Overview of Lucity Spatial

In this session, we'll cover the key components of Lucity Spatial.

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Lucity Spatial

Since version 2014, Lucity offers the ability to store work order and work request spatial components directly in the Lucity database. Storing the spatial component (geometry) in the Lucity database allows for faster analysis, better efficiency, and more flexibility when showing these locations in a map.

Requirements

A few requirements must be met before implementing Lucity Spatial:

- The Lucity database must be one of the following:
  - SQL Server 2008 or higher
  - Oracle with MDSYS.SDO_GEOMETRY data type enabled
- The Lucity Services must be installed
- Each Lucity linked feature class must be assigned to a default map service
- Lucity linked feature classes must be one of the following geometry types:
  - Point
  - Line (including multi-line features)
  - Polygon (including multi-polygon features)
- System Settings in UI Admin must be configured:
  - The *Enable Lucity Spatial* system setting must be set to TRUE
  - The *Max amount of days to process spatial history* must be set to a value greater than 0
- A default Geocoding Service must be defined
  - This is set in the Lucity Administration GIS Services
  - The geocoding service must be on version 10.2 or higher (supporting single line input)

Notes:

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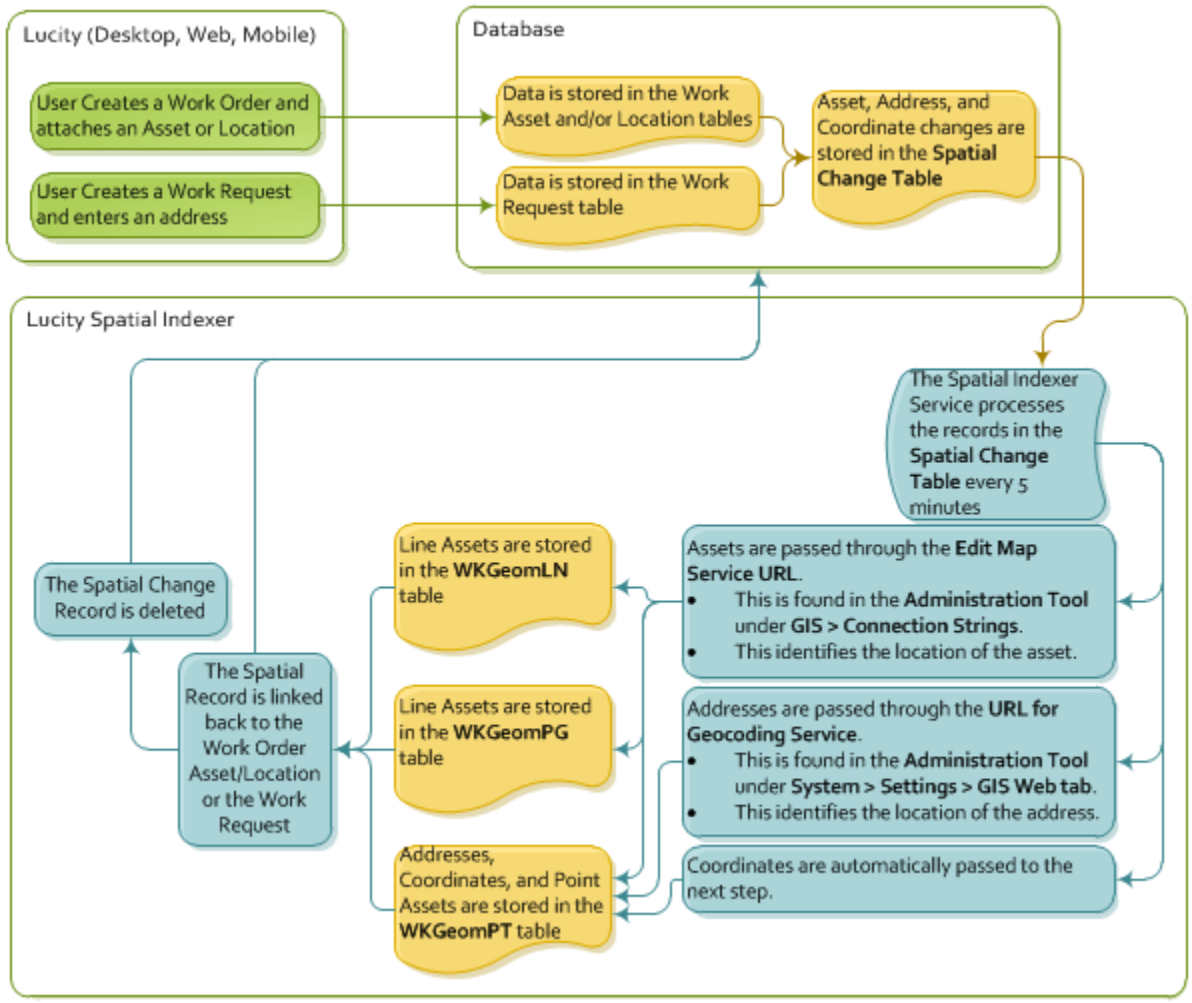
Supported Modules

Lucity Spatial is enabled with the following modules:

- **Work**: Requests, Work Orders, PM/Work Templates, Master Project Management, Sub Project Management, Work Permits
- **Sewer**: PACP Inspections, TV Inspections, Smoke Testing, Building Inspections, Sewer Overflows
- **Storm**: PACP Inspections, TV Inspections
- **Water**: Water Flushing Routes, Mainbreaks (distribution, recycled, raw)
- **Street**: Street Routes, Sidewalk Inspections

How it works

As records are created, updated, and deleted in Lucity, a Lucity service processes the changes and adds the spatial location (geometry) directly into the Lucity database. This spatial information can then be easily retrieved and viewed with the Lucity tools provided in ArcMap, ArcGIS Pro, and the Lucity webmap.



Behind-the-scenes

The following Lucity tables and views are used with Lucity Spatial:

- WKSPATIALCHANGE
    - This table is updated automatically by the Lucity application with any change made to Work Requests and Work Orders that deal with location information.
    - The Lucity Spatial Updater service processes these records by obtaining their corresponding geometries
- WKGEOMPT- This table stores all point geometries populated by the Lucity Spatial Updater service retrieved when processing WKSPATIALCHANGE
- WKGEOMLN- This table stores all linear geometries populated by the Lucity Spatial Updater service retrieved when processing WKSPATIALCHANGE
- WKGEOMPG- This table stores all polygon geometries populated by the Lucity Spatial Updater service retrieved when processing WKSPATIALCHANGE
- GIS_WKGEOMLNRQ- View showing all linear Request locations
- GIS_WKGEOMPGRQ- View showing all polygon Request locations
- GIS_WKGEOMPTRQ- View showing point Request locations (asset only)
- GIS_WKGEOMPTRQLOC- View showing point Request locations (address and x/y)
- GIS_WKGEOMLNWO- View showing all linear Work Order locations
- GIS_WKGEOMPGWO- View showing all polygon Work Order locations
- GIS_WKGEOMPTWO- View showing point Work Order locations (asset only)
- GIS_WKGEOMPTWOLOC- View showing point Work Order locations (address and x/y)

