

# Integrating Esri Production Mapping with ArcGIS® for Land Records



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# Integrating Esri Production Mapping with ArcGIS for Land Records

## An Esri White Paper

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# Integrating Esri Production Mapping with ArcGIS for Land Records

**Background** Esri's [ArcGIS® for Land Records](http://resources.arcgis.com/content/local-government/land-records)<sup>1</sup> solution is a suite of templates focused on parcel data that is downloadable from the [ArcGIS Resource Center for Local Government](http://resources.arcgis.com/content/local-government)<sup>2</sup>. Included in these downloadable resources is a local government information model designed to work cohesively with the map and application templates available on the Resource Center for desktop, web, and mobile devices. The information model incorporates different data types that are collected and maintained by local governments in performance of their daily operations. The parcel fabric is the part of this local government information model that deals specifically with land records data. It is a composite group layer that contains implicit topology rules relating points, lines, and polygons into a seamless network of parcel data. These downloadable land records resources, when used with the Parcel Editor toolbar now in ArcGIS for Desktop, provide an effective set of tools for editing the parcel fabric. Currently, the local government data model is geared toward US customers only.

**Why Parcel Fabric?** The parcel fabric provides many avenues for improving the data quality of parcel boundaries. It offers solutions to address common drawbacks that are present when using simple feature classes to track land records. One component that appeals to everyone is the ability to track the history of parcels and parcel boundaries as they change over time. It also introduces control points as a way to tie the parcels to the earth at exact coordinates, thereby enhancing the confidence in the location and orientation of the parcels. It has a user-friendly traverse grid that saves the coordinate geometry of each line while creating the parcel polygon at the same time. Lastly, when taking advantage of the option to do least squares adjustments on the parcel fabric, you can also adjust associated feature classes that use parcel boundaries as a point of reference.

**Challenge** Many government entities, including departments of revenue or tax assessor's offices, are migrating their existing tax parcel and land records data into this new parcel fabric data model. This migration is often part of a larger conversion of an overall geographic information system (GIS) from a much older version of ArcGIS, or even from a completely different platform, such as CAD.

Migrating to the ArcGIS for Land Records solution, including the parcel fabric data model, requires developing new editing procedures and creating new standard operating procedures (SOPs) for GIS/cartography staff. Developing a workflow that is managed by an administrator and that guides staff through the tasks assigned to them makes this migration process and subsequent parcel maintenance operations more streamlined and

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<sup>1</sup> <http://resources.arcgis.com/content/local-government/land-records>

<sup>2</sup> <http://resources.arcgis.com/content/local-government>

efficient. This paper explains how Esri® Production Mapping can tremendously ease the amount of work necessary to prepare the data for migration and help ensure consistency during the migration process as well as in daily maintenance operations after the migration is complete. Before migration, the quality control tools in Production Mapping can be used to restructure the existing parcel data to match the new parcel fabric data model. During migration, validation of parcel geometry and attributes can be performed. After migration, the workflow management tools in Production Mapping can make the day-to-day operations easier to track and manage to ensure consistency throughout your parcel fabric maintenance operations.

## **Overview of Esri Production Mapping**

Esri Production Mapping helps you create and maintain GIS data and maps in standardized workflows that reduce your day-to-day costs through smaller requirements on your staff's time and increase the speed at which new information is made available to your users. Whether your team is small or large, Production Mapping helps improve the quality and timely availability of GIS data and maps through the building of standardized and repeatable workflows that fit your needs.

With Esri Production Mapping, you can

- Efficiently produce geospatial data and map products while adhering to the parcel fabric data model and migration requirements.
- Centralize GIS workflow creation and management for parcel and other data to ensure consistency throughout the organization.
- Enhance your staff's productivity by standardizing data collection and validation, cartography, workflows, and data management tools and processes.
- Streamline the editing process within the ArcGIS for Land Records solution, including migration into the parcel fabric.
- Implement an efficient and consistent review process by automating spatial data quality control tasks, such as validating parcel geometry and updating its attributes.
- Standardize and centralize detailed map production with tools for creating and maintaining symbology, page elements, and maps.

