Data Quality Tools for GIS and Lucity Spatial

In this session, we'll cover the tools that can be used to ensure your GIS data is clean in regard to Lucity, as well as the tools that can check for and fix any erroneous data in the Lucity Spatial tables.

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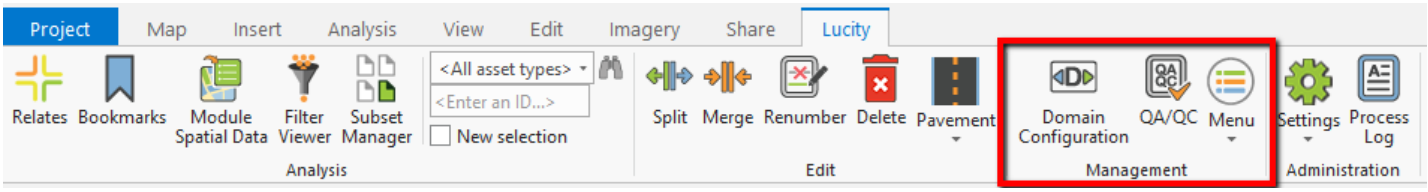
Highlights for version 2019

- Update Show in Map Flag results are written to the Lucity Process Log.
- Added a Field in all Asset modules called ‘GIS Needed’ To indicate if a Record in Lucity needs geometry created or edited by GIS Admins.

GIS – ArcGIS Pro Tools

The first part of this session covers data quality tools for your GIS data that is linked to Lucity. All these tools exist within the Management group of the Lucity ArcGIS Pro add-in. Although not shown in this session, these tools also exist within the ArcCatalog portion of the Lucity GIS Desktop extension.

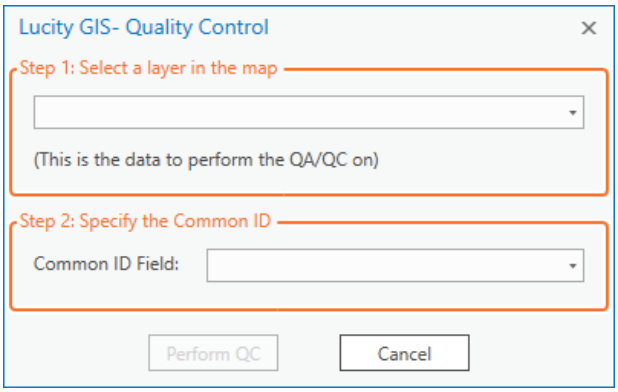
In ArcGIS Pro, the Lucity Management Tools group:



QA/QC

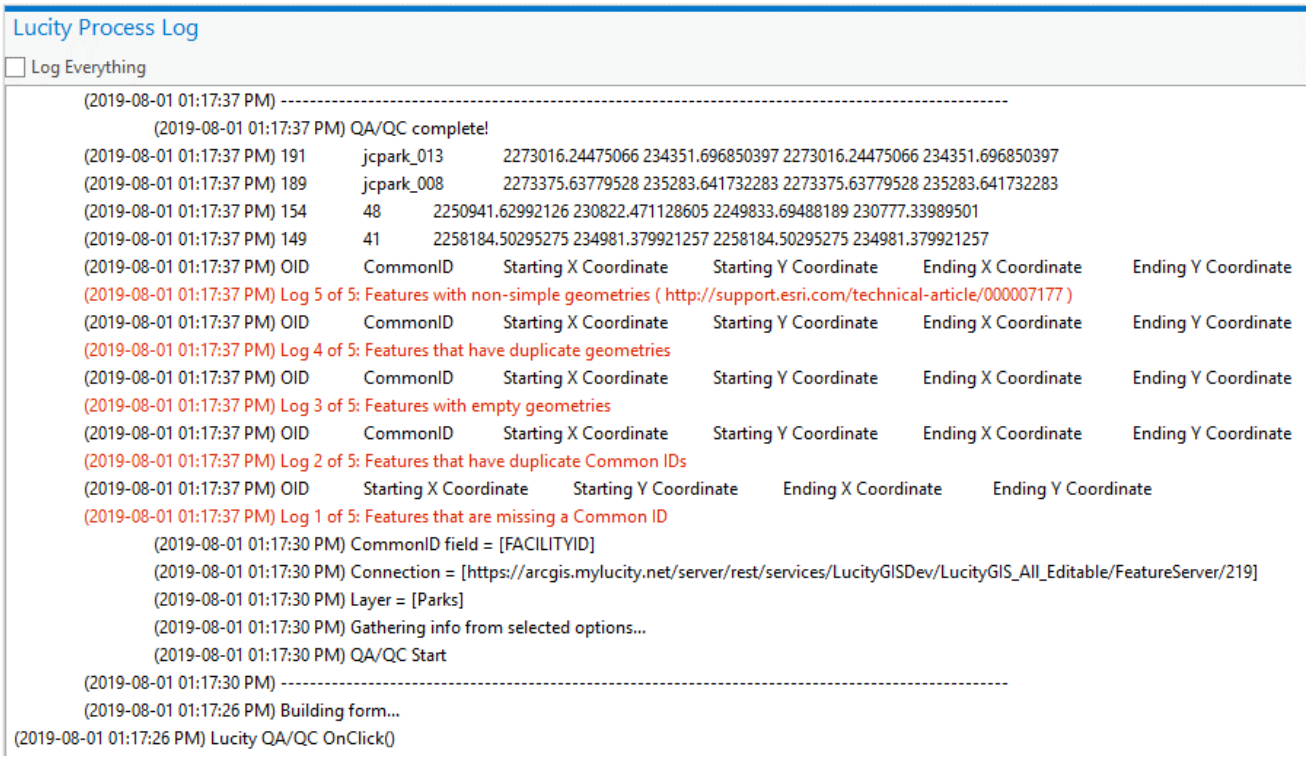
The QA/QC tool can be used against any layer to identify potential data problems that can impact functionality between GIS and Lucity.

To use the tool, click the **QA/QC** button. The following dialog will appear:



- **Step 1: Select a layer in the map:** This is the layer for which you would like to perform the QA/QC tests. This can be any layer, regardless of whether it is linked to Lucity.
- **Step 2: Specify the Common ID:** This is the field in the GIS layer that either is, or will be, linked to the Common ID field in the Lucity module, and is used for two of the QA/QC tests. This field is used to determine the linkage between any given GIS feature and its corresponding Lucity record. It is required to be unique.