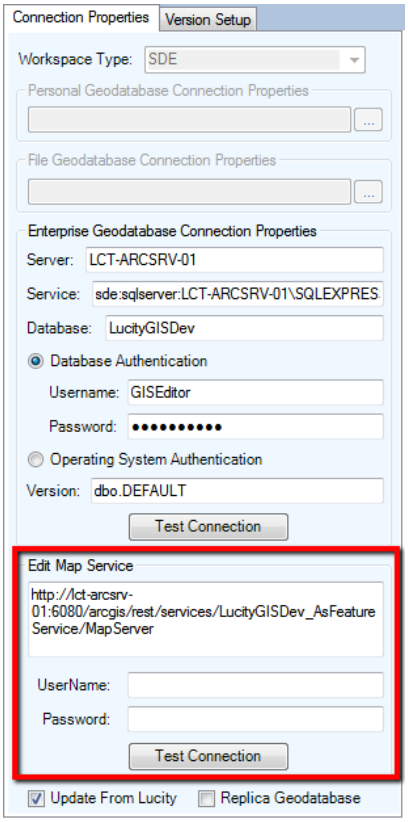
Setup

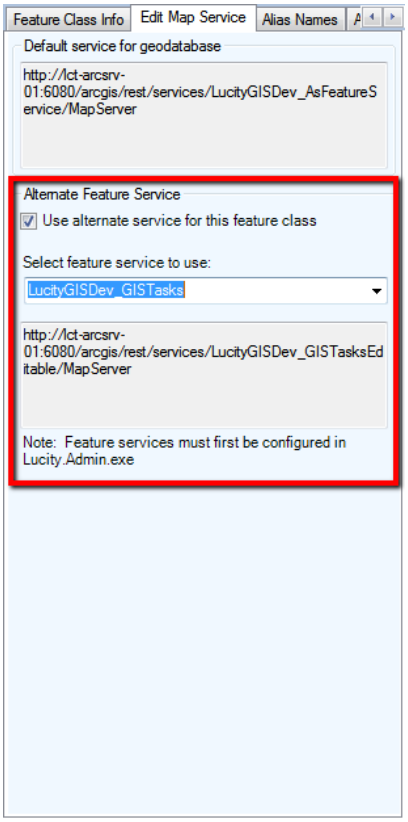
Assign default map services

The Lucity Spatial Updater service interacts with map services in order to obtain an asset's geometry to store in the Lucity database. To obtain the geometry for an asset the following process is followed:

1. Determine the list of feature classes linked to a given asset type
2. Do the following for each feature class until the asset geometry is returned:
    a. Determine the map service
        i. If a map service is defined at the feature class level then that one will be used.
        ii. If a map service isn't defined at the feature class level then the one defined at the geodatabase level will be used.
    b. Query the map service for the asset
        i. If it exists, return the geometry
        ii. If it doesn't exist, move to the next feature class

- The geodatabase map service is defined in the Geodatabase Configuration Tool in ArcCatalog. It is listed under the Connection Properties tab when you have a geodatabase node selected.
- A service defined at the feature class level will be listed under the Edit Map Service tab when you have the feature class node selected.

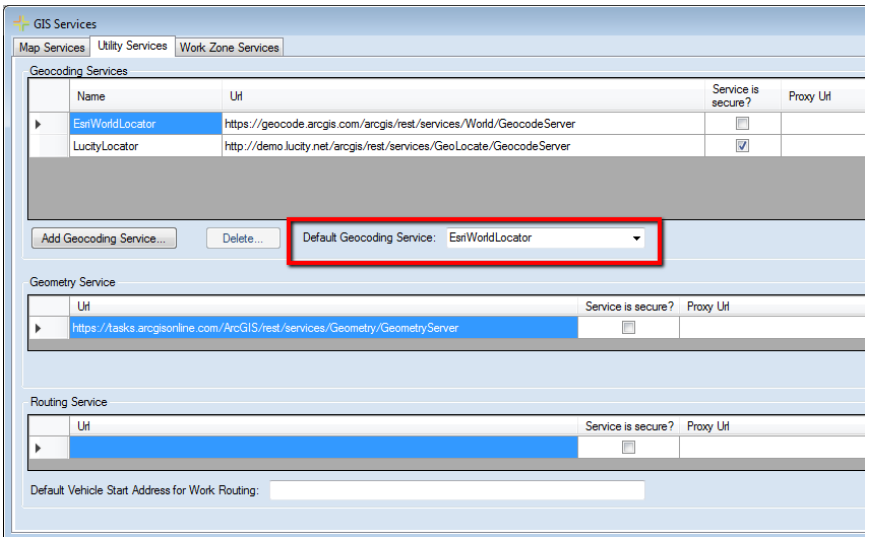




Configure Default Geocoding Service

In UI Admin's GIS Services, the following must be configured:

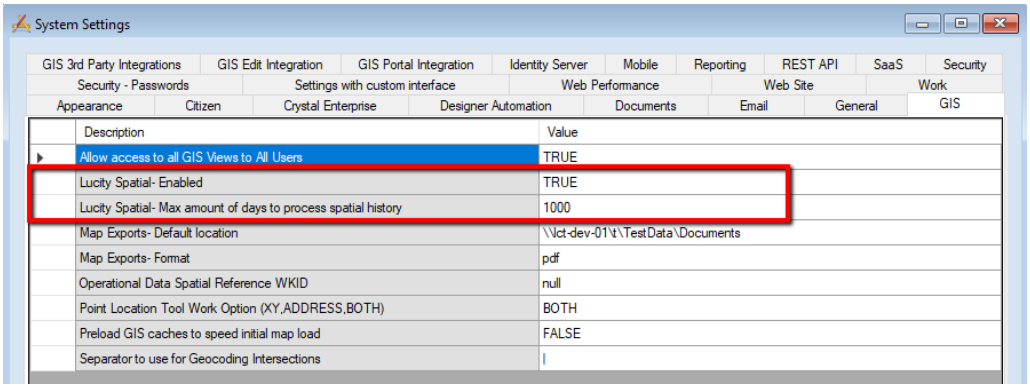
1. On the Utility Services tab, configure a geocoding service with Lucity and make sure to set a default as shown in the red outline below:



Configure System Settings

In UI Admin, system settings the following must be configured:

1. On the GIS tab, set the Enable Lucity Spatial to TRUE



2. On the General tab, adjust the Max amount of days to process spatial history (must be greater than 0).
    a. Example: If you enter 180, the Lucity Spatial Updater will process all work orders/requests modified today and within the last 180 days.
    b. Note: The Lucity Spatial Updater service is reliant on back end configuration that was added to the Lucity database in 7.4. Therefore, depending on your upgrade history there could be a few years' worth of locations that have the potential to be processed.

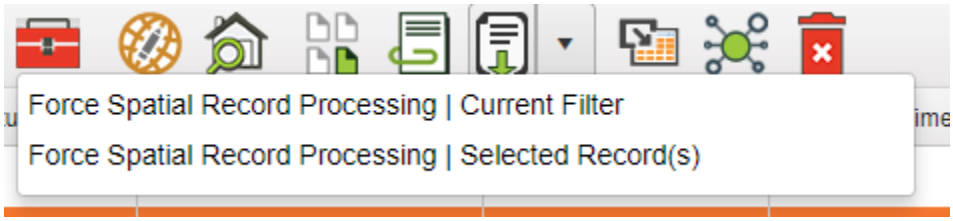
Force Spatial Record Processing

Once you have completed the configuration and setup of Lucity Spatial, you may find the need to force spatial record processing of existing work and inspection data.

Please refer to the How it Works section for further details on how Lucity Spatial operates, but in simple terms it will only process Lucity work and inspection records that are inserted or updated once Lucity Spatial has been enabled for a particular module.

For example, you have just upgraded to 19r2 and would like to see the most recent sewer smoke test observations in the map. Since sewer smoke test observations were not supported with Lucity Spatial until version 18r2, smoke observation records added prior to 18r2 would not have been processed. Therefore, in order to see those smoke observations in the map, you first need to run the Force Spatial Record Processing toolkit against those records.

1. Open the Lucity Module View for the work or inspection module.
2. You can either filter your records to be only those that you are interested in processing, or run it on a selection.
    a. If you have a large amount of data, it is recommended that you use a filter and limit it to only include the necessary records.
3. On the module toolbar, click the Toolbox button, and you should see a couple of options pertaining to *Force Spatial Record Processing*. Go ahead and select the desired option.



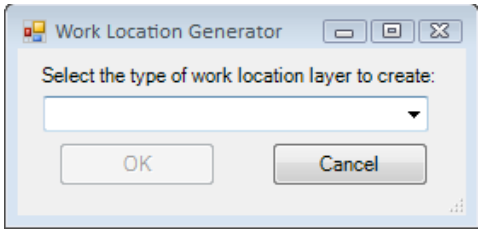
4. The toolkit will add the records to the Lucity Spatial cache and will be processed within the next 5 minutes by the SpatialUpdater service on the Lucity Services server. For large amount of data, you may need to give it more time to complete processing. Refer to the Troubleshooting section of this help guide for information on how to track the process.

