GIS POD Analysis Workflow (Part II)

Part II of the GIS workflow uses the POD point layer created in Part I to run a regional analysis in an Area of Interest (AOI) (e.g., watershed). Once an AOI has been established, the workflow outlines a series of steps to identify and correct erroneous POD locations, resulting in a more accurate POD dataset for the AOI.

For Part II you will need to add the following layers to the GIS map template in addition to those added for Part 1:
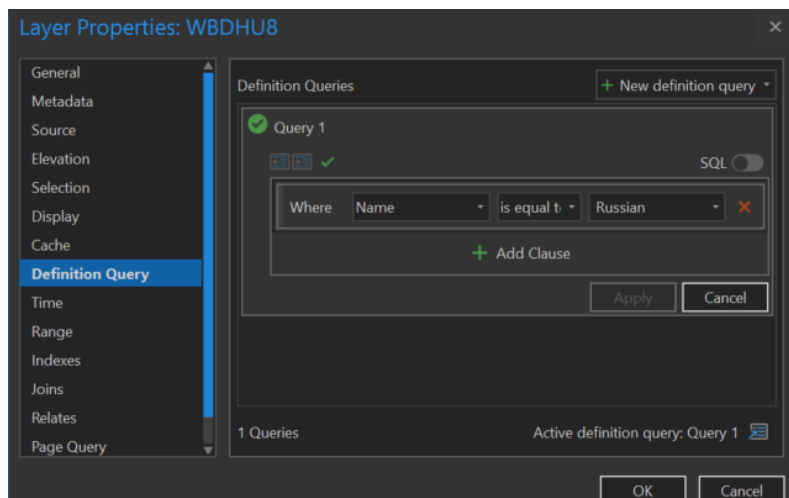
NHD watershed Boundaries
NHD Catchments from you AOI region (usually downloaded by HUC 4)
NHDplusEROMMA table

All NHD Plus HR Data can be downloaded at: TNM Download v2 (nationalmap.gov) using Basin or sub-basin HUC Numbers

1. **Designate your Area of Interest (AOI)**
   As an example, we chose the Russian River Watershed by right clicking on the HUC 8 layer > properties > definition query > new definition query:

Alternatively, you could define the definition query as: WHERE 'HUC8' = 18010110

Because both MTRS (Meridian, Township, Range, Section) and Latitude/Longitude are regularly entered incorrectly in eWRIMS, we will plot the PODS using both fields, and identify all POD points that are associated with our AOI using the following conditions

   a) WHERE the FFMTRS field in the Statewide POD layer matches the MTRS field in the RR_Section_Intersect layer (The concatenated MTRS field listed in the flat file matches the MTRS field of the PLSS Section layer.)
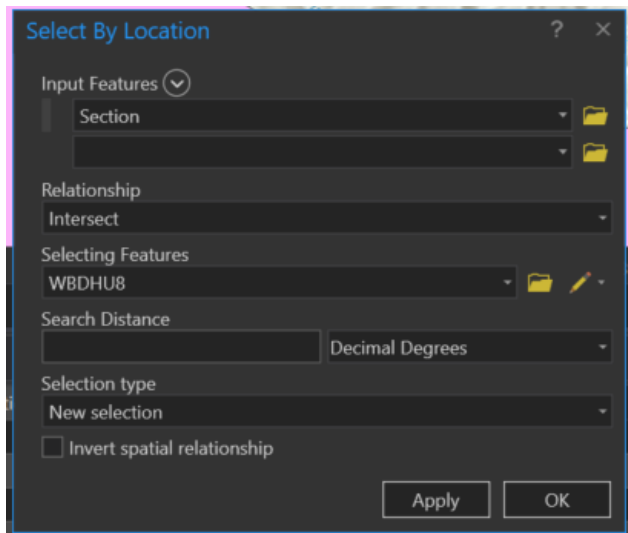
   OR

b) WHERE the MTRS field in the Statewide POD layer matches the MTRS field in the RR_Section_Intersect layer. (The MTRS Field the POD point falls on matches the MTRS field of the PLSS Section layer.)