Once you have clicked **Perform QC**, the process begins. When the tool is finished running, the Lucity Process Log will open with all five logs (one for each test) visible:



> *Note: The QA/QC Results can be exported from the Process Log by clicking the burger button (3 horizontal lines) at the top right of the Process Log >> **Export**. Exported logs will display with newest logs at the bottom (rather than in the viewer, which displays the newest logs at the top).*

GIS features that fail each test have the following written to the log:

1. Esri ObjectID (OID)
2. Common ID (except for test #1)
3. Beginning and Ending X/Y Coordinates

Here's an explanation of each test:

- **Features that are missing a common ID:** These are features that have a null or empty value in their Common ID field. These features are unable to be found by Lucity because a non-null Common ID value is required to find a Lucity-linked feature in GIS.
- **Features that have duplicate common IDs:** These are features that have the same Common ID value as other features in GIS. If this Common ID value exists in Lucity, this means that all the GIS features with that Common ID are linked to the same record in Lucity, which is not a supported setup (the Common ID must be a unique, one-to-one relationship).

- **Features with empty geometries:** These are features that exist in the GIS layer's attribute table, but have no spatial information associated to them. This particularly can cause issues with editing, as editing operations attempted on empty geometry will likely fail.
- **Features that have duplicate geometries:** These are features that have the same geometry as other features within the GIS layer (features that are sitting on top of each other). This may or may not cause failures with editing but will likely affect things like spatial relationships.
- **Features with non-simple geometries:** These are features that have complex, often erroneous geometries. Esri's description: "Non-simple features may interrupt data processing and/or produce error messages when working with them in ArcGIS". Some examples include self-intersecting lines, discontinuous parts, null Z-values, and duplicate vertices. More information: http://support.esri.com/en/technical-article/000007177

> *Note: Although the test for non-simple geometries can be helpful in assessing GIS data quality, we strongly suggest utilizing Esri's geometry validation tools as well, as they provide much more depth than the Lucity QA/QC tool is capable of.*

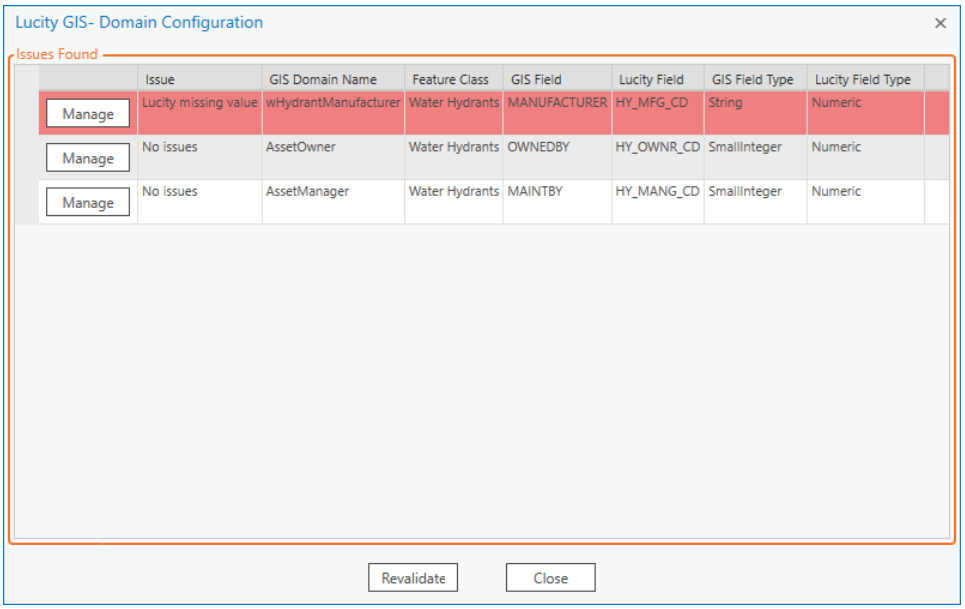
Other ArcGIS Pro Tools

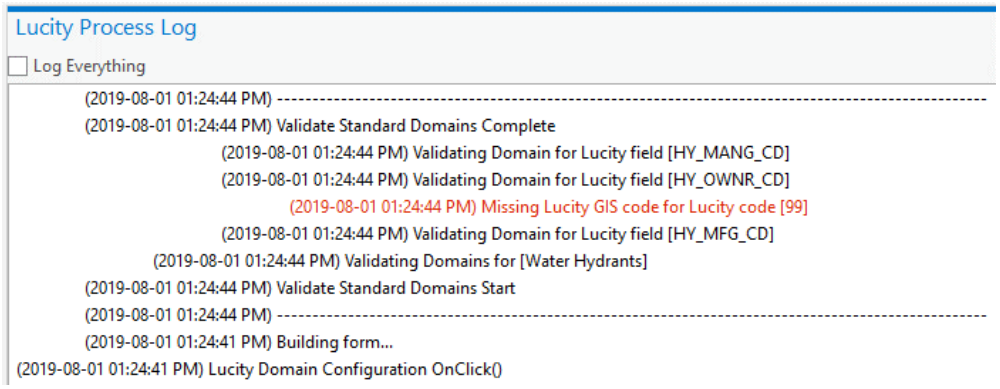
The following tools do not solely exist as data quality tools, but they can be helpful in improving the quality of your GIS data. These include Domain Configuration, Update GIS Values, and Update Show in Map Flag.