## **Premigration**

### ***Preparing Your Data for Migration into the Local Government Information Model***

Prior to starting the data migration process, it is very important that you assess the readiness of your existing data for migration into the parcel fabric. [ArcGIS Data Reviewer](#)<sup>3</sup>, available as part of Esri Production Mapping and as a separate extension to ArcGIS for Desktop, is well suited for performing this assessment. It provides over 40 [automated checks](#)<sup>4</sup> that enable you to identify discrepancies in your data, both geometry and attribution. These checks can be run on features residing in different datasets. Spatial relationship checks can be performed without cracking or clustering the geometry of the features. If your parcel data does not currently have enforced topology rules, you can identify anomalies and track their correction using Data Reviewer. First,

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<sup>3</sup> <http://www.esri.com/datareviewer>

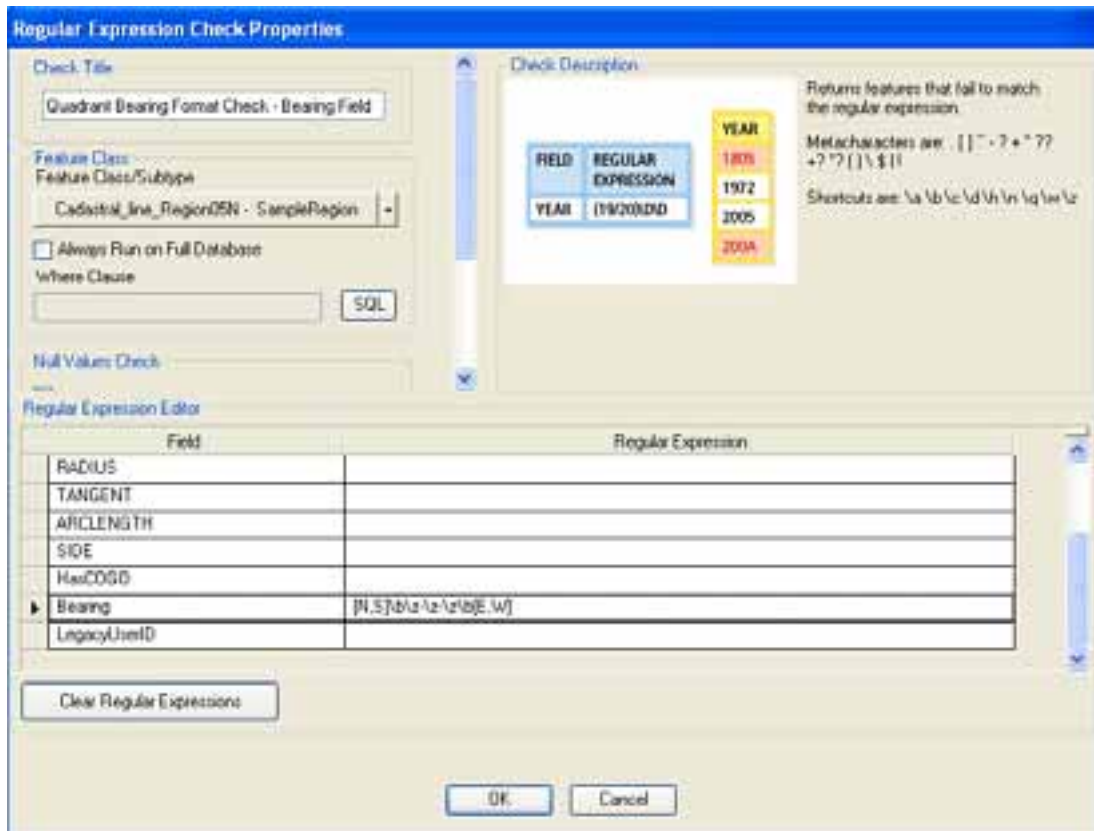
<sup>4</sup> [http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/Checks\\_in\\_Data\\_Reviewer/010200000mv000000/](http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/Checks_in_Data_Reviewer/010200000mv000000/)

you would ensure that your line features do not have dangles and do not overlap. As a second step, you would apply the parcel fabric-specific topology checks listed below. You can import geodatabase topology errors into Data Reviewer to track corrections. **Note:** There are six topology rules required for the parcel lines and parcel polygons that must be met before loading into the fabric:

- [Line feature class] Must Be Covered By Boundary Of [Polygon feature class].
- [Line feature class] Must Not Self-Overlap.
- [Line feature class] Must Not Self-Intersect.
- [Line feature class] Must Be Single Part.
- [Line feature class] Must Not Intersect Or Touch Interior.
- [Polygon feature class] Boundary Must Be Covered By [Line feature class].

In addition to spatial relationship cleanup, sometimes attribute updates are required before migration. Table checks performed by Data Reviewer are useful for validating attribute values such as ensuring data entered into the fields is consistent in format. For example, the bearing of a line should always be entered in the same format, whether it is quadrant bearing, north azimuth, or polar angle. If multiple formats are present in the original database, Data Reviewer can be used to discover and correct these problems. For example, by running the Regular Expression check, you can find records that are not in the desired format. Figure 1 shows how this type of check is configured using a string of metacharacters, `[N,S]b\z-\z-\z\b[E,W]`, to find records not in the Quadrant Bearing format (e.g., N 45-20-53 E).