ArcMap

Generating Live Work Layers

After you setup the Lucity Spatial Updater and the service has begun processing work locations you are ready to display and interact with the results. The Lucity GIS extension in ArcMap provides some out-of-the-box tools to facilitate the generation of layers that can be used to show the work locations.

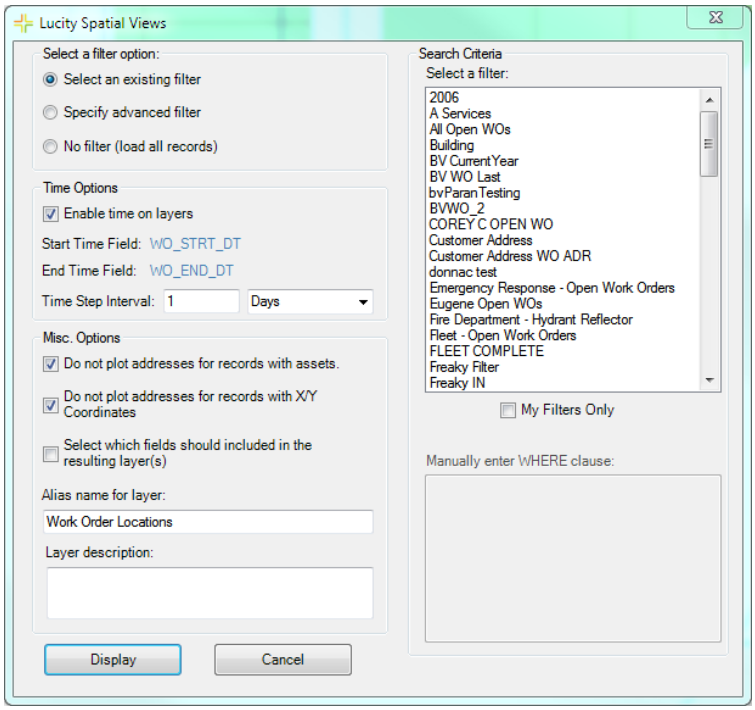
1. In ArcMap on the Lucity toolbar, click on the  button. The following pop-up will appear:



2. Select the type of work location you would like to create from the drop down list and Click OK.

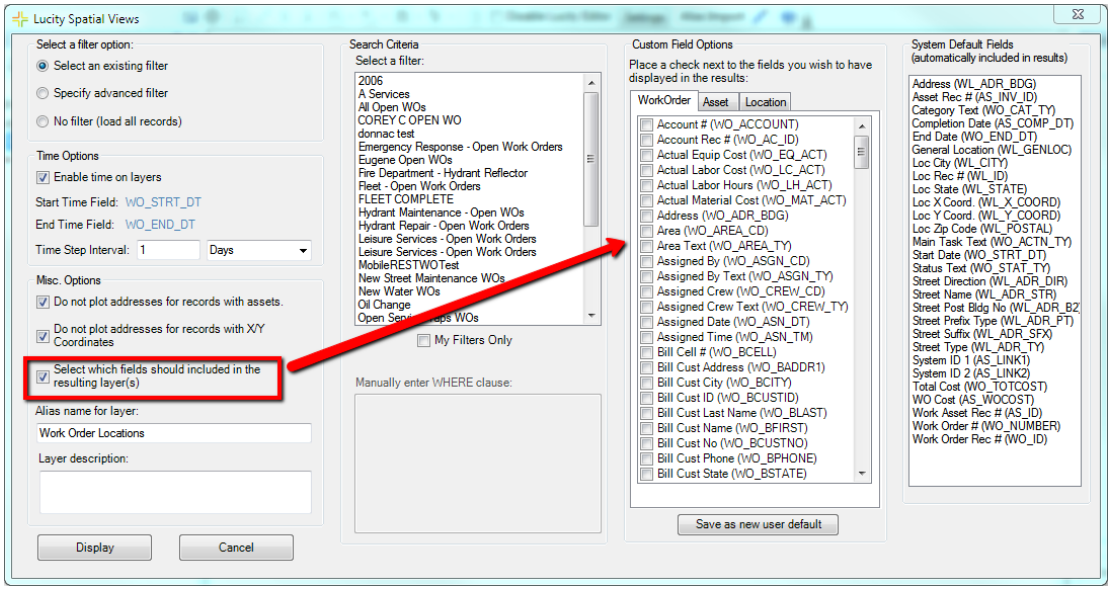
Available Views	
Requests	This creates temporary static layers of work request locations based on Dates, Categories, Filters, and Spatial Filters.
Requests (Live)	This creates dynamic (live) views of work request data based on a filter.
Work Orders	This creates temporary static layers of work order locations based on Dates, Categories, Filters, and Spatial Filters.
Work Orders (Live)	This creates dynamic (live) views of work order data based on a filter.
PM/Routine	This creates temporary static layers of Master Projects based on a filter.
Master Projects	This creates temporary static layers of PM/Routine locations based on a Dates, Categories, Filters, and Spatial Filters.

3. The associated tool will appear allowing you to provide further details specific to the type of work.

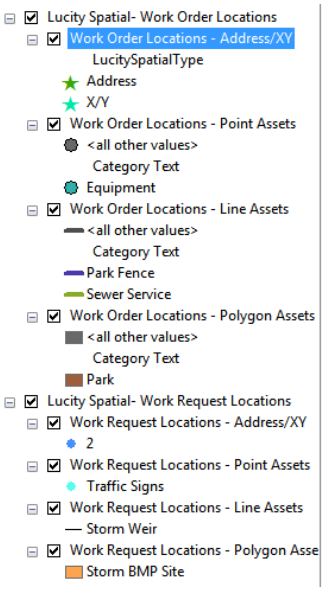


Select a filter option	Provides several ways for users to select a set of work requests to display.	
	Select an existing filter	Allows users to select a filter that was previously created and saved in the Requests module.
	Specify advanced filter	Allows users to manually enter a filter using SQL.
	No filter (load all records)	Displays all requests that have spatial information.
Search Criteria	These fields allow users to select or add a filter depending on their previous selection	
	Select a Filter	Displays all filters that were previously created and saved in the ***Requests module***. Check the ***My Filters Only*** box to show only the filters created by the current user.
	Manually enter WHERE clause	Type in a filter for the request module using SQL. Start with **WHERE....**
Time Options	These allow users to enable time functions within the layer. This allows users to use the ESRI Time functions within ArcMap.	
	Enable Time on Layers	This enables the time function for the request layers.
	Start Time Field ***End Time Field***	These are the pre-configured fields that the time functions will use.
	Time Step Interval	Fill out the number of days/weeks/ months that the time functions should group the requests into. Note: This can be changed in the layer properties after the layer is created.
Misc Options	These allow users to control the results in several other ways.	
	Do not plot addresses for requests with assets...	This option causes the results to not plot the address of the work request if there is an associated asset. If this is turned off the work request will plot both.
	Do not plot addresses for work request locations with X/Y Coordinates	This option causes the results to not plot the address of the request if there is an X/Y coordinate set. If this is turned off the request will plot both.
	Select which fields should be included in the resulting layer(s)	The results produced by this tool will plot the location of different requests and will contain attribute information from the Request module in the Attribute table. Check this option to open another section of the tool to change which fields from the Request module show up in the Attribute table.
	Alias name for layer	The name that will appear in the able of contents.
	Layer description	The description that will appear in the layer's properties.

4. Fill out the form based upon the various settings and options that are available.
    a. Note: All request and work order fields are available for use in the resulting layer. To adjust which fields should be included in the results you will want to check the "Select which fields should be included in the resulting layer(s)".

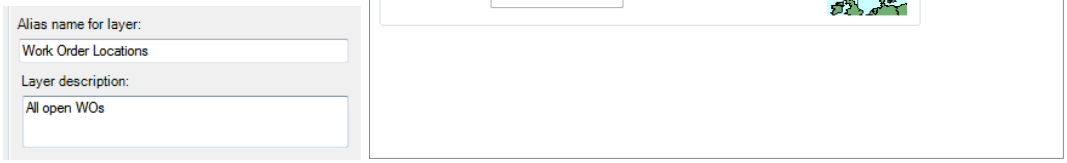


5. Click Display once you are ready to generate the layers. Once the tool has completed processing, the resulting grouped layer will be added to the map.