Domain Configuration

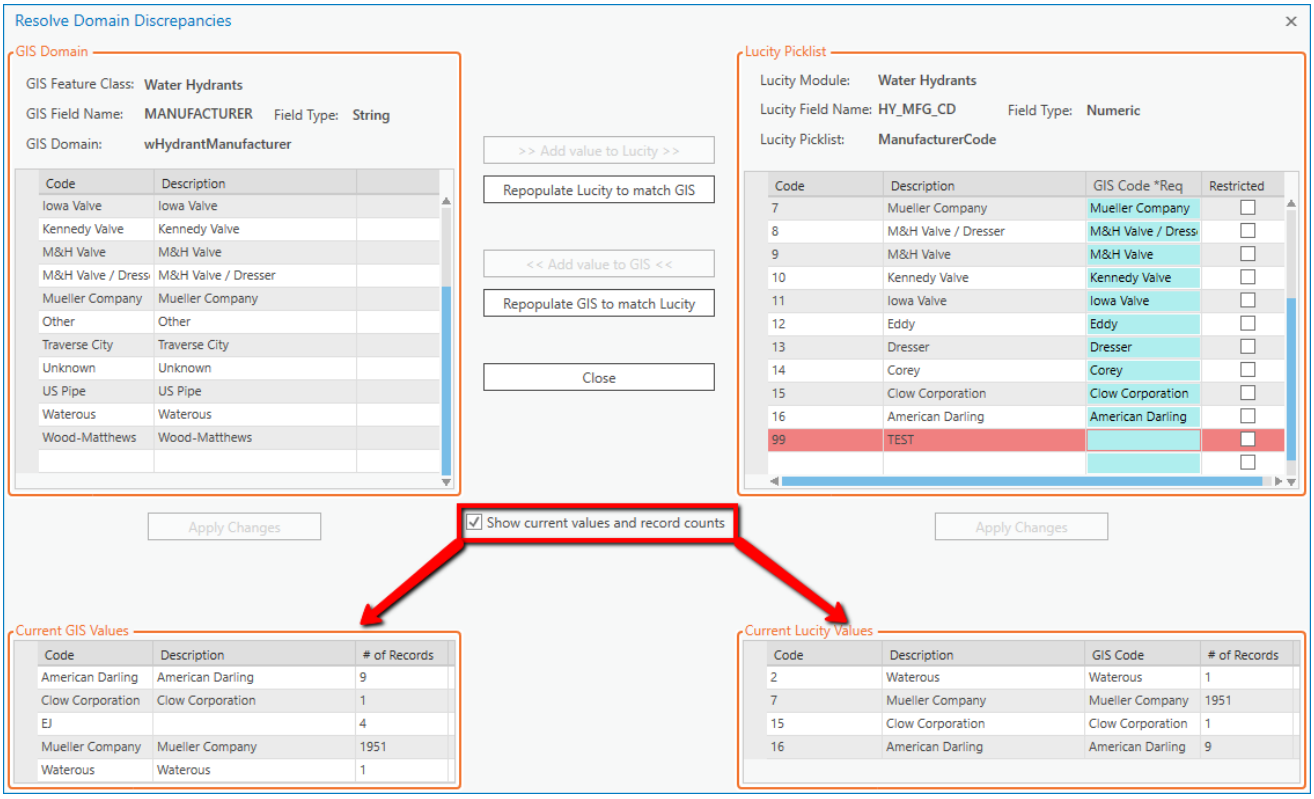
The Domain Configuration tool can be useful in ensuring your GIS domains (and the features in your layers that use them) are in sync with the linked Lucity picklists.

To use the tool, click the **Domain Configuration** button >> select **Standard Domains** >> check which layer(s) to validate >> click **OK**. The following dialog will appear, and information will be written to the Lucity Process Log:





Domains that are out of sync with Lucity will have their rows highlighted in red in the grid. Click **Manage** to handle the discrepancies. The following dialog will appear:



Values shown in red in the top two grids have no match in GIS/Lucity. You can check **Show current values and record counts** to see how many records in GIS/Lucity are using each domain/picklist value. This helps give an idea of what needs to be changed to get the GIS domain back in sync with the corresponding Lucity picklist, and what would be affected by the changes. It is useful to run this tool before syncing data into Lucity from GIS, as it will prevent data issues caused by mismatched picklist values.

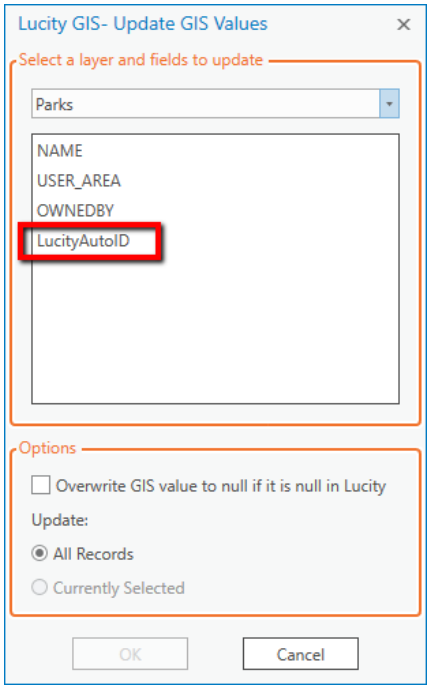
To use the tool, make changes by adding, deleting, or modifying values in the top grids, or using the **Add Value** or **Repopulate** buttons. When finished, click **Apply Changes** for GIS and/or Lucity.

For more details about the Domain Configuration Tool, please see the *Overview of ArcGIS Pro with Lucity* session.

Update GIS Values

The Update GIS Values tool supports updating the Lucity Auto ID field in GIS. There are some Lucity GIS tools that will use the Lucity Auto ID before the Common ID, if there is a field for it in GIS; it is these places that require the Lucity Auto ID value to be correct.

To use the Update GIS Values tool, click **Menu** >> **Update GIS Values**. The following dialog will appear, asking for a layer to update. Once a layer is selected, all the fields in that layer that can be updated from Lucity, including the field that stores the Lucity Auto ID, will show up in the list box:

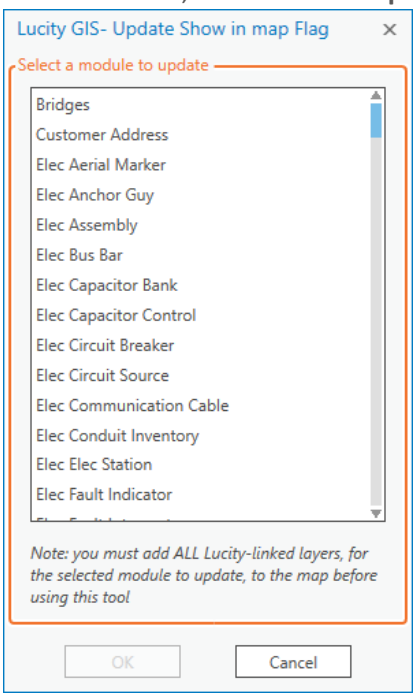


Click **OK**, and all selected fields in GIS will be updated with the value that is in Lucity. In the case of the Lucity Auto ID field, the correct Lucity Auto ID will be assigned to the GIS features.