**Figure 1**  
**An Example of Regular Expression Check in Data Reviewer**



Other useful attribute data checks easily performed using Data Reviewer include running a Unique ID check on the Name field of the polygons prior to migration as a way to check the success of the migration.

### ***Ensuring a Complete Successful Migration into the Fabric***

Data Reviewer is equally valuable for quality control at later stages in the parcel data migration process. For example, it is an important quality control measure to check the fabric after running the Load a Topology to a Fabric geoprocessing tool to compare the source to the target and ensure that no data was lost. There is a simple way to do this with Data Reviewer. Running a Table to Table check to compare the Name attributes of the source polygons to the target fabric parcels can easily identify dropped features. For this check, the Not option included in the check dialog box should be selected to find where the source does not match the target.

### **Postmigration**

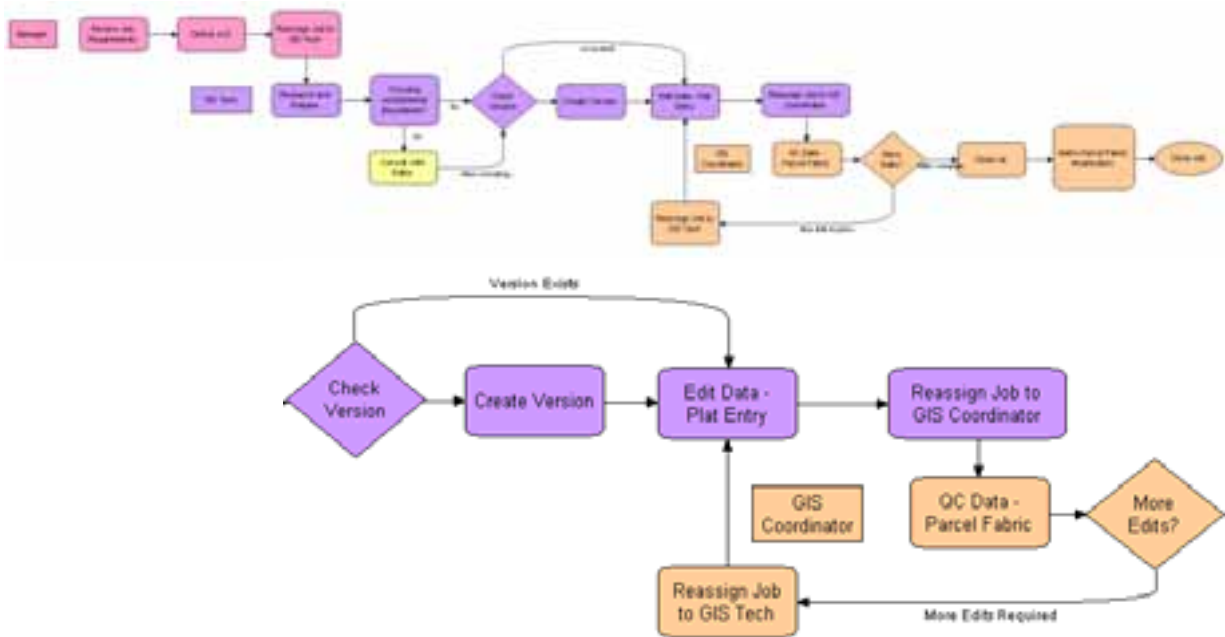
#### ***Managing Workflows***

When parcel data is collected and processed, there are several people involved from start to finish. For example, the paper records may be handled by one staff member and the data entered into the computer database by another, passed to the GIS/cartography staff for map edits, submitted to the QA/QC staff for quality control, and finally sent to

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another person for notification of changes to be posted. This is made clear in figure 2, with the different colors representing different staff members' tasks.

**Figure 2**  
An Example of an Assessor's Office Workflow in ArcGIS Workflow Manager



Developing standard operating procedures transforms this process into a workflow of digital tasks, which can be stepped through electronically via desktop computer or the web. The [ArcGIS Workflow Manager](http://www.esri.com/workflowmanager)<sup>5</sup> module of Esri Production Mapping (also available as a separate extension to ArcGIS for Desktop and ArcGIS for Server) helps guide and track this type of complex, multistep process. Workflow Manager also notifies staff via e-mail when steps are ready for their attention. Thus, implementing Workflow Manager as part of migrating to ArcGIS for Land Records helps avoid communication breakdowns and improves the completion time for your work.