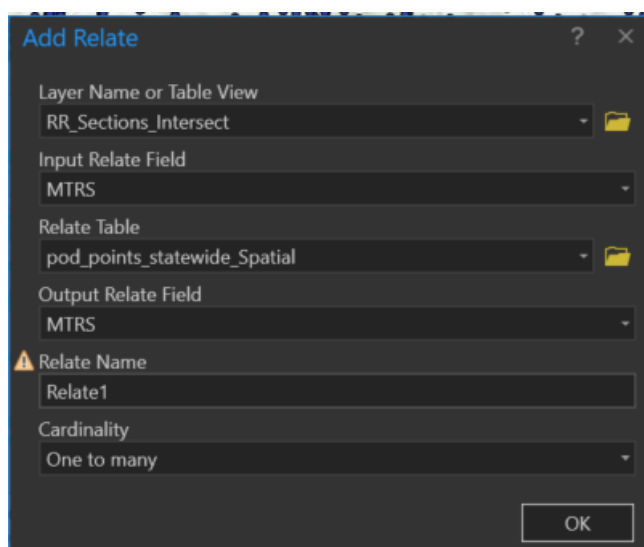We can then identify and correct all erroneous POD points for our AOI

2. **Create a Subset of PLSS Sections that intersect the** HUC8
Select the PLSS Section layer by location as shown below. Create a new layer from this selection and name it RR_Section_Intersect (Note, in this example RR in the file names stands for Russian River and you may want to use a different naming convention for files associated with your AOI)
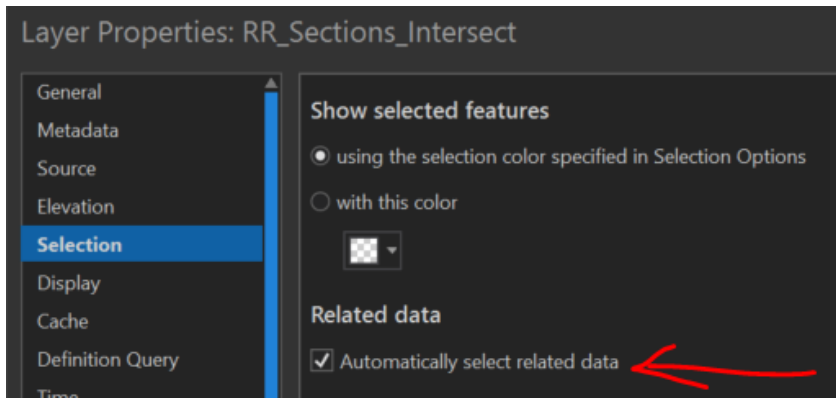

3. **Create a "Relate" between the PLSS Subset and the pod_points_statewide_Spatial Layer**
Right click the RR_Section_Intersect layer in the contents pane > Joins and Relates > New Relate. Assign the related tables and fields as shown below. Make sure the cardinality is set to "One to Many"

One of the powers of the "Relate" tool in ArcGIS is the ability to select features in other layers based upon the relationship defined in the related tables. Right click on the RR_Section_Intersect layer in the contents pane > properties > Selection > Check the box to Automatically Select Related data

4. **Select POD Points WHERE the MTRS field in the pod_points_statewide_Spatial layer matches the MTRS field in the RR_Section_Intersect layer.**

   Open the attribute table and Select all Polygons in the RR_Section_Intersect layer. Because we opted to automatically select related data in step 3, all the related POD points will also be selected. Right click on the Statewide POD Layer > Selection > make new layer from selection. Name this new layer RR_pod_points_MTRS_relate. **CLEAR ALL SELECTIONS!**
   **Note: we could have just plotted all the points that intersect RR_Section_Intersect layer but it would return the same subset of POD Points as this method