Update Show in Map Flag

While Update Show in Map Flag does not modify your GIS data or schema, it can be very helpful in determining what records in Lucity have no matching feature in GIS, and vice versa. Normally, this field is automatically updated. However, in some circumstances it may not be, so this tool ensures that the in-map flag field in Lucity is correct.

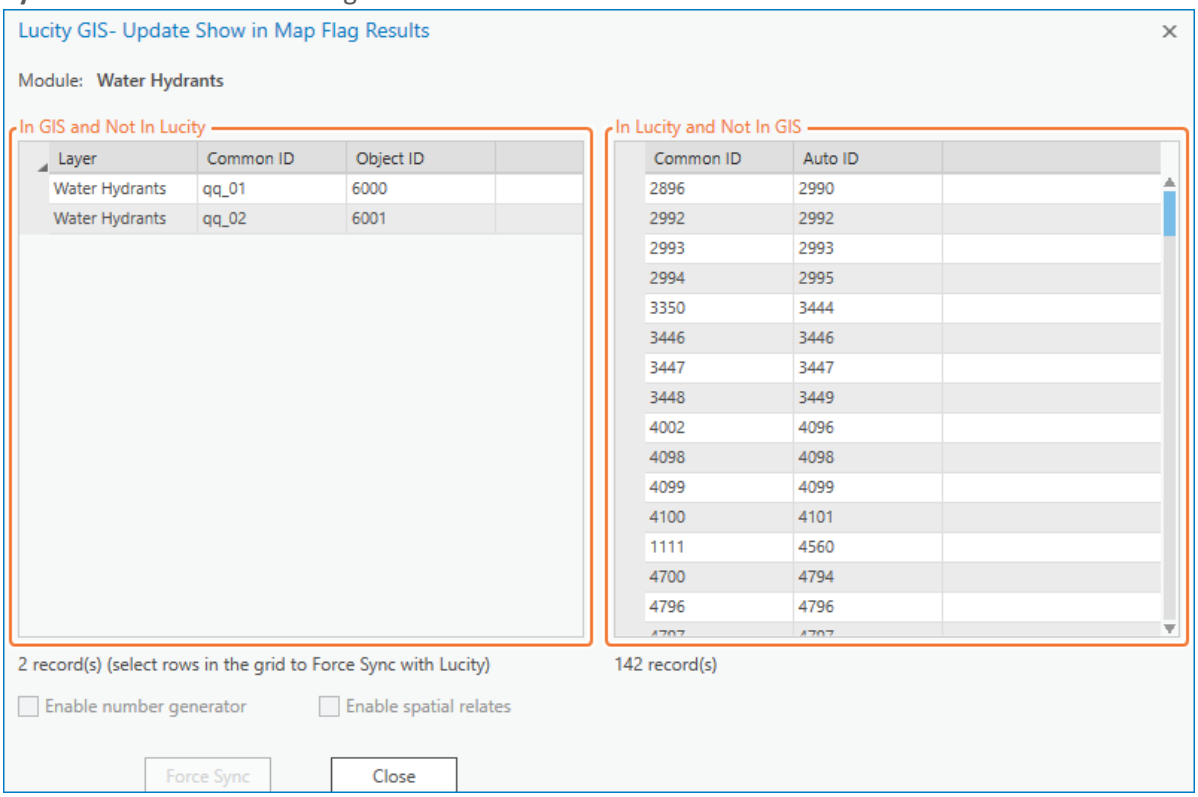
To use the tool, click **Menu** >> **Update Show in Map Flag**. The following dialog will appear:



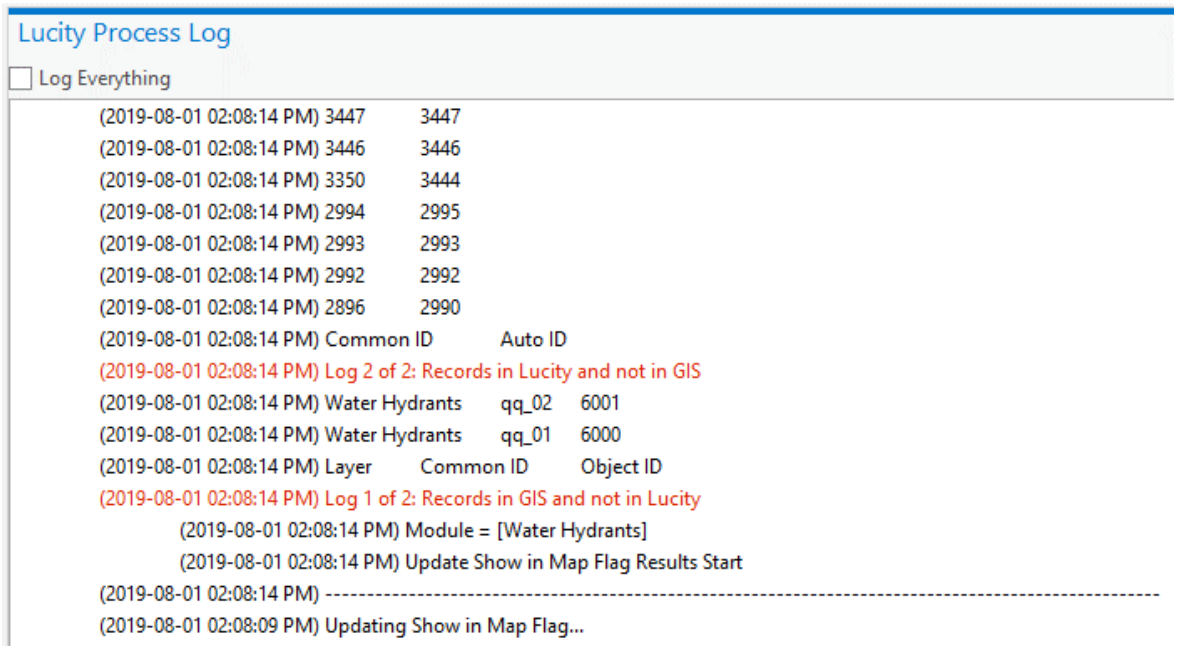
Select the module for which you would like to update the in-map flag. You must have all layers linked to the selected module present in the map for the process to work.

