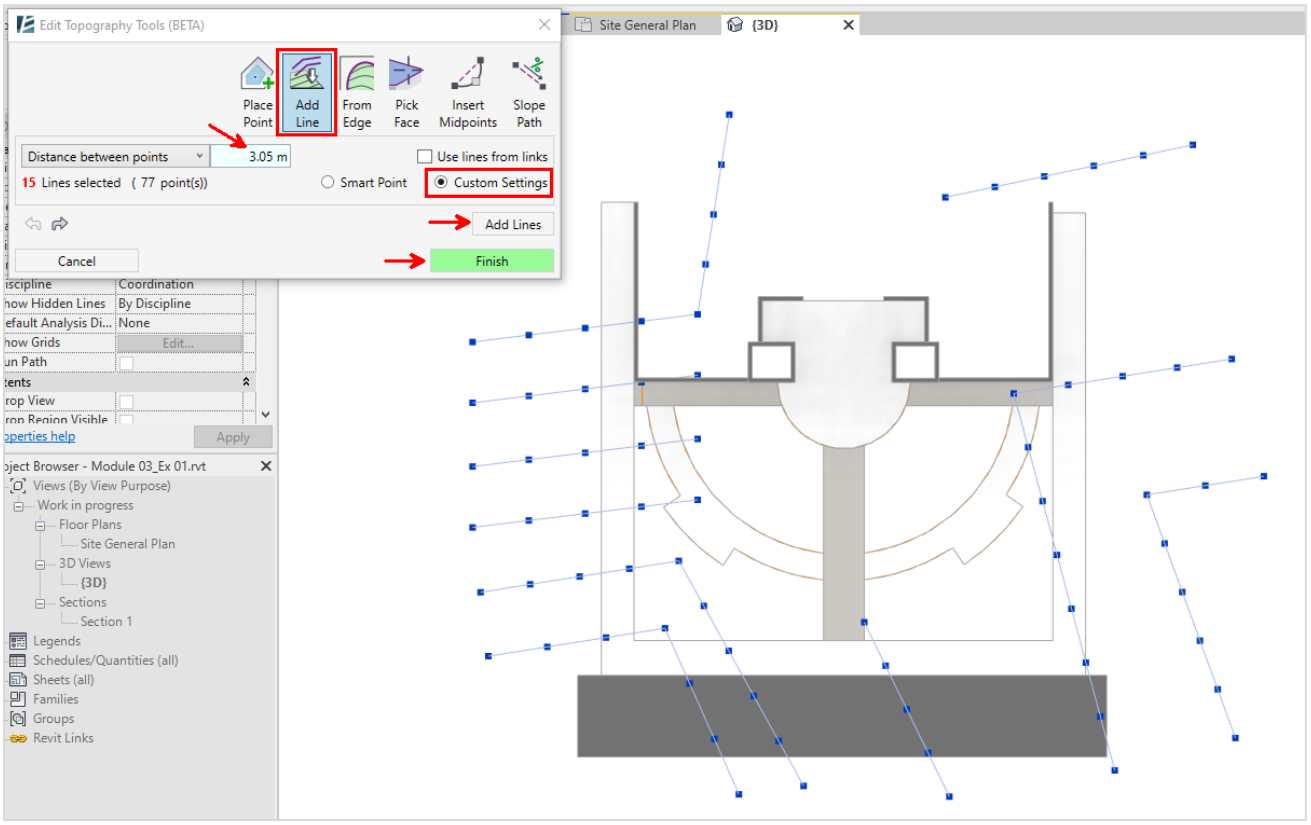


- Switch the visual style to Consistent Colors to preview the surface we will be creating.



- Go to the **Environment** tab and open the **Topography Tools** window to create a new surface.
- Select the **Add Line** tool and select all the relevant **Model Lines** (make sure to not select any of the other help lines we created).
- Pick the **Custom Settings** option to adjust the number of elevation points added on each line.



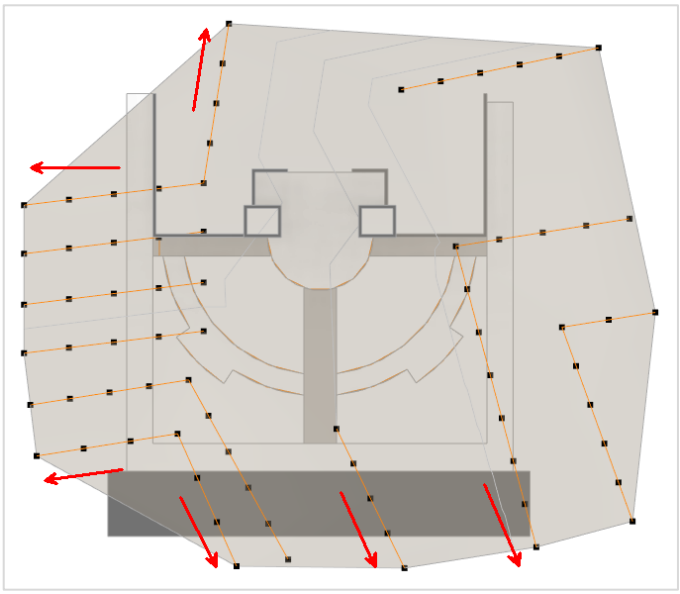


- Click on the **Add Lines** button to add elevation points along the selected **Model Lines** and hit **Finish** to exit the command.

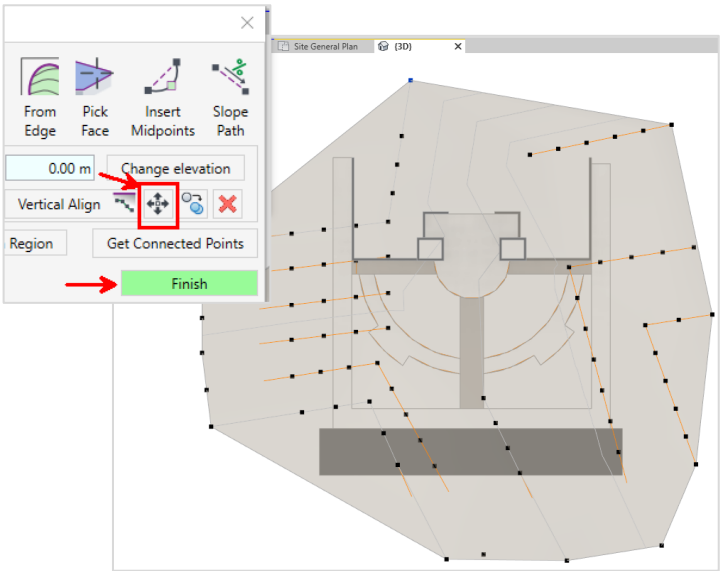
- Now, we want to make sure that the helper surface **covers all of the Floors for which we wish to create slopes with the aid of the surface.**
- Switch to top **View** or **Floor Plan View.**

- Select the new topography and on the **Modify** tab, click on **Topography Tools** again to edit the surface. (Some actions are possible via the regular Edit Surface tool, however, All actions are available through Environment's **Topography Tools**).

***Tip**: Arrange the points in the direction of the topography lines to maintain a consistent slope.*



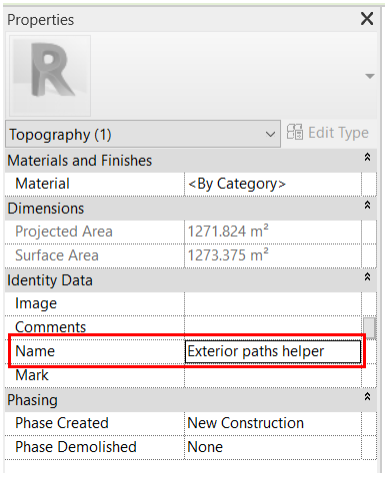
- Using the **Move** tool in the **Topography Tools** window, select and drag the relevant points to enlarge the surface so that it will cover all of the **Floors** without changing the slopes.



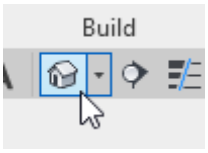
Part 2 – Sloping a Floor according to a 'help surface'

In this exercise, we wish to create a topography as a help surface (reference surface) to aid in assigning slopes to the flat **Floors** we modeled as the exterior paths.

- Select the surface and give it a name in the Properties window under the 'Name' parameter. This will allow us to identify each surface by its purpose later in the modeling process.

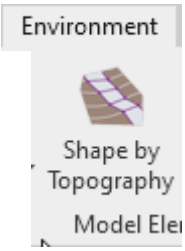


- Switch to 3D **View**

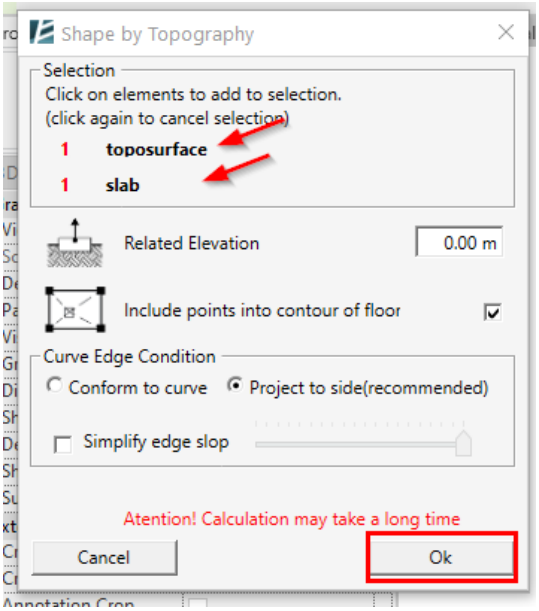


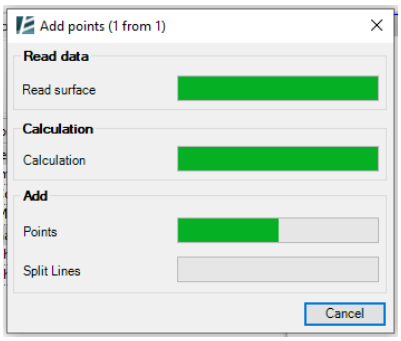
Drape a Floor over a help Toposurface using Shape by Topography

- Select the topography and **Floors** and click on **Environment** > **Shape by Topography** (you can select the topography and the floors before or after starting the command).

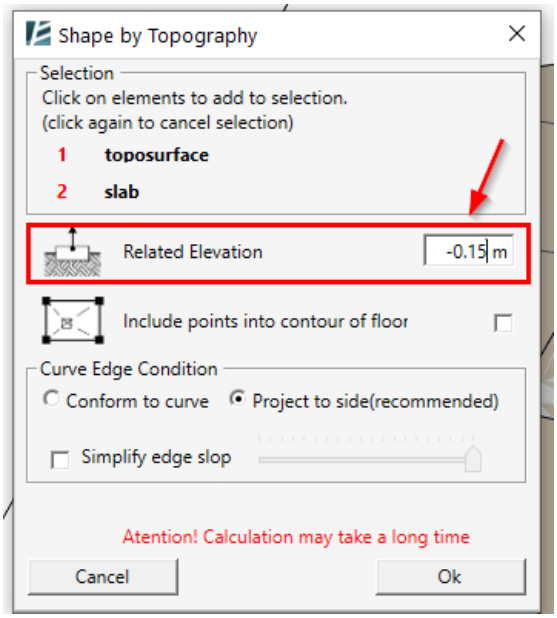


- Define the "Related Elevation" of the top of the **Floor** relative to the helper surface. In our case it's 0.

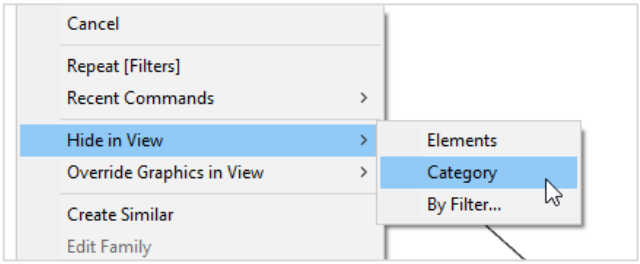




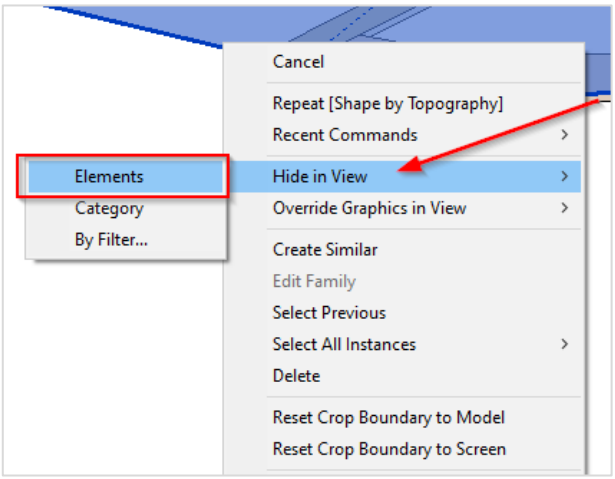
- Now, we'll repeat the command in order to slope the road, but in this case, we'll define an offset in the **Related Elevation** parameter, such that the road will be 15 cm lower than the sidewalk.