5. **Select POD Points WHERE the FFMTRS field in the Statewide POD layer matches the MTRS field in the RR_Section_Intersect layer**
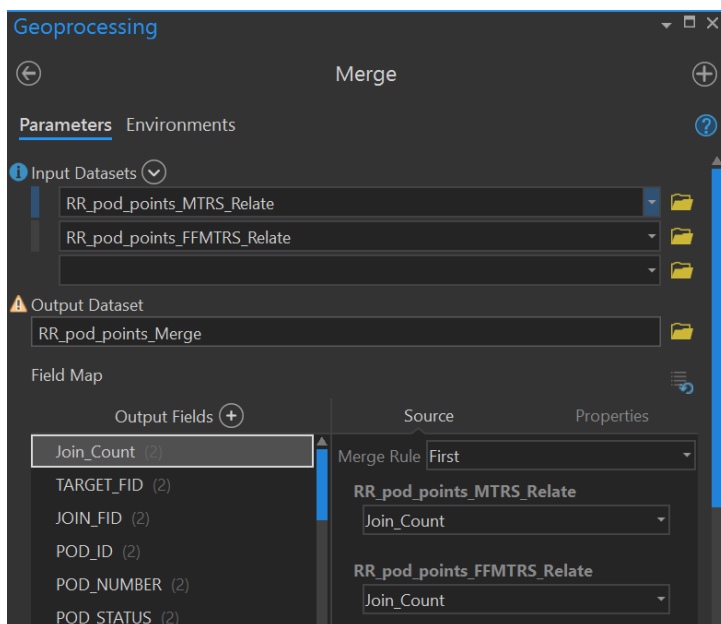
   Right click on the Statewide POD layer > Joins and Relates > Remove all Relates
   Right click again on the Statewide POD layer > Joins and Relates > Add Relates, Create a Relate just as we did in Step 3. However, this time choose the "FF_MTRS" field as the Output Related Field.
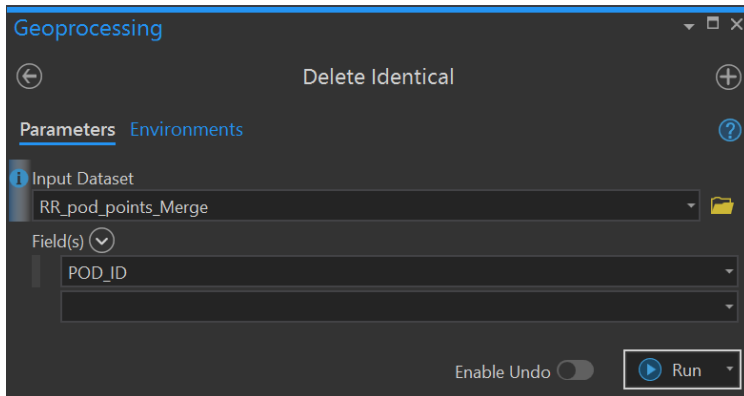
   Open the attribute table and Select all Polygons in the RR_Section_Intersect layer. Because we opted to automatically select related data in step 3, all the related POD points will also be selected. Right click on the Statewide POD Layer > Selection > make new layer from selection. Name this new layer RR_pod_points_FFMTRS_relate **CLEAR ALL SELECTIONS!**

6. **Merge both Layers created in steps 4&5 and delete duplicate records**
   Click on the Analysis Tab > Tools > Merge. Perform a Merge as shown below.

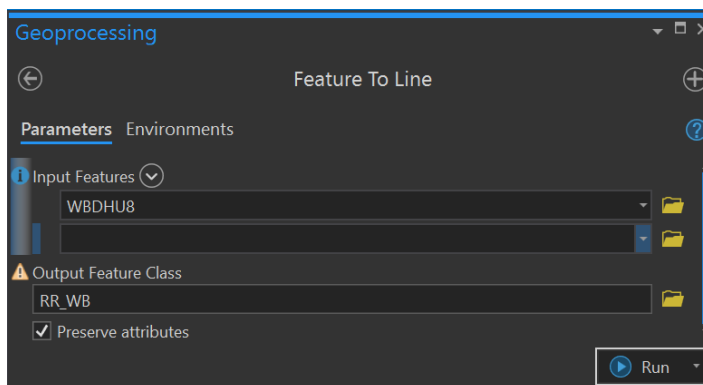Click on the Analysis Tab > Tools >Delete Identical. Perform a delete as shown below.

We now have all the POD points associated with our AOI using both the Lat/Long and MTRS fields in the POD Flat file. Our next step will be to systematically identify points we want to include or exclude from the dataset.