Once the process begins, a list of all Common IDs from each linked layer will be passed to Lucity. Using this list, the process will determine if each Common ID has a matching record in Lucity, updating the in-map flag accordingly along the way.

The process also builds a list of orphans in GIS, a list of orphans in Lucity, and returns the results to ArcGIS Pro to be displayed. For GIS records that aren't in Lucity, there is an option on the dialog to **Force Sync** records selected in the grid:



The results are also written to the Lucity Process Log:

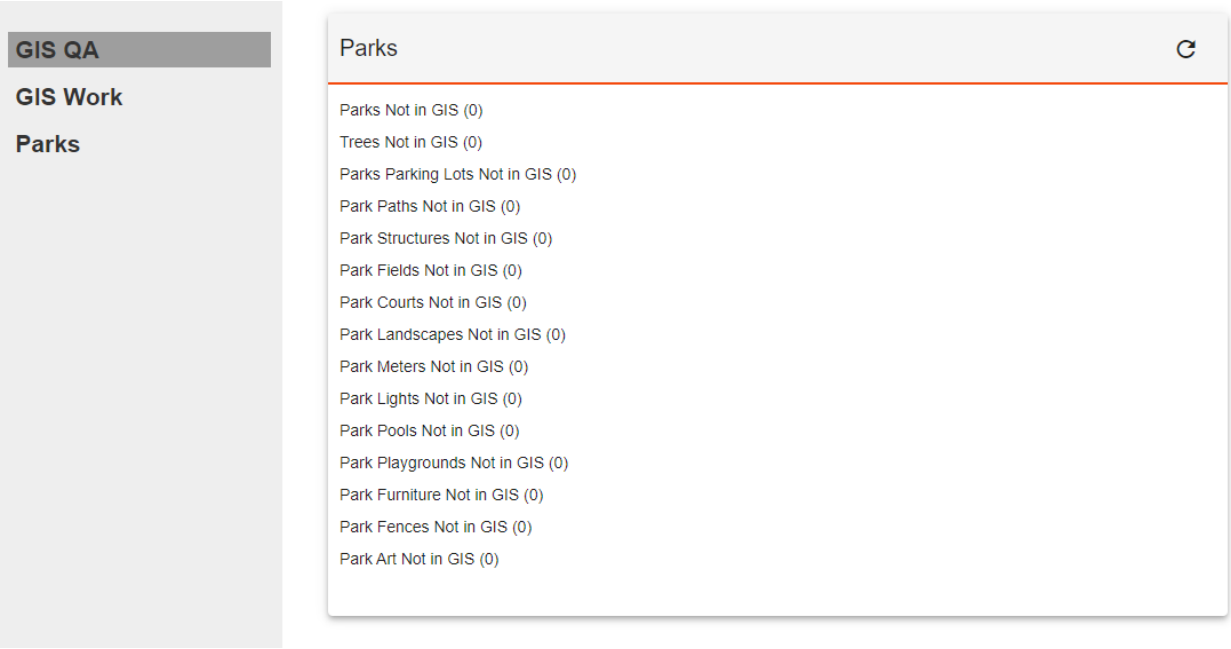


GIS Data Quality Dashboards

The GIS Data quality dashboards are a live dashboard for a GIS Analyst or admin within your organization to show them the assets within Lucity that may have a disconnect to the Assets in GIS or that need to be edited within GIS. The two Dashboard tabs are the 'QA' dashboards and the 'Work' dashboards. These dashboards will be provided to Clients after they have received a GIS Review from a Lucity Tech Team member.

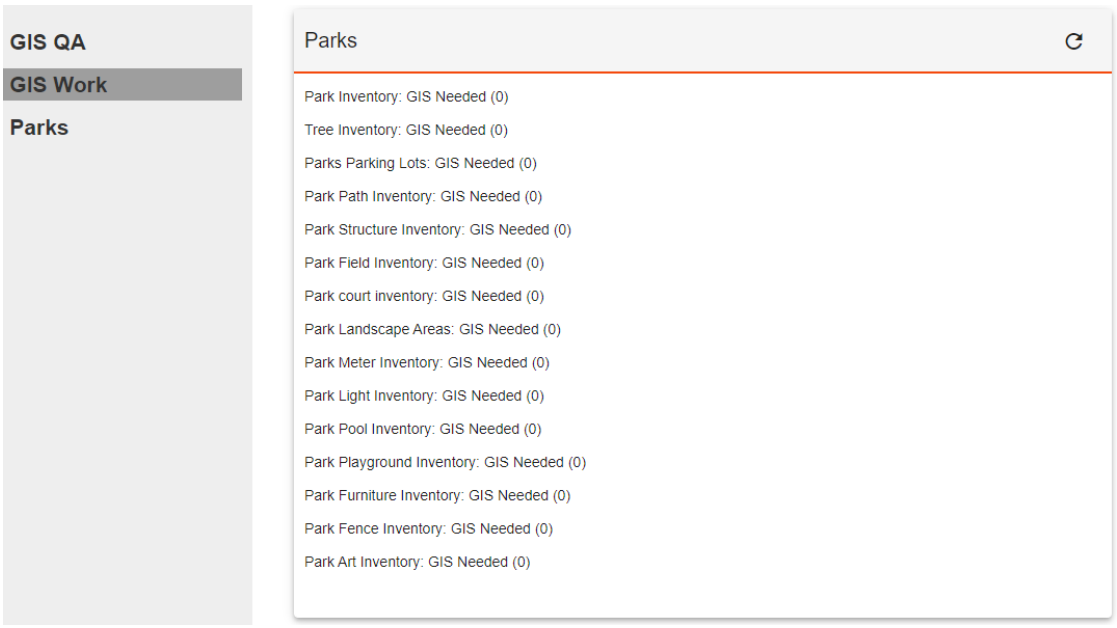
GIS QA Dashboards

The GIS QA Dashboards are created to show all assets that are within Lucity, that are not currently linked to an asset in the associated GIS Feature class. So, either the Assets within GIS were deleted and the associated Lucity record did not get updated. Or a record was created in Lucity and GIS does not have an asset created in the feature class that is associated with it. The filters for all these plugins are created using the INMAP field which is in all Lucity asset tables. These plugins look for all records that have an InMap flag value of '0'.