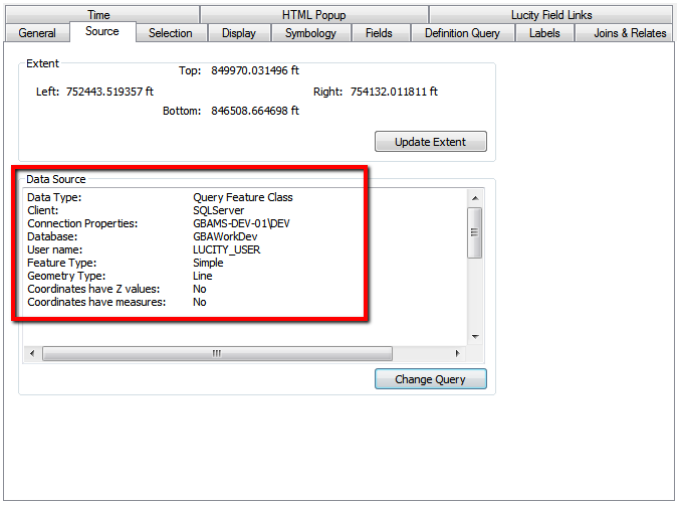
Examining the resulting layers:

- The tool will generate 4 layers:
  - Point layer for address and x/y data
  - Point layer for asset data
  - Polyline layer for asset data
  - Polygon layer for asset data
- General- The resulting layer name and description is determined by the user specified settings that were defined on the Lucity Spatial Views form.

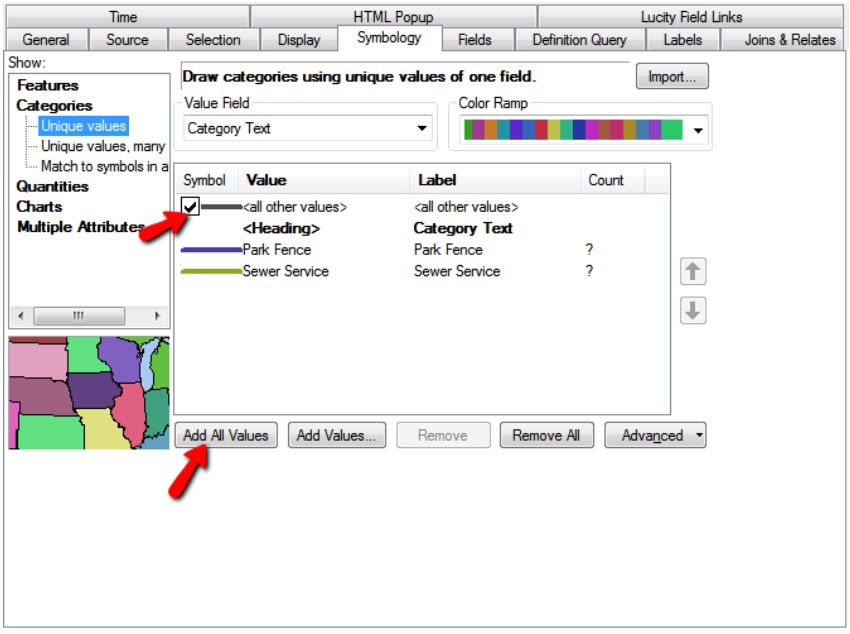


  - **Note**: The Description will start with "LucitySpatialWork:" or "LucitySpatialRequest:". You can modify the description, but the description **must** start with these key words. This is a requirement if these layers are to be used in the Lucity Web Map.

- Source- The source used for the work layers is the GBAWork database. The tool connects to the GBAWork database as Lucity_User. You will need to know this information if you wish to publish the layer as a service later.

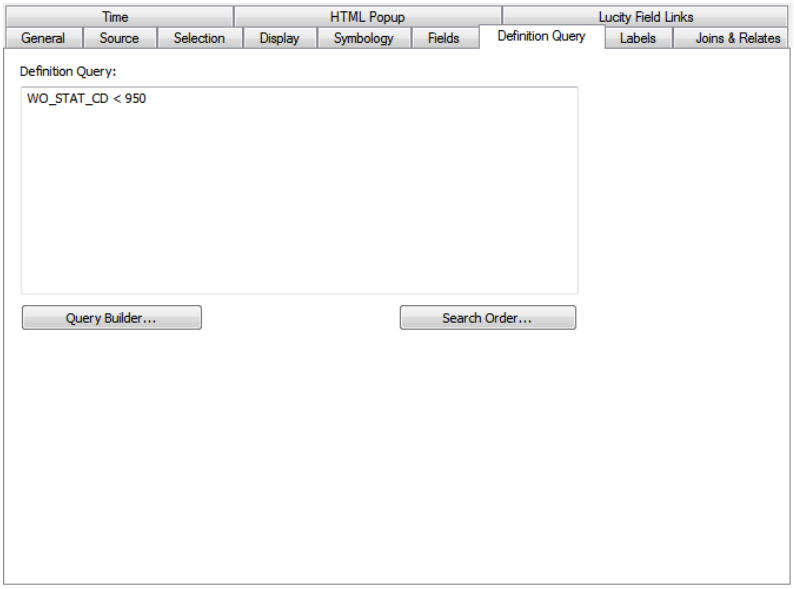


- Symbology- The default for the tool is to symbolize based upon the Work Category Text (RQ_CAT_TY, WO_CAT_TY). The symbology can be altered by going to the layer's symbology tab.

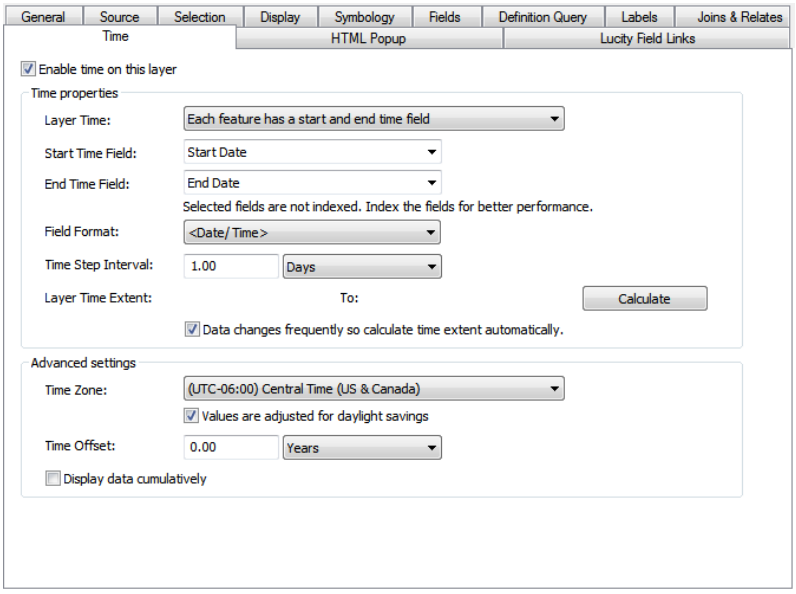


  - Note: The symbology is not dynamic. In other words, if a new work order/request is created that as is assigned to a category that hasn't been used yet- it will not show in the layer. To account for this situation:
    - Adjust the symbology to include the "<All other values>". Even though you visually won't be able to tell what work category the work item has been assigned, at least it will be visible in the layer.
    - Occasionally you will want to update the symbology of the layer by using "Add All Values".

- Definition Query- A definition query was applied to the layer if the option to use an existing filter or an advanced filter was specified on the Lucity Spatial Views Form.



- Time- If the option to enable time on the generated layer was set, then the Time tab on the resulting layer will have some additional settings that can be configured.