7. **Create an AOI PLSS section edge layer for use in Cases 1 & 2 in step 8**
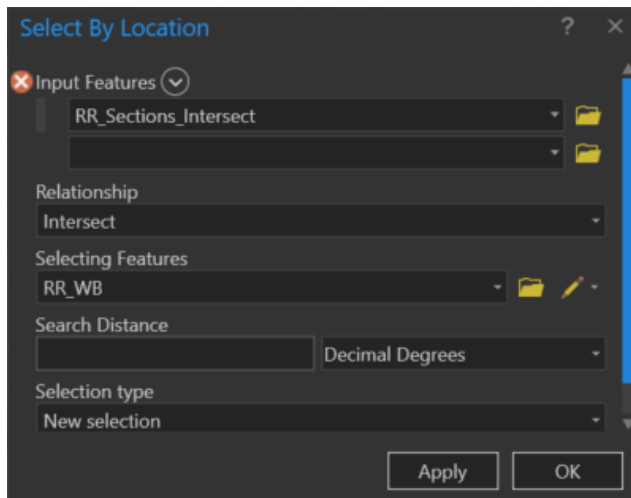   To Check the edge case scenarios (Cases 1 & 2 below) we need to select only the POD points that fall on the PLSS Sections that intersect the boundary of the AOI

   Click on the analysis Tab > tools > feature to Line and complete a feature conversion as shown below, naming the line representing the Russian River Watershed Boundary as "RR_WB"

   Select all PLSS Sections that intersect the RR_WB line.

Click the Map Tab > Select by Location and complete the selection as shown below:

Create a new layer from this selection and name it, "RR_Sections_RR_WB_Intersect"

To keep Track of the POD Points and cases we will check in step 8 as well as if/how the errors were corrected, we will add some columns to the RR_pod_points_Merge Table.

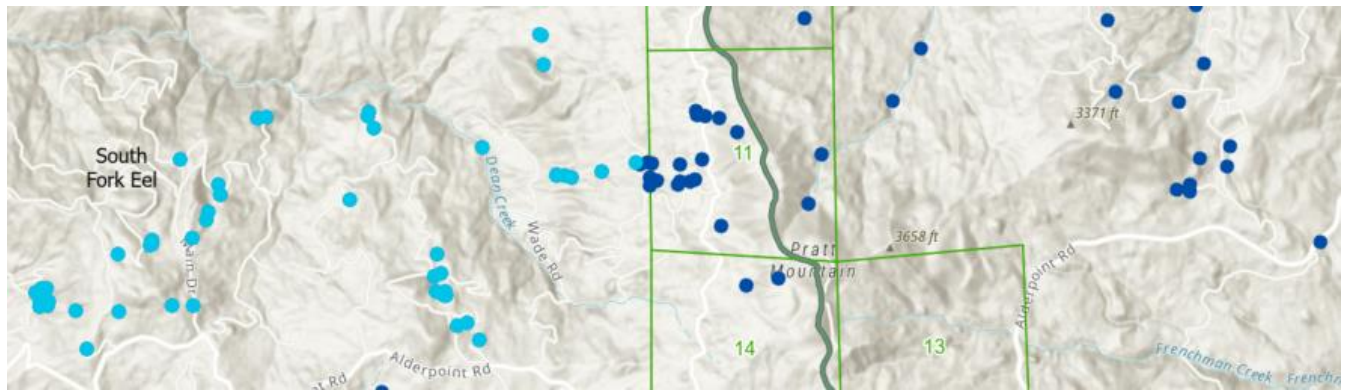Right click on the RR_pod_points_Merge table > Design > Fields and add 5 new fields as shown below:

Visible	Read Only	Field Name	Alias	Data Type	Allow NULL	Highlight	Number Format	Domain	Default	Length
✓	☐	Error_Case	Error_Case	Text	✓	☐				6
✓	☐	Error_Resolved	Error_Resolved	Text	✓	☐				255
✓	☐	New_Latitude	New_Latitude	Double	✓	☐				
✓	☐	New_Longitude	New_Longitude	Double	✓	☐				
✓	☐	New_MTRS	New_MTRS	Text	✓	☐				255

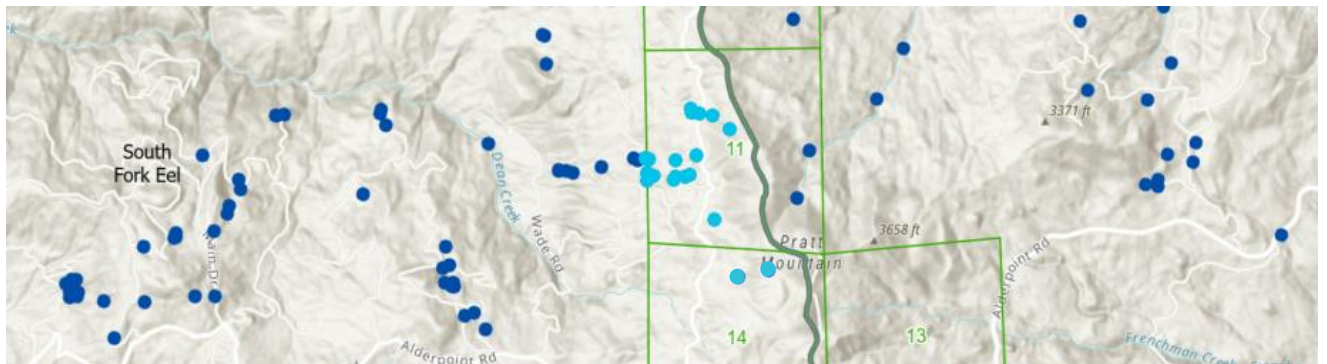We will use these new fields to track any spatial corrections made.