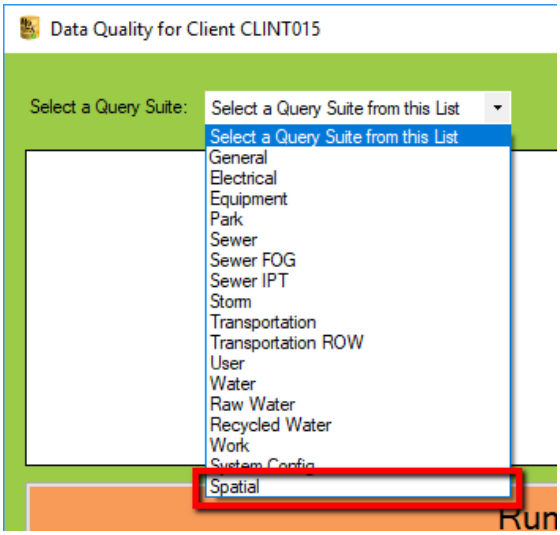
GIS Work Dashboards

The GIS Work dashboards are created to provide a field for end users to check to indicate when Geometry or attributes of the GIS features need to be edited by the GIS Admin.



Lucity Spatial – DataQuality.exe (DQS)

The second part of this session covers data quality tools for the Lucity Spatial tables. All these tools exist as queries within the Spatial Query Suite inside the Lucity Data Quality Tool. If you have a complete install of Lucity Desktop, the Lucity Data Quality Tool can be found in your local workstation's bin directory or can be accessed from **Start** >> **All Programs** >> **Lucity** >> **Admin Tools**.



These queries (10 total) are ran against the Lucity Work Spatial tables that are used by the Lucity Spatial Indexer, which include the work geometry tables for points, lines, and polygons (WKGEOMPT, WKGEOMLN, and WKGEOMPG), and the work spatial change table (WKSPATIALCHANGE).

> *Note: All queries in the Spatial Query Suite are only supported for SQL Server. These queries are not currently available for Oracle databases.*

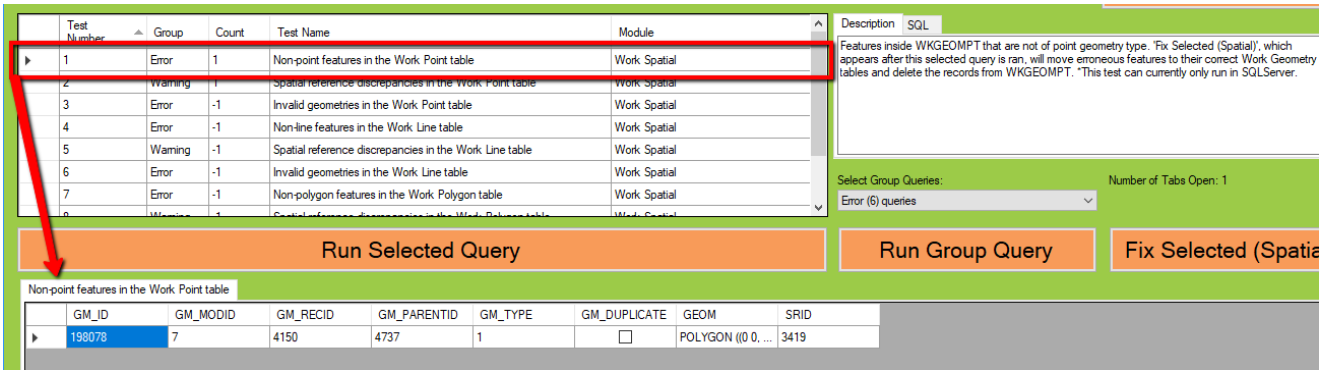
For more information about the Lucity Spatial Indexer, see the *Overview of Lucity Spatial* session.

Wrong Geometry Types

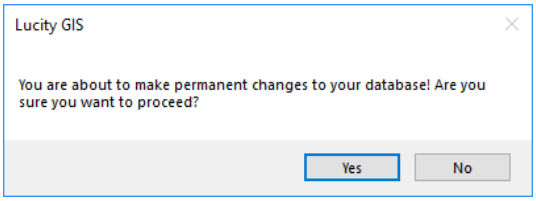
Three Lucity Work Geometry tables exist to store points, lines, and polygons. Although incredibly unusual, features of the wrong geometry type have ended up in these tables before (i.e. polygons in the points table). There are three queries to test for this:

- Non-point features in the Work Point table (Test #1).
- Non-line features in the Work Line table (Test #4).
- Non-polygon features in the Work Polygon table (Test #7).

Since this situation can cause errors in processing, these queries fall under the **Error** Group. To run any of these queries, select the row for the test in the top grid, and click **Run Selected Query**. A results grid will appear at the bottom of the dialog:



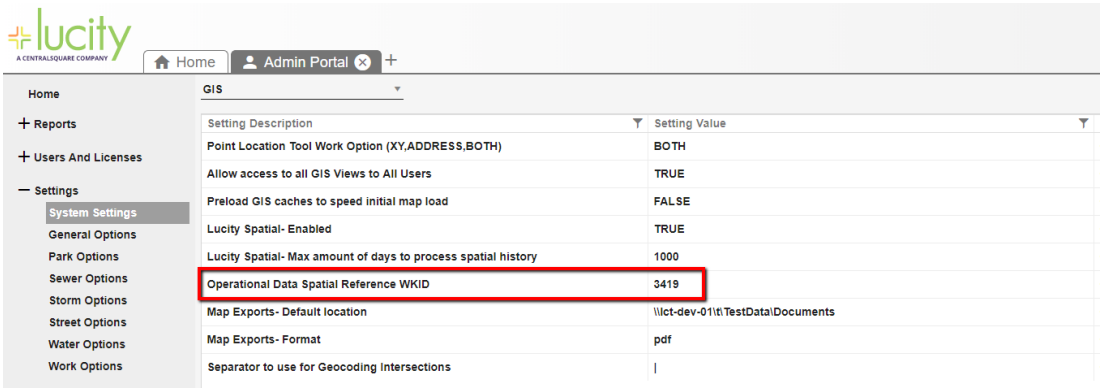
All erroneous records will display in the results grid. For this query type, there is an option to fix the data. To do this, select the record in the results grid, and click **Fix Selected (Spatial)**. The following dialog will appear:



Clicking **Yes** will move all erroneous records to their correct geometry table and delete them from the current table. In the example in the screenshot above, the record will be copied into the Work Polygons table (WKGEOMPG) and be deleted from the Work Points table (WKGEOMPT).

Spatial reference discrepancies

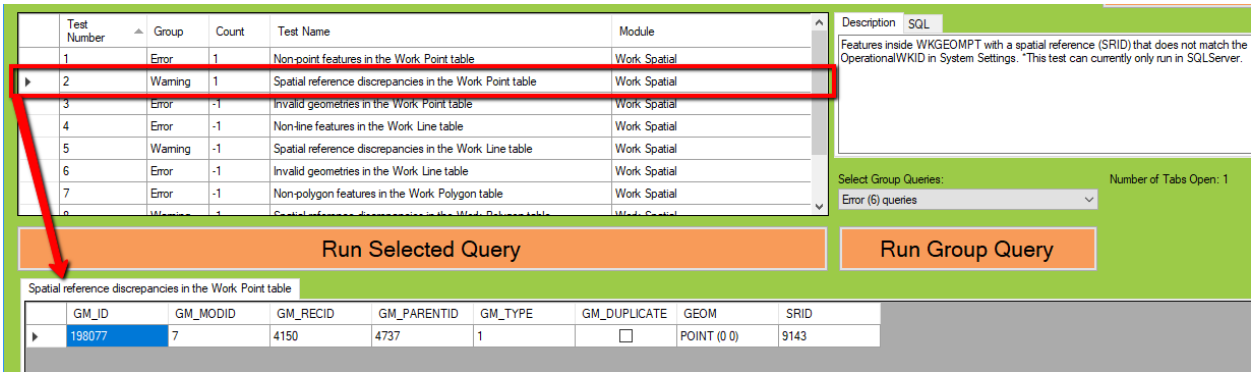
This set of queries tests for records in the WKGEOM tables that have a spatial reference different from what is defined in the **Operational Data Spatial Reference WKID** field within **Lucity System Settings**:



There are three queries to test for this:

- Spatial reference discrepancies in the Work Point table (Test #2).
- Spatial reference discrepancies in the Work Line table (Test #5).
- Spatial reference discrepancies in the Work Polygon table (Test #8).

These queries belong to the **Warning** group, since they may or may or may not cause issues with processing but will likely cause unexpected results. To run any of these queries, select the test in the top grid and click **Run Selected Query**. The results are displayed in the bottom grid:



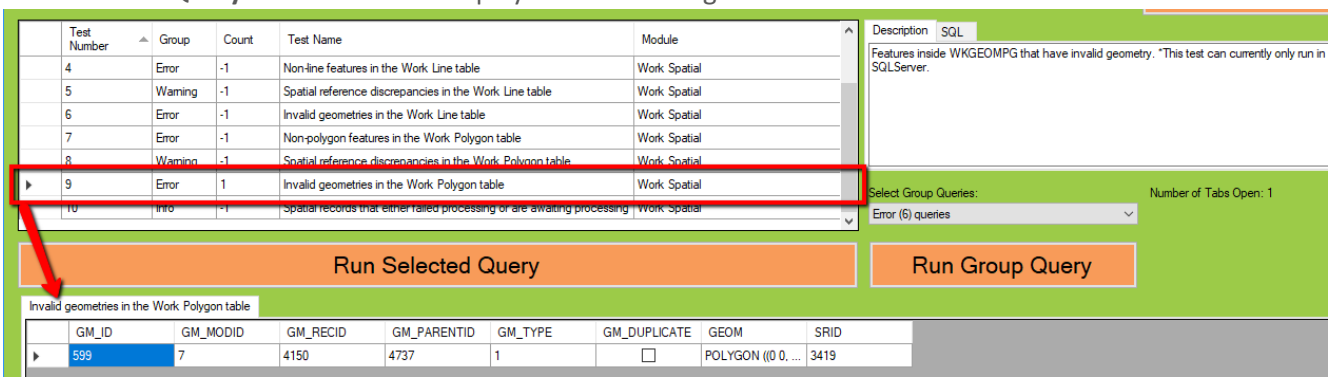
Invalid Geometries

If there are features with non-simple geometries in your GIS (see above section on the QA/QC tool), there is potential that these can be processed and copied into the work geometry tables, and cause issues down the road. SQL Server recognizes these geometries as invalid geometries.

There are three queries to test for this:

- Invalid geometries in the Work Point table (Test # 3).
- Invalid geometries in the Work Line table (Test #6).
- Invalid geometries in the Work Polygon table (Test #9).

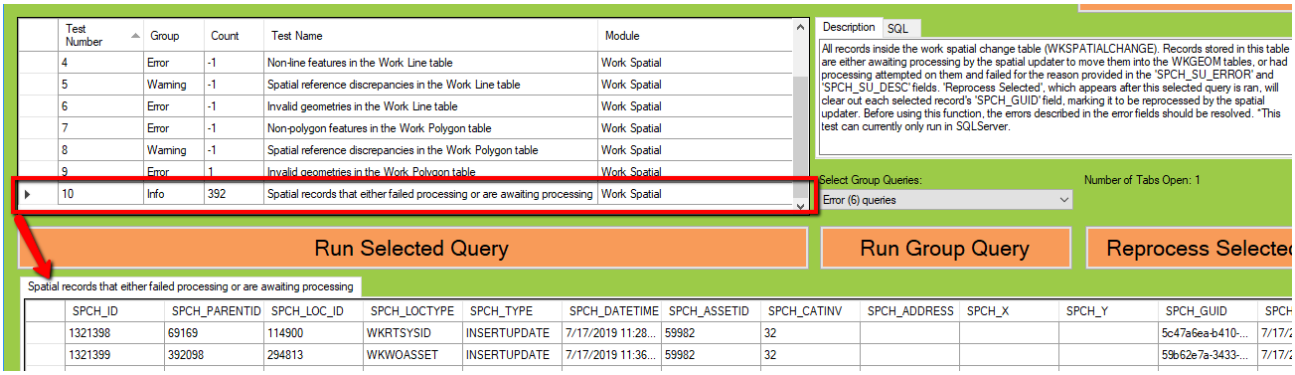
These queries belong to the **Error** group because any process attempted on records in the Lucity Spatial tables with invalid geometry will fail. To run any of these queries, select the test in the top grid and click **Run Selected Query**. The results will display in the bottom grid:



Spatial records that failed processing/are awaiting processing

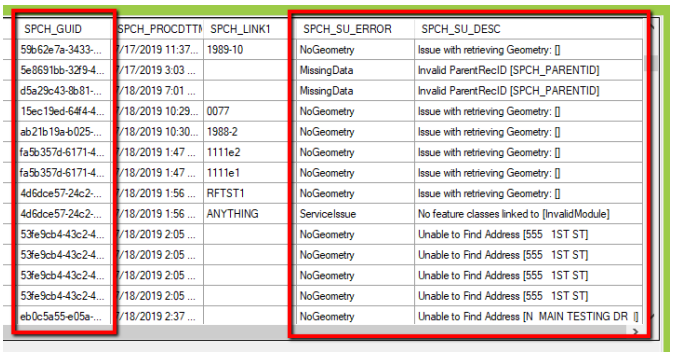
Sometimes the Spatial Indexer fails to process a record, and the geometry never gets written to the appropriate work geometry table. This shows up later when the expected geometry is missing from the results of one of the tools that uses the spatial tables. All records that fail processing remain in the WKSPATIALCHANGE table with an error message and description, while successfully processed records are moved out of the table.

To run this query, select the test in the top grid and click **Run Selected Query**. The results will display in the bottom grid:



This query returns all records from WKSPATIALCHANGE and it belongs to the **Info** query group.

Records that failed processing will have the following fields populated: **SPCH_GUID**, **SPCH_SU_ERROR**, and **SPCH_SU_DESC**. Records that are awaiting processing by the Spatial Indexer will exist in the results but will not have these fields populated.

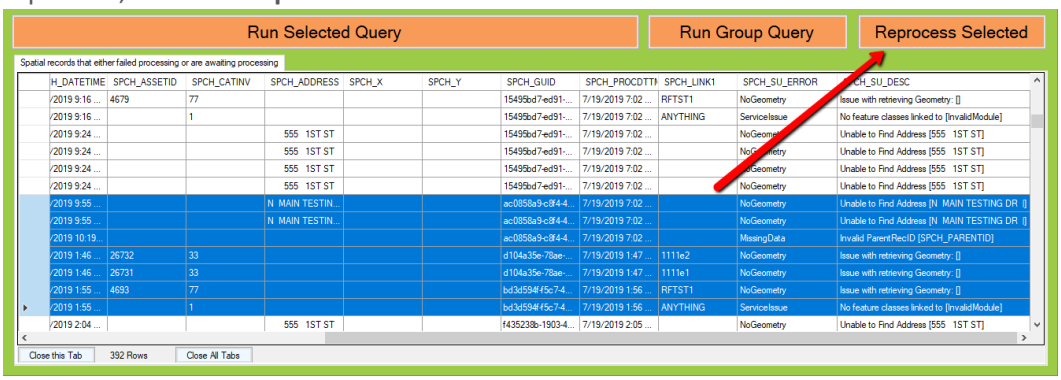


SPCH_GUID	SPCH_PROCDTTM	SPCH_LINK1	SPCH_SU_ERROR	SPCH_SU_DESC
59b62e7a-3433-...	/17/2019 11:37...	1989-10	NoGeometry	Issue with retrieving Geometry: []
5e8691bb-32f9-4...	/17/2019 3:03 ...		MissingData	Invalid ParentRecID [SPCH_PARENTID]
d5a29c43-8b81-...	/18/2019 7:01 ...		MissingData	Invalid ParentRecID [SPCH_PARENTID]
15ec19ed-64f4-4...	/18/2019 10:29...	0077	NoGeometry	Issue with retrieving Geometry: []
ab21b19a-b025-...	/18/2019 10:30...	1988-2	NoGeometry	Issue with retrieving Geometry: []
fa5b357d-6171-4...	/18/2019 1:47 ...	1111e2	NoGeometry	Issue with retrieving Geometry: []
fa5b357d-6171-4...	/18/2019 1:47 ...	1111e1	NoGeometry	Issue with retrieving Geometry: []
4d6dce57-24c2-...	/18/2019 1:56 ...	RFTST1	NoGeometry	Issue with retrieving Geometry: []
4d6dce57-24c2-...	/18/2019 1:56 ...	ANYTHING	ServiceIssue	No feature classes linked to [InvalidModule]
53fe9cb4-43c2-4...	/18/2019 2:05 ...		NoGeometry	Unable to Find Address [555 1ST ST]
53fe9cb4-43c2-4...	/18/2019 2:05 ...		NoGeometry	Unable to Find Address [555 1ST ST]
53fe9cb4-43c2-4...	/18/2019 2:05 ...		NoGeometry	Unable to Find Address [555 1ST ST]
53fe9cb4-43c2-4...	/18/2019 2:05 ...		NoGeometry	Unable to Find Address [555 1ST ST]
eb0c5a55-e05a-...	/18/2019 2:37 ...		NoGeometry	Unable to Find Address [N MAIN TESTING DR []

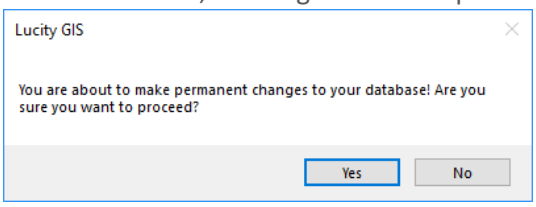
To fully utilize this query to resolve records that failed processing in the Spatial Indexer, follow these steps:

1. Correct whatever errors show up within the **SPCH_SU_ERROR** and **SPCH_SU_DESC** fields. These are usually related to issues with the editable GIS service (feature doesn't exist in the service, layer doesn't exist in the service, the service can't be accessed while processing is attempted, etc.).

2. Once these errors are corrected, select however many rows in the bottom grid that you want to reprocess, and click **Reprocess Selected**.



3. The following dialog will appear. Click **Yes**, and the **SPCH_GUID** field is cleared out for all the selected records, marking them to be processed again by the Spatial Indexer.



Note: The Spatial Indexer runs every 5 minutes, so you may not see results immediately when reprocessing a selected set of records. If you get stuck while troubleshooting this, please contact Lucity Support for further assistance.