

Arrow Platform

Data Preparation Guide



Overview

Boundaries

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Network Equipment

Existing Fiber Cables

Road Conduits

Other Conduits

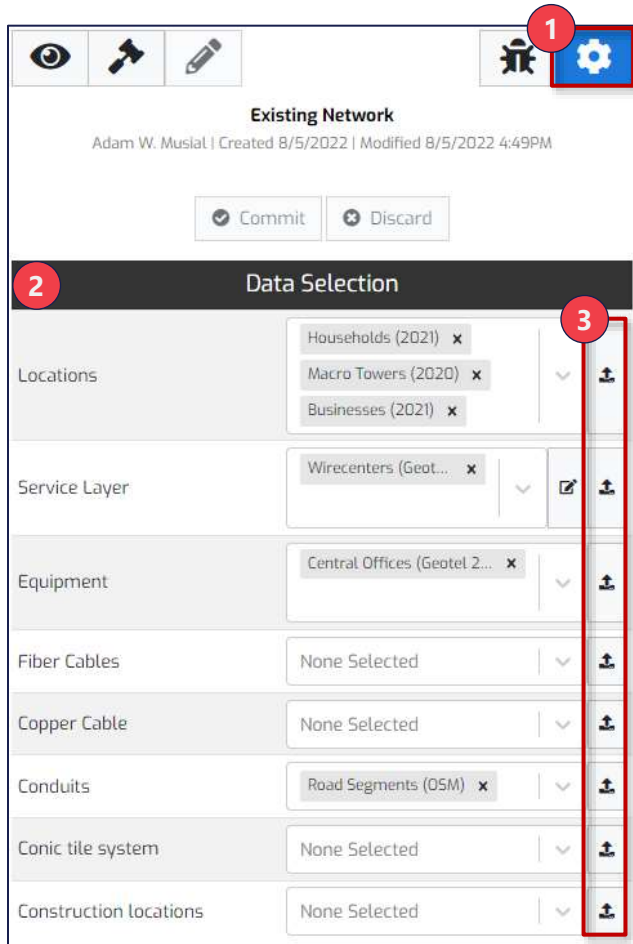
Other

While Arrow requires numerous datasets to run optimization, most of them can be uploaded through UI

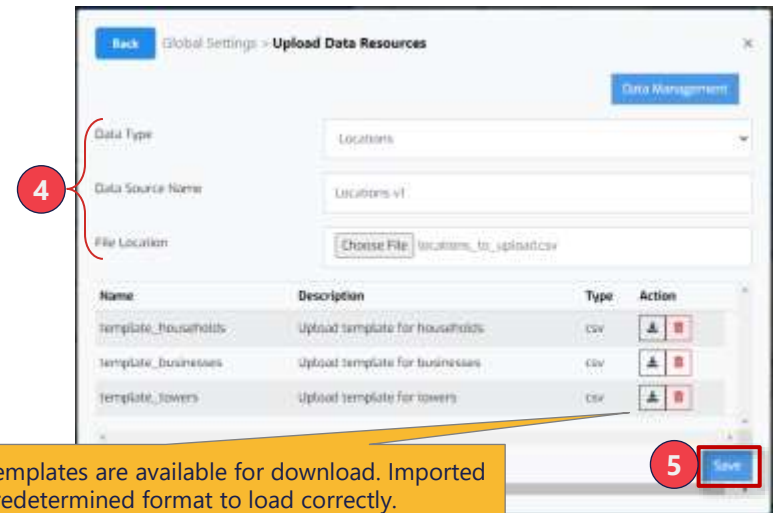
Summary of data categories used in Arrow

Category	Description	Upload through UI	Acceptable Formats	How to prepare and upload data
Boundaries	Polygons defining individual analysis areas	✓	kml, kmz	See p.6
Target Endpoints	Locations (Residential, SMB, Enterprise, Towers) used as optimization targets	✓	csv	Upload template available; See p.11
Network Equipment	Existing network equipment (e.g., central offices, splice points, terminals)	✓	csv	Upload template available; See p.14
Existing Fiber Cables	Existing fiber cables (to splice from)	✓	kml, kmz, shp	See p.16
Road Conduits	Base conduit layer defining where new fiber routes can go	✗	kml, kmz, shp	See p.19 Arrow team loads the data
Other Conduits	Alternative routing conduits (e.g., ducts, sewers) that the tool can use in plotting new fiber routes	✓	kml, kmz, shp	See p.21
Clutter Data	Clutter data used for calculating wireless signal degradation	✓	txt/zip	Arrow team prepares and loads the data

Users can load their desired data layers through dedicated upload menus in Data Selection pane



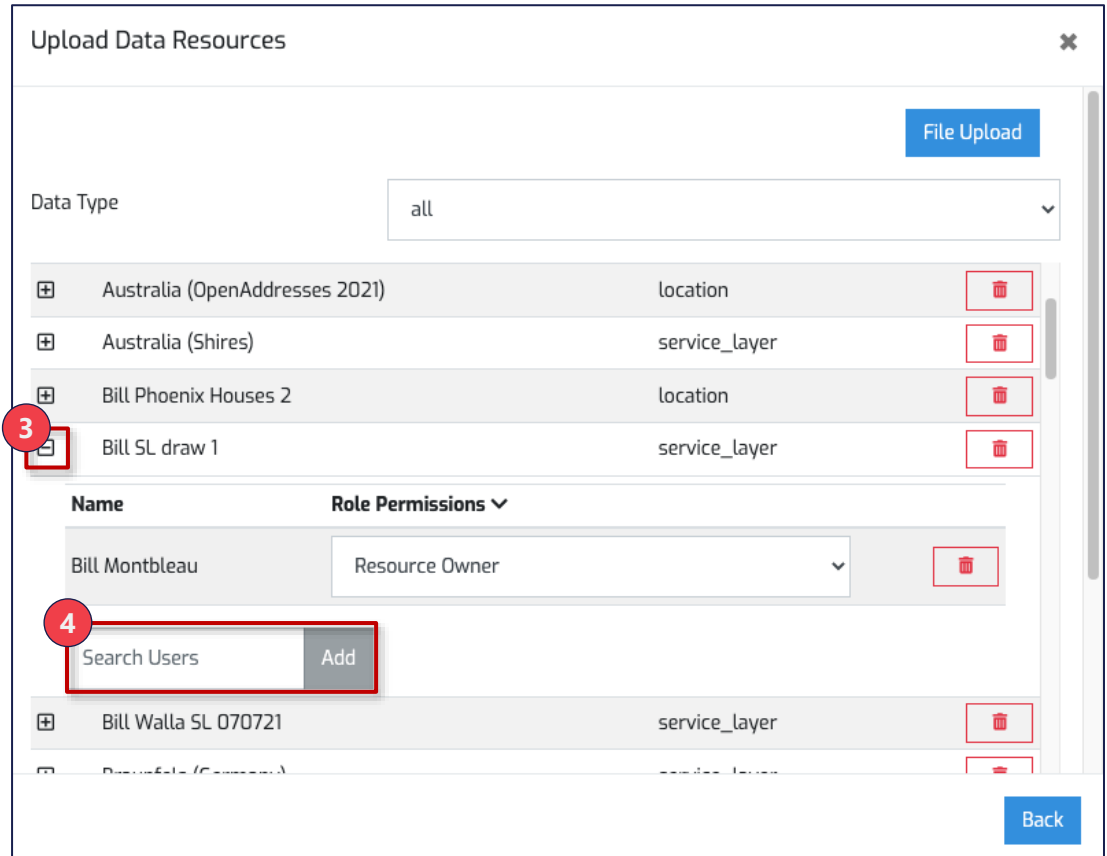
1. Navigate to Settings (gear icon in the upper right)
2. Open Data Selection pane (if not already visible)
3. Use the upload button corresponding to your target data type to open dedicated import wizard
4. Confirm/change desired data type, name the new layer, and select file you wish to upload
5. Hit save to begin the upload process
6. Once done uploading, the file will be available in the dropdown menu corresponding to the type that was uploaded
7. You can now grant user and/or group access to this resource to use in their plans (*see next slide for details*)



Where applicable, upload templates are available for download. Imported files must match predetermined format to load correctly.

Once uploaded, individual data layers can be shared with other users and user groups

1. From the upload manager click the “Data Management” button.
2. Locate the resource you uploaded and want to share
3. Click the [+] bottom on the left to expand the panel and enter the group name in the “Search Users” field.
4. Once the group is selected hit the Add button and set to the appropriate role permissions.



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There are 3 ways to define / upload service area boundaries into Arrow

1
Draw in the UI

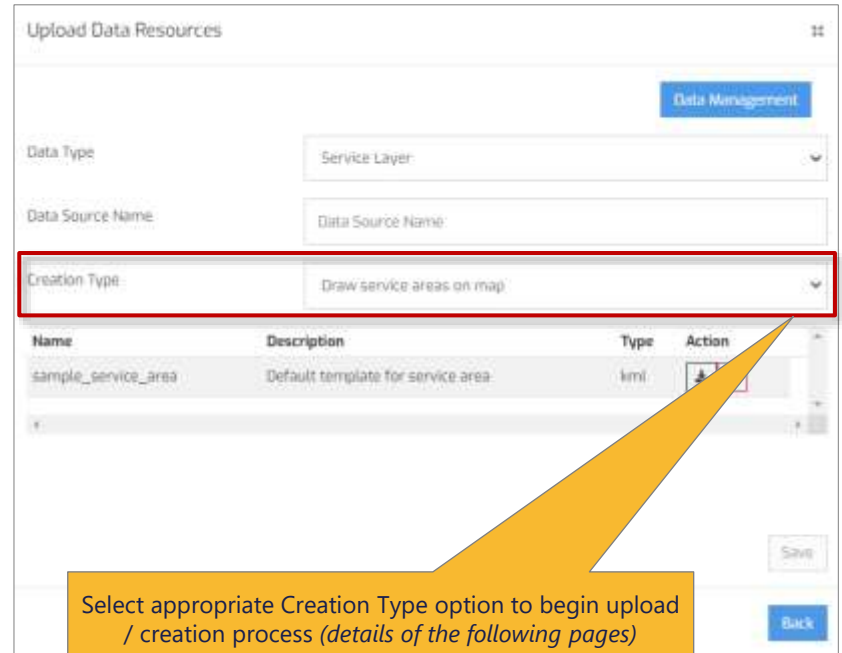
Use polygon drawing tool to define boundaries of (multiple) service area(s) directly in the tool

2
Buffer around existing equipment

Create non-overlapping circular polygons centered around existing equipment locations (e.g., COs)

3
Upload polygons from file

Upload shapes created in other mapping tools, using standard GIS file formats (kml/kmz)

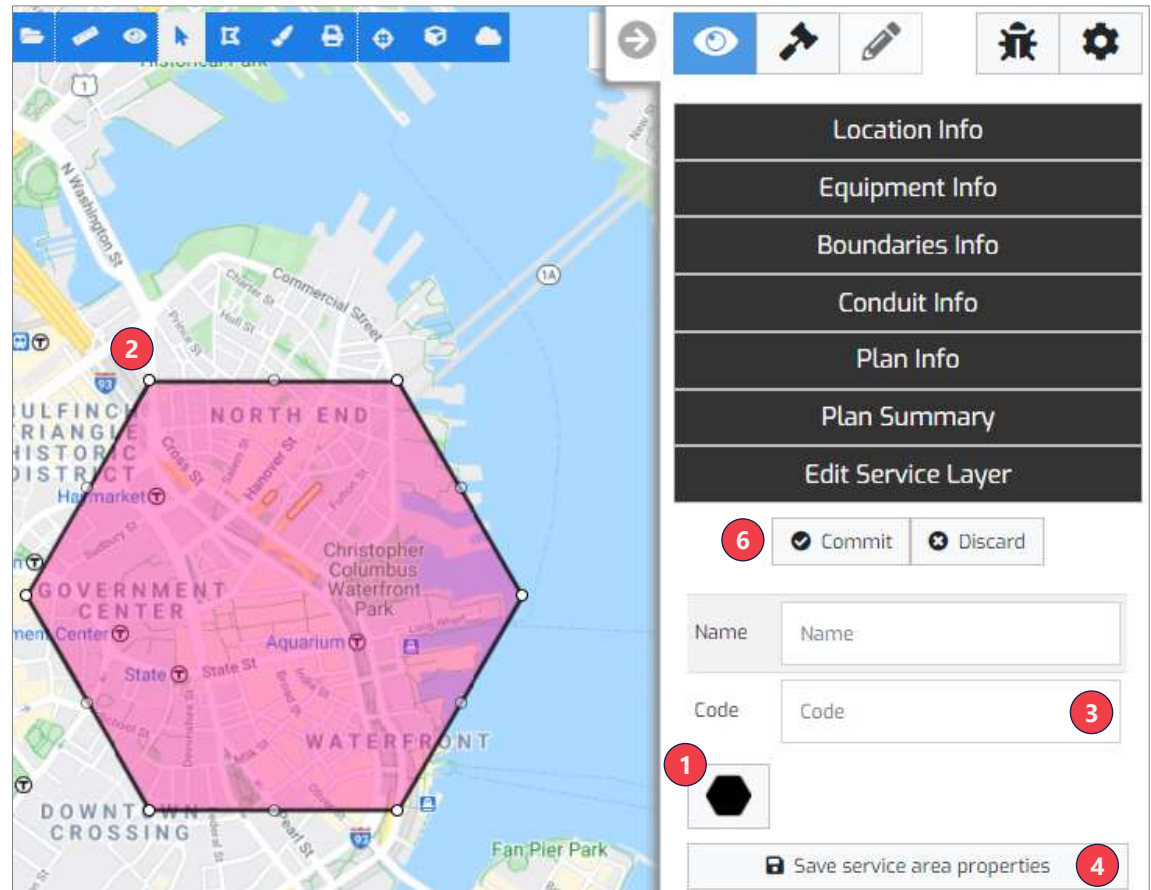


Note:

- While not strictly enforced in the tool, there is a practical limit to how large each service area can get.
- For optimal performance, aim for **each service area polygon to encompass fewer than 50k target endpoints** and/or 50k conduit edges (e.g., road segments)
- When analysis area gets too large, tool's performance deteriorates and may result in plans not running to completion

Intuitive drag and drop tool allows users to precisely define multiple service areas as part of the same service layer

1. Once in Edit Service Layer Mode, **drag the hexagon onto a map** to begin defining service area
2. **Adjust polygon corners** to desired shape
3. **Name** the area
(Note: Only 'Code' field is displayed in the UI and output reports)
4. Once done editing this polygon, hit **"Save service area properties"**
(This saves changes to this specific polygon only)
5. Repeat steps 1-4 to define multiple polygons within the same service layer *(Note: Make sure that all polygons do not overlap)*
6. When done editing all polygons, hit **"Commit"** to save all edits to the service layer



Arrow can auto-generate non-overlapping service areas by buffering around existing equipment

1. Select "Create Polygon from Equipment"
2. **Select which equipment layer should be used** to define center points of each polygon
(Note: every element in that layer will be used)
3. **Specify buffer radius**, in meters, for the new service areas
(This defines maximum radius; in areas with more equipment elements, Arrow will create largest non-overlapping area possible)
4. Don't forget to **name the service layer**
5. Hit "**Save**"
(Depending on the buffer size, and number of equipment points the creation process can take up to a couple of minutes)

Upload Data Resources

Data Management



Data Type: Service Layer

Data Source Name: test equip (4)

Creation Type: Create Polygon From Equipment (1)

Select Equipment layers: Central Offices (Geotel 2021) (2)

Polygon radius (meters): 20000 (3)

Name	Description	Type	Action
sample_service_area	Default template for service area	kml	 

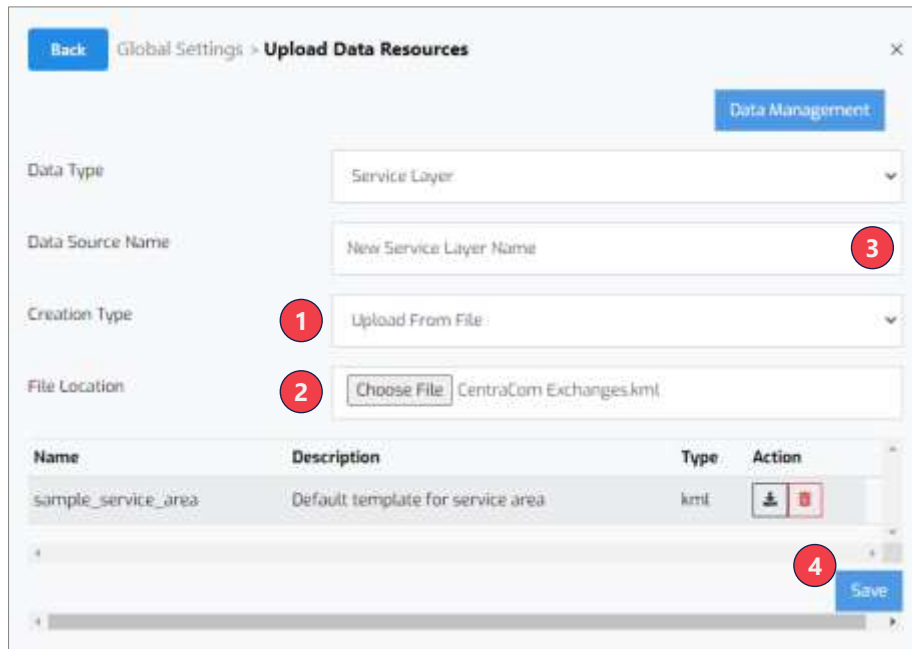
Save (5) Back

Any valid polygon generated outside of Arrow can be turned into service area by uploading kml/kmz file directly into the tool

1. Select "Upload From File"
2. **Select file to upload** from your device
3. Don't forget to **name the service layer**
4. Hit "**Save**" to begin data upload process

Data Preparation & Requirements:

- Can upload kml and kmz files only
- Each feature should be defined as Polygon geometry type, not MultiPolygon
(i.e. areas should be defined as contiguous shapes, no "donuts", or carveouts for islands, etc.)
- **Attribute column "name", when available, is automatically used to name each service area.**
(when not available, system will auto-generate a name. Those names can later be edited using service area editing functionality)



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Target endpoints can be easily uploaded into Arrow using dedicated upload templates

1. Location endpoints are loaded through UI using csv file only
2. Depending on type (residential, business, towers) list of required columns varies (*see below*)

	A	B	C	D	E	F
1	entity_category_id	lat	longitude	number_of_households	number_of_employees	industry_id
2	household	55.063437	9.378095821	✓	✗	✗
3	celltower	55.063437	9.378095821	✗	✗	✗
4	business	55.063437	9.378095821	✗	✓	✓

Number of doors at the address/lat-long. Above Arrow's MDU threshold (12 by default), location will be automatically reclassified as MDU

4-digit SIC code. If unknown, set to 5099.

Number of employees determined business size classification. By default: <20 for small, 20-999 for medium, and 1,000+ for large

3. The columns need to be listed in the above order, all lowercase
 - It is best to remove columns not relevant to the location type being uploaded (*e.g. remove industry_id column when uploading residential locations*)
4. Any number of additional location attributes can be stored for future reference
 - List the attributes immediately to the right of the required columns
 - Column headers automatically become attribute keys
 - All attributes are stored as *text* (*e.g. scientific notation does not get converted into number; comas and decimal points become part of the text string, i.e. when uploading numbers, remove ALL formatting from columns*)
 - These attributes can be then visualized in the UI, and referenced in custom reports
5. Users also have the ability to override global ROIC and ARPU Resource Managers settings with values specific to individual locations, via a list of predefined attribute keywords (*see next page*)

Optional fields can be provided to override global location settings and provide users with granular plan controls

BAU Case Settings:

bau_start_penetration – Current subscriber penetration of legacy product (0.00 – 1.00 value range)

bau_monthly_revenue – ARPU for legacy product (0.0001+ value range)

bau_fair_share – Used to prescribe terminal fair share value of legacy product (0.0001 – 1.00 value range)

Plan Case Settings

plan_monthly_revenue – ARPU for the new fiber product (0.0001+ value range) *(Note: Revenue fields are only used when ARPU manager is set to 'Location Layer' strategy)*

plan_fair_share – Used to prescribe fair share value of planned fiber network (0.0001 – 1.00 value range)

plan_subsidy – Known one-time subsidy amount to be received by connecting given location

grant_eligible – 0 or 1 (*binary*), to specify whether location is eligible for subsidies *(when Arrow is used to calculate them)*

Note:

- Include only the overrides you wish to use *(i.e. do not upload files with column headers containing no content below)*
- When using any of the above overrides, do not leave any cells blank or otherwise invalid *(i.e. every column needs to be fully populated)*
- Do not apply any custom formatting to values in these fields *(e.g. \$ or , signs will prevent Arrow from converting these text strings to usable numeric inputs)*

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Network Equipment data can be easily uploaded into Arrow using dedicated upload template

- Network equipment points are loaded through UI using csv file only, and must contain the following 3 columns:
 - entity_category_id** – *text* field – keyword defining type of equipment each point represents (*see below for a list of available equipment types*)
 - lat** – *numeric* field, specifying latitude of the point
 - longitude** – *numeric* field, specifying longitude of the point
- The columns need to be listed in the above order, all lowercase
- Optional attribute, **site_cli** (*text*), can be used to name each node
 - If provided, this name will be made available in the UI
- Typically, only central offices and/or splice points are loaded
 - Remaining equipment types are usually not needed for optimizations
 - Please check in with Arrow team if you think your analysis needs to leverage one of the other equipment types (e.g. Network Connectors require additional information during upload to function correctly within the system)

	A	B	C	D
1	entity_category_id	lat	longitude	site_cli
2	central_office	56.07839087	12.53463843	
3	splice_point			
4	fiber_distribution_hub			
5	fiber_distribution_terminal			
6	bulk_distribution_terminal			
7	bulk_distribution_consumer			
8	cell_5g			
9	junction_splitter			
10	dslam			
11	loop_extender			
12	network_anchor			
13	multiple_dwelling_unit			
14	location_connector			
15	subnet_node			
16	network_connector			
17	olt			
18	slack_loop			

Sample upload template is available to Altman Solon teams [here](#).

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Existing fiber network infrastructure can be loaded into Arrow to use it in plans

1. Specify **Cable Type**
(Note: Only "feeder" and "distribution" types can be used in 'route from fiber' plans; All other types are for visualization/reference purposes only)
2. **Select file to upload** from your device
3. Don't forget to **name the new layer**
4. Hit "**Save**" to begin data upload process

Data Preparation & Requirements:

- Can upload kml, kmz or shp files (zip file of all shp files)
- Single and MultiLineStrings are accepted
- It is best (safest), to exclude non-line elements from the file before uploading

Global Settings > Upload Data Resources

Data Management

Data Type: Fiber Cables

Data Source Name: New Fiber Layer Name

Cable Type: feeder

File Location: Choose File CentraCom Exchanges.kml

Name	Description	Type	Action
sample_fiber	Default sample fiber	kml	

Save

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Base road layers can only be loaded directly into the database by Arrow team

Arrow team typically uses OpenStreetMap (OSM) road datasets as base roads layer.

Any collection of lines, however, can serve as primary road conduits, provided it meets the following criteria:

1. Each roads dataset must include **geometry** column:
 - only SingleLineStrings geometries are accepted
 - do not include non-line elements in the file(s) to upload
 - if providing csv files, geometry field needs to be stored as Well-Known Text (WKT)
 2. The following columns are recommended to include, if available:
 - **feature_sub_type** – *text* field, equivalent of fclass in OSM datasets, allows the tool to run its routing algorithms more efficiently (faster plan runtime when using K-Means location clustering)
 - **construction_type** – *text* field, (e.g. aerial vs. buried vs. underground), that allows the tool to assign precise fiber construction cost specific to this edge's construction/placement type
 3. Additional attributes can be stored alongside each element, based on the need. Typical attributes include:
 - **osm_id** – *text* or *numeric* field; unique identifier
 - **name** – *text* field, e.g. street name
- Arrow team can upload data from multitude of geospatial file formats, but **shp and csv files are strongly preferred.**

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Preparation and upload of other conduits (e.g. sewers/ducts) mimics that of existing fiber cables

1. Specify **Spatial Edge Type**
(Note: Only "sewer" and "duct" types are currently supported by the system)
2. Specify **Conduit Size**
(Note: Leave as is, unless you discussed with Arrow team your special case that requires usage of multiple conduit sizes)
3. **Select file to upload** from your device
4. Don't forget to **name the new layer**
5. Hit "**Save**" to begin data upload process

Data Preparation & Requirements:

- Can upload kml, kmz or shp files (*zip file of all shp files*)
- Single and MultiLineStrings are accepted (*Single preferred*)
- Do not include non-line elements in the upload file

The screenshot shows the 'Global Settings > Upload Data Resources' window. It contains several form fields and a table. Red circles with numbers 1 through 5 point to specific elements: 1 points to the 'Spatial Edge Type' dropdown menu showing 'sewer'; 2 points to the 'Default Conduit Size' dropdown menu showing 'Small'; 3 points to the 'File Location' field which includes a 'Choose File' button and the text 'CentraCom Exchanges.kml'; 4 points to the 'Data Source Name' field containing 'New Fiber Layer Name'; 5 points to the 'Save' button at the bottom right of the form.

Name	Description	Type	Action
sample_edges	Default sample edges	kml	 

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Arrow can leverage other types of data to suit additional use cases

1. Clutter Data

- Foliage information used in calculating wireless signal degradation in fixed wireless ray tracing Arrow optimizations
- Uploaded through the UI, but it can only be prepared by Arrow and AI teams
- Please contact Arrow team members for additional information

2. Copper Cables:

- Existing copper cable network to visualize in the tool
- Data preparation mirrors that of existing fiber cables
- Users can upload files through UI via "Copper Cable" data type upload modal

3. Construction Locations:

- Existing tower structures that can be used in a plan at reduced cost
(i.e. the structure is already in place, and there is no additional cost for erecting the tower; only new networking equipment is priced)
- Can be uploaded through UI with a template that closely matches that for target endpoints
- Please contact Arrow team members for additional information, and instructions how to correctly format data for upload

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