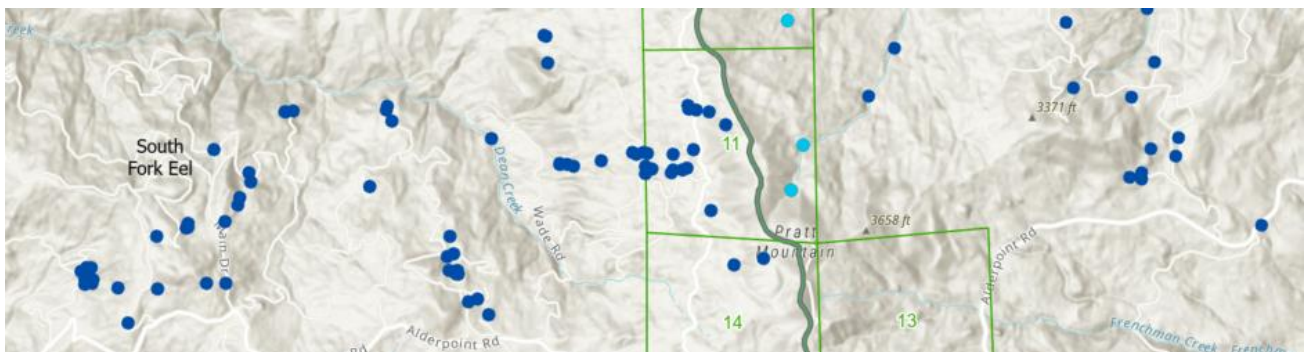8. **Correct erroneous POD points using the following Cases (see case examples from the SF Eel below)**

