

What's Needed

- ArcGIS Data Interoperability Extension (using one of the following)
 - ArcGIS Pro 2.1.x
 - ArcGIS Enterprise 10.6.x
- Source Data
- [Water Distribution Utility Network Configuration](#)
- [Utility Network Package Tools](#)
- Water Distribution Utility Network Migration Tools
- ArcGIS Enterprise 10.6
 - ArcGIS Utility Network Management Extension
-



FME 2017.1.1.0 build 17650 can be used in place of the ArcGIS Data Interoperability Extension.

What's Included

In the migration tools download you get the following:

- ArcGIS Data Interoperability / FME workspace (.FMW)
- Sample Microsoft Excel schema mapper file
- Sample source data

Preparing to Migrate to the Utility Network

To facilitate a smooth migration to the utility network there should be pre-migration planning, validation, and if necessary data clean-up. Consistent and clean data reduces the likelihood of data migration errors when migrating to the utility network. Esri has provided [ArcGIS Data Reviewer checks](#) that can be configured against the source data to identify data issues that need to be resolved prior to the migration.

Any errors identified by the ArcGIS Data Reviewer checks should be corrected prior to executing the migration tools to mitigate migration errors. Attention should also be given to the consistency of how related records are stored and managed. Related records should be consistently managed; for example, if a fuse point on an electric network is protecting three phases, the related record should have three-unit records, one for each phase. It should not be also represented as one-unit record with all three phases.

The image contains two side-by-side screenshots of the ArcGIS Identify tool. Both screenshots show the 'Identify' window with 'Identify from: <Top-most layer>' selected.

Screenshot 1 (Left):

- Feature Hierarchy:** Fuse > AB > FuseUnit > 110037 > 48657
- Location:** -76.793701 42.189292 Decimal Degrees
- Table Data:**

Field	Value
Subtype	Fuse/Cutout
Feeder ID	5201605
Feeder ID 2	<null>
Operating Voltage	12500
Electric Trace W...	<null>
Feeder Informat...	<null>
Symbol Rotation	2
Normal Position...	Closed
Normal Position...	Closed
Normal Position...	Closed
Present Position...	Closed
Present Position...	Closed
Present Position...	Closed
Label Text	<null>
Phase Designation	AB
Nominal Voltage	<null>
- Status:** Identified 1 feature

Screenshot 2 (Right):

- Feature Hierarchy:** Fuse > ABC > FuseUnit > 48842
- Location:** -76.799322 42.188651 Decimal Degrees
- Table Data:**

Field	Value
Subtype	Fuse/Cutout
Feeder ID	5201605
Feeder ID 2	<null>
Operating Voltage	12500
Electric Trace W...	<null>
Feeder Informat...	<null>
Symbol Rotation	151
Normal Position...	Closed
Normal Position...	Closed
Normal Position...	Closed
Present Position...	Closed
Present Position...	Closed
Present Position...	Closed
Label Text	<null>
Phase Designation	ABC
Nominal Voltage	<null>
- Status:** Identified 1 feature

Some of the issues that cause issues, outside of rule violations, are:

- Stacked features (without Z value)
- Self-intersecting lines

Utility Network Representation

The utility network has the capability to represent network assets in high fidelity, just like they are constructed in the real world. This is accomplished via the utility network information model and the domain specific data models that enable modeling of network relationships down to every terminal.

In planning to migrate to the utility network, you should consider the level of representation you will be migrating to. The granularity of how the data is represented in the target utility network can be categorized as:

- Simple - data migrated in its current form from the geometric network
- Basic - includes modeling and representing the real world in a higher fidelity to support better analytics within and outside the GIS
- Advanced - a step beyond basic to support planning, design and extended modeling within the GIS



How you migrate your data will depend on the quality and robustness of your source data as well as the amount of time and effort you want to put into the overall migration versus addressing a more granular representation post-migration.

For example, you want a more detailed representation of your pump stations, rather than the single point that represents a pump station in your current source data. With additional work to the migration workspace, you could generate content of a pump station based on defined static assumptions. Conversely, if you have the detail of the pump station, you could modify the migration workspace to accommodate the additional detail that you maintain.

Please review the help documentation for the utility network for the benefits of a more detailed representation of your data with ArcGIS. General reasons for a more detailed representation include:

- Many of the other systems (ADMS, outage management, modeling packages, etc.) you exchange data with require the more advanced representation. By storing this representation in the GIS you can simplify the data exchange routines with the other systems.
- A more advanced representation in ArcGIS allows for more modeling to be done within the GIS.
- Better accounting of the devices you actually have in the field.



Typical water utility source data is a simple network representation. Accordingly, the Water Distribution Utility Network Migration Tools are designed to support a “simple” representation migration.

Water Distribution Utility Network Configuration

Esri has provided a series of tools to assist with the implementation of your utility network. It is recommended that these tools be used to stage the target utility network. In addition, these tools also support applying the Asset Package that is outputted from the migration workspace, to the utility network. Please refer to the [Utility Network Package Tools](#) for staging an environment for the output Asset Package.

Now that you have an understanding of migration representation options, it is now time to start with your water distribution utility network configuration. The [help documentation](#) provides you with the steps to get you started with your implementation. Following this documentation, you will stop after you complete the “Stage utility network” step in the “Create a water utility network”. We will continue where we left off later in this process.

Asset Package

Once you have cleaned the source data and have an understanding of the innerworkings of all the assets in your source data, it is then time to review the target water Asset Package. The target water Asset Package is a representative configuration of a common data model as well as rules and other network properties for the target utility network. You should take time to familiarize yourself with the water Asset Package so that you understand the feature classes, Asset Groups / Asset Types, attributes, rules and other properties. Gaining understanding of the target water Asset Package will help with:

- How to map source features to the target Asset Package
- Identifying gaps between data elements in the source features against the water Asset Package

The [Asset Package](#) is simply a way to model the components of a utility network. Asset Packages can be used to configure a utility network and as an interchange file to import and export the properties of a utility network.

Asset Packages are stored in a file geodatabase and can include the components that model a utility network as well as data to load into a utility network. The Water Utility Network Migration Tools leverage Asset Packages for data loading.

It is important to understand that while Asset Packages can contain data and can be interacted with by ArcGIS clients, they are not an actual utility network. They are used to configure and interchange data with utility network.

An Asset Package is supplied with the Water Distribution Utility Network Configuration that provides a common set of water distribution network behavior to a utility networks. Users can further refine this Asset Package to add additional attributes and/or network behavior.

The Asset Package supplied with the Water Distribution Utility Network Migration Tools is also contains sample data for loading to a utility network. Because you will not load the sample data and will be loading your migrated data instead are a few pre-processing steps that need to be performed in order to convert it to a Template Asset Package that will be used by the migration workspace. The pre-processing steps are performed by the [Change Asset Package Spatial Reference tool](#) which is included in the download. This tool updates the spatial reference of the Asset Package to your coordinate system and truncates the sample data in the Asset Package so you can load your own. The result output is the Asset Package Template that you will use in your parameter configuration when running your workspace.

For more information about the structure of the Asset Package see the [Asset Package Reference](#).

Schema Mapper Spreadsheet

Now that your source data has been cleaned and you have an understanding of the water Asset Package, it is time to map your source data to the target water Asset Package. This mapping is done with the included schema mapping spreadsheet. The schema mapping spreadsheet is referenced by the SchemaMapper transformers in the migration workspace of the ArcGIS Interoperability extension or FME Workbench workspace file. The spreadsheet has several tabs that map the source ArcGIS schema to the target utility network schema. The information below is a guide to updating the schema mapping spreadsheet. In addition, the sample schema mapping spreadsheet has been populated with sample

inputs from the published water Asset Package as well as source mappings to the sample data that is provided with the migration tools.:

- **Assettypes:** defines the asset group and asset type mappings
- **Domains:** Defines source to target domain and subtype mappings
- **Feature Classes:** These tabs are used to map the source ArcGIS attributes to the target Utility Network attributes.

Limitations:

- **Nulls:** Microsoft Excel does not handle true NULLs. In cases where a true NULL needs to be mapped to the target add “<Null>” to the cell.
- **Case:** the spreadsheets and FME are case sensitive so ensure the case for attributes and values in the source and target mappings match the data you are working with.
- **Filters:** simple ‘and’ filters or joins are used in the spreadsheet to identify which row to use for the schema mapping. For example:

```
If ArcGISFeatureClass = wControlValve AND VALVETYPE = PC  
then ASSETGROUP = 1 AND ASSETTYPE = 0
```

More complex logic for identifying mappings that might require AND, OR to formulate the mappings might need to be added to the workspace.

	Users will have to review and update the schema mapping Microsoft Excel spreadsheet based on source data and target Asset Package schema.
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Assettypes Tab – Defines how the source data will map to the target FeatureClass.AssetGroup.AssetType

- UNFeatureClass—defines the target feature class for the domain network and structure network
- assetgroupValue—the coded value of the Asset Group
- assetgroupDesc—the description of the Asset Group that is presented for the coded value of the Asset Group
- assettypeValue—the coded value of the Asset Type
- assetgroupDesc—the description of the Asset Type that is presented for the coded value of the Asset Type
- ArcGISFeatureClass—defines the source feature class that supplies the data to the target FeatureClass.AssetGroup.AssetType
- Primary / Secondary / TertiaryAttrValue—fields that define simple “and” logic to source the data values for the target FeatureClass.AssetGroup.AssetType. At a minimum PrimaryAttrValue is required. Additional AttrValues are used when additional logic is required: Material = “ST” and Subtype = “2” maps to WaterLine.FireService.Unknown
- Primary / Secondary / TertiaryAttrName—the field name where the Primary / Secondary / TertiaryAttrValue data is stored.
- assetTypeAttr—constant value that must be added that defines the Asset Type field in the target. This value will always be “ASSETTYPE”.

- assetgroupAttr—constant value that must be added that defines the Asset Group field in the target. This value will always be “ASSETGROUP” and must match the case stored in the target Asset Package.
- FeatureTypeAttr—the variable that the schema mapper transformer in the workspace uses. This will always be: “fme_feature_type” for any mapped values. Every row with a mapped value in the schema mapper spreadsheet requires that “fme_feature_type” be added to the FeatureTypeAttr column.
- assetTypeDescAttr—constant value that must be added that defines the Asset Type description field in the target. This value will always be “ASSETTYPEDESC” and must match the case stored in the target Asset Package.
- assetGroupDescAttr—constant value that must be added that defines the Asset Group description field in the target. This value will always be “ASSETGROUPDESC” and must match the case stored in the target Asset Package.

Domains Tab—Defines source to target domain and subtype mappings. This tab defines how the existing coded values in the source will be translated to the target Asset Package.

- ArcGISFeatureClass—defines the source feature class that supplies the data to the target domain/subtype
- ArcGISAttrName—name of the field that stores the source data
- UNAttrName—name of the field that stores the target data
- ArcGISDesc—description of the coded value in the source database that is presented to users through ArcGIS user interfaces
- ArcGISCode—coded domain/subtype value stored in the source geodatabase
- UNDesc—description of the coded value in the utility network that is presented to users through ArcGIS user interfaces
- UNCode—coded domain/subtype value stored in the target utility network geodatabase
- FeatureTypeAttr - The variable that the schema mapper transformer in the workspace uses. This will always be: “fme_feature_type” for any mapped values.
- Primary / Secondary / TertiaryAttrValue—fields that define simple “and” logic to source the data values for the target FeatureClass.AssetGroup.AssetType.
- Primary / Secondary / TertiaryAttrName—the field name where the Primary / Secondary / TertiaryAttrValue data is stored.

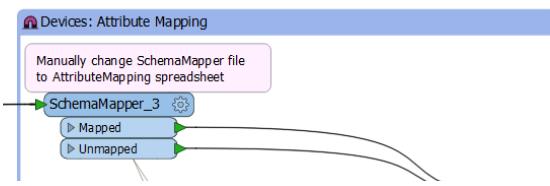
Feature Class Tabs – Each feature class tab will have the name of the utility network’s information model feature class (minus SubnetLine and ServiceTerritory): DomainAssembly, DomainDevice, DomainJunction, DomainLine, StructureBoundary, StructureJunction, StructureLine. These tabs are used to map the source attributes to the target attributes.

- UNAttrName—name of the source field that is being mapped to the target utility network
- ArcGISFeatureAttr—name of the target field that the source is being mapped to
- UNAttrDefaultValue—default value to be populated in the translation (if any)
- Note: The following fields should be excluded in the mapping as they are managed by the workspace:
 - GlobalID

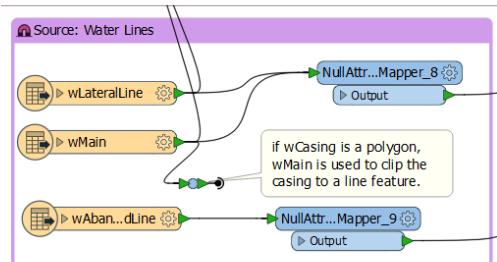
- *ShapeLength*
- *Assetgroup*
- *Assettype*
- *Fields that are domain fields should be excluded, or for clarity, flagged as a domain, i.e. LIFECYCLESTATUS (domain mapping), since they will also appear in the Domains tab*

Review the Migration Workspace

In addition to the documentation included here, the migration workspace has many documentation comments and bookmarks within it to support a successful configuration. Some of the comments within the workspace provide guidance on working around known issues:



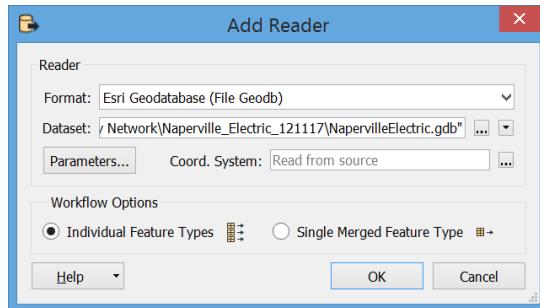
While others are tips to help with understanding what the workspace is doing, in case more advanced configuration is required:



To accommodate the advanced rules defined within the Asset Package, and to minimize rule violations when loading your Asset Package into the utility network, there is a workspace transformer process that creates junctions at the intersections of Lateral Lines and Pressurized Mains if they do not already exist. This additional transformer process adds the necessary Water Junctions Asset Group | Asset Type to meet the connectivity rules for Edge-Junction-Edge and Junction-Edge rules defined in the target Water Asset Package.

Update Source Feature Types

Source features will need to be updated in the migration workspace to support your source ArcGIS data model. In the “Readers” menu, select “Add Reader”.

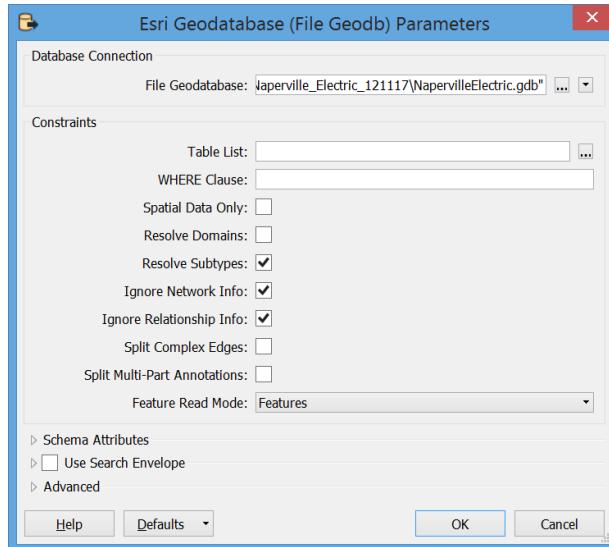


Define the type of source data in the “Format” dialog:

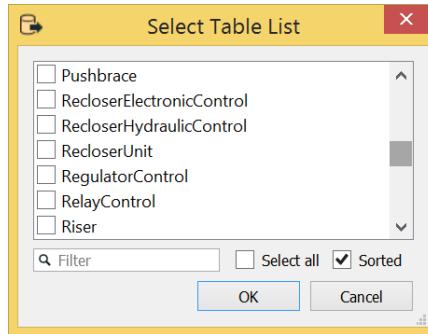
- File Geodatabase
- Enterprise Geodatabase
- Etc.

Then define the location of the source data in the “Dataset” dialog.

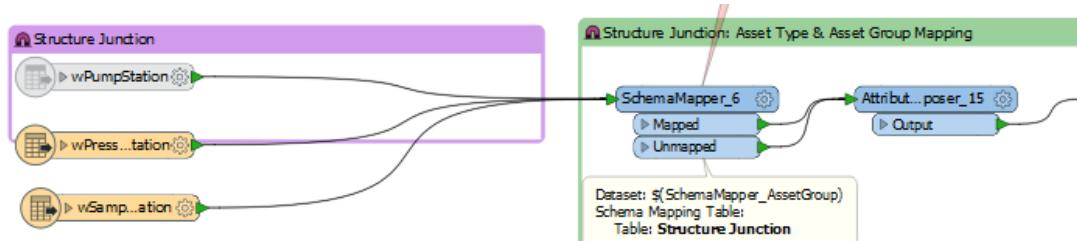
Once the source data has been defined, select “Parameters...” to define what source features will be added to the migration workspace.



Select the “...” next to the “Table List” dialog, this will open a “Select Table List” dialog allowing the user to select the features that will be brought into the migration workspace.



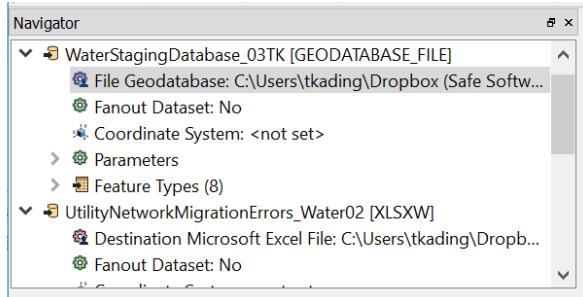
Select all the features that will be migrated to the Asset Package and select “OK”. Then select “OK” in the “Add Reader” dialog. This will bring your source features into the migration workspace. The added feature types will be added to the left-hand side of the workspace as individual feature records. These feature types will be brought in independent of any workspace migration transformers; in other words, they will not be connected to the proper SchemaMapper transformer. Once the added source features are added to the workspace, the user must then drag and drop the source feature arrow to the appropriate SchemaMapper transformer. Note: Existing sample source feature types should be disabled by right clicking on the sample source feature(s) and selecting “Disable”. Users may need to iterate through the disabling of sample source features and the dragging and dropping of added source features to the appropriate SchemaMapper transformer to fully disable all sample features and map all added source features.



Update Target Feature Types

Target feature types only need to be updated if there have been schema changes to the published Asset Package; for instance, if a new asset group / asset type has been added or a new attribute field has been added. There is a two-step process for updating the Asset Package being used in the workspace writer:

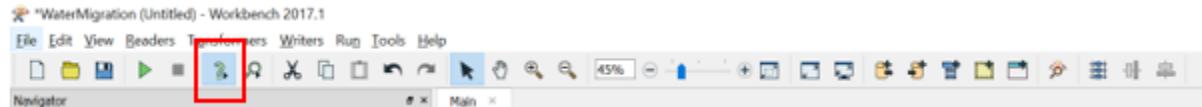
- 1) Change the Template Geodatabase—in the Navigator pane select the writer file geodatabase and double click the “File Geodatabase” to change the template. Once the dialog opens, point to the location of the modified Asset Package. By changing the template, all future runs of the migration tools will use the version of the modified Asset Package rather than the default version included with the migration tools.



- 2) Update the Writer—in the “Writer” menu, select “Update Feature Types”. When the dialog pops up, select the template that was just updated in step 1. Once the template is chosen, then another pop-up dialog will appear prompting for the location of the Asset Package that will be used. Update the location to the modified Asset Package.

Running the Migration Workspace

The workspace is designed to be run in prompt-mode to help minimize configuration issues. To ensure your workspace is running in prompt mode, select the “Set Workbench to Prompt Before Running” button.



By selecting this button, the workspace will prompt the user for configuration parameters:

- Location of “Target Asset Package File Geodatabase”
- Location of “Data Error Excel File”
- Location of “Schema Mapper Excel File”
- Location of “File Geodatabase Template (.gdb)”
- Location of “Error File Geodatabase”
- “What is the name of the Laterals Feature Class”
- “What is the name of the Water Mains Feature Class”
- Location of “Source Geodatabase”

	Parameters will vary depending on the domain (gas, water, electric).
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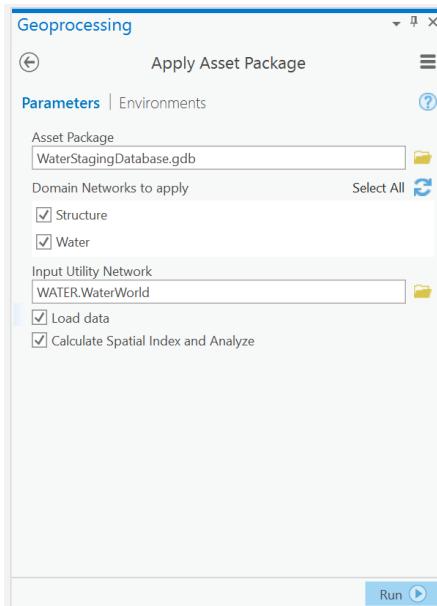
Press the “Run Translation” button to begin running the migration workspace.

Applying the Asset Package to a Utility Network

It is time to continue on with where we left off in our Water Distribution Utility Network Configuration: “[Apply an Asset Package](#)”. The following information provides a different perspective of the steps as well as additional context around the migration of the sample data.

Once the data has been migrated to the staging Asset Package, the Asset Package will need to be applied to the utility network that was staged. Using the ArcGIS Solutions’ “apply Asset Package” tool:

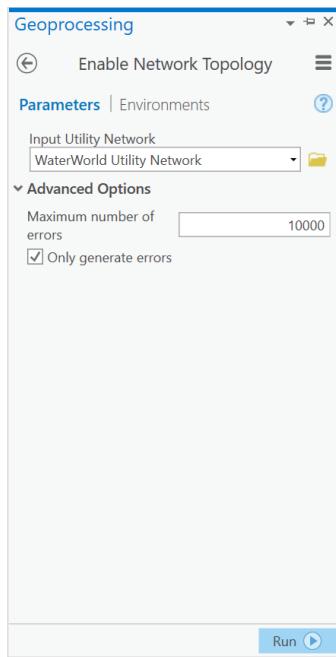
- Add the location of the staging Asset Package
- Select the domains that will be applied
- Define the target utility network the Asset Package will be applied to
- Select “Load Data” and “Calculate Spatial Index and Analyze”



This will load the staging Asset Package to the target utility network.

	When applying the Asset Package to the utility network, the files used to apply the properties of the Asset Package are written to the “AP workspace” folder; such as the associations and rules.
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With the Asset Package applied to the utility network, run the “Enable Topology” geoprocessing tool. By selecting the “Only generate errors” option, you can validate the quality and suitability of the migration for the utility network.



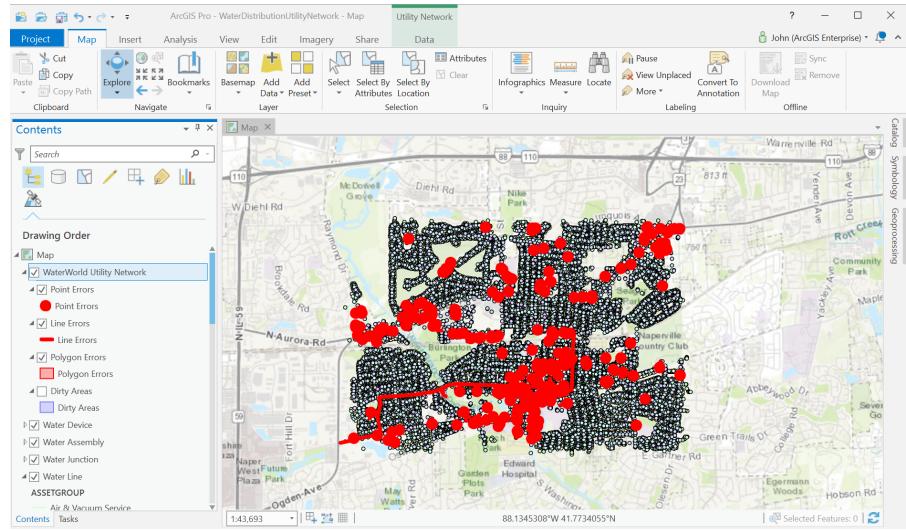
At this stage, the topology errors identify distinct items that you may need to reconsider:

- Data mapping issues in the schema mapper that result in rule violations
- Bad data that result in rule violations:
 - Stacked features
- Utility network rules that need to be updated to support data



The sample staging Asset Package and the migration tools themselves have mappings that result in some of the errors described above. This is by design to familiarize you with:

- Data quality issues
- Importance of understanding your source data and the target Asset Package
- Importance of data mapping
- Understanding utility network rules



The errors in the staging Asset Package can be resolved in one of several ways:

- Update the rules in the utility network
- Update the schema mapper spreadsheet by mapping to actual devices rather than “Unknown”
- Resolve data issues in the source data



After loading your own data you will need perform additional edits to create associations between features and assign features as controllers for your subnetworks.