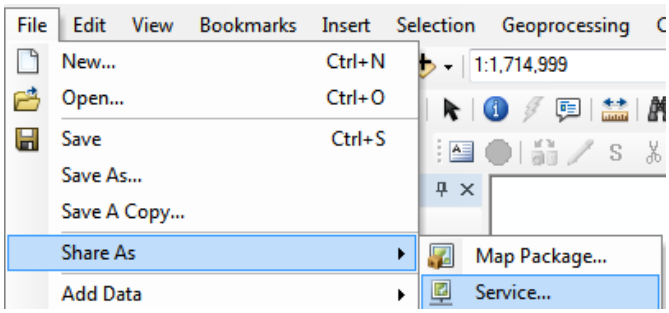
- Customizations to the layer settings (symbology, labelling, etc) can be saved and used as the default for future runs of the Lucity Spatial View tool. For more information on how to save these settings refer to the Lucity Symbology default tool: http://help.lucity.com/webhelp/v140/gis/index.htm#25859.htm
- The Lucity extension tries to handle all the situations needed with generating query layers; however, there may be some additional requirements needed based upon the underlying database platform. Refer to http://resources.arcgis.com/en/help/main/10.2/index.html#/Preparing_to_use_query_layers/00s500000032000000/ for more information.

Publishing Live Work Layers

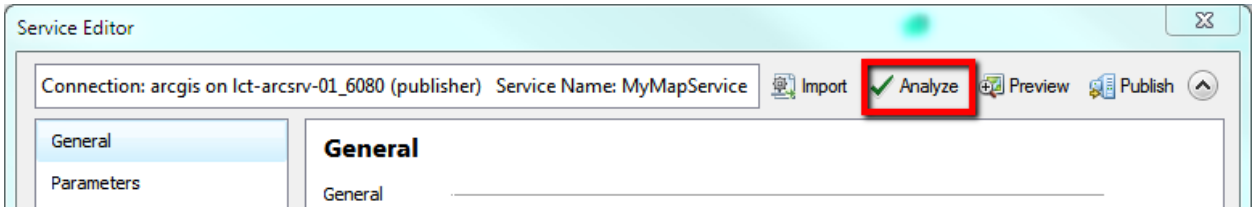
After you have created the live work layers, you can distribute access to those layers for users on the ArcGIS Desktop platform. If you wish to provide access to those layers in the Lucity web map, or any of the Lucity mobile applications then you will need to create a map service that contains these layers.

There is more than one way to publish a map service; the following is an example of how you can create the service from within an ArcMap document (.mxd).

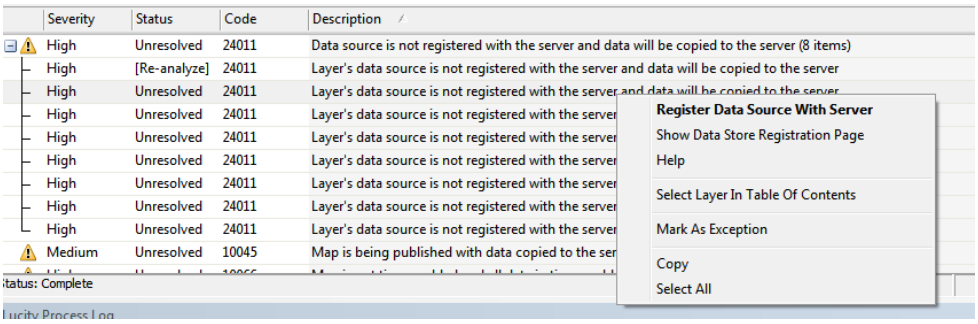
- In ArcMap add the live work layers to the map and customize properties so the map is displaying the data as you like.
- In ArcMap, click File>>Share As>>Service.



- Before you publish the service, you will want to analyze.



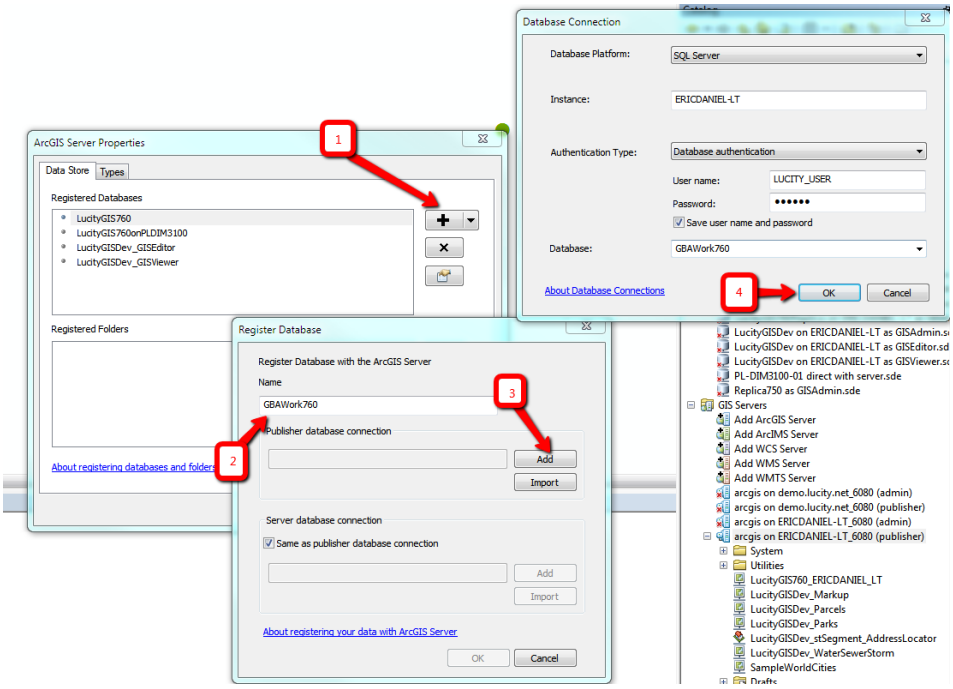
- The following are some common warnings/errors found when publishing the Lucity Live Work Layers and how they can be resolved:
    - Layer's data source is not registered with the server and data will be copied to the server



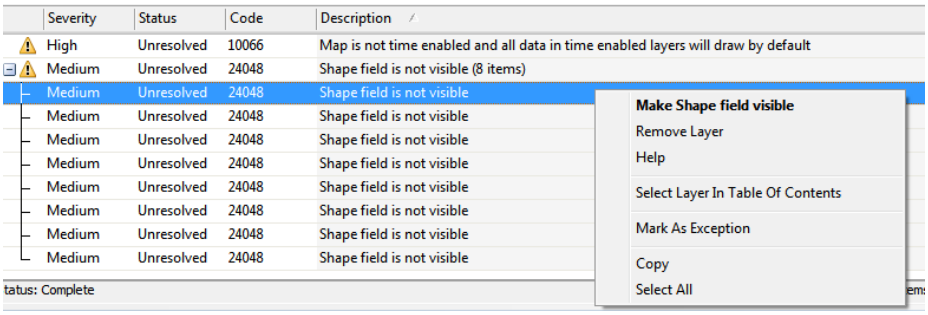
    i. This must be fixed; otherwise, the layer will not be refreshed with updates.

    ii. To resolve, right-click on the error and select the Register Data Source With Server option.

iii. If needed, you may need to manually create a db connection to GBAWork using Lucity_User.



- Shape field is not visible



i. This must be resolved before publishing

ii. To resolve, right-click and select Make Shape Field Visible

- Once you resolved all the issues, you can publish the service. Once published, you can add this service to the Lucity web map or mobile applications.

The Lucity Live Work layers are essentially query layers. They are pointing to various spatial views in the Lucity database. These layers are 'live' meaning if a work location is added/updated/deleted this information automatically refreshed in the live work layer.

Notes:_____

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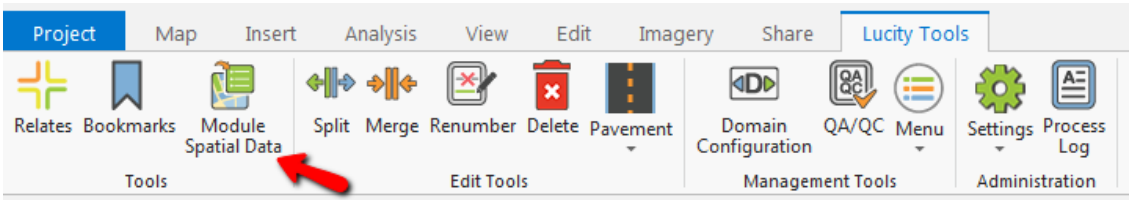
ArcGIS Pro

Module Spatial Data Tool

The Lucity Module Spatial Data tool in ArcGIS Pro allows a user to display Lucity Work data and inspection data easily in the map.

