Arrow Platform

Data Preparation Guide

ARROW
by altman solon

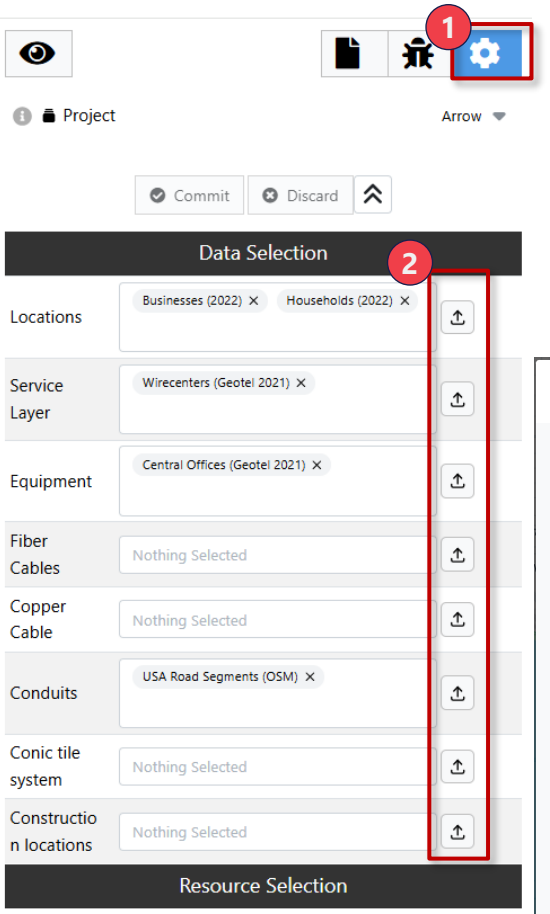
altman solon

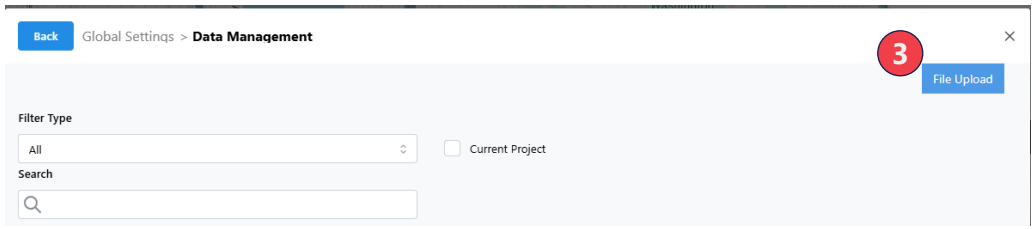
While Arrow requires numerous datasets to run optimization, most of them can be uploaded through UI

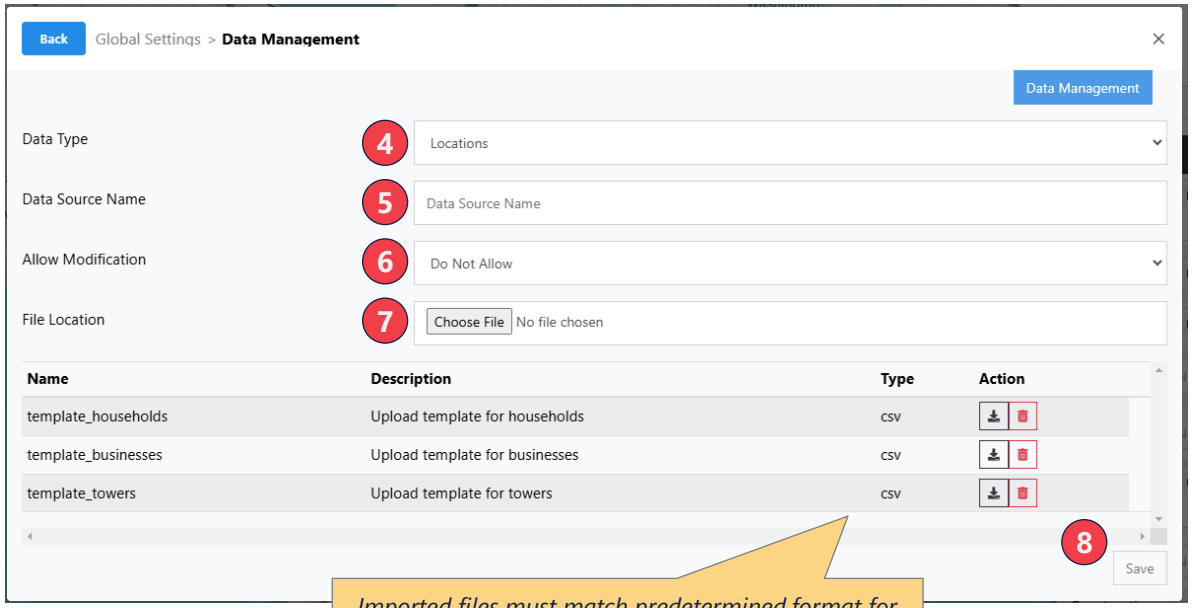
Summary of data categories used in Arrow

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, zipped 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, zipped shp	See p.16
Road Conduits	Base conduit layer defining where new fiber routes can go	✗	kml, kmz, zipped 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, zipped shp	See p.21
Clutter Data	Clutter data used for calculating wireless signal degradation	✓	zipped txt	Arrow team prepares and loads the data

User data can be imported to Arrow via upload templates







Imported files must match predetermined format for Arrow to load them correctly. Upload templates can be downloaded for reference here.

Uploading Data Sources

1. **Open Settings** – Click "Plan Settings Mode" button to open the pane and "Data Selection" tab in the accordion
2. **Select Data Type** – click the upload icon to the right of relevant data source type. This will open the Data Management screen
3. **Select File Upload –** click the File Upload button.
4. **Data Type** – If not already selected, use the dropdown to specify data type
5. **Name the Layer** – Give the data source a name to display in the dropdown menu
6. **Allow Modification** – If you would like to be able to modify the data set on the map canvas after it is uploaded select Allow otherwise leave unchanged.
7. **Select File** – Click "Choose File" to select the file to upload
8. **Save** – Click "Save" to begin data upload. Once completed, the manager will close, and the new data source will be available from the data type dropdown

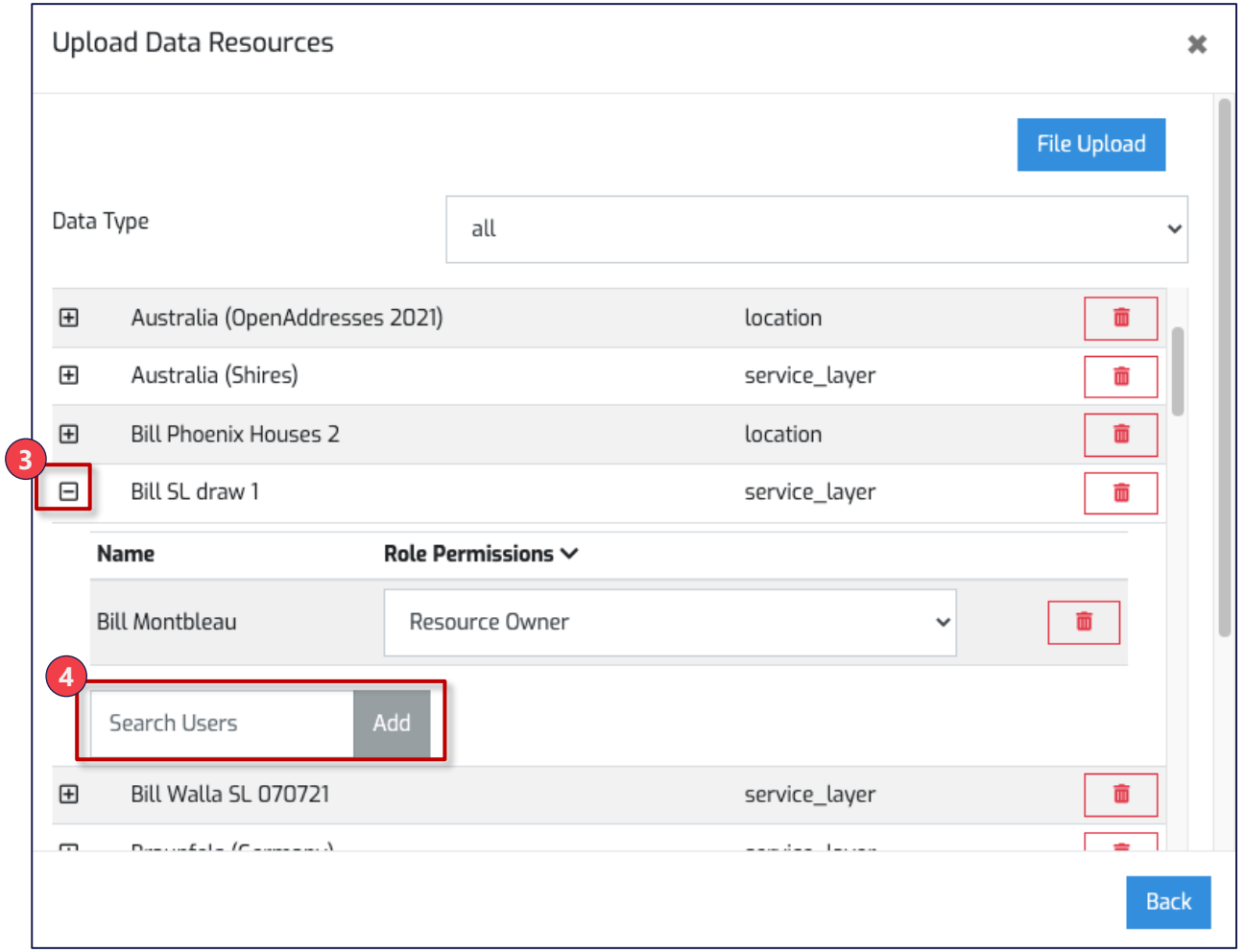
Once uploaded, individual data layers can be shared with other users and user groups

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.



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

1. **Draw in the UI**

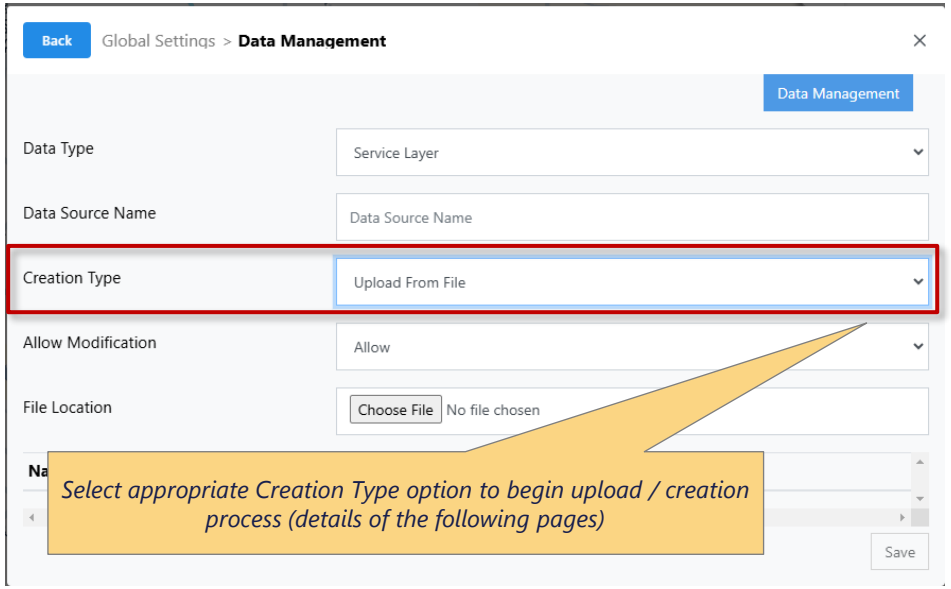
   Use polygon drawing tool to define boundaries of (multiple) service area(s) directly in the tool

2. **Buffer around existing equipment**

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

3. **Upload polygons from file**

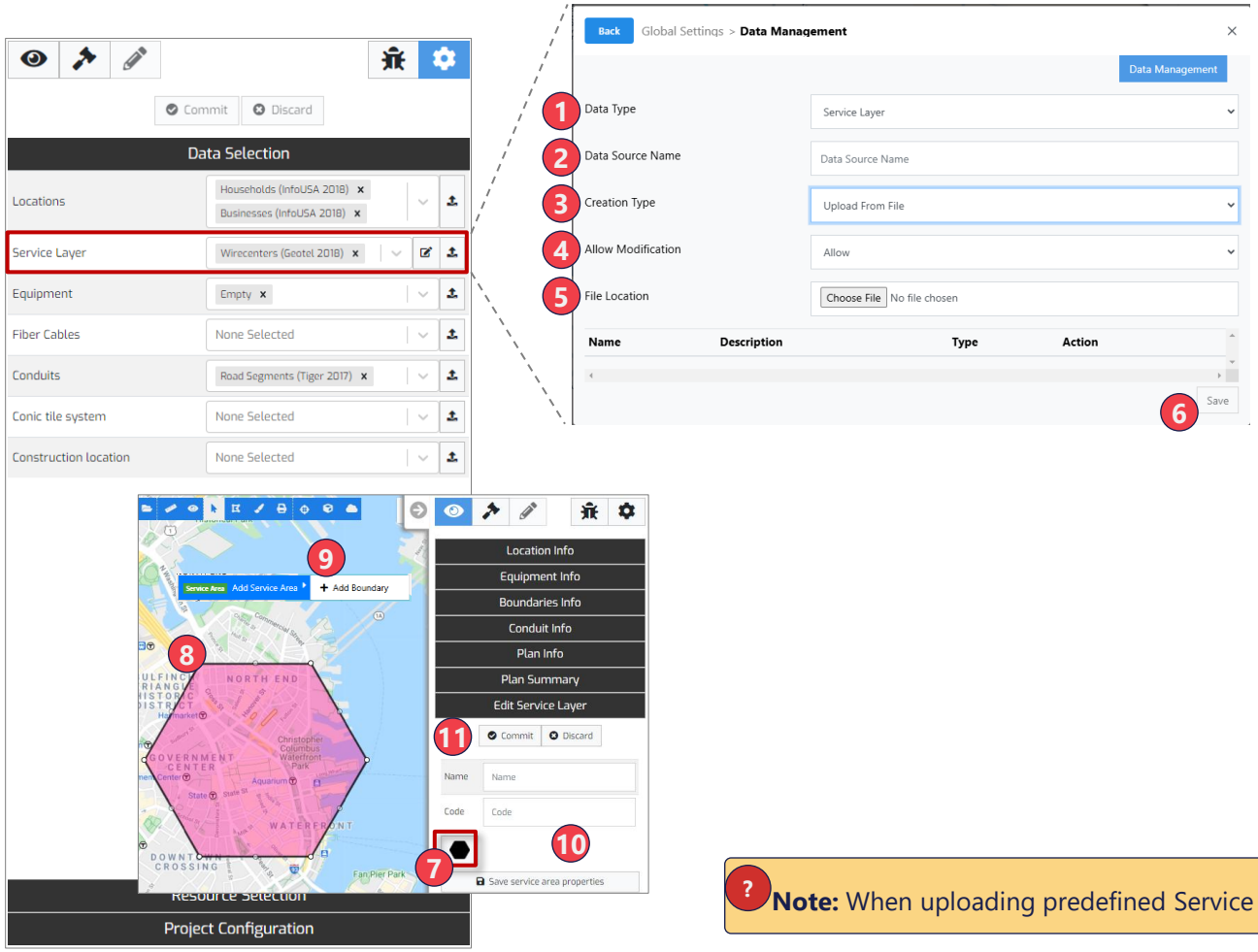
   Upload shapes created in other mapping tools, using standard GIS file formats (kml/kmz)



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 200k 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



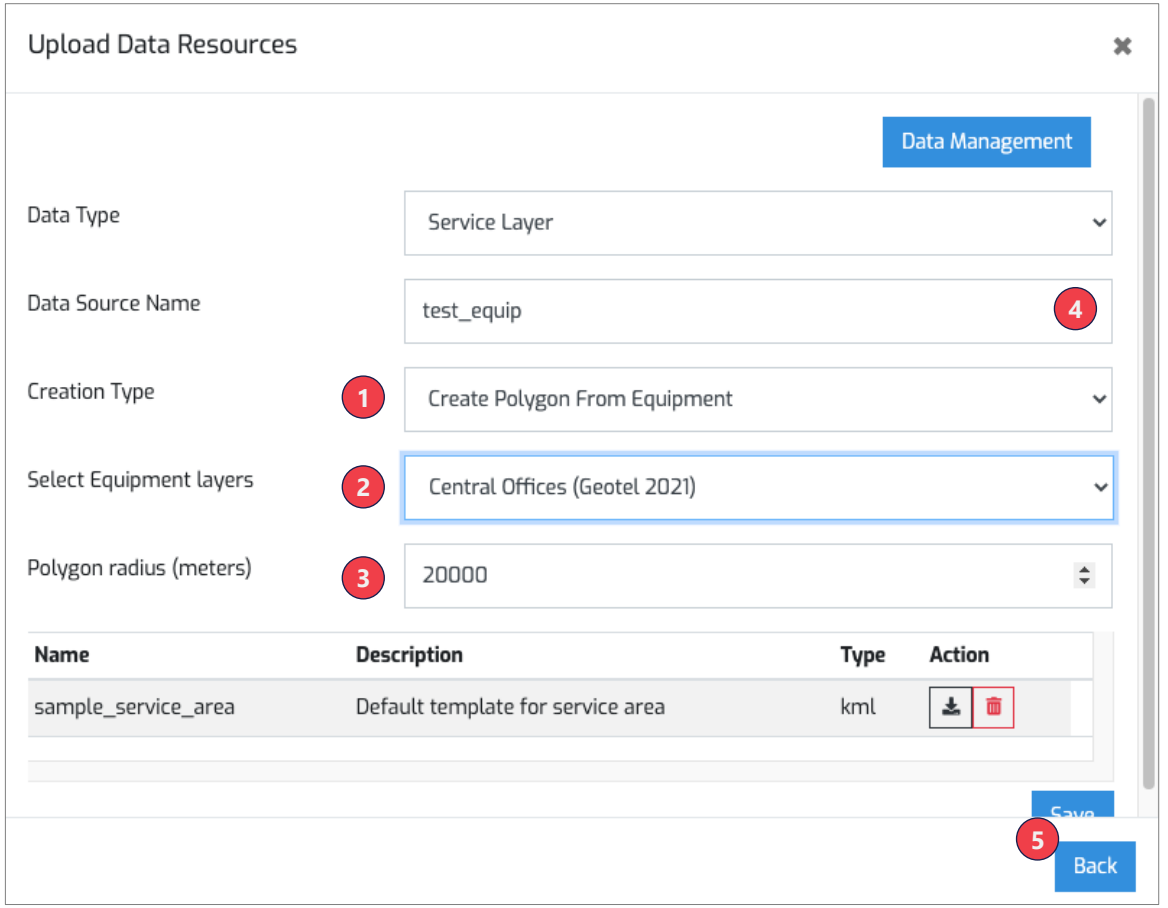
Drawing Service Layers

1. **Data Type** – If not already selected, use the dropdown to specify "Service Layer" data type
2. **Name the Layer** – Give the data source a name
3. **Creation Type** – Select draw service area on map
4. **Allow Modification** – Select Allow otherwise select Do Not Allow
5. **Save** – Click "Save" to begin data upload/progress to drawing your own service area
6. **Drag** – Drag polygon and drop onto map to create new service area. Dragging it multiple times will create multiple polygons for the same service layer. Make sure the polygons do not overlap.
7. **Adjust** – Drag and adjust polygon corners to shape the area
8. **Add Boundary** – An alternative to dragging and adjusting the polygon is to right-click on the map canvas and draw the polygon.
9. **Save** – Save changes for each polygon
10. **Commit** – When done with all polygons, commit changes to the service layer

Note: When uploading predefined Service Layers make sure there are no self intersecting polygons.

Arrow can auto-generate non-overlapping service areas by buffering around existing Central Office 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, and only Central Office points can be used to create the new polygons)
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)

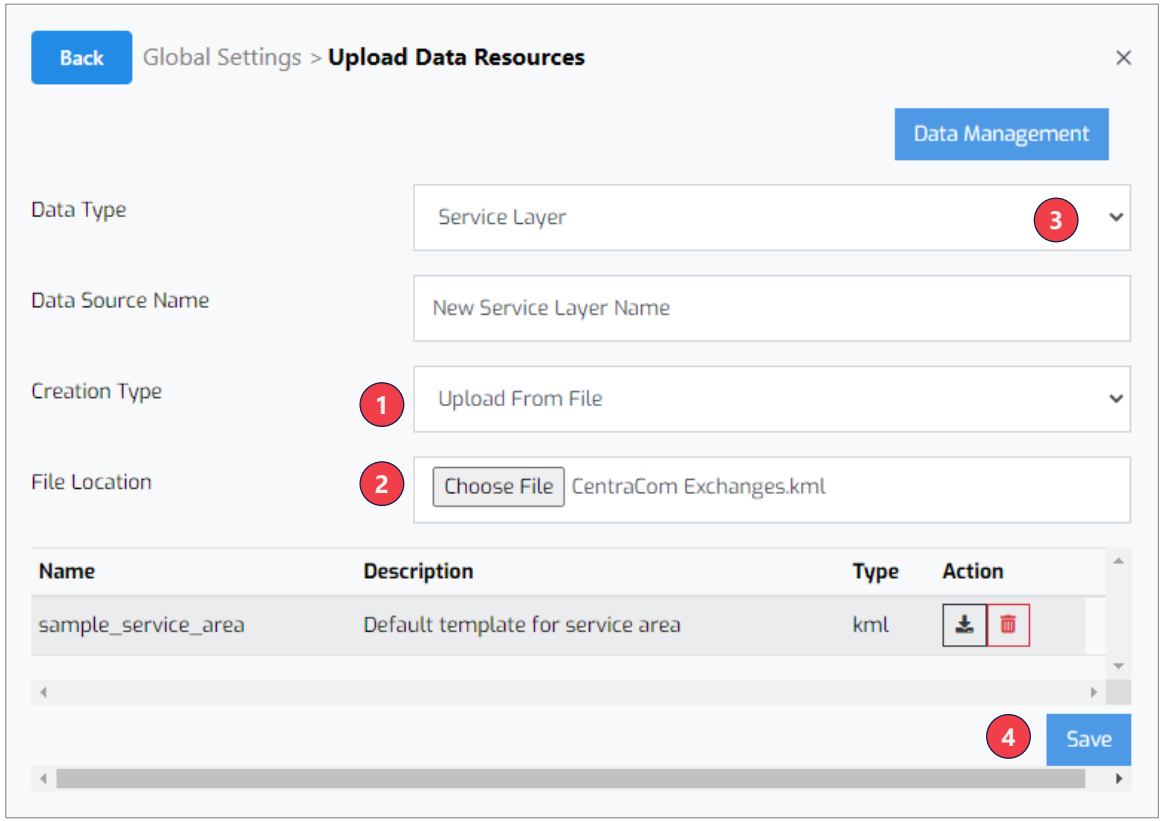


Any valid polygon generated outside of Arrow can be turned into service area by uploading kml/kmz file directly into the tool

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)
- Coordinates should not include more than 6 digits of precision.



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

1. Location endpoints are loaded through UI using csv file only, up to 500MB in size which can be zipped
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	9.378096	✓	✗	✗
3	mdu	55.063437	9.378096	✓	✗	✗
4	celltower	55.063437	9.378096	✗	✗	✗
5	business	55.063437	9.378096	✗	✓	✓

Locations uploaded as households can be treated as MDUs based on adjusting the MDU threshold in the Network Architecture Manager

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 can 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:

ROIC.BAU.START_PENETRATION – Current subscriber penetration of legacy product (0.00 – 1.00 value range)

ROIC.BAU.MONTHLY_ARPU – ARPU for legacy product (0.0001+ value range)

ROIC.BAU.FAIR_SHARE – Used to prescribe terminal fair share value of legacy product (0.0001 – 1.00 value range)

Plan Case Settings

ROIC.PLAN.MONTHLY_ARPU – 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)*

ROIC.PLAN.FAIR_SHARE – Used to prescribe fair share value of planned fiber network (0.0001 – 1.00 value range)

ROIC.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 using Subsidy feature)*

comp_object_id – BDC fabric residential location id from CostQuest to enable location-level fair-share evaluation

! See the ROIC Resource Manager section in the Arrow Platform User Guide for a complete list of override input fields

Note:

- Attribute keys/column headers are case-sensitive
- 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)

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

1. Network equipment points are loaded through UI using csv file only, and must contain the following 3 columns:
   - **A. entity_category_id** – *text* field – keywork defining type of equipment each point represents *(see below for a list of available equipment types)*
   - **B. lat** – *numeric* field, specifying latitude of the point
   - **C. longitude** – *numeric* field, specifying longitude of the point

2. The columns need to be listed in the above order, all lowercase

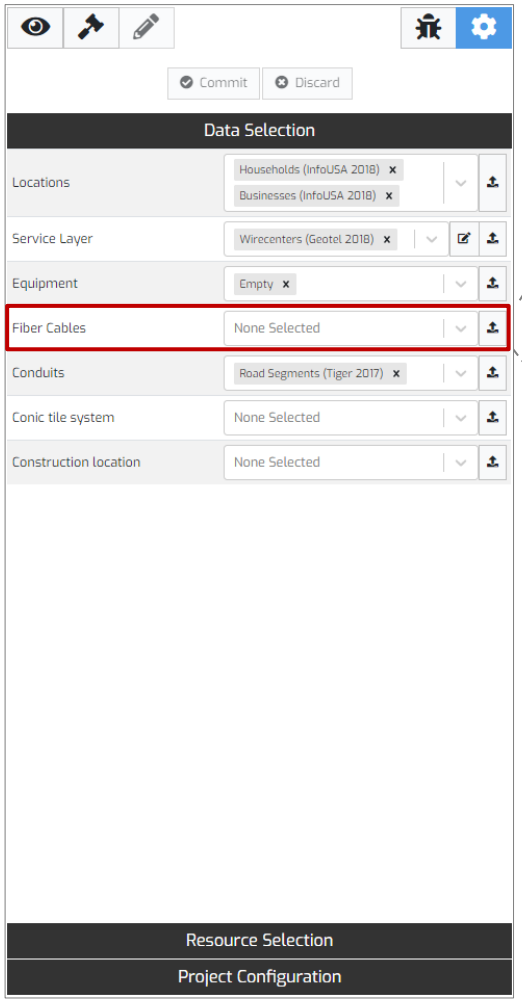
3. Optional attribute, **site_clli** (*text*), can be used to name each node
   - If provided, this name will be made available in the UI

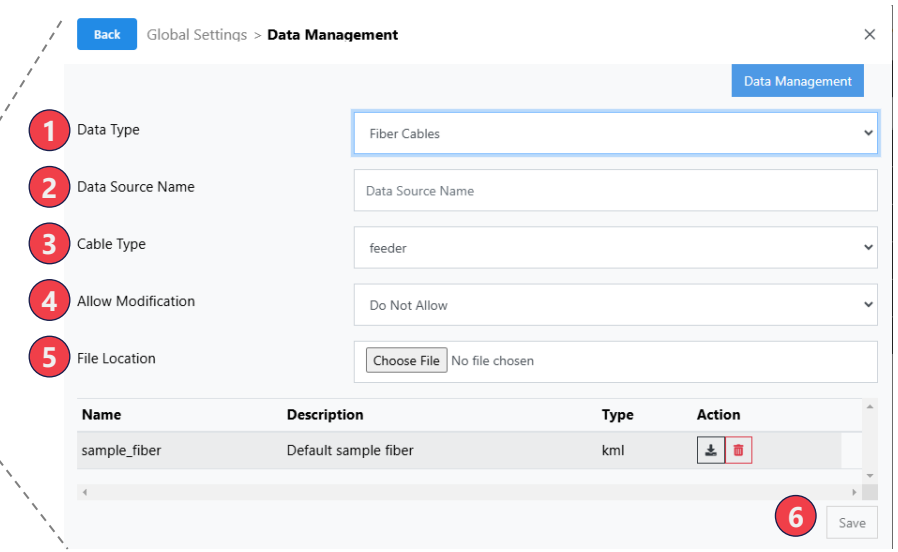
4. Typically, only central offices and/or splice points are loaded
   - Remaining equipment types are usually not needed for optimizations
   - Please check in with Arrow team if you think your analysis needs to leverage one of the other equipment types (e.g. Network Connectors require additional information during upload to function correctly within the system)

Sample upload template is available to Altman Solon teams here.

	A	B	C	D
1	**entity_category_id**	**lat**	**longitude**	**site_clli**
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			

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





Uploading Fiber

1. **Data Type** – If not already selected, use the dropdown to specify "Fiber Cables" data type
2. **Name the Source** – Give the data source a name to display in the dropdown menu
3. **Cable Type** – Specify cable type (e.g., Feeder, Distribution) Note, only feeder and distribution fiber types can be used to splice from (when running plans that route from existing fiber)
4. **Select File** – Click "Choose File" to select a kml or kmz file for upload
5. **Allow Modification** – If you would like to be able to modify the data set on the map canvas after it is uploaded select Allow otherwise leave unchanged.
6. **Save** – Click "Save" to begin data upload. Once completed, the manager will close, and the new data source will be available from the data type dropdown

Tip:
Only feeder and distribution cable types can be used as a branching off point for new planned fiber cables.

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)

1. The following columns are recommended to include, if available:

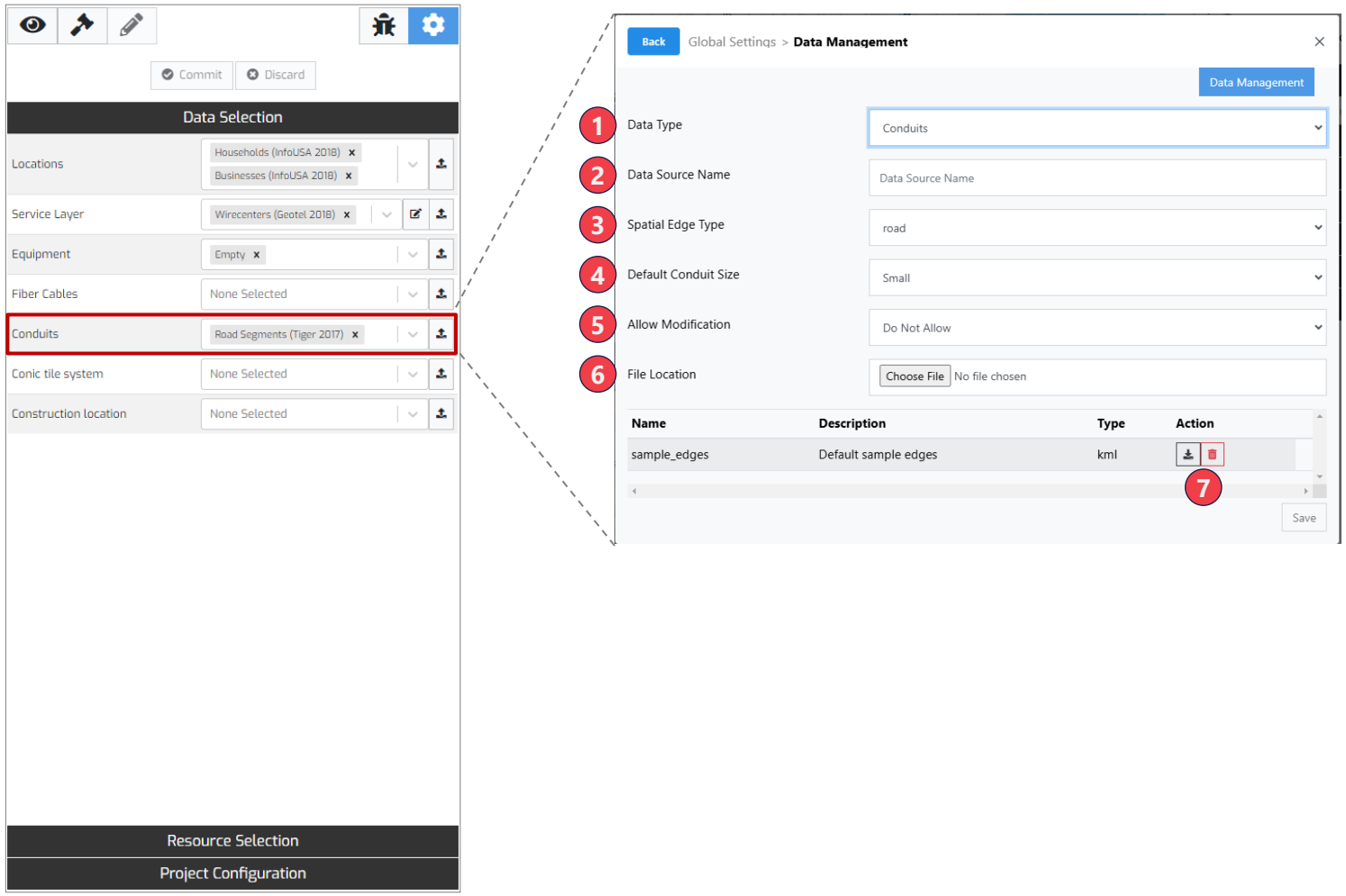
- **feature_sub_type** – *text* field, equivalent of fclass in OSM datasets, allows the tool to run its routing algorithms more efficiently (faster plan runtime when using K-Means location clustering)
- **construction_type** – *text* field, (e.g. aerial vs. buried vs. underground), that allows the tool 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.**

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



Uploading Fiber

1. **Data Type** – If not already selected, use the dropdown to specify "Conduits" data type
2. **Name the Source** – Give the data source a name to display in the dropdown menu
3. **Spatial Edge Type** – Use the dropdown to specify edge type (road, duct, sewer, etc.)
4. **Default Conduit Size** – If uploading ducts/sewers users can specify their size (S/M/L)
5. **Allow Modification** – If you would like to be able to modify the data set on the map canvas after it is uploaded select Allow otherwise leave unchanged.
6. **Select File** – Click "Choose File" to select a kml or kmz file for upload
7. **Save** – Click "Save" to begin data upload. Once completed, the manager will close, and the new data source will be available from the data type dropdown

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

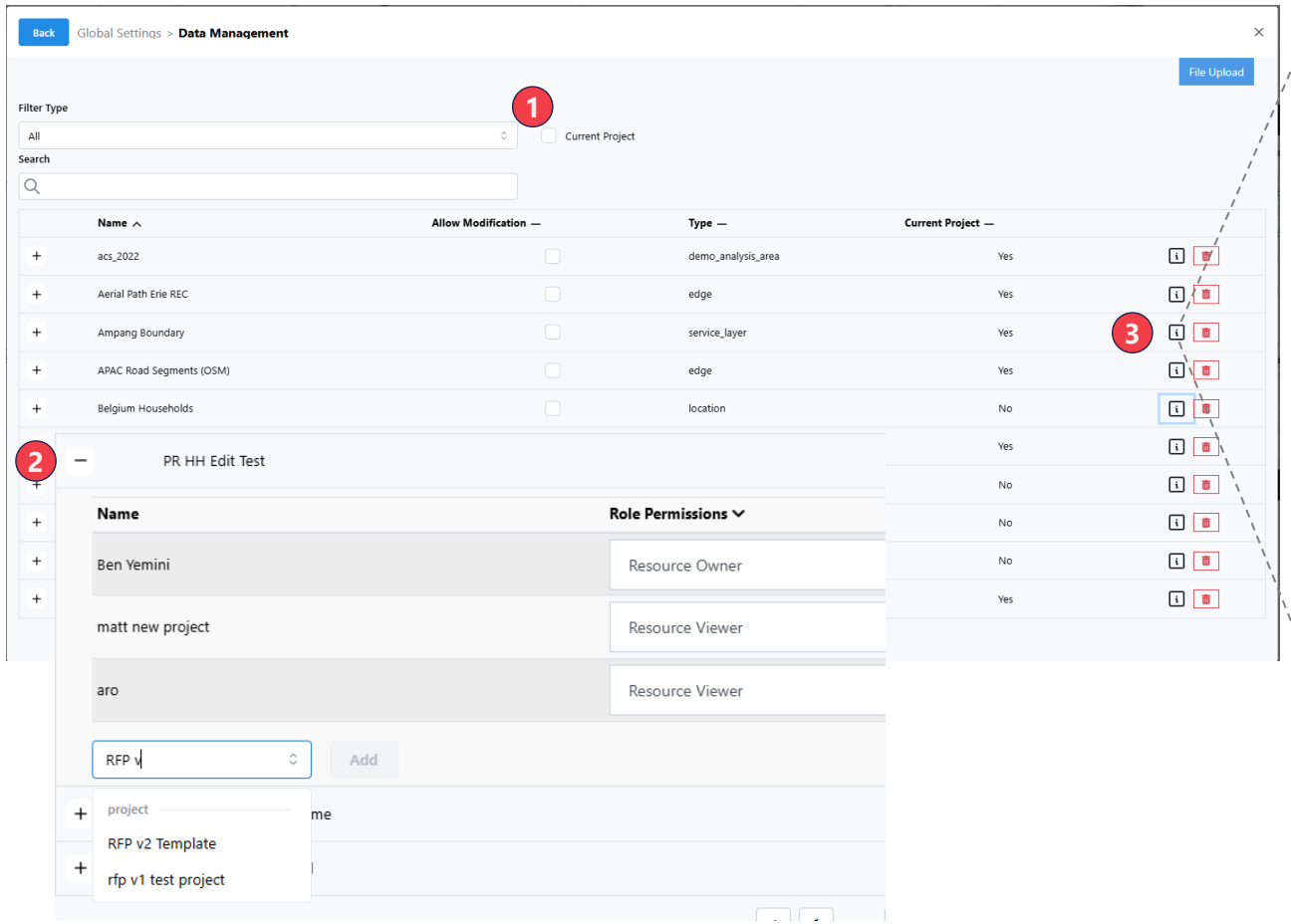
2. Copper Cables

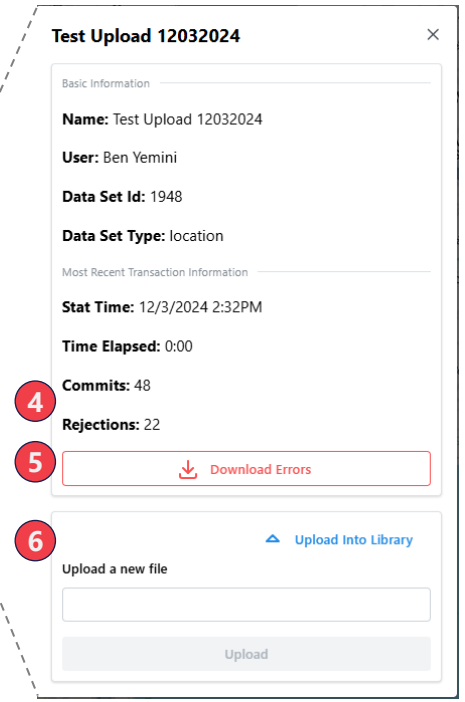
- Existing copper cable network to visualize in the tool
- Data preparation mirrors that of existing fiber cables
- Users can upload files through UI via “Copper Cable” data type upload modal

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

The Data Management panel enables you to manage access, add additional data and understand status of existing data sets





Data Management

1. **Filter** – Select a specific data type or limit selection to only those data sets available in your current project
2. **Data Set Permissions** – Give users, groups, or projects access to the data set. This is where you can add a data set to any existing projects.
3. **Info** – View additional information on the data set
4. **Upload Status** – Commits are the number of records that were added successfully. Rejections are the number of records that had an issue.
5. **Download Errors** – If there are any errors, you can download the records with an error.
6. **Upload a New File** – You can add new records to an existing data set. This includes fixing issues in the download errors list and uploading those records.