The reporting capabilities within Workflow Manager enable managers to track the progress of specific jobs and resources to identify issues or concerns with a schedule. Documenting start and end dates, holds on a job, and status updates is an extremely useful way to always know where a project stands in a workflow and assign resources to balance the workload across your team. With the resource constraints facing local governments today, these types of productivity tools found in Esri Production Mapping prove very useful.

In addition to helping with schedule and resource management, Workflow Manager provides tools to avoid database conflicts that arise as part of data maintenance tasks. For example, a common concern when working with parcel data relates to conflicts that can

<sup>5</sup> <http://www.esri.com/workflowmanager>

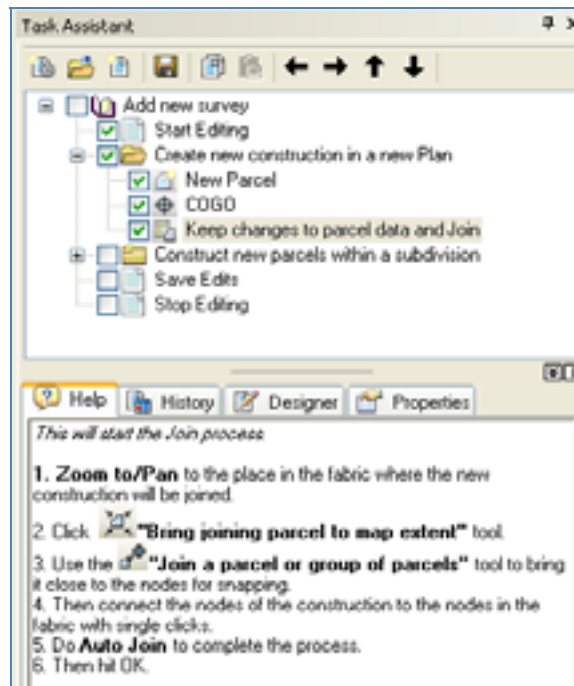


arise when two staff members are editing adjacent areas. When joining their line work to the fabric, surrounding parcels can shift, causing conflict during the database reconcile and post processes. Workflow Manager provides an option to define an area of interest (AOI) for each job created. The AOI describes where the edits will be taking place in the form of a sketch or a selected feature. The option can be set to not allow distinct jobs to work in overlapping AOIs. Additionally, by defining the AOI so that it is buffered slightly from the construction area, conflicts such as the problem described above can be avoided during reconcile and post of the edited versions.

### ***Microlevel Workflow Management within ArcMap***

ArcGIS Workflow Manager is a useful management tool to define and standardize your macrolevel processes. However, you may also want to standardize tasks within ArcMap® to ensure that edits are performed in a consistent manner. [Task Assistant Manager](#)<sup>6</sup> (TAM) is a microlevel workflow management tool that allows you to create step-by-step instructions for completing various GIS tasks. These workflows can execute ArcMap commands or geoprocessing tools; set map layer properties such as visibility, selectability, and snapping; or simply provide guidance on what should be done next. As you click the steps, commands are executed, and a history of actions is stored. Step descriptions can be added that provide information about each step while working through a given workflow. Using the check box option can help track the progress made as each step is completed.

**Figure 3**  
**Define and Standardize Processes within ArcMap**



One way to view Task Assistant Manager is as a built-in paperless user guide. TAM workflows provide a way to assist new GIS users by putting all the necessary tools in one

<sup>6</sup> <http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//005t0000001000000.htm>

### ***Improving Data Quality***

window. The need for large amounts of toolbars that may take away from your map real estate can be eliminated. Task Assistant Manager is also incredibly helpful as a time-saving measure; by linking different commands together in the appropriate order, you can accomplish in a single click what would normally take several clicks. For example, in the parcel fabric, where there are overlapping polygons and polygons with duplicate geometry, it is necessary to toggle on/off visibility and selectability to isolate the one polygon you intend to edit. You may have to do this repeatedly while editing in the fabric. With Task Assistant Manager, you can reduce the number of clicks required and thereby save time on such tasks.

Once the fabric has been successfully created and is being utilized for regular parcel maintenance, Data Reviewer can be used to perform routine quality control checks. For example, a batch job can be created to run against the fabric before you post versions to the default at the end of a job. The batch job can run several checks at once to make sure the attributes were entered correctly during editing. Batch jobs can be run using TAM steps within ArcMap or outside ArcMap using Workflow Manager steps.

A typical check that is often included as part of a batch job is reviewing parcels that have been marked historic to ensure that the legal end date and the history type were added. An Execute SQL check, such as the one below for looking at the attribute value combinations, could be used.

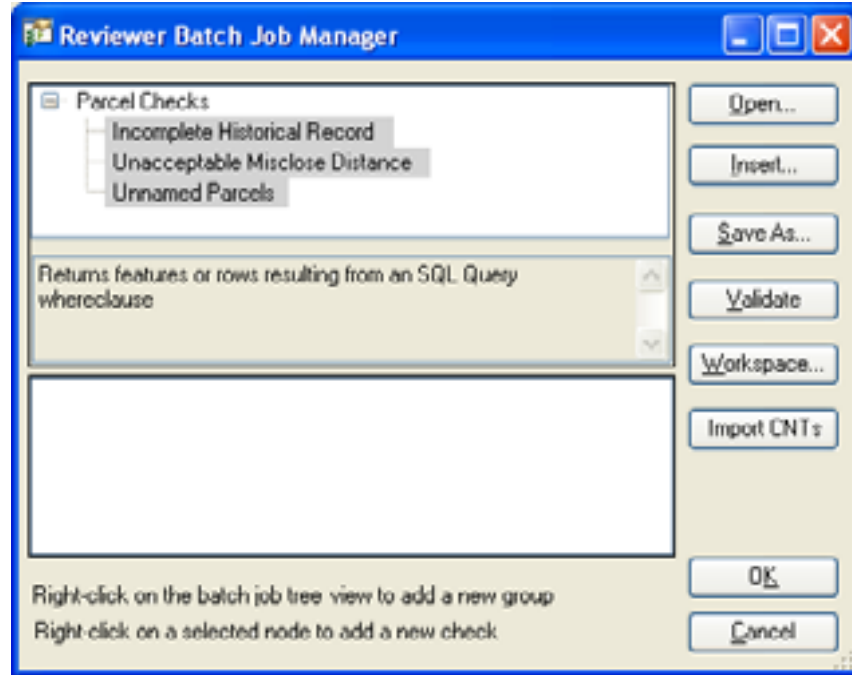
*(Historical = 1 AND LegalEndDate IS NULL) OR (Historical = 1 AND HistoryType IS NULL )*

The check can be run on the Definition Query, where "Type"=7, to check only the tax parcels.

Another check might look for high misclose values. Once a threshold has been decided on, an Execute SQL check could search for MiscloseDistance values greater than the threshold.

A third check might look for unnamed parcels. The default name for all parcel types is 0000000000. These types of checks are easily configured as part of Data Reviewer.

**Figure 4**  
**An Example of a Batch Job in Data Reviewer**



**Figure 5**  
**An Example of Results of the Batch Job in the Reviewer Table**

RENEWSTATUS	OBJECTID	SUBTYPE	REVIEWCATEGORY	CATEGORY	REVIEWCODE	SESSIONS	CHECKTITLE	ORIGTABLE	ORIGCHECK	NOTES
75	467		1	Feature Parcel	23	3	Unnamed Parcels	Parcel.dwg_Parcel	Execute SQL Check	Review with proper state

**Customizable Map Layout**

In addition to its wide range of capabilities for data quality assurance, data editing, and data maintenance described previously, Esri Production Mapping contains a variety of capabilities that assist with map product outputs as either pages of an atlas or export files. The map element tool called Graphic Table Element (GTE) is one such capability. It supports creating map layouts that are informative and appealing by providing a dynamic table of the attribute information for the features represented in the map. A variety of options are available for configuring GTE to fit your workflow requirements. For example, a definition query can be used to limit the table to only the newly edited features. The table can be designed to list only the new tax parcel identification numbers assigned within the map extent. Other options include the display of the plat name as well as any other attributes chosen from the list. The table is highly configurable and will update dynamically when the map display is panned to other areas. The GTE complements the dynamic text labels within the new [Data Driven Pages](http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//00sr00000006000000.htm)<sup>7</sup> functionality of ArcGIS 10 for making atlases.

<sup>7</sup> <http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//00sr00000006000000.htm>

**Figure 6**  
**An Example of a Graphic Table Element**  
**Displaying Attributes of Newly Edited Parcels**

Echo Park Merge			
Name	Historical	LegalStartDate	LegalEndDate
1916352011	0	11/15/2011	
1916352002	1	8/25/1985	11/15/2011
1916352001	1	8/25/1985	11/15/2011

***Streamlined Data***  
***Editing of Other***  
***Feature Types***

While this paper is focused on using Production Mapping with the ArcGIS for Land Records parcel fabric data model, there are other data types within the local government information model that land records offices are often responsible for maintaining. One example is road centerlines. The Production Mapping editing tools can be used on these features as well.

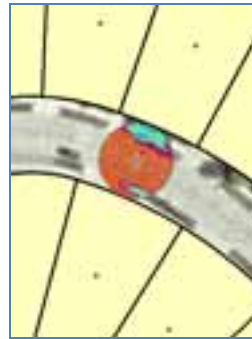
Using Production Mapping to split road centerlines into separate line features at every intersection for the address geocoding is just one illustration of efficient editing tools available. In the local government information model, each street segment has four attributes—FROMLEFT, TOLEFT, FROMRIGHT, and TORIGHT—that track the range of addresses on the left and right sides of the street (from lowest to highest). The efficient editing tools of Production Mapping enable your staff to digitize the entire length of a street instead of each segment one by one. While digitizing the whole street, the Create and Intersect Features tool automatically splits the line where it crosses existing road features. This creates distinct line features with associated attribute tables on either side of the intersection. Subsequently, the attributes are entered by the editor. The labeling process for map publishing can also be expedited by specifying which attribute to use, as seen in figure 7.

**Figure 7**  
**Road Centerlines, Labeled with FROMRIGHT Attribute**



Another tool in Esri Production Mapping, called Sketch Halo, is also used for editing road centerlines. If the parcel fabric and an underlying aerial photograph are the only reference layers used to digitize the road centerline, a sketch halo is set up to maintain the proper distance from the parcel road frontage line to the centerline. The red halo in figure 8 has a 25-foot radius. By keeping the edges of the circle at the parcel boundary, you can ensure that the road centerline is at the midpoint of the two edges.

**Figure 8**  
**The Sketch Halo Centered between Parcels**



In cases where existing centerlines need to be extended along their trajectories, for example, construction of new roads or extending old roads into new land, you can leverage the Dynamic Extend tool. With this tool, you can drop one or more vertices beyond the original start or end point without needing to flip the sketch.

When a new Tax Increment Finance (TIF) district has been granted within a surrounding taxable area, you may want to cut a hole into an existing polygon to create this new TIF district polygon inside the existing polygon. The Production Create Hole tool allows the editor to digitize the new boundary of the island on top of the existing polygon. When the task is complete, a donut has been created with a hole in the middle. Using the Copy Part to Target tool, you can fill the hole with a polygon from a different feature class or choose the same feature class with the Copy Part to Feature tool.

### ***Efficient Cartography Tools***

**Views**<sup>8</sup> are map settings that allow you to manage the properties of a data frame and layers so they can be reapplied at any time and help create a standard look and feel to a map document. Views can be saved to and retrieved from any geodatabase, including the Product Library component of Production Mapping described below.

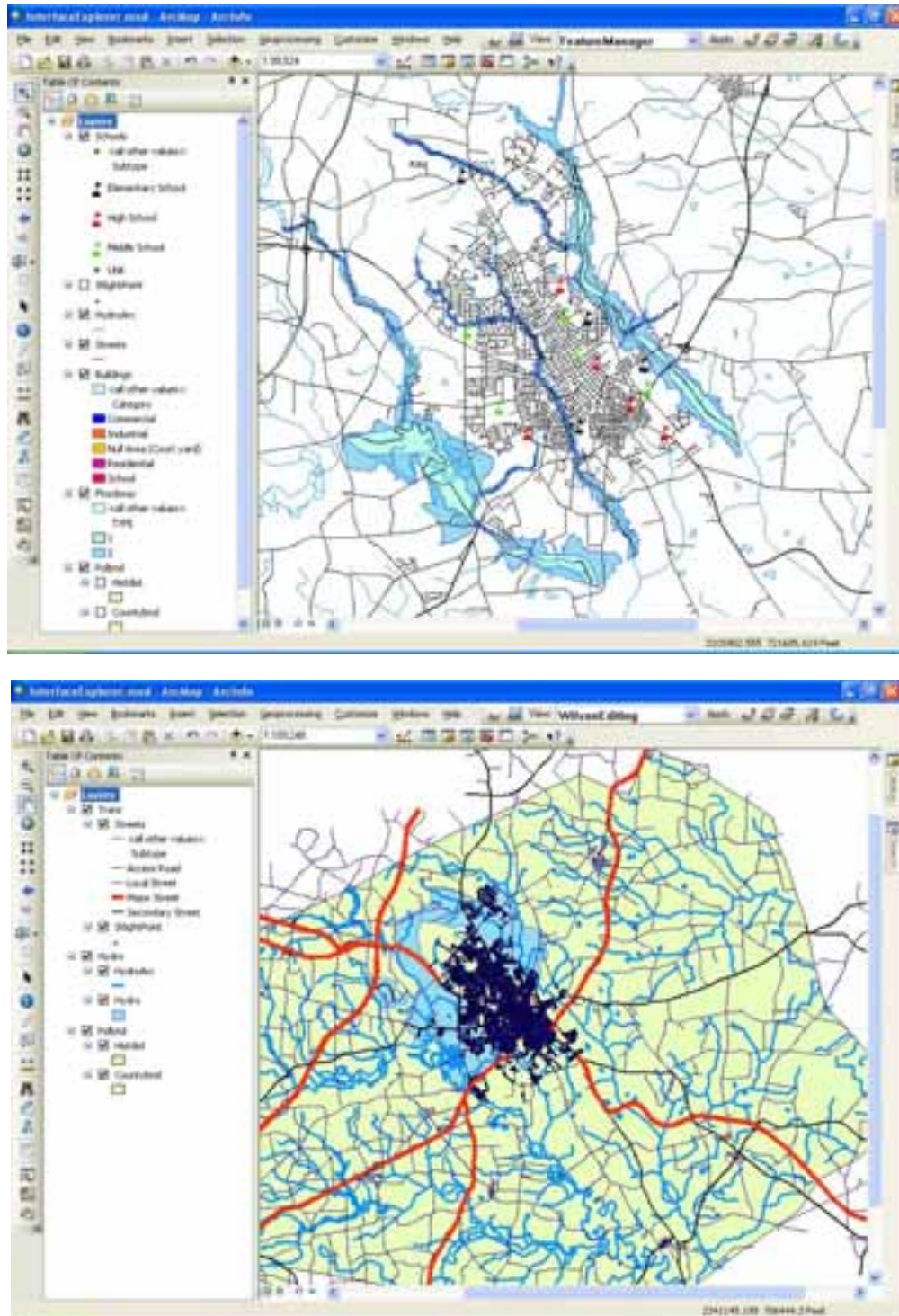
Views save the settings for scale, symbology, labeling, data layers present, map extent, layer visibility, and so forth. Using views is an alternative to having multiple map documents for different functions (i.e., one for editing, one for quality control, one for publishing, and so forth).

In the current functionality, views will perform best if there is no parcel fabric added to the map. It is recommended that views be used in maps with other types of local government data, as shown in figure 9.

<sup>8</sup> <http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//010300001pp000000.htm>

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**Figure 9**  
**An Example of the Same Map Document with Two Different Views Applied**

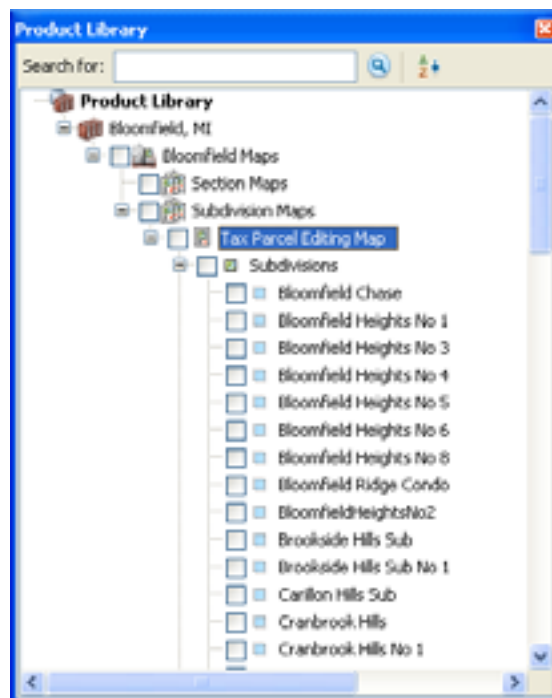


### *Spatially Enabled Document Management System*

[Product Library](#)<sup>9</sup> is an overarching piece of functionality within Esri Production Mapping that enables you to store and manage files associated with your GIS work such as documents, business rules, data and cartographic specifications, and map products. It is a geodatabase that helps you organize and interact with the various parts of your work. You can maintain file versions, manage permissions, and enable locking when configuring, retrieving, and sharing products using Product Library. In essence, it can be considered a spatially enabled document management system. By storing all your information in a central location, you ensure consistency and improve efficiency of GIS tasks within your organization.

Product Library can store editing configurations, validation rules that have been configured as batch jobs, MXDs, documentation, map products, views, and visual specifications. The stored data validation rules can be applied to a newly created feature within the editing session before it is committed to the geodatabase. This on-the-fly validation is performed when using Feature Manager to create or update your features. Feature-level metadata is used to track the name of the editor and the date/time stamp of the edit. This kind of metadata can differentiate between when a feature was created and when it was last modified and can help increase the level of accountability for every editor on the team. Feature-level metadata is configured in Product Library.

**Figure 10**  
**The Product Library Tree Structure**



Product Library can also be used to manage your map products. Because of its tree structure, child nodes inherit certain characteristics from parent nodes by default. For example, if you are creating a map series using the same map document as a template,

<sup>9</sup> <http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//010300001r1000000.htm>

that map document can be associated with the parent node, and all maps managed at the child nodes will inherit that template and represent the pages of your map series. Product Library can also manage more complex map products, where each product may have a different scale or extent, map layout, and/or data frames with different features layers. A common step in the workflow for entering new parcel data is to create a PDF copy of the edited area. GIS editors usually have two different map layouts, portrait and landscape, that they use to make the best-looking PDF. These map layouts are reused; that way, the map surround elements need not be created each time. These different map products can then be stored in Product Library for the GIS team to easily access. Additionally, you can import Data Driven Pages-enabled map documents into Product Library to manage them centrally. Once imported, they are locked when checked out and can be edited as a standard Data Driven Pages map document. Versions of the map document are also created by default in Product Library, allowing you to go back to a previous state of the file if required.

You can also store map surround elements, such as your organization's logo, north arrows, legends, tables, and notes, within Product Library to easily find and add them to your map layouts.

### **Summary**

Local government entities are constantly looking for ways to improve the efficiency of their operations and reduce their operating costs in the process. Esri Production Mapping offers several ways to accomplish this efficiency and cost savings through streamlining data collection and data quality procedures, improving work efficiency, and expediting delivery of data and map products to constituents. Esri Production Mapping, when used in sync with the ArcGIS for Land Records solution, provides an excellent platform for achieving these goals during each step of your data management workflows. Incorporating Esri Production Mapping into your migration strategy at the beginning will enable you to take complete advantage of its capabilities.

### ***Service Package Offerings***

Esri Professional Services offers service packages to assist users with migration to ArcGIS for Land Records, including two packages specifically designed to assist with implementing the parcel fabric. The first, Parcel Data Migration Jump Start, is an on-site, three-day kickoff session during which Esri experts help migrate a sample of your parcel dataset to the parcel fabric. At the conclusion of the jump start, you will receive a step-by-step guide to migrating data that addresses your specific needs. The second service package, Parcel Maintenance Workshop, teaches your GIS staff how to use the Parcel Editor toolbar and outlines best practices for editing the parcel fabric. This workshop can be extended to provide you with instruction in using the Workflow Manager and Task Assistant Manager components of Esri Production Mapping.

There are also jump starts and workshops for ArcGIS Workflow Manager and ArcGIS Data Reviewer. Jump starts are designed to help you quickly become self-sufficient in installing, implementing, and managing Esri software. They provide knowledge transfer and best practices in using Esri products. Workshops are interactive, hands-on technology transfers. The table below lists the various packages available:



## Jump Starts

Services	Duration
ArcGIS Workflow Manager Jump Start	5 days
ArcGIS Data Reviewer Jump Start	5 days
Parcel Data Migration Jump Start	3 days

## Workshops

Services	Duration
ArcGIS Workflow Manager Workshop	3 days
ArcGIS Data Reviewer Workshop	3 days
Parcel Maintenance Workshop	3 days

**For More Information**

For more information, visit [esri.com/productionmapping](http://esri.com/productionmapping) or e-mail [productionmapping@esri.com](mailto:productionmapping@esri.com). Helpful resources, such as tutorials, sample scripts, tools, and forums, can be accessed via the [Esri Production Mapping Resource Center](#)<sup>10</sup> under the Gallery tab. The white paper [Loading Data into a Parcel Fabric](#)<sup>11</sup> describes how to get your data into the parcel fabric.

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<sup>10</sup> <http://resources.arcgis.com/content/esri-production-mapping/10.0/about>

<sup>11</sup> [http://www.esri.com/library/whitepapers/pdfs/loading\\_data\\_parcel\\_fabric.pdf](http://www.esri.com/library/whitepapers/pdfs/loading_data_parcel_fabric.pdf)



## About Esri

Since 1969, Esri has been helping organizations map and model our world. Esri's GIS software tools and methodologies enable these organizations to effectively analyze and manage their geographic information and make better decisions. They are supported by our experienced and knowledgeable staff and extensive network of business partners and international distributors.

A full-service GIS company, Esri supports the implementation of GIS technology on desktops, servers, online services, and mobile devices. These GIS solutions are flexible, customizable, and easy to use.

## Our Focus

Esri software is used by hundreds of thousands of organizations that apply GIS to solve problems and make our world a better place to live. We pay close attention to our users to ensure they have the best tools possible to accomplish their missions. A comprehensive suite of training options offered worldwide helps our users fully leverage their GIS applications.

Esri is a socially conscious business, actively supporting organizations involved in education, conservation, sustainable development, and humanitarian affairs.

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