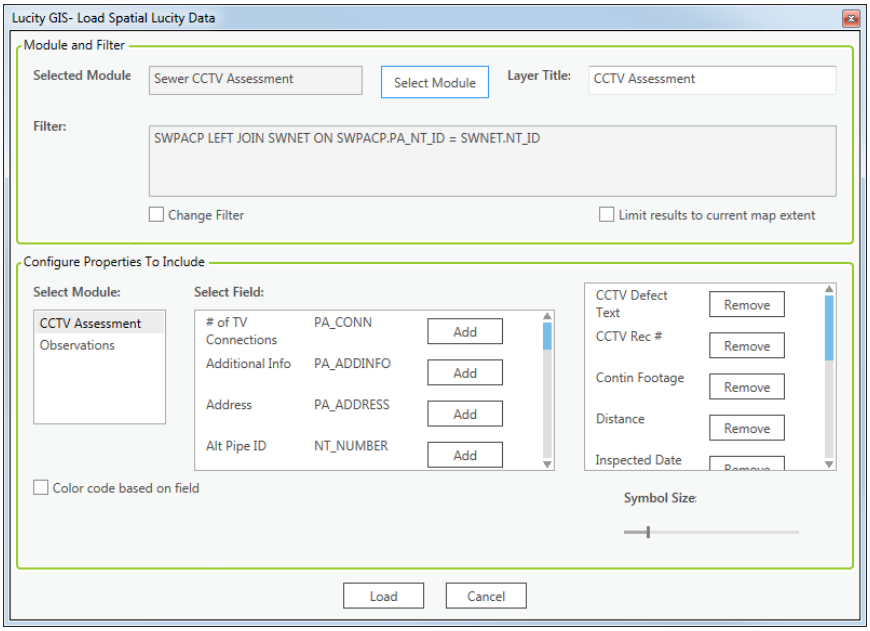


The Module Spatial Data tool loads spatial work/inspection data into ArcGIS Pro with the following steps:

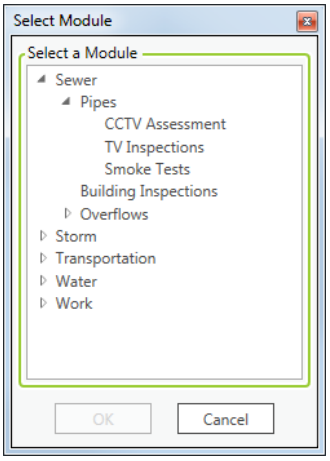
1. Spatial features are returned to ArcGIS Pro from Lucity.
2. LucityGISTools.gdb is created in the current Windows user's temp folder, if it doesn't already exist.
3. Feature classes (for each geometry type returned) are created in the LucityGISTools.gdb.
4. Fields that the user specified to be included in the results are added to the feature classes.
5. The feature classes are populated with the spatial features from Lucity.
6. The feature classes are added to the current map as layers.

To use the Module Spatial Data Tool:

1. Click the Module Spatial Data button. The following dialog will appear:

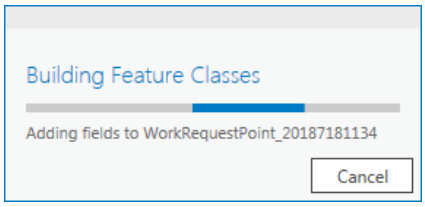


- **Selected Module:** The module for which to load spatial features. This is set by clicking the Select Module button, which opens the following dialog:

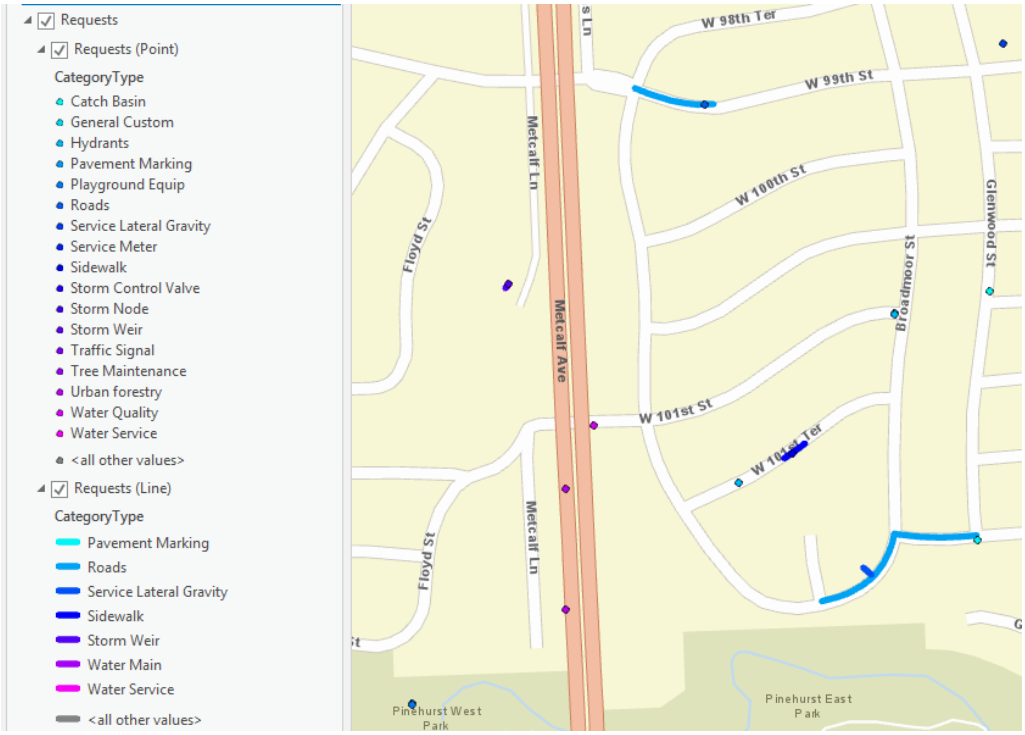


- **Layer Title:** The name to apply to the resulting layer(s) in the map.
- **Filter:** The filter used to retrieve spatial data from the selected module.
- **Change Filter:** Enables the filter textbox so that the user may modify the filter. Also displays a dropdown list of current filters for the selected module.
- **Limit results to current map extent:** Passes a spatial filter to Lucity so that only features within the current map extent will be returned.
- **Select Module:** Controls which fields are shown in the Select Field list view. This will either be the parent module, or one of the child modules.
- **Select Field:** Displays a list of all fields in the selected parent or child module selected under the Select Module list view. Clicking Add will add a field to the far-right list view, which holds fields to be included in the results. Clicking Remove from the far-right list view removes the field from the list of fields to be included in the results.
- **Color code based on field:** Indicates that the resulting layers will be symbolized based on unique values of a given field. If checked, the user must specify a field to symbolize on and a color palette to use.
- **Symbol size:** The symbol size for point/line features in the resulting layers. The default is 4.