a. **Case 0:** If a POD point lies within our AOI And MTRS_Match = Y and the POD is NOT near the edge (intersecting the "RR_Sections_RR_WB_Intersect" layer) of our AOI, then we can be reasonably certain we want to include it in our dataset.
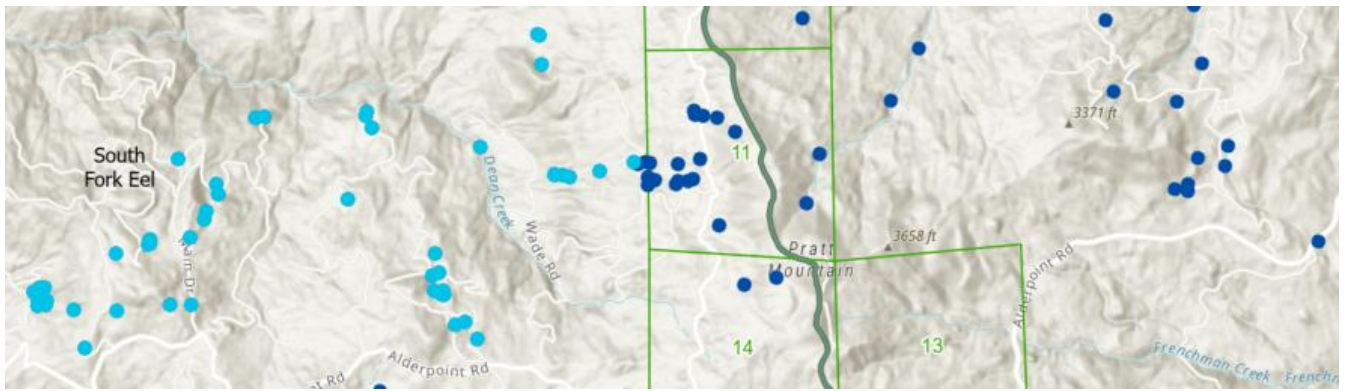
b. **Case 1:** If a POD point lies within our AOI AND MTRS_Match = Y AND IS near the edge of our AOI, we must check the AOI edge case scenario where the POD was plotted on the correct PLSS Section but, should be located in an adjacent watershed. If this scenario is discovered, the POD should be moved outside the AOI boundary but within the same PLSS Section polygon and removed from the AOI dataset.
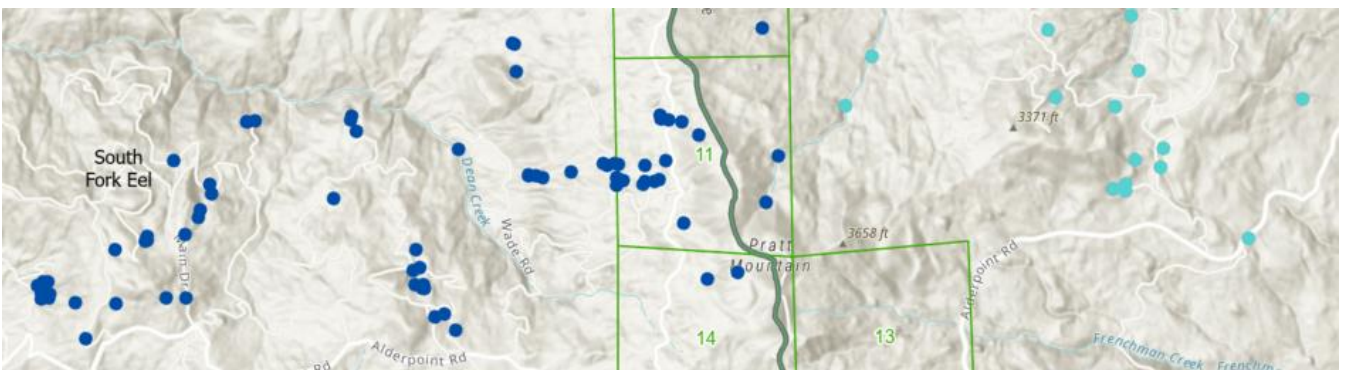

c. **Case 2:** Similarly, we must check the boundary case scenario where the MTRS_Match= Y, the POD point was plotted in an adjacent watershed, but should be located in our AOI. If this scenario is discovered, the POD should be moved inside the AOI within the same PLSS Section and added to the AOI dataset.

d. **Case3:** If a POD point lies within our AOI and MTRS_Match = N, we must check if the POD should be included in our AOI. If it should be included in our AOI, the FF_MTRS or Latitude/Longitude field needs to be corrected so that the MTRS_Match = Y

e. Case4: If a POD Falls outside our AOI and the MTRS_Match = N. Likewise, we must check if the POD should be included in our AOI. If it should be included in our AOI, the FF_MTRS or Lat/Long field needs to be corrected so that the MTRS_Match = Y

9. **Relate each POD to it's NHD catchment and assign it an estimated mean annual Flow**
   Now that we have corrected all the PODs associated with our AOI, we will add some attributes from its coincident NHD catchment. The NHD gauge adjusted mean annual flow estimate will be used in subsequent steps as a proxy for the relative amount of water available to a Water right. If a water right has multiple PODs located in different catchments, the POD with the Maximum amount of mean annual flow will be assigned as the Water right's representative POD.

   First, we will create a subset of the NHD Catchments that are within the Russian River HUC8 Click on the Map tab > Select By Location and run the tool as shown below:
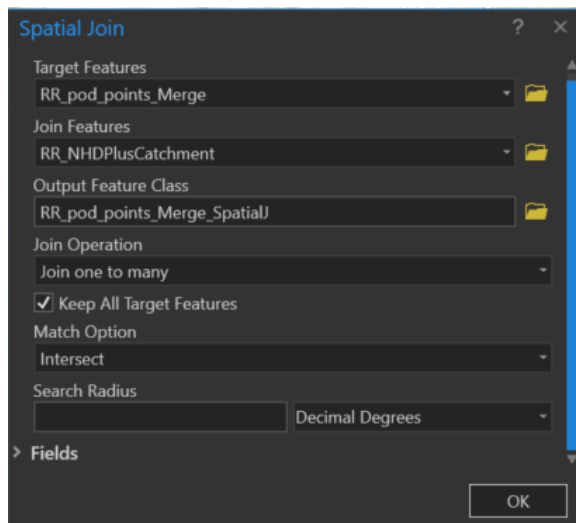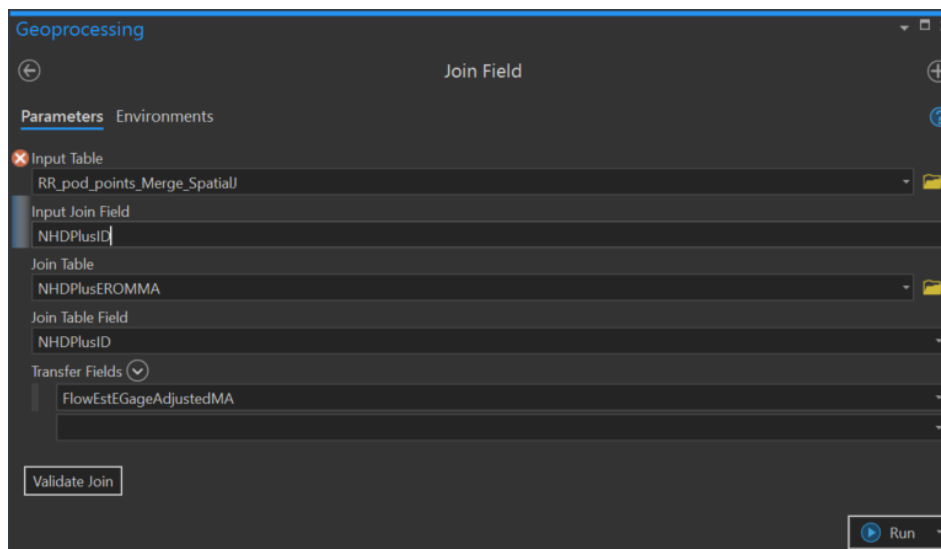
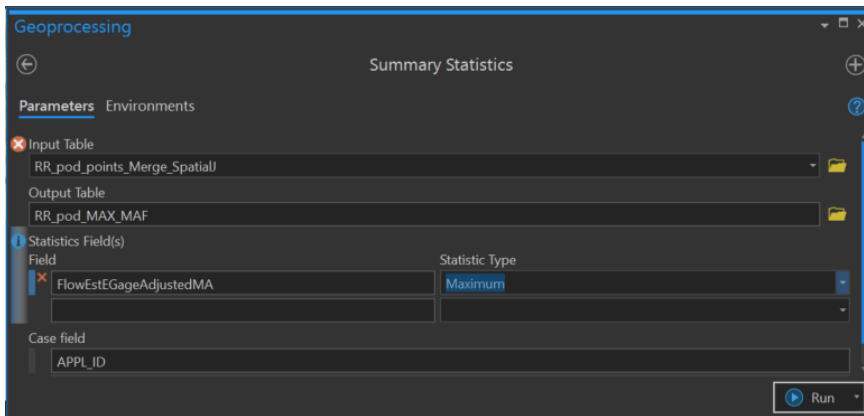Save the selection as a new layer and name it: RR_NHDPlusCatchment

Now we can perform a spatial join between the RR_pod_points_Merge layer and the catchments:
Right click on the RR_pod_point_Merge layer > Joins and Relates > Spatial Join and perform as
Spatial Join as shown below

Now join the "QEMA" field (alias: FlowEstEGageAdjustedMA) from the NHDPlusEROMMA table
to the RR_pod_point_Merge_SpatialJ layer using the NHDPlusID field. Click on the Analysis tab >
Tools > Join Field…

Now we have a gauge adjusted flow estimate appended for each POD record. In the case when
there are multiple PODs associated with a Water Right, We want the POD with the maximum flow
to represent that water right. Click the analysis tab > Tools > Summary Statistic

Using the APP_ID as the Case field tells the geoprocessing tool to calculate the POD max flow statistic separately for each APP_ID value.

Unfortunately, the POD_ID is not carried over in the resulting table. However, we can create a new common field by concatenating the "APP_ID" Field and the "QEMA" field in both the RR_pod_MAX_MAF table and the RR_pod_point_Merge_SpatialJ layer. Then we can Join the RR_pod_point_Merge_SpatialJ fields to the RR_pod_MAX_MAF table. The result is a table containing all the water rights in our AOI along with their single representative POD information.