- Open the **Visibility Graphic Overrides** (VG) menu and turn off the 'Help Line' line style **Category** in this **View**.
- Alternatively, you can right-click with your mouse on one of the lines, and click on **Hide in View > Category.**



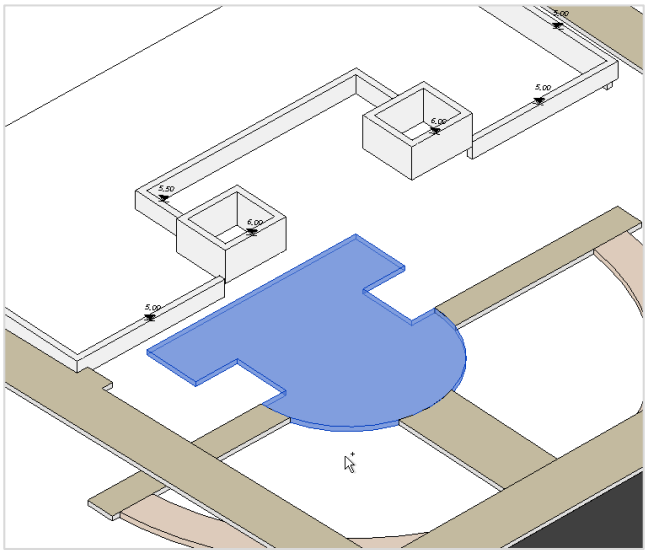
- Select the **Toposurface** and hide it in this **View**.



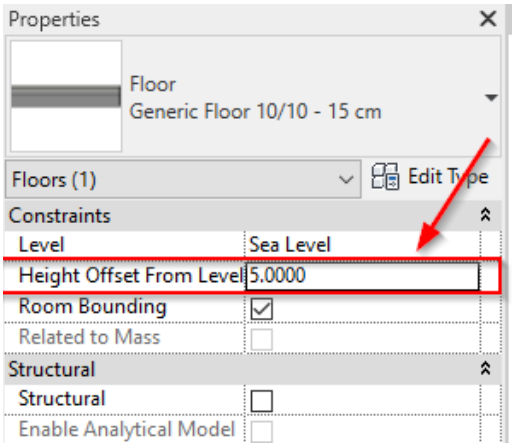
***Pay attention**: When showing or hiding an element in a **View**, make sure you understand the difference between **hiding a specific element and hiding an entire category**.*

Part 3 – Implementing all of the different methods for creating sloped surfaces

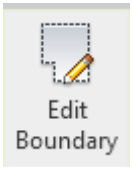
Defining a Floor's elevation using a Slope Arrow



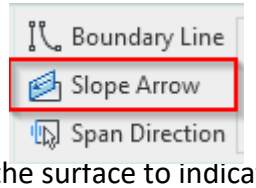
- Select the **Floor** and set its elevation to 5 meters above sea level.



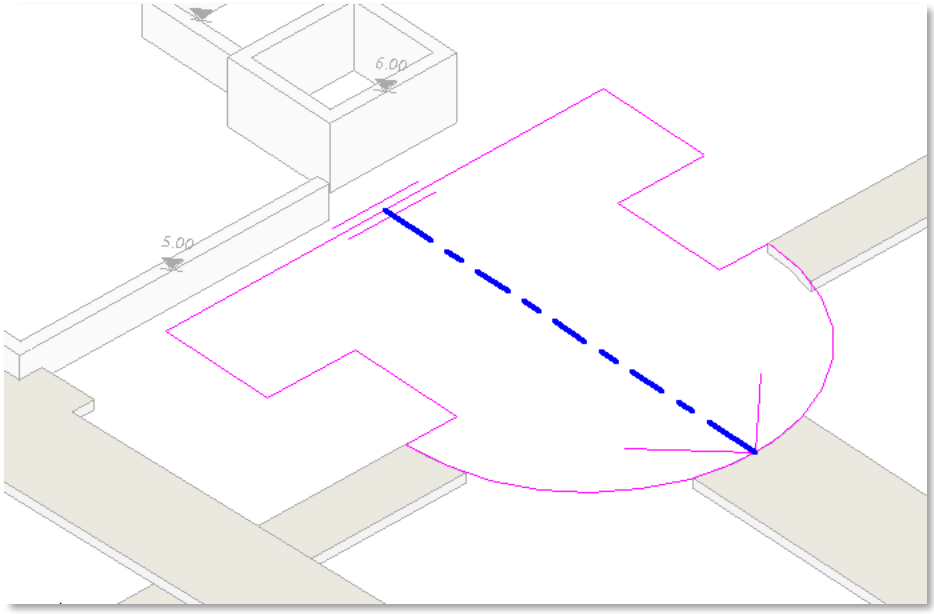
- Select the **Floor** and initiate the **Edit Boundary** command In the **Modify** ribbon.



- Select "**Slope Arrow**"

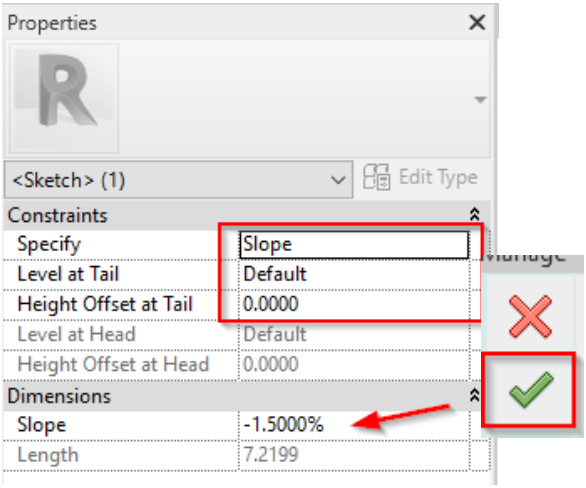


- Draw the Slope Arrow on the surface to indicate slope location and direction, as follows:



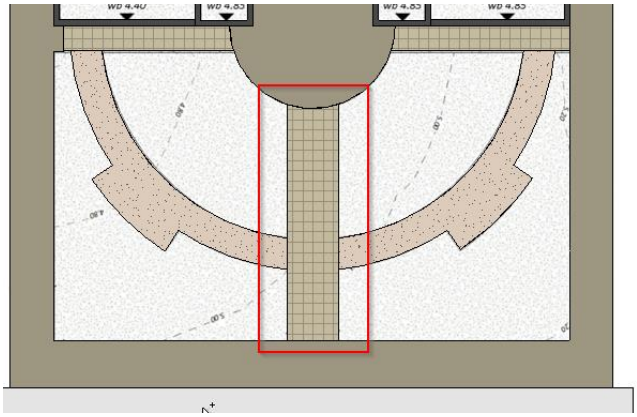
- Set the slope grade (percentage)

***Note**: The Slope Arrow element accounts for the **Height Offset from the Level** assigned to the **Floor** and creates a slope according to the length and in the direction of the arrow.*

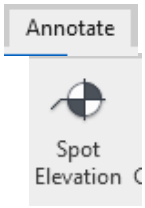


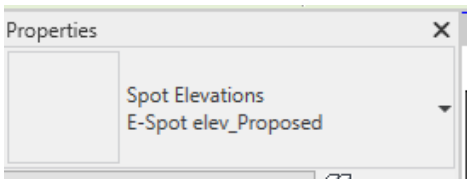
- Click the green checkmark to approve and exit the command.

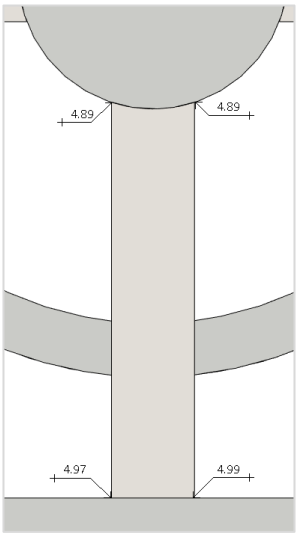
Slope a Floor by defining each and every elevation point



- Place '**Spot Elevation'** annotations over the four points where this path connects to the other paths, to indicate the elevation we should assign to its four corners.

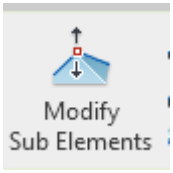




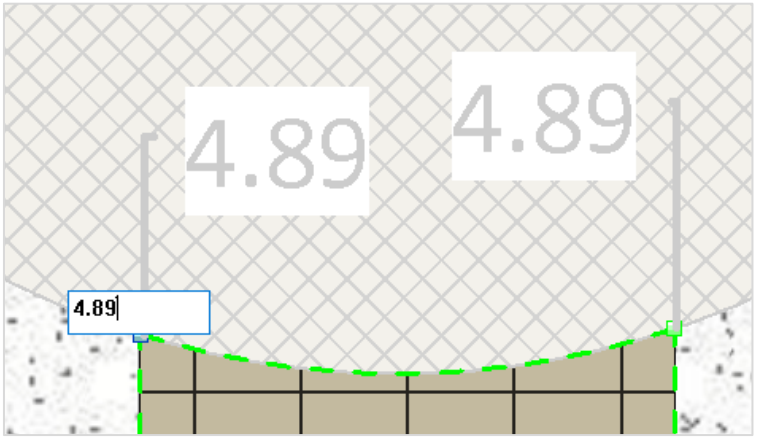


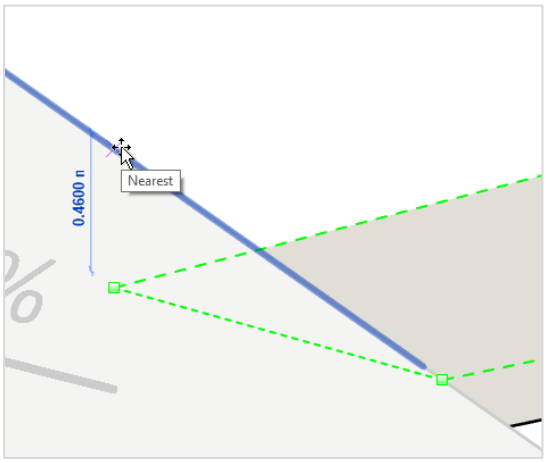
__Tip__: Use the '__TAB__' button to identify the __Floor__ you wish to annotate. Continue pressing 'TAB' until the system identifies the correct __Floor's__ points.

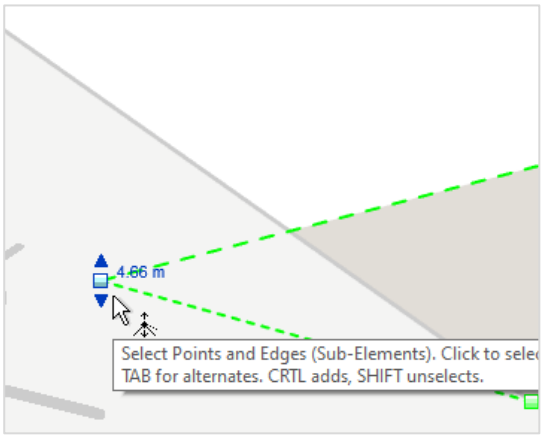
- Select the **Floor** and initiate the command for editing the points – **Modify Sub Elements.**



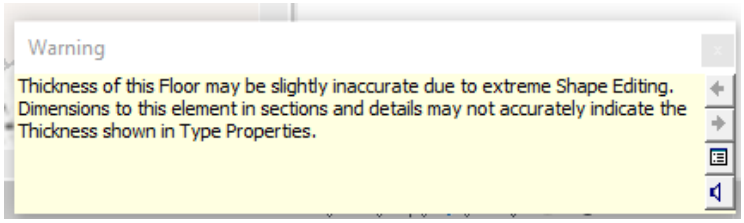
- We can change the height of the pathway by selecting each point and assigning them elevations or by switching to 3D and changing a point's elevation by selecting and dragging it using the arrows, until it attaches to the relevant **Floor** edge.



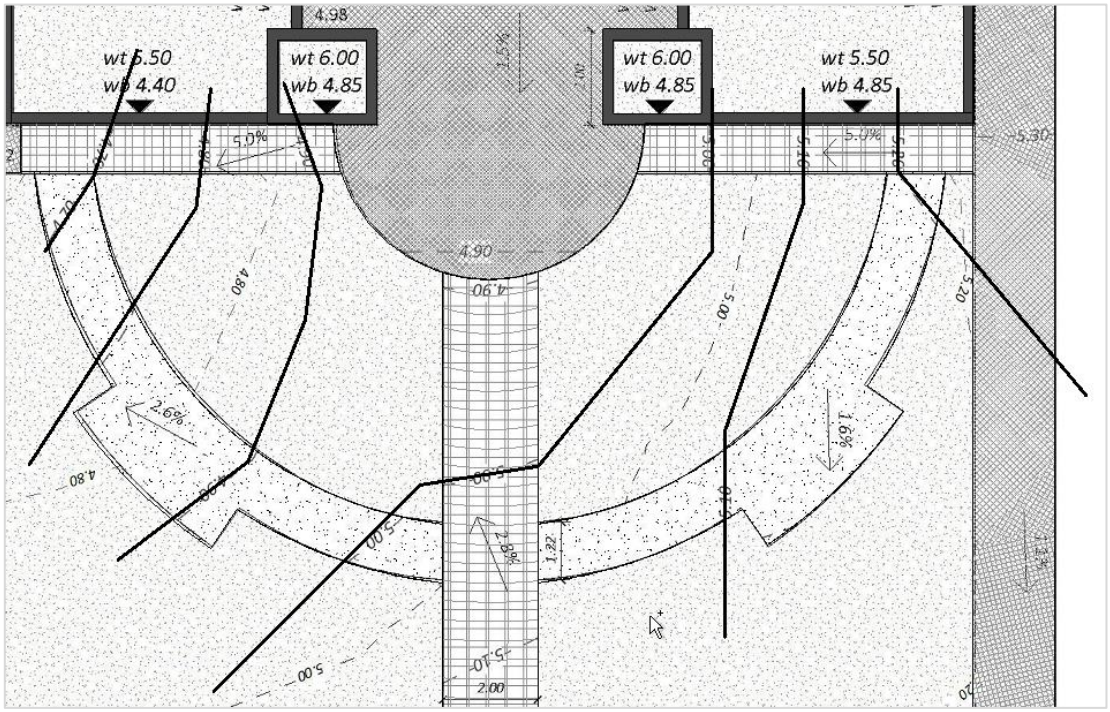




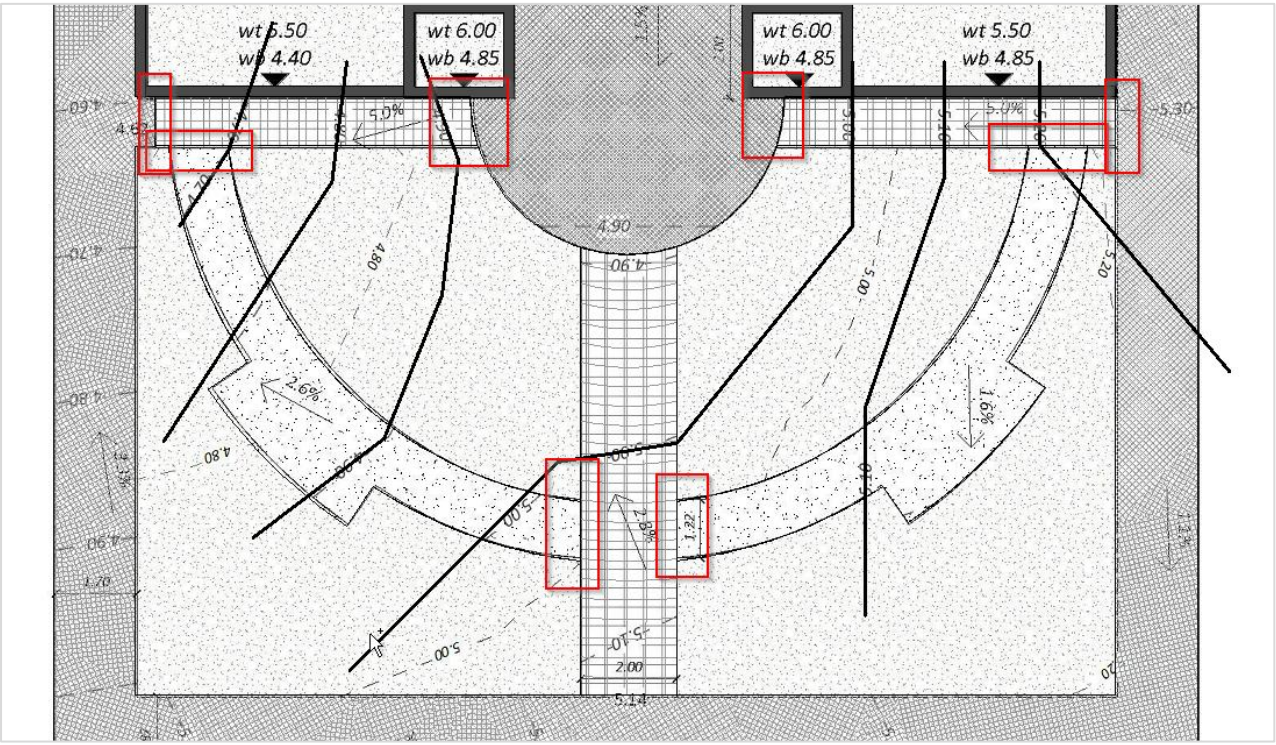
***Note**: When you set the elevation of the first point, Revit will display a warning that it has detected that the **Floor**'s slope is too steep. You can ignore this message, because the slope will work itself out once you set the elevations for all of the relevant points.*



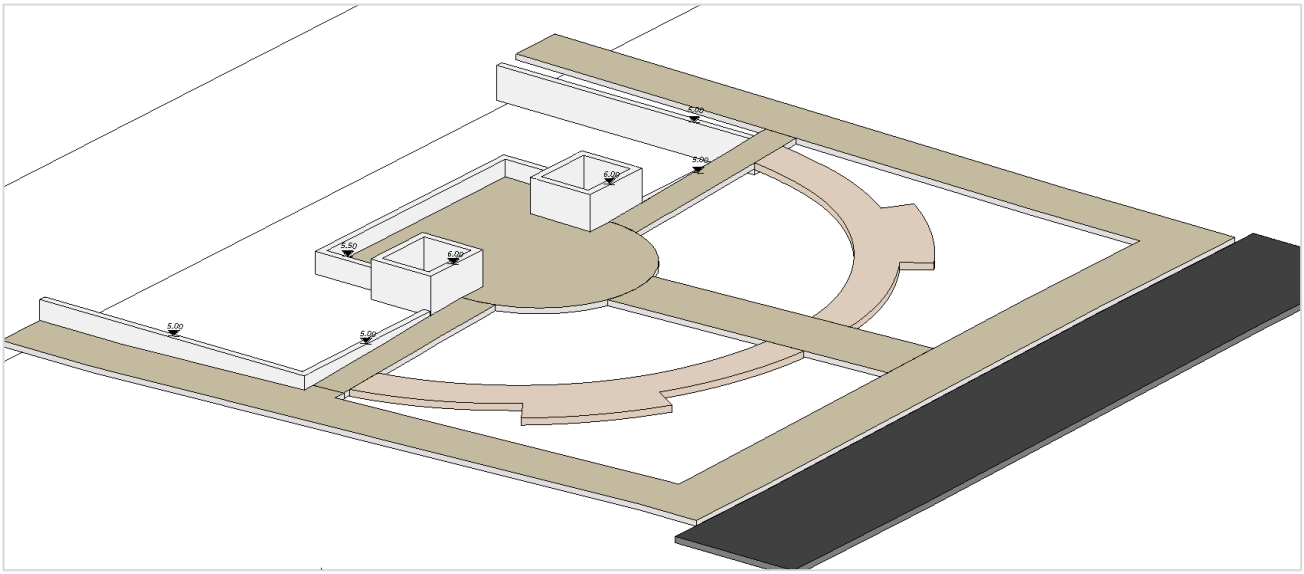
- To create a sloped **Floor** for the rounded paths in the plan, follow the first method we described of **creating a helper Toposurface and shaping the Floor on top of it**.
  Draw the **Model Lines** according to the following image and set the lines' elevations according to the plan.



- After shaping the **Floor** on top of the helper **Toposurface**, adjust the **Floor's** elevation points with the '**Modify Sub Element**' command, to connect it to the surrounding paths.



- Switch to 3D to **View** the end result with sloped **Floors**.

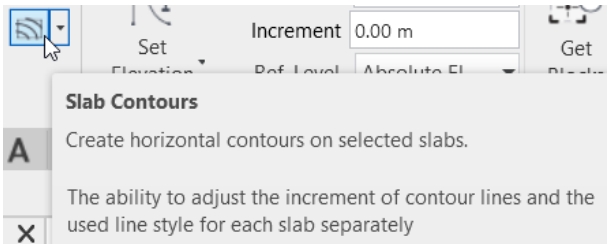


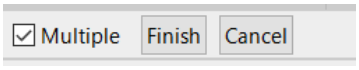
Part 4 – Floor contours, Floor patterns and secondary surfaces

Adding contour lines to the Floors:

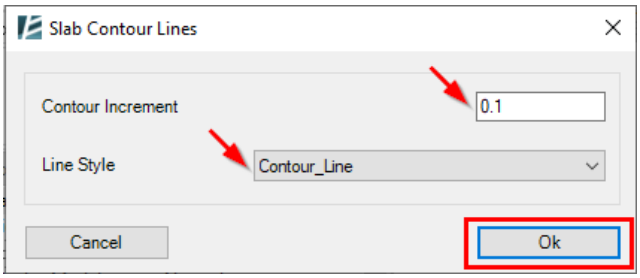
__Note__: In Revit, topographies can 'naturally' display their contour lines according to predefined settings. __Floors__, however, don't have this feature, so we use an __Environment__ feature to add smart __Model Lines__ to the __Floor__ face instead of contour lines.

- Select all of the **Floors** within the model and select the "**Slab Contours**" command (you may also click on the command first, and then select the **Floors** and click 'Finish').





- Define vertical distances / height intervals between the contour lines on the **Floors** and define line **Types**.



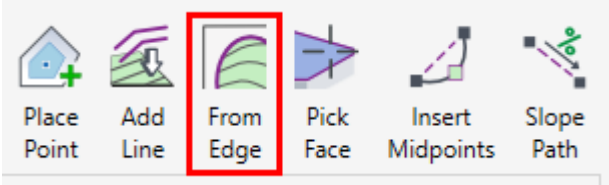
- Add contour elevation labels to the lines – Check Elevation

__Tip__: You can place elevation labels by manually selecting single lines or by drawing a line across a number of contour lines at once.

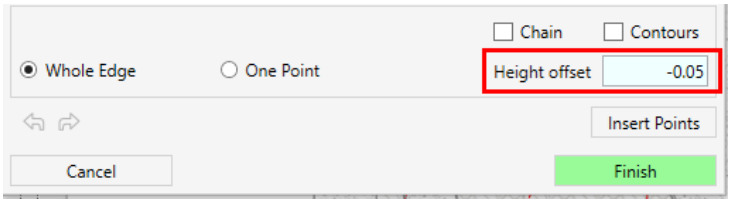
Secondary surfaces: Modeling the gardening areas with Toposurfaces.

- Switch to 3D **View**

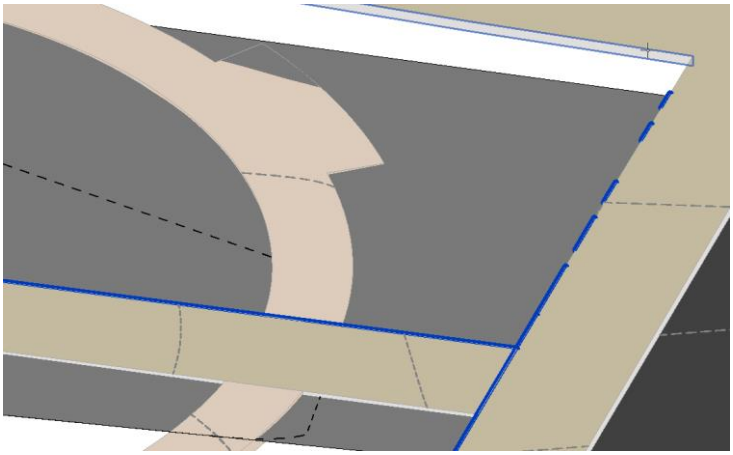
- Select the "**Topography Tools**" command and pick the '**From Edge**' tool to create a new topography.



- Define a **Height Offset** as indicated in the image to create a surface 5 cm below the pathway.

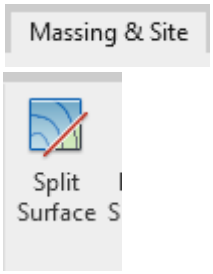


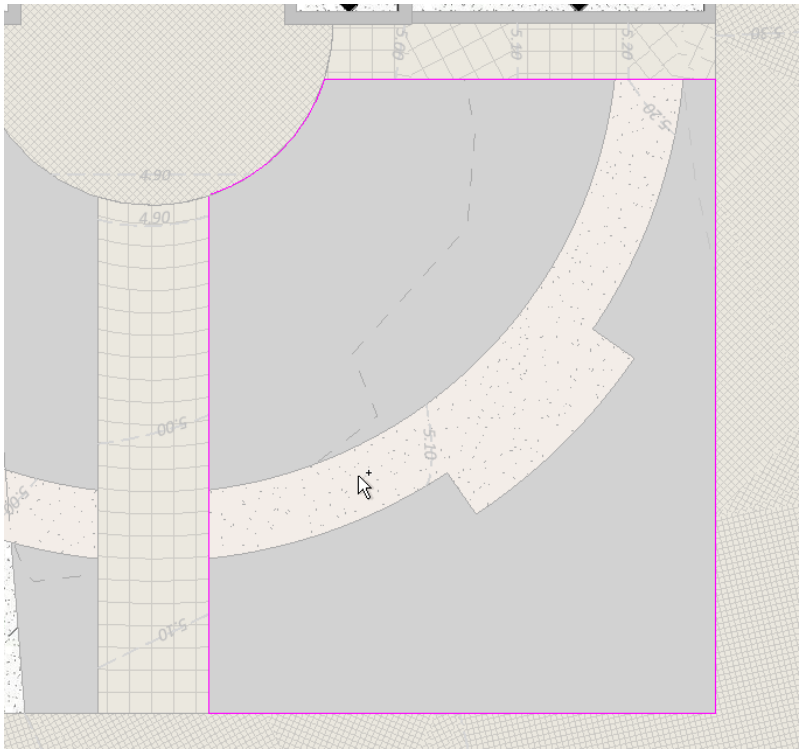
- Select the edges that you want to serve as the basis for creating the surface and execute the command. **You can unselect an edge by clicking on it a second time.**



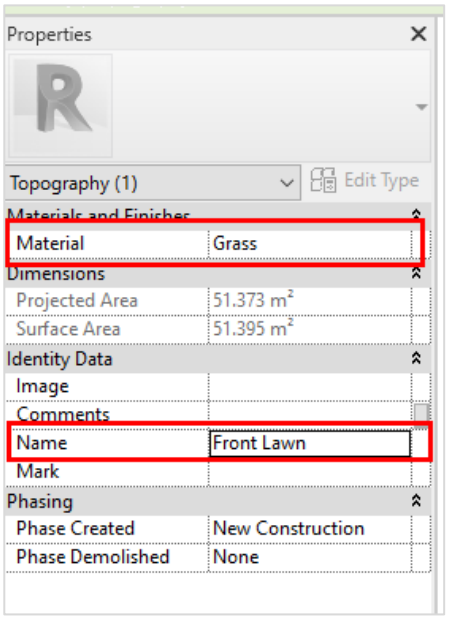
__Tip__: After we've selected all of the edges, we recommend enlarging the surface a little by selecting the '__One Point__' option and clicking on points outside the surface boundary. This will help simplify __splitting the topography__ later on.

- Switch to **Floor Plan** and split the topography based on the paths that define its boundaries.
- Select the **Split Surface** command and then select the topography.



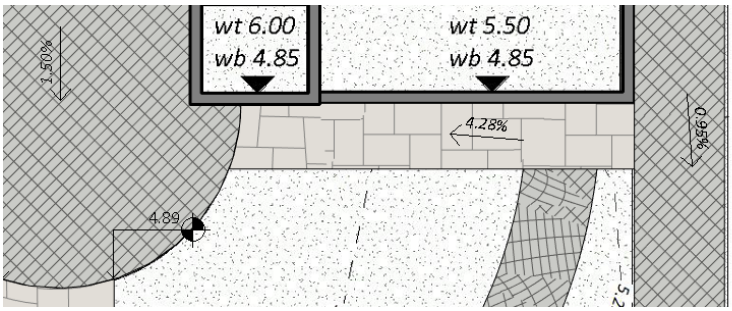


- Change the topography's 'Material' and 'Name'.



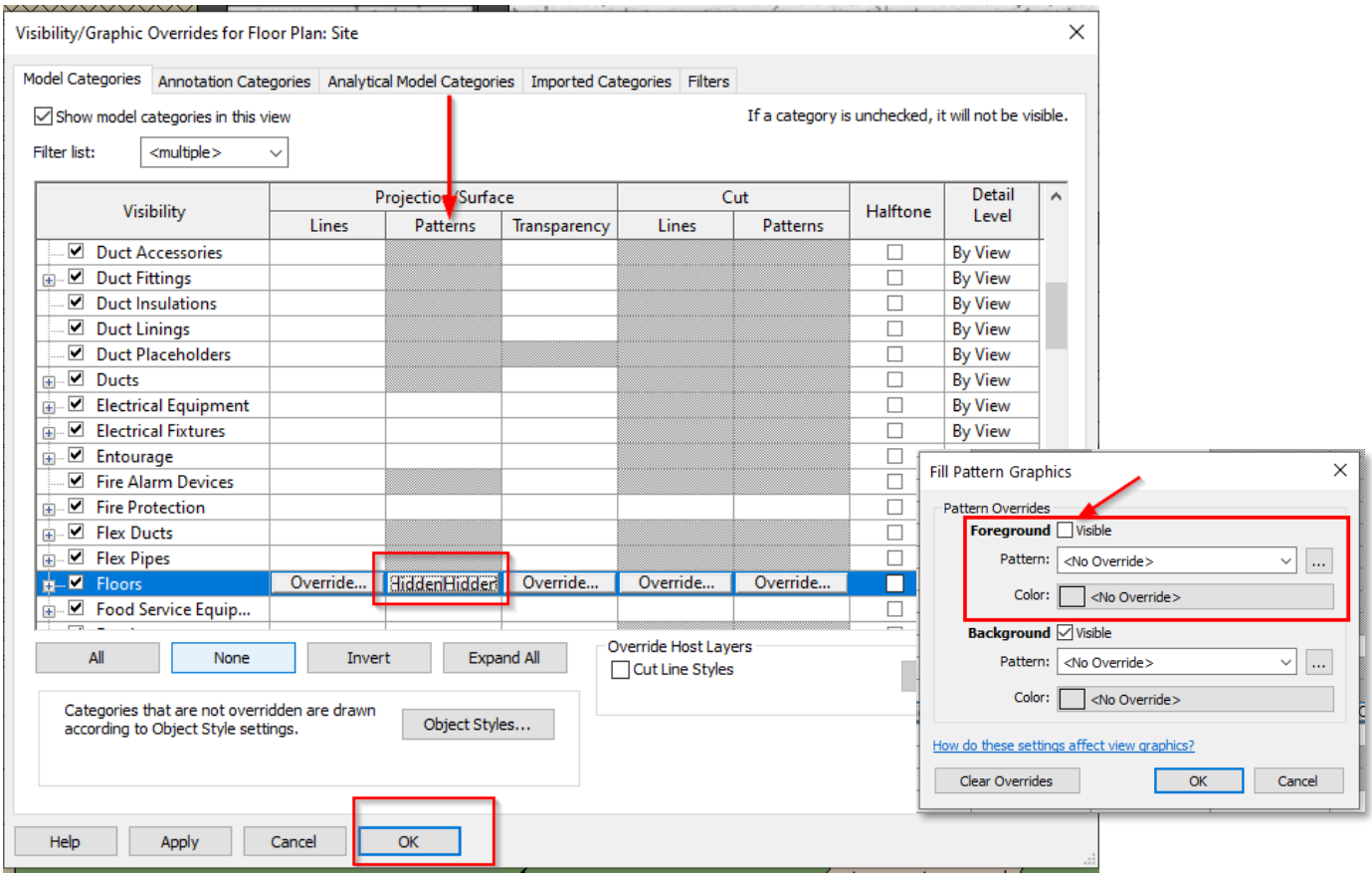
- Repeat these actions to create the project's western gardening area in the same manner.
- Switch to the **Site General Plan View**.

- Because the **Floors** are sloped, their texture might be displayed as distorted. To correct this – we'll turn off the **Floors**' top texture and, in this **View**, we'll create a two-dimensional texture that will cover the **Floors** and display a clean texture. **Pay attention** – **this solution applies only to the specific View in question.**

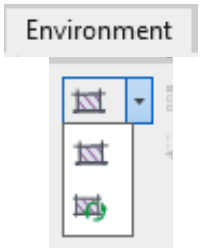


- In the "**Visibility Graphics**" window, turn off the "**Patterns**" property for all of the **Floors** in the **View**.

***Tip**: You can open the **Visibility Graphics** window by using the keyboard shortcut "**VG**".*



- Now we'll create a new Pattern using the **Object Outline** command in the **Environment** tab.

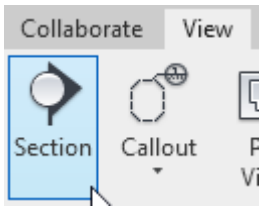


***Note:** Revit's '**Filled Region**' is a two-dimensional, **View** specific element. You can also create one via the Annotation ribbon, but the one you created using **Environment>Object Outline** will be **linked to the Floor** it was created from and will adapt as you edit the **Floor**'s boundaries.*
***Environment** creates a new '**Filled Region**' **Type** to cover the **Floorings**, but it behaves as a separate element from the **Floors**. This means that we can delete it at any time, without deleting the underlying **Floors**.*

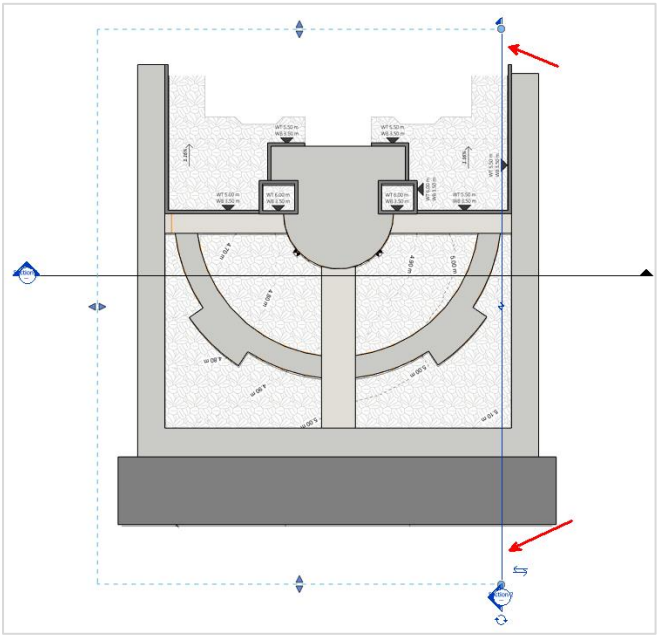
- Select all of the **Floors** and then select the command.

Part 5 – Creating a Section View and controlling topography appearance

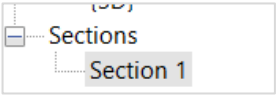
- Go to the **View** tab and click on **Section** to create a new section **View.**

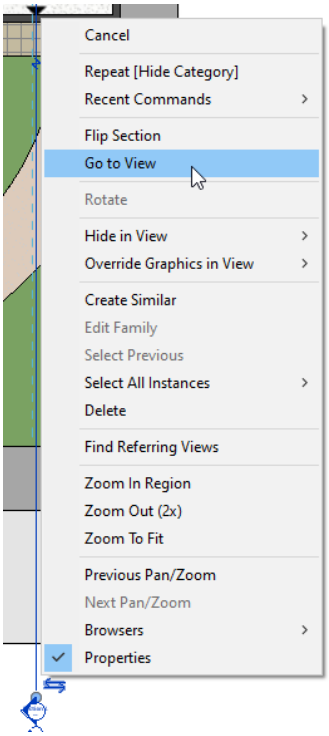


- Draw the new section **View** as follows:



- Switch to the "Section 02" **View** from the project browser, or by selecting the section symbol in the current **Floor Plan View**, right-clicking on it and selecting "**Go to View**".

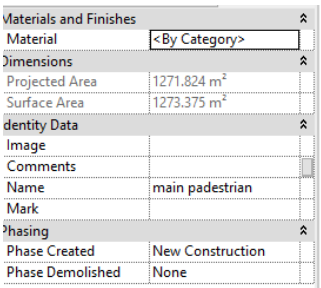


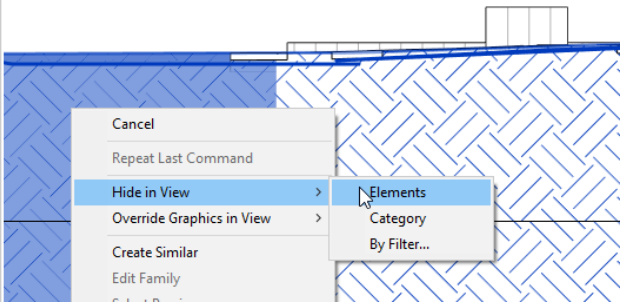


***Important**: When creating a new **Section** mark on a plan **View**, the Section View inherits its scale from the current **Floor Plan View**, thus the Section mark will not appear on plans with a scale greater than this. To change the appearance of a section symbol for larger scale **Views**, select the section and change the 'Hide at scale coarser than' Parameter.*

- In the section **View**, hide the project's helper surfaces and help lines.

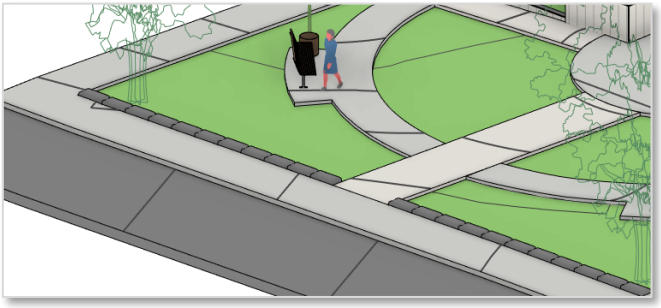
  You can identify a helper surface by selecting a surface and looking at its name in the Properties window. Then hide it in this **View**:

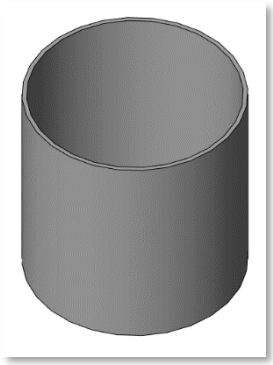


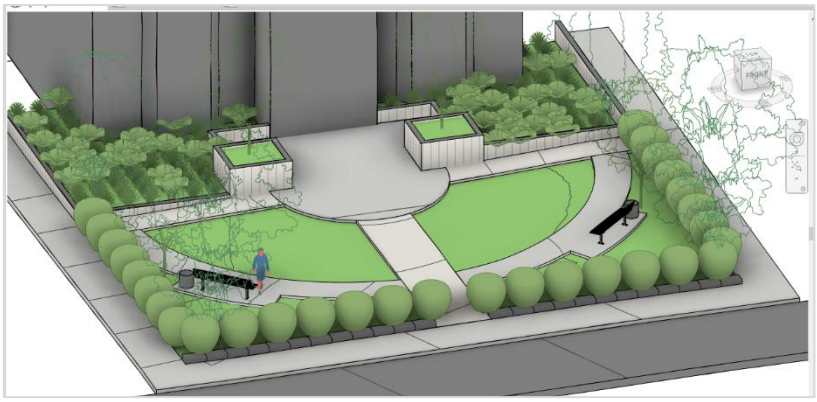


***Tip**: At this point, the topography in this section **View** appears a lot deeper than the planned elevation. We can change this by opening the "**Site Settings**" window in the "**Massing and Site**" ribbon and changing the '**Elevation of poche base**' parameter.*

Module 4 – Placing and Creating Families







Module 4 – Placing and Creating Families

Part 1 – Adding Families to your model

- Adding **Families** to a model - **Component**
- The **Types** of each **Family**
- Placing a **Family** on a surface – **Host surface**
- Adding new **Families** to a file – **Load Family**
- Placement angle – using the space bar
- Editing a **Family** – **Edit Family**
- Changing the level of detail in a **View** – **Detail Level**

Part 2 – Creating a new Family

- Creating a new **Family** – **Metric Generic Model**
- Setting a **Category** to a new **Family**
- The **Family** workspace
- Modeling a **Family** - **Extrusion**
- Loading a **Family** to a file
- Changing a **Family's** or a **Type's** name through **Project Browser**
- Loading a Revit **Family** from Autodesk libraries
- Getting to know **Family** download sites

Part 3 –Scattering elements based on predefined parameters

- Adding a rockery **Family** – **Rockery Element**
- Arranging a line of rocks – **Array**
- Scattering a row of bushes – **Line Scatter**
- Attaching element elevations to surfaces – **Align to Surface**
- Scattering a group of plants in an area – **Area Scatter**

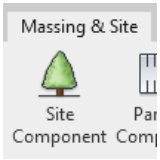
Exercise 4

Part 1 – Adding Families to your model

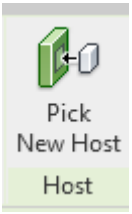
Component → Components are all Revit **Families** with a defined 3D or 2D geometry that are used for purposes of building and representation in our project.

Placing trees in the model and importing new Families

- Open the Module 04_Ex 01 file, and switch to the **Site General Plan View**.
- Add a new tree **Family** from the **Massing & Site** menu or the **Architecture > Component** menu.

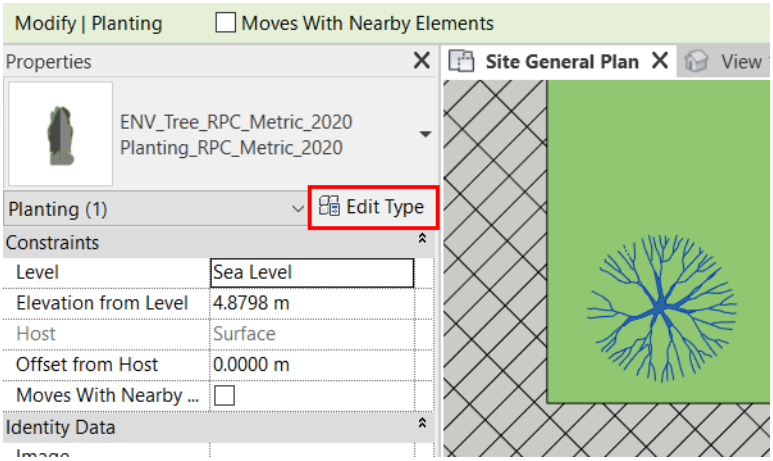


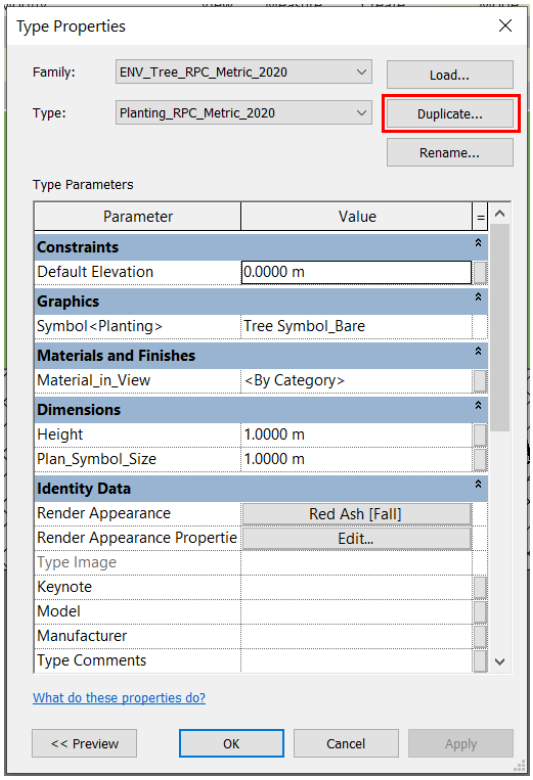
***Tip**: When placing a component in a model, Revit will automatically assign it the height of the surface on which we placed the element. This property is called "**Host**", i.e., the hosting element. We can change the newly added element's host by selecting it and clicking on "**Pick New Host**".*



***Tip:** We recommend browsing through the various tree **Families** within the file – what parameters does each **Family** make available and how does each **Family** look in different **Views** and in different visual styles.*

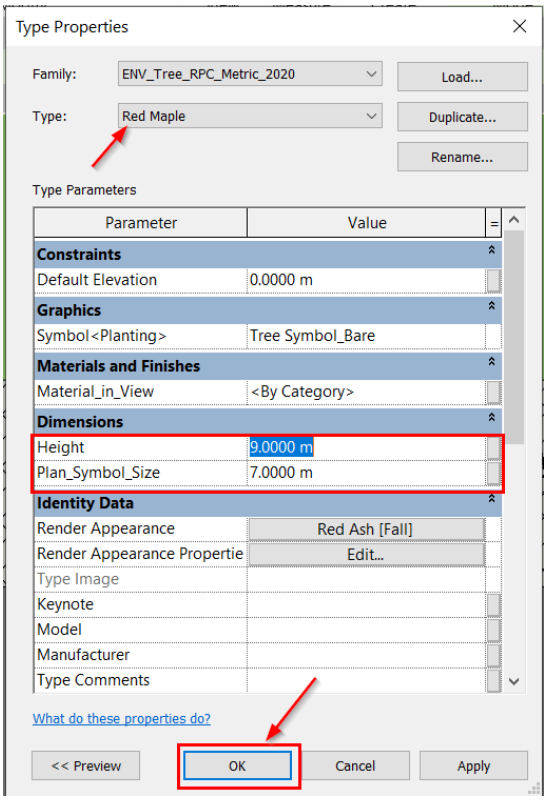
- Create a new **Type** of tree: select the tree component and click on the "**Edit Type**" button to open the **Type Properties** window. Within the window, select the **Duplicate** option.



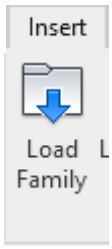


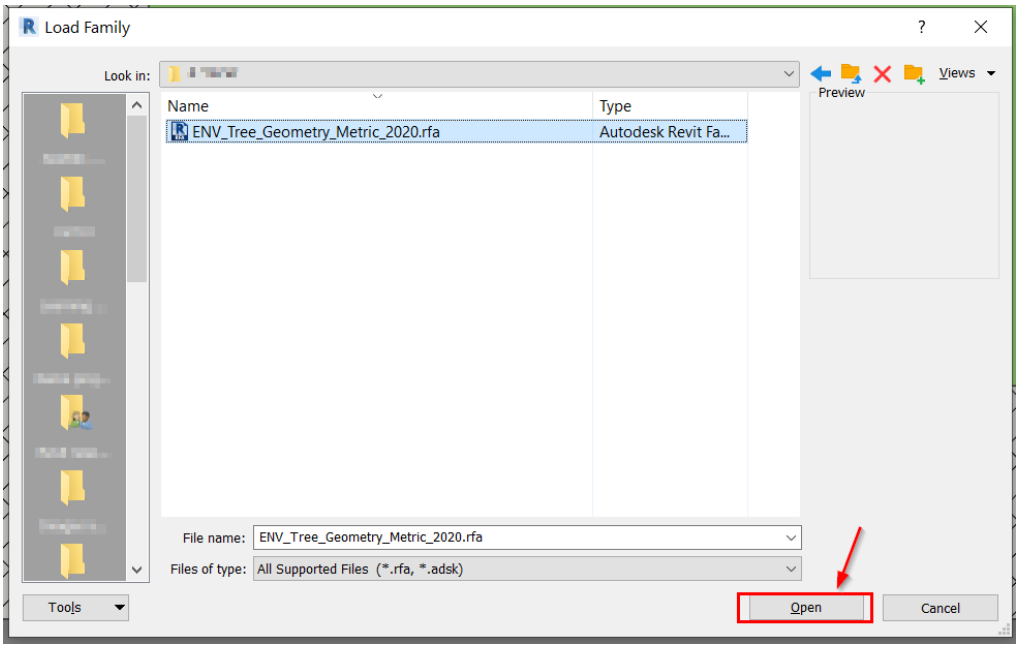
- Give the new **Type** a name and change the height of the tree and it's radius ("Plan Symbol Size").

Tip**: the height parameter is a built-in parameter for the planting Category. Other parameters, such as '**Plan Symbol Size**', depend on the creator of the specific **Family.



- Next, go to the Insert tab and click on **Load Family** to add a new **Family** of trees to the file. Browse to select the following **Family** from the Module 04 folder. This **Family** presents different graphics and properties.

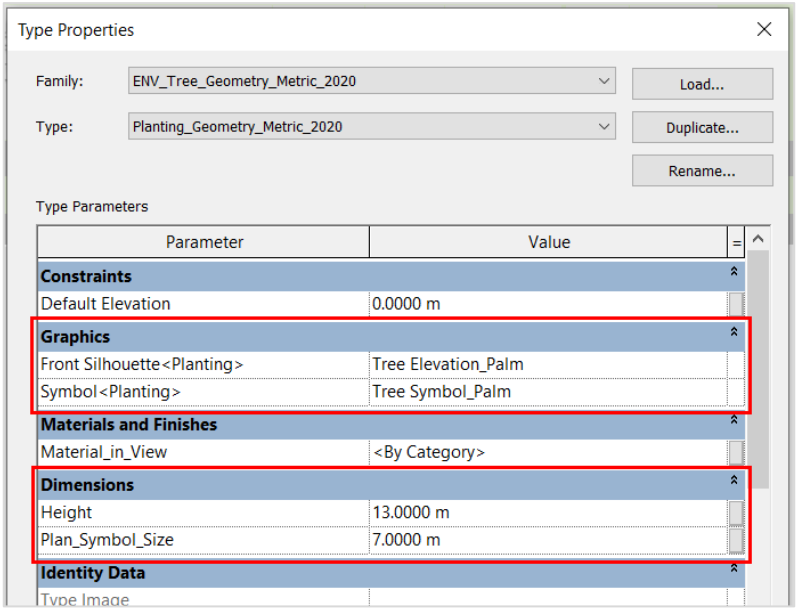




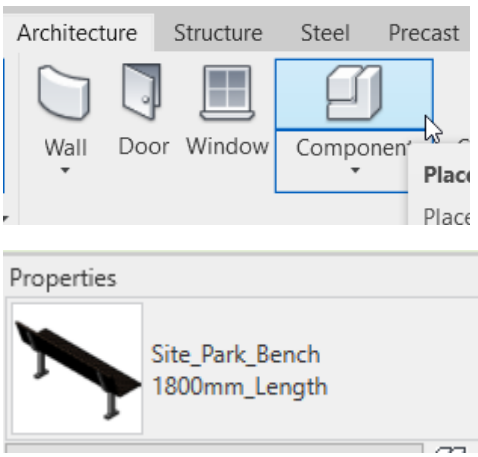
- To place the new **Family** within your model, click on the '**Site Component**' menu from the **Massing and Site** ribbon, and select the **Family** from the list above the **Properties** palette.

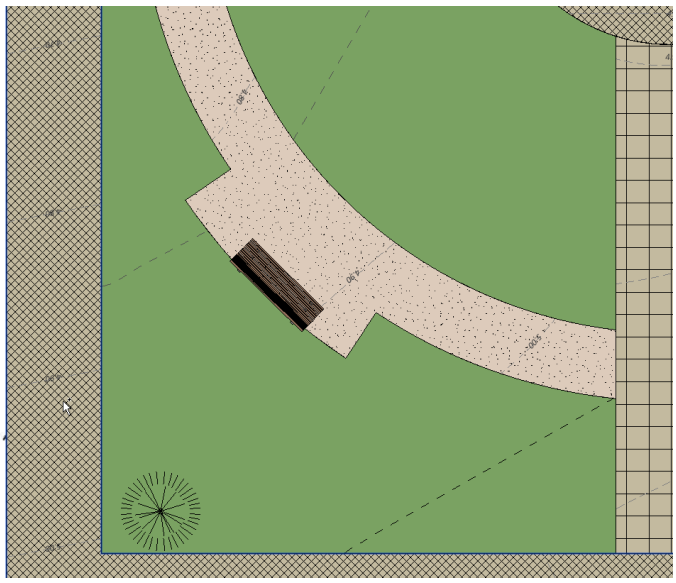
- Now we'll create a new **Type**, similarly to the way we created a new **Floor Type** – Click on "**Edit Type**", select "**Duplicate**" in the **Type Properties** window, and change the following parameters:

*Note: This **Family** has additional parameters that can be changed, because whomever created the **Family** decided to make these parameters changeable variables.*



- Next, create a number of additional tree **Types** in the same way, and place them in your model as you see fit.
- Arrange benches and trees within the model using the **Architecture** > **Component** command.

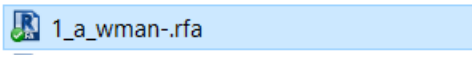




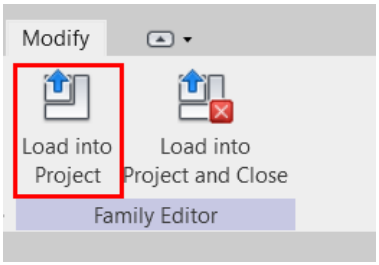
***Tip**: To position components based on a guiding line within the model, select the **Family** you want to insert and hover over the edge or line without clicking on it. Press the **spacebar** a number of times to turn the component in the correct direction.*

Loading people Families into the model

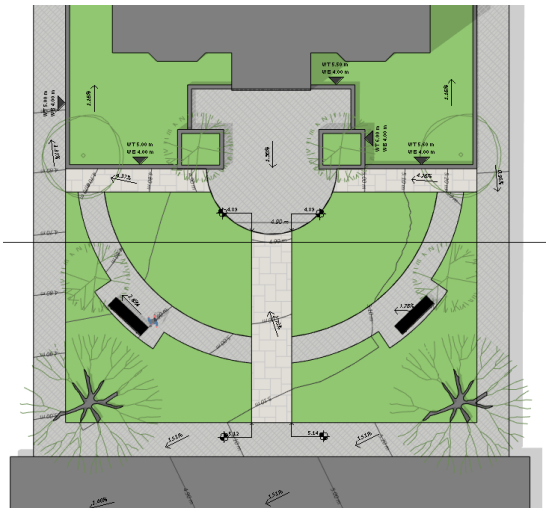
- Open this lesson's folder and find the following **Family**. Open the **Family** by double clicking it:

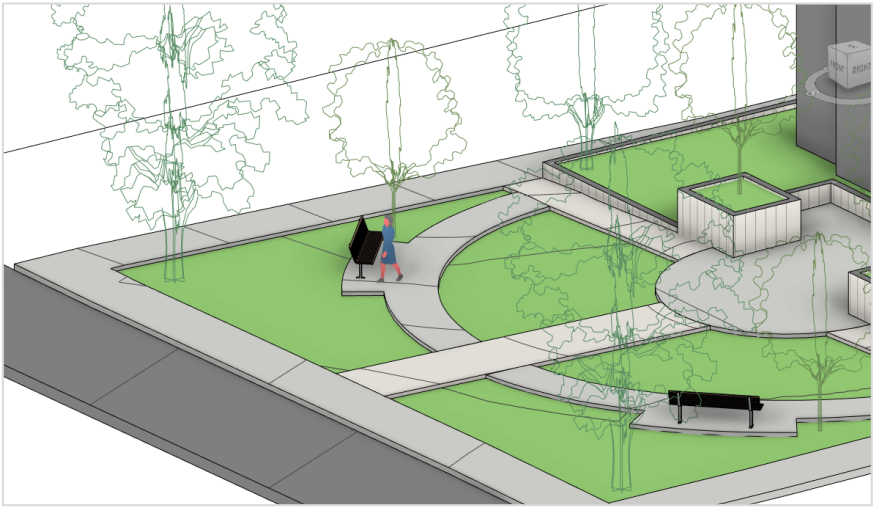


*Please notice that a Revit '**Family**' file has been opened, and not a '**Project**' file. You can see that this is the case by the fact that the toolbar and the tools within are different than those we see when opening a project.*

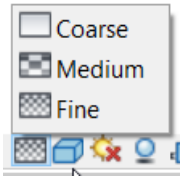


- To load this **Family** into the file, click on "**Load into Project**".
- Now we'll select the project into which we wish to add the **Family**, and we'll place the people in the desired **View**.





__Tip__: On the bottom toolbar next to "__Visual Style__", you will find a button named "__Detail Level__". Certain __Family__ elements will be displayed differently when we change the __View's__ level of detail. How an element will respond when different levels of detail are applied, is, again, up to the element's creator.

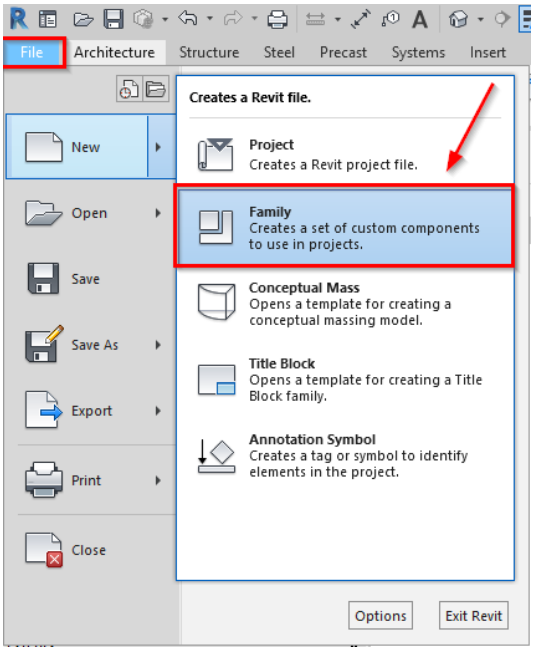


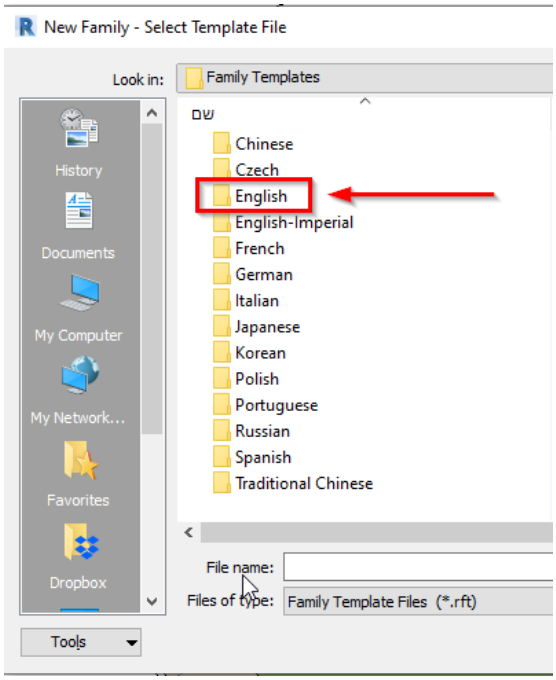
Part 2 – Creating a new Family

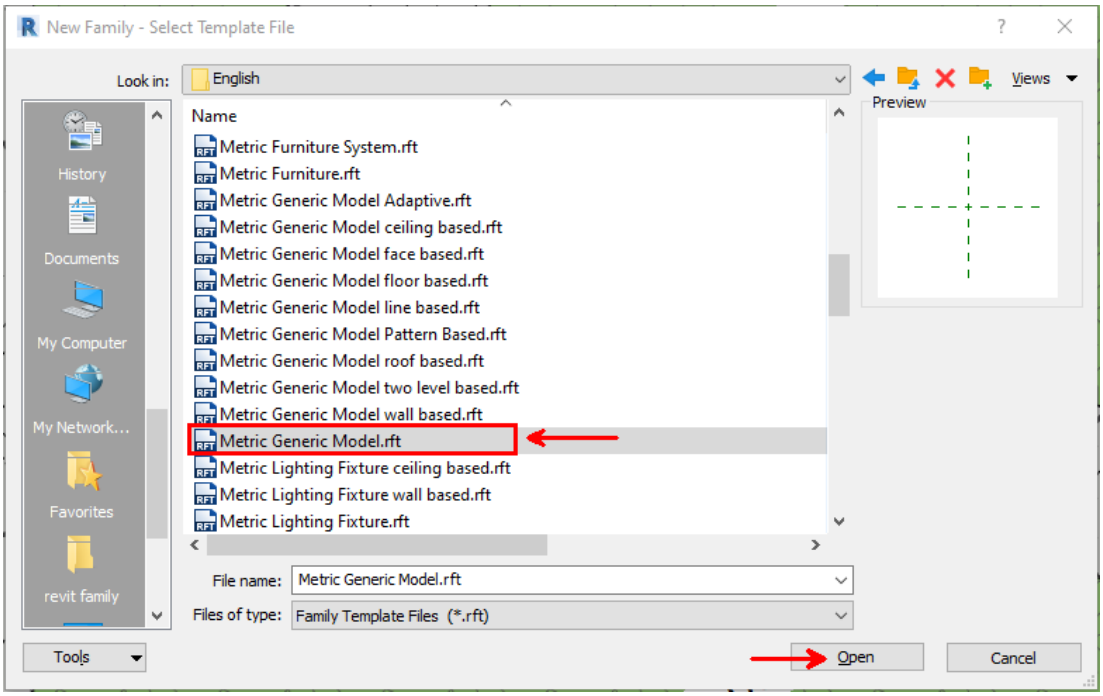
Opening a new Family- Generic Model

***Attention**: There are quite a few **Types** of **Families** you can create, and the topic is worthy of a course of its own. In this course we'll learn a few basic actions to familiarize ourselves with the topic and that will provide us with the flexibility to work with other **Families** in the future.*

- Open a new file of **Type Family** (".rfa" file extension).
- Select the appropriate **Template** from Revit's default lists - *Metric Generic Model*

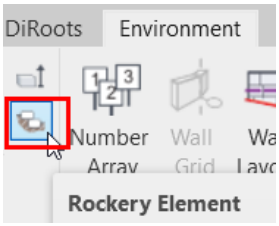




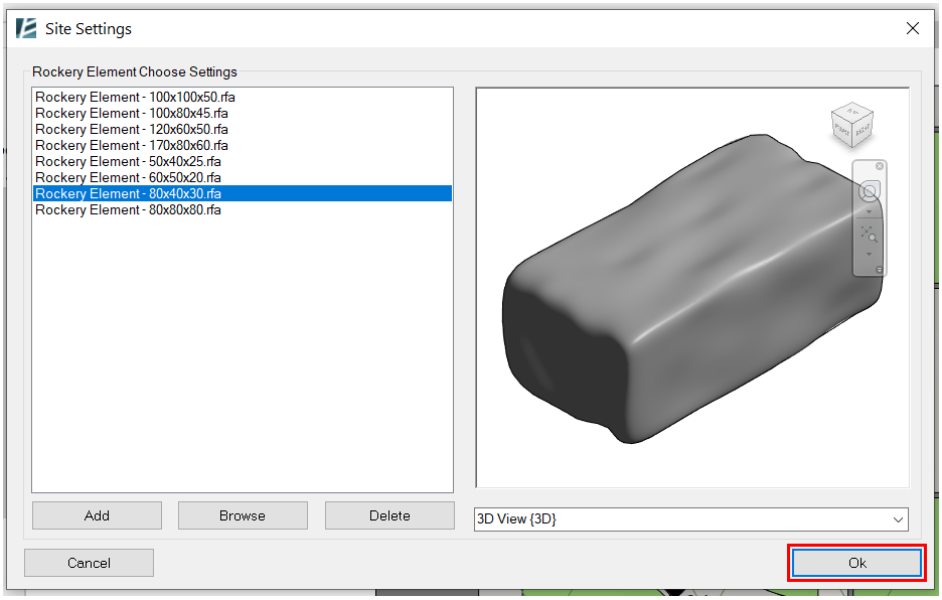


Part 3 – Placing elements in the model: Array and Scatter

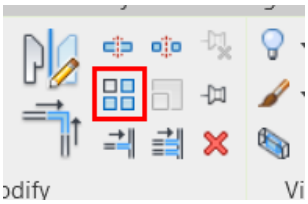
Placing a row of rocks using the Array command

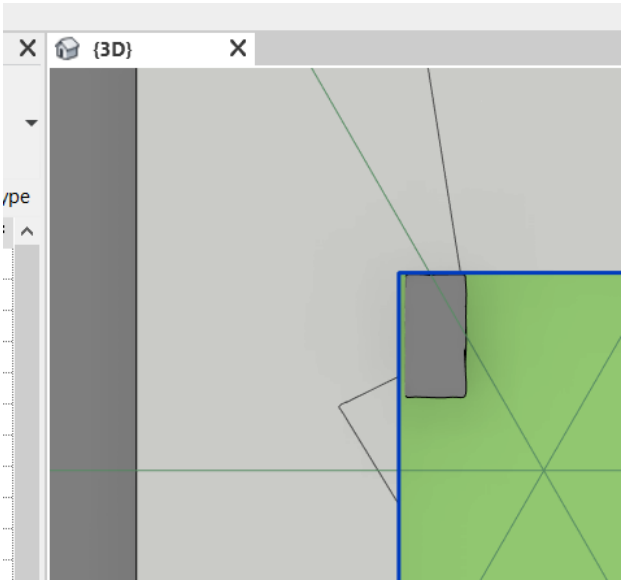


- On the **Environment** tab, select the **Rockery Element** command in order to import a **Family** of rocks into the model.
- Select one of the rock **Types** and import it into the model.



- Lay the first rock in the corner nearest to the road, select it, and click on the Array command (before placing the rock on the topography, hover over the sidewalk's edge and use the spacebar to align the rock with the pathway).



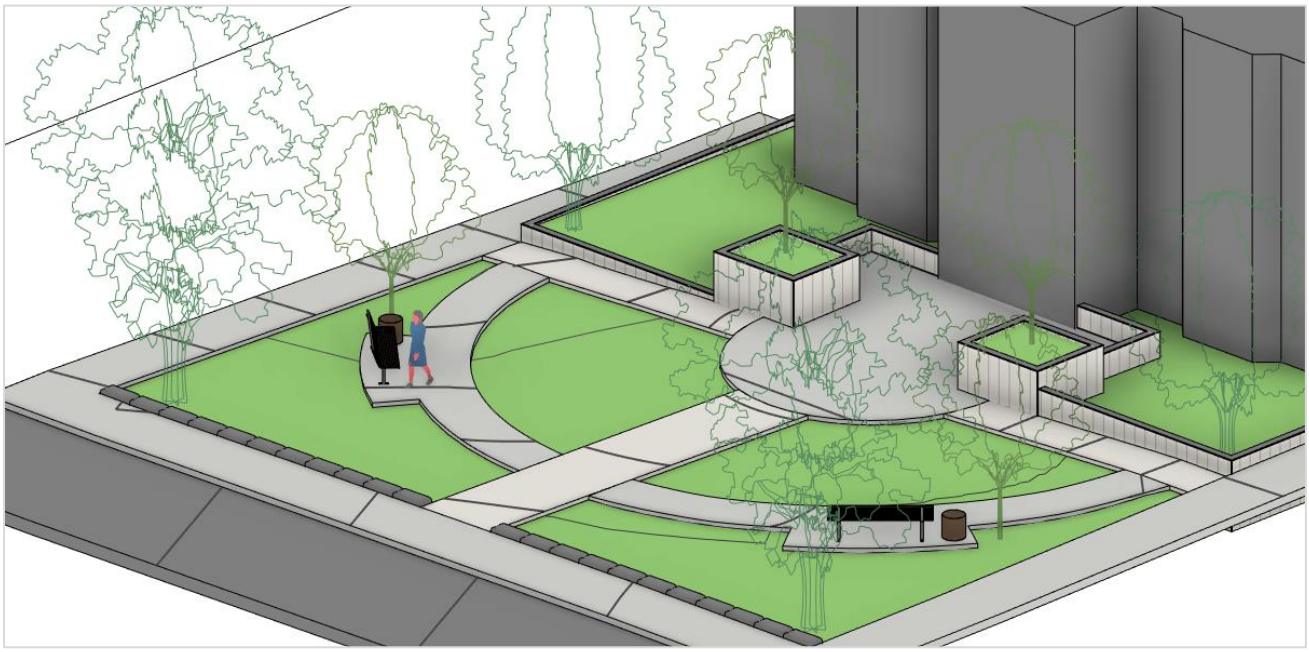


- Use the following settings and create the row of rocks.

- Next, click once at the edge of the first rock and click again at the edge of your planned row of rocks to set the desired row length.

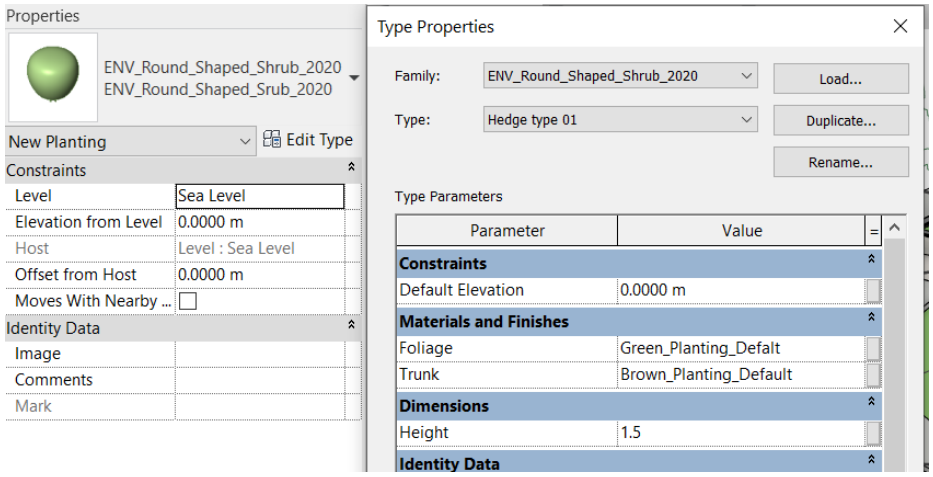
***Tip**: We can also use Group and Associate to edit the number of rocks in the group after exiting the command.*

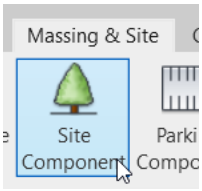
- Repeat this process to create an identical row of rocks on the other side of the pathway.

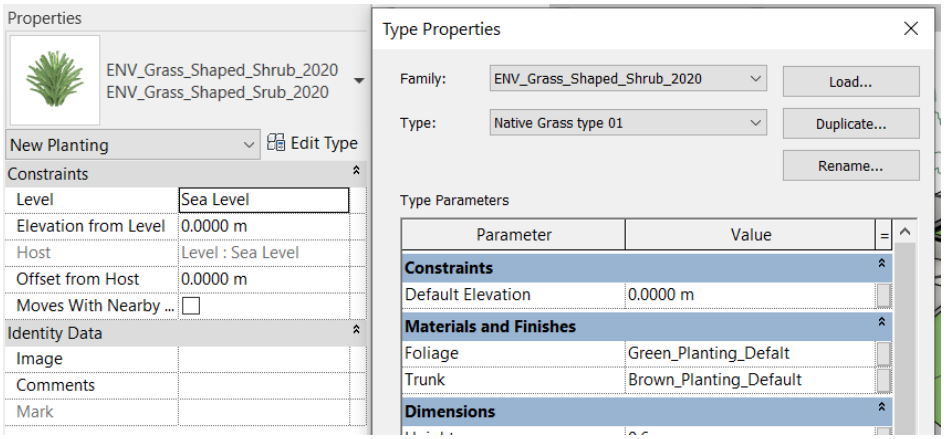


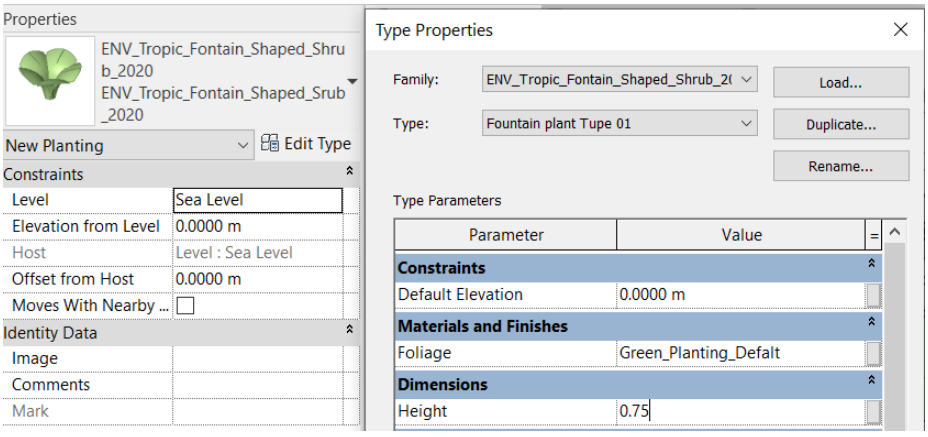
Modeling a row of shrubs using Line Scatter on the Environment tab

- Select a **Family** of bushes and create three different **Types** of vegetation.

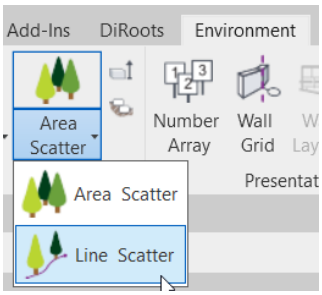




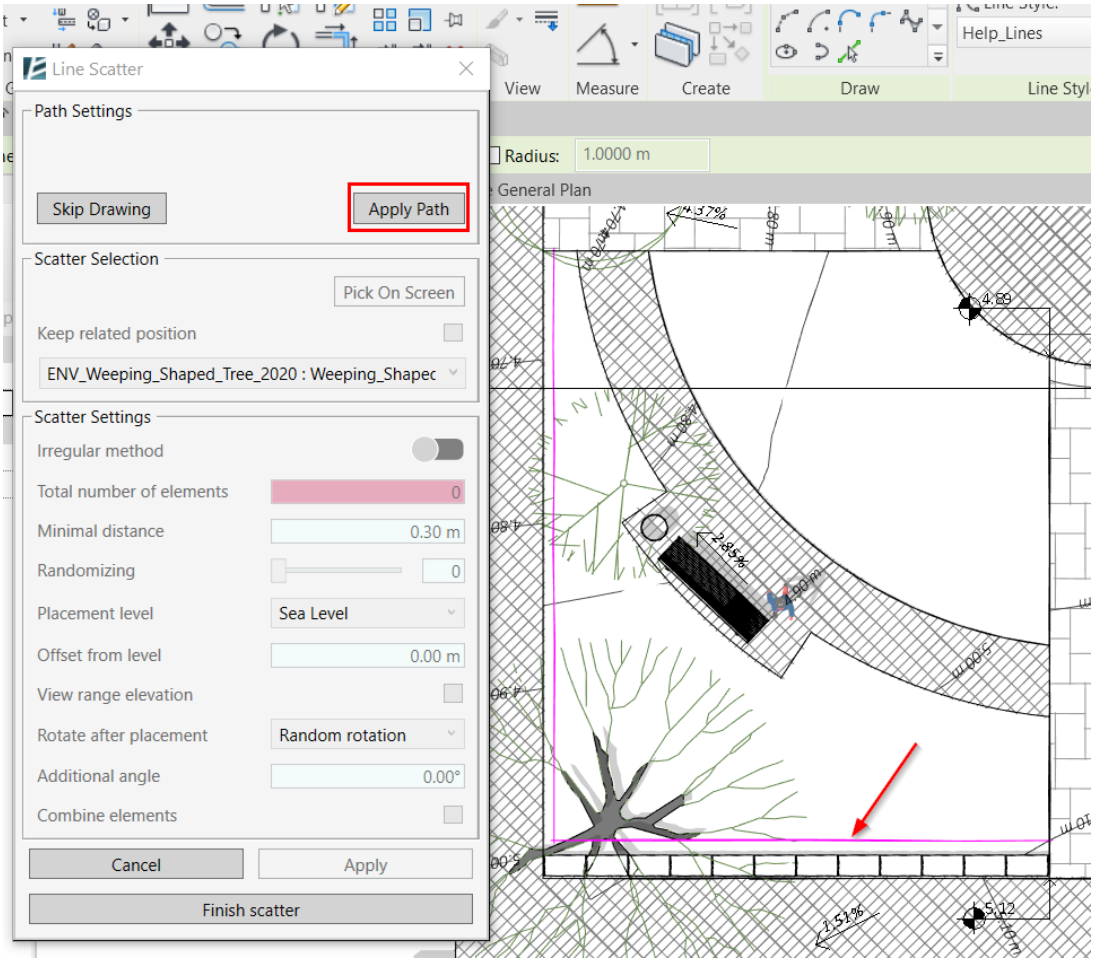




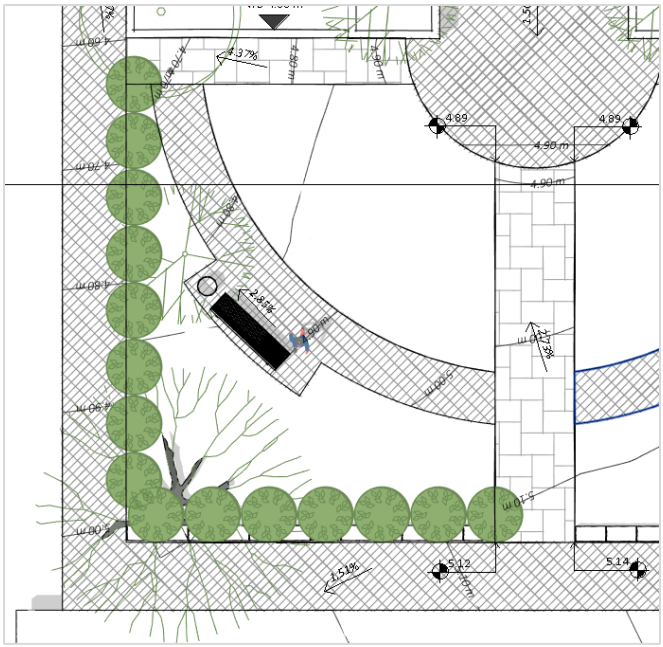
- Switch to the 'Site General Plan' and select the **Line Scatter** command on the **Environment** tab.

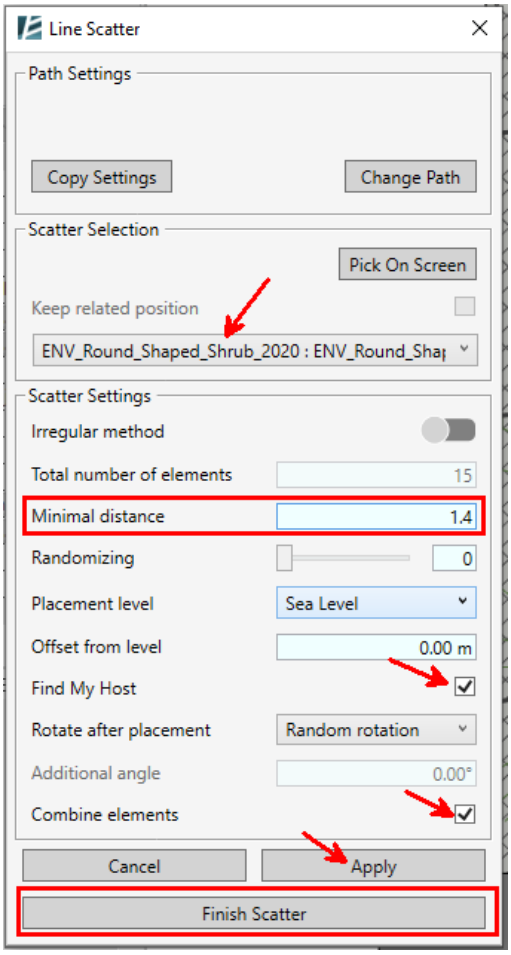


- This displays a window in which we will select "**Draw Path**" and draw a continuous path on which to position the bushes.
- After completing the sketching, click on **Apply Path**

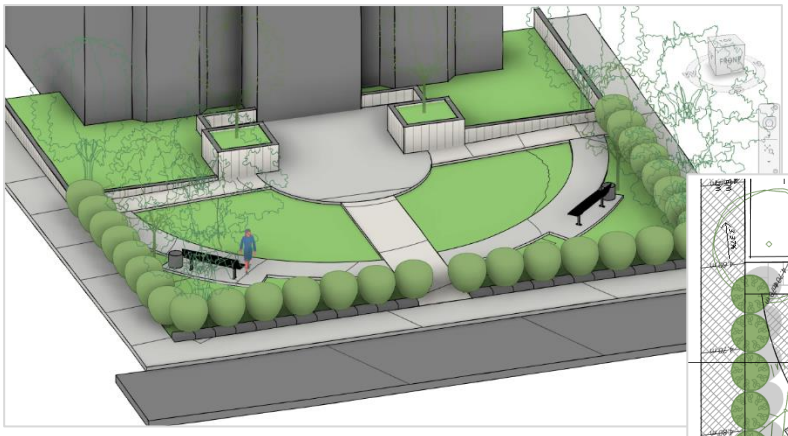


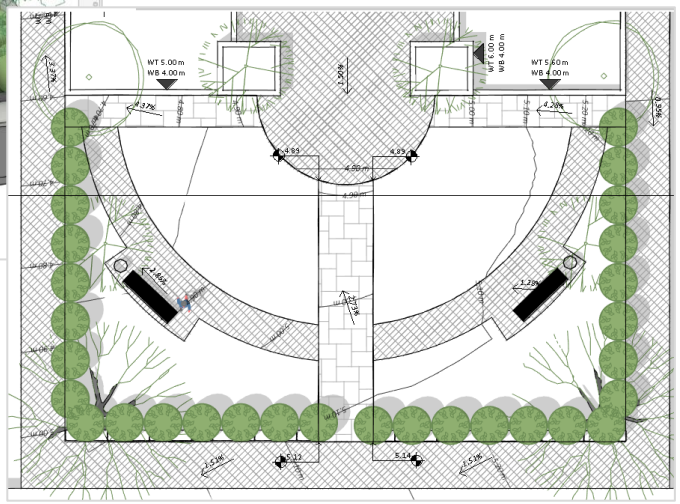
- Select the desired **Type** and enter placement settings.





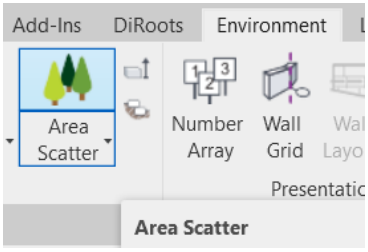
- Arrange a similar row of bushes on the other side of the path.



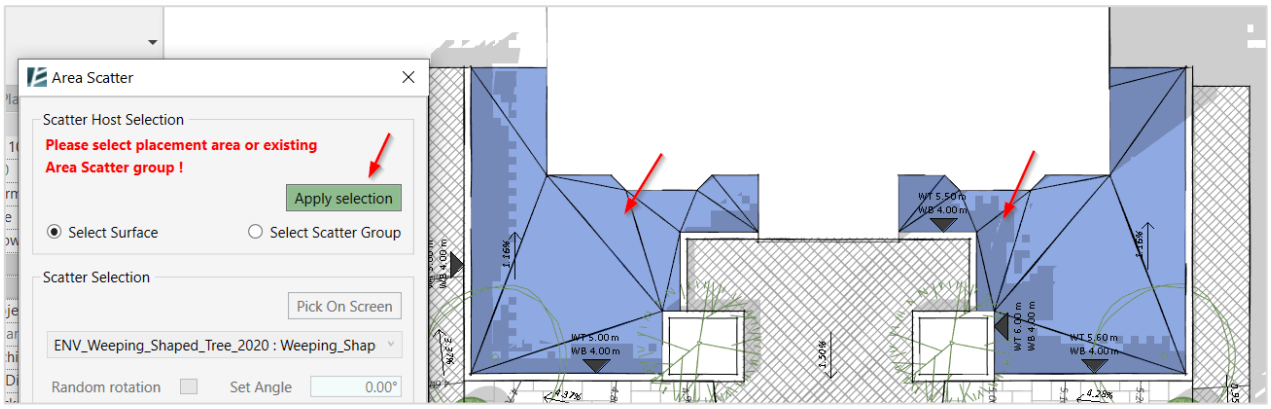


Modeling groups of mixed vegetation using Area Scatter

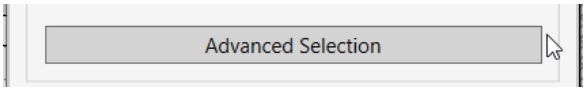
- Select the **Area Scatter** command under the **Environment** Tab.

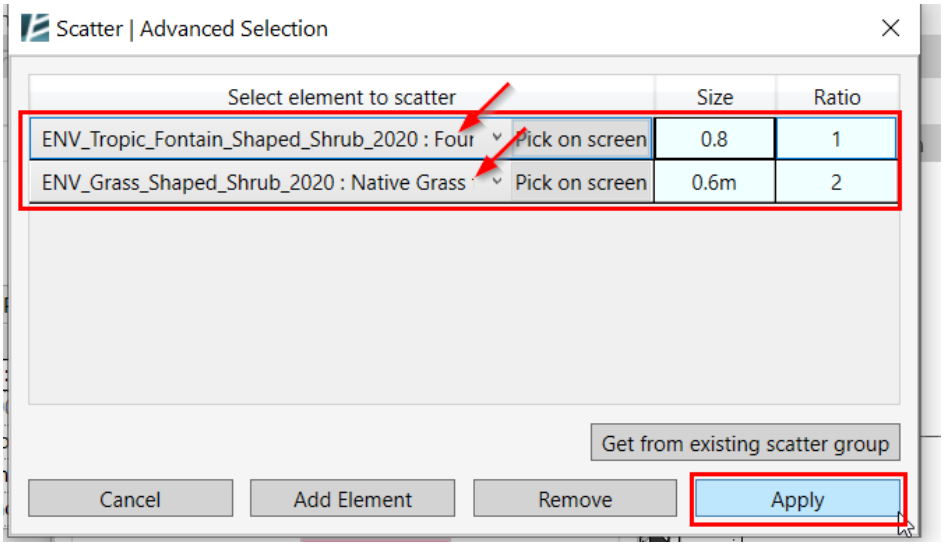


- Next, select any surface to set the surface on which to scatter the elements.
  You may choose any surface to be used as the area for the scatter command.



- Create a mix of elements.





- Define the placement of the elements in an orderly grid.

- Continue to scatter vegetation and additional elements as you see fit.