2. Once you have set the options to your desired configuration, click Load. While geoprocessing tools are working to create and load feature classes, a cancelable progress indicator is provided:



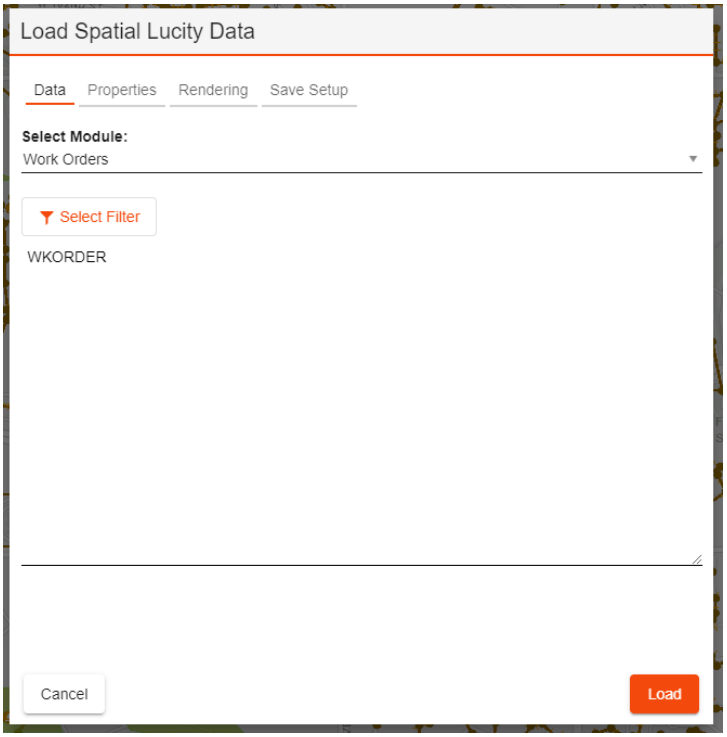
3. Upon completion, the resulting layer(s) are symbolized and added to the map under a group layer:


Requests
Requests (Point)
CategoryType
Catch Basin
General Custom
Hydrants
Pavement Marking
Playground Equip
Roads
Service Lateral Gravity
Service Meter
Sidewalk
Storm Control Valve
Storm Node
Storm Weir
Traffic Signal
Tree Maintenance
Urban forestry
Water Quality
Water Service
<all other values>
Requests (Line)
CategoryType
Pavement Marking
Roads
Service Lateral Gravity
Sidewalk
Storm Weir
Water Main
Water Service
<all other values>
W 98th Ter
W 99th St
W 100th St
W 101st St
W 102nd Ter
Metcalf Ln
Metcalf Ave
Floyd St
Broadmoor St
Glenwood St
Pinehurst West Park
Pinehurst East Park

Lucity Web Map

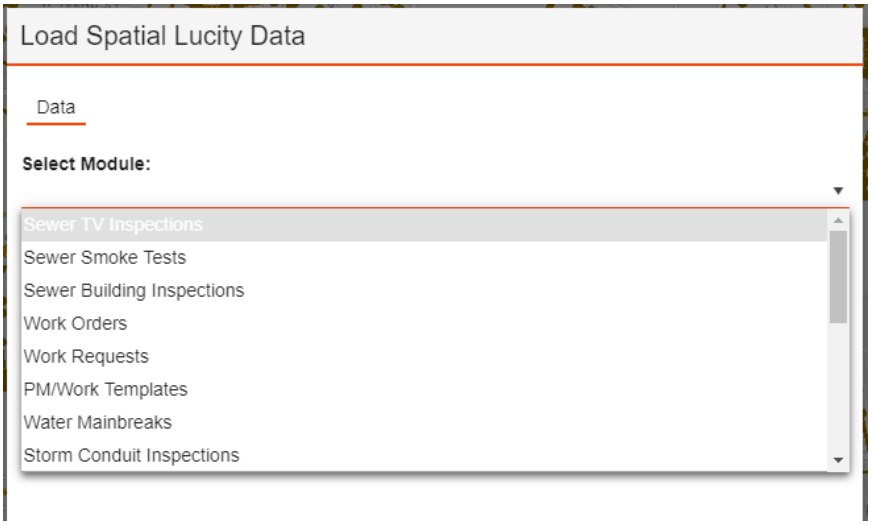
Module Spatial Data Tool

The Module Spatial Data tool enables users to display Lucity Work data and some Lucity inspection data in the map. The layers that are loaded are a live view of the information in the Lucity database.

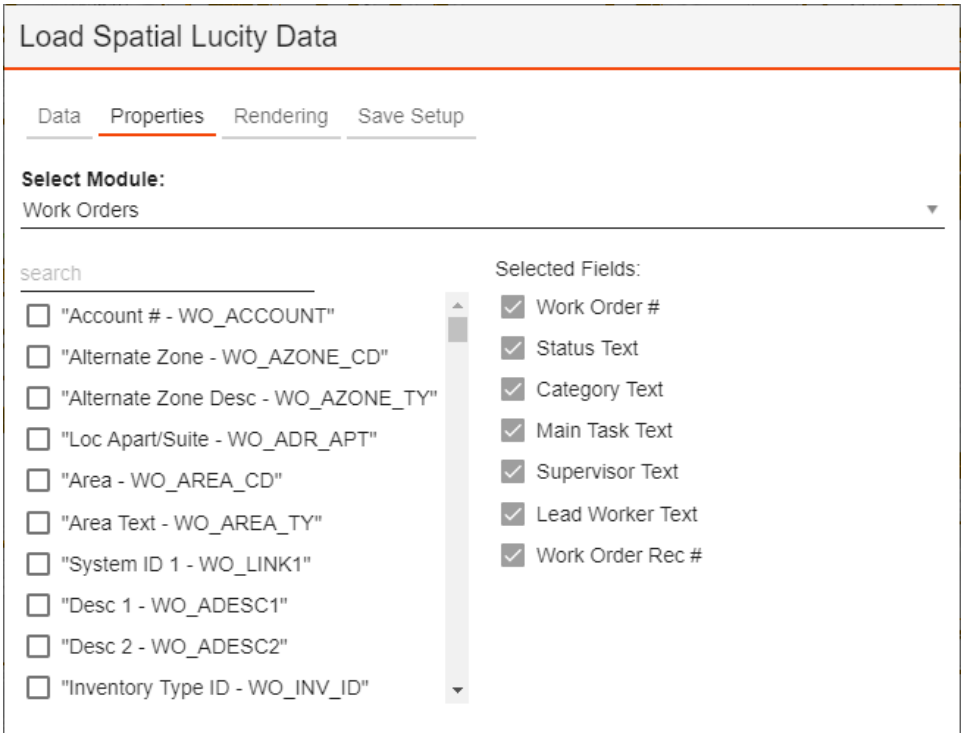


Note: The use of this tool requires that Lucity Spatial has been enabled and the service is running.

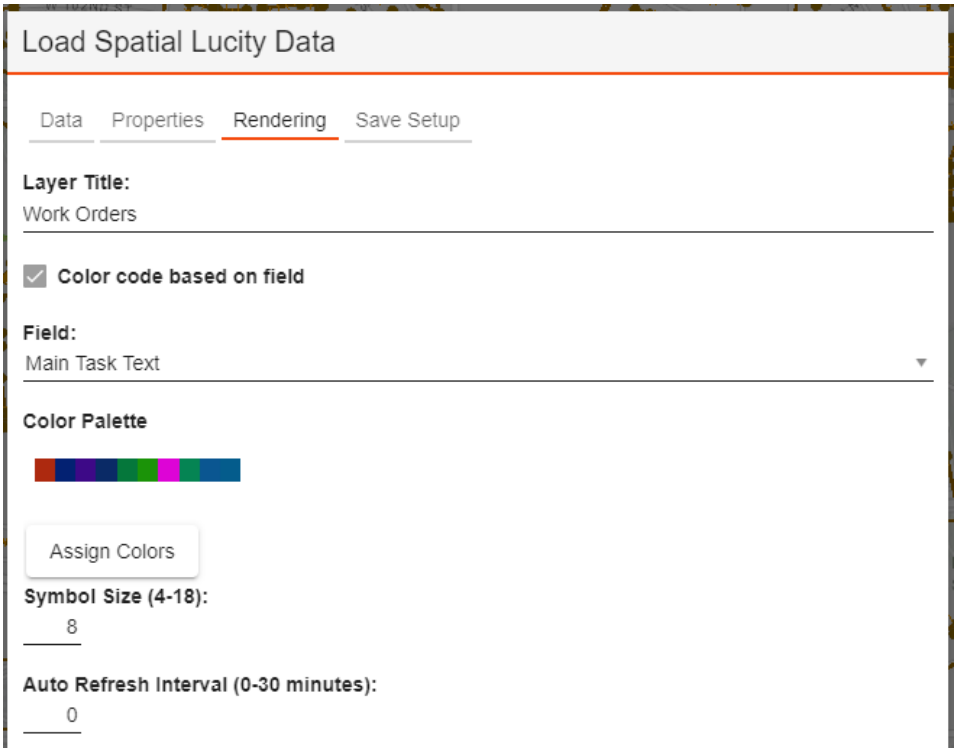
1. Click the Module Spatial Data tool
2. On the Load Spatial Lucity Data form, select a module.



3. Click the Select Filter button to use a filter.
4. On the Properties tab, check any additional fields that you would like to include in the results.

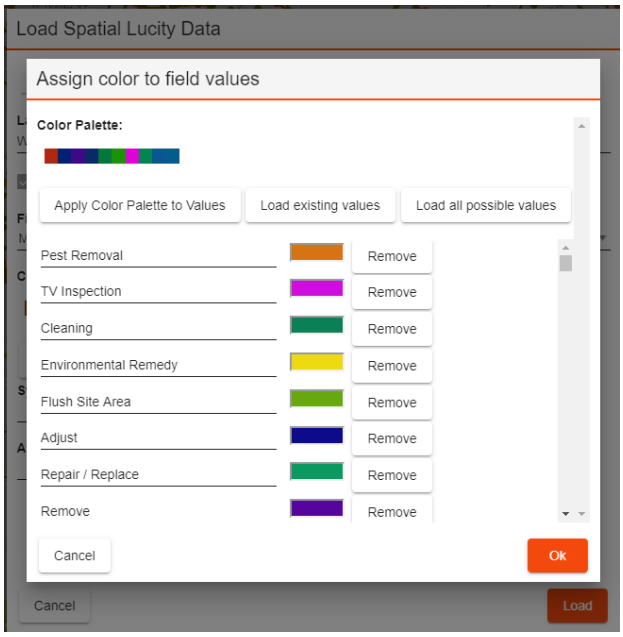


5. On the Rendering tab, you can override the default title used for the results, and change the various properties related to the rendering of the layer.



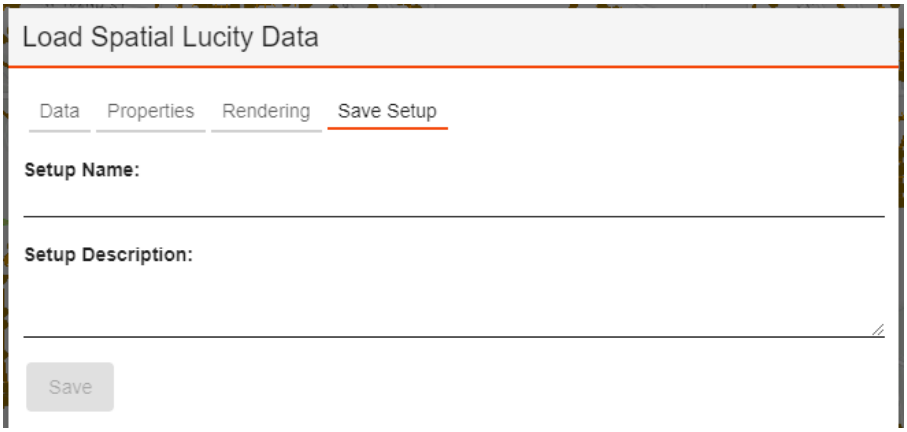
6. Set a symbol color and size, or choose the *Color code based on field* option to select a field and color palette.

    a. If you choose the *Color code based on field* option you can further customize the results by pre-assigning a color to each possible field value. Click the Assign Colors button to assign a color to a value.



7. If you would like the results to automatically update in the map as new records are being added, removed, and updated in the Lucity database, then set the *Auto Refresh Interval*.

8. If you would like to save the setup so the results are automatically included each time the GIS View is loaded, then specify a name and description on the Save Setup tab and click Save.



9. Finally, click Load to process the setup and add the results to the current GIS View.

Troubleshooting

Sometimes there may be records that fail to process. When a spatial change record cannot be processed it is kept in the Spatial Change table (Lucity.WKSPATIALCHANGE) and marked with an error code. These records are kept in the Spatial Change table for 30 days after they were initially processed. After 30 days they are deleted.

The error codes are found in the SPCH_SU_ERROR column:

- MissingData
    - Usually means that there was an issue with the data in WKSPATIALCHANGE like the moduleID is invalid; ParentRecID is invalid, invalid x/y data, etc.
- ServiceIssue
    - This occurs if there isn't a map service associated with the feature class or the feature class related to the asset type is not in the service
- NoGeometry
    - Returned if a record's geometry was found but was empty, if the indexer was unable to geocode an address, or if there was an issue with the REST call to retrieve the geometry.
- NoLucityRecord
    - Returned if the associated record no longer exists in Lucity

How to Process Records that have failed:

1. In the WKSPATIALCHANGE table find the record that failed
2. Review the error code for the record and resolve the problem
3. Delete the contents of the SPCH_GUID and SPCH_SU_ERROR fields for the record
4. The next time the Lucity Spatial Updater service runs it will attempt to process the skipped record again.

Admin Portal Tool

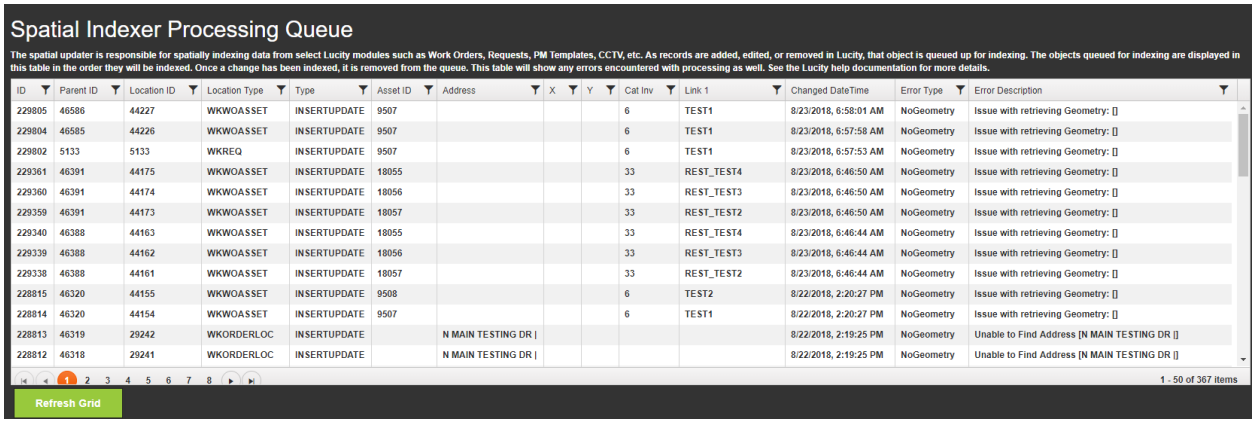
The Lucity Web Admin Portal contains a section to show the details of the Spatial Indexer Processing Queue. This is essentially the WKSPATIALCHANGE table as described in the Behind-the-scenes and Troubleshooting sections of this document.

To view the processing queue:

1. Click the Open Admin Portal tool in the Application toolbar:

2. This will open a new tab, titled Admin Portal, expand the Web App Management section, and select the Spatial Updater Processing option.

3. This will open the Spatial Indexer Processing Queue similar to below:



4. You can review the information as needed. Refer to the Behind-the-scenes or Data Quality Tool sections of this document for more information about the data found in this table and how to resolve errors.

Data Quality Tool

The Lucity Data Quality Services Tool (DQS) was modified in 2016r2 so there is now an option to run queries on the work spatial tables. In addition, there is an option to fix the issues found. Note: This functionality is currently only available for SQL Server database clients.

The DQS tool queries the Lucity spatial tables (WKGEOMPT, WKGEOMLN, WKGEOMPG) for the following data problems:

- Features of a different geometry type than what is supposed to be in the table (i.i. points in the polygon table).
    - This is marked as an error because this will cause problems with functionality.
- Features where the spatial reference does not match that of the Operational WKID as listed in Lucity system settings.
    - This is marked as a warning because this may impact certain functionality.
- Features that have invalid geometry (i.e. lines that intersect themselves, incomplete polygons, multiple vertices on top of each other, etc.).
    - This is marked as an error because this will cause problems with functionality.

The queries are in a new query suite titled “Spatial” and work the same way as other